香港考試及評核局
HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

香港中學文憑考試
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

練習卷
PRACTICE PAPER

生物　試卷一
BIOLOGY　PAPER 1

評卷參考
MARKING SCHEME

(2012年2月24日修訂稿)
(updated as at 24 Feb 2012)

本評卷參考乃香港考試及評核局專為本科練習卷而編寫，供教師和學生參考之用。學生不應將評卷參考視為標準答案，硬背死記，活剝生吞。這種學習態度，既無助學生改善學習，學懂應對及解難，亦有違考試着重理解能力與運用技巧之旨。

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Section A

Question No.	Key	Question No.	Key
1	C	21	C
2	D	22	C
3	A	23	B
4	B	24	C
5	D	25	A
6	B	26	A
7	C	27	C
8	A	28	A
9	A	29	B
10	D	30	B
11	B	31	B
12	A	32	A
13	A	33	D
14	B	34	C
15	D	35	D
16	C	36	D
17	D		
18	B		
19	C		
20	D		

Section B

Marking Scheme

General Notes for Teachers on Marking

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1. Cholera: B
Dengue fever: E 1

2. (a) (Palisade / spongy) mesophyll cell * 1

(b)

Structure	Process of ATP synthesis
Q (1)	oxidative phosphorylation (1)
S (1)	photophosphorylation / photochemical reactions (1)
P (1)	substrate level phosphorylation / glycolysis (1)

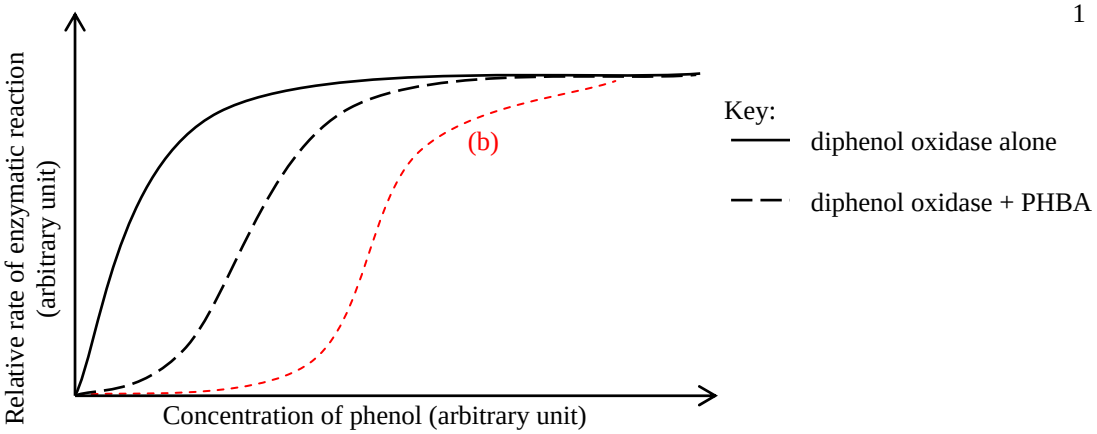
} any 2 sets [1+1] x 2

3. (a) Retina* 1

(b) Photoreceptor A cannot distinguish colours 1
while photoreceptor B is responsible for colour vision. 1
Photoreceptor B is only stimulated by strong light, and 1
a larger number of photoreceptor B is stimulated in bright light than in dim light. / a smaller number of photoreceptor B is stimulated in dim light. 1
Thus the coloured object is perceived as being more colourful in bright light.

4. (a) PHBA reduces the rate of enzymatic reaction. 1
However, the rate of enzymatic reaction is increased and reaches a rate which is comparable to that without PHBA when the substrate concentration is increased. 1
This shows that PHBA is a competitive inhibitor of the enzyme diphenol oxidase. 1

(b) 1



(c) pH 1
A change in pH may cause conformational change in the active site / change in the shape of the active site of the enzyme. 1
The substrate then cannot fit into the active site of the enzyme to form the enzyme-substrate complex 1
and hence would affect the activity of the enzyme.

5. (a)
- No replicate is carried out and so the results may not be representative.)
- Quadrat sampling is not accurate for determining the number of mobile animals like crabs.) any 3 1x 3
- Burrowing bivalves will be missed if only animals on the surface are collected.)
- Sampling is not random and hence a biased sample may be taken.)

