



**IMPLEMENTASI KURIKULUM INTERNASIONAL *CAMBRIDGE* DAN  
DAMPAKNYA TERHADAP PENGELOLAAN PEMBELAJARAN BIOLOGI:  
STUDI KASUS DI SAINT JOHN'S CATHOLIC SCHOOL SEMARANG**

skripsi

disusun sebagai salah satu syarat  
untuk memperoleh gelar Sarjana Pendidikan Biologi

Oleh

Monica Elisabeth

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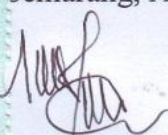
**JURUSAN BIOLOGI  
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM  
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## PERNYATAAN KEASLIAN SKRIPSI

Saya menyatakan dengan sebenar-benarnya bahwa skripsi saya yang berjudul “Implementasi Kurikulum Internasional *Cambridge* dan Dampaknya Terhadap Pengelolaan Pembelajaran Biologi: Studi Kasus Di Saint John’s Catholic School Semarang” disusun berdasarkan hasil penelitian saya dengan arahan dari dosen pembimbing. Sumber informasi atau kutipan yang dari karya yang diterbitkan telah disebutkan dalam teks dan dicantumkan dalam daftar pustaka di bagian akhir skripsi ini. Skripsi ini belum pernah diajukan untuk memperoleh gelar dalam program sejenis apapun di perguruan tinggi manapun.

Semarang, Agustus 2014



  
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## PENGESAHAN

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Implementasi Kurikulum Internasional *Cambridge* Dan Dampaknya Terhadap Pengelolaan Pembelajaran Biologi: Studi Kasus Di Saint John's Catholic School Semarang

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## ABSTRAK

**Elisabeth, Monica. 2014. Implementasi Kurikulum Internasional Cambridge dan Dampaknya Terhadap Pengelolaan Pembelajaran Biologi: Studi Kasus di Saint John's Catholic School Semarang. Skripsi, Jurusan Pendidikan Biologi. Fakultas Matematika dan Ilmu Pengetahuan Alam. Universitas Negeri Semarang. Drs. Krispinus Kedati Pukan, M.Si.**

Kurikulum mengakomodasi siswa untuk mengembangkan pemahaman, pengetahuan dan keterampilan siswa melalui pengalaman belajar. Kurikulum 2013 secara implisit mengikuti kurikulum internasional *Cambridge*, yang menitikberatkan kemampuan siswa dalam pemahaman, pengetahuan, keterampilan dan berpikir kritis. Keunggulan kurikulum *Cambridge* merupakan kurikulum internasional yang digunakan di lebih dari 150 negara. Melihat keunggulan dari kurikulum *Cambridge* inilah, maka dilakukan penelitian terhadap kurikulum internasional di sekolah internasional di Semarang. Penelitian ini bertujuan mengetahui implementasi kurikulum internasional *Cambridge* di Saint John's Catholic School bidang studi Sains (Biologi) dan mengetahui prestasi belajar siswa Saint John's Catholic School.

Pengumpulan data penelitian menggunakan dokumentasi, observasi, dan wawancara. Metode analisis data menggunakan teknik triangulasi. Penelitian ini berlokasi di Saint John's Catholic School, sedangkan subjek dalam penelitian ini adalah Kepala Bagian Pendidikan Dasar dan Menengah Dinas Pendidikan Kota Semarang, Kepala Sekolah dan coordinator Bidang Kurikulum IGSC Saint John's Catholic School.

Hasil penelitian menunjukkan tingkat keterlaksanaan silabus *Cambridge* di Saint John's Catholic School bidang studi Sains (Biologi) sangat tinggi, proses pembelajaran di Saint John's Catholic School berkualifikasi internasional, dan implementasi kurikulum internasional *Cambridge* memiliki dampak yang positif terhadap prestasi sekolah dan belajar siswa. Berdasarkan hasil penelitian dan pembahasan disimpulkan bahwa implementasi kurikulum internasional *Cambridge* di Saint John's Catholic School sesuai dengan kurikulum internasional *Cambridge* dan berdampak positif terhadap pengelolaan pembelajaran Biologi.

Kata Kunci: Kurikulum *Cambridge*, implementasi, dampak, sekolah internasional, Biologi.

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Penulis

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# BAB I PENDAHULUAN

## A. LATAR BELAKANG

Upaya peningkatan kualitas pendidikan di Indonesia sampai saat ini tidak pernah berhenti. Usaha tersebut dilakukan untuk menyesuaikan dan mengimbangi kebutuhan dan perkembangan yang terjadi di tingkat global. Upaya pemerintah meningkatkan mutu pendidikan salah satunya dengan kurikulum. Perkembangan kurikulum terakhir yang terjadi di Indonesia adalah kurikulum 2013, yang mengedepankan kompetensi sikap, pengetahuan, dan keterampilan melalui pengalaman personal (Depdiknas 2012). Aspek-aspek tersebut telah terlebih dahulu diterapkan dalam kurikulum internasional. Landasan kurikulum *Cambridge* khususnya, adalah pemahaman, pengetahuan, dan keterampilan peserta didik sebagai inti dari pengalaman belajar (CIE 2012).

Persamaan dan perbedaan Standar Kompetensi Lulusan (SKL) antara kurikulum 2013 dengan kurikulum *Cambridge* tampak dari Tabel 1.

Tabel 1 Persamaan dan Perbedaan Standar Kompetensi Lulusan (SKL) antara kurikulum 2013 dengan kurikulum *Cambridge*

	Kurikulum 2013	Kurikulum <i>Cambridge</i>
Mendefinisikan	✓	✓
Menjelaskan	✓	✓
Mengklasifikasikan	✓	✓
Menerapkan	✓	✓
Menganalisis	✓	✓
Menghitung	✓	✓
Mengevaluasi	✓	✓
Mensintesis		✓
Mengoperasikan prinsip		✓
<i>Scientific literacy</i>		✓
<i>Critical thinking order</i>		✓
<i>Reasoning thinking order</i>		✓
<i>Scientist thinking</i>		✓

\*Diadaptasi dari Hidayat A (2011)

Kurikulum 2013 diarahkan untuk mengadaptasi dan mengadopsi keunggulan mutu pendidikan dari salah satu negara OECD (*Organization for Economic Co-Operation and Development*) atau negara maju lainnya, yang tentu mencakup 8 Standar Nasional Pendidikan (SNP), seperti standar kompetensi lulusan dan standar isi. Standar kompetensi lulusan dan standar isi yang digunakan oleh negara OECD dan negara maju secara luas adalah kurikulum *Cambridge*. Kurikulum *Cambridge* merupakan salah satu dari empat jenis kurikulum internasional yang ada. Kurikulum *Cambridge*, yang merupakan bagian dari *University of Cambridge Local Examination Syndicate* (UCLES), digunakan di lebih dari 150 negara (CIE 2014).

Keunggulan kurikulum *Cambridge* lainnya yakni menjadi salah satu pilihan utama kurikulum di Sekolah Internasional di Indonesia, karena dalam kurikulum ini tidak hanya membangun pengetahuan, tetapi juga kemampuan berpikir yang membantu siswa menjadi pembelajar yang mandiri dan mempersiapkan siswa memasuki kehidupan bermasyarakat (CIE 2014). Penggunaan kurikulum *Cambridge* di Sekolah Internasional Indonesia adalah bentuk eksistensi pendidikan nasional Indonesia yang dapat mencetak siswa dengan kualitas internasional, sehingga diakui di mata dunia dan memiliki daya saing dengan negara-negara maju lainnya (Fadlilah 2008).

Melihat keunggulan dari kurikulum *Cambridge* inilah, maka perlu dilakukan penelitian “implementasi kurikulum internasional *Cambridge* dan dampaknya terhadap pengelolaan pembelajaran biologi: studi kasus di Saint John’s Catholic School Semarang.”

## **B. FOKUS PENELITIAN**

Fokus penelitian yang ingin dicapai dalam penelitian ini meliputi:

1. implementasi kurikulum *Cambridge* di Saint John’s Catholic School Semarang bidang studi biologi,
2. dampak implementasi kurikulum *Cambridge* di Saint John’s Catholic School Semarang.

**C. TUJUAN**

1. Mendeskripsikan implementasi kurikulum *Cambridge* di Saint John's Catholic School Semarang bidang studi Sains (Biologi),
2. Mendeskripsikan dampak implementasi kurikulum *Cambridge* di Saint John's Catholic School Semarang.

**D. MANFAAT**

1. Memberikan informasi tentang implementasi dan dampak kurikulum internasional terhadap pengelolaan pembelajaran biologi di Sekolah Internasional Semarang.
2. Sebagai bahan referensi untuk sekolah nasional dalam peningkatan kualitas sekolah.

## **BAB II**

### **TINJAUAN PUSTAKA**

#### **A. Tinjauan Pustaka**

##### **1. Implementasi Kurikulum**

Implementasi berasal dari bahasa Inggris yaitu *to implement*. Dalam Kamus Besar Meriam-Webster (2008), *to implement* (mengimplementasikan) berarti *to provide the means for carrying out* (menyediakan sarana untuk melaksanakan sesuatu); dan *to give practical effect to* (untuk menimbulkan dampak/akibat terhadap sesuatu). Menurut Kamus Besar Bahasa Indonesia, implementasi adalah penerapan.

Tahapan penting dalam siklus kebijakan pendidikan adalah implementasi kurikulum. Implementasi merupakan tahap suatu kebijakan dilaksanakan secara maksimal dan dapat mencapai tujuan kebijakan itu sendiri. Implementasi juga dimaknai dengan penerapan suatu kebijakan yang telah diputuskan sesuai ketentuan berlaku dan ditetapkan sebelumnya. Implementasi terdiri dari cara-cara atau saran-saran tertentu yang dirancang atau didesain secara khusus serta diarahkan menuju tercapainya tujuan-tujuan dan sasaran-sasaran yang dikehendaki.

Secara etimologi kurikulum berasal dari kata *Currere* (Latin), yang bermakna berlari cepat, maju dengan cepat, menjelajahi, merambat, mengelilingi lapangan, gelanggang perlombaan dan sejenisnya. Jadi *curriculum* diartikan "jarak" yang harus "ditempuh" oleh pelari. Pada mulanya kata ini lazim digunakan dalam bidang atletik, namun dalam perkembangan lebih lanjut diadopsi sebagai perbendaharaan umum di dunia pendidikan. (Hernawan AS & Susilana R 2009)

Dari sekian banyak unsur sumber daya pendidikan, kurikulum merupakan salah satu unsur yang bisa memberikan kontribusi yang signifikan untuk mewujudkan proses berkembangnya kualitas potensi

peserta didik. Pada Undang-Undang nomor 20 tahun 2003 tentang Sistem Pendidikan Nasional, disebutkan bahwa kurikulum adalah seperangkat rencana dan pengaturan mengenai tujuan, isi dan bahan pelajaran serta cara yang digunakan sebagai pedoman penyelenggaraan kegiatan pembelajaran untuk mencapai tujuan pendidikan tertentu.

Menurut Sukmadinata (2009) kurikulum merupakan rancangan pendidikan yang merangkum semua pengalaman belajar yang disediakan bagi siswa di sekolah. Dalam kurikulum terintegrasi filsafat, nilai-nilai, pengetahuan, dan perbuatan pendidikan. Kurikulum disusun oleh para ahli pendidikan atau ahli kurikulum, ahli bidang ilmu, pendidik, pejabat pendidikan serta unsur-unsur masyarakat lainnya. Rancangan ini disusun dengan maksud memberi pedoman kepada para pelaksana pendidikan, dalam proses pembimbingan perkembangan siswa, mencapai tujuan yang dicita-citakan oleh siswa sendiri, keluarga maupun masyarakat.

Suatu kurikulum harus memiliki kesesuaian atau relevansi, (Sukmadinata 2009) kesesuaian kurikulum meliputi dua hal yaitu pertama kesesuaian kurikulum dengan tuntutan, kebutuhan, kondisi dan perkembangan masyarakat. Kedua, kesesuaian antar komponen kurikulum, yaitu tujuan, isi dan organisasi.

Ada berbagai pandangan dalam menginterpretasikan kurikulum, TIMSS (Bass *et al.* 1996) mengkategorikan kurikulum menjadi tiga ranah yakni:

1. *documented curriculum* (kurikulum berbentuk dokumen yang diidamkan)

*Documented curriculum* adalah pedoman pembelajaran berupa kerangka pembelajaran yakni topik/materi pembelajaran. Terdapat harapan dan idaman dalam pembelajaran yang dikemas dalam *documented curriculum*, sehingga ranah ini memiliki variasi pada tiap negara.



## 2. *implemented curriculum* (aplikasi kurikulum)

*Implemented curriculum* adalah bentuk pengajaran topik/materi pembelajaran yang disusun dalam *documented curriculum*. Ranah ini meliputi proses pembelajaran dalam kelas, cara guru menggunakan buku teks dan teknologi.

## 3. *achieved curriculum*

*Achieved curriculum* adalah pencapaian siswa berupa hasil belajar siswa yang terangkum dalam prestasi akademik siswa, *output/outcome* siswa.

Terdapat tiga peranan implementasi kurikulum yang sangat penting (Teguh & Yusuf 2012), yakni peranan konservatif, peranan kritis atau evaluatif dan peranan kreatif. Peranan konservatif kurikulum adalah mentransmisikan dan menafsirkan warisan sosial pada generasi muda. Selain itu, kurikulum turut berperan aktif dalam kontrol sosial dan memberi penekanan pada unsur berpikir kritis. Peranan kreatif, yakni kurikulum berperan dalam melakukan berbagai kegiatan kreatif dan konstruktif, dalam artian menciptakan dan menyusun suatu hal yang baru sesuai dengan kebutuhan masyarakat di masa sekarang dan masa mendatang.

## 2. **Dampak**

Pengertian dampak adalah benturan atau pengaruh yang mendatangkan akibat baik positif maupun negatif. Pengaruh adalah daya yang ada dan timbul dari sesuatu (orang, benda) yang ikut membentuk watak, kepercayaan atau perbuatan seseorang (KBBI 2008). Dampak implementasi kurikulum bersifat holistik dan permanen.

Dampak positif dan negatif dari kurikulum dirasakan baik oleh siswa maupun sekolah. Menurut Direktorat Pengembangan UNIKOM, dampak positif dari kurikulum yang tepat antara lain memudahkan dalam menyampaikan pelajaran terlihat dari prestasi siswa dalam bidang akademik dan hasil Ujian Nasional. Dampak negatif dari

kurikulum yang tidak tepat adalah *input*/siswa yang masuk ke sekolah internasional tidak berasal dari sekolah unggulan, *output*/kelulusan rendah dan *outcome*/penerimaan siswa ke jenjang lebih lanjut terfavorit sedikit.

Dampak kurikulum berbeda pada tiap sekolah, tergantung pada komponen yang ada di sekolah, yakni struktur internal, fungsional sekolah, kualitas guru, fasilitas sekolah, dan siswa. Sekolah yang mengimplementasikan kurikulum tertentu harus bertanggungjawab atas dampak yang terjadi. Bentuk tanggung jawab adalah dengan mengevaluasi secara berkala untuk memastikan kurikulum yang digunakan sejalan dengan visi dan misi sekolah (CIE 2012).

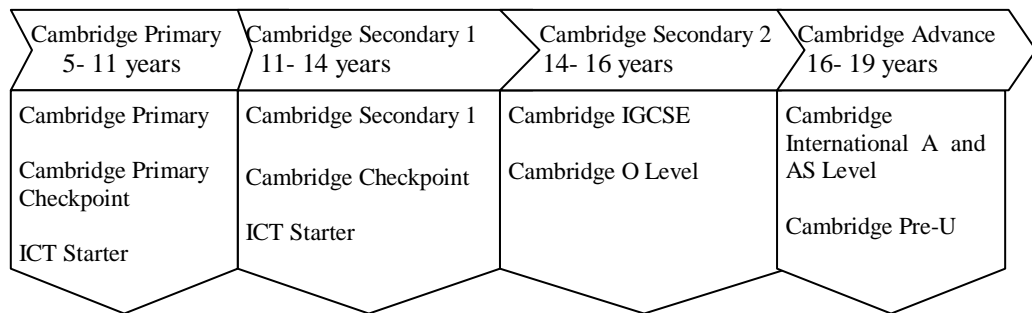
### **3. Kurikulum Internasional dan Kurikulum *Cambridge***

Kurikulum internasional yang berlaku di Indonesia adalah kurikulum yang diadaptasi dari lembaga internasional yang memiliki kualifikasi internasional dan diakui secara luas, misalnya *Cambridge*, IB (*International Baccalaureat*), NSTA (*Nastional Science Teacher Association*) dan lain-lain. Tidak semua lembaga pendidikan di Indonesia menerapkan kurikulum internasional, karena kurikulum tersebut bukan kurikulum wajib yang harus diterapkan di setiap lembaga pendidikan Indonesia. Kurikulum internasional yang diimplementasikan di Indonesia dipedomankan pada SNP. Sehingga terdapat perpaduan antara kurikulum Indonesia dengan kurikulum internasional. Sekolah internasional yang mengimplementasikan perpaduan ini, biasanya memiliki latar belakang tersendiri. Sebagai contoh IB (*International Baccalaureat*) diperuntukkan bagi peserta didik yang sering berpindah domisili, sehingga mempermudah peserta didik tersebut menyesuaikan pelajaran di negara manapun.

*Cambridge International Examinations* (2012) mendefinisikan kurikulum antara lain sebagai *school curriculum* yaitu kombinasi mata pelajaran yang dipelajari dalam kegiatan belajar mengajar, *subject curriculum* yaitu topik dan kompetensi yang terkandung dalam

silabus, *co-curricular curriculum* yaitu aktivitas pendidikan yang mendukung kegiatan pembelajaran dikelas dan sebagai *experienced curriculum* yaitu pembelajaran kontekstual yang siswa dapatkan sebagai hasil dari seluruh kegiatan belajar mengajar.

Kurikulum *Cambridge* menekankan pada pengembangan pemahaman, pengetahuan dan keterampilan peserta didik sebagai inti dari pengalaman belajar. Kurikulum *Cambridge* adalah kurikulum terbesar di dunia yang diperuntukkan bagi siswa dengan rentang usia 5–19 tahun dan tersusun atas empat jenjang atau level. Level kurikulum *Cambridge* disajikan dalam Gambar 1.



Gambar 1 Bagan level kurikulum *Cambridge* (CIE 2014)

Gambar 1 menunjukkan level kurikulum *Cambridge* yakni *Cambridge Primary* untuk usia 5-11 tahun (dengan asesmen *Cambridge Primary*, *Cambridge Primary Checkpoint*, dan *ICT Starters*); *Cambridge Secondary 1* untuk usia 11-14 tahun (dengan assessmen *Cambridge Primary 1*, *Cambridge Checkpoint* dan *ICT Starters*); *Cambridge Secondary 2* untuk usia 14-16 tahun (dengan asesmen *Cambridge IGCSE*); dan *Cambridge Advance* untuk usia 16–19 tahun (dengan asesmen *Cambridge International A* dan *AS level* serta *Cambridge Pre-University*).

Program ini menawarkan pendekatan pembelajaran yang mendorong penelitian independen dan berpikir kritis. Sekolah dapat menawarkan sebagian besar kombinasi/integrasi dari berbagai pilihan mata pelajaran yang tersedia. Peserta didik memiliki kebebasan untuk memilih mata pelajaran yang tepat bagi mereka dan mengkhususkan

diri dalam bidang tertentu. Kurikulum *Cambridge* mendukung perkembangan peserta didik bahkan guru dengan lima kemampuan yakni *confident* (kepercayaan diri), *responsible* (bertanggung jawab), *reflective* (reflektif), *innovative* (inovatif) dan *engaged* (terlibat dalam pembelajaran) (CIE 2012).

Kurikulum *Cambridge* menekankan pada proses, karena proses mencerminkan bagaimana pikiran siswa bekerja. Program yang menaungi kurikulum *Cambridge* adalah *Cambridge International Examinations* (CIE), salah satu program pendidikan internasional dan kualifikasi untuk anak berusia 5-19 tahun. Kualifikasi ini digunakan di lebih dari 150 negara dan diakui oleh universitas-universitas, penyedia pendidikan dan pengusaha di seluruh dunia. Misi dari CIE adalah untuk memberikan pendidikan yang unggul berkelas dunia melalui penyediaan kurikulum, penilaian dan jasa. CIE berkomitmen untuk memperluas akses pendidikan yang berkualitas tinggi kepada peserta didik di seluruh dunia.

Kelebihan dari kurikulum *Cambridge* (CIE 2012) antara lain memiliki fleksibilitas, yaitu sekolah dapat dengan mudah mengadaptasi kurikulum *Cambridge* untuk memenuhi kebutuhan sekolah. Sehingga, sekolah dengan program bilingual dapat mengintegrasikan program *Cambridge* dengan kurikulum nasional. Kelebihan lainnya adalah berstandar internasional, yaitu *Cambridge International Level IGCSE* dan *International A Level* dapat cocok dengan kurikulum nasional, kedua level tersebut dikaji ulang secara berkala untuk mengikuti perubahan terkini dalam bidang pendidikan. Penilaian eksternal juga merupakan kelebihan kurikulum ini, yaitu berbagai penilaian yang tersedia di berbagai tahapan kurikulum, penilaian ini membantu belajar siswa secara langsung, memberikan catatan pencapaian, pengakuan prestasi atas kecerdasan yang siswa miliki. Kurikulum *Cambridge* memiliki program *Global*

*outlook*, yaitu program *Cambridge* dalam mengembangkan kesadaran global dan meningkatkan kemampuan bahasa.

Kebijakan sekolah bertaraf internasional (Depdiknas 2007) menyatakan bahwa sekolah bertaraf internasional dapat mengadaptasi kurikulum *Cambridge* di Indonesia, dengan memenuhi beberapa standar sesuai dengan peraturan perundang-undangan yang berlaku di Indonesia, yakni:

1. Undang-Undang nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional. Pendidikan nasional adalah pendidikan yang berdasarkan Pancasila dan Undang-Undang Dasar 1945 yang mengakar pada nilai-nilai agama, kebudayaan nasional Indonesia dan tanggap terhadap tuntutan perubahan zaman.
2. Peraturan pemerintah Republik Indonesia No. 19 tahun 2005 tentang Standar Nasional Pendidikan, yang terdiri dari Standar Isi, Standar Kompetensi Lulusan, Standar Pendidik dan Tenaga Kependidikan, Standar Sarana Prasarana, Standar Pengelolaan, Standar Pembiayaan serta Standar Penilaian Pendidikan.
3. Permendiknas No. 22, 23, 24 tahun 2006 tentang Standar Isi, SKL dan implementasinya untuk satuan pendidikan, yakni meletakkan dasar dan peningkatan kecerdasan, pengetahuan, kepribadian, akhlak mulia serta keterampilan untuk hidup mandiri dan mengikuti pendidikan yang lebih lanjut.

Pada penelitian ini konten biologi pada jenjang *Cambridge Secondary 2* dengan asesmen *Cambridge International Level IGCSE (International General Certificate of Secondary Education)* disajikan pada tabel 2.

Tabel 2 Konten Biologi Pada Jenjang *Cambridge Secondary 2* dengan Assesmen *Cambridge International Level IGCSE*

No	Topik Pembelajaran
	Section I: Characteristics and classification of living organisms
1	Characteristics of living organisms
2	Classification and diversity of living organisms
3	Simple key (dichotomous keys)
	Section II: Development of the organism and the continuity of life
1	Cell structure and organization
2	Levels of organization
3	Size of specimens
4	Movement in and out of cells
5	Enzymes
6	Nutrition
7	Transportation
8	Respiration
9	Excretion in humans
10	Coordination and response
	Section III: Development of the organism and the continuity of life
1	Reproduction
2	Growth and development
3	Inheritance
	Section IV: Relationships of organisms with one another and with their environment
1	Energy flow
2	Food chains and food webs (emphasize on examples occurring locally)
3	Nutrient cycles
4	Population size
5	Human influences on the ecosystem

\* Sumber: Cambridge International Examinations (2014)

Tabel 2 menunjukkan bahwa silabus *Cambridge International Level IGCSE* memiliki empat bab terdiri atas 21 topik utama. Setiap materi ajar disampaikan pada peserta didik pengguna kurikulum *Cambridge International Level IGCSE* dengan mengedepankan pengalaman belajar.

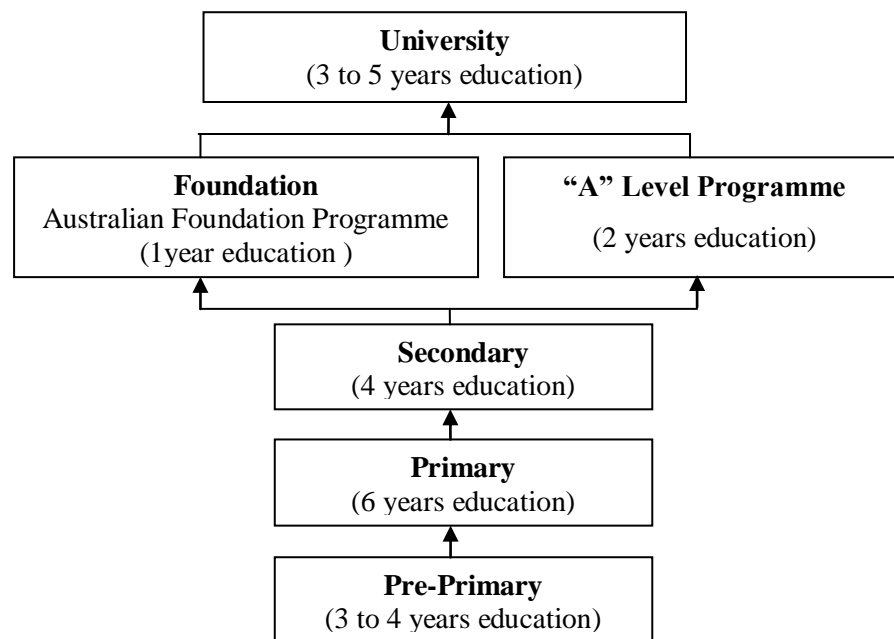
Assesmen di dalam silabus biologi *Cambridge International Level IGCSE* terbagi atas tiga ranah yakni *knowledge with understanding*, *handling information and problem solving*, *experimental skills and investigations*. Ranah *knowledge with understanding* adalah kemampuan kognitif siswa yaitu penguasaan materi, ranah *handling information and problem solving* adalah kemampuan siswa dalam menghubungkan teori yang dipelajari dengan masalah yang terjadi di lingkungan dan ranah *experimental skills and investigations* adalah kemampuan untuk melakukan praktikum dan menyelidiki hal-hal yang berhubungan dengan materi yang diajarkan melalui percobaan.

*Grading* di dalam silabus terbagi atas rentang A\* sampai F yaitu rentang nilai 90-30. *Grade A\** untuk siswa dengan nilai 90, *Grade A* untuk siswa dengan nilai 80, *Grade B* untuk siswa dengan nilai 70, *Grade C* untuk siswa dengan nilai 60, *Grade D* untuk siswa dengan nilai 50, *Grade E* untuk siswa dengan nilai 40 dan *Grade F* bagi siswa dengan nilai 30. Nilai akhir didapat dari 50% *knowledge with understanding* dijumlah dengan 30% *handling information and problem solving* dan 20% *experimental skills and investigations*.

#### **4. Saint John's Catholic School**

Sekolah internasional adalah satuan pendidikan hasil kerjasama antara lembaga pendidikan asing yang terakreditasi atau diakui di negaranya dengan satuan pendidikan di Indonesia yang terakreditasi A (Hidayat 2011).

Jalur progresif pendidikan yang diterapkan oleh sekolah internasional pengguna kurikulum *Cambridge* ditampilkan pada Gambar 2.



Gambar 2 *Progression Pathway* (Cambridge, 2002)

Gambar 2 menunjukkan jalur progresif pendidikan yang akan ditempuh siswa pengguna kurikulum *Cambridge*. *Pre-Primary* merupakan masa pendidikan sebelum memasuki kelas *Primary* dengan lama pendidikan tiga sampai empat tahun. Sekolah internasional membagi kelas *Pre-Primary* menjadi *Nursery*, *Pre-Kindergarten* dan *Kindergarten*. Jenjang pendidikan *Primary* terbagi atas *Primary 1-6* dengan lama pendidikan enam tahun. Jenjang pendidikan *Secondary* terbagi atas *Secondary 1-4* dengan lama pendidikan empat tahun. Setelah jenjang *Secondary*, peserta didik dapat memilih *Foundation* (program Diploma) dengan lama pendidikan satu tahun atau *Advanced* (program persiapan menuju universitas) dengan lama pendidikan dua tahun. Jenjang pendidikan *University* ditempuh peserta didik dengan lama pendidikan tiga sampai lima tahun (Cambridge 2002)

Sekolah Internasional di Semarang dalam penelitian ini adalah sekolah yang bekerjasama dengan lembaga pendidikan Cambridge University. Tujuan kerjasama ini untuk mempersiapkan siswa yang ingin melanjutkan pendidikan ke Cambridge University tanpa ujian masuk. Penelitian ini dilakukan di sekolah internasional yang menggunakan kurikulum *Cambridge*, yakni di Saint John's Catholic School Semarang.



Saint John's Catholic School merupakan sekolah internasional berlokasi di Jl. Kencana Loka Raya No 8 Semarang. Sekolah ini telah berdiri selama delapan tahun sejak 6 Januari 2006 di bawah naungan yayasan Yohanes. Tenaga karyawan dan pengajar berjumlah 100 orang. Jumlah siswa di sekolah ini adalah 360 siswa dengan komposisi per kelas terdiri atas 13 murid. Ruangan kelas terbagi atas satu kelas *Nursery*, tiga kelas *Pre-Kindergarten*, tiga kelas *Kindergarten*, dua kelas pada tiap jenjang *Primary* dan dua kelas pada tiap jenjang *Secondary*. Bahasa pengantar dalam pembelajaran adalah bahasa Inggris, namun bahasa Indonesia, bahasa Jerman maupun bahasa Mandarin dapat dipergunakan sesuai kesepakatan. Slogan Saint John's Catholic School adalah pendidikan dengan penyatuan tiga dasar yang ideal, yaitu *Scientia* (Ilmu pengetahuan), *Virtus* (kebajikan) dan *Vita* (kehidupan), yang bersumber dari nilai-nilai kristiani.

Menurut Ms. RP selaku Kepala Sekolah, Saint John's Catholic School merupakan sekolah internasional terakreditasi A yang memiliki komitmen dalam pendidikan bermutu serta memperlengkapi siswa dengan kompetensi, percaya diri, kepemimpinan, nilai-nilai kristiani yang memiliki belas kasih dan peduli terhadap kaum berkekurangan. Saint John's Catholic School memilih menjadi sekolah internasional karena menyadari pendidikan bermutu dan bertaraf internasional dibutuhkan masyarakat untuk meningkatkan daya saing di tingkat internasional.

Saint John's Catholic School mendapat predikat internasional karena adanya kerjasama (*sister school*) dengan Goethe-Institut Jerman. Proses kegiatan pembelajaran di Saint John's Catholic School dimulai 07.30–15.30 setiap hari Senin–Jumat. Saint John's Catholic School terbagi atas tiga gedung utama yakni satu gedung untuk kelas *Pre-Kindergarten* dan *Kindergarten*, satu gedung untuk kelas *Primary* dan satu gedung untuk kelas *Secondary*.

Proses pendidikan terbagi atas kegiatan akademik dan non akademik yakni kegiatan akademik dan non-akademik. Kegiatan akademik meliputi pelajaran agama, pendidikan moral dan kewarganegaraan, bahasa Indonesia, *english second language* (ESL), *mathematics*, *sciences* yang meliputi *physics*, *biology*, *chemistry*, *socials* yang terdiri atas *economics*, *history*, *geography*, *business studies*, pelajaran *information and communication (ICT)*, dan bahasa Jerman/bahasa Mandarin.

Kegiatan non-akademik terdiri atas olahraga yang meliputi bulutangkis, anggar, catur, futsal, basket, dan tenis meja. Kegiatan non-akademik lainnya yakni tari dan musik yang terbagi atas band, paduan suara, ansambel dan tari. Kegiatan lainnya yakni olimpiade matematika, olimpiade IPA dan TOEFL. Pengembangan kemampuan individu yang difasilitasi sekolah meliputi putra/putri altar, tata boga, tata kecantikan, seni lukis, fotografi, klub bahasa Inggris, klub bahasa Jepang, klub bahasa Jerman, jurnalis, manga dan dewan sekolah.

Jenjang pendidikan yang tersedia di Saint John's Catholic School diawali dari *Pre-Kindergarten* dan *Kindergarten* dengan masa tempuh pendidikan tiga sampai empat tahun. *Primary* dengan masa tempuh pendidikan enam tahun. *Secondary Programme* dengan masa tempuh pendidikan empat tahun, dengan mengikuti standar pendidikan Indonesia dan *International General Certificate of Secondary Education* (IGSCE). Peserta didik akan mengikuti Ujian Nasional pada pertengahan kelas *Secondary 2* (kelas 9 SMP) dengan menginduk pada SMP 27 Semarang dan IGSCE pada akhir kelas *Secondary 2*.

### **BAB III**

#### **METODE PENELITIAN**

##### **A. Rancangan Penelitian**

Penelitian ini menggunakan rancangan penelitian deskriptif kualitatif yakni menggali data berupa pandangan responden dalam bentuk cerita rinci atau asli (Moleong 2007). Responden dalam penelitian ini meliputi Dinas Pendidikan Kota Semarang dan Saint John's Catholic School. Subjek penelitian adalah Bapak S selaku Kepala Bagian Pendidikan Dasar dan Menengah Dinas Pendidikan Kota Semarang, Ms. RP selaku Kepala Sekolah, dan Ms. PD selaku koordinator Bidang Kurikulum IGSCCE Saint John's Catholic School. Peneliti memberikan penafsiran, sehingga dapat memberikan informasi tentang implementasi dan dampak implementasi kurikulum *Cambridge* terhadap pengelolaan pembelajaran di Saint John's Catholic School.

##### **B. Lokasi dan Waktu Penelitian**

Penelitian ini dilakukan di Sekolah Internasional di Semarang yang menggunakan kurikulum *Cambridge*, yakni Saint John's Catholic School dengan memfokuskan topik penelitian tentang implementasi kurikulum internasional *Cambridge* dan dampaknya terhadap pengelolaan pembelajaran biologi di sekolah tersebut. Waktu penelitian adalah April- Juni 2014.

##### **C. Data dan Metode Pengumpulan Data**

Moleong (2007) mengemukakan, sumber data penelitian kualitatif terbagi atas data primer dan sekunder. Sumber data primer yaitu Kepala Sekolah dan koordinator bidang kurikulum IGSCCE berupa informasi implementasi kurikulum *Cambridge* yang disusun oleh sekolah internasional dan diperoleh melalui kegiatan wawancara. Data tentang proses belajar mengajar di Saint John's Catholic School melalui observasi dan wawancara terhadap responden.

Sumber data sekunder diperoleh dari buku, bahan referensi dan hasil-hasil kajian yang semuanya mendukung atau memperkaya sumber data primer. Dalam penelitian ini dicari informasi yang diperoleh dari Saint John's Catholic School, juga dari beberapa dokumen seperti komponen silabus, *lesson plan*, dokumentasi prestasi, *grading and reporting*, *input*, *output*, dan *outcome* Saint John's Catholic School yang ada di sekolah internasional tersebut.

Metode Pengumpulan data ini dilakukan dalam tiga tahap, yaitu tahap orientasi yakni mengumpulkan data tentang kurikulum internasional melalui observasi pada Dinas Pendidikan Kota Semarang mengenai Sekolah Internasional Semarang. Kemudian, melakukan observasi di Saint John's Catholic School mengenai keadaan umum sekolah antara lain sejarah sekolah, latar belakang berdirinya sekolah, visi dan misi sekolah, jumlah peserta didik, daftar guru, daftar pegawai, sarana serta prasarana sekolah. Tahap yang kedua adalah tahap eksplorasi yakni menfokuskan penelitian pada subjek penelitian. Hal ini dilakukan dengan wawancara mengenai peran Kepala Sekolah, Koordinator Bidang Kurikulum IGSC dan guru biologi di Saint John's Catholic School dalam implementasi kurikulum *Cambridge*. Tahap ketiga penelitian terfokus yakni komponen silabus kurikulum *Cambridge* yang diterapkan. Kemudian diperdalam dengan *lesson plan*, dokumentasi prestasi, *input*, *output*, dan *outcome* Saint John's Catholic School.

Instrumen penelitian yang digunakan untuk pengumpulan data dalam penelitian ini berdasarkan kebijakan sekolah bertaraf internasional yang ditetapkan oleh Departemen Pendidikan Nasional (2007). Instrumen silabus *Cambridge* dalam penelitian ini berdasarkan *Cambridge International Examinations* (2014). Teknik pengumpulan data tersaji dalam Tabel 3.

