

Class	Register Number	Name
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南洋女子中学校
NANYANG GIRLS' HIGH SCHOOL

End-of-Year Examination 2012
Secondary Three

BIOLOGY

Paper 2

Theory Paper

Friday

12 October 2012

Additional materials: Writing papers

1 hour 45 minutes

0915 - 1100

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write your name, register number and class in the spaces at the top of this page and on any separate answer paper used.

Section A (40 marks)

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B (30 marks)

Answer **all** questions including questions **6, 7** and **8 Either** or **8 Or**.

Write your answers on the separate writing papers provided.

At the end of the examination,

- fasten all your work securely together;
- tick **8 Either** (for *Either*) or **8 Or** (for *Or*) next to the number 8 in the grid below to indicate which question you have answered.

INFORMATION FOR CANDIDATES

The intended number of marks is given in the brackets [] at the end of each question or part question. You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

Examiner's Use	
Section A	
Section B	
6	
7	
8 Either	
8 Or	
Total	

This document consists of 13 printed pages.

Setters: F-YYM, OC, AM

NANYANG GIRLS' HIGH SCHOOL

[Turn over

Section A

Answer **all** questions.

Write your answers in the spaces provided.

A1 (a) State the function of the cell plasma membrane.

[1]

- (b) In the 1970s, scientists Larry Frye and Michael Edidin studied the structure of the cell plasma membrane extensively. In one of their experiments, they labeled the plasma membrane proteins of a mouse cell and a human cell with two different markers and fused the cells (note: markers are scientific tools which can be used to label and distinguish different components). Using a microscope, they observed the distribution of the markers in the hybrid cell, which is a cell that results from a fusion of cells from different species. **Figure 1b** shows the result of the distribution of the markers on the hybrid cell.

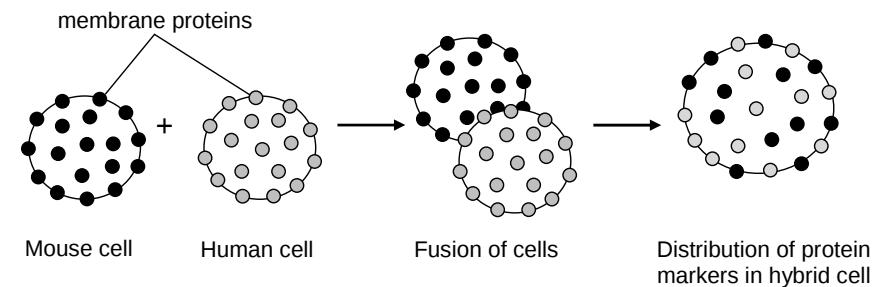


Figure 1b

Source: L.D. Frye and M. Edidin (1970). The rapid intermixing of cell surface antigens after formation of human-mouse heterokaryons, *Journal of Cell Science*, 7: 319.

(i) State one function of plasma membrane proteins.

[1]

(ii) Explain how the results of the experiment supported the 'fluid mosaic model' of cell plasma membrane.

[2]

- (c) Cholesterol is the most abundant lipid in the cell plasma membrane. In an experiment, the effect of temperature on the amount of cholesterol in cell plasma membrane of two different species of copepods - *Calanus finmarchicus* and *Temora longicornis* were investigated. Copepods are small animals found in freshwater and in the sea. **Figure 1c** shows the results of the investigation.

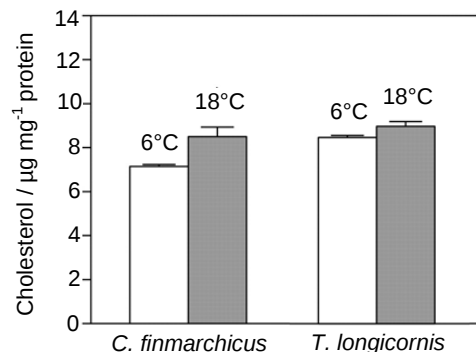


Figure 1c

Source: R.P. Hassett and E.L. Crockett (2007). Habitat temperature is an important determinant of cholesterol contents in copepods, *Journal of Experimental Biology*, 212: 71.

- (i) Describe the effect of temperature on the amount of cholesterol in cell plasma membrane in the copepods.

[1]

- (ii) Explain how the change in amount of cholesterol may allow the copepods to survive better at warmer temperatures.

[2]

- (d) State two differences between diffusion and facilitated diffusion.

[2]

1.

2.

- (e) The unicellular organism, *Paramecium caudatum