(b) The population size of the crabs remains constant (1) 2
as the crabs will eat more snails when the abundance of clams is reduced. (1)
OR
The population size of the crabs may be reduced (1)
as more snails are consumed when the number of clams is reduced. The number of snails may not be enough to maintain the population size of the crab. (1)

6. (a) Since the bacteria were taken from a human being, the human body temperature is therefore suitable for the growth of the bacteria.

(b) (i) D, A, C, B 1

(ii) The antibiotic diffuses outward from the paper disc. 1
The farther away from the disc, the lower is the concentration of the antibiotic. 1
A larger clear zone indicates that the antibiotic is effective in inhibiting bacterial growth even at a lower concentration. 1

(c) Genetic variations exist among bacteria in their resistance to antibiotic B. 1
The non-resistant strain of this bacteria has been continuously eliminated by antibiotic B while the resistant strain of this bacteria has survived 1
and reproduced to produce resistant offspring. 1
The proportion of the resistant strain in this bacteria population increases. 1
Thus, the effectiveness of antibiotic B decreases.

7. (a) (i) Coronary artery 1

(ii) The workload of the heart muscle cells is increased during exercise. 1
Narrowing of artery X results in a reduced blood flow to the heart muscles, and thus reducing the supply of oxygen and glucose to the heart muscle cells. 1
Some heart muscle cells may die. 1
Thus, Mr. Chan may suffer from a heart attack during vigorous exercise.

(b) (i) The carbon monoxide in cigarette smoke will reduce the oxygen-carrying capacity of the blood. / Quitting smoking reduces the amount of carbon monoxide inhaled, and hence helps increase the blood oxygenation. 1

(ii) A low fat diet reduces the chance of fatty substances in the diet being deposited on the wall inside the coronary artery. 1

8. (a) (Primary / ecological) succession 1

(b) (i) (1) nitrogen fixing bacteria 1

(2) The bacteria fixed atmospheric nitrogen into ammonium compounds 1
and supplied the nitrogenous compounds for plant species A and B to synthesise proteins. 1
The decay / decomposition of the plant species A and B after their death released the fixed nitrogen to the soil. 1
This increased the soil nitrogen content in Stages 1 and 2.

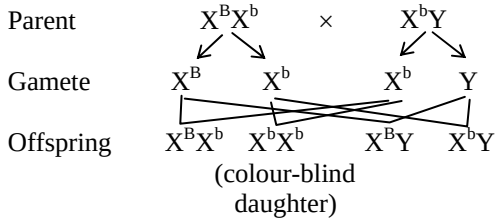
(ii) The nitrogen requirement of species C should be quite high, which means it was unable to survive in Stage 1 when the nitrogen content was low. / The absence of symbiotic nitrogen fixing bacteria in species C means that it was unable to survive in Stage 1 when the nitrogen content was low. 1
Its growth was only possible in Stage 2 when the soil nitrogen content was sufficiently high. 1
Species C out-competed species A and B in Stage 3 and became the dominant species. 1

9. (a) During gamete formation / meiosis, members of the 21st homologous chromosomes fail to separate.
After the gamete bearing the extra chromosome fuses with a normal gamete, the foetus formed will have Down syndrome. 1

(b) (i) Being a sex-link trait, the allele for colour blindness is located on the X-chromosome. 1
As the X chromosome of individual E must come from the mother (B), 1
the mother must have an X chromosome with an allele for colour blindness. 1
Being normal, the mother must bear the allele for normal colour vision on the other X chromosome. 1
Hence, the genotype of the mother must be heterozygous / X^BX^b (where B is the allele for normal colour vision & b is the allele for colour blindness). 1

(ii) Let B represent the allele for normal colour vision,
and b represent the allele for colour blindness. 1

Genetic diagram:



1
1
1

Genetic diagram not in a proper format (parent, gamete and offspring not indicated) -1

The probability of giving birth to a colour-blind daughter is ¼. 1

10. (a) Wind 1
The anther sacs are hanging out of the flowers 1

(b) Water is needed
- to soften the seed coat for the emergence of the radicle.)
- to activate the enzymes needed for germination.)
- to hydrolyse the stored food (e.g. starch) for use in respiration to provide the energy needed.) any 2 1 x 2
- to provide a medium for transporting the soluble food to growing parts for use.)