Tabel 3 Teknik pengumpulan data

Data	Responden	Cara Pengumpulan Data	
Silabus kurikulum <i>cambridge</i>	Koordinator Kurikulum IGCSE dan Guru	Dokumentasi	
<i>lesson plan</i>		Dokumentasi	
Proses belajar mengajar	Guru Kepala Sekolah dan Koordinator Kurikulum	Observasi Wawancara	Kesesuaian informasi dari sumber data menjamin data valid.
Prestasi belajar siswa	Depdiknas dan Kepala Sekolah	Dokumentasi Wawancara	

\* Diolah dari Sugiyono (2009)

Teknik pengumpulan data yang digunakan berupa pengamatan (observasi), wawancara (*interview*), dan teknik dokumentasi. Teknik observasi dalam penelitian ini adalah mengamati segala sesuatu yang dapat mendukung permasalahan penelitian tentang kurikulum *Cambridge* pada Saint John's Catholic School meliputi proses belajar mengajar Saint John's Catholic School.

Teknik pengumpulan data yang digunakan selain observasi adalah teknik wawancara. Informan kunci dalam penelitian ini adalah Bapak S selaku Kepala Bagian Pendidikan Dasar dan Menengah Dinas Pendidikan Kota Semarang, Ms. RP selaku Kepala Sekolah Saint John's Catholic School dan Ms. PD selaku koordinator kurikulum IGCSE. Informan harus memiliki kualifikasi sebagai berikut, mempunyai pengetahuan yang luas dalam bidang manajemen sekolah, mengetahui arah perkembangan sekolah sesuai visi dan misi sekolah, memahami prinsip pengembangan kurikulum *Cambridge*, memahami prosedur pengembangan kurikulum *Cambridge*, memahami konsep dari kurikulum *Cambridge* dan mengetahui dampak penerapan kurikulum *Cambridge*. Penelitian digunakan cara pencatatan langsung dengan alat *recording*, dan pencatatan dari ingatan secara terpadu.

Proses wawancara diarahkan untuk menggali sejarah berdirinya sekolah, visi dan misi, prestasi yang pernah diraih sekolah, kondisi lingkungan sekolah dan peserta didik serta tenaga kependidikan yang terlibat dalam pelaksanaan kurikulum *Cambridge*. Proses wawancara juga mengungkap mengenai tugas serta fungsi Kepala Sekolah dan koordinator Bidang Kurikulum IGSCCE dalam penerapan kurikulum *Cambridge* di Saint John's Catholic School. Data lain yang akan digali saat proses wawancara adalah konsep serta pelaksanaan belajar mengajar kurikulum *Cambridge* di Saint John's Catholic School. Serta, data mengenai dampak pelaksanaan kurikulum *Cambridge* di Saint John's Catholic School (prestasi siswa dalam bidang akademik, hasil Ujian Nasional, *input*/siswa yang masuk ke sekolah internasional, *output*/kelulusan ujian sertifikasi *Cambridge* dan *outcome*/penerimaan siswa sekolah internasional ke jenjang lebih lanjut terfavorit).

Teknik pengumpulan data berikutnya adalah dokumentasi yakni pencarian data sekunder dengan jalan mengadakan studi kepustakaan dan rekaman. Data yang dikumpulkan dengan teknik ini adalah struktur organisasi kurikulum Saint John's Catholic School dan kaitannya dengan penerapan kurikulum *Cambridge*, daftar pegawai dan guru. Data lainnya adalah arsip tentang kebijakan kaitannya dengan penerapan kurikulum *Cambridge* di Saint John's Catholic School, perangkat pembelajaran yakni silabus dan *lesson plan*. Data mengenai dampak implementasi kurikulum *Cambridge* yang didokumentasikan adalah arsip mengenai prestasi siswa dalam bidang akademik, hasil Ujian Nasional di Semarang, *grading and reporting* siswa. Data lain yang dikumpulkan adalah jumlah *input*/siswa yang masuk ke sekolah internasional di Semarang, *output*/kelulusan ujian sertifikasi *Cambridge* dan *outcome*/penerimaan siswa sekolah internasional ke jenjang lebih lanjut terfavorit).

#### **D. Metode Analisis Data**

Peneliti berpedoman pada langkah-langkah deskriptif analitis yakni menelaah seluruh data, klasifikasi dan penafsiran. Menelaah seluruh data dengan dikumpulkan melalui wawancara, observasi dan dokumentasi, selanjutnya data tersebut dibaca, dipelajari, ditelaah serta dipahami dengan seksama kemudian dikembangkan dan diuraikan secara keseluruhan dari berbagai fenomena di Saint John's Catholic School. Langkah selanjutnya adalah klasifikasi yaitu menggolong-golongkan jawaban dan data lainnya. Selanjutnya, diklasifikasikan menurut indikator yang ditetapkan dalam tujuan penelitian. Langkah terakhir adalah penafsiran, yakni melakukan analisis data dengan komparasi (perbandingan) dengan sumber lainnya. Hasil dari tafsiran data adalah pemaparan tentang situasi dan gejala dalam bentuk pemaparan naratif.

Moleong (2007) mengemukakan teknik triangulasi digunakan agar data dapat benar-benar dikatakan absah yang terdiri dari:

1. Triangulasi metode, yakni membandingkan informasi atau data dengan metode yang berbeda. Metode pengumpulan data dalam penelitian ini menggunakan wawancara, observasi, dan dokumentasi, sehingga gabungan dari hasil metode diperoleh kebenaran informasi dan gambaran yang utuh mengenai implementasi kurikulum *Cambridge* dan dampaknya terhadap pengelolaan pembelajaran biologi. Penelitian ini juga menggunakan informan yang berbeda untuk mengecek kebenaran informasi tersebut.
2. Triangulasi sumber data adalah menggali kebenaran informasi implementasi kurikulum *Cambridge* dan dampaknya terhadap pengelolaan pembelajaran biologi melalui berbagai sumber perolehan data. Penelitian ini menggunakan wawancara sehingga diperoleh sumber data berupa uraian lisan dari responden. Penelitian ini menggunakan observasi sehingga diperoleh sumber data berupa gambar atau foto. Penelitian ini juga menggunakan dokumentasi

sehingga diperoleh sumber data berupa dokumen tertulis, arsip, dokumen. Masing-masing cara tersebut akan menghasilkan bukti atau data yang selanjutnya akan memberikan pandangan mengenai fenomena yang diteliti.



## **BAB IV**

### **HASIL PENELITIAN DAN PEMBAHASAN**

#### **A. Hasil Penelitian**

Saint John's Catholic School mendapat akreditasi A sejak tahun 2007, pelaksanaan sekolah bertaraf internasional dimulai sejak tahun pelajaran 2008/2009. Pada tahun pelajaran 2013/2014, Saint John's Catholic School telah memasuki tahun keenam dalam pelaksanaan program sekolah internasional. Sesuai dengan fokus penelitian dalam penelitian ini, yaitu implementasi kurikulum internasional *Cambridge* dan dampaknya terhadap pengelolaan pembelajaran biologi di Saint John's Catholic School, hasil deskriptif yang berkaitan dengan fokus penelitian dijabarkan sebagai berikut:

#### **1. Implementasi Kurikulum *Cambridge* di Saint John's Catholic School Semarang Bidang Studi Biologi**

Implementasi kurikulum adalah proses pembimbingan perkembangan siswa, mencapai tujuan pembelajaran yang diidamkan/dicitakan. Implementasi kurikulum *Cambridge* yang diterapkan di Saint John's Catholic School dideskripsikan melalui keterterapan silabus *Cambridge* dan karakteristik pengelolaan pembelajaran Biologi.

Hasil wawancara dengan Kepala Sekolah mengungkapkan bahwa keterterapan silabus *Cambridge* di Saint John's Catholic School bidang studi biologi sangat tinggi. Pengalokasian waktu untuk mengajar setiap *core* (materi ajar) di Saint John's Catholic School sangat baik, sehingga mampu mengefektifkan kegiatan pembelajaran dengan maksimal (wawancara, 5 Mei 2014). Hasil dokumentasi pada silabus *Cambridge* di Saint John's Catholic School mendukung pernyataan informan yang memperlihatkan pada setiap *section* memiliki tingkat keterterapan yang tinggi (lampiran 2).

*Section I core* terlaksana mencakup sebagian besar tujuan pembelajaran mengenai *characteristic and classification of living organisms, classification and diversity, adaptation of organism*, dan

*simple keys. Core tidak terlaksana pada section I terdapat pada sub-section classification and diversity yakni pada tujuan pembelajaran list the main features of the vertebrates.*

Hasil dokumentasi pada *section II* menunjukkan *Core* yang terlaksana mencakup sebagian besar tujuan pembelajaran mengenai *cell structure and organization, levels of organization, size of specimens, movement in and out cells, enzymes, nutrition, transportation, respiration, excretion in humans, coordination and response*. *Core* yang tidak terlaksana pada *section II* terdapat pada sub-section *cell structure and organization, levels of organization* pada tujuan pembelajaran *define the living organism are made of cell, define tissue as a group of cell*. *Core* yang tidak terlaksana pada *section II* terdapat pada sub-section *enzymes*, pada tujuan pembelajaran *define enzymes as proteins that function as biological catalyst*. *Core* yang tidak terlaksana pada *section II* terdapat pula pada sub-section *nutrition*, pada tujuan pembelajaran *state the word equation of simple photosynthesis, define world food supplies, define ingestion, define digestion, define peristalsis movement, state the absorption, describe the role of fat* dan *describe the structure of villus*. *Core* yang tidak terlaksana pada *section II* terdapat pula pada sub-section *transportation*, pada tujuan pembelajaran *state the function of xylem and floem, state the water uptake* dan *name the main blood vessel*. *Core* yang tidak terlaksana pada *section II* terdapat pula pada sub-section *respiration* pada tujuan pembelajaran *state the aerobic and anaerobic respiration*. *Core* yang tidak terlaksana pada *section II* terdapat pada sub-section *coordination and response*, pada tujuan pembelajaran *state the role of hormone adrenaline, identify picture of skin lining* dan *define a drug as substance*.

Hasil dokumentasi pada *section III* memperlihatkan *Core* yang terlaksana mencakup sebagian besar tujuan pembelajaran mengenai *reproduction, growth and development* dan *inheritance*. *Core* yang tidak terlaksana pada *section III* terdapat pada sub-section *reproduction* pada tujuan pembelajaran *state the function of sexual reproduction in plants, name the agent of pollination* dan *state the function of placenta*. *Core* yang

tidak terlaksana pada *section III* terdapat pula pada sub-*section inheritance*, pada tujuan pembelajaran *define haploid* dan *state the role of mitosis*.

Hasil dokumentasi pada *section IV* menunjukkan *Core* yang terlaksana mencakup sebagian besar tujuan pembelajaran mengenai *energy flow, food chains and food webs, nutrient cycle, population size, human influence, pollution* dan *conservation*. *Core* yang tidak terlaksana pada *section IV* terdapat pada sub-*section nutrient cycle* pada tujuan pembelajaran *state the nitrogen cycle*. *Core* yang tidak terlaksana pada *section IV* terdapat pula pada sub-*section pollution*, pada tujuan pembelajaran *describe the effect of water pollution*.

Berdasarkan wawancara, kajian dokumen dan hasil observasi mengenai keterterapan silabus Biologi dapat disimpulkan bahwa keterterapan silabus *Cambridge* di Saint John's Catholic School bidang studi biologi sangat tinggi. Konten silabus biologi *Cambridge* diajarkan dengan efektif dan efisien di Saint John's Catholic School, sehingga kurikulum *Cambridge* benar-benar menjadi *documented curriculum/kerangka pembelajaran* yang diidamkan. Silabus *Cambridge* menjadi *documented curriculum* yang unggul karena memiliki aspek *section* yakni tema besar materi, *core* yakni materi ajar, dan *supplement* yaitu perangkat operasional untuk menambah pemahaman. Pada silabus biologi Saint John's Catholic School keunggulan terdapat pada aspek *learning outcome* yang berfungsi untuk memusatkan sasaran tujuan pembelajaran.

Kegiatan belajar mengajar juga mencerminkan implementasi kurikulum. Pengelolaan pembelajaran internasional dalam sekolah Saint John's Catholic School melalui observasi terbagi atas *lecture class* dan *tutorial class*. Melalui observasi terhadap *lecture class*, menunjukkan seluruh siswa dikumpulkan pada kelas yang besar (auditorium), kemudian para peserta didik akan dijelaskan materi secara umum, seperti karakteristik dan klasifikasi makhluk hidup, tujuan materi dan contoh soal/aplikasi sederhana. Melalui observasi terhadap *tutorial class*

menunjukkan kelas dirancang menjadi kelas kecil (13 siswa), para peserta didik belajar secara aktif dan dibimbing seorang guru bidang studi. Proses pembelajaran di kelas meliputi diskusi secara kelompok (*discussion*), presentasi (*presentation*) dengan menggunakan *LCD projector* dan *power point/flash*, pembahasan *project/home assignment*, *simulation* dan *quiz*, atau *role-playing* (permainan) serta *experimental (lab work)*.

Informasi diatas didukung oleh pendapat Guru Biologi Mr. S yakni kelas terbagi atas *lecture class* dan *tutorial class* dengan jumlah tatap muka dalam *lecture class* dilakukan minimal satu kali dalam sebulan. Jumlah tatap muka lebih banyak dialokasikan pada *tutorial class* sehingga siswa dapat dibimbing lebih intensif oleh guru (wawancara, 12 Mei 2014). Kegiatan belajar mengajar bidang studi biologi dilaksanakan satu kali dalam seminggu dengan durasi dua jam pelajaran (150 menit/jam pelajaran).

Karakteristik pengelolaan pembelajaran kurikulum *Cambridge* meliputi program, penyelenggaraan sekolah, kegiatan belajar mengajar, tenaga pendidik, dan sarana prasarana di Saint John's Catholic School diperoleh melalui observasi, dokumentasi dan wawancara. Data observasi mengenai karakteristik pengelolaan pembelajaran di Saint John's Catholic School Semarang dapat disimak pada Tabel 4.

Tabel 4 Karakteristik Pengelolaan Pembelajaran di Saint John's Catholic School Semarang

No	Karakteristik	Pelaksanaan di Saint John's Catholic School
1	Program	Pengakuan Internasional dibuktikan dengan sertifikasi dan akreditasi berpredikat baik dari Cambridge (lampiran 7).
2	Sekolah	<ul style="list-style-type: none"> <li>a. Terakreditasi A+ dari Badan Akreditasi Sekolah</li> <li>b. Sekolah Kategori Mandiri (SKM)</li> <li>c. Meraih sertifikat ISO 9001 versi 2000 dibuktikan dengan sertifikat (lampiran 7)</li> <li>d. Menjalin hubungan "<i>sister school</i>" dengan Goethe Institut dibuktikan dengan sertifikat (lampiran 7)</li> <li>e. Penyelenggaraan sekolah 1 shift (tidak double shift)</li> </ul>
3	Proses Belajar Mengajar	<ul style="list-style-type: none"> <li>a. Diperkaya dengan model proses pembelajaran sekolah unggul dari Cambridge dibuktikan dengan dokumentasi (lampiran 7)</li> <li>b. Menerapkan pembinaan dan pembelajaran berbasis TIK pada semua mata pelajaran dibuktikan dengan dokumentasi (lampiran 7)</li> <li>c. Pembelajaran kelompok sains, matematika, dan inti kejuruan menggunakan bahasa Inggris, sementara pembelajaran mata pelajaran lainnya dapat menggunakan bahasa pengantar yang disepakati</li> </ul>
4	Pendidik	<ul style="list-style-type: none"> <li>a. Semua guru mampu memfasilitasi pembelajaran berbasis TIK dibuktikan dengan dokumentasi (lampiran 7)</li> <li>b. Guru kelompok mata pelajaran sains, matematika, dan inti kejuruan mampu mengampu pembelajaran dengan berbahasa Inggris</li> <li>c. 40% guru berpendidikan S2 dari perguruan tinggi yang program studinya berakreditasi A dibuktikan dengan arsip daftar guru dan karyawan (lampiran 6)</li> </ul>
5	Kepala Sekolah	<ul style="list-style-type: none"> <li>a. Kepala sekolah berpendidikan S2 dari perguruan tinggi yang program studinya berakreditasi A dan telah menempuh pelatihan kepala sekolah dari lembaga yang diakui oleh Pemerintah dibuktikan dengan darsip daftar guru dan karyawan.</li> <li>b. Kepala sekolah mampu berbahasa Inggris secara aktif dan mampu mengoperasikan komputer</li> <li>c. Kepala sekolah bervisi internasional, mampu membangun jejaring internasional, memiliki kompetensi manajerial, serta jiwa kepemimpinan dan entrepreneur yang kuat.</li> <li>d. Memiliki SK Pengangkatan dari pejabat yang berwenang</li> </ul>
6	Sarana dan Prasarana	<ul style="list-style-type: none"> <li>a. Setiap ruang kelas dilengkapi dengan sarana pembelajaran berbasis TIK dibuktikan dengan dokumentasi (lampiran 7)</li> <li>b. Perpustakaan dilengkapi dengan sarana digital yang memberikan akses ke sumber pembelajaran berbasis TIK di seluruh dunia dibuktikan dengan dokumentasi (lampiran 7)</li> <li>c. Memiliki 3 laboratorium IPA (Fisika, Kimia, Biologi) dibuktikan dengan dokumentasi (lampiran 7)</li> <li>d. Memiliki laboratorium komputer dan akses internet dibuktikan dengan dokumentasi (lampiran 7)</li> <li>e. Memiliki web Sekolah dibuktikan dengan dokumentasi (lampiran 7)</li> <li>f. Tersedia ruang kelas yang sesuai dengan rombongan belajar (peserta didik 13 orang) dibuktikan dengan dokumentasi (lampiran 7)</li> <li>g. Memiliki kultur sekolah yang baik (bersih, bebas asap rokok, bebas kekerasan, rindang) dibuktikan dengan dokumentasi (lampiran 7)</li> </ul>

\*Data selengkapnya disajikan pada lampiran 5

Hasil observasi pada Tabel 4 menunjukkan karakteristik yang unggul dalam pengelolaan pembelajaran di Saint John's Catholic School Semarang. Hasil ini diperkuat dengan dokumentasi sertifikat pengakuan internasional dari *Cambridge*, sertifikat ISO 9001 versi 2000, sertifikat "sister school" dengan Goethe-Institut Jerman, arsip daftar guru dan karyawan dan dokumentasi foto proses belajar mengajar serta sarana prasarana (lampiran 7). Wawancara dengan Koordinator Bidang Kurikulum IGCSE mendukung pula hasil observasi dan dokumentasi. Melalui hasil wawancara diketahui bahwa Saint John's Catholic School memiliki program yang berpredikat baik, sekolah yang terakreditasi, mandiri dan menjalin kerjasama dengan Geothe-Institut, kegiatan belajar mengajar yang menggunakan model internasional. Tenaga pendidik dan kepala sekolah berkualifikasi baik yakni mampu menggunakan TIK, mampu berbahasa Inggris aktif dan berpendidikan S2 dari perguruan tinggi terkemuka. Saint John's Catholic School juga memiliki sarana prasarana lengkap untuk menunjang proses pembelajaran (wawancara, 19 Mei 2014).

Berdasarkan observasi, kajian dokumen dan wawancara terlihat bahwa Saint John's Catholic School memiliki program, penyelenggaraan sekolah, kegiatan belajar mengajar, tenaga pendidik, dan sarana prasarana berkualitas internasional. Adaptasi dan adopsi kurikulum *Cambridge* di Saint John's Catholic School diiringi dengan sumber daya pendidik dan kelengkapan fasilitas yang memadai untuk pengimplementasian kurikulum *Cambridge* yang menekankan pada kerja ilmiah.

## **2. Dampak implementasi kurikulum *Cambridge* di Saint John's Catholic School Semarang.**

Dampak implemementasi kurikulum *Cambridge* tampak dalam prestasi belajar siswa. Prestasi belajar merupakan penilaian pendidikan tentang perkembangan dan kemajuan peserta didik yang berkenaan dengan penguasaan bahan pelajaran serta nilai-nilai yang terdapat dalam kurikulum. Prestasi belajar siswa diperoleh melalui wawancara, observasi dan dokumentasi kepada Kepala Bagian Pendidikan Menengah (Kabag

Dikmen) Kota Semarang dan Kepala Sekolah Saint John's Catholic School yang disajikan pada Tabel 5.

Tabel 5 Prestasi Belajar di Saint John's Catholic School

No	Apek-aspek Prestasi	Prestasi Saint John's Catholic School
1	Ujian Nasional 2011-2013	Rata-rata nilai 32.66, 32.74, 32.96 untuk 4 mata pelajaran. Bidang studi IPA khususnya, rata-rata nilai 8.17, 8.25, 8.43. Persentase kelulusan UN 2011-2013 100%.
2	Prestasi akademik di bidang studi Biologi	<i>Finalistbig 5 Science Competition</i> in Swiss German University pada tahun 2013, <i>finalistbig 10 Academic Excellence in Washington</i> pada tahun 2013. <i>Reporting and Grading</i> dengan rata-rata Apadasiswa Saint John's Catholic School bidang studi Biologi (lampiran 15).
3	<i>Input/</i> siswa yang masuk	Sekolah Pelita Harapan International, St. Ignatius International School, Global Jaya International School dll.
4	<i>Output/</i> kelulusan sertifikasi Cambridge	100 %
5	<i>Outcome/</i> penerimaan ke jenjang lebih lanjut	Oklahoma State University, Goethe Institut, Singapore Instute, National Chi Nan University. Alumni Saint John's Catholic School diterima pula di universitas terkemuka dalam negeri antara lain Universitas Gajah Mada, Universitas Tarumanegara dan lainnya dibuktikan dengan <i>testimony</i> alumni (lampiran 12).

\*Data selengkapnya disajikan pada lampiran 10

Hasil observasi menunjukkan prestasi yang diraih siswa Saint John's Catholic School sangat tinggi. Hasil ini sesuai dengan hasil wawancara yang diungkap Kepala Bagian Pendidikan Menengah Kota Semarang dalam wawancara pada tanggal 15 April 2014 sebagai berikut:

“Rata-rata nilai siswa Saint John's Catholic School tahun 2011-2014 sangat baik yaitu 32.66, 32.74, 32.96 untuk 4 mata pelajaran. Bidang studi IPA, rata-rata nilainya 8.17, 8.25, 8.43. Persentase kelulusan UN 2011-2013 selalu 100%.” (lampiran 12)

Kajian dokumentasi mengenai hasil Ujian Nasional, *grading and reporting, input, output* dan *outcome* menunjukkan kualitas siswa Saint John's Catholic School yang diakui kualitasnya, baik di tingkat nasional dan internasional.

Berdasarkan wawancara, kajian dokumen dan observasi, prestasi yang diraih siswa Saint John's Catholic School memang sangat tinggi. Prestasi didapatkan karena siswa dan guru mengedepankan nilai-nilai inkuiri, memiliki kreatifitas dan minat yang tinggi dalam mata pelajaran IPA, khususnya biologi.

## B. Pembahasan

### 1. Implementasi Kurikulum *Cambridge* di Saint John's Catholic School Bidang Studi Biologi

Keterlaksanaan kurikulum *Cambridge* yang ditunjukkan dari hasil dokumentasi silabus Biologi *Cambridge* di Saint John's Catholic didukung dengan lembar observasi terhadap aspek *core* (materi ajar) silabus *Cambridge* yang sudah ditetapkan *Cambridge International Examinations* (CIE). Pemberian tanda cek (✓) pada setiap *core* pelaksanaan bahan ajar silabus *Cambridge* pada lembar observasi silabus (lampiran 2). Data mengenai karakteristik pengelolaan pembelajaran kurikulum *Cambridge* program, penyelenggaraan sekolah, kegiatan belajar mengajar, tenaga pendidik, dan sarana prasarana di Saint John's Catholic School diperoleh melalui observasi, dokumentasi dan wawancara. Pendokumentasian data tersebut terdapat pada lembar lampiran 7 dan memberikan tanda cek (✓) pada instrumen observasi karakteristik pengelolaan pembelajaran kurikulum *Cambridge* (lampiran 17).

Keterlaksanaan silabus biologi kurikulum *Cambridge* yang tinggi dikarenakan konten silabus *Cambridge* di Saint John Catholic School memuat nilai-nilai inkuiri. Yulaelawati (2004) menyatakan bahwa silabus merupakan seperangkat rencana yang disusun secara sistematis memuat komponen-komponen yang saling berkaitan untuk mencapai penguasaan kompetensi dasar. Silabus *Cambridge* di Saint John Catholic School juga di desain dengan aplikatif, komprehensif dan integral dengan adanya komponen *learning outcome* (tujuan pembelajaran) dan *supplement* (perangkat operasional untuk menambah pemahaman) yang saling berkaitan sehingga peserta didik mampu mencapai kompetensi yang diharapkan.

Keterlaksanaanya penyampaian *core* silabus Biologi yang tinggi didukung dengan *lesson plan* Biologi di Saint John's Catholic School yang berkualitas. Hasil observasi menunjukkan terdapat aspek *big idea* dan *importance* yang mudah dan mendasar, seperti siswa memahami akibat perbedaan struktur DNA dalam evolusi.



Aspek-aspek dalam *lesson plan* Biologi di Saint John's Catholic School membantu guru dan siswa memahami penerapan pembelajaran secara praktis, sesuai dengan pendapat Kunandar (2007) *lesson plan* membantu guru dan siswa melihat makna dalam bahan pelajaran yang mereka pelajari. Aspek *big idea* yaitu suatu keterampilan dan pengetahuan mengenai *core* yang akan dipelajari siswa. *Big idea* dalam kurikulum Cambridge tercapai melalui kegiatan diskusi dan *problem-solving* sehingga menjadi kegiatan pembelajaran *student centered active learning*. *Big idea* merupakan aspek yang penting karena siswa melakukan pembelajaran secara kontekstual. Siswa juga mampu berpikir kritis dan independen tidak hanya terkait materi, namun juga kemampuan untuk berpikir kreatif, inkuiri, memecahkan masalah melalui diskusi maupun tugas yang berhubungan dengan kehidupan sehari-hari. Contoh masalah dapat dilihat pada *lesson plan characteristic and classification living organism* yakni adanya *big task about problem in vital functions* (lampiran 3).

Hasil observasi diperkuat dengan wawancara dengan Koordinator Bidang Kurikulum Cambridge yang menyatakan aspek *Importance* dalam *lesson plan* biologi di Saint John's Catholic School adalah target pembelajaran yang memberi arahan bagi guru dan siswa untuk mencapai *big idea*. Aspek *essential questions (EQ)* adalah pertanyaan-pertanyaan untuk mencapai *big idea*. *EQ* menstimulasiswa untuk mengklarifikasikan teori dengan kehidupan sehari-hari dan meningkatkan inkuiri siswa (wawancara, 28 Mei 2014). Hal ini sesuai dengan pendapat Dewey (2005) yakni pembelajaran dikatakan berkualitas bila menekankan daya pikir yang tinggi, transfer ilmu pengetahuan, mengumpulkan dan menganalisis data, memecahkan masalah-masalah aplikatif baik secara individu maupun kelompok.

Koordinator Bidang Kurikulum Cambridge juga mengungkapkan terdapat pula aspek *grade level expectations (GLE)* yang dengan terbagi atas aspek *student will know (SWK)* dan *student will be able to (SWBAT)* yakni pengetahuan dan keterampilan yang diperoleh siswa setelah kegiatan

pembelajaran. Aspek strategi pembelajaran juga beragam, sehingga dapat meningkatkan keaktifan siswa seperti yang tertera dalam *lesson plan* Biologi di Saint John's Catholic School, presentasi dengan *power point*, penerapan metode *jig saw*, serta diskusi kelompok (wawancara, 28 Mei 2014). Strategi ini sesuai dengan pendapat Silberman (2009) yaitu strategi pembelajaran aktif menjadikan siswa berpartisipasi aktif dalam kegiatan belajar, memiliki kreatifitas dan minat yang tinggi dalam suatu mata pelajaran.

Menurut Pandoyo (2006) tujuan asesmen adalah meningkatkan aktivitas belajar, mendorong siswa mampu bekerja sendiri dan membimbing siswa secara baik ke arah pengembangan konsep. Tujuan tersebut sesuai dengan aspek penilaian didalam *lesson plan* kurikulum Cambridge berupa tes, esai, kegiatan diskusi dan tugas rumah dalam bentuk *project*. Contoh *project* yang dilakukan siswa terlihat pada *lesson plan core natural selection* yakni siswa mampu membuat simulasi seleksi antara ngengat berwarna cerah dan gelap dalam *pepper moth activity* (lampiran 4). Soal ujian Cambridge (lampiran 16) selain mencantumkan skor tiap soal sehingga nilai bersifat transparan, konsisten dan reliable, siswa juga diperbolehkan menggunakan kalkulator, agar siswa lebih fokus untuk belajar pemecahan masalah, daya nalar, logika, dan analisa.

Hasil dokumentasi pada lembar asesmen siswa (lampiran 18) menjabarkan mengenai penilaian ranah *knowledge with understanding, handling information and problem solving, experimental skills and investigation*. Penilaian ranah *knowledge with understanding* meliputi penilaian ujian, tugas kelompok dan nilai *project* individu. Penilaian ranah *handling information and problem solving* yakni keaktifan siswa dalam berkomentar baik dalam bentuk saran, prediksi atau penjelasan mengenai permasalahan dari topik pembelajaran. Penilaian ranah *experimental skills and investigation* meliputi kemampuan melakukan kerja ilmiah yakni merancang, membuat serta mendemonstrasikan eksperimen yang berkaitan dengan materi pelajaran.

Hasil observasi menunjukkan bahwa tidak terlaksananya penyampaian *core* silabus Biologi dikarenakan *core* tersebut telah terangkum dalam tugas *project* yang dilakukan siswa diluar jam pelajaran. Hasil *project* akan menjadi asesmen untuk mengukur pemahaman siswa tentang *core* yang tidak diajarkan tersebut, apabila siswa mengalami *misconceptions* maka sebelum awal *core* selanjutnya diadakan konfirmasi.

Efektivitas pengelolaan pembelajaran terlihat dari hasil observasi yang menunjukkan karakteristik Saint John's Catholic School telah sesuai dengan indikator-indikator yang diperlukan sebagai sekolah internasional, sehingga menunjang keoptimalan proses kegiatan belajar mengajar. Efektivitas ini sejalan dengan pernyataan Bass *et al* (1996) yaitu peranan kurikulum sebagai *implemented curriculum* adalah pengelola pembelajaran topik/materi pembelajaran secara efektif untuk mencapai *documented curriculum*. Faktor-faktor atau komponen-komponen sebagai syarat sekolah internasional (Departemen Pendidikan Nasional 2007) telah dilengkapi oleh Saint John's Catholic School antara lain siswa yang aktif, guru yang profesional, kurikulum yang dinamis, sarana dan prasarana yang lengkap, pengelolaan sekolah yang baik, dan proses belajar mengajar yang terorganisir.

Kurikulum sebagai ranah *implemented curriculum* terlihat pada cara guru menggunakan buku teks dan teknologi. Buku sumber yang wajib adalah *Cambridge IGCSE Biology Coursebook*. Buku teks dipublikasi langsung oleh *Cambridge press*, sehingga materi ajar yang terdapat di buku teks berisi seluruh konten silabus *Cambridge*. Buku teks Biologi terbitan *Cambridge press* terdiri dari teori untuk menambah pemahaman siswa, *questions* sebagai umpan balik sejauh mana siswa telah memahami pembelajaran dan *practical* sebagai pedoman praktikum. Guru di Saint John's Catholic School menggunakan teknologi dengan sangat maksimal terlihat dari pembelajaran yang bervariasi selain *power point* dan mikroskop ada pula *flash* dan setiap pembelajaran menggunakan fasilitas internet untuk menambah referensi baik dari jurnal maupun artikel elektronik.

Hasil observasi menunjukkan siswa aktif di dalam kelas karena pengetahuan dialami, dipelajari, dan ditemukan oleh siswa. Siswa melakukan sesuatu untuk memahami materi pelajaran (membangun pemahaman), mengkomunikasikan sendiri hasil pemikirannya di depan kelas, dan siswa mampu berpikir reflektif. Siswa juga aktif mengikuti kegiatan/perlombaan akademik dan non-akademik. Hasil ini sesuai dengan pendapat Suparno (1997) yang mengatakan bahwa pengetahuan yang abadi tidak diterima siswa secara pasif, melainkan dikonstruksi secara aktif oleh siswa, gagasan-gagasan atau pemikiran-pemikiran guru tidak dapat dipindahkan langsung kepada siswa.

Guru profesional adalah guru yang mentransformasikan kemampuan profesional kedalam tindakan persiapan, pelaksanaan, dan evaluasi pengajaran (Suryasubroto 2002). Keprofesionalan di Saint John's Catholic School terlihat dalam penyusunan program pengajaran sesuai tahap perkembangan anak, penyiapan pengajaran, penggunaan bahan-bahan ajar mengelola kegiatan belajar murid dan pelaksanaan evaluasi belajar. Undang-Undang Nomor 14 Tahun 2005 tentang guru yang menegaskan bahwa guru wajib memiliki kualifikasi akademik, sosial dan kompetensi. Tenaga pengajar di Saint John's Catholic School merupakan lulusan universitas ternama, sehingga kemampuan kompetensi, sosial dan pedagogik sangat baik. Hasil observasi menunjukkan guru Biologi khususnya berjumlah empat orang pada jenjang *Secondary*, yakni Ms. YA serta Mr. SU merupakan lulusan dari Universitas Pendidikan Indonesia, dan Mr. AR serta Ms. HH merupakan lulusan dari Universitas Pelita Harapan dengan rata-rata pengalaman mengajar selama empat tahun. Kualifikasi tenaga laboran di Saint John's Catholic School telah terseleksi dengan baik sehingga memenuhi standar Permendiknas 26 tahun 2008 yakni kompetensi kepribadian, sosial, administrasi dan profesional. Tenaga laboran adalah Mr. BM yang merupakan lulusan Geothe-Institut Jerman dan HS yang merupakan lulusan Universitas Pelita Harapan.

Permendiknas Nomor 24 dan Departemen Pendidikan Nasional (2007) memberikan pedoman mengenai kebutuhan sarana dan prasarana yang

harus tersedia karena kelengkapan sarana dan prasarana yang baik sangat menunjang aktivitas pembelajaran. Saint John's Catholic School memiliki sarana prasarana yang terdiri dari laboratorium fisika, kimia, biologi, laboratorium komputer dan laboratorium audiovisual, gedung olahraga (*indoor* dan *outdoor*), perpustakaan, kolam renang, ruang musik, ruang seni, ruang masak, ruang tari, kapel, lift, aula, dan mobil sekolah.

Sarana prasarana yang menunjang pembelajaran biologi khususnya adalah laboratorium biologi. Saint John's Catholic School memfasilitasi berbagai macam peralatan dan bahan antara lain torso, meja permanen, wastafel, mikroskop, LCD, pemadam kebakaran, lemari alat, meja demonstrasi, meja guru, meja kerja dan lemari asam. Kelengkapan ini sesuai dengan pernyataan Widyarti (2005) yang menyatakan laboratorium adalah suatu ruangan tempat melakukan kegiatan praktek atau penelitian yang ditunjang oleh adanya seperangkat alat-alat laboratorium serta adanya infrastruktur laboratorium yang lengkap. Berdasarkan hasil observasi frekuensi siswa belajar di laboratorium adalah 50% dan frekuensi siswa belajar di kelas 40%, dan 10% siswa belajar di luar ruang kelas maupun lab, seperti taman sekolah maupun *study tour* ke objek wisata. Siswa belajar di ruang kelas saat *lecture class* kemudian saat dibagi kedalam *tutorial class*, pembelajaran Biologi lebih banyak didalam laboratorium untuk memudahkan dalam melakukan pembuktian suatu materi ajar melalui alat-alat yang tersedia di dalam laboratorium sehingga setiap anak difasilitasi dengan satu mikroskop. Intensitas pemakaian laboratorium Biologi adalah dua kali dalam sebulan untuk setiap *grade*.

Pengelolaan Saint John's Catholic School meliputi situasi dan kondisi kelas yang kondusif dan nyaman, pengaturan jadwal pengajaran secara tepat dalam setiap periode, pengelolaan siswa dengan kegiatan kerohanian berkala dan ruang konseling, tata tertib yang telah disepakati oleh semua pihak sebagai satu acuan kedisiplinan dalam belajar dan bekerja. Proses belajar mengajar yang terorganisir di Saint John's Catholic School sehingga efektifnya pendayagunaan alat/fasilitas dan kegiatan pembelajaran sesuai alokasi waktu yang ditetapkan.

