Marking Schemes

This document was prepared for markers' reference. It should not be regarded as a set of model answers. Candidates and teachers who were not involved in the marking process are advised to interpret its contents with care.

Paper 1

SECTION A

Question No.	Key		Question No.	Key	
1.	D	(71%)	21.	C	(58%)
2.	C	(54%)	22.	A	(76%)
3.	B	(76%)	23.	B	(74%)
4.	A	(69%)	24.	B	(51%)
5.	D	(37%)	25.	D	(36%)
6.	D	(89%)	26.	A	(50%)
7.	A	(74%)	27.	B	(96%)
8.	C	(63%)	28.	A	(63%)
9.	C	(41%)	29.	D	(28%)
10.	A	(78%)	30.	B	(76%)
11.	D	(69%)	31.	B	(81%)
12.	A	(39%)	32.	C	(64%)
13.	C	(77%)	33.	B	(77%)
14.	A	(91%)	34.	A	(38%)
15.	D	(61%)	35.	D	(20%)
16.	D	(51%)	36.	C	(66%)
17.	C	(59%)			
18.	C	(63%)			
19.	B	(73%)			
20.	D	(50%)			

Note: Figures in brackets indicate the percentages of candidates choosing the correct answers.

General Marking Instructions

1. In order to maintain a uniform standard in marking, markers should adhere to the marking scheme agreed at the markers' meeting.

2. The marking scheme may not exhaust all possible answers for each question. Markers should exercise their professional discretion and judgment in accepting alternative answers that are not in the marking scheme but are correct and well-reasoned.

3. The following symbols are used:

/	A single slash indicates an acceptable alternative within an answer.
*	Correct spelling required

4. In questions asking for a specified number of reasons or examples etc. and a candidate gives more than the required number, the extra answers should not be marked. For instance, in a question asking candidates to provide two examples, and if a candidate gives three answers, only the first two should be marked.

5. In cases where a candidate answers more questions than required, the answers to all questions should be marked. However, the excess answer(s) receiving the lowest score(s) will be disregarded in the calculation of the final mark.

6. Award zero marks for answers which are contradictory.

7. Where applicable, markers should put a tick (✓) against the answer which counts for a point of merit and the aggregated mark awarded for each question should be entered into the mark box of the OSM system in the right-hand side. If no marks are to be given, a cross (X) should be inserted there instead.

Paper 1 Section B

				Marks
1.	(a)	•	B (1) • C and D (1)	(2)
	(b)	(i)	vibrations (1)	
		(ii)	oval window / cochlea (1)	(4)
		(iii)	lymph / fluid (1)	
		(iv)	auditory nerve (1)	
				6 marks
2.	(a)	•	vacuole * (1)	(1)
	(b)	Any ***two*** of the following: • the cell membrane / cytoplasm of the leaf cells has detached from the cell wall / the leaf cell is plasmolysed (1) • chloroplasts condense to the centre of the cell (1) • the vacuole / X has shrunk (1)		(2)
	(c)	•	sucrose solution has a lower water potential than the cell content (1) • there is a net movement of water from the cell content to the bathing solution by osmosis (1)	(2)
				5 marks
3.	(a)	(i)	• P (1)	(1)
		(ii)	• closely packed / located at the upper side facing the sun directly (1) • this maximises light absorption for photosynthesis (1)	(1+1)
	(b)	•	when the leaves are oriented vertically, both sides of the leaves have chance of receiving sunlight (1) • therefore, the photosynthetic tissues are evenly distributed on both sides of the leaf (1) • such that photosynthesis can be carried out effectively regardless of the change in the orientation of sun / the direction of illumination from sun during daytime (1)	(3)
				6 marks
4.	(a)	•	low-income countries (1)	(1)
	(b)	Any ***two*** of the following: • poor public / personal hygienic conditions led to easy spreading of infectious diseases (1) • poor healthcare systems failed to treat patients at critical time (1) • poor income could not afford the medical costs for treating infectious diseases (1)		(2)

Marks

(c)
- consumption of high calorie food / fatty food / lack of exercise (1)
- increases the risk of plaque formation / deposition of cholesterol / fat in coronary arteries (1)
- which leads to narrowing of the lumen of arteries / blockage in arteries / decrease blood flow to the heart (1) (4)
- heart muscles do not have enough nutrients / food and oxygen supply (1), resulting in heart attack

7 marks

5. (a)
- (1)

(b)
- somatic cells (1)
- because there are 2 sets of chromosomes / 46 chromosomes / 23 pairs of chromosomes (1) (1+1)