(c) Sample size: Soak a sufficiently large number of wheat grains (e.g. 50) in water added with pesticide X. 1
Setting up of the control: Soak equal number of wheat grains in water without pesticide X. 1
Controlled variables: Allow the grains in the 2 set-ups to germinate under identical environmental conditions for the same period of time. 1
Measurement: Compare the success rate of germination to see if there is any significant difference. 1

11. (a) (i) The cell membrane is composed of a phospholipid bilayer.
Being non-polar, the fatty acids can dissolve in the phospholipid layer and diffuse through the cell membrane. 1

(ii) Being polar, the amino acids are repelled by the phospholipid bilayer / cannot dissolve in the phospholipid bilayer (1) and thus cannot diffuse across the cell membrane.
Some proteins spanning across the phospholipid bilayer (1)
provide (hydrophilic) channels for the passage of the amino acids / act as carriers for transporting the amino acids across the membrane. (1)
Transport of amino acids by these channels / carriers is unidirectional. (1) max. 3

(b) Active transport* 1

- Active transport requires energy whereas diffusion is a passive process which does not requires energy. (1)
- Active transport needs carrier proteins for transporting glucose while diffusion does not need carrier proteins. (1)
- Active transport can transport a substance against its concentration gradient whereas diffusion cannot. (1)

) 1
) any one

[Acceptable alternative answer:
Facilitated diffusion* (1); Carrier proteins are needed for facilitated diffusion whereas no carrier proteins are needed for diffusion. (1)]

12. Positive phototropic response of the shoot (1) enables the leaves to be brought into positions that enable them to receive maximum sunlight for photosynthesis (1) 2
OR
Negative phototropic response of the root (1) enables the root to grow deep into the soil for firm anchorage / obtain water from deeper ground. (1)

Nature:
Tropic response is a directional growth response of some parts of the plant to a unidirectional stimulus (1)
whereas reflex action is a stereotyped response to a stimulus. (1)
[i.e. growth response Vs non-growth response; unidirectional stimulus Vs stimulus not necessarily be unidirectional]

Process:
Tropic response is mediated by auxins / chemical substances while reflex action is mediated by nerve impulses which are electrochemical in nature. (1)
The response in tropism is slow whereas the reflex response is always fast. (1)
Different effectors (e.g. shoot tips / root tips) can show different responses (positive or negative) to the same stimulus (e.g. unidirectional light). However, the effectors in the reflex action always give the same response. (1)
The same stimulus can cause tropic responses in different parts of the plants (e.g. root tips and shoot tips), but the response in reflex action is localised. (1) max. 5

Communication 3

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 irrelevant 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. Candidate shows no attempt to organise thoughts.

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SECTION A **Human Physiology : Regulation and Control**

1. (a) (i) ovulation* 1

(ii) A high LH level stimulates the ruptured follicle to develop into a corpus luteum (yellow body) after day 14. 1
The production of progesterone by the corpus luteum accounts for the continuous rise in plasma concentration of progesterone from day14 onwards. 1
The high level of progesterone (after day 28) indicates that this woman is pregnant and the corpus luteum continues to produce progesterone. 1

(iii) A significant drop in the progesterone level will cause miscarriage / cause the detachment of the uterine lining / trigger menstruation. 1

(iv) A high progesterone level after day 14 causes the levels of both FSH and LH to become low. 1
At a low level of FSH and LH, there is no follicular development / no maturation of egg, 1
and hence no ovulation will take place. 1
Thus, progesterone can be used as a drug for contraception.

1.(b) (i)

	At rest	Light exercise	Vigorous exercise
Cardiac output (dm^3 / min)	5.25	13.05	20.9
Ventilation rate (dm^3 / min)	12.04	40.08	100

1
1

(ii) Both the cardiac output and ventilation rate increase with the increasing level of exercise. 1
These changes enable a greater supply of oxygen and glucose to reach the skeletal muscles 1
for respiration to produce more energy for contraction, 1
and speed up the removal of carbon dioxide and lactic acid to prevent their accumulation in the body and muscles respectively. 1

(iii) During exercise, the sympathetic nerve innervating the heart is more active and increases its output (releases more noradrenaline) / stimulates the adrenal gland to release more adrenaline. 1
This stimulates the SA node to increase its activity, 1
thus increasing both the heart rate and stroke volume and hence the cardiac output.