Keterlaksanaan kurikulum *Cambridge* yang tinggi tentunya berbanding lurus dengan proses guru mengajarkan silabus *Cambridge*. Menurut Cambridge International Examination (2012), materi silabus Biologi ini dialokasikan dalam waktu yang lama yakni dua tahun, dengan pembagian materi yaitu *section* I dan II untuk *secondary* 1 serta materi *section* III dan IV untuk *secondary* 2. Kegiatan belajar mengajar dilaksanakan satu kali dalam seminggu dengan durasi dua jam pelajaran (150 menit/jam pelajaran). Alokasi waktu yang lama inilah memungkinkan guru dan siswa untuk melakukan langkah-langkah pembelajaran yang konseptual antara lain riset pustaka, eksplorasi dan eksperimen. Langkah-langkah ini sejalan dengan pendapat Gagne (1979) yang mendefinisikan proses pembelajaran sebagai “*a set events embedded in purposeful activities that facilitate learning*”. Aktifitas yang sengaja diciptakan dengan maksud untuk memudahkan terjadinya proses belajar, sehingga proses pembelajaran di kelas siswa memiliki antusias yang sangat tinggi ketika melaksanakan pembelajaran. Hal ini dibuktikan oleh hampir seluruh siswa di dalam kelas secara serius mengungkapkan gagasannya atas permasalahan yang diberikan dalam bentuk presentasi di depan kelas dan berargumentasi. Penguatan materi pembelajaran ditambah dengan tugas mengenai permasalahan yang terjadi dalam kehidupan sehari-hari yang terkait dengan materi pembelajaran.

Peran guru dalam pengelolaan pembelajaran kurikulum adalah melakukan perencanaan pembelajaran (desain instruksional) yang harus memperhatikan kondisi yang ada dalam diri siswa dan kondisi yang ada di luar diri siswa (Gagne 1979). Kesesuaian peran guru dengan teori Gagne terlihat dalam hasil observasi di Saint John’s Catholic School, yakni guru memastikan terciptanya pengalaman belajar pada anak didik dengan menjelaskan setiap *core* (materi ajar) serta kegiatan diskusi sesuai dengan pada karakteristik, visi dan misi sekolah, serta sesuai dengan pengalaman belajar yang dibutuhkan siswa. Menurut Sagala (2003) guru mampu menguasai sepenuhnya bahan dan materi ajar, metode dan penggunaan alat dan perlengkapan pembelajaran, menyampaikan kurikulum atas dasar

bahasan dan mengelola alokasi waktu yang tersedia dan membelajarkan siswa sesuai yang diprogramkan, sejalan dengan pengorganisasian kegiatan pembelajaran yang ditunjukkan dalam *lesson plan* guru Biologi di Saint John's Catholic School.

Hasil observasi *lesson plan* Biologi menunjukkan bahwa pada awal pelajaran guru mengulang pembelajaran sebelumnya agar mampu mengkaitkan dengan materi selanjutnya. Hal ini sesuai dengan tujuan pengembangan siswa yang menekankan terbangunnya pemahaman sendiri secara aktif, kreatif, dan produktif berdasarkan pengetahuan terdahulu dan dari pengalaman belajar yang bermakna (Muslich 2007). Menurut Sagala (2003), guru harus mengkomunikasikan rencana-rencana dan keputusan-keputusan yang berkaitan dengan pembelajaran kepada pihak yang berkepentingan, hal ini sejalan dengan hasil observasi di Saint John's Catholic School yakni pada awal pembelajaran guru menyatakan tujuan dan isi pelajaran yang akan disampaikan. Guru menentukan strategi pembelajaran dan asesmen untuk mengukur pemahaman siswa. Branch (2002), menyatakan bahwa evaluasi untuk mengembangkan pendidikan dilaksanakan dengan cara yang konsisten dan reliable, hal ini searah dengan bentuk ujian *Cambridge* yang mencantumkan skor per soal, sehingga skor transparan, konsisten dan reliable. Keunggulan lain dari *lesson plan* ini adalah pada akhir pembelajaran guru mengkonfirmasi *misconceptions* yang umum ditemui, kemudian melakukan *review* melalui pertanyaan sebagai *ticket out the door*.

Keunggulan pengelolaan pembelajaran terlihat dari kegiatan penunjang materi dipilih dengan cermat sehingga menarik dan bisa menambah pengetahuan siswa. Contoh dalam *lesson plan* (lampiran 3) terdapat kegiatan eksplorasi *watch the march of the Penguins trailer-students have to list all the different adaptations mentioned*. Ketika siswa mempelajari *core natural selection*, siswa dimotivasi untuk membuat hubungan-hubungan antara pengetahuan dan aplikasinya. Pembelajaran ini sesuai dengan pendapat Dewey (2005) yakni siswa belajar dengan baik

jika apa yang dipelajari terkait dengan apa yang telah diketahui dengan kegiatan atau peristiwa yang terjadi disekelilingnya.

Menurut Sagala (2003) asesmen mengandung proses yang rasional, dan sifat optimisme yang didasarkan atas kepercayaan bahwa akan dapat mengatasi berbagai macam permasalahan dalam konteks realita. Asesmen dalam *lesson plan* biologi menunjukkan bahwa adanya proses berpikir rasional dan optimis yang ditunjukkan dalam *project activity* (lampiran 4) dan ujian (lampiran 16) yang menekankan pada analisis. Contoh soal ujian (lampiran 16) terdapat tabel *volume of air in lungs per seconds at rest and vigorous exercise*, dengan perintah agar siswa *state and calculate how many breath are taken and volume of oxygen are absorbed in one minute at rest*, melalui soal ini siswa diajak berpikir menggunakan kemampuan *high order thinking* (HOT). Soal ini dirancang untuk menghubungkan pengetahuan mengenai volume dan kapasitas paru-paru dengan analisis yang disertai penghitungan saat kondisi istirahat dan latihan, sehingga siswa diharapkan memiliki pemahaman yang mendalam bukan sekedar menghafal pengertian dan teori. Proses belajar mengajar terbagi atas dua sesi yakni *lecture class* yakni kelas yang menjelaskan materi secara umum dan *tutorial class* meliputi diskusi secara kelompok (*discussion*), presentasi (*presentation*) dengan menggunakan *LCD projector* dan *power point/flash*, pembahasan *project/home assignment*, *simulation* dan *quiz*, atau *role-playing* (permainan) serta *experimental (lab work)*.

Hasil observasi, wawancara dan dokumentasi menunjukkan bahwa keterterapan silabus *Cambridge* dan karakteristik pengelolaan pembelajaran biologi sangat baik. Hasil ini diperkuat oleh program yang berpredikat baik, sekolah yan terakreditasi, mandiri dan menjalin kerjasama dengan Geothe-Institut, kegiatan belajar mengajar yang unggul, tenaga pendidik dan kepala sekolah yang berkualifikasi baik dan memiliki sarana prasarana lengkap.



## **2. Dampak implementasi kurikulum *Cambridge* di Saint John's Catholic School Semarang.**

Pengaruh implementasi kurikulum *Cambridge* dibuktikan dengan prestasi belajar siswa Saint John's Catholic School yang terangkum dalam Ujian Nasional, prestasi akademik siswa, *grading and reporting*, *output/outcome* siswa, hal ini sesuai dengan pernyataan Bass *et al* (1996) yaitu peranan kurikulum sebagai *achieved curriculum* berupa pencapaian siswa dalam hasil belajar.

Hasil wawancara dengan Dinas Pendidikan Kota Semarang bahwa Diknas memfasilitasi siswa dari sekolah internasional untuk mengikuti UN hanya yang berasal dari kalangan Warga Negara Indonesia (WNI). Pelaksanaan UN bagi siswa sekolah internasional harus menggabung dengan sekolah lain yang terdekat dikarenakan peserta yang mengikuti UN dari Saint John's Catholic School berjumlah tiga siswa pada tahun 2011, lima siswa pada tahun 2012 dan tiga siswa pada tahun 2013. Rata-rata nilai Ujian Nasional di tahun 2011-2013 adalah 32.66, 32.74, 32.96 untuk empat mata pelajaran. Bidang studi IPA khususnya, rata-rata nilai 8.17, 8.25, 8.43. Persentase kelulusan UN 2011-2013 100%.

Prestasi akademik siswa Saint John's Catholic School yang unggul terbukti dari hasil dokumentasi, *grading and reporting* maupun *testimony* alumni. Prestasi yang terekam dalam *grading and reporting* (lampiran 15) siswa *Secondary I* dan *II* menunjukkan siswa mendapat nilai rata-rata A pada setiap ranah yakni *knowledge with understanding*, *handling information and problem solving*, *experimental skills and investigations* di bidang studi biologi. Ranah *knowledge with understanding* bernilai rata-rata A mengindikasikan kemampuan kognitif siswa bernilai rata-rata 80 dalam penguasaan materi. Ranah *handling information and problem solving* bernilai rata-rata A mengindikasikan kemampuan siswa bernilai rata-rata 80 dalam menghubungkan teori yang dipelajari dengan masalah yang terjadi di lingkungan dan ranah *experimental skills and investigations* bernilai rata-rata A mengindikasikan kemampuan untuk melakukan

praktikum dan menyelidiki hal-hal yang berhubungan dengan materi yang diajarkan melalui percobaan bernilai rata-rata 80.

Hasil wawancara dengan Koordinator Kurikulum IGCSE mengungkapkan prestasi lain yakni *input*/siswa yang masuk ke sekolah Saint John's Catholic School berasal dari sekolah internasional terkemuka. Menurut Azwar (2005) prestasi atau keberhasilan belajar dapat dioperasionalkan dalam bentuk-bentuk atau indikator-indikator berupa *output*/kelulusan yang baik, hal ini sesuai dengan angka kelulusan sertifikasi Cambridge yang mencapai 100%. *Outcome*/penerimaan sekolah lulusan Saint John's Catholic School di universitas terkemuka di luar negeri dan dalam negeri. Hasil observasi menunjukkan *input* siswa sangat ketat yakni diperlukannya rapor sekolah sebelumnya dan adanya ujian masuk Saint John's Catholic School untuk menjaga kualitas *output* dan *outcome*.

Taraf kemampuan yang sudah dicapai peserta didik Saint John's Catholic School sesudah mengikuti proses belajar mengajar sebuah materi mengakibatkan perubahan pada tingkah laku, keterampilan serta pengetahuan peserta didik menjadi lebih inkuiri. Prestasi ini mengindikasikan tingginya tingkat keterkaitan siswa di dalam proses belajar mengajar, sehingga materi pelajaran dengan sempurna dapat dipahami oleh peserta didik.

Informasi yang bisa dipelajari dari setiap data dan pemaparan responden tersebut telah memberi bukti secara kolektif (*collective evidence*) tentang implementasi kurikulum *Cambridge* dan dampaknya terhadap pengelolaan pembelajaran Biologi. Ary (2006) menyatakan terdapat hal yang bisa dipelajari (*lesson learnt*) dari temuan-temuan riset kualitatif. Dalam penelitian ini sekurang-kurangnya ada dua hal yang dapat dipelajari dari responden, yaitu:

1. Implementasi kurikulum Cambridge yang diterapkan di Saint John's Catholic School memerlukan kegiatan belajar mengajar dengan model yang mengedepankan *High Order Thinking*, tenaga pendidik yang

berkualitas, dan sarana prasarana yang memadai untuk penyelenggaraan pembelajaran yang berbasis kerja ilmiah

2. Dampak positif dari implementasi kurikulum *Cambridge* di Saint John's Catholic School Semarang didukung oleh tenaga pendidik yang berusaha sebaik mungkin dalam mencapai tujuan pembelajaran yang dirumuskan dalam silabus. Kompetensi yang telah dimiliki siswa dimotivasi oleh guru untuk terus melakukan pengembangan potensi diri setiap peserta didik.

## **BAB V**

### **SIMPULAN DAN SARAN**

#### **A. Simpulan**

Berdasarkan hasil analisis data dan pembahasan hasil penelitian, maka simpulan yang dapat ditarik adalah kurikulum internasional *Cambridge* telah diimplementasikan dengan baik di Saint John's Catholic School, terlihat dari keterterapan silabus *Cambridge* yang tinggi dan model pembelajaran serta kelengkapan telah memenuhi standar sekolah bertaraf internasional. Implementasi kurikulum internasional *Cambridge* di Saint John's Catholic School memiliki dampak yang positif terhadap prestasi sekolah dan belajar siswa.

#### **B. Saran**

Saran untuk sekolah internasional di Indonesia agar mutu pendidikan bisa lebih baik sekiranya perlu diadakan pembenahan beberapa hal antara lain perlunya penyaringan dalam melakukan adopsi dan adaptasi kurikulum internasional agar sesuai dengan kondisi pendidikan negara Indonesia, sehingga siswa sekolah internasional yang mengikuti Ujian Nasional dapat menyesuaikan pelajaran dalam kurikulum nasional dengan baik. Saran lainnya adalah perlunya sekolah internasional membawa dampak positif terhadap mutu pendidikan di Indonesia dengan memberikan saran terhadap sekolah nasional dalam peningkatan kualitas sekolah.

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# LAMPIRAN

**Section I: Characteristics and classification of living organisms**  
(5% of teaching time)

**1. Characteristics of living organisms**

**Core**

- List and describe the characteristics of living organisms
- Define the terms:
  - *nutrition* as taking in of nutrients which are organic substances and mineral ions, containing raw materials or energy for growth and tissue repair, absorbing and assimilating them
  - *excretion* as removal from organisms of toxic materials, the waste products of metabolism (chemical reactions in cells including respiration) and substances in excess of requirements
  - *respiration* as the chemical reactions that break down nutrient molecules in living cells to release energy
  - *sensitivity* as the ability to detect or sense changes in the environment (stimuli) and to make responses
  - *reproduction* as the processes that make more of the same kind of organism
  - *growth* as a permanent increase in size and dry mass by an increase in cell number or cell size or both
  - *movement* as an action by an organism or part of an organism causing a change of position or place

**2. Classification and diversity of living organisms**

2.1 Concept and use of a classificatory system

**Core**

- Define and describe the *binomial system* of naming species as a system in which the scientific name of an organism is made up of two parts showing the genus and species
- List the main features of the following vertebrates: bony fish, amphibians, reptiles, birds and mammals

**Supplement**

- Know that there are other classification systems e.g. cladistics (based on RNA/ DNA sequencing data)
- List the main features used in the classification of the following groups: viruses, bacteria and fungi, and their adaptation to the environment, as appropriate

2.2 Adaptations of organisms to their environment  
(to be illustrated by examples wherever possible)

**Core**

- List the main features used in the classification of the following groups: flowering plants (monocotyledons and eudicotyledons (dicotyledons)), arthropods (insects, crustaceans, arachnids and myriapods), annelids, nematodes and molluscs

<b>3. Simple keys</b>	
<b>Core</b>	
<ul style="list-style-type: none"> <li>Use simple dichotomous keys based on easily identifiable features</li> </ul>	
<b>Section II: Organisation and maintenance of the organism (50% of teaching time)</b>	
<b>1. Cell structure and organisation</b>	
<b>Core</b>	<b>Supplement</b>
<ul style="list-style-type: none"> <li>State that living organisms are made of cells</li> <li>Identify and describe the structure of a plant cell (palisade cell) and an animal cell (liver cell), as seen under a light microscope</li> <li>Describe the differences in structure between typical animal and plant cells</li> </ul>	<ul style="list-style-type: none"> <li>Relate the structures seen under the light microscope in the plant cell and in the animal cell to their functions</li> </ul>
<b>2. Levels of organisation</b>	
<b>Core</b>	
<ul style="list-style-type: none"> <li>Relate the structure of the following to their functions: <ul style="list-style-type: none"> <li>ciliated cells – in respiratory tract</li> <li>root hair cells – absorption</li> <li>xylem vessels – conduction and support</li> <li>muscle cells – contraction</li> <li>red blood cells – transport</li> </ul> </li> <li>Define: <ul style="list-style-type: none"> <li><i>tissue</i> as a group of cells with similar structures, working together to perform a shared function</li> <li><i>organ</i> as a structure made up of a group of tissues, working together to perform specific functions</li> <li><i>organ system</i> as a group of organs with related functions, working together to perform body functions</li> </ul> </li> </ul> <p>using examples covered in Sections II and III</p>	
<b>3. Size of specimens</b>	
<b>Core</b>	
<ul style="list-style-type: none"> <li>Calculate magnification and size of biological specimens using millimetres as units</li> </ul>	

4. Movement in and out of cells	
<p>4.1 Diffusion</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>diffusion</i> as the net movement of molecules from a region of their higher concentration to a region of their lower concentration down a concentration gradient, as a result of their random movement</li> <li>Describe the importance of diffusion of gases and solutes and of water as a solvent</li> </ul>	
<p>4.2 Active Transport</p>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Define <i>active transport</i> as movement of ions in or out of a cell through the cell membrane, from a region of their lower concentration to a region of their higher concentration against a concentration gradient, using energy released during respiration</li> <li>Discuss the importance of active transport as an energy-consuming process by which substances are transported against a concentration gradient, e.g. ion uptake by root hairs and uptake of glucose by epithelial cells of villi</li> </ul>
<p>4.3 Osmosis</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>osmosis</i> as the diffusion of water molecules from a region of their higher concentration (dilute solution) to a region of their lower concentration (concentrated solution), through a partially permeable membrane</li> <li>Describe the importance of osmosis in the uptake of water by plants, and its effects on plant and animal tissues</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Describe and explain the importance of a water potential gradient in the uptake of water by plants</li> </ul>
5. Enzymes	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define the term <i>catalyst</i> as a substance that speeds up a chemical reaction and is not changed by the reaction</li> <li>Define <i>enzymes</i> as proteins that function as biological catalysts</li> <li>Investigate and describe the effect of changes in temperature and pH on enzyme activity</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain enzyme action in terms of the 'lock and key' model</li> <li>Explain the effect of changes in temperature and pH on enzyme activity</li> <li>Describe the role of enzymes in the germination of seeds, and their uses in biological washing products and in the food industry (including pectinase and fruit juice)</li> <li>Outline the use of microorganisms and fermenters to manufacture the antibiotic penicillin and enzymes for use in biological washing powders</li> <li>Describe the role of the fungus <i>Penicillium</i> in the production of antibiotic penicillin</li> </ul>

6. Nutrition	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>nutrition</i> as taking in of nutrients which are organic substances and mineral ions, containing raw materials or energy for growth and tissue repair, absorbing and assimilating them</li> </ul>	
<p>6.1 Nutrients</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>List the chemical elements that make up: <ul style="list-style-type: none"> <li>carbohydrates</li> <li>fats</li> <li>proteins</li> </ul> </li> <li>Describe the synthesis of large molecules from smaller basic units, i.e. <ul style="list-style-type: none"> <li>simple sugars to starch and glycogen</li> <li>amino acids to proteins</li> <li>fatty acids and glycerol to fats and oils</li> </ul> </li> <li>Describe tests for: <ul style="list-style-type: none"> <li>starch (iodine solution)</li> <li>reducing sugars (Benedict's solution)</li> <li>protein (biuret test)</li> <li>fats (ethanol)</li> </ul> </li> <li>List the principal sources of, and describe the importance of: <ul style="list-style-type: none"> <li>carbohydrates</li> <li>fats</li> <li>proteins</li> <li>vitamins (C and D only)</li> <li>mineral salts (calcium and iron only)</li> <li>fibre (roughage)</li> <li>water</li> </ul> </li> <li>Describe the deficiency symptoms for: <ul style="list-style-type: none"> <li>vitamins (C and D only)</li> <li>mineral salts (calcium and iron only)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Describe the use of microorganisms in the food industry, with reference to yoghurt and single cell protein</li> <li>Describe the uses, benefits and health hazards associated with food additives, including colourings</li> </ul>
<p>6.2 Plant nutrition</p>	
<p>6.2.1 Photosynthesis</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>photosynthesis</i> as the fundamental process by which plants manufacture carbohydrates from raw materials using energy from light</li> <li>State the word equation for the production of simple sugars and oxygen</li> <li>Investigate the necessity for chlorophyll, light and carbon dioxide for photosynthesis, using appropriate controls</li> <li>Describe the intake of carbon dioxide and water by plants</li> <li>Explain that chlorophyll traps light energy and converts it into chemical energy for the formation of carbohydrates and their subsequent storage</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>State the balanced equation for photosynthesis in symbols  <math display="block">6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2</math> </li> <li>Investigate and state the effect of varying light intensity, carbon dioxide concentration and temperature on the rate of photosynthesis (e.g. in submerged aquatic plants)</li> <li>Define the term <i>limiting</i> factor as something present in the environment in such short supply that it restricts life processes</li> <li>Explain the concept of limiting factors in photosynthesis</li> <li>Explain the use of carbon dioxide enrichment, optimum light and optimum temperatures in glasshouse systems</li> </ul>

<p>6.2.2 Leaf structure</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Identify and label the cuticle, cellular and tissue structure of a dicotyledonous leaf, as seen in cross-section under the light microscope, and describe the significance of these features in terms of functions, to include:</li> <li>distribution of chloroplasts – photosynthesis</li> <li>stomata and mesophyll cells – gas exchange</li> <li>vascular bundles (xylem and phloem) – transport and support</li> </ul>	
<p>6.2.3 Mineral requirements</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Describe the importance of: <ul style="list-style-type: none"> <li>nitrate ions for protein synthesis</li> <li>magnesium ions for chlorophyll synthesis</li> </ul> </li> <li>Describe the uses, and the dangers of overuse, of nitrogen fertilisers</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain the effects of nitrate ion and magnesium ion deficiency on plant growth</li> </ul>
<p>6.3 Animal nutrition</p>	
<p>6.3.1 Diet</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>State what is meant by the term balanced diet and describe a balanced diet related to age, sex and activity of an individual</li> <li>Describe the effects of malnutrition in relation to starvation, coronary heart disease, constipation and obesity</li> </ul>	
<p>6.3.2 Food supply</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Discuss ways in which the use of modern technology has resulted in increased food production (to include modern agricultural machinery, chemical fertilisers, pesticides and herbicides, artificial selection)</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Discuss the problems of world food supplies</li> <li>Discuss the problems which contribute to famine (unequal distribution of food, drought and flooding and increasing population)</li> </ul>
<p>6.3.3 Human alimentary canal</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>ingestion</i> as taking substances (e.g. food, drink) into the body through the mouth</li> <li>Define <i>egestion</i> as passing out of food that has not been digested, as faeces, through the anus</li> <li>Identify the main regions of the alimentary canal and associated organs including mouth, salivary glands, oesophagus, stomach, small intestine: duodenum and ileum, pancreas, liver, gall bladder, large intestine: colon and rectum, anus</li> <li>Describe the functions of the regions of the alimentary canal listed above, in relation to ingestion, digestion, absorption, assimilation and egestion of food (cross reference 6.3.4, 6.3.5, 6.3.6 and 6.3.7)</li> </ul>	

<p>6.3.4 Mechanical and physical digestion</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>• Define <i>digestion</i> as the break-down of large, insoluble food molecules into small, water-soluble molecules using mechanical and chemical processes</li> <li>• Identify the types of human teeth and describe their structure and functions</li> <li>• State the causes of dental decay and describe the proper care of teeth</li> <li>• Describe the process of chewing</li> <li>• Describe the role of longitudinal and circular muscles in peristalsis</li> <li>• Outline the role of bile in emulsifying fats, to increase the surface area for the action of enzymes</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>• Describe how fluoride reduces tooth decay and explain arguments for and against the addition of fluoride to public water supplies</li> </ul>
<p>6.3.5 Chemical digestion</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>• State the significance of chemical digestion in the alimentary canal in producing small, soluble molecules that can be absorbed</li> <li>• State where, in the alimentary canal, amylase, protease and lipase enzymes are secreted</li> <li>• State the functions of a typical amylase, a protease and a lipase, listing the substrate and end-products</li> </ul>	
<p>6.3.6 Absorption</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>• Define <i>absorption</i> as movement of digested food molecules through the wall of the intestine into the blood or lymph</li> <li>• Identify the small intestine as the region for the absorption of digested food</li> <li>• Describe the significance of villi in increasing the internal surface area of the small intestine</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>• Describe the structure of a villus, including the role of capillaries and lacteals</li> <li>• State the role of the hepatic portal vein in the transport of absorbed food to the liver</li> <li>• Identify the role of the small intestine and colon in absorption of water (the small intestine absorbs 5–10 dm<sup>3</sup> per day, the colon 0.3–0.5 dm<sup>3</sup> per day)</li> </ul>
<p>6.3.7 Assimilation</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>• Define <i>assimilation</i> as movement of digested food molecules into the cells of the body where they are used, becoming part of the cells</li> <li>• Describe the role of the liver in the metabolism of glucose (glucose → glycogen) and amino acids (amino acids → proteins and destruction of excess amino acids)</li> <li>• Describe the role of fat as an energy storage substance</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>• Define <i>deamination</i> as removal of the nitrogen-containing part of amino acids to form urea, followed by release of energy from the remainder of the amino acid</li> <li>• State that the liver is the site of breakdown of alcohol and other toxins</li> </ul>

7. Transportation	
<p>7.1 Transport in plants</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>State the functions of xylem and phloem</li> <li>Identify the positions of xylem and phloem tissues as seen in transverse sections of unthickened, herbaceous, dicotyledonous roots, stems and leaves</li> </ul>	
<p>7.1.1 Water uptake</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Identify root hair cells, as seen under the light microscope, and state their functions</li> <li>State the pathway taken by water through root, stem and leaf (root hair, root cortex cells, xylem, mesophyll cells)</li> <li>Investigate, using a suitable stain, the pathway of water through the above-ground parts of a plant</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Relate the structure and functions of root hairs to their surface area and to water and ion uptake</li> </ul>
<p>7.1.2 Transpiration</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>transpiration</i> as evaporation of water at the surfaces of the mesophyll cells followed by loss of water vapour from plant leaves, through the stomata</li> <li>Describe how water vapour loss is related to cell surfaces, air spaces and stomata</li> <li>Describe the effects of variation of temperature, humidity and light intensity on transpiration rate</li> <li>Describe how wilting occurs</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain the mechanism of water uptake and movement in terms of transpiration producing a tension ('pull') from above, creating a water potential gradient in the xylem, drawing cohesive water molecules up the plant.</li> <li>Discuss the adaptations of the leaf, stem and root to <b>three</b> contrasting environments, to include pond, garden and desert, with emphasis on local examples (where appropriate) and the factors described in the core</li> </ul>
<p>7.1.3 Translocation</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>translocation</i> in terms of the movement of sucrose and amino acids in phloem; <ul style="list-style-type: none"> <li>from regions of production</li> <li>to regions of storage OR to regions of utilisation in respiration or growth</li> </ul> </li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Describe translocation throughout the plant of applied chemicals, including systemic pesticides</li> <li>Compare the role of transpiration and translocation in the transport of materials from sources to sinks, within plants at different seasons</li> </ul>
<p>7.2 Transport in humans</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Describe the circulatory system as a system of tubes with a pump and valves to ensure one-way flow of blood</li> <li>Describe the double circulation in terms of a low pressure circulation to the lungs and a high pressure circulation to the body tissues and relate these differences to the different functions of the two circuits</li> </ul>	



<p>7.2.1 Heart</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Describe the structure of the heart including the muscular wall and septum, chambers, valves and associated blood vessels</li> <li>Describe the function of the heart in terms of muscular contraction and the working of the valves</li> <li>Investigate, state and explain the effect of physical activity on pulse rate</li> <li>Describe coronary heart disease in terms of the blockage of coronary arteries and state the possible causes (diet, stress and smoking) and preventive measures</li> </ul>	
<p>7.2.2 Arteries, veins and capillaries</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Name the main blood vessels to and from the heart, lungs, liver and kidney</li> <li>Describe the structure and functions of arteries, veins and capillaries</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain how structure and function are related in arteries, veins and capillaries</li> <li>Describe the transfer of materials between capillaries and tissue fluid</li> </ul>
<p>7.2.3 Blood</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Identify red and white blood cells as seen under the light microscope on prepared slides, and in diagrams and photomicrographs</li> <li>List the components of blood as red blood cells, white blood cells, platelets and plasma</li> <li>State the functions of blood: <ul style="list-style-type: none"> <li>red blood cells – haemoglobin and oxygen transport</li> <li>white blood cells – phagocytosis and antibody formation</li> <li>platelets – causing clotting (no details)</li> <li>plasma – transport of blood cells, ions, soluble nutrients, hormones, carbon dioxide, urea and plasma proteins</li> </ul> </li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Describe the immune system in terms of antibody production, tissue rejection and phagocytosis</li> <li>Describe the function of the lymphatic system in circulation of body fluids, and the production of lymphocytes</li> <li>Describe the process of clotting (fibrinogen to fibrin only)</li> </ul>
<p><b>8. Respiration</b></p>	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>respiration</i> as the chemical reactions that break down nutrient molecules in living cells to release energy</li> <li>State the uses of energy in the body of humans: muscle contraction, protein synthesis, cell division, active transport, growth, the passage of nerve impulses and the maintenance of a constant body temperature</li> </ul>	
<p>8.1 Aerobic respiration</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>aerobic respiration</i> as the release of a relatively large amount of energy in cells by the breakdown of food substances in the presence of oxygen</li> <li>State the word equation for aerobic respiration</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>State the equation for aerobic respiration using symbols (<math>C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O</math>)</li> </ul>

<p>8.2 Anaerobic respiration</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>anaerobic respiration</i> as the release of a relatively small amount of energy by the breakdown of food substances in the absence of oxygen</li> <li>State the word equation for anaerobic respiration in muscles during hard exercise (glucose → lactic acid) and the microorganism yeast (glucose → alcohol + carbon dioxide)</li> <li>Describe the role of anaerobic respiration in yeast during brewing and bread-making</li> <li>Compare aerobic respiration and anaerobic respiration in terms of relative amounts of energy released</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>State the balanced equation for anaerobic respiration in muscles (<math>C_6H_{12}O_6 \rightarrow 2C_3H_6O_3</math>) and the microorganism yeast (<math>C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2</math>), using symbols</li> <li>Describe the effect of lactic acid in muscles during exercise (include oxygen debt in outline only)</li> </ul>
<p>8.3 Gas exchange</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>List the features of gas exchange surfaces in animals</li> <li>Identify on diagrams and name the larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries</li> <li>State the differences in composition between inspired and expired air</li> <li>Use lime water as a test for carbon dioxide to investigate the differences in composition between inspired and expired air</li> <li>Investigate and describe the effects of physical activity on rate and depth of breathing</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Describe the role of the ribs, the internal and external intercostal muscles and the diaphragm in producing volume and pressure changes leading to the ventilation of the lungs</li> <li>Explain the role of mucus and cilia in protecting the gas exchange system from pathogens and particles</li> <li>Explain the link between physical activity and rate and depth of breathing in terms of changes in the rate at which tissues respire and therefore of carbon dioxide concentration and pH in tissues and in the blood</li> </ul>
<p><b>9. Excretion in humans</b></p>	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>excretion</i> as the removal from organisms of toxic materials, the waste products of metabolism (chemical reactions in cells including respiration) and substances in excess of requirements. Substances should include carbon dioxide, urea and salts</li> <li>Describe the function of the kidney in terms of the removal of urea and excess water and the reabsorption of glucose and some salts (details of kidney structure and nephron are <b>not</b> required)</li> <li>State the relative positions of ureters, bladder and urethra in the body</li> <li>State that urea is formed in the liver from excess amino acids</li> <li>State that alcohol, drugs and hormones are broken down in the liver</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Outline the structure of a kidney (cortex, medulla, and the start of the ureter) and outline the structure and functioning of a kidney tubule including: <ul style="list-style-type: none"> <li>role of renal capsule in filtration from blood of water, glucose, urea and salts</li> <li>role of tubule in reabsorption of glucose, most of the water and some salts back into the blood, leading to concentration of urea in the urine as well as loss of excess water and salts</li> </ul> </li> <li>Explain dialysis in terms of maintenance of glucose and protein concentration in blood and diffusion of urea from blood to dialysis fluid</li> <li>Discuss the application of dialysis in kidney machines</li> <li>Discuss the advantages and disadvantages of kidney transplants, compared with dialysis</li> </ul>

10. Coordination and response	
<p>10.1 Nervous control in humans</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Describe the human nervous system in terms of the central nervous system (brain and spinal cord as areas of coordination) and the peripheral nervous system which together serve to coordinate and regulate body functions</li> <li>Identify motor (effector), relay (connector) and sensory neurones from diagrams</li> <li>Describe a simple reflex arc in terms of sensory, relay and motor neurones, and a reflex action as a means of automatically and rapidly integrating and coordinating stimuli with responses</li> <li>State that muscles and glands can act as effectors</li> <li>Describe the action of antagonistic muscles to include the biceps and triceps at the elbow joint</li> <li>Define sense <i>organs</i> as groups of receptor cells responding to specific stimuli: light, sound, touch, temperature and chemicals</li> <li>Describe the structure and function of the eye, including accommodation and pupil reflex</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Distinguish between voluntary and involuntary actions</li> <li>Distinguish between rods and cones, in terms of function and distribution</li> </ul>
<p>10.2 Hormones</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define a <i>hormone</i> as a chemical substance, produced by a gland, carried by the blood, which alters the activity of one or more specific target organs and is then destroyed by the liver</li> <li>State the role of the hormone adrenaline in chemical control of metabolic activity, including increasing the blood glucose concentration and pulse rate</li> <li>Give examples of situations in which adrenaline secretion increases</li> <li>Compare nervous and hormonal control systems</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Discuss the use of hormones in food production</li> </ul>
<p>10.3 Tropic responses</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define and investigate <i>geotropism</i> (as a response in which a plant grows towards or away from gravity) and <i>phototropism</i> (as a response in which a plant grows towards or away from the direction from which light is coming)</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain the chemical control of plant growth by auxins including geotropism and phototropism in terms of auxins regulating differential growth, and the effects of synthetic plant hormones used as weedkillers</li> </ul>
<p>10.4 Homeostasis</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>homeostasis</i> as the maintenance of a constant internal environment</li> <li>Identify, on a diagram of the skin: hairs, sweat glands, temperature receptors, blood vessels and fatty tissue</li> <li>Describe the maintenance of a constant body temperature in humans in terms of insulation and the role of temperature receptors in the skin, sweating, shivering, vasodilation and vasoconstriction of arterioles supplying skin-surface capillaries and the coordinating role of the brain</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain the concept of control by negative feedback</li> <li>Describe the control of the glucose content of the blood by the liver, and by insulin and glucagon from the pancreas</li> </ul>

<p>10.5 Drugs</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define a drug as any substance taken into the body that modifies or affects chemical reactions in the body</li> <li>Describe the medicinal use of antibiotics for the treatment of bacterial infection</li> <li>Describe the effects of the abuse of heroin: a powerful depressant, problems of addiction, severe withdrawal symptoms and associated problems such as crime and infection e.g. HIV/AIDS</li> <li>Describe the effects of excessive consumption of alcohol: reduced self-control, depressant, effect on reaction times, damage to liver and social implications</li> <li>Describe the effects of tobacco smoke and its major toxic components (tar, nicotine, carbon monoxide, smoke particles) on the gas exchange system</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain why antibiotics kill bacteria but not viruses</li> </ul>
<p><b>Section III: Development of the organism and the continuity of life (25% of teaching time)</b></p>	
<p><b>1. Reproduction</b></p>	
<p>1.1 Asexual reproduction</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>asexual reproduction</i> as the process resulting in the production of genetically identical offspring from one parent</li> <li>Describe asexual reproduction in bacteria, spore production in fungi and tuber formation in potatoes</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Discuss the advantages and disadvantages to a species of asexual reproduction</li> </ul>
<p>1.2 Sexual reproduction</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>sexual reproduction</i> as the process involving the fusion of haploid nuclei to form a diploid zygote and the production of genetically dissimilar offspring</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Discuss the advantages and disadvantages to a species of sexual reproduction</li> </ul>
<p>1.2.1 Sexual reproduction in plants</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Identify and draw, using a hand lens if necessary, the sepals, petals, stamens, anthers, carpels, ovaries and stigmas of one, locally available, named, insect-pollinated, dicotyledonous flower, and examine the pollen grains under a light microscope or in photomicrographs</li> <li>State the functions of the sepals, petals, anthers, stigmas and ovaries</li> <li>Use a hand lens to identify and describe the anthers and stigmas of one, locally available, named, wind-pollinated flower, and examine the pollen grains under a light microscope or in photomicrographs</li> </ul>	<p><b>Supplement</b></p>