(c)
- mother will produce only one type of eggs with an X chromosome (1)
- father will produce two types of sperm cells, one with an X chromosome while another one with a Y chromosome (1) (3)
- the sex of offspring will be determined by which type of sperm cells is involved in the fertilisation (1), which is a random process

6 marks

6. (a)
- the blood cells of blood group O contain neither antigen A nor B (1)
- therefore, it can be transfused to patients of any of the ABO blood groups / group O individuals are universal donors (1)
- it will be used for transfusion to other blood groups if there are not enough blood reserve for other blood groups, (1) (max. 3)
- the population of blood group O individuals is the largest of all blood groups in Hong Kong (1)

(b)
- male donors can donate blood more frequently than female donors or vice versa (1) because

Any ***two*** of the following:
- females have regular loss of blood (1) (3)
- due to menstruation (1)
- compensatory production of blood cells after blood donation is faster in males (1)

6 marks

				Marks
7.	(a)	•	digestion of foods containing carbohydrates to form glucose (1) • absorption of glucose from the small intestine into the blood (1)	(2)
	(b) (i)	•	insulin* (1)	(1)
	(ii)	•	it stimulates the body cells and liver cells to take up more glucose from blood (1) • increases respiration in body cells to consume glucose (1) • it stimulates the conversion of glucose to glycogen by the liver / muscle cells (1)	(3)
	(iii)	•	has initial basal value and drops back to basal value at the end (1), effect lags behind (1)	(2)
	(c)	•	low GI food will lead to small fluctuations in blood glucose level (1) • the chance of having too high blood glucose level / glucose appearing in urine is reduced (1)	(2)
				10 marks
8.	(a)	•	Triglyceride / fat $\xrightarrow{\text{lipase}}$ glycerol + fatty acids	(2)
	(b) (i)	•	type of milk (1)	(1)
	(ii)	•	colour of the mixture in Tube A turned from pink to white (1) • colour of the mixture in Tube B turned from pink to pale pink / became pale (1)	(2)
	(iii)	•	Tube A (1) • Tube A turned white, showing that the mixture in Tube A was acidic (1) • Tube B remained pale pink, showing that the mixture in Tube B was alkaline (1) • full fat fresh milk release more fatty acid than half fat fresh milk after fat digestion (1), eventually resulting in to the acidic condition of the mixture in Tube A	(4)
				9 marks
9.	(a)	•	gene mutation involves alteration in the nucleotide / base sequence / triplet code in DNA of a single gene (1) • polypeptide produced from the mutated gene has a different amino acid sequence (1) • it folds into an enzyme with a different active site shape / 3D conformation (1) • this enzyme can no longer function in the oxidative phosphorylation (1) / fail to produce a functional enzyme / active site of this enzyme can no longer fit the substrate	(4)
	(b)	•	it regenerates NAD and FAD (1) • which are important hydrogen carriers in glycolysis / Krebs cycle (1) • it leads to the formation of ATP (1) • which is an important energy source to support cellular activities / reactions (1)	(4)

Marks

(c) (i)
- during fertilization, only the head of the sperm, which contains nucleus, will enter the egg / the middle piece of sperm, which contains mitochondria, will not enter the egg / be left outside the egg (1)

as a result, the sperm does not contribute any mitochondria to zygote — (1)

(ii)
- Nucleus: from Lily and Lily's husband (1)
- Mitochondria: mainly from donor (1) — (2)

11 marks

10. (a)

	Lamarck	Darwin
Characters developed during life time can be passed on to the ...	✓	
Organisms become more adaptive to the environment over generations	✓	✓

(2)

(b)
- genetic variation existed in the giraffe population, some with longer necks and others with shorter necks (1)
- individuals with longer necks has better ability to obtain food / could get more food than those with shorter necks (1)
- they have greater chance to survive and reproduce (1)
- thus the population of the subsequent generations would have a greater proportion of giraffes with longer neck (1)

(4)

(c)
- science is culturally embedded / influenced by social and cultural factors (1) — (1)

7 marks

Marks

11. **(A) How the carbon atom was released from dinosaur to the atmosphere (max 1 mark)**

the dead body of the dinosaur might be

- decomposed by microorgansisms to form carbon dioxide containing the carbon atom (1) — max 1
- turned into a portion of fossil fuels, which is then released as carbon dioxide to the atmosphere by combustion (1)

(B) The cycling of the carbon atom before reaching Sharon (max 3 marks)

- the carbon dioxide containing the carbon atom was used by plants in photosynthesis (1)
- and converted to organic matter (1)
- the carbon passed on to consumers by feeding the plants / passed along the food chain (1) — max 3
- the carbon atom in the biomass of these organisms would be released to the atmosphere by respiration / decomposition (1)

this cycle repeated until the carbon atom finally reached Sharon

(C) How Sharon obtained the carbon atom (max 2 marks)