(iv) During vigorous exercise, the person sweats more to prevent overheating of the body. 1
The water loss due to sweating results in a decrease in the water potential of the blood. 1
The pituitary gland is stimulated to secrete more ADH into the blood, 1
which makes the collecting ducts of the nephrons in the kidneys more permeable to water so that a greater proportion of water is reabsorbed along the collecting ducts. 1
Hence, a smaller volume of urine is produced.

SECTION B Applied Ecology

2.(a) (i) Mark-and-recapture method (e.g. mark the birds at the site in Canada by putting specific rings on the legs of the birds and check if the ringed birds be retrieved at the wintering ground in the U.S.A.) / Installing a GPS tracking device on the birds

(ii) (1) The average January temperature in the U.S.A. shows an increasing trend. 1

(2) The bird species have shifted their winter destination farther north as these areas have become warmer. 1

As the northern part becomes warmer, the birds can find a suitable habitat with adequate food supply for wintering without flying farther south. 1

(3) The migratory bird species may

- compete for food / territory with native bird species. 1
- become the prey of native bird species and this may lead to a growth in the population of the native birds. 1

(Accept other correct alternatives.)

(4) The atmospheric concentration of carbon dioxide / methane (greenhouse gases) has been increasing 1

due to the increasing consumption of fossil fuels *(for stating carbon dioxide as the greenhouse gas)* /rearing of livestock or decomposition of increasing amount of organic waste dumped in landfills *(for stating methane as the greenhouse gas)*. 1

When the Earth surface emits (the) radiation (it absorbs from the sun) into the atmosphere, the radiation is trapped / absorbed by the greenhouse gases and warms the atmosphere. 1

This leads to global warming and thus the increase in the average January temperature. 1

2.(b) (i) Any **two** of the following sets of answers: 2 x 2

- Acid rain deposited in water bodies decreases the pH, which may kill organisms that are sensitive to acidity. (1) This reduces the populations of specific species in the habitat. (1)
- Acid rain enhances the release of aluminium ions from soil which are toxic to plant roots. (1) This reduces the population size of plants / reduces biodiversity. (1)
- Acid rain reduces soil fertility / dissolves soil nutrients and facilitates their loss through leaching. (1) This reduces plant productivity. (1)

[For each set of answer, 1 mark is for the cause leading to the impact and 1 mark is for the impact.]

(ii) Logging removes the biomass above the forest floor. 1

Forest B will reestablish more quickly after logging 1

because it retains a greater proportion of nutrients in the roots and soil below the forest floor. 1

(iii) (1) Any **one** of the following: 1

- Biodiversity provides us with a variety of useful materials for human use directly (e.g. food) or indirectly (e.g. wood products).
- Biodiversity helps maintain the stability of an ecosystem / recovery of an ecosystem after disturbance.
- Biodiversity provides biological resources (e.g. breeding stocks, population reservoirs, gene pools) for scientific research / education.
- Biodiversity provides recreational service to humans (e.g. ecotourism).

(2) Any **one** of the following criteria: 1

- capable of establishing themselves in damaged land
- fast-growing

(Accept other correct alternatives.)

Any **one** of the following disadvantages: 1

- lack of biodiversity in the plantation
- the plantation may quickly be destroyed as the spread of diseases / parasites specific to it will be quick
- depletion of specific soil nutrients

(Accept other correct alternatives.)

SECTION C Microorganisms and Humans

3 (a) (i) Stage 1 is essential for making the system ready for fermentation. The fungus secretes enzymes to digest the soy beans and wheat to:

- release the raw materials (e.g. break proteins into amino acids) for fermentation into the final products (e.g. MSG).
- provide respiratory substrates and food to enable the fermenting agent (bacteria and yeasts) to grow.

} any 1 — 1

(ii) The high salt concentration creates a selective condition which effectively inhibits the growth of other undesirable microbes. — 1
This ensures the desired fermentation (by the salt tolerant bacteria and yeasts) can proceed. — 1

(iii) Pasteurisation is carried out at a temperature at which the proteins and amino acid composition in the soy sauce can be preserved. — 1
The high temperature denatures the enzymes / stops the activities of the enzymes in the raw soy sauce to stabilise / avoid further change in the quality of the soy sauce. — 1

(iv) Principles:

- Making sure that the workplace is clean / fermentation tank and all equipment used is sterilised — 1
- Avoiding contamination by microbes — 1
- Proper sanitary management of personnel / workers in the refining process [stage 3] (e.g. wearing laboratory gowns; sterilising the hands before working / covering the mouth and nose during work) — 1

3. (b) (i) (1) Microbe M is a virus / bacteriophage. — 1
Any **one** of the following differences: — 1

– Microbe M is much smaller in size than *E. coli*.
– Microbe M has a head and a tail but *E. coli* does not.
– *E. coli* is rod-shaped but microbe M is not.
– *E. coli* has a cell wall but microbe M does not.