<p>1.2.2 Sexual reproduction in humans</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Identify on diagrams of the male reproductive system, the testes, scrotum, sperm ducts, prostate gland, urethra and penis, and state the functions of these parts</li> <li>Identify on diagrams of the female reproductive system, the ovaries, oviducts, uterus, cervix and vagina, and state the functions of these parts</li> <li>Describe the menstrual cycle in terms of changes in the uterus and ovaries</li> <li>Outline sexual intercourse and describe fertilisation in terms of the joining of the nuclei of male gamete (sperm) and the female gamete (egg)</li> <li>Outline early development of the zygote simply in terms of the formation of a ball of cells that becomes implanted in the wall of the uterus</li> <li>Outline the development of the fetus</li> <li>Describe the function of the placenta and umbilical cord in relation to exchange of dissolved nutrients, gases and excretory products (no structural details are required)</li> <li>Describe the ante-natal care of pregnant women including special dietary needs and maintaining good health</li> <li>Outline the processes involved in labour and birth</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Compare male and female gametes in terms of size, numbers and mobility</li> <li>Explain the role of hormones in controlling the menstrual cycle (including FSH, LH, progesterone and oestrogen)</li> <li>Indicate the functions of the amniotic sac and amniotic fluid</li> <li>Describe the advantages and disadvantages of breast-feeding compared with bottle-feeding using formula milk</li> </ul>
<ul style="list-style-type: none"> <li>Candidates should expect to apply their understanding of the flowers they have studied to unfamiliar flowers</li> <li>Define <i>pollination</i> as the transfer of pollen grains from the male part of the plant (anther of stamen) to the female part of the plant (stigma)</li> <li>Name the agents of pollination</li> <li>Compare the different structural adaptations of insect-pollinated and wind-pollinated flowers</li> <li>Describe the growth of the pollen tube and its entry into the ovule followed by fertilisation (production of endosperm and details of development are <b>not</b> required)</li> <li>Investigate and describe the structure of a non-endospermic seed in terms of the embryo (radicle, plumule and cotyledons) and testa, protected by the fruit</li> <li>Outline the formation of a seed (limited to embryo, cotyledons, testa and role of mitosis) and fruit (produced from the ovary wall)</li> <li>State that seed and fruit dispersal by wind and by animals provides a means of colonising new areas</li> <li>Describe, using named examples, seed and fruit dispersal by wind and by animals</li> </ul>	<ul style="list-style-type: none"> <li>Distinguish between self-pollination and cross-pollination</li> <li>Discuss the implications to a species of self-pollination and cross-pollination</li> </ul>

<p>1.3 Sex hormones</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Describe the roles of testosterone and oestrogen in the development and regulation of secondary sexual characteristics at puberty</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Describe the sites of production and the roles of oestrogen and progesterone in the menstrual cycle and in pregnancy (cross reference 1.2.2)</li> </ul>
<p>1.4 Methods of birth control</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Outline the following methods of birth control: <ul style="list-style-type: none"> <li>natural (abstinence, rhythm method)</li> <li>chemical (contraceptive pill, spermicide)</li> <li>mechanical (condom, diaphragm, femidom, IUD)</li> <li>surgical (vasectomy, female sterilisation)</li> </ul> </li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Outline artificial insemination and the use of hormones in fertility drugs, and discuss their social implications</li> </ul>
<p>1.5 Sexually transmissible diseases</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Describe the symptoms, signs, effects and treatment of gonorrhoea</li> <li>Describe the methods of transmission of human immunodeficiency virus (HIV), and the ways in which HIV/AIDS can be prevented from spreading</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Outline how HIV affects the immune system in a person with HIV/AIDS</li> </ul>
<p><b>2. Growth and development</b></p>	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>growth</i> in terms of a permanent increase in size and dry mass by an increase in cell number or cell size or both</li> <li>Define <i>development</i> in terms of increase in complexity</li> <li>Investigate and state the environmental conditions that affect germination of seeds: requirement for water and oxygen, suitable temperature</li> </ul>	
<p><b>3. Inheritance</b></p>	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>inheritance</i> as the transmission of genetic information from generation to generation</li> </ul>	
<p>3.1 Chromosomes</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define the terms: <ul style="list-style-type: none"> <li><i>chromosome</i> as a thread of DNA, made up of a string of genes</li> <li><i>gene</i> as a length of DNA that is the unit of heredity and codes for a specific protein. A gene may be copied and passed on to the next generation</li> <li><i>allele</i> as any of two or more alternative forms of a gene</li> <li><i>haploid nucleus</i> as a nucleus containing a single set of unpaired chromosomes (e.g. sperm and egg)</li> <li><i>diploid nucleus</i> as a nucleus containing two sets of chromosomes (e.g. in body cells)</li> </ul> </li> <li>Describe the inheritance of sex in humans (XX and XY chromosomes)</li> </ul>	

<p>3.2 Mitosis</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>mitosis</i> as nuclear division giving rise to genetically identical cells in which the chromosome number is maintained by the exact duplication of chromosomes (details of stages are <b>not</b> required)</li> <li>State the role of mitosis in growth, repair of damaged tissues, replacement of worn out cells and asexual reproduction</li> </ul>	
<p>3.3 Meiosis</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>meiosis</i> as reduction division in which the chromosome number is halved from diploid to haploid (details of stages are <b>not</b> required)</li> <li>State that gametes are the result of meiosis</li> <li>State that meiosis results in genetic variation so the cells produced are not all genetically identical</li> </ul>	
<p>3.4 Monohybrid inheritance</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define the terms: <ul style="list-style-type: none"> <li><i>genotype</i> as genetic makeup of an organism in terms of the alleles present (e.g. Tt or GG)</li> <li><i>phenotype</i> as the physical or other features of an organism due to both its genotype and its environment (e.g. tall plant or green seed)</li> <li><i>homozygous</i> as having two identical alleles of a particular gene (e.g. TT or gg). Two identical homozygous individuals that breed together will be pure-breeding</li> <li><i>heterozygous</i> as having two different alleles of a particular gene (e.g. Tt or Gg), not pure-breeding</li> <li><i>dominant</i> as an allele that is expressed if it is present (e.g. T or G)</li> <li><i>recessive</i> as an allele that is only expressed when there is no dominant allele of the gene present (e.g. t or g)</li> </ul> </li> <li>Calculate and predict the results of monohybrid crosses involving 1 : 1 and 3 : 1 ratios</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain codominance by reference to the inheritance of ABO blood groups – phenotypes, A, B, AB and O blood groups and genotypes <math>I^A</math>, <math>I^B</math>, and <math>I^O</math></li> </ul>
<p>3.5 Variation</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>State that continuous variation is influenced by genes and environment, resulting in a range of phenotypes between two extremes, e.g. height in humans</li> <li>State that discontinuous variation is caused by genes alone and results in a limited number of distinct phenotypes with no intermediates e.g. A, B, AB and O blood groups in humans</li> <li>Define <i>mutation</i> as a change in a gene or chromosome</li> <li>Describe mutation as a source of variation, as shown by Down's syndrome</li> <li>Outline the effects of ionising radiation and chemicals on the rate of mutation</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Describe sickle cell anaemia, and explain its incidence in relation to that of malaria</li> </ul>

<p>3.6 Selection</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Describe the role of artificial selection in the production of varieties of animals and plants with increased economic importance</li> <li>Define <i>natural selection</i> as the greater chance of passing on of genes by the best adapted organisms</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Describe variation and state that competition leads to differential survival of, and reproduction by, those organisms best fitted to the environment</li> <li>Assess the importance of natural selection as a possible mechanism for evolution</li> <li>Describe the development of strains of antibiotic resistant bacteria as an example of natural selection</li> </ul>
<p>3.7 Genetic Engineering</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>genetic engineering</i> as taking a gene from one species and putting it into another species</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain why, and outline how, human insulin genes were put into bacteria using genetic engineering</li> </ul>
<p><b>Section IV: Relationships of organisms with one another and with their environment (20% of teaching time)</b></p>	
<p><b>1. Energy flow</b></p>	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>State that the Sun is the principal source of energy input to biological systems</li> <li>Describe the non-cyclical nature of energy flow</li> </ul>	
<p><b>2. Food chains and food webs (emphasis on examples occurring locally)</b></p>	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define the terms: <ul style="list-style-type: none"> <li><i>food chain</i> as a chart showing the flow of energy (food) from one organism to the next beginning with a producer (e.g. mahogany tree → caterpillar → song bird → hawk)</li> <li><i>food web</i> as a network of interconnected food chains showing the energy flow through part of an ecosystem</li> <li><i>producer</i> as an organism that makes its own organic nutrients, usually using energy from sunlight, through photosynthesis</li> <li><i>consumer</i> as an organism that gets its energy by feeding on other organisms</li> <li><i>herbivore</i> as an animal that gets its energy by eating plants</li> <li><i>carnivore</i> as an animal that gets its energy by eating other animals</li> <li><i>decomposer</i> as an organism that gets its energy from dead or waste organic matter</li> <li><i>ecosystem</i> as a unit containing all of the organisms and their environment, interacting together, in a given area e.g. decomposing log or a lake</li> <li><i>trophic level</i> as the position of an organism in a food chain, food web or pyramid of biomass, numbers or energy</li> </ul> </li> <li>Describe energy losses between trophic levels</li> <li>Draw, describe and interpret pyramids of biomass and numbers</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain why food chains usually have fewer than five trophic levels</li> <li>Explain why there is an increased efficiency in supplying green plants as human food and that there is a relative inefficiency, in terms of energy loss, in feeding crop plants to animals</li> </ul>



3. Nutrient cycles	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Describe the carbon and the water cycles</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Describe the nitrogen cycle in terms of:               <ul style="list-style-type: none"> <li>the role of microorganisms in providing usable nitrogen-containing substances by decomposition and by nitrogen fixation in roots</li> <li>the absorption of these substances by plants and their conversion to protein</li> <li>followed by passage through food chains, death, decay</li> <li>nitrification and denitrification and the return of nitrogen to the soil or the atmosphere</li> </ul> </li> </ul> <p>(names of individual bacteria are not required)</p> <ul style="list-style-type: none"> <li>Discuss the effects of the combustion of fossil fuels and the cutting down of forests on the oxygen and carbon dioxide concentrations in the atmosphere</li> </ul>
4. Population size	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Define <i>population</i> as a group of organisms of one species, living in the same area at the same time</li> <li>State the factors affecting the rate of population growth for a population of an organism (limited to food supply, predation and disease), and describe their importance</li> <li>Identify the lag, exponential (log), stationary and death phases in the sigmoid population growth curve for a population growing in an environment with limited resources</li> <li>Describe the increase in human population size and its social implications</li> <li>Interpret graphs and diagrams of human population growth</li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>Explain the factors that lead to the lag phase, exponential (log) phase and stationary phase in the sigmoid curve of population growth making reference, where appropriate, to the role of limiting factors</li> </ul>
5. Human influences on the ecosystem	
<p><b>Core</b></p> <ul style="list-style-type: none"> <li>Outline the effects of humans on ecosystems, with emphasis on examples of international importance (tropical rain forests, oceans and important rivers)</li> </ul>	
<p>5.1 Agriculture</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>List the undesirable effects of deforestation (to include extinction, loss of soil, flooding, carbon dioxide build up)</li> <li>Describe the undesirable effects of overuse of fertilisers (to include eutrophication of lakes and rivers)</li> </ul>	

<p>5.2 Pollution</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>• Describe the undesirable effects of pollution to include: <ul style="list-style-type: none"> <li>• water pollution by sewage and chemical waste</li> <li>• air pollution by sulfur dioxide</li> <li>• air pollution by greenhouse gases (carbon dioxide and methane) contributing to global warming</li> <li>• pollution due to pesticides including insecticides and herbicides</li> <li>• pollution due to nuclear fall-out</li> </ul> </li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>• Discuss the effects of non-biodegradable plastics in the environment</li> <li>• Discuss the causes and effects on the environment of acid rain, and the measures that might be taken to reduce its incidence</li> <li>• Explain how increases in greenhouse gases (carbon dioxide and methane) are thought to cause global warming</li> </ul>
<p>5.3 Conservation</p> <p><b>Core</b></p> <ul style="list-style-type: none"> <li>• Describe the need for conservation of: <ul style="list-style-type: none"> <li>• species and their habitats</li> <li>• natural resources (limited to water and non-renewable materials including fossil fuels)</li> </ul> </li> </ul>	<p><b>Supplement</b></p> <ul style="list-style-type: none"> <li>• Explain how limited and non-renewable resources can be recycled (including recycling of paper and treatment of sewage to make the water that it contains safe to return to the environment or for human use)</li> </ul>

\*Diambil dari Cambridge International Examinations (2014)

Lampiran 2 Konten Biologi pada Jenjang *Cambridge Secondary 2* dengan Asesmen *Syllabus Cambridge International Level IGCSE*

**SILABUS**

School : SAINT JOHN'S CATHOLIC SCHOOL  
 Subject : Biology  
 Level : Secondary 2

No	Core	Ada	Tidak Ada
1	Section I: Characteristics and classification of living organisms	√	
	1. Characteristics of living organisms	√	
	Learning outcomes		
	Candidates should be able to:		
	i. List and describe the characteristics of living organisms	√	
	ii. Define the terms:		
	• nutrition as taking in of nutrients which are organic substances and mineral ions, containing raw materials or energy for growth and tissue repair, absorbing and assimilating them	√	
	• excretion as removal from organisms of toxic materials, the waste products of metabolism (chemical reactions in cells including respiration) and substances in excess of requirements	√	
	• respiration as the chemical reactions that breakdown nutrient molecules in living cells to release energy	√	
	• sensitivity as the ability to detect or sense changes in the environment (stimuli) and to make responses	√	
	• reproduction as the processes that make more of the same kind of organism	√	
	• growth as a permanent increase in size and dry mass by an increase in cell number or cell size or both	√	
	• movement as an action by an organism or part of an organism causing a change of position or place	√	
	2. Classification and diversity of living organisms and use of a classificatory system	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define and describe the binomial system of naming species as a system in which the scientific name of an organism is made up of two parts showing the genus and species	√	
	ii. List the main features of the following vertebrates: bony fish, amphibians, reptiles, birds and mammals		√
	<b>Supplement</b>		

No	Core	Ada	Tidak Ada
	❖ Know that there are other classification systems e.g. cladistics (based on RNA/DNA sequencing data)	√	
	❖ List the main features used in the classification of the following groups: viruses, bacteria and fungi, and their adaptation to the environment, as appropriate	√	
	2.2 Adaptations of organisms to their environment (to be illustrated by examples wherever possible)	√	
	Learning outcomes		
	Candidates should be able to:		
	i. List the main features used in the classification of the following groups: flowering plants (monocotyledons and eudicotyledons (dicotyledons), arthropods (insects, crustaceans, arachnids and myriapods), annelids, nematodes and mollusks	√	
	3. Simple Keys	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Use simple dichotomous keys based on easily identifiable features	√	
2	Section II: Organization and maintenance of the organism	√	
	2.1. Cell structure and organization	√	
	Learning outcomes		
	Candidates should be able to:		
	i. State that living organisms are made of cells		√
	ii. Identify and describe the structure of a plant cell (palisade cell) and an animal cell (liver cell), as seen under a light microscope	√	
	iii. Describe the differences in structure between typical animal and plant cells	√	
	<b>Supplement:</b>		
	❖ Relate the structures seen under the light microscope in the plant cell and in the animal cell to their functions	√	
	2.2 Levels of organization	√	
	Learning outcomes		
	Candidates should be able to:		

No	Core	Ada	Tidak Ada
	i. Relate the structure of the following to their functions:		
	• ciliated cells – in respiratory tract	√	
	• root hair cells – absorption	√	
	• xylem vessels – conduction and support	√	
	• muscle cells – contraction	√	
	• red blood cells – transport	√	
	ii. Define:		
	• tissue as a group of cells with similar structures, working together to perform a shared function		√
	• organ as a structure made up of a group of tissues, working together to perform specific functions	√	
	• organ system as a group of organs with related functions	√	
	2.3 Size of specimens	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Calculate magnification and size of biological specimens using millimetres as units	√	
	2.4. Movement in and out of cells	√	
	2.4.1 Diffusion	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define diffusion as the net movement of molecules from a region of their higher concentration to a region of their lower concentration down a concentration gradient, as a result of their random movement	√	
	ii. Describe the importance of diffusion of gases and solutes and of water as a solvent	√	
	2.4.2 Active Transport	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define active transport as movement of ions in or out of a cell through the cell membrane, from a region of their lower concentration to a region of their higher concentration against a concentration gradient, using energy released during respiration	√	
	ii. Discuss the importance of active transport as an energy-consuming process by which substances are transported against a concentration gradient, e.g. ion uptake by root hairs and uptake of glucose by epithelial cells of villi	√	

No	Core	Ada	Tidak ada
	2.4.3 Osmosis	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define osmosis as the diffusion of water molecules from a region of their higher concentration (dilute solution) to a region of their lower concentration (concentrated solution), through a partially permeable membrane	√	
	ii. Describe the importance of osmosis in the uptake of water by plants, and its effects on plant and animal tissues	√	
	<b>Supplement:</b>		
	❖ Describe and explain the importance of a water potential gradient in the uptake of water by plants	√	
	2.5. Enzymes	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define the term catalyst as a substance that speeds up a chemical reaction and is not changed by the reaction	√	
	ii. Define enzymes as proteins that function as biological catalyst		
	iii. Investigate and describe the effect of changes in temperature and pH on enzyme activity	√	√
	<b>Supplement:</b>		
	❖ Explain enzyme action in terms of the 'lock and key' model	√	
	❖ Explain the effect of changes in temperature and pH on enzyme activity	√	
	❖ Describe the role of enzymes in the germination of seeds, and their uses in biological washing products and in the food industry (including pectinase and fruit juice)	√	
	❖ Outline the use of microorganisms and fermenters to manufacture the antibiotic penicillin and enzymes for use in biological washing powders	√	
	❖ Describe the role of the fungus <i>Penicillium</i> in the production of antibiotic penicillin	√	
	2.6. Nutrition	√	
	Learning outcomes candidates should be able to:		
	i. Define nutrition as taking in of nutrients which are organic substances and mineral ions, containing raw materials or energy for growth and tissue repair, absorbing and assimilating them	√	
	2.6.1 Nutrients	√	
	i. List the chemical elements that make up:		
	• carbohydrates	√	
	• fats	√	

No	Core	Ada	Tidak ada
	<ul style="list-style-type: none"> <li>• proteins</li> </ul>	√	
	ii. Describe the synthesis of large molecules from smaller basic units, i.e.		
	<ul style="list-style-type: none"> <li>• simple sugars to starch and glycogen</li> <li>• amino acids to proteins</li> <li>• fatty acids and glycerol to fats and oils</li> </ul>	√ √ √	
	• Describe tests for:	√	
	• starch (iodine solution)	√	
	• reducing sugars (Benedict's solution)	√	
	• protein (biuret test)	√	
	• fats (ethanol)	√	
	ii. List the principal sources of, and describe the importance of:		
	• carbohydrates	√	
	• fats	√	
	• proteins	√	
	• vitamins (C and D only)	√	
	• mineral salts (calcium and iron only)	√	
	• fibre (roughage)	√	
	• water	√	
	iii. Describe the deficiency symptoms for:		
	• vitamins (C and D only)	√	
	• mineral salts (calcium and iron only)	√	
	2.6.2 Plant nutrition	√	
	2.6.2.1 Photosynthesis	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define photosynthesis as the fundamental process by which plants manufacture carbohydrates from raw materials using energy from light	√	√
	ii. State the word equation for the production of simple sugars and oxygen		
	iii. Investigate the necessity for chlorophyll, light and carbon dioxide for photosynthesis, using appropriate controls	√	
	iv. Describe the intake of carbon dioxide and water by plants		
	v. Explain that chlorophyll traps light energy and converts it into chemical energy for the	√	

No	Core	Ada	Tidak ada
	formation of carbohydrates and their subsequent storage		
	<b>Supplement:</b>		
	❖ State the balanced equation for photosynthesis in symbols $6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{light}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$	√	
	❖ Investigate and state the effect of varying light intensity, carbon dioxide concentration and temperature on the rate of photosynthesis (e.g. in submerged aquatic plants)	√	
	❖ Define the term limiting factor as something present in the environment in such short supply that it restricts life processes	√	
	❖ Explain the concept of limiting factors in photosynthesis	√	
	❖ Explain the use of carbon dioxide enrichment, optimum light and optimum temperatures in glasshouse systems	√	
	2.6.2.2 Leaf structure	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Identify and label the cuticle, cellular and tissue structure of a dicotyledonous leaf, as seen in cross-section under the light microscope, and describe the significance of these features in terms of functions	√	
	ii. distribution of chloroplasts – photosynthesis stomata and mesophyll cells – gas exchange vascular bundles (xylem and phloem) – transport and support	√	
	2.6.2.3 Mineral requirements	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Describe the importance of:		
	• nitrate ions for protein synthesis	√	
	• magnesium ions for chlorophyll synthesis	√	
	ii. Describe the uses, and the dangers of overuse, of nitrogen fertilizers	√	
	<b>Supplement:</b>		
	❖ Explain the effects of nitrate ion and magnesium ion deficiency on plant growth	√	
	2.6.3 Animal nutrition	√	
	2.6.3.1 Diet	√	



No	Core	Ada	Tidak ada
	Learning outcomes		
	Candidates should be able to:		
	i. State what is meant by the term balanced diet and describe a balanced diet related to age, sex and activity of an individual	√	
	ii. Describe the effects of malnutrition in relation to starvation, coronary heart disease, constipation and obesity	√	
	2.6.3.2 Food Supply	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Discuss ways in which the use of modern technology has resulted in increased food production (to include modern agricultural machinery, chemical fertilisers, pesticides and herbicides, artificial selection)	√	
	<b>Supplement:</b>		
	❖ Discuss the problems of world food supplies	√	√
	❖ Discuss the problems which contribute to famine (unequal distribution of food, drought and flooding and increasing population)		
	2.6.3.3 Human alimentary canal		√
	i. Define ingestion as taking substances (e.g. food, drink) into the body through the mouth	√	
	ii. Define egestion as passing out of food that has not been digested, as faeces, through the anus	√	
	iii. Identify the main regions of the alimentary canal and associated organs including mouth, salivary glands, oesophagus, stomach, small intestine: duodenum and ileum, pancreas, liver, gall bladder, large intestine: colon and rectum, anus	√	
	iv. Describe the functions of the regions of the alimentary canal listed above, in relation to ingestion, digestion, absorption, assimilation and egestion of food		
	2.6.3.4 Mechanical and physical digestion	√	
	i. Define digestion as the break-down of large, insoluble food molecules into small, water-soluble molecules using mechanical and chemical processes		√
	ii. Identify the types of human teeth and describe their structure and functions	√	
	iii. State the causes of dental decay and describe the proper care of teeth	√	
	iv. Describe the process of chewing		
	v. Describe the role of longitudinal and circular muscles in peristalsis		√
	vi. Outline the role of bile in emulsifying fats, to increase the surface area for the action of enzymes	√	
	<b>Supplement:</b>	√	

No	Core	Ada	Tidak ada
	❖ Describe how fluoride reduces tooth decay and explain arguments for and against the addition of fluoride to public water supplies	√	
	2.6.3.5 Chemical digestion	√	
	i. State the significance of chemical digestion in the alimentary canal in producing small, soluble molecules that can be absorbed	√	
	ii. State where, in the alimentary canal, amylase, protease and lipase enzymes are secreted	√	
	iii. State the functions of a typical amylase, a protease and a lipase, listing the substrate and end-products	√	
	2.6.3.4 Absorption	√	
	i. Define absorption as movement of digested food molecules through the wall of the intestine into the blood or lymph	√	
	ii. Identify the small intestine as the region for the absorption of digested food	√	
	iii. Describe the significance of villi in increasing the internal surface area of the small intestine	√	
	<b>Supplement:</b>		
	❖ Describe the structure of a villus, including the role of capillaries and lacteals		
	❖ State the role of the hepatic portal vein in the transport of absorbed food to the liver	√	√
	❖ Identify the role of the small intestine and colon in absorption of water (the small intestine absorbs 5–10 dm <sup>3</sup> per day, the colon 0.3–0.5 dm <sup>3</sup> per day)	√	
	2.6.3.5 Assimilation	√	
	iii. Define assimilation as movement of digested food molecules into the cells of the body where they are used, becoming part of the cells	√	
	iv. Describe the role of the liver in the metabolism of glucose (glucose → glycogen) and amino acids (amino acids → proteins and destruction of excess amino acids)	√	
	v. Describe the role of fat as an energy storage substance		√
	<b>Supplement:</b>		
	❖ Define deamination as removal of the nitrogen-containing part of amino acids to form urea, followed by release of energy from the remainder of the amino acid	√	
	❖ State that the liver is the site of breakdown of alcohol and other toxins	√	
	2.7. Transportation		
	2.7.1 Transport in plants	√	

No	Core	Ada	Tidak ada
	Learning outcomes		
	Candidates should be able to:		
	• State the functions of xylem and phloem		√
	• Identify the positions of xylem and phloem tissues as seen in transverse sections of unthickened, herbaceous, dicotyledonous roots, stems and leaves	√	
	2.7.1.1 Water uptake		√
	Candidates should be able to:		
	Learning outcomes		√
	i. Identify root hair cells, as seen under the light microscope, and state their functions		√
	ii. State the pathway taken by water through root, stem and leaf (root hair, root cortex cells, xylem, mesophyll cells)		√
	iii. Investigate, using a suitable stain, the pathway of water through the above-ground parts of a plant		√
	<b>Supplement:</b>		√
	Relate the structure and functions of root hairs to their surface area and to water and ion uptake		
	2.7.1.2 Transpiration		√
	Learning outcomes		
	Candidates should be able to:		
	i. Define transpiration as evaporation of water at the surfaces of the mesophyll cells followed by loss of water vapour from plant leaves, through the stomata		√
	ii. Describe how water vapour loss is related to cell surfaces, airspaces and stomata		√
	iii. Describe the effects of variation of temperature, humidity and light intensity on transpiration rate		√
	iv. Describe how wilting occurs		√
	<b>Supplement:</b>		√
	❖ Explain the mechanism of water uptake and movement in terms of transpiration producing a tension ('pull') from above, creating a water potential gradient in the xylem, drawing cohesive water molecules up the plant.		√
	❖ Discuss the adaptations of the leaf, stem and root to three contrasting environments, to include pond, garden and desert, with emphasis on local examples (where appropriate) and the factors described in the core		

No	Core	Ada	Tidak ada
	2.7.1.3 Translocation	√	
	Learning outcomes		
	Candidates should be able to		
	i. Define translocation in terms of the movement of sucrose and amino acids in phloem;		
	• from regions of production	√	
	• to regions of storage OR to regions of utilisation in respiration or growth	√	
	<b>Supplement:</b>		
	❖ Describe translocation throughout the plant of applied chemicals, including systemic pesticides	√	
	❖ Compare the role of transpiration and translocation in the transport of materials from sources to sinks, within plants at different seasons	√	
	2.7.2 Transport in humans	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Describe the circulatory system as a system of tubes with a pump and valves to ensure one-way flow of blood	√	
	ii. Describe the double circulation in terms of a low pressure circulation to the lungs and a high pressure circulation to the body tissues and relate these differences to the different functions of the two circuits	√	
	2.7.2.1 Heart	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Describe the structure of the heart including the muscular wall and septum, chambers, valves and associated blood vessels	√	
	ii. Describe the function of the heart in terms of muscular contraction and the working of the valves	√	
	iii. Investigate, state and explain the effect of physical activity on pulse rate	√	
	iv. Describe coronary heart disease in terms of the blockage of coronary arteries and state the possible causes (diet, stress and smoking) and preventive measures	√	
	2.7.2.2 Arteries, veins and capillaries	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Name the main blood vessels to and from the heart, lungs, liver and kidney	√	√
	ii. Describe the structure and functions of arteries, veins and capillaries		

No	Core	Ada	Tidak ada
	2.7.2.3 Blood	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Identify red and white blood cells as seen under the light microscope on prepared slides, and in diagrams and photomicrographs	√	
	ii. List the components of blood as red blood cells, white blood cells, platelets and plasma	√	
	iii. State the functions of blood:		
	• red blood cells – haemoglobin and oxygen transport	√	
	• white blood cells – phagocytosis and antibody formation	√	
	• platelets – causing clotting (no details)	√	
	• plasma – transport of blood cells, ions, soluble nutrients, hormones, carbon dioxide, urea and	√	
	• plasma proteins	√	
	<b>Supplement:</b>		
	❖ Describe the immune system in terms of antibody production, tissue rejection and phagocytosis	√	
	❖ Describe the function of the lymphatic system in circulation of body fluids, and the production of lymphocytes	√	
	❖ Describe the process of clotting (fibrinogen to fibrin only)	√	
	2.8. Respiration	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define respiration as the chemical reactions that break down nutrient molecules in living cells to release energy	√	
	ii. State the uses of energy in the body of humans: muscle contraction, protein synthesis, cell division, active transport, growth, the passage of nerve impulses and the maintenance of a constant body temperature	√	
	2.8.1 Aerobic respiration	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define aerobic respiration as the release of a relatively large amount of energy in cells by the breakdown of food substances in the presence of oxygen	√	
	ii. State the word equation for aerobic respiration	√	
	<b>Supplement:</b>		
	State the equation for aerobic respiration using Symbols $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$	√	

No	Core	Ada	Tidak ada
	2.8.2 Anaerobic respiration	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define anaerobic respiration as the release of a relatively small amount of energy by the breakdown of food substances in the absence of oxygen	√	
	ii. State the word equation for anaerobic respiration in muscles during hard exercise (glucose → lactic acid) and the microorganism yeast (glucose → alcohol + carbon dioxide)	√	
	iii. Describe the role of anaerobic respiration in yeast during brewing and bread-making	√	
	iv. Compare aerobic respiration and anaerobic respiration in terms of relative amounts of energy released		√
	<b>Supplement:</b>		
	❖ State the balanced equation for anaerobic respiration in muscles ( $C_6H_{12}O_6 \rightarrow 2C_3H_6O_3$ ) and the microorganism yeast ( $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ ), using symbols	√	
	❖ Describe the effect of lactic acid in muscles during exercise (include oxygen debt in outline only)	√	
	2.8.1.3 Gas exchange		
	Learning outcomes	√	
	Candidates should be able to:		
	i. List the features of gas exchange surfaces in animals	√	
	ii. Identify on diagrams and name the larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries	√	
	iii. State the differences in composition between inspired and expired air	√	
	iv. Use lime water as a test for carbon dioxide to investigate the differences in composition between inspired and expired air	√	
	v. Investigate and describe the effects of physical activity on rate and depth of breathing	√	
	<b>Supplement:</b>		
	❖ Describe the role of the ribs, the internal and external intercostal muscles and the diaphragm in producing volume and pressure changes leading to the ventilation of the lungs	√	
	❖ Explain the role of mucus and cilia in protecting the gas exchange system from pathogens and particles	√	
	❖ Explain the link between physical activity and rate and depth of breathing in terms of changes in the rate at which tissues respire and therefore of carbon dioxide concentration and pH in tissues and in the blood	√	
	2.9. Excretion in humans	√	

No	Core	Ada	Tidak ada
	Learning outcomes		
	Candidates should be able to:		
	i. Define excretion as the removal from organisms of toxic materials, the waste products of metabolism (chemical reactions in cells including respiration) and substances in excess of requirements. Substances should include carbon dioxide, urea and salts	√	
	ii. Describe the function of the kidney in terms of the removal of urea and excess water and the reabsorption of glucose and some salts (details of kidney structure and nephron are not required)	√	
	iii. State the relative positions of ureters, bladder and urethra in the body	√	
	iv. State that urea is formed in the liver from excess amino acids	√	
	v. State that alcohol, drugs and hormones are broken down in the liver	√	
	<b>Supplement:</b>	√	
	❖ Outline the structure of a kidney (cortex, medulla, and the start of the ureter) and outline the structure and functioning of a kidney tubule including:	√	
	• role of renal capsule in filtration from blood of water, glucose, urea and salts	√	
	• role of tubule in reabsorption of glucose, most of the water and some salts back into the blood, leading to concentration of urea in the urine as well as loss of excess water and salts	√	
	❖ Explain dialysis in terms of maintenance of glucose and protein concentration in blood and diffusion of urea from blood to dialysis fluid	√	
	❖ Discuss the application of dialysis in kidney machines	√	
	❖ Discuss the advantages and disadvantages of kidney transplants, compared with dialysis	√	
	2.10. Coordination and response	√	
	2.10.1 Nervous control in humans	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Describe the human nervous system in terms of the central nervous system (brain and spinal cord as areas of coordination) and the peripheral nervous system which together serve to coordinate and regulate body functions	√	
	ii. Identify motor (effector), relay (connector) and sensory neurones from diagrams	√	
	iii. Describe a simple reflex arc in terms of sensory, relay and motor neurones, and a reflex action as a means of automatically and rapidly integrating and coordinating stimuli with responses	√	

No	Core	Ada	Tidak ada
iv.	State that muscles and glands can act as effectors	√	
v.	Describe the action of antagonistic muscles to include the biceps and triceps at the elbow joint	√	
vi.	Define sense organs as groups of receptor cells responding to specific stimuli: light, sound, touch, temperature and chemicals	√	
vii.	Describe the structure and function of the eye, including accommodation and pupil reflex	√	
	<b>Supplement:</b>	√	
	❖ Distinguish between rods and cones, in terms of function and distribution	√	
	2.10.2 Hormones	√	
	Learning outcomes		
	Candidates should be able to:		
i.	Define a hormone as a chemical substance, produced by a gland, carried by the blood, which alters the activity of one or more specific target organs and is then destroyed by the liver	√	
ii.	State the role of the hormone adrenaline in chemical control of metabolic activity, including increasing the blood glucose concentration and pulse rate	√	
iii.	Give examples of situations in which adrenaline secretion increases	√	
iv.	Compare nervous and hormonal control systems	√	
	<b>Supplement:</b>	√	
	❖ Discuss the use of hormones in food	√	
	❖ Production		
	2.10.3 Tropic responses	√	
	Learning outcomes		
	Candidates should be able to:	√	
i.	Define and investigate geotropism (as a response in which a plant grows towards or away from gravity) and phototropism (as a response in which a plant grows towards or away from the direction from which light is coming)	√	
	<b>Supplement:</b>		
	❖ Explain the chemical control of plant growth by auxins including geotropism and phototropism in terms of auxins regulating differential growth, and the effects of synthetic plant hormones used as weedkillers	√	



No	Core	Ada	Tidak ada
	2.10.4 Homeostasis	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define homeostasis as the maintenance of a constant internal environment	√	
	ii. Identify, on a diagram of the skin: hairs, sweat glands, temperature receptors, blood vessels and fatty tissue	√	
	iii. Describe the maintenance of a constant body temperature in humans in terms of insulation and the role of temperature receptors in the skin, sweating, shivering, vasodilation and vasoconstriction of arterioles supplying skin surface capillaries and the coordinating role of the brain	√	
	<b>Supplement:</b>		
	❖ Explain the concept of control by negative feedback	√	
	❖ Describe the control of the glucose content of the blood by the liver, and by insulin and glucagon from the pancreas	√	
	2.10.5 Drugs	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define a drug as any substance taken into the body that modifies or affects chemical reactions in the body	√	
	ii. Describe the medicinal use of antibiotics for the treatment of bacterial infection	√	
	iii. Describe the effects of the abuse of heroin: a powerful depressant, problems of addiction, severe withdrawal symptoms and associated problems such as crime and infection e.g. HIV/AIDS	√	
	iv. Describe the effects of excessive consumption of alcohol: reduced self-control, depressant, effect on reaction times, damage to liver and social implications	√	
	v. Describe the effects of tobacco smoke and its major toxic components (tar, nicotine, carbon monoxide, smoke particles) on the gas exchange system	√	
	<b>Supplement:</b>		
	❖ Explain why antibiotics kill bacteria but not viruses	√	
3	Section III: Development of the organism and the continuity of life	√	
	1. Reproduction	√	
	1.1 Asexual reproduction	√	
	Learning outcomes		