- Sharon obtained the carbon atom by feeding / from the food chain (1)
- the food containing the carbon atom was digested and absorbed in the small intestine (1) — max 2
- Sharon breathes in the carbon dioxide containing the carbon atom and breathes out (1)

(D) What happened inside Sharon's body (max 2 marks)

- the absorbed food containing the carbon atom travels along the circulatory system (1)
- and is taken up by body cells for respiration (1)
- to form carbon dioixde (1) — max 2
- the carbon dioxide containing the carbon atom travels along the circulatory system to the lungs for gas exchange / breathing out (1)

(E) Effective communication (0-3) — max 3

11 marks

Mark award for communication:

Mark	Clarity of expression and relevance to the question	Logical and systematic presentation
3	• Answers are easy to understand. They are fluent showing good command of language. • There is no or little irrelevant material.	• Answers are well structured showing coherence of thought and organisation of ideas.
2	• Language used is understandable but there is some inappropriate use of words. • A little relevant material is included, but does not mar the overall answer.	• Answers are organised, but there is some repetition of ideas.
1	• Markers have to spend some time and effort on understanding the answer(s). • Irrelevant material obscures some minor ideas.	• Answers are a bit disorganised, but paragraphing is evident. Repetition is noticeable.
0	• Language used is incomprehensible. • Irrelevant material buries the major ideas required by the question.	• Ideas are not coherent and systematic. Candidates show no attempt to organise thoughts.

Paper 2 Section A

Marks

1. (a) (i)
- Group C did not drink any liquid in the experiment, therefore the water potential of the blood in persons in group C was lower than that of the groups A and B (1)
- this was detected by the osmoreceptors / the hypothalamus (1)
- which then stimulated the pituitary gland to release more ADH (1) into the blood
- more ADH resulted in higher permeability of collecting duct of the nephron to water (1)
- as a result, a larger proportion of / more water was reabsorbed at the collecting duct (1), i.e. less urine was produced

(5)

(ii) (1)
- alcohol consumption resulted in the production of more urine (1)

(1)

(2)
- more urine production suggested that the release / production of ADH might have been inhibited by alcohol (1)

(1)

(iii)
- to prevent the participants from losing water through sweating (1)
- as this may reduce the urine production (1) and interfere with the results

(2)

(b) (i)
- increased humidity increases the real feel temperature (1)
- sweat evaporation will be hindered at higher relative humidities (1)
- as a result, heat cannot be lost to surrounding effectively by sweat evaporation (1), leading to a feeling of higher temperature at lower relative humidities

(3)

(ii)
- the effect intensifies / is stronger / is more serious at at higher temperatures (1)
- because gradient between body temperature and air temperature is narrower at a higher temperature (1)
- therefore, heat loss through conduction / convection / radiation is less effective (1), resulting in a feel of an even higher temperature

(3)

(iii) Any *two* sets of the following, mark the first two sets if more than two sets:
- wind speed / air movement (1), higher wind speed increases evaporation of sweat (1)
- sunshine / light intensity / sunny / cloudiness (1), skin absorbs more heat radiation when the intensity is higher (1)
- precipitation (1), wetted skin loses heat to water faster through conduction and evaporation (1)

(4)

(iv)
- to compensate for the water loss due to continuous sweating (1)

OR

- if the body does not have sufficient water, sweating may be cut down and heat stroke may occur (1)

(1)

Paper 2 Section B

Marks

2. (a) (i) (1) • Cadmium = 1.2 /0.6 = 2 (1) (1)

(2) • when the ratio is greater than 1, it means there is accumulation / magnification of heavy metal / cadmium in the body of the consumer / bivalve (1) (1)

(3) • the ratio for cadmium is higher than that of copper (1) because
Any *two* of the following:
  - copper is more readily excreted than cadmium, or vice versa (1)
  - copper is more readily detoxified / metabolised than cadmium, or vice versa (1)
  - copper is less readily soluble in fat than cadmium, or vice versa (1)

(3)

(ii)
- keep the same / similar number of bivalves at different concentrations of cadmium (1)
- for a fixed period of time (1)
- record the percentage of death / no. of death / mortality / mortality rate at the end of the experiment (1)

(3)

(iii) • Any reasonable answers that apply the 3R principles of (reduce, replace, recycle) (2)

(b) (i)
- increasing the amount of organic pollutants increases the carrying capacity of the habitat / the food supply to the invertebrates (1)
- hence, the birth rate is greater than the death rate / reproductive rate increases / this attracts other invertebrates to move to this area (1), i.e. the community is expanding