(2) Microbe M adheres itself to the surface of the *E. coli* — 1
and injects its nucleic acid into the *E. coli*. — 1

(3) Any **two** of the following: — 1 × 2

– The plasmids in the cytoplasm of bacteria is a desirable vector for recombinant DNA technology. (1)
– The following characteristics of bacteria make it a commonly used host in DNA recombinant technology:
  - They reproduce rapidly by asexual reproduction and produce a large amount of the gene products within a short time. (1)
  - They are easy to cultivate as their growth conditions are known / can be conveniently manipulated. (1)
  - The pathogenicity of *E coli* is weak in general and poses little danger to human health (1). (Acceptable only if the candidate uses *E. coli* as an example.)

(ii) (1) A high *E. coli* count indicates a high level of water pollution due to faecal contamination and suggests the possible presence of a large number of disease-causing microbes in the water. — 1

(2) (I) Each *E. coli* cell trapped in the membrane filter reproduces (by binary fission) during the incubation period to a sufficiently large amount to form a visible colony. — 1
The number of colonies will correspond to the number of *E. coli* cells present in the water sample tested. — 1
Thus, the colony count obtained after the incubation will give the *E. coli* count.

(II) The quality of the beach is not 'Very Poor' because the *E. coli* count in the water sample
= 26 × 2 per 100 cm^3 — 1
= 52 per 100 cm^3, which is below 1600 per 100 cm^3 as water — 1

SECTION D Biotechnology

4. (a) (i) Bone marrow stem cells are capable of differentiating into lymphocytes so that the patients can be protected against infections. 1

(ii) Somatic gene therapy works by inserting a normal gene into the patient's cells to correct the genetic disorder by compensating for the malfunctioning gene (i.e. production of lymphocytes can be resumed in this case). 1
Advantage: no need to wait for a matching donor for the bone marrow cells / no problem of rejection 1

(iii) All the cells in the offspring will contain the normal gene if germ-line therapy is employed. However, only the body cells having the inserted gene and their daughter cells will have the normal gene in somatic gene therapy. 1
With germ-line gene therapy, the normal gene can be inherited by the subsequent generations. However, the normal gene obtained by somatic gene therapy is not inheritable. 1

(iv) The desired gene carried by the vector virus is randomly inserted into the patient's genome. 1
This desired gene may be inserted into the DNA sequence of another gene and affect the expression of that gene. 1

4.(b) (i) At 95°C, the complementary stands of DNA are separated into two single DNA strands. 1
At 55°C, primers are annealed to the single stranded DNA templates by complementary base pairing. 1
At 72°C, DNA polymerase adds nucleotides to (the 3' end of) the primers to synthesise the new DNA. 1

(ii) (1) PCR amplifies the small amount of DNA present in the hair follicle for further analysis. 1

(2) The products of PCR are separated by gel electrophoresis into bands according to their molecular masses / sizes. 1
The banding pattern produced after gel electrophoresis is the 'DNA fingerprint' of the owner of the piece of hair. 1
The DNA fingerprint is then compared to that of the suspect to see if they match. 1
Positive matching can be used as evidence against the suspect as the DNA of an individual is unique.

(iii) (1) As shown in the analysis, the marker in the GM maize will always show up in a DNA analysis. 1
This allows maize cells which have been successfully incorporated the desired foreign gene (transformed maize cells) to be screened for use. 1

(2) Example: GM rice that contains a precursor of vitamin A (β-carotene) 1+
The incidence of night blindness among people living in poor countries can be reduced if they are consuming this GM rice. 1
(Accept other correct alternatives.)

(3) The GM plants may disperse away from the farmland. They may out-compete other native plants and upset the ecological balance. 1
The toxin may accumulate along the food chain and cause poisoning in consumers in the higher trophic levels. 1
(Accept other correct alternatives.)