No	Core	Ada	Tidak ada
	Candidates should be able to:	√	
	i. Define asexual reproduction as the process resulting in the production of genetically identical offspring from one parent	√	
	ii. Describe asexual reproduction in bacteria, spore production in fungi and tuber formation in potatoes	√	
	<b>Supplement:</b>	√	
	❖ Discuss the advantages and disadvantages to a species of asexual reproduction	√	
	1.2 Sexual reproduction		
	Learning outcomes		
	Candidates should be able to:	√	
	i. Define sexual reproduction as the process involving the fusion of haploid nuclei to form a diploid zygote and the production of genetically dissimilar offspring	√	
	<b>Supplement:</b>		
	❖ Discuss the advantages and disadvantages to a species of sexual reproduction		
	1.2.1 Sexual reproduction in plants	√	
	Learning outcomes		
	Candidates should be able to:	√	
	i. Identify and draw, using a hand lens if necessary, the sepals, petals, stamens, anthers, carpels, ovaries and stigmas of one, locally available, named, insect-pollinated, dicotyledonous flower, and examine the pollen grains under a light microscope or in photomicrographs	√	
	ii. State the functions of the sepals, petals, anthers, stigmas and ovaries	√	√
	iii. Use a hand lens to identify and describe the anthers and stigmas of one, locally available, named, wind-pollinated flower, and examine the pollen grains under a light microscope or in photomicrographs	√	
	iv. Candidates should expect to apply their understanding of the flowers they have studied to unfamiliar flowers	√	
	v. Define pollination as the transfer of pollen grains from the male part of the plant (anther of stamen) to the female part of the plant (stigma)	√	
	vi. Name the agents of pollination	√	√
	vii. Compare the different structural adaptations of insect-pollinated and wind-pollinated flowers	√	
	viii. Describe the growth of the pollen tube and its entry into the ovule followed by fertilization (production of endosperm and details of development are not required)	√	
	ix. Investigate and describe the structure of a non-endospermic seed in terms of the embryo (radicle, plumule and cotyledons) and testa, protected by the fruit	√	

No	Core	Ada	Tidak ada
x.	Outline the formation of a seed (limited to embryo, cotyledons, testa and role of mitosis) and fruit (produced from the ovary wall)	√	
xi.	State that seed and fruit dispersal by wind and by animals provides a means of colonising new areas	√	
xii.	Describe, using named examples, seed and fruit dispersal by wind and by animals	√	
	<b>Supplement:</b>		
❖	Distinguish between self-pollination and cross-pollination	√	
❖	Discuss the implications to a species of self-pollination and cross-pollination	√	
	1.2.2 Sexual reproduction in humans	√	
	Learning outcomes		
	Candidates should be able to:		
i.	Identify on diagrams of the male reproductive system, the testes, scrotum, sperm ducts, prostate gland, urethra and penis, and state the functions of these parts	√	
ii.	Identify on diagrams of the female reproductive system, the ovaries, oviducts, uterus, cervix and vagina, and state the functions of these parts	√	
iii.	Describe the menstrual cycle in terms of changes in the uterus and ovaries	√	
iv.	Outline sexual intercourse and describe fertilisation in terms of the joining of the nucleus of male gamete (sperm) and the female gamete (egg)	√	
v.	Outline early development of the zygote simply in terms of the formation of a ball of cells that becomes implanted in the wall of the uterus	√	
vi.	Outline the development of the fetus	√	
vii.	Describe the function of the placenta and umbilical cord in relation to exchange of dissolved nutrients, gases and excretory products (no structural details are required)	√	
viii.	Describe the ante-natal care of pregnant women including special dietary needs and maintaining good health	√	
ix.	Outline the processes involved in labour and Birth	√	
	<b>Supplement:</b>		
❖	Compare male and female gametes in terms of size, numbers and mobility	√	
❖	Explain the role of hormones in controlling the menstrual cycle (including FSH, LH, progesterone and oestrogen)	√	
❖	Indicate the functions of the amniotic sac and amniotic fluid	√	
❖	Describe the advantages and disadvantages of breast-feeding compared with bottle-feeding using formula milk	√	

No	Core	Ada	Tidak ada
	1.3 Sex hormones	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Describe the roles of testosterone and oestrogen in the development and regulation of secondary sexual characteristics at puberty	√	
	<b>Supplement:</b>		
	❖ Describe the sites of production and the roles of oestrogen and progesterone in the menstrual cycle and in pregnancy	√	
	1.4 Methods of birth control	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Outline the following methods of birth control:		
	• natural (abstinence, rhythm method)	√	
	• chemical (contraceptive pill, spermicide)	√	
	• mechanical (condom, diaphragm, femidom, IUD)	√	
	• surgical (vasectomy, female sterilisation)	√	
	<b>Supplement:</b>		
	❖ Outline artificial insemination and the use of hormones in fertility drugs, and discuss their social implications	√	
	1.5 Sexually transmissible diseases	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Describe the symptoms, signs, effects and treatment of gonorrhoea	√	
	ii. Describe the methods of transmission of human immunodeficiency virus (HIV), and the ways in which HIV/AIDS can be prevented from spreading	√	
	<b>Supplement:</b>		
	❖ Outline how HIV affects the immune system in a person with HIV/AIDS	√	
	2. Growth and development		
	Learning outcomes	√	

No	Core	Ada	Tidak ada
	Candidates should be able to:		
	i. Define growth in terms of a permanent increase in size and dry mass by an increase in cell number or cell size or both	√	
	ii. Define development in terms of increase in complexity	√	
	iii. Investigate and state the environmental conditions that affect germination of seeds: requirement for water and oxygen, suitable temperature	√	
	3 .Inheritance	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define inheritance as the transmission of genetic information from generation to generation	√	
	3.1 Chromosomes		
	Learning outcomes	√	
	Candidates should be able to:		
	i. Define the terms:		
	a. chromosome as a thread of DNA, made up of a string of genes	√	
	b. gene as a length of DNA that is the unit of heredity and codes for a specific protein. A gene may be copied and passed on to the next generation	√	
	c. allele as any of two or more alternative forms of a gene		
	d. haploid nucleus as a nucleus containing a single set of unpaired chromosomes (e.g. sperm and egg)	√	√
	e. diploid nucleus as a nucleus containing two sets of chromosomes (e.g. in body cells)	√	
	ii. Describe the inheritance of sex in humans (XX and XY chromosomes)	√	
	3.2 Mitosis	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define mitosis as nuclear division giving rise to genetically identical cells in which the chromosome number is maintained by the exact duplication of chromosomes (details of stages are not required)	√	
	ii. State the role of mitosis in growth, repair of damaged tissues, replacement of worn out cells and asexual reproduction		√

No	Core	Ada	Tidak ada
	3.3 Meiosis	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define meiosis as reduction division in which the chromosome number is halved from diploid to haploid (details of stages are not required)	√	
	ii. State that gametes are the result of meiosis	√	
	iii. State that meiosis results in genetic variation so the cells produced are not all genetically identical		
	3.4 Monohybrid inheritance	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define the terms:		
	• genotype as genetic makeup of an organism in terms of the alleles present (e.g. Tt or GG)	√	
	• phenotype as the physical or other features of an organism due to both its genotype and its environment (e.g. tall plant or green seed)	√	
	• homozygous as having two identical alleles of a particular gene (e.g. TT or gg). Two identical homozygous individuals that breed together will be pure-breeding	√	
	• heterozygous as having two different alleles of a particular gene (e.g. Tt or Gg), not pure breeding dominant as an allele that is expressed if it is present (e.g. T or G)	√	
	• recessive as an allele that is only expressed when there is no dominant allele of the gene present (e.g. t or g)	√	
	ii. Calculate and predict the results of monohybrid		
	iii. crosses involving 1 : 1 and 3 : 1 ratios		
	<b>Supplement:</b>		
	❖ Explain codominance by reference to the inheritance of ABO blood groups – phenotypes, A, B, AB and O blood groups and genotypes $I^A$ , $I^B$ , and $I^O$	√	
	3.5 Variation	√	
	Learning outcomes		
	Candidates should be able to:		
	i. State that continuous variation is influenced by genes and environment, resulting in a range of phenotypes between two extremes, e.g. height in humans	√	

No	Core	Ada	Tidak ada
	ii. State that discontinuous variation is caused by genes alone and results in a limited number of distinct phenotypes with no intermediates e.g. A, B, AB and O blood groups in humans	√	
	iii. Define mutation as a change in a gene or chromosome	√	
	iv. Describe mutation as a source of variation, as shown by Down's syndrome	√	
	v. Outline the effects of ionising radiation and chemicals on the rate of mutation	√	
	<b>Supplement:</b>	√	
	❖ Describe sickle cell anaemia, and explain its incidence in relation to that of malaria	√	
	3.6 Selection	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Describe the role of artificial selection in the production of varieties of animals and plants with increased economic importance	√	
	ii. Define natural selection as the greater chance of passing on of genes by the best adapted organisms	√	
	<b>Supplement:</b>		
	❖ Describe variation and state that competition leads to differential survival of, and reproduction by, those organisms best fitted to the environment	√	
	❖ Assess the importance of natural selection as a possible mechanism for evolution	√	
	❖ Describe the development of strains of antibiotic resistant bacteria as an example of natural selection	√	
	3.7 Genetic Engineering	√	
	Learning outcomes		
	Candidates should be able to:		
	• Define genetic engineering as taking a gene from one species and putting it into another Species	√	
4	Section IV: Relationships of organisms with one another and with their environment		
	4.1 Energy flow	√	
	Learning outcomes		
	Candidates should be able to:		
	i. State that the Sun is the principal source of energy input to biological systems	√	
	ii. Describe the non-cyclical nature of energy flow	√	

No	Core	Ada	Tidak ada
4. 2.	Food chains and food webs (emphasis on examples occurring locally)	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Define the terms:		
	a. food chain as a chart showing the flow of energy (food) from one organism to the next beginning with a producer (e.g. mahogany tree → caterpillar → song bird → hawk)	√	
	b. food web as a network of interconnected food chains showing the energy flow through part of an ecosystem	√	
	c. producer as an organism that makes its own organic nutrients, usually using energy from sunlight, through photosynthesis	√	
	d. consumer as an organism that gets its energy by feeding on other organisms	√	
	e. herbivore as an animal that gets its energy by eating plants	√	
	f. carnivore as an animal that gets its energy by eating other animals	√	
	g. decomposer as an organism that gets its energy from dead or waste organic matter	√	
	h. ecosystem as a unit containing all of the organisms and their environment, interacting together, in a given area e.g. decomposing log or a lake	√	
	i. trophic level as the position of an organism in a food chain, food web or pyramid of biomass, numbers or energy	√	
	ii. Describe energy losses between trophic levels	√	
	iii. Draw, describe and interpret pyramids of biomass and numbers	√	
	<b>Supplement:</b>		
	❖ Explain why food chains usually have fewer than five trophic levels	√	
	❖ Explain why there is an increased efficiency in supplying green plants as human food and that there is a relative inefficiency, in terms of energy loss, in feeding crop plants to animals	√	
4.3.	Nutrient cycles	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Describe the carbon and the water cycles		
	<b>Supplement:</b>		√
	❖ Describe the nitrogen cycle in terms of:	√	
	a. the role of microorganisms in providing	√	
	b. usable nitrogen-containing substances by decomposition and by nitrogen fixation in roots the absorption of these	√	



No	Core	Ada	Tidak ada
	c. substances by plants and their conversion to protein	√	
	d. followed by passage through food chains, death, decay	√	
	e. nitrification and denitrification and the return of nitrogen to the soil or the atmosphere (names of individual bacteria are not required)	√	
	❖ Discuss the effects of the combustion of fossil fuels and the cutting down of forests on the oxygen and carbon dioxide concentrations in the atmosphere	√	
	4.4. Population size		
	Learning outcomes	√	
	Candidates should be able to:		
	i. Define population as a group of organisms of one species, living in the same area at the same time	√	
	ii. State the factors affecting the rate of population growth for a population of an organism (limited to food supply, predation and disease), and describe their importance	√	
	iii. Identify the lag, exponential (log), stationary and death phases in the sigmoid population growth curve for a population growing in an environment with limited resources	√	
	iv. Describe the increase in human population size and its social implications		
	v. Interpret graphs and diagrams of human population growth	√	
	<b>Supplement:</b>		
	❖ Explain the factors that lead to the lag phase, exponential (log) phase and stationary phase in the sigmoid curve of population growth making reference, where appropriate, to the role of limiting factors	√	
	4.5. Human influences on the ecosystem	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Outline the effects of humans on ecosystems, with emphasis on examples of international importance (tropical rain forests, oceans and important rivers)	√	
	4.5.1 Agriculture	√	
	Learning outcomes		
	Candidates should be able to:		
	i. List the undesirable effects of deforestation (to include extinction, loss of soil, flooding, carbon dioxide build up)	√	
	ii. Describe the undesirable effects of overuse of fertilisers (to include eutrophication of lakes and rivers)	√	

No	Core	Ada	Tidak ada
	4.5.2 Pollution	√	
	Learning outcomes		
	Candidates should be able to:		
	i. Describe the undesirable effects of pollution to include:		
	a. water pollution by sewage and chemical waste	√	
	b. air pollution by sulfur dioxide	√	
	c. air pollution by greenhouse gases (carbon dioxide and methane) contributing to global warming	√	
	d. pollution due to pesticides including insecticides and herbicides	√	
	e. pollution due to nuclear fall-out	√	
	<b>Supplement:</b>		
	❖ Discuss the effects of non-biodegradable plastics in the environment	√	
	❖ Discuss the causes and effects on the environment of acid rain, and the measures that might be taken to reduce its incidence	√	
	❖ Explain how increases in greenhouse gases (carbon dioxide and methane) are thought to cause global warming	√	
	4.5.3 Conservation		
	Learning outcomes	√	
	Candidates should be able to:		
	i. Describe the need for conservation of:		
	• species and their habitats	√	
	• natural resources (limited to water and non-renewable materials including fossil fuels)	√	
	<b>Supplement:</b>		
	❖ Explain how limited and non-renewable resources can be recycled (including recycling of paper and treatment of sewage to make the water that it contains safe to return to the environment or for human use)	√	

\*Diadaptasi dari Cambridge International Examinations (2014)

Lampiran 3 Lesson plan Secondary 1- Secondary 4

**Biology 1.1 Characteristics of living organism**

Blocks: 4 x 75 minute lessons

**Big Idea: Living things on the environment**

**Importance:** For students to understand the reasons why things are classified as living and non-living, vital functions, and the examples.

**Relevant PLOs:** Refer to BC Biology 14 IRP- PIO C1

**Assessment Evidence:** Unit Test, Essay

No	Lesson name (PURPOSE)	Activities and Strategies	Assessment Strategies (Linked to PLO)	SWBAT/PLO	Resources/Handouts/ Materials
1	<b>Characteristic of living organism</b>	<ul style="list-style-type: none"> <li>• Unit overview (Outline textbook readings Comic Analysis)</li> <li>• Discussing in group about the environment in school                             <ul style="list-style-type: none"> <li>○ Living things</li> <li>○ Non-living things</li> <li>○ Discuss and describe the criteria to decide if the thing is living or non-living.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• FOR learning: key questions during text reading</li> <li>• FOR learning: discussing activity, students are successfully describing the criteria to decide if the thing is living or non-living.</li> <li>• Ticket out the door: envelopes with problem of vital malfunction which could be happen in living things.</li> </ul>	C1-a SWBAT- describe the criteria to decide if the thing is living or non-living	Environment around the school; Characteristic of living organism activity handout; envelopes with problems; Textbook reading list
2	<b>Define the terms:</b> •feeding •excretion •respiration •sensitivity •reproduction •growth •movement	<ul style="list-style-type: none"> <li>• Power Point/Presentation by each group                             <ul style="list-style-type: none"> <li>○ nutrition</li> <li>○ excretion</li> <li>○ respiration</li> <li>○ sensitivity</li> <li>○ reproduction</li> <li>○ growth</li> <li>○ movement</li> </ul> </li> <li>○ Key question “Why those characteristics needed for?”</li> <li>• Picture of life cycle of frog; kangaroo with joeys in pouch; butterfly complete metamorphosis and grasshopper incomplete metamorphosis.                             <ul style="list-style-type: none"> <li>○ Key questions-Why they have different life cycle?</li> </ul> </li> <li>• Power Point/Lecture Notes: Conclusion</li> </ul>	<ul style="list-style-type: none"> <li>• FOR learning: key questions during power point to other group</li> <li>• FOR learning: key questions during life cycle</li> <li>• Ticket out the door: mention other life cycle</li> <li>• Short Essay: Mention the 7 characteristic of living things and life cycle of complete and incomplete metamorphosis.</li> </ul>	C1-b SWBAT- List the 7 pieces of characteristic of living things SWBAT- Mention life cycle of complete and incomplete metamorphosis.	power point presentation; classwork handouts; note handout; homework handout; pictures of life cycle of frog; kangaroo with joeys in pouch; butterfly complete metamorphosis and grasshopper incomplete Metamorphosis.

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## UNIT 1.1 Characteristics of living organism

Part 1 – Characteristics and classification of living organism			
Grade: Secondary 1	<b>Subject:</b> Biology – Science	<b>Course: Characteristics of living organism</b>	Length of Unit 4x 75 Minutes

### Big Idea (BI) and Essential Questions (EQ)

- **BI** - Living things in the environment.
- **EQ**

EQ1: What is the characteristic of living organism?

EQ2: How the life cycle in complete and incomplete metamorphosis?

Part 2-Standards		
Standards for this unit	Key (GLE) Content Knowledge and Concepts/Skills	
<p><i>Bold Face indicates priority standards</i></p> <ul style="list-style-type: none"> <li>- <b>feeding: food which is needed to obtain energy and growth</b></li> <li>- <b>excretion: elimination of waste products produced by metabolism</b></li> <li>- <b>respiration: exchange gasses with environment</b></li> <li>- <b>sensitivity: respond to a stimulus</b></li> <li>- <b>reproduction: production of new individuals (offsprings)</b></li> <li>- <b>growth: increase in size or becoming more complex</b></li> <li>- <b>movement: change place or direction to grow and/or search for food</b></li> </ul> <p>Enrichment Secondary Biology, Evolution:</p>	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. The living and non-living things in environment.</li> <li>2. Classify the thing is living or non-living</li> <li>3. Describe the criteria to decide if the thing is living or non-living</li> <li>4. Define the 7 pieces of characteristic of living things</li> <li>5. Explain the life cycle of complete and incomplete metamorphosis.</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. Compare and contrast between the theories and real condition in the environment.</li> <li>2. Explain how important the vital function for living</li> <li>3. Predict what happens to the body if there is any malfunction</li> <li>4. Compare and contrast types of life cycle in complete and incomplete metamorphosis</li> </ol>

### Part 3 – Common Unit Assessments

Pre-test on unit: pre- Characteristics of living organism

Unit Test –after the fourth meeting

Biology 1. The unit test, as a result, is combined with the final exam.

### Part 4 – Common/Assured Learning Experiences

1.) Activities for exploring classification and using dichotomous keys (examples below).

“Classifying Organisms” 1995: Laboratory Manual: Biology Course book, Pages 193 - 201.

“The organization of living things” 2005: Cambridge IGCSE Biology Course book, Pages 1.

## Part 5 – Teacher Notes

### General Notes

- Assigned Readings from Class Textbook: Chapter 1 (all sections, Pages 1-4), Chapter 1 (all sections, pages 5-6)
- Lecture Notes/PowerPoint Presentations.
- Other activities per teacher discretion:  
“The organization of living things” 2005: Cambridge IGCSE Biology Course book, Pages 16- 172.  
“Life Cycle” 2004: Cambridge IGCSE Biology Course book, Pages 1-6

### Embedded Technology and Web Resources:

- Applet/Simulation of life cycle: An edutainment to help student knowing the complete and incomplete metamorphosis
- <http://phet.colorado.edu/en/simulation/life-cycle>

### Embedded Literacy:

- On classification living and non-living organism  
Brownlee, C. (2004) “Living and non living organism”  
Science News Online, Vol. 166 No. 23, p. 360.  
[http://www.phschool.com/science/science\\_news/articles/dna\\_bar\\_codes.html](http://www.phschool.com/science/science_news/articles/dna_bar_codes.html)
- On metamorphosis  
Milius, S (2003) “How the complete and incomplete metamorphosis happen.” Science News Online Vol 162 No 2, p. 3.  
[http://www.phschool.com/science/science\\_news/articles/complete\\_incomplete\\_metamorphosis.html](http://www.phschool.com/science/science_news/articles/complete_incomplete_metamorphosis.html)
- Collection of classroom student notes and activities  
<http://www.biology.ubc.ca/~bio336/Bio336/Lectures/Lecture5/Overheads.html>
- Classroom activities of characteristics of living thing <http://evolution.berkeley.edu/activities.html>
- Other resources can be found at:  
Connecting News with National Science Standards <http://expertvoices.nsd.org/connectingnews/>  
The New York Times Daily Lesson Plan <http://query.nytimes.com/gst/learning.html>  
Calibrated Peer Review (reading and writing-free and online) <http://cpr.molsci.ucla.edu/>  
Science News Online <http://www.sciencenews.org/>

### Common Misconceptions:

- Classification:  
Common misconception on how students conceptualize classification.  
<http://beyondorganism.nsd.org/issue/column.php?date=January2008&departmentid=professional&columnid=professional!misconceptions>
- feeding: food which is needed to obtain energy and growth
- excretion: elimination of waste products produced by metabolism
- respiration: exchange gasses with environment
- sensitivity: respond to a stimulus
- reproduction: production of new individuals (off springs)
- growth: increase in size or becoming more complex
- movement: change place or direction to grow and/or search for food
- Sources  
Jones, Mary dan Geoff Jones. Cambridge IGCSE Biology Coursebook. 2012  
[http://livingorganism.berkeley.edu/evolibrary/misconceptions\\_faq.php](http://livingorganism.berkeley.edu/evolibrary/misconceptions_faq.php)  
Berthelsen, B (2002) Students Naïve Conceptions in Life Science. MSTA Journal 44 (1) pp. 13-19.  
[www.msta-mich.org](http://www.msta-mich.org)  
Keeley, P and J. Tugel (2009) Uncovering Student Ideas in Science vol 4. NSTA Press, Arlington.
- Pertinent Videos\*  
Living organism and their characteristics  
\*Optional movie typically shown if

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<b>Course</b>	Biology 1	<b>Topic</b>	<b>Characteristics and classification of living organisms</b>
<b>Term</b>	n/a	<b>Unit:</b>	Characteristics of living organisms
<b>Date</b>	December 4 <sup>th</sup> , 2013	<b>Allotted Time:</b>	4 X 75 min

**PLOs:**  
C1- c, d

**Materials/Resources to bring to class:**

Power point presentation; classwork handouts; Note handout; homework handout; envelopes with problems; Pictures of life cycle of frog; kangaroo with joey in pouch; Butterfly complete metamorphosis and grasshopper incomplete metamorphosis.

**Purpose: Should be able to give reasons why things are classified as living and non-living, to define the 7 vital functions, and giving the example.**

Lesson Sequence		Assessment for/as/of learning
<b>Time (min)</b> 5 min	<b>Attendance:</b>	
25 min	<p><b>Introduction/Hook/Purpose:</b> Walk out to the garden where the student can sit on the Benches. Explaining the aims of this lesson Hook: Pre-test about the contrast between the living thing and non-living things</p>	<ul style="list-style-type: none"> <li>FOR learning: students can accurately compare and contrast between the living thing and non-living things.</li> </ul>
95 min	<p><b>Lesson:</b></p> <ul style="list-style-type: none"> <li>In groups consist of 2 <ul style="list-style-type: none"> <li>Student is assigned write down a list of 6 living things and non-living things that they see.</li> <li>Students document the differences in a table on the sheet.</li> <li>Group Discussion questions-Why they are categorized in living things or non-living</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: teacher monitors during group activity, students are engaged in discussion and making their group.</li> </ul>
95 min	<ul style="list-style-type: none"> <li>Presentation for each group about their list and Why they are categorized in living or non-living</li> <li>Big Task about problem in vital functions: <ol style="list-style-type: none"> <li>Hand out working paper and read background together as a class.</li> <li>Read through and review the malfunction.</li> <li>Students use remaining time to discuss the paper and make a note.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>OF learning: big task activity worksheet submitted for grade.</li> </ul>
50 min	Correcting the common misconception on how students conceptualize by asking and questioning session	<ul style="list-style-type: none"> <li>FOR learning: students correctly conceptualize</li> </ul>
5 min	<p><b>Closure/Ticket out the door:</b></p> <ul style="list-style-type: none"> <li>What is the characteristic of living things.</li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: students correctly answer totd.</li> </ul>
<b>REFLECTION:</b>		<b>Reminders/Notes:</b>
		Hand in note next class.

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## **Biology 2.8 Respiration**

Blocks: 4 x 75 minute lessons

**Big Idea:** The necessary of glycolysis and the factors of anaerobic respiration in the absence of oxygen

**Importance:** For students to understand how the process of fermentation allows glycolysis to continue when oxygen is not present.

**Relevant PLOs:** Refer to BC Biology 14 IRP- PIO C1

**Assessment Evidence:** Unit Test, Essay, Practicum

<b>No</b>	<b>Lesson name (PURPOSE)</b>	<b>Activities and Strategies</b>	<b>Assessment Strategies (Linked to PLO)</b>	<b>SWBAT/PLO</b>	<b>Resources/Handouts/Materials</b>
1	<b>Define anaerobic respiration as the release of a relatively small amount of energy</b>	<ul style="list-style-type: none"> <li>Unit overview (Outline textbook readings Comic Analysis)</li> <li>Watching movies one on aerobic respiration and the other on fermentation.               <ul style="list-style-type: none"> <li>Discuss and compare aerobic and anaerobic respiration to fermentation using a Venn diagram</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: key questions during text reading</li> <li>FOR learning: discussing activity, students are successfully describing the criteria to decide if the respiration aerobic and anaerobic</li> <li>Ticket out the door: compare aerobic and anaerobic respiration</li> </ul>	C1-a SWBAT- describe the criteria to decide if the respiration aerobic and anaerobic	Movies of aerobic respiration and the fermentation. Textbook reading list
2	<p><b>- State the word equation for anaerobic respiration in muscles during hard exercise and yeast</b></p> <p><b>- Describe the role of anaerobic respiration in yeast</b></p> <p><b>- Compare aerobic and anaerobic respiration</b></p>	<ul style="list-style-type: none"> <li>during hard exercise (glucose → lactic acid) and the microorganism yeast (glucose → alcohol + carbon dioxide)</li> <li>the process of fermentation produces carbon dioxide gas and compare fermentation to aerobic respiration.</li> <li>Fermentation allows the process of glycolysis to continue when oxygen is unavailable.               <ul style="list-style-type: none"> <li>Key question “Why glycolysis needed for?”</li> </ul> </li> <li>Mechanism of cellular respiration and fermentation.</li> <li>Power Point/Lecture Notes: Conclusion</li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: the word equation for anaerobic respiration in muscles during hard exercise and yeast</li> <li>FOR learning: key questions the necessary of glycolysis</li> <li>Ticket out the door: mention other life cycle</li> <li>Short Essay: Mention the Mechanism of cellular respiration and fermentation.</li> </ul>	C1-b SWBAT- Mention (glucose → lactic acid) and the microorganism yeast (glucose → alcohol + carbon dioxide)	power point presentation; classwork handouts; note handout; homework handout; video of anaerobic respiration in muscle
				C1-c SWABT- the necessary of glycolysis	practicum, laboratory hand out
				SWABT- compare and contrast aerobic respiration and anaerobic respiration (fermentation).	

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## UNIT 2.8Respirations

Part 2 – Anaerobic respiration			
Grade: Secondary 2	<b>Subject:</b> Biology – Science	<b>Course:Respiration</b>	Length of Unit 4x 75 Minutes

### Big Idea (BI) and Essential Questions (EQ)

- **BI** - The necessary of glycolysis and the factors of anaerobic respiration in the absence of oxygen
- **EQ**

EQ1: 1. Why is glycolysis necessary for fermentation to proceed?

EQ2: What factors affect the rate of fermentation in yeast?

Part 2-Standards		
Standards for this unit	Key (GLE) Content Knowledge and Concepts/Skills	
<p><i>Bold Face indicates priority standards</i></p> <p>- <b>the first major step in producing ATP is glycolysis. When oxygen is available, cells can use the Krebs cycle (citric acid cycle) and the electron transport chain to make up to 27 ATP molecules. This is called aerobic respiration.</b></p> <p>- <b>When oxygen is not available, yeast cells use a process called fermentation. Fermentation does not produce additional ATP, but it restores molecules needed for glycolysis to continue. Fermentation in yeast cells produces ethanol and CO<sub>2</sub>. Obviously, glycolysis plus anaerobic fermentation yields much less ATP per glucose molecule than aerobic respiration, but this process is very useful when O<sub>2</sub> is not available.</b></p> <p>Enrichment Secondary Biology, Aerobic and anaerobic respiration:</p>	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. anaerobic respiration as the release of a relatively small amount of energy.</li> <li>2. equation for anaerobic respiration in muscles during hard exercise and yeast</li> <li>3. role of anaerobic respiration in yeast</li> <li>4. aerobic and anaerobic respiration</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. Compare and contrast between the Aerobic and anaerobic respiration.</li> <li>2. Explain how necessary glycolysis for anaerobic respiration</li> <li>3. Predict what happens to the muscle if there is no oxygen</li> <li>4. Explain glycolysis plus anaerobic fermentation yields much less ATP per glucose molecule than aerobic respiration</li> <li>5. Practice n showyeast can metabolize sugar and produce a gas which we will presume is carbon dioxide</li> </ol>

### Part 3 – Common Unit Assessments

Pre-test on unit: pre-Anaerobic respiration

Unit Test –after the respiration meeting

Biology 1. The unit test, as a result, is combined with the final exam.



#### **Part 4 – Common/Assured Learning Experiences**

1.) Activities for exploring Anaerobic respiration

“Anaerobic respiration” 2005: Cambridge IGCSE Biology Course book, Pages 110-112.

“Factors Influencing the Rate of Yeast” 2006: California, Irvine.

#### **Part 5 – Teacher Notes**

##### **General Notes**

- Assigned Readings from Class Textbook: Chapter 3 (all sections, Pages 115-124), Chapter 3 (all sections, pages 105-106)

- Lecture Notes/PowerPoint Presentations.

- Other activities per teacher discretion:

“Anaerobic respiration” 2005: Cambridge IGCSE Biology Course book, Pages 110-112.

“Factors Influencing the Rate of Yeast” 2006: California, Irvine.

##### **Embedded Technology and Web Resources:**

- Applet/Simulation of life cycle: An edutainment to help student knowing the Anaerobic respiration

- <http://www.bioresearchonline.com/article.mvc/What-Is-Fermentation-Biochemistry-0001>

##### **Embedded Literacy:**

- Inside the human body: the respiratory system. Retrieved April 08, 2009, from Teacher Planet Web site: <http://www.teacherplanet.com/subpages/notobacco025.php>

[http://www.lung.ca/children/teachers/resources7\\_12.html#lung\\_health](http://www.lung.ca/children/teachers/resources7_12.html#lung_health)

- Reed Hanna, Bonnie Love Your Lungs. Retrieved April 8, 2009, from Lesson Plans Page Website: <http://www.lessonspage.com/printables/PPEScienceRespiratorySystem>

##### **Common Misconceptions:**

- Classification:

Common misconception on how students conceptualize fermentation

<http://beyondorganism.nsd.org/issue/column.php?date=March2008&departmentid=professional&columnid=professional!misconceptions>

Fermentation is a process that is important in anaerobic conditions when there is insufficient oxygen to maintain the production of ATP. For fermentation to proceed there has to be an initial breakdown of glucose (glycolysis) to produce pyruvates. Fermentation then follows in one of two ways: homolactic fermentation produces lactic acid from pyruvate while alcoholic fermentation converts pyruvate into ethanol and carbon dioxide.

- Sources

Jones, Mary dan Geoff Jones. Cambridge IGCSE Biology Coursebook. 2012

<http://www.bioresearchonline.com/article.mvc/What-Is-Fermentation-Biochemistry-0001>

Berthelsen, B (2002) Students Naïve Conceptions in Life Science. MSTA Journal 49 (1) pp. 43-45.

[www.msta-mich.org](http://www.msta-mich.org).

Keeley, P and J. Tugel (2009) Uncovering Student Ideas in Science vol 4. NSTA Press, Arlington.

- Practicum “Is Yeast Alive?”

- Pertinent Videos\*

Aerobic respiration and the fermentation.

\*Optional movie typically shown if

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<b>Course</b>	Biology 1	<b>Topic</b>	<b>Anaerobic respiration</b>
<b>Term</b>	n/a	<b>Unit:</b>	Respiration
<b>Date</b>	January 5 <sup>th</sup> , 2014	<b>Allotted Time:</b>	4 X 75 min

**PLOs:**

C1- c, d

**Materials/Resources to bring to class:**

Movies of aerobic respiration and the fermentation, Textbook reading list, power point presentation, class work handouts, note handout, homework handout, video of anaerobic respiration in muscle, practicum, laboratory hand out

**Purpose: Should be able to explain how the process of fermentation allows glycolysis to continue when oxygen is not present.**

Lesson Sequence		Assessment for/as/of learning
<b>Time (min)</b> 5 min	<b>Attendance:</b> Collect active transport project	OF learning: Project is graded
25 min	<b>Introduction/Hook/Purpose:</b> Explaining the aims of this lesson Hook: Pre-test -What is the function of cellular respiration in organisms? - During what conditions do organisms switch from aerobic respiration to fermentation? - How are the processes of cellular respiration and fermentation similar? Different?	<ul style="list-style-type: none"> <li>FOR learning: students can accurately compare and contrast between the aerobic and anaerobic respiration</li> </ul>
120 min	<b>Lesson:</b> <ul style="list-style-type: none"> <li>In laboratory <ul style="list-style-type: none"> <li>Student is prepared in group consist of 2 for the practicum by reading the yeast test procedure</li> <li>Student make prediction about the result of practicum</li> <li>Student is assigned to do the procedure</li> <li>Students document the result.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: teacher monitors practicum activity, students are engaged in practicum.</li> <li>OF learning: document result submitted for grade.</li> </ul>
95 min	<ul style="list-style-type: none"> <li>Presentation for each group about their result after the practicum</li> <li>Students use remaining time to compile data from other group and make line graph.</li> </ul>	<ul style="list-style-type: none"> <li>OF learning: compile data handed in for grade.</li> </ul>
50 min	Correcting the common misconception on how students conceptualize by asking and questioning session	<ul style="list-style-type: none"> <li>FOR learning: students correctly conceptualize</li> </ul>
5 min	<b>Closure/Ticket out the door:</b> <ul style="list-style-type: none"> <li>What is the characteristic of living things.</li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: students correctly answer totd.</li> </ul>
<b>REFLECTION:</b>		<b>Reminders/Notes:</b>  Hand in work paper of practicum in next class.

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**NAME:**

**DATE:**

**PERIOD:**

## **Is Yeast Alive?**

Humans use yeast every day. What is yeast, and what are some common uses of yeast?

You can buy yeast to make bread in the grocery store. This yeast consists of little brown grains. Do you think that these little brown grains of yeast are alive? Why or why not?

To find out whether yeast is alive, we first need to think about what makes something alive. What are some characteristics of living organisms?

To begin to answer the question, "Is yeast alive?", you will test whether the grains of yeast have two characteristics of living things -- the ability to grow and the ability to use energy (referred to as metabolism).

### **Scientific Experiment to Test for Metabolism**

We will carry out an indirect test for metabolism. In other words, we will be indirectly testing whether yeast can use energy, which is one of the characteristics of living organisms.

When yeast, humans, and other living organisms use energy, they break down high-energy molecules like sugar to get the energy they need and give off a gas called carbon dioxide as a by-product of this reaction.

We will test whether yeast can metabolize sugar and produce a gas which we will presume is carbon dioxide. Specifically, we will test whether yeast produces a gas when it has sugar available as a food vs. when no sugar is available.

**Research Question:**

Does yeast metabolize sugar and produce a gas?

**Predictions:**

Do you expect yeast to produce a gas when sugar is available?

Do you expect yeast to produce a gas when no sugar or other food is available?

Explain the reasons for your predictions.

**Procedure to Test Your Predictions**

1. Set up four test tubes in a test tube rack.
2. Label each tube with a number, 1-4. Test tubes 1 and 2 will both have yeast, sugar and water. Test tubes 3 and 4 will both have only yeast and water, with no sugar.
3. Fill test tube 1  $\frac{4}{5}$  full with warm tap water. Add one packet of dry yeast a little bit at a time, mixing the yeast in thoroughly before adding more. Mix by putting your hand or thumb over the top of the test tube and shaking.
4. Pour the yeast solution so that there is an equal amount in each of the four test tubes.
5. Add  $\frac{1}{2}$  packet of sugar to test tube 1 and the other half to test tube 2. These tubes will be your experimental group. Do not add sugar to tubes 3 and 4.
6. Add warm tap water to each test tube, filling each test tube  $\frac{4}{5}$  of the way to the top.
7. Cover the opening of each test tube with a balloon to catch any gas that is formed. Using the balloon to seal the end of the test tube, hold a finger over the end of each test tube and shake it vigorously to thoroughly mix the contents.
8. Observe the test tubes and record your observations carefully in the table on the next page. Then, every 5 minutes for 25 minutes, observe what occurs in the test tubes and any changes in the balloons which cover each test tube, and record your observations.

If the yeast grains are capable of metabolism, it will take some time to produce enough carbon dioxide to see the change in the balloons. While you are waiting for this change, set up the experiment to test growth (see page 4).