(2)

(ii) (1)
- the biomass of the community is decreasing (1)
- while the abundance / total number of organisms is increasing (1)
- this indicates that the body size of the organisms in the community is decreasing (1), i.e. the proportion of larger invertebrates is declining

(3)

(2)
- microbial decomposition of such a large amount of organic pollutants consumes / depletes a large amount of oxygen in the seabed (1)
- larger invertebrates have higher oxygen demands than smaller invertebrates (1)
- they die due to suffocation / they migrate to other places (1)

(3)

(iii) • the number of species continues to drop (1) (1)

(iv) • very small / high turnover rate / anoxia tolerance / high pollution tolerance (any one) (1)

Paper 2 Section C

Marks

3. (a) (i)
- mutualism (1)
- humans provide habitat / food for the microorganisms and the microorganisms provide services to human (1) (2)

(ii) (1) Any *two* of the followings: (2)
- pH of the stomach / gastric environment (1)
- how long / the period that the ingested food stays inside the stomach (1)
- content / volume of gastric juice (1)
- the churning actions of the stomach, such as magnitude and frequency (1)

(2)
- after incubation, conduct serial dilution of the culture (1)
- a fixed amount of each diluted culture is spread on a nutrient agar plate for incubation (1)
- a plate with considerable number of colonies (~30-300) is chosen for counting (1)
- calculate the number of viable cells using the dilution factor of the chosen plate (1)

OR (4)
- after incubation, mix the culture with stain (trypan blue) which stained dead cell (1)
- transfer a small amount of mixture to a cell counter (1)
- count the number of viable cells (cells not stained) in some randomly selected large squares for estimation of number of viable cells (1)
- carry out serial dilution if too many cells are overlapping and repeat with the counting (1)

(3)
- antibiotics kill both probiotics and pathogens inside the gut (1)
- consuming food that contains probiotics transfers probiotics to the gut, which multiply to a large population (1) (3)
- that outcompetes the pathogens (1) / help defence against pathogens

(b) (i)
- compound X had an inhibitory effect on fungal growth (1)
- and its effect was dose-dependent / more compound X had greater inhibition (1) (3)
- while compound Y did not affect the fungal growth (1)

(ii) (1)
- compound X increased the permeability of fungal membrane to the green dye (1) (2)
- which went right into the nucleus (1)

(2)
- compound X on the paper disc diffused through the agar to reach the fungal colony (1) (2)
- which caused the lysis of fungal cells (1)

(iii)
- to ensure that the agar plates will not be contaminated with other microorganisms (1) (1)

(iii)
- leather protection spray / anti-fungal paint / anti-fungal spray (1) (any reasonable answer) (1)

Marks

4. (a) (i) Any *two* of the following:
- it has to be performed regularly (1)
- risk of contracting infectious diseases via blood transfusion (1)
- iron accumulation / deposition in the liver may occur (1)

(2)

(ii) (1)
- stem cells have the ability to divide and reproduce new cells (1)
- differentiate into liver cells with normal functions / so cells with ability to produce the blood clotting protein will be produced in John for his lifetime (1)

(2)

(2)
- as the transformation / transfer of the gene by viral vector was carried out outside John's body (1)
- the risk of having the viral vector triggering immune response in John is removed (1)
- cell culture allows the selection of transfected cells which can successfully produce the protein for transplantation / which are free from other abnormalities (1)
- this eliminates the risk of having the gene inserted into the wrong position and fails to express / causing cancers / disrupting other functioning of the cells (1)

(4)

(b) (i)
- Stage I (1)
- the temperature is high enough (1)
- to break the hydrogen bonds between the two strands of double helix DNA (1)

(3)

(ii) (1)
- Primer I: CGGTAGTGGG ATACGACGAT (1)
- Primer II: TGTTATCCGC TCACAATTCC (1)

(2)

(2)
- 380 base pairs (1)

(1)

(iii) (1)
- to screen bacteria which have picked up plasmids during transformation (1)
- as theses bacteria have the plasmid with ampicillin resistant gene, they can survive on agar plates with ampicillin (1)

OR

- to eliminate bacteria that do not have the plasmid / are not transformed (1)
- as they do not have the plasmid with ampicillin resistant gene, they are killed by the ampicillin in the agar plate (1)

(2)

(2)
- blue colonies (1)
- for bacteria which have picked up the plasmid without DNA insert, the Z gene remains intact (1)
- as a result, these bacteria / plasmids produce the enzyme (1)
- which convert substance X to blue compounds (1), resulting in blue colonies

(4)