### Observations of Yeast Test Tubes

	0 minutes	5 minutes	10 minutes	15 minutes	20 minutes	25 minutes
Test tube 1 (with sugar)						
Test tube 2 (with sugar)						
Test tube 3 (water)						
Test tube 4 (water)						

9. Discuss the results you obtained with your group. How do you interpret your results? Do your results match your predictions?
  
10. Why is it better to have two test tubes with yeast, sugar, and water and two test tubes with just yeast and water, instead of only one test tube with each type of mixture?
  
11. When you make bread, if you just mix flour, sugar and water, the dough does not rise, and the bread will be flat and hard. If you include yeast in the bread dough, then the dough rises and the bread is bigger and fluffier. Can you explain how the yeast helps the bread dough to rise?

## Procedure to Test for Growth

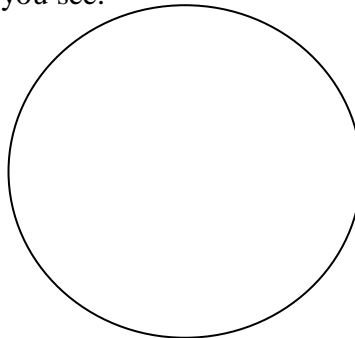
**Research Question:** Can the little brown grains of yeast grow?

### Instructions

1. Obtain a Petri dish with yeast growth media, and label the bottom with your name, teacher, and class period. (A Petri dish is a flat, covered dish used by scientists, and the yeast growth media in the Petri dish contains a mixture of substances that yeast requires to grow.)
2. Spread 10-12 grains of yeast across your plate.
3. Add several drops of water on the grains of yeast.
4. Your plates will be incubated at 37° C until the next lab class. How warm or cold is that?  
37° C is equivalent to \_\_\_\_\_ ° F.

### Observations

5. At the next lab class, inspect your plate. Do you see any signs of growth on the plate? Sketch what you see.



6. Take a sample of the growth and observe it under the microscope. Describe what you see.

### Conclusions

Based on your findings, do you think the little brown grains of yeast are alive? Explain why or why not.

**Biology 3.6 Selection**

Blocks: 4 x 75 minute lessons

**Big Idea: Living things have changed over time based on their environment.**

**Importance:For students to understand current evolutionary theory and appreciate how the unique structure of DNA contributes to evolution.**

**Relevant PLOs:Refer to BC Biology 14 IRP- PIO C1**

**Assessment Evidence:Unit Test, Essay, Project**

No	Lesson name (PURPOSE)	Activities and Strategies	Assessment Strategies (Linked to PLO)	SWBAT/PLO	Resources/Handouts/Materials
1	<b>Basic structure of DNA and Transcription</b>	<ul style="list-style-type: none"> <li>• Unit overview (Outline textbook readings Comic Analysis)</li> <li>• Power Point/Lecture notes Outline Basic Structure of DNA               <ul style="list-style-type: none"> <li>○ Double helix</li> <li>○ Nucleotides, Sugar Phosphate backbone</li> <li>○ ATCG and complementary base pairing</li> </ul> </li> <li>• Cut and paste DNA activity</li> <li>• Power point/lecture notes: Idea that DNA codes for proteins and the basic process of translation/transcription.</li> </ul>	<ul style="list-style-type: none"> <li>• FOR learning: key questions during powerpoint</li> <li>• FOR learning: DNA building activity, students are successfully modeling the structure of DNA.</li> <li>• Ticket out the door: Complementary base pairing (teacher says A, student says T etc.)</li> </ul>	C1-a SWBAT- Create models of DNA	DNA/Evolution Powerpoint DNA activity handout Textbook reading list
2	<b>Evidence for Evolution</b>  <b>Evolutionary Theory of Natural Selection</b>	<ul style="list-style-type: none"> <li>• Power Point/Lecture notes: Evidence for Evolution.               <ul style="list-style-type: none"> <li>○ Fossil Record</li> <li>○ Embryological evidence</li> <li>○ Body structure: homologous structures/vestigial organs</li> <li>○ Biochemical evidence (DNA/ATP)</li> </ul> </li> <li>•Key question “How does evolutionary change occur?”</li> <li>•2 person jigsaw- DarwinvsLamarck               <ul style="list-style-type: none"> <li>○ Key questions-Which theory do you believe? Why would Lamarck be criticized? Darwin?</li> </ul> </li> <li>•Power Point/Lecture Notes: AGENT OF EVOLUTIONARY CHANGE I (Natural Selection) Adaptation, fitness, process of NS</li> </ul>	<ul style="list-style-type: none"> <li>• FOR learning: key questions during powerpoint</li> <li>• FOR learning: key questions during powerpoint and Jigsaw activity</li> <li>• Ticket out the door: What is one piece of evidence for evolution?</li> <li>• Short Essay: Evidence for Evolution</li> </ul>	C1-b SWBAT- List the 4 pieces of evidence for Evolution SWBAT- Discuss historical evolutionary theories	DNA/Evolution Powerpoint Darwin versus Lamarck reading and discussion questions.  Short Essay: Evidence for Evolution (worksheet)

No	Lesson name (PURPOSE)	Activities and Strategies	Assessment Strategies (Linked to PLO)	SWBAT/PLO	Resources/Handouts/Materials
3	<b>The role of DNA in Evolution</b>	<ul style="list-style-type: none"> <li>•Peppered moth activity. <ul style="list-style-type: none"> <li>○ Do activity and complete lab worksheet.</li> </ul> </li> <li>•Key Question: One important part of Darwin's theory is that variation exists within a population. Where does this variation come from?</li> <li>•AGENT OF EVOLUTIONARY CHANGE II Power Point Lecture: <ul style="list-style-type: none"> <li>○ Different types of Mutations</li> <li>○ Sexual Reproduction.(Meiosis/crossing over)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• OF learning: Peppered moth activity questions for marking.</li> <li>• Ticket out the door : "DNA is the blueprint for _____ (proteins)"</li> <li>• Adaptations Worksheet</li> </ul>	C1-c	DNA/Evolution Powerpoint  Peppered Moth Activity Worksheet  Adaptations worksheet
4	<b>More agents of Evolutionary Change.</b>	<ul style="list-style-type: none"> <li>• Question "We understand how we get variation in the population, and we understand how evolution occurs by natural selection. How do we create new species?"</li> <li>• Power point: Speciation, Convergent evolution, Divergent evolution</li> <li>• Key Question: "Describe the following agents of evolutionary change: <ul style="list-style-type: none"> <li>○ Natural Selection (done)</li> <li>○ Mutation (done)</li> <li>○ Genetic Drift</li> <li>○ Gene Flow</li> <li>○ Non-random mating</li> </ul> </li> </ul> <p>Power point lecture:</p> <ul style="list-style-type: none"> <li>• AGENT OF EVOLUTIONARY CHANGE III (Genetic Drift) Power point lecture:</li> <li>• AGENT OF EVOLUTIONARY CHANGE IV/V (GeneFlow/ Non random mating) Power point lecture</li> <li>• When does evolutionary change happen? <ul style="list-style-type: none"> <li>○ Gradual change model vs punctuated equilibrium.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• FOR learning: key questions during powerpoint</li> <li>• Ticket out the door: Name one agent of evolutionary change.</li> <li>• Agents of Evolutionary Change worksheet</li> </ul>	C1-c, d	DNA/Evolution Powerpoint  Agents of Evolutionary Change Worksheet.
5	<b>Review Class</b>	<ul style="list-style-type: none"> <li>• Evolutionary Cartoon Analysis</li> <li>• Evolution Jeopardy</li> <li>• Review Questions Sheet/study time.</li> </ul>	<p>Assessment for learning: answers to the jeopardy game.</p> <p>Agents of evolutionary change project</p>	C1-d, e	DNA/Evolution Powerpoint Evolution Jeopardy Review Question sheet
6	<b>Unit Test and presentations</b>	<ul style="list-style-type: none"> <li>• Unit test</li> </ul>	<p>Assessment of learning: Unit test</p>	C1	Unit Test

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## UNIT 3.6– Selection

### Part 1 – Evolution and Classification

Grade: Secondary 3	<b>Subject:</b> Biology – Science	<b>Course:</b> Inheritance	Length of Unit 4 x 75 Minutes
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#### Big Idea (BI) and Essential Questions (EQ)

- **BI** - Living things have changed over time based on their environment.
- **EQ**

EQ1: What processes are responsible for life’s unity and diversity?

EQ2: How is scientific knowledge created and communicated? (*Classification*)

### Part 2-Standards

Standards for this unit	Key (GLE) Content Knowledge and Concepts/Skills	
<p><i>Bold Face indicates priority standards</i></p> <p>- <b>Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.</b></p> <p>- <b>Living organisms have the capability of producing populations of unlimited size, but the environment can support only a limited number of individuals from each species.</b></p> <p>Enrichment Secondary Biology, Evolution:</p> <p>The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time. Evolution is the result of genetic changes that occur in constantly changing environments.</p>	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. Evolution is the explanation on how species came to be.</li> <li>2. Darwin’s theory of evolution was influenced by multiple other theories and observations.</li> <li>3. Define evolution and identify evidence in support of Darwin’s ideas</li> <li>4. Gene pools are the source of variation in a population.</li> <li>5. Hardy and Weinberg described genetic equilibrium using an equation.</li> <li>6. Genetic equilibrium requires maintenance of certain conditions.</li> <li>7. Extinction occurs and creates patterns of evolution.</li> <li>8. Linnaeus’s classification scheme involved form fitting function and related species being within multiple taxonomic categories.</li> <li>9. Species are named using binomial nomenclature system developed by Linnaeus.</li> <li>10. Explain how evolutionary relationships now fit with modern classification.</li> <li>11. Name the six kingdoms as they are now identified.</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. Compare and contrast the ideas of Lamarck and Darwin.</li> <li>2. Explain how certain traits came to be using the idea of inheritance of acquired characteristics and natural selection.</li> <li>3. Predict what happens to alleles using the Hardy-Weinberg equation when certain factors are change such as population size, genetic drift and catastrophes.</li> <li>4. Explain how natural selection affects single and polygenic gene traits.</li> <li>5. Compare and contrast types of speciation and mechanisms of speciation.</li> <li>6. Use a classification key to identify unknown organisms.</li> <li>7. Explain and predict where a species belongs along an evolutionary tree.</li> </ol>

### Part 3 – Common Unit Assessments

Pre-test on unit: Pre-evolution

Unit Test –after the fourth meeting

Biology 1. The unit test, as a result, is combined with the final exam.

### Part 4 – Common/Assured Learning Experiences

1.) Activities for exploring classification and using dichotomous keys.

“Classifying Organisms” 1995: Laboratory Manual: Biology Coursebook, Pages 193 - 201.

“Natural Selection” 2005: Cambridge IGCSE Biology Coursebook, Pages 203 - 208.

## Part 5 – Teacher Notes

### General Notes

- Assigned Readings from Class Textbook: Chapter 15 (all sections, Pages 369-391), Chapter 16 (all sections, pages 392-415), Chapter 17 (section 4, pages 435-440) and Chapter 18 (all sections, pages 446-467). Chapter 17 (all remaining sections, pages 416-445) can be assigned for enrichment.

- Lecture Notes/PowerPoint Presentations.

- Other activities per teacher discretion:

“Interpreting Events from Fossil Evidence” (2005) Cambridge IGCSE Biology Coursebook, Pages 167 - 172.

“Amino Acid Sequence and Evolutionary Relationships” (2005) Laboratory Manual: Cambridge IGCSE Biology Coursebook, Pages 173 - 180.

### Embedded Technology and Web Resources:

- Applet/Simulation on Natural Selection: Student can manipulate phenotypes, rates of mutation and predation on a population of rabbits.

- <http://phet.colorado.edu/en/simulation/natural-selection>

### Embedded Literacy:

- On using DNA to catalog the diversity of life and classification

Brownlee, C. (2004) “DNA Barcodes: Life under the Scanner”

Science News Online, Vol. 166 No. 23, p.

360. [http://www.phschool.com/science/science\\_news/articles/dna\\_bar\\_codes.html](http://www.phschool.com/science/science_news/articles/dna_bar_codes.html)

- On variation and evolution

Milius, S (2003) “How the Butterfly gets its Spots: and what they tell us about fate.” Science News Online Vol 163 No 3, p. 35.

[http://www.phschool.com/science/science\\_news/articles/butterfly\\_gets\\_spots.html](http://www.phschool.com/science/science_news/articles/butterfly_gets_spots.html)

- Collection of classroom student notes and activities

<http://www.zoology.ubc.ca/~bio336/Bio336/Lectures/Lecture5/Overheads.html>

- Classroom activities covering multiple facets of evolution. <http://evolution.berkeley.edu/activities.htm>

- Other resources can be found at:

Connecting News with National Science Standards <http://expertvoices.nsd.org/connectingnews/>

The New York Times Daily Lesson Plan <http://query.nytimes.com/gst/learning.html>

Calibrated Peer Review (reading and writing-free and online) <http://cpr.molsci.ucla.edu/>

Science News Online <http://www.sciencenews.org/>

### Common Misconceptions:

- Classification:

Common misconception on how students conceptualize classification.

<http://beyondpenguins.nsd.org/issue/column.php?date=January2009&departmentid=professional&columnid=professional!misconceptions>

- Evolution:

“Evolution is a theory about the origin of life.” 1,3

“Organisms are always getting ‘better’”. 1

“Evolution happens by ‘chance’”. 1

“Organisms are ‘trying’ to change”. 1 Adaptation are an intention (intentional change) by the organism to satisfy a desire or need to survive. 3

“Natural selection gives organisms what the “need”. 1

“Evolution is just [another] theory”, and

“It is in crisis (not observable, gaps in support, other theories valid Scientifically)”. 1

“Individuals can adapt to changes in the environment”, “Acquired traits are in heritable”. 2

Fitness misinterpreted as meaning physically fit, rather than the ability to survive and reproduce.

- Sources

Jones, Mary dan Geoff Jones. Cambridge IGCSE Biology Coursebook. 2012

[http://evolution.berkeley.edu/evolibrary/misconceptions\\_faq.php](http://evolution.berkeley.edu/evolibrary/misconceptions_faq.php)

Berthelsen, B (2002) Students Naïve Conceptions in Life Science. MSTA Journal 44 (1) pp. 13-19.

[www.msta-mich.org](http://www.msta-mich.org).

Keeley, P and J. Tugel (2009) Uncovering Student Ideas in Science vol 4. NSTA Press, Arlington.

- Pertinent Videos\*

Evolution–Darwin’s Dangerous Idea (2001) Clear Blue Sky Productions. School

Library Code; DVD 576.8 Evo.

\*Optional movie typically shown if

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<b>Course</b>	Biology 3	<b>Topic</b>	<b>Inheritance</b>
<b>Term</b>	n/a	<b>Unit:</b>	Selection
<b>Date</b>	February 4 <sup>th</sup> , 2014	<b>Allotted Time:</b>	4 X 75 min

**PLOs:**

C1- c, d

**Materials/Resources to bring to class:**

DNA Power Point/Student Notes, Peppered Moth activity worksheets, Newspaper, hole punches, Lamarck/Darwin Jigsaw Reading

**Purpose: To compare and contrast the evolutionary theories of Lamarck and Darwin and observe the process of Natural selection using a simulation activity.**

Lesson Sequence		Assessment for/as/of learning
<b>Time (min)</b> 5 min	<b>Attendance/ Homework Check/Business:</b> Collect DNA to adaptation flow chart	OF learning: Flow chart is graded.
25 min	<b>Introduction/Hook/Purpose/Review from Last Class:</b> Review: What is an adaptation? Hook: Watch the March of the Penguins Trailer- students have to list all the different adaptations mentioned.	<ul style="list-style-type: none"> <li>FOR learning: students can accurately describe the process of natural selection using the diagrams provided.</li> </ul>
95 min	<b>Lesson:</b> <ul style="list-style-type: none"> <li>2 person jigsaw- Darwin vs Lamarck <ul style="list-style-type: none"> <li>Student is assigned to read Lamarck or Darwin's explanation of how evolution occurs. They are paired with a person who read the other and tell them about it.</li> <li>Students document the differences in a table on the sheet.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: teacher monitors during jigsaw activity, students are engaged in discussion and making their table.</li> </ul>
95 min	<ul style="list-style-type: none"> <li>Group Discussion questions-Which theory do you believe? Why would Lamarck be criticized? Darwin?</li> <li>How would Darwin/Lamarck explain how a giraffe evolved to have a long neck.</li> </ul>	
25 min	<ul style="list-style-type: none"> <li>Peppered Moth: Natural Selection Simulation Activity <ol style="list-style-type: none"> <li>Hand out Activity worksheet and read background together as a class.</li> <li>Read through and review each step of the activity.</li> <li>Guide students through 2 rounds of predation and then allow them to complete the remaining 4 rounds on their own, recording the results after each round.</li> <li>Students use remaining time to compile data and make line graph.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>OF learning: peppered moth activity worksheet submitted for grade.</li> <li>OF learning: Worksheet handed in for grade.</li> </ul>
25 min	Correcting the common misconception on how students conceptualize by asking and questioning session	<ul style="list-style-type: none"> <li>FOR learning: students correctly conceptualize</li> </ul>
5 min	<b>Closure/Ticket out the door:</b> <ul style="list-style-type: none"> <li>What is the name of Darwin's evolutionary theory.</li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: students correctly answer totd.</li> </ul>
<b>REFLECTION:</b>		<b>Reminders/Notes:</b>  Hand in Peppered Moth activity report next class.

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## Biology 2.1 Pollution

Blocks: 4 x 75 minute lessons

**Big Idea: Knowing the human role in ecosystem equilibrium**

**Importance:** For students to analyzing the relationship between the components of the ecosystem, changes in matter and energy and the role of humans in the ecosystem balance

**Relevant PLOs:** Refer to BC Biology 14 IRP- PIO C1

**Assessment Evidence:** Unit Test, Essay, Project

No	Lesson name (PURPOSE)	Activities and Strategies	Assessment Strategies (Linked to PLO)	SWBAT/PLO	Resources/Handouts/Materials
1	<b>Characteristic of waste product</b>	<ul style="list-style-type: none"><li>• Unit overview (Outline textbook readings Comic Analysis)</li><li>• Discussing in group about the waste product in home based on the characteristics<ul style="list-style-type: none"><li>○ Wastewater</li><li>○ Solid waste</li><li>○ Waste gases and particles</li></ul></li><li>○ Discuss and describe the criteria to decide if the thing is wastewater, solid waste or waste gases and particles</li></ul>	<ul style="list-style-type: none"><li>• FOR learning: key questions during text reading</li><li>• FOR learning: discussing activity, students are successfully describing the criteria to decide if the thing is wastewater, solid waste or waste gases and particles.</li><li>• Ticket out the door: mention the example of wastewater, solid waste or waste gases and particles</li></ul>	C1-a SWBAT- describe the criteria to decide if the thing is wastewater, solid waste or waste gases and particles	Waste product from home Characteristic of waste product activity handout; Textbook reading list
2	<b>Describe the undesirable effects of pollution to soil by non-biodegradable plastics</b>	<ul style="list-style-type: none"><li>• Video of effects of plastic to the earth</li><li>• Power Point/Presentation by each group<ul style="list-style-type: none"><li>○ Key question “Why those plastics have bad effects to the soil?”</li></ul></li></ul>	<ul style="list-style-type: none"><li>• FOR learning: key questions during power point to other group</li><li>• Short Essay: Mention the effects of plastic</li><li>• FOR learning: key questions during life cycle</li><li>• Ticket out the door: mention other life cycle</li></ul>	C1-b SWBAT- List the effects of plastic to the earth SWBAT- Mention effects of plastic to soil	power point presentation; Video of effects of plastic to the earth
3.	<b>Waste recycling and re-use of waste</b>	<ul style="list-style-type: none"><li>• Showing things made from recycle of plastic</li><li>• Project for making a new things made from recycle of plastic</li><li>• Power Point/Lecture Notes: Conclusion</li></ul>	<ul style="list-style-type: none"><li>• FOR learning: making a new things made from recycle of plastic</li></ul>		

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## UNIT 2.1 Pollution

### Part 1 – Describe the undesirable effects of pollution

Grade: Secondary 4	<b>Subject:</b> Biology – Science	<b>Course: Characteristics of waste product</b>	Length of Unit 4x 75 Minutes
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#### Big Idea (BI) and Essential Questions (EQ)

- BI -Knowing the human role in ecosystem equilibrium
- EQ

EQ1: What is the characteristic of wastewater, solid waste or waste gases and particles?

EQ2: How to recycle and re-use of waste product?

### Part 2-Standards

Standards for this unit	Key (GLE) Content Knowledge and Concepts/Skills	
<p><i>Bold Face indicates priority standards</i></p> <ul style="list-style-type: none"> <li>- Waste is discarded objects, both derived from nature or from the results of the process technology.</li> <li>- Waste generated from the production process of both industrial and domestic (household, which is better known as junk), whose presence at a particular time and place environmentally undesirable because it has no economic value.</li> <li>- Waste can be a pile of junk, the rest of the animal waste, plants, or vegetables.</li> </ul> <p>Enrichment Secondary Biology, Pollution:</p>	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. The characteristic of wastewater, solid waste or waste gases and particles</li> <li>2. Explain the necessary of recycling and re-use of waste</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. reduce undesirable effects of pollution to soil</li> <li>2. Explain how important recycling and reuse waste product.</li> <li>3. Making a new things made from recycle of plastic</li> </ol>

### Part 3 – Common Unit Assessments

Pre-test on unit: pre- Characteristics of wastewater, solid waste or waste gases and particles

Unit Test –after the pollution meeting

Biology 1. The unit test, as a result, is combined with the final exam.

### Part 4 – Common/Assured Learning Experiences

1.) Activities for exploring classification and using waste product (examples below).

“Classifying Waste Product” 1995: Laboratory Manual: Biology Course book, Pages 210 - 215.

“Pollution” 2005: Cambridge IGCSE Biology Course book, Pages 169.

### Part 5 – Teacher Notes

#### General Notes

- Assigned Readings from Class Textbook: Chapter 1 (all sections, Pages 1-4), Chapter 1 (all sections, pages 5-6)

- Lecture Notes/PowerPoint Presentations.

- Other activities per teacher discretion:

“The organization of living things” 2005: Cambridge IGCSE Biology Course book, Pages 16- 17.

“Life Cycle” 2004: Cambridge IGCSE Biology Course book, Pages 18-20

#### Embedded Technology and Web Resources:

- Applet/Simulation of life cycle: An edutainment to help student knowing the wastewater, solid waste or waste gases and particles

- <http://phet.colorado.edu/en/simulation/pollution>

### **Embedded Literacy:**

- On classification wastewater, solid waste or waste gases and particles

Brownlee, C. (2004) "Pollution"

Science News Online, Vol. 18No. 12, p. 109.

[http://www.phschool.com/science/science\\_news/articles/dna\\_bar\\_codes.html](http://www.phschool.com/science/science_news/articles/dna_bar_codes.html)

- wastewater, solid waste or waste gases and particles

Milius, S (2003) "Pollution." Science News Online Vol 126 No 1, p. 36.

[http://www.phschool.com/science/science\\_news/articles/waste\\_product.html](http://www.phschool.com/science/science_news/articles/waste_product.html)

- Collection of classroom student notes and activities

<http://www.biology.ubc.ca/~bio336/Bio336/Lectures/Lecture5/Overheads.html>

- Classroom activities of characteristics of wastewater, solid waste or waste gases and particles.

<http://pollution.berkeley.edu/activities.htm>

- Other resources can be found at:

Connecting News with National Science Standards

<http://expertvoices.nsd.org/connectingnews/>

The New York Times Daily Lesson Plan

<http://query.nytimes.com/gst/learning.html>

Calibrated Peer Review (reading and writing-free and online)

<http://cpr.molsci.ucla.edu/>

Science News Online

<http://www.sciencenews.org/>

### **Common Misconceptions:**

- Classification:

Common misconception on how students conceptualize waste product.

<http://wasteproduct.nsd.org/issue/column.php?date=December2008&departmentid=professional&columnid=professional!misconceptions>

-Waste is discarded objects, both derived from nature or from the results of the process technology. Waste can be a pile of junk, the rest of the animal waste, plants, or vegetables.

- Liquid waste is leftover from a business or activity that results in a liquid

-Air pollution is the contamination of air by some particulate matter (waste) containing particles (smoke and soot), hydrocarbons, sulfur dioxide, nitrogen oxides, ozone (smog chemical), carbon monoxide and lead.

- Reuse of goods which without material processing, for the same purpose or different from the original objective. For example, the use of plastic materials / waste paper for souvenir items, secondhand tires to place pots or lawn chairs, bottles of water, which has been vacant filled back and forth.

- Recycle: the activities that take advantage of used goods by processing the material for further use. For example, waste paper or scrap, glass or shards of glass, metal or scrap metal and organic waste from the kitchen or the market can be recycled into compost (fertilizer).

- Sources

Jones, Mary dan Geoff Jones. Cambridge IGCSE Biology Coursebook. 2012

[http://pollution.berkeley.edu/evolibrary/misconceptions\\_faq.php](http://pollution.berkeley.edu/evolibrary/misconceptions_faq.php)

Berthelsen, B (2002) Students Naïve Conceptions in Life Science. MSTA Journal 44 (1) pp. 13-19.

[www.msta-mich.org](http://www.msta-mich.org).

Keeley, P and J. Tugel (2009) Uncovering Student Ideas in Science vol 4. NSTA Press, Arlington.

- Pertinent Videos\*

Video of effects of plastic to the earth

\*Optional movie typically shown if

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<b>Course</b>	Biology 1	<b>Topic</b>	<b>Pollution</b>
<b>Term</b>	n/a	<b>Unit:</b>	Characteristics of waste product
<b>Date</b>	May 12 <sup>th</sup> , 2014	<b>Allotted Time:</b>	4 X 75 min

**PLOs:**

C1- c, d

**Materials/Resources to bring to class:**

Waste in home, Characteristic of waste product activity handout; Textbook reading list power point presentation; Video of effects of plastic to the earth

**Purpose: Should be able to give reasons why things are classified as living and non-living, to define the 7 vital functions, and giving the example.**

Lesson Sequence		Assessment for/as/of learning
5 min	<b>Attendance:</b> Collect Nutrient Cycle paper	OF learning: Paper is graded
25 min	<b>Introduction/Hook/Purpose:</b> Waste product from home is showed in the in front of the class Explaining the aims of this lesson Hook: Pre-test about the contrast between the wastewater, solid waste or waste gases and particles	<ul style="list-style-type: none"> <li>FOR learning: students can accurately compare and contrast between the wastewater, solid waste or waste gases and particles</li> </ul>
95 min	<b>Lesson:</b> <ul style="list-style-type: none"> <li>In groups consist of 2 <ul style="list-style-type: none"> <li>Student is assigned write down the contrast between the wastewater, solid waste or waste gases and particles that they can find at home</li> <li>Group Discussion questions-Why they are categorized in wastewater, solid waste or waste gases and particles</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: teacher monitors during group activity, students are engaged in discussion and making their group.</li> </ul>
95 min	<ul style="list-style-type: none"> <li>Presentation for each group about their assignment and Why they are categorized in wastewater, solid waste or waste gases and particles</li> <li>Big Task about problem in earth because of waste product</li> <li>Hand out working paper and read background together as a class.</li> </ul>	<ul style="list-style-type: none"> <li>OF learning: big task activity worksheet submitted for grade.</li> </ul>
50 min	<ul style="list-style-type: none"> <li>Read through and review the pollution</li> <li>students use remaining time to discuss the paper and make a note.</li> <li>Correcting the common misconception on how students conceptualize by asking and questioning session</li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: students correctly conceptualize</li> </ul>
5 min	<b>Closure/Ticket out the door:</b> <ul style="list-style-type: none"> <li>What is the characteristic of living things.</li> </ul>	<ul style="list-style-type: none"> <li>FOR learning: students correctly answer totd.</li> </ul>
<b>REFLECTION:</b>		<b>Reminders/Notes:</b>
		Project of recycling and reuse of plastic is handed in next class.

\*Diambil dari lesson plan guru Biologi Saint John's Catholic School

NAME:

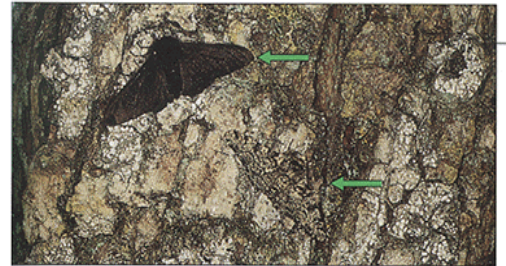
DATE:

PERIOD:

# Peppered Moth Activity

## Introduction:

The Peppered Moth is a light coloured moth with grey spots. This moth was very common in England in the 1800s. The Peppered Moth species displayed VARIATION in its population, and occasionally dark grey moths could be found. The peppered Moth lives in the woods and is frequently preyed upon by birds. Around 1850, people noticed that the darker moths were becoming more and more common, usually in areas that had coal burning factories. These factories produced a lot of black smoke. Our job is to simulate what happened in England to try to better understand the increased number of dark grey moths in the population of Peppered Moths.



**Figure 14.11** Individuals of a moth population that has undergone directional selection in response to changes in the environment. Light-winged and dark-winged peppered moths (*Biston betularia*) are resting on a lichen-covered tree trunk in (a) and on a soot-darkened tree trunk in (b).

Why did the dark-colored moths increase in places near the factories? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Procedure:

1. Lay out a piece of newspaper on your desk. What does this newspaper represent?  
\_\_\_\_\_
2. Count out 20 newspaper circles and 20 white paper circles. What do the different circles represent?  
\_\_\_\_\_
3. **SPRINKLE** all of the circles **EVENLY** onto your background.
4. **DECIDE!** Decide which partner will be the bird for the first round (you will be alternating for each round)
5. **WAIT!** When everything is ready, you begin your hunt...just wait ☺
6. **3-2-1 SUCK!** The “bird” will have 15 seconds to try to “hunt” the “moths” using a straw. As you suck up the pieces of paper, place them into a secure dish **ONE AT A TIME**. Try to capture as many moths as possible.
7. **COUNT!** At the end of the round, record the number of “UNEATEN” moths (black and white) by subtracting the captured moths from 20 original moths of each color. (EG. 20 to start – 5 captured= 15 uneaten)



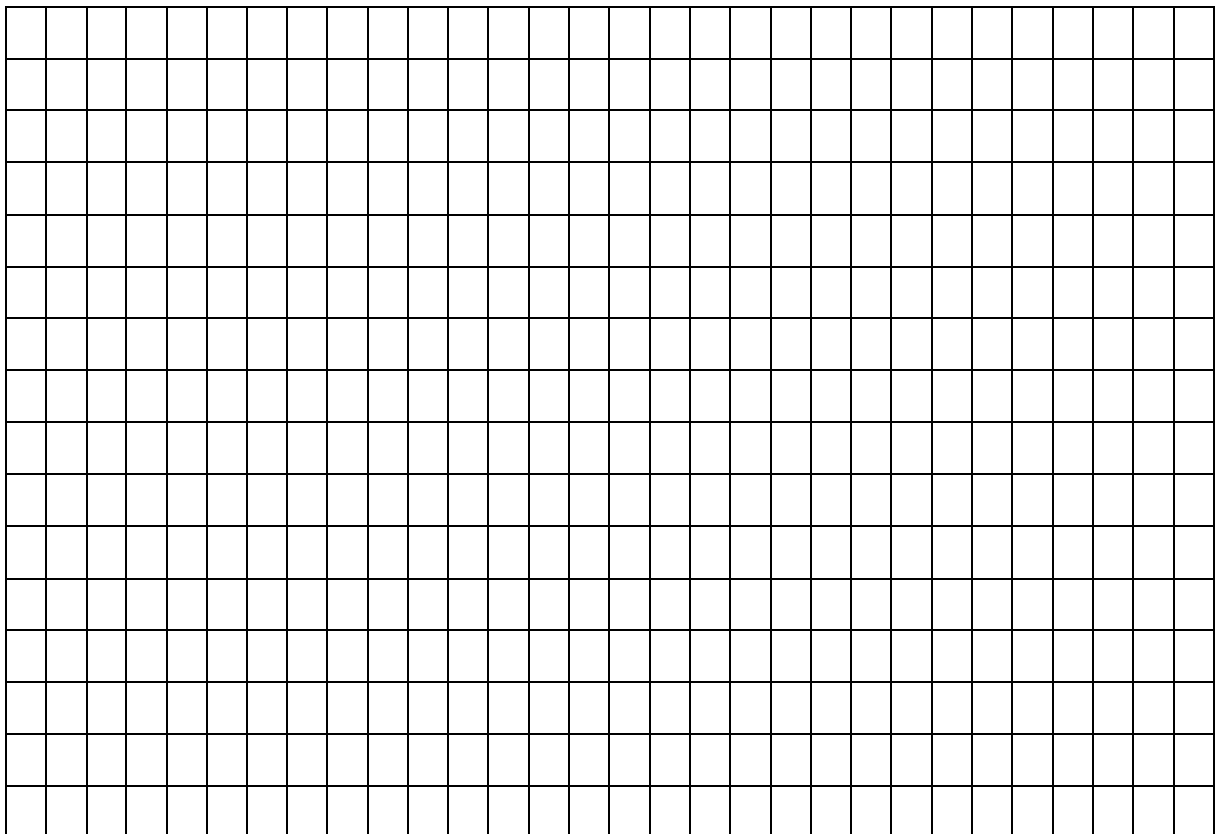
8. **REPRODUCE!** For each “uneaten” moth left on the newspaper, add another moth of the same color. This represents the next generation of moths reproducing. (Eg. 15 uneaten white moths. Add another 15 white moths for a total of 30 white moths).
  9. **RECORD!** Record the NEW number of each type of moth in the table on the following page. (from the previous example...you would record 30 white moths)
- REPEAT** steps 5-9 for 6 rounds.

**Data Table:** # of white and peppered moths remaining after each round.

	# of WHITE moths remaining after doubling	# of DARK moths remaining after doubling
<b>Generation 1 (START)</b>	20	20
<b>Generation 2</b>		
<b>Generation 3</b>		
<b>Generation 4</b>		
<b>Generation 5</b>		
<b>Generation 6</b>		

Plot your data in the graph below. There should be **two lines** on this graph (one for white moths and one for dark moths...don't forget your legend).

*Graph of white and peppered moths after six generations*



**Analysis Questions:**

1. What happened to the population of white **and** dark moths over the course of the 6 generations. (2 marks)
2. What moth color is best adapted for this “dark” environment? Explain using the data you collected.  
(2 marks)
3. How does this simulation model the process of Natural Selection? (these key words might help you: *advantage, trait, selected, camouflage, fitness*) (4 marks)
4. Most coal burning factories today “scrub” the smoke (they catch the particles of soot) before it leaves the smokestack. What do you predict has happened to the moth population since the factories began doing this? **EXPLAIN YOUR ANSWER!** (4 marks)

Have I...

- Completed all of the blanks on all pages of this lab?
- Filled in my data table completely?
- Created a graph with 2 lines and correct axis and line labels?
- Answered all the analysis questions using fluent sentences?

Lampiran 5. Karakteristik pengelolaan pembelajaran kurikulum *Cambridge* di Saint John's Catholic School

A. Lampiran observasi

No	Karakteristik Program	Iya	Tidak
1.	Mempunyai pengakuan internasional yang dibuktikan dengan hasil sertifikasi dan akreditasi berpredikat baik dari <i>Cambridge</i> .	√	

No	Karakteristik Sekolah	Iya	Tidak
1.	Telah memiliki akreditasi A dari Badan Akreditasi Sekolah	√	
2.	Sekolah Kategori Mandiri (SKM)	√	
3.	Meraih sertifikat ISO 9001 versi 2000 atau sesudahnya dan ISO 14000;	√	
4.	Menjalin hubungan "sister school" dengan sekolah bertaraf internasional di luar negeri;	√	
5.	Penyelenggaraan sekolah 1 shift (tidak double shift);	√	

No	Karakteristik Proses Belajar Mengajar	Iya	Tidak
1.	Diperkaya dengan model proses pembelajaran sekolah unggul dari <i>Cambridge</i>	√	
2.	Menerapkan pembinaan dan pembelajaran berbasis TIK pada semua mata pelajaran	√	
3.	Pembelajaran kelompok sains, matematika, dan inti kejuruan menggunakan bahasa Inggris, sementara pembelajaran mata pelajaran lainnya dapat menggunakan bahasa pengantar yang disepakati	√	
4.	Terdapat ICTM ( <i>International Class Teacher Meeting</i> ), untuk diseminasi guru dan program pembinaan peserta didik	√	

No	Karakteristik Pendidik	Iya	Tidak
1.	Semua guru mampu memfasilitasi pembelajaran berbasis TIK	√	
2.	Guru kelompok mata pelajaran sains, matematika, dan inti kejuruan mampu mengampu pembelajaran dengan berbahasa Inggris	√	
3.	Minimal 20% guru berpendidikan S2/S3 dari perguruan tinggi yang program studinya berakreditasi A untuk SMP	√	
4.	Minimal 30% guru berpendidikan S2/S3 dari perguruan tinggi yang program studinya berakreditasi A untuk SMP	√	

No	Karakteristik Kepala Sekolah	Iya	Tidak
1.	Kepala sekolah berpendidikan minimal S2 dari perguruan tinggi yang program studinya berakreditasi A dan telah menempuh pelatihan kepala sekolah dari lembaga yang diakui oleh Pemerintah	√	
2.	Kepala sekolah mampu berbahasa Inggris secara aktif dan mampu mengoperasikan komputer	√	
3.	Kepala sekolah/madrasah bervisi internasional, mampu membangun jejaring internasional, memiliki kompetensi manajerial, serta jiwa kepemimpinan dan entrepreneur yang kuat.		
4.	Memiliki SK Pengangkatan dari pejabat yang berwenang	√	

No	Karakteristik Sarana dan Prasarana	Iya	Tidak
1.	Setiap ruang kelas dilengkapi dengan sarana pembelajaran berbasis TIK	√	
2.	Perpustakaan dilengkapi dengan sarana digital yang memberikan akses ke sumber pembelajaran berbasis TIK di seluruh dunia	√	
3.	Memiliki 3 laboratorium IPA (Fisika, Kimia, Biologi)	√	
4.	Memiliki laboratorium komputer dan akses internet	√	
5.	Memiliki web Sekolah		
6.	Tersedia ruang kelas yang sesuai dengan rombongan belajar (peserta didik maksimum 15 orang)	√	
7.	Memiliki kultur sekolah yang memadai (bersih, bebas asap rokok, bebas kekerasan, rindang)	√	



## SAINT JOHN'S CATHOLIC SCHOOL

Jl. Kencana Loka No.8, Telp.0370-623873, Fax: 7587 3345 - 7587 3565  
SEMARANG

### TEACHER AND STAFF 2014

No.	Name	Place and Date of Birth	Position
1	RIANCY P. DJOEWANTA, M.Ed	Jakarta, 3 <sup>rd</sup> February 1973	Principal
2	POPPY D, M.Pd	Jakarta, 10 <sup>th</sup> May 1984	VP of Cambridge programme
3	ADRIANUS PAKAKELENM.Ed	Ambon, 8 <sup>th</sup> March 1973	VP of Administration and Facilities Affairs
4	ALRED DEDY DAIMOIM.Pd	Flores, 2 <sup>nd</sup> January 1977	VP of Student Affairs
5	CRISTIN NATALIA PIHIWIM.Si	Flores, 9 <sup>th</sup> April 1974	Laboratories staff
6	BENN Mc ADAM M.Sc	USA, 1 <sup>st</sup> June 1976	Laboratories staff
7	IVONNE WHITE S.M.Ed	USA, 4 <sup>th</sup> August 1975	Laboratories staff
8	JENIANTI MARURU'M.Si	Ambon, 6 <sup>th</sup> December 1974	Teacher
9	CARLO H BRIGHT M.Ed	USA, 11 <sup>th</sup> July 1977	Teacher
10	MAGDALENA MUIPIAM.Sc	USA, 13 <sup>th</sup> September 1973	Teacher
11	MARKUS PETER AMORM. Sc	USA, 12 <sup>th</sup> November 1976	Teacher
12	MELIANDARI SAMMAM.Si	Jakarta, 15 <sup>th</sup> October 1974	Teacher
13	MELRIST ALLOYS LUSDIC UNENORM.Si	Ambon, 14 <sup>th</sup> March 1977	Teacher
14	PRESIHLIA FERNANDA SURINTAM.Pd	Semarang, 19 <sup>th</sup> January 1974	Teacher
15	ROSALINE DIAMONDM.Ed	USA, 16 <sup>th</sup> April 1976	Teacher
16	RIFKY RISKY SEROYM.Pd	Manado, 23 <sup>th</sup> February 1975	Teacher
17	SRI IRNA IRAWATIM.Pd	Semarang, 18 <sup>th</sup> May 1977	Teacher
18	ALEX RUMTEHM.Pd	Flores, 30 <sup>th</sup> August 1974	Teacher
19	BERT WINSTONM.Ed	USA, 22 <sup>th</sup> June 1975	Teacher

20	DANIEL FREDERICKM.Ed	USA, 29 <sup>th</sup> August 1973	Teacher
21	FLORENT DIAZM.Ed	USA, 20 <sup>th</sup> October 1976	Teacher
22	HELMERIA HORIKM.Pd	Manado, 28 <sup>th</sup> July 1977	Teacher
23	HERYANIM.Pd	Jakarta, 24 <sup>th</sup> November 1974	Teacher
24	HIZKI TAMTELAHITUM.Pd	Ambon, 27 <sup>th</sup> September 1975	Teacher
25	IRISH HAMILTONM.Ed	USA, 4 <sup>th</sup> December 1973	Teacher
26	IGNATIUS KUPAKOREYAUM.Pd	Flores, 5 <sup>th</sup> March 1974	Teacher
27	DEBRILIA KALIGISM.Pd	Flores, 20 <sup>th</sup> January 1975	Teacher
28	DELVITRIA ANGELINA LINGITUBUNM.Pd	Medan, 9 <sup>th</sup> April 1977	Teacher
29	FERDINAND PEKEYM.Pd	Flores, 21 <sup>th</sup> February 1973	Teacher
30	HERDIA FAIDIBANM.Pd	Ambon, 6 <sup>th</sup> May 1976	Teacher
31	MARGARETH SILKM.Ed	USA, 29 <sup>th</sup> August 1975	Teacher
32	MAURICE SANDYM.Ed	USA, 11 <sup>th</sup> June 1975	Teacher
33	MEGAWATI ANDRIANIM.Pd	Semarang, 22 <sup>th</sup> September 1974	Teacher
34	MERDIAS TABUNIM.Pd	Jakarta, 7 <sup>th</sup> July 1976	Teacher
35	HOLY PIETERM.Ed	USA, 28 <sup>th</sup> December 1973	Teacher
36	YULISDA KADEMBOM.Pd	Manado, 12 <sup>th</sup> November 1977	Teacher
37	NAOMIM.Pd	Jakarta, 23 <sup>th</sup> March 1973	Teacher
38	NURLINDAM.Pd	Semarang, 8 <sup>th</sup> October 1974	Teacher
39	SHERLIN GIFTM.Ed	USA, 24 <sup>th</sup> February 1975	Teacher
40	STEFANUS KOGAM.Pd	Jakarta, 13 <sup>th</sup> May 1973	Teacher
41	STEFAN GEORGE M.Ed	USA, 4 <sup>th</sup> March 1976	Teacher
42	STEVANUS UTAURUM.Pd	Ambon, 14 <sup>th</sup> January 1974	Teacher
43	WAWAN SETIAWANM.Pd	Semarang, 5 <sup>th</sup> December 1977	Teacher
44	YOPI ALFARESMARLISAM.Pd	Jakarta, 16 <sup>th</sup> April 1974	Teacher
45	YUNI IRWANTYM.Pd	Semarang, 6 <sup>th</sup> November 1980	Teacher
46	JANNY WAYNEM.Ed	USA, 14 <sup>th</sup> June 1982	Teacher
47	JHON LUCKM.Ed	USA, 13 <sup>th</sup> September 1979	Teacher
48	VANESSA CALLM.Ed	USA, 1 <sup>st</sup> July 1982	Teacher
49	JULY FAMEM.Ed	USA, 3 <sup>rd</sup> October 1981	Teacher

50	KORNELIS MITOPO S.Pd	Jakarta, 18 <sup>th</sup> January 1983	Teacher
51	KARLO NGUTRA S.Pd	Ambon, 19 <sup>th</sup> March 1982	Teacher
52	KLOWI SARA DIMARA S.Pd	Ambon, 22 <sup>th</sup> May 1981	Teacher
53	LODIA UBRO S.Pd	Semarang, 17 <sup>th</sup> February 1979	Teacher
54	MEGA IRIANTY S.Pd	Jakarta, 29 <sup>th</sup> April 1979	Teacher
55	NURDIANA S.Pd	Jakarta, 24 <sup>th</sup> December 1982	Teacher
56	OLVIN ORIN MANUPUTTI S.Pd	Jakarta, 15 <sup>th</sup> June 1981	Teacher
57	RICKY BRYAN SAIBAB S.Pd	Jakarta, 19 <sup>th</sup> November 1979	Teacher
58	BERNARDETA WAUKATEYAO S.Pd	Jakarta, 15 <sup>th</sup> July 1983	Teacher
59	BENYAMIN PIGAI S.Pd	Semarang, 6 <sup>th</sup> September 1980	Teacher
60	CHISTINA MAMPASA CERIANI S.Pd	Jakarta, 19 <sup>th</sup> August 1980	Teacher
61	DAMASCUS MAKIRA S.Pd	Semarang, 8 <sup>th</sup> May 1979	Teacher
62	FRANSISKA TEMORUBUN S.Pd	Jakarta, 15 <sup>th</sup> January 1982	Teacher
63	FREDERIKA BEANAL S.Pd	Semarang, 18 <sup>th</sup> September 1981	Teacher
64	IRIANI BIU S.Pd	Jakarta, 29 <sup>th</sup> February 1983	Teacher
65	JULIAN PEKEI S.Pd	Jakarta, 14 <sup>th</sup> May 1982	Teacher
66	JEFRIANUS PAMPUT S.Pd	Jakarta, 5 <sup>th</sup> October 1981	Teacher
67	MAGDALENA IWITIYU S.Pd	Jakarta, 24 <sup>th</sup> March 1980	Teacher
68	MARTINA YASINTA RENYAAN S.Pd	Semarang, 19 <sup>th</sup> December 1983	Teacher
69	MARIA NANLOHY S.Pd	Semarang, 4 <sup>th</sup> April 1980	Teacher
70	MARIA RAHEL WARAT S.Pd	Semarang, 24 <sup>th</sup> July 1981	Teacher
71	MARIUS PEKEI S.Pd	Jakarta, 10 <sup>th</sup> August 1982	Teacher
72	NUR SYAMSUHA APRILIA S.Pd	Semarang, 12 <sup>th</sup> June 1983	Teacher
73	NATALIS PIGOME S.Pd	Semarang, 1 <sup>st</sup> January 1980	Teacher
74	OLA PAKAGE S.Pd	Jakarta, 22 <sup>nd</sup> March 1979	Teacher
75	OKTOFINA MAKAI S.Pd	Semarang, 6 <sup>th</sup> May 1983	Teacher
76	SUDARMI KONDE S.Pd	Semarang, 19 <sup>th</sup> October 1982	Teacher
77	SUSANA ELEUYAAN S.Pd	Semarang, 23 <sup>th</sup> February 1981	Teacher
78	REMSA RORRONG S.Th	Semarang, 9 <sup>th</sup> June 1982	Teacher
79	VALENTINUS PATUT S.Th	Semarang, 13 <sup>th</sup> August 1980	Teacher

80	YULITA WAINE S.Pd	Semarang, 26 <sup>th</sup> July 1982	Teacher
81	YUNA PAKAGE S.Pd	Semarang, 8 <sup>th</sup> March 1975	Librarian
82	YULIANA RAHAYAAN S.Pd	Semarang, 25 <sup>th</sup> May 1976	Librarian
83	YUNUS PAKAGE S.Pd	Semarang, 19 <sup>th</sup> June 1980	Librarian
84	YOSEP NGAMELUBUN S.Pd	Semarang, 19 <sup>th</sup> April 1974	Librarian
85	DAMIANA WALEWAWAN S.Pd	Semarang, 12 <sup>th</sup> May 1979	Librarian
86	EDUARDUS RAHANERA S.Pd	Semarang, 11 <sup>th</sup> February 1973	Librarian
87	ELISABET MAPEREYAU S.Pd	Semarang, 19 <sup>th</sup> August 1978	Laboratories staff
88	HENDRA SILALAH S.Pd	Medan, 14 <sup>th</sup> January 1979	Laboratories staff
89	FITRIANA SIBARANI S.Pd	Medan, 18 <sup>th</sup> May 1979	Laboratories staff
90	FRANSISKUS MAMEYAU S.E	Semarang, 20 <sup>th</sup> July 1980	Administration
91	GENEVEVA.UTANAPEYAU S.E	Semarang, 10 <sup>th</sup> October 1983	Administration
92	HASNA SULU' S.E	Semarang, 13 <sup>th</sup> June 1982	Administration
93	FX. ALEXANDER S.E	Semarang, 9 <sup>th</sup> November 1978	Administration
94	JENIATI SAMMA RANTE LINGGI S.E	Semarang, 13 <sup>th</sup> April 1976	Administration
95	KIKI FITRIA S.Pd	Semarang, 6 <sup>th</sup> February 1979	Administration
96	MARIA FINANSYA LAMANE S.Pd	Semarang, 18 <sup>th</sup> November 1978	Administration
97	MERNI PARANGGAI S.Pd	Semarang, 7 <sup>th</sup> March 1982	Administration
98	MARIA INOSENSIA WARAT S.Pd	Semarang, 5 <sup>th</sup> September 1983	Administration
99	MEYSTOR PASOMBO SESA S.Pd	Semarang, 15 <sup>th</sup> January 1980	Administration
100	NATALIS PIGOME S.Pd	Semarang, 4 <sup>th</sup> December 1981	Administration



This is to certify that

**SAINT JOHN'S CATHOLIC SCHOOL**

is a registered member of the

**Cambridge International Secondary Programme**



Ann Puntis, Chief Executive  
University of Cambridge International Examinations

REGISTERED CENTRE ID110

ISSUED ON 05 JULY 2007



UNIVERSITY of CAMBRIDGE  
International Examinations

This is to certify that

**Saint John's Catholic School**

has met all the standards  
required to be a

**Cambridge International Centre**



Ann Purkis, Chief Executive  
University of Cambridge International Examinations

REGISTERED CENTRE ID130  
ISSUED ON 05 JULY 2007



**GOETHE  
INSTITUT**

## Certification

Awarded to

### **SAINT JOHN'S CATHOLIC SCHOOL**

GOETHE INSTITUT Certification certify that the Management System of the above organization has been audited and found to be in accordance with the requirements of the management system standards detailed below

Standard

**ISO 9001:2000**

Scope of supply

**SECONDARY**

Original Approval Date: **26<sup>th</sup> July 2006**

Subject to the continued satisfactory operation of the organization's Management System, this certificate is valid until: **26<sup>th</sup> July 2014**

To check this certificate validity please call (62-21-5210393)

Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by contacting the organization

Certificate Number: **233400**

Date: **26<sup>th</sup> July 2006**



Bureau Veritas Certification  
Using the accreditation  
certificate number 008

008

Certification Authority: Bureau Veritas Certification Indonesia, Gedung Sate, Penthouse 1 Floor  
Jl. HR Rasuna Said Blok S.2 Kot. 1 Jakarta 12910, Indonesia  
Managing Office: Bureau Veritas Certification Indonesia, Gedung Sate, Penthouse 1 Floor  
Jl. HR Rasuna Said Blok S.2 Kot. 1 Jakarta 12910, Indonesia

Gambar 3. pengakuan internasional atas karakteristik program



Gambar 4. *Lecture Class*



Gambar 5. *Tutorial Class*



Gambar 6 Kondisi bangunan sekolah



Gambar 7. Ruang kelas



Gambar 8. Ruang IGCSE Cambridge



Gambar 9. Fasilitas kolam renang sekolah



Gambar 10. Fasilitas lift sekolah



Gambar 11. Fasilitas ruang kesehatan





Gambar 12. Tenaga pendidik yang profesional



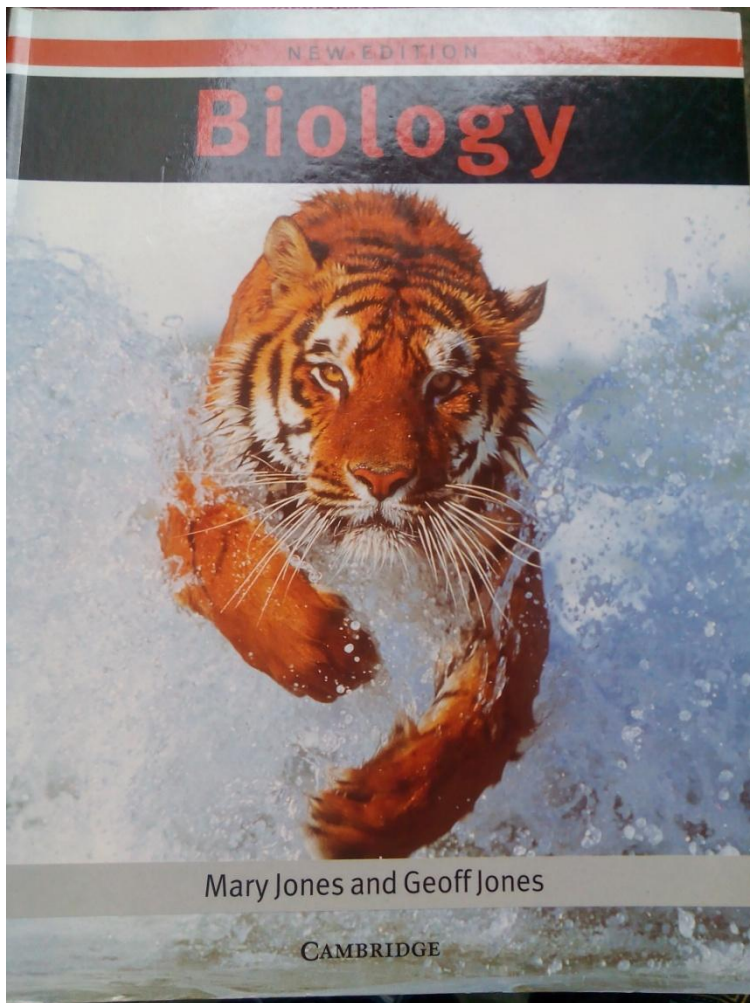
Gambar 13. Tenaga laboran



Gambar 14. Guru BK



Gambar 15. Laboratorium Biologi



Gambar 16. Buku paket Biologi



Gambar 17. Akses internet



**CONGRATULATIONS**  
**1<sup>ST</sup> WINNER**  
**in Taekwondo Proteam Cup II**  
**23<sup>rd</sup> February 2014**  
**Ergie Wiharja**



### Great Moment in Berlin



The Diversity week of the DiversMbassy project in Berlin was held from June 1 to 7. Eight Saint John's students with one teacher joined the other participants there. It was a great moment for the students. For one student, it was his first chance to go abroad, while for others it was their first time being abroad without the company of their family members.

Tweet 0

Share

Read more: [Great Moment in Berlin](#)

### The SWAP Exhibition



On Thursday 10<sup>th</sup> June 2014, Saint John's Work and Art Photography club (SWAP) held an exhibition in the 4<sup>th</sup> floor dance room. The club which consisted more than 10 students, worked together to decorate the whole room with their creative photos. Each sides of the wall were plastered with black cardboard and overlaid with the students' photos. The room decoration was simple and minimalistic.

Tweet 0

Share

Read more: [The SWAP Exhibition](#)

### Polishing Confidence Through the Interlude



The students of Saint

#### News and articles

- ① Eight Saint John's Students Representing Indonesia to the International Diversity Week in Berlin
- ② Leadership Training Program Performed by Alumni and School Fellows
- ③ Mobile Programming with Android Workshop
- ④ Lesson Learned from Love's Labour's Lost
- ⑤ Come and See Shakespeare's "Love's Labour's Lost"
- ⑥ Expand Your Horizon Like an Eagle, Fill Your Life with Love
- ⑦ A Great Time in the Blackberry STEM Innovation Camp
- ⑧ Sharing Knowledge with Teachers from the Papua New Guinea
- ⑨ Inauguration of the New SHS Building
- ⑩ Three International Wushu Medals for Nicolas Sutanto
- ⑪ Entering the School Experience Program with Sampoerna Foundation
- ⑫ Saint John's Primary Ensemble Goes to RRI
- ⑬ High School Students Learned How to Become Investors
- ⑭ Opening the Year 2013 with a Celebration of Saint John's Day

#### Upcoming Event

JULY 2014						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Gambar 18. Web sekolah



Gambar 19. Laboratorium audio visual



Gambar 20. Ruang masak



Gambar 21. Ruang tari



Gambar 22. Ruang Musik

## JULI 2013

MON	TUE	WED	THU	FRI	SAT	SUN
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4

## SETTLING MONTH INDEPENDENCE MONTH

Date	Activity / Event
15 Jul	Students Orientation
16 Jul	First day of School
2 Aug	Closing Intramural
5 - 14 Aug	Idul Fitri Holiday
17 Aug	Independence Day - Flag Hoisting

## AUGUST 2013

MON	TUE	WED	THU	FRI	SAT	SUN
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

## SEPTEMBER 2013

MON	TUE	WED	THU	FRI	SAT	SUN
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	1	2	3	4	5	6

## BIBLE MONTH ROSARY & UNITED NATION MONTH

Date	Activity / Event
7 Sep	Open House (Opening SYNC)
14 Sep	Closing SYNC (OH - KG)
23 - 27 Sep	Mid Semester Test
4 Oct	Half Day - Deliberation No Classes - Report Preparation
5 Oct	Report Distribution - Edufair
15 Oct	Idul Adha
28 Oct	Flag Hoisting (Youth Day)

## OCTOBER 2013

MON	TUE	WED	THU	FRI	SAT	SUN
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3

## NOVEMBER 2013

MON	TUE	WED	THU	FRI	SAT	SUN
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	1

## TEACHERS MONTH SHARING MONTH

Date	Activity / Event
5 Nov	Islamic New Year
2 - 6 Dec	Final Semester Test
9 Dec	Outreach
10 Dec	Year End Party - Evening (Deliberation)
11 - 12 Dec	No Classes (Report Preparation)
13 Dec	Report Card Distribution
16 Dec - 3 Jan	Christmas & Year End Holiday

## DECEMBER 2013

MON	TUE	WED	THU	FRI	SAT	SUN
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

## JANUARY 2014

MON	TUE	WED	THU	FRI	SAT	SUN
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2

## NEW YEAR MONTH ART & FAMILY MONTH

Date	Activity / Event
6 Jan	First Day of School (Mass- St. John's Name Celebration)
13 - 15 Jan	SC Leadership Training
14 Jan	Prophet Muhammad's Birthday
17 Jan	Language Elocution
20 - 22 Jan	Grade 12 Retreat
22 - 24 Jan	Grade 9 Retreat
30 - 31 Jan	Chinese New Year
14 Feb	Valentine's Day Celebration

## FEBRUARY 2014

MON	TUE	WED	THU	FRI	SAT	SUN
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	1	2

## MARCH 2014

MON	TUE	WED	THU	FRI	SAT	SUN
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

## LENT MONTH ENVIRONMENT MONTH

Date	Activity / Event
5 Mar	Ash Wednesday
10 - 14 Mar	Mid Semester Examination
18 - 20 Mar	Deliberation Meeting (No Classes - Report Preparation)
21 Mar	Report Distribution
31 Mar	Nyepi Holiday
16 - 18 Apr	Easter Holiday

## APRIL 2014

MON	TUE	WED	THU	FRI	SAT	SUN
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4

## MAY 2014

MON	TUE	WED	THU	FRI	SAT	SUN
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

## READING MONTH MOVING UP MONTH

Date	Activity / Event
2 May	Flag Hoisting (Education Day)
14 May	Vesakh Day
16 May	Teachers Appreciation Day
25 May	Isra Miraj
29 May	Ascension of Jesus Christ
2 - 6 Jun	Final Semester Test
7 Jun	Graduation Day
9 Jun	Recollection
10 Jun	Student Activity
11 - 12 Jun	No Classes (report preparation)
13 Jun	Report Distribution
13 Jun	Long Holiday Begins

## JUNE 2014

MON	TUE	WED	THU	FRI	SAT	SUN
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	1	2	3	4	5	6

Gambar 23. Kalender akademik



Gambar 24. Perpustakaan



## Lampiran 8 Lampiran Wawancara

### a. Wawancara Dinas Pendidikan Kota Semarang

1. Apa kebijakan dinas pendidikan terkait dengan sekolah internasional di Semarang?

Jawaban: “Dari pihak Dinas Pendidikan ingin sekolah internasional memenuhi seluruh syarat untuk mendirikan sekolah internasional. Mulai dari karakteristik pengelolaan pembelajaran, tenaga pendidik, sampai sarana prasarana. Selain itu harus menyertakan mata pelajaran wajib seperti Pendidikan Kewarganegaraan dan Bahasa Indonesia.”

2. Apa bentuk pengawasan Dinas Pendidikan ke sekolah internasional?

Jawaban: “Sekolah internasional tidak termasuk wilayah pengawasan otonomi daerah. Pengawasan langsung dilakukan Kementerian Pendidikan dan Kebudayaan. Dalam Undang–Undang tidak diamanatkan bahwa Dinas Pendidikan Kota melakukan pengawasan ke Sekolah Internasional. Jumlah Pengawas di Dinas Pendidikan Kota Semarang ada 8 orang, sedangkan jumlah sekolah di Semarang ada 174. Karena terbatasnya tenaga, pemantauan hanya saat rapat/sosialisasi program di Dinas Pendidikan. Sekolah internasional juga sering mengirimkan perwakilan untuk mengikuti rapat/sosialisasi itu. Setelah kasus JIS ini, Dinas Pendidikan akan mulai mengagendakan pemantauan setelah UAN SMP.”

### b. Wawancara Kepala Sekolah

1. Bagaimana sejarah berdirinya sekolah dan perkembangan Saint John’s Catholic School?

Jawaban: “Sekolah ini untuk lahir dari kerinduan melahirkan generasi yang terbaik dalam karir, produktif di masyarakat, mandiri, disiplin, kreatif, punya pemikiran kritis, cinta pada budaya, dan menjadi saksi iman kristiani kepada dunia. Visi kami adalah memberikan dasar hidup yang terdiri atas *Scientia, Virtus et Vita*, pengetahuan, kebajikan dan kehidupan. Misi sekolah ini adalah memberikan program akademik yang relevan dan bermutu, meningkatkan nilai spiritual dan moral, menghargai setiap pribadi sebagai manusia yang memiliki potensi yang luar biasa, meningkatkan tanggung jawab sosial pada pembangunan bangsa, dan mempersiapkan generasi muda Indonesia untuk tanggap pada pertumbuhan global. Sekolah ini telah berdiri selama 8 tahun

sejak 6 Januari 2006, memiliki 360 murid dengan total tenaga pendidik dan *staff* 100 orang.”

2. Apa tugas ibu sebagai kepala sekolah Saint John’s Catholic School?

Jawaban: “Menugaskan guru dan memberi pengarahan pada guru dan murid mengenai kurikulum *Cambridge*, menganalisis hasil kegiatan belajar mengajar, mengesahkan keputusan berkenaan dengan kegiatan belajar mengajar dan mengesahkan hasil ujian sertifikasi *Cambridge*.”

3. Apa yang melatarbelakangi Saint John’s Catholic School mendapat predikat sekolah internasional?

Jawaban: Karena ingin terus meningkatkan kualitas dan mutu pendidikan di sekolah Saint John’s. setelah mendapat predikat A, Saint John’s melakukan kerjasama dengan Goethe Institut dan mengadopsi kurikulum *Cambridge*.

4. Apa yang melatarbelakangi Saint John’s Catholic School menerapkan kurikulum *Cambridge*?

Jawaban: “Sekolah ini berdiri sudah 8 tahun, dan menggunakan kurikulum *Cambridge* sudah 7 tahun. Banyak hal yang dipertimbangkan sebelum menerapkan kurikulum *Cambridge*, seperti kesesuaian dengan visi, misi sekolah serta seberapa besar kesesuaian dengan kurikulum nasional. Kurikulum ini sangat mirip dengan kurikulum 2013 yang dipakai di Indonesia sehingga tidak menyulitkan bagi siswa yang ingin mengambil Ujian Nasional. Selain itu, kurikulum ini dipakai oleh sebagian besar negara di dunia, dan memudahkan siswa yang ingin melanjutkan pendidikan ke Cambridge University atau sekolah di luar negeri lainnya, tanpa ujian masuk lagi.”

5. Bagaimana cara menjalin kerjasama? Apakah dengan sister school/Info web/diadaptasi setelah kunjungan?

Jawaban: “Sister School dengan Goethe Institut.”

6. Bagaimana proses awal Saint John’s Catholic School menjalankan kurikulum? Langsung pakai/*ditraining*?

Jawaban: “Proses awal adalah merencanakan kurikulum, karena sudah ada dalam peraturan pemerintah, tinggal kita menyesuaikan dengan kondisi siswa dan kondisi sekolah. Kemudian baru menjalankan dengan cara di Training oleh pihak CIE yang memiliki kantor perwakilan di Jakarta.”

7. Yayasan apa yang menaungi Saint John’s Catholic School?

Jawaban: “Yayasan Yohanes”

c. Wawancara Staf Kurikulum Saint John's Catholic School.

1. Apa tugas ibu sebagai *staff* kurikulum dan kaitannya dalam penerapan kurikulum *Cambridge*?

Jawaban: “tugas saya antara lain memilih guru mata pelajaran yang kompeten dan memiliki pengetahuan mengenai kurikulum *Cambridge*. Mempromosikan Saint John's Catholic School sebagai pengguna kurikulum *Cambridge* kepada masyarakat. Mengurus administrasi, buku-buku referensi untuk menunjang kegiatan pembelajaran, dan mengurus ujian sertifikasi ke kantor perwakilan CIE di Jakarta. Biasanya saya sibuk diawal dan diakhir semester.”

2. Berapa muatan pelajaran dalam jenjang pendidikan di Saint John's Catholic School?

Jawaban: “Pelajaran Agama, Pendidikan Moral dan Kewarganegaraan, Bahasa Indonesia, *English Second Language (ESL)*, *Mathematics*, *Sciences (Physics, Biology, Chemistry)*, *Socials (Economics, History, Geography, Business Studies)*, *Information and Communication (ICT)*, Bahasa Jerman/Bahasa Mandarin.”

3. Mata pelajaran apa yang termasuk dalam kurikulum *Cambridge* Saint John's Catholic School?

Jawaban: “7 silabus yakni *Mathematic*, *Physics*, *Chemistry*, *Biology*, *English Second Language*, *Economics*, dan *Business Studies*”

4. Apa latar belakang Saint John's Catholic School menerapkan kurikulum *Cambridge*?

Jawaban: “Sebelum menentukan untuk menggunakan kurikulum *Cambridge*, orang tua siswa dan siswa diminta pendapatnya mengenai kurikulum yang ingin diadopsi. Sebagian besar menyatakan keinginan untuk menggunakan kurikulum *Cambridge* karena kurikulum ini banyak dipakai seluruh negara di dunia. Serta siswa yang ingin melanjutkan pendidikan ke Cambridge University atau sekolah di luar negeri, tidak perlu ujian masuk lagi.”

5. Bagaimana bentuk pembinaan guru dan murid mengenai kurikulum *Cambridge* dan sebelum ujian sertifikasi *Cambridge*?

Jawaban: “Terdapat ICTM (*International Class Teacher Meeting*) untuk guru dan murid. Serta diminta komitmen waktu, tenaga, pikiran yang lebih dengan diberikannya *Letter of Agreement* yang merupakan bentuk perjanjian tertulis siswa dan guru karena kurikulum *Cambridge* memiliki konten materi ajar

yang sedikit berbeda dari kurikulum nasional. Disamping menggunakan kurikulum *Cambridge*, siswa yang ingin mengikuti Ujian Nasional harus mengikuti kelas tambahan khusus mempersiapkan Ujian Nasional.”

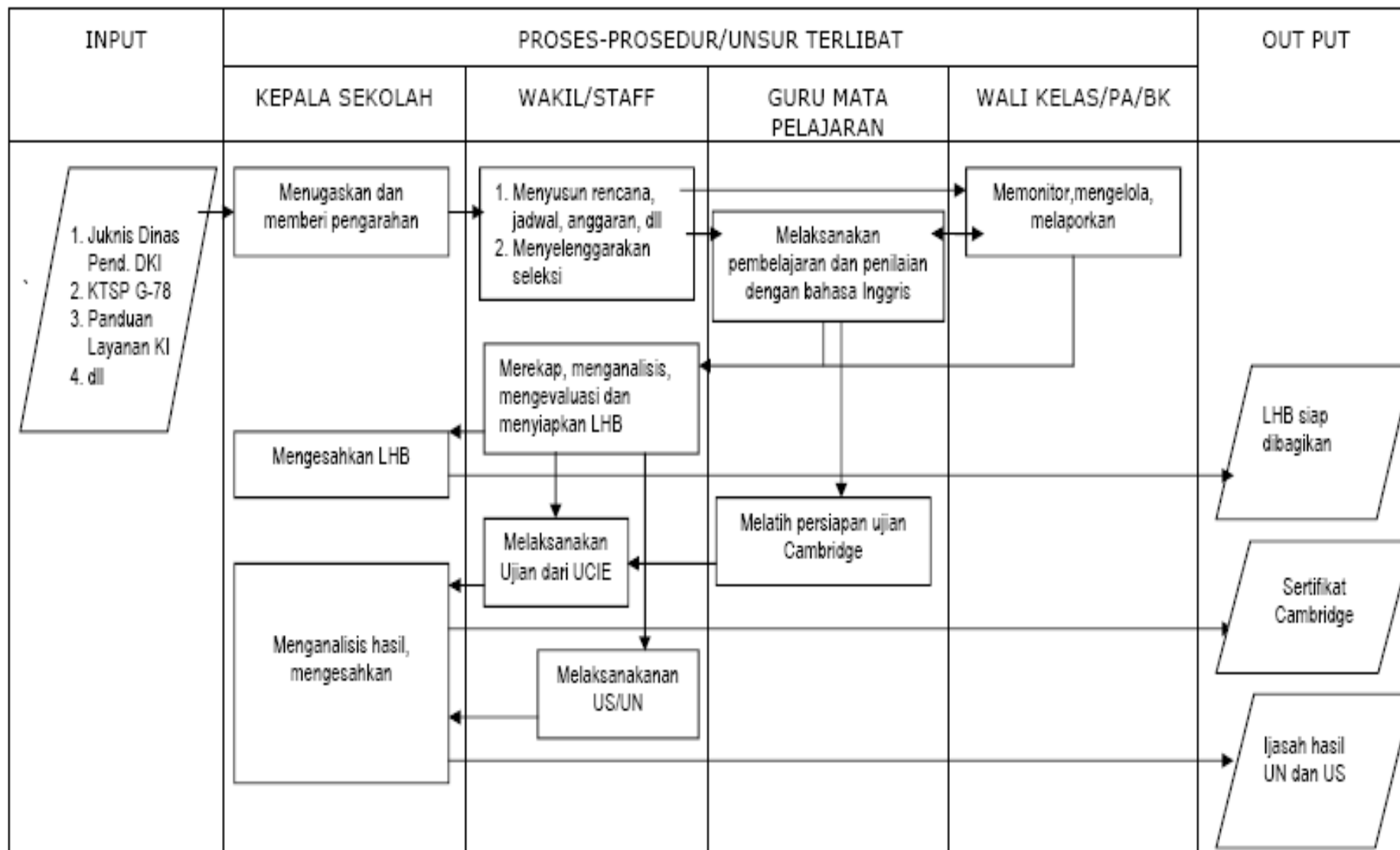
6. Bagaimana bentuk ujian sertifikasi *Cambridge*?

Jawaban: “Ujian diselenggarakan dua kali dalam setahun, yaitu bulan Mei-Juni (pendaftaran di kantor perwakilan CIE pada Desember-Februari) dan Oktober-November (pendaftaran di kantor perwakilan CIE pada bulan Juli-Agustus). Biaya yang harus dikeluarkan oleh orangtua adalah biaya pendaftaran Rp. 400.000,- biaya administrasi Rp. 450.000,-/*subject*, dan biaya ujian IGCSE Rp. 825.000,- (dibayar per *subject*). Ujian praktikum di level IGCSE untuk Kimia, Biologi, dan Fisika dengan biaya Rp 1.000.000,-/*subject*.”(Soal Ujian Sertifikasi Cambridge disajikan pada lampiran 10)

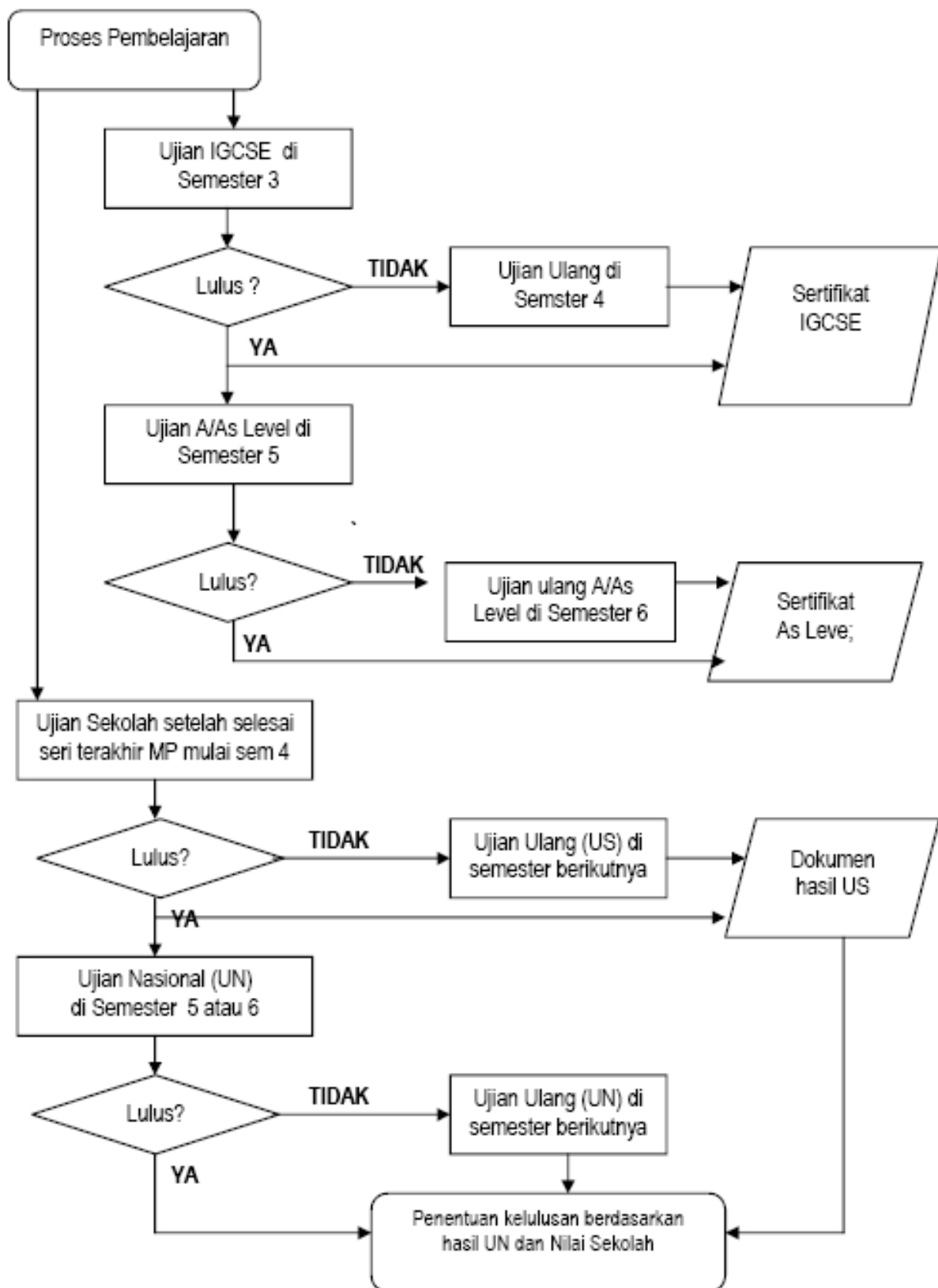
7. Bagaimana alur sekolah untuk mendapatkan sertifikat kelulusan ujian *Cambridge*?

Jawaban: “Input Juknis Dinas dan lain-lain diterima oleh sekolah, Kepala Sekolah menugaskan dan member pengarahan kepada Wakil Kepala Sekolah Bidang Kurikulum untuk menyusun rencana jadwal, anggaran. Sedangkan guru mata pelajaran melaksanakan pembelajaran sesuai silabus serta melatih persiapan ujian *Cambridge*. Kemudian Wakil Kepala Sekolah Bidang Kurikulum melaksanakan ujian *Cambridge*, Kepala Sekolah menganalisa hasil dan mengesahkan kemudian dikeluarkanlah sertifikat *Cambridge* per *subject* yang dipilih siswa.” (lampiran 9)

Lampiran 9 Proses Prosedur dan Unsur yang terlibat dalam ujian *Cambridge*



Lampiran 10 Instruksi Kerja Pelaksanaan Ujian Cambridge



Lampiran 11. Dokumentasi Wawancara



Gambar 25. Wawancara dengan Bapak S selaku Kepala Bagian Pendidikan Dasar dan Menengah Dinas Pendidikan Kota Semarang



Gambar 26. Wawancara dengan Ms. PD selaku koordinator Bidang Kurikulum IGSC Saint John's Catholic School.

Lampiran 12 Lampiran Wawancara Dampak Implementasi Kurikulum *Cambridge Saint John's Catholic School*

a. Wawancara untuk Dinas Pendidikan Kota Semarang.

1. Bagaimana hasil ujian Nasional peserta didik Saint John's Catholic School tahun 2011-2014?

Jawaban: Rata-rata nilai siswa Saint John's Catholic School tahun 2011-2013 sangat baik yaitu 32.66, 32.74, 32.96 untuk 4 mata pelajaran. Bidang studi IPA, rata-rata nilainya 8.17, 8.25, 8.43. Persentase kelulusan UN 2011-2013 selalu 100%.

b. Wawancara untuk Staf Kurikulum Saint John's Catholic School.

1. Apa prestasi akademik peserta didik?

Jawaban: Prestasi akademik ada banyak sekali seperti 1<sup>st</sup> *Debate Competition*, 2<sup>nd</sup> *Business Plan Competition*, 2<sup>nd</sup> *German Language Olympiade*. IPA khususnya siswa mendapat, *Finalist big 5 Science Competition*, *finalist big 10 Academic Excellence*.

2. Bagaimana hasil ujian Nasional peserta didik Saint John's Catholic School tahun 2011-2014??

Jawaban: Selalu diatas 8, Tahun 2011-2013 siswa kami mendapat nilai rata-rata 32.66, 32.74, 32.96 untuk 4 mata pelajaran. Untuk bidang studi IPA, rata-rata nilainya 8.17, 8.25, 8.43. Persentase kelulusan UN 2011-2013 selalu 100% tiap tahun.

3. Bagaimana studi lanjut peserta didik lulusan Sekolah Internasional Semarang?

Jawaban: Alumni Saint John's Catholic School banyak diterima di universitas Oklahoma State University, Goethe Institut, Singapore Institute, National Chi Nan University. Selain itu, Alumni Saint John's Catholic School diterima di Universitas Gajah Mada, Universitas Tarumanegara dan Universitas Trisakti.



Lampiran 13. Dokumentasi Prestasi Belajar Siswa Saint John's Catholic School



3<sup>rd</sup>, Grace, Gebyar Sains Nasional Sekolah Pembangunan Jaya 2013

2<sup>nd</sup>, Clarisa, News Casting, President University Qualify student in German Language, Olivie 2013

2<sup>nd</sup>, Kristina Tening, German Olympiad-Province level 2013



Gambar 27. Prestasi Akademik



## *Timothy Pasaribu*

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My name is Timothy Pasaribu, I am currently a senior student at the Oklahoma State University. I was proudly graduated from St. John's Catholic School in 2010 and moved to the United States afterwards.

During my time at SJCS, I had the opportunity to lead the Student Council, which was one of the best moments in my life. I enjoyed every moment of it, especially when our school was successfully held the first ever Saint John's Cup, which nowadays is well known as SYNC! SJCS has prepared myself to be a leader. At first, I was overwhelmed with the position itself, but with the encouragement and supports of the people around me, I developed the ability to take leadership in any way I could. During my time in the USA, I took up a handful of leadership positions:

Vice President of Collegiate Relations| Delta Sigma Pi Fraternity (Gamma Epsilon Chapter)

President | Indonesian Overseas Student Association (Stillwater, OK Chapter)

President | Phi Theta Kappa Honor Society (Beta Alpha Alpha Chapter)

President | Multicultural and International Students Association

With these responsibilities, I had the chance to gain several opportunities, such as attending conferences in Houston, Los Angeles, Chicago as well as in New York City. The best part of it is that I can connect with different professionals in my field, which is a very good thing to have. Without the experiences at Saint John's Catholic School, I would not have the courage to think outside the box. Therefore, I appreciate all the people in Saint John's who have shown me the importance of taking the leadership role.

Lampiran 15. *Grading and Reporting* Siswa



**SAINT JOHN'S CATHOLIC SCHOOL**  
 Jl. Kencana Loka No.8, Telp.0370-623873, Fax: 7587 3345 - 7587 3565  
 SEMARANG

**GRADING AND REPORTING**

**Class: Secondary 1 James**

**Teacher: Ms. YA**

**Major: Biology**

**Mr. SU**

SPN	Name	Reporting							Grading
		Section I			Section II			Block Plan I	
		Knowledge with Understanding	Handling Info & Problem Solving	Experiment skill & Investigations	Knowledge with Understanding	Handling Info & Problem Solving	Experiment skill & Investigations		
1310001	Abram Nathan	A*	A	A*	A*	A	A	B	A*
1310002	Adriel Albert	A	A	A*	A	A	A	B	A*
1310003	Agatha Settham	A	A	B	B	B	A	B	A
1310011	Aryo Setyotama	A	A*	A	B	A	A*	B	A*
1310015	Chriselda Feber	A	A	A	A	A	A	B	A
1310021	Daniel	A	A	B	A	A*	A	B	A
1310090	David Harsono	B	A	B	A	A*	B	B	A
1310025	Desy Natalia	B	A	B	A	B	B	B	A
1310031	Ezra Nehemia	A*	A	A	A*	A	A	B	A*
1310032	Farz Alexander	B	B	A	A	A	B	B	A
1310034	FernandSeth	B	A	B	A	B	A	B	A
1310037	Geffen Rahard	A	A*	A*	A	A	A*	B	A*
1310039	Gionardy Goper	A	A	A*	A	A	A	B	A*



### GRADING AND REPORTING

**Class: Secondary 1 Philip**

**Teacher: Ms. HH**

**Major: Biology**

**Mr. AR**

SPN	Name	Reporting							Grading
		Section I			Section II			Block Plan I	
		Knowledge with Understanding	Handling Info & Problem Solving	Experiment skill & Investigations	Knowledge with Understanding	Handling Info & Problem Solving	Experiment skill & Investigations		
1310007	Antonius Willy	A	B	A	A*	A	A	B	A*
1310010	Arya Saca	A	A	A*	A	A	A	B	A*
1310012	Bianca Anatta	A*	A	B	A	B	A	B	A
1310016	Christian Mike	A	A	A	B	A	A	B	A
1310018	Citra Hosanna	A	A	A	A	A	A	B	A*
1310019	ClarissSiemman	A	A*	B	A	A	A	B	A
1310022	David Diegel	A	B	B	A	A	A	B	A
1310023	Davin Agland	A	B	B	A	A	A	B	A
1310028	Edbert Prathama	A*	A	B	A	A	A	B	A
1310042	Hernando Borosi	A	A	A	A*	A	A	B	A*
1310056	LeonardoMarcel	A	A	A	B	B	B	B	B
1310062	Maria Angela	A*	A	B	A	A	A	B	A*
1310063	Maria Reza	A	A	A*	A	B	A	B	A*



**GRADING AND REPORTING**

**Class: Secondary 2 Peter**

**Teacher: Ms. HH**

**Major: Biology**

**Mr. SU**

SPN	Name	Reporting						Block Plan II	Grading
		Section III			Section IV				
		Knowledge with Understanding	Handling Info & Problem Solving	Experiment skill & Investigations	Knowledge with Understanding	Handling Info & Problem Solving	Experiment skill & Investigations		
1310014	Catherine Tjahja	A	A	A*	A	B	A	B	A*
1310017	Christopher Gerr	A	A	A	A*	A	B	B	A*
1310020	Claudia Alfetta	A	A	B	A	B	B	B	A
1310024	Davis Parardhya	A	A	A	B	A	A	B	A
1310026	Diviya Agatha	A	B	A	A	A	B	B	A
1310027	Don Bravo Carlo	A	A	A*	A	A	A	B	A*
1310029	Elizabeth Seth	B	A	A	B	A	B	B	A
1310033	Felicia Clarissa	B	A	A	B	A	B	B	A
1310040	Glenn Seriff	A*	A	A	A	A	A	B	A*
1310041	Hanny Diamond	B	B	A	B	A	B	B	B
1310045	Jason Tedja	B	B	B	B	B	B	B	B
1310048	Joshua Ariel	A*	A	A	A	A	A	B	A
1310049	Josua Krisfredo	A	A	A	B	A	A	B	A



**GRADING AND REPORTING**

**Class: Secondary 2 Thomas**

**Teacher: Ms. YA**

**Major: Biology**

**Mr. AR**

SPN	Name	Reporting							Grading
		Section III			Section IV			Block Plan II	
		Knowledge with Understanding	Handling Info & Problem Solving	Experiment skill & Investigations	Knowledge with Understanding	Handling Info & Problem Solving	Experiment skill & Investigations		
1310006	Angelina Surya	A	A	B	A	A	A	A	A
1310008	Antony Benputra	A	B	A	B	A	B	A	A
1310009	Arcel Christia	B	A	B	B	B	B	A	A
1310013	Bianca Isabelle	A	B	A	B	A	A	B	A
1310030	Evita Cenora	A	A	A*	A	B	A	A	A*
1310035	Franscinella Dab	A	A*	A	A	B	A	A	A*
1310036	Gabriela Bianca	B	A	A	B	B	A	B	A
1310038	Gerry	B	B	A	A	A	A	A	A
1310094	Ignacia Leoni	B	A	A	A	A	A	A	A
1310046	Jehuda Reinhard	A	A	A	A	A	B	B	A
1310051	Justin Tanner	B	A	B	A	B	B	A	A
1310054	Kevin Dunn	A*	A	A	A*	A	A	A	A*
1310057	Lidwina Joseph	A	B	A	B	A	A	B	A

Lampiran 16. Soal Ujian Cambridge



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

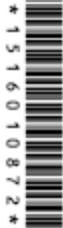
CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
NUMBER

--	--	--	--



**BIOLOGY**  
Paper 2 Core

**0610/22**  
**October/November 2012**  
**1 hour 15 minutes**

Candidates answer on the Question Paper.  
No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.  
Write in dark blue or black pen.  
You may use a pencil for any diagrams or graphs.  
Do not use staples, paper clips, highlighters, glue or correction fluid.  
**DO NOT WRITE IN ANY BARCODES.**

Answer all questions.

Electronic calculators may be used.  
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.  
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
<b>Total</b>	

This document consists of 19 printed pages and 1 blank page.

- 1 Animals without backbones are classified into a number of groups.

Draw **one** line from each of the named groups to its description.

group	description
annelids	hard, jointed exoskeleton, three pairs of jointed legs
insects	long cylindrical body, segmented, has bristles but no legs
molluscs	long cylindrical body, not segmented, no legs
myriapods	has soft body, head and muscular foot, most have a hard shell
nematodes	exoskeleton, segmented body, jointed legs on each segment

*For  
Examiner's  
Use*

[4]

[Total: 4]



2 (a) (i) State what is meant by the term *excretion*.

.....  
.....  
.....  
..... [2]

(ii) Name the main substance that is excreted in expired air.

..... [1]

(iii) Urine contains water. Name **two** other excretory products found in the urine of a healthy person.

..... and ..... [1]

(b) Fig. 2.1 shows the kidneys and associated structures.

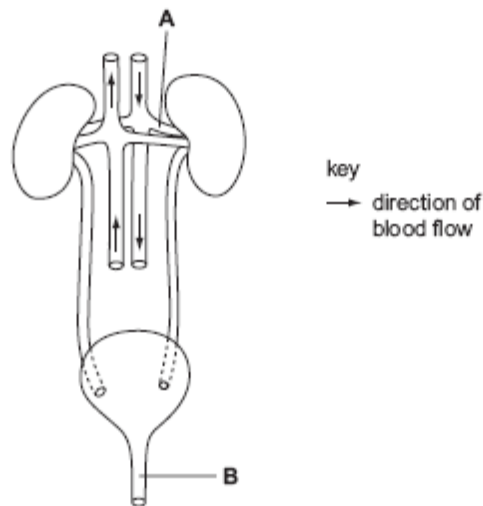


Fig. 2.1

Name the structures labelled **A** and **B**.

**A** .....  
**B** ..... [2]



3 (a) Fig. 3.1 shows the fruits of two species of plants.

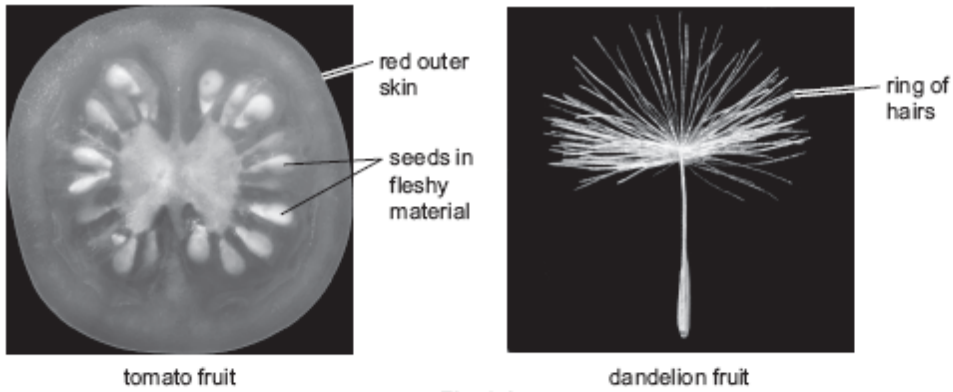


Fig. 3.1

For Examiner's Use

Suggest and explain how seeds from each of these two plants are transported away from the parent plant.

tomato .....

.....

.....

..... [2]

dandelion .....

.....

.....

..... [2]

(b) Explain why it is important that seeds are transported well away from the parent plant.

.....

.....

.....

.....

..... [3]

[Total: 7]

- 4 Table 4.1 shows the percentage of each of the gases present in the atmosphere and in expired air.

For  
Examiner's  
Use

Table 4.1

gas	% of atmospheric air	% of expired air
carbon dioxide	0.04	4.00
oxygen	21.00	16.00
X	78.00	78.00
other gases	0.96	2.00

- (a) Identify gas X.

..... [1]

- (b) Fig. 4.1 shows the volume of air exchanged during each breath at rest and during vigorous exercise.

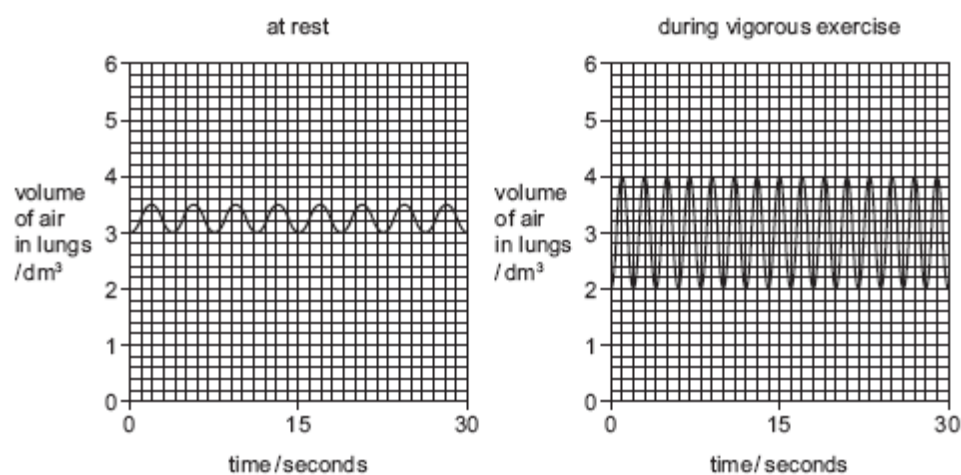


Fig. 4.1

- (i) State the volume of air inhaled in each breath at rest.

..... dm<sup>3</sup> [1]

(ii) State how many breaths are taken in one minute at rest.  
..... [1]

(iii) Calculate the volume of air exchanged in one minute at rest.  
..... dm<sup>3</sup> [1]

(iv) Using information from Table 4.1, calculate the volume of oxygen absorbed in one minute at rest.  
Show your working.  
..... dm<sup>3</sup> [2]

(c) (i) Describe what happens to both the rate and depth of breathing during vigorous exercise.  
.....  
..... [1]

(ii) Suggest why the changes in the rate and depth of breathing are important for the person doing exercise.  
.....  
.....  
..... [2]

(iii) Suggest why the person's heart rate also changes during exercise.  
.....  
.....  
.....  
..... [3]

[Total: 12]



(iv) Complete a food chain of five stages from this food web.

For  
Examiner's  
Use



[2]

(b) Jaguars are big cats that are hunted for their fur.

Suggest and explain how the numbers of eagles might be affected if the jaguars were removed from this food web.

.....  
.....  
.....  
..... [2]

(c) Suggest how humans who live in the Amazon rainforest might be affected if large areas of trees are removed.

.....  
.....  
.....  
..... [2]

[Total: 11]

6 Fig. 6.1 shows a human fetus developing inside a uterus.

For  
Examiner's  
Use

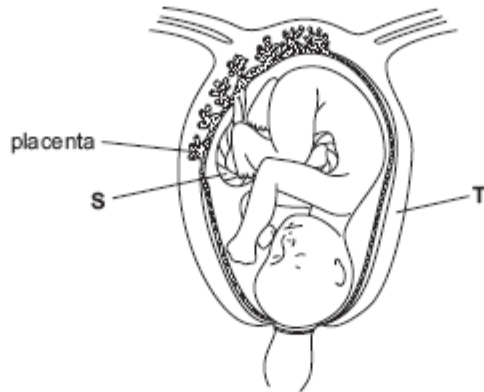


Fig. 6.1

(a) (i) Name the structures labelled S and T.

S ..... [1]  
T .....

(ii) Explain the function of the placenta in the healthy development of the fetus.

.....  
.....  
.....  
.....  
..... [3]



(iii) The blood supply of the mother and of the fetus are kept separate from each other at the placenta.

*For  
Examiner's  
Use*

Suggest and explain two reasons why these two blood systems must not be joined to each other.

1 .....

.....

.....

.....

2 .....

.....

.....

..... [4]



7 Fig. 7.1 shows the water cycle.

For  
Examiner's  
Use

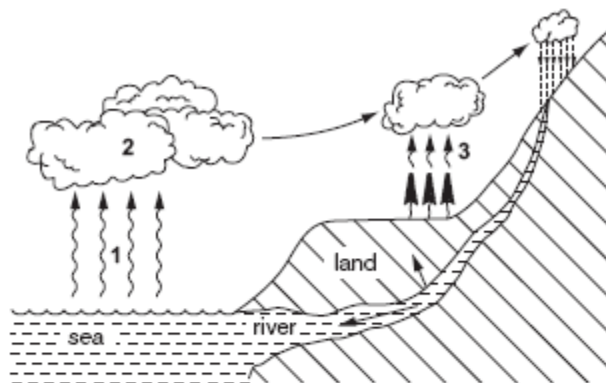


Fig. 7.1

(a) Name the processes that are happening at points 1, 2 and 3 in the water cycle.

- 1 .....
- 2 .....
- 3 ..... [3]

(b) On mountains, rainwater drains over the surface and sinks into the soil.

Explain why the soil on mountainsides may be poor for agriculture.

- .....
- .....
- .....
- ..... [2]

[Total: 5]

8 Fig. 8.1 shows a section through a leaf.

For  
Examiner's  
Use

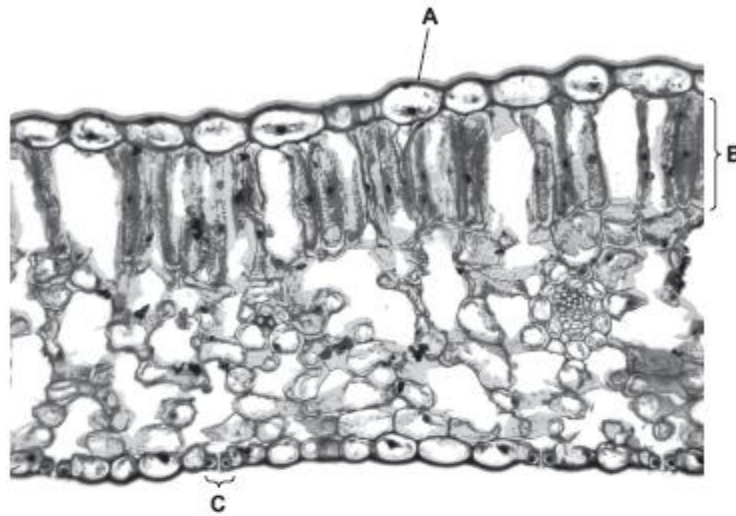


Fig. 8.1

(a) (i) Name layers A and B.

A .....  
B ..... [2]

(ii) State a function of layer A.

.....  
..... [1]

(iii) Describe the function of C.

.....  
..... [1]

- (b) Measurements were made of the mass of water taken in and lost by a plant every two hours for 24 hours.

For  
Examiner's  
Use

Fig. 8.2 is a graph showing the mass of water lost from the plant by transpiration.

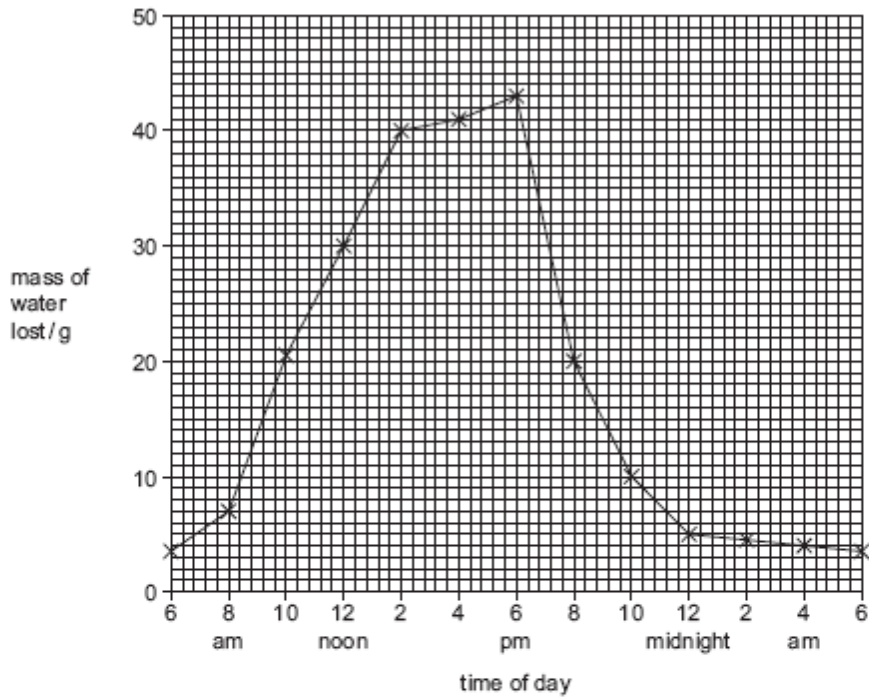


Fig. 8.2

- (i) Use the graph, Fig. 8.2, to state the time when the mass of water lost was greatest.

..... [1]

Table 8.1 shows the mass of water taken in by the plant every two hours. Some of the data has been plotted in Fig. 8.3.

*For  
Examiner's  
Use*

**Table 8.1**

time of day	mass of water taken in by plant / g
6 am	plotted
8 am	plotted
10 am	22
12 noon	40
2 pm	50
4 pm	44
6 pm	30
8 pm	10
10 pm	plotted
12 midnight	plotted
2 am	plotted
4 am	plotted
6 am	plotted

Fig. 8.3 shows the mass of water lost and the mass of water taken in by the plant during the same period.

For  
Examiner's  
Use

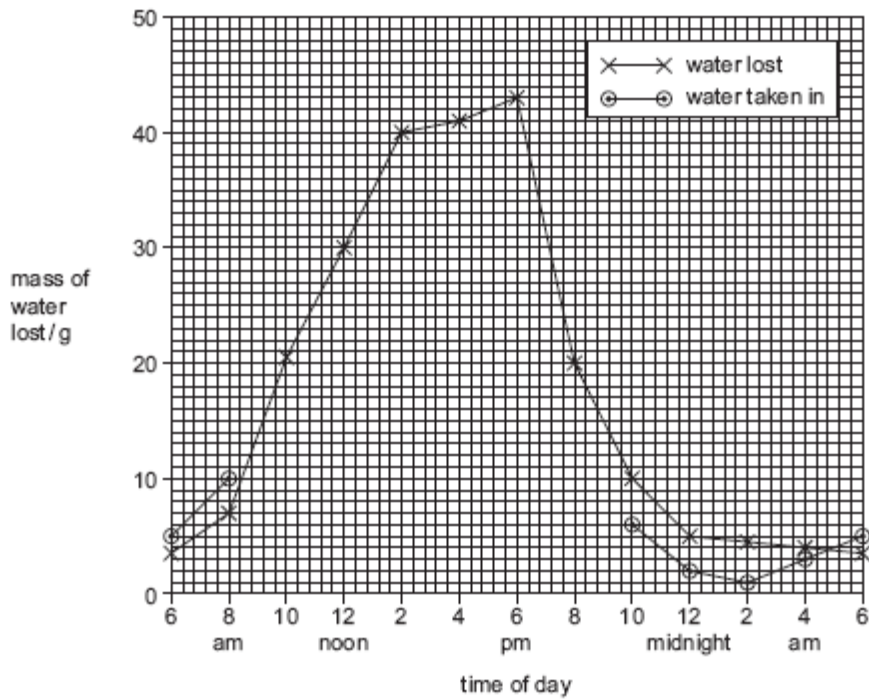


Fig. 8.3

(ii) Complete the graph, Fig. 8.3, to show the mass of water taken in by the plant from 8 am to 10 pm.

Draw your graph on Fig. 8.3. [2]

(iii) State the period of time during which water taken in was less than water lost.

..... [1]

(iv) Describe the state of the stomata between 6 am and 2 pm.

..... [1]

(v) Suggest one factor that caused the state in (b)(iv).

..... [1]

(vi) Name and explain **one** factor, other than your answer to (b)(v), that might increase the loss of water from a leaf during the day.

*For  
Examiner's  
Use*

.....  
.....  
.....  
.....  
.....  
.....

[3]

[Total: 13]



- 9 Table 9.1 shows the percentage of the main types of foods in the diet of two teenage girls. One girl lives in Great Britain and the other girl in sub-Saharan Africa.

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Table 9.1

food type	girl in Great Britain % of diet	girl in sub-Saharan Africa % of diet
cereals	15.0	75.0
fruit and vegetables	35.0	15.0
milk and cheese	15.0	7.5
eggs, fish and meat	30.0	2.5
sweets and sugar	5.0	0.0

- (a) Compare the percentage of foods rich in fats in the two diets.

.....  
..... [1]

- (b) Suggest how the lack of sweets and sugar in the diet of the African girl might benefit her health.

.....  
.....  
.....  
..... [2]

- (c) The diet of the African girl contains much less protein than that of the British girl. Suggest and explain **one** way in which a diet containing little protein might affect her physical development.

.....  
.....  
.....  
..... [2]

[Total: 5]

---

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Lampiran 17. Instrumen observasi karakteristik pengelolaan pembelajaran kurikulum *Cambridge* di Saint John's Catholic School

No	Karakteristik Program	Iya	Tidak
1.	Memiliki keunggulan yang ditunjukkan dengan pengakuan internasional terhadap proses dan hasil atau keluaran pendidikan yang berkualitas dan teruji dalam berbagai aspek	√	
2.	Mempunyai pengakuan internasional yang dibuktikan dengan hasil sertifikasi dan akreditasi berpredikat baik dari <i>Cambridge</i> .	√	

No	Karakteristik Sekolah	Iya	Tidak
1.	Telah memiliki akreditasi A dari Badan Akreditasi Sekolah	√	
2.	Sekolah Kategori Mandiri (SKM)	√	
3.	Meraih sertifikat ISO 9001 versi 2000 atau sesudahnya dan ISO 14000;	√	
4.	Menjalin hubungan "sister school" dengan sekolah bertaraf internasional di luar negeri;	√	
5.	Penyelenggaraan sekolah 1 shift (tidak double shift);	√	

No	Karakteristik Proses Belajar Mengajar	Iya	Tidak
1.	Diperkaya dengan model proses pembelajaran sekolah unggul dari <i>Cambridge</i>	√	
2.	Menerapkan pembinaan dan pembelajaran berbasis TIK pada semua mata pelajaran	√	
3.	Pembelajaran kelompok sains, matematika, dan inti kejuruan menggunakan bahasa Inggris, sementara pembelajaran mapel lainnya dapat menggunakan bahasa pengantar yang disepakati	√	
4.	Terdapat ICTM (International Class Teacher Meeting), untuk diseminasi guru dan program pembinaan peserta didik	√	

No	Karakteristik Pendidik	Iya	Tidak
1.	Semua guru mampu memfasilitasi pembelajaran berbasis TIK	√	
2.	Guru kelompok mata pelajaran sains, matematika, dan inti kejuruan mampu mengampu pembelajaran dengan berbahasa Inggris	√	
3.	Minimal 40% guru berpendidikan S2/S3 dari perguruan tinggi yang program studinya berakreditasiA untuk SMP/MTs	√	

No	Karakteristik Kepala Sekolah	Iya	Tidak
1.	Kepala sekolah berpendidikan minimal S2 dari perguruan tinggi yang program studinya berakreditasi A dan telah menempuh pelatihan kepala sekolah dari lembaga yang diakui oleh Pemerintah	√	
2.	Kepala sekolah mampu berbahasa Inggris secara aktif dan mampu mengoperasikan komputer	√	
3.	Kepala sekolah/madrasah bervisi internasional, mampu membangun jejaring internasional, memiliki kompetensi manajerial, serta jiwa kepemimpinan dan entrepreneur yang kuat.	√	
4.	Memiliki SK Pengangkatan dari pejabat yang berwenang	√	

No	Karakteristik Sarana dan Prasarana	Iya	Tidak
1.	Setiap ruang kelas dilengkapi dengan sarana pembelajaran berbasis TIK	√	
2.	Perpustakaan dilengkapi dengan sarana digital yang memberikan akses ke sumber pembelajaran berbasis TIK di seluruh dunia	√	
3.	Memiliki 3 laboratorium IPA (Fisika, Kimia, Biologi)	√	
4.	Memiliki laboratorium komputer dan akses internet	√	
5.	Memiliki web Sekolah	√	
6.	Tersedia ruang kelas yang sesuai dengan rombongan belajar (peserta didik maksimum 15 orang)	√	
7.	Memiliki kultur sekolah yang memadai (bersih, bebas asap rokok, bebas kekerasan, rindang)	√	

\*Diadaptasi dari Depdiknas (2007)



**SCIENCES**

**Individual Candidate Record Card**

**IGCSE 2014**

Please read the instructions printed on the previous page and the General Coursework Regulations before completing this form.											
Centre number					Centre name		June/November	2	0	1	4
Candidate number					Candidate name		Teaching group/set				
Syllabus code	0	6	1	0	Syllabus title	BIOLOGY	Component number	0	4	Component title	COURSEWORK

Date of assessment	Experiment number from Sciences Experiment Form	Assess at least twice: ring highest two marks for each skill (Max 6 each assessment)				Relevant comments (for example, if help was given)
		C1	C2	C3	C4	
Marks to be transferred to						TOTAL
Coursework Assessment Summary Form		(max 12)	(max 12)	(max 12)	(max 12)	(max 48)



Lampiran 19. Surat Ijin Penelitian



KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN  
UNIVERSITAS NEGERI SEMARANG  
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM

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No : 2167 /UN37.1.4/LT/2014

Lamp. : -

Hal : Ijin Penelitian

Kepada

Yth. Kepala Dinas Pendidikan Kota Semarang

Di Dinas Pendidikan Kota Semarang

Dengan hormat,

Bersama ini kami mohon ijin pelaksanaan penelitian untuk menyusun skripsi/tugas akhir oleh mahasiswa sebagai berikut:

Nama : MONICA ELISABETH

NIM : 4401410053

Prodi : Pendidikan Biologi, S1

Topik : IMPLEMENTASI KURIKULUM INTERNASIONAL *CAMBRIDGE* DAN DAMPAKNYA TERHADAP PENGELOLAAN PEMBELAJARAN BIOLOGI: STUDI KASUS DI SAINT JOHN'S CATHOLIC SCHOOL

Tempat : SAINT JOHN'S CATHOLIC SCHOOL

Waktu : April - Juni 2014

Atas perhatian dan kerjasamanya disampaikan terima kasih.



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No : 2168/UN37.1.4/LT/2014

Lamp. :

Hal : Ijin Penelitian

Kepada

Yth. Kepala Saint John's Catholic School

Di Semarang

Dengan hormat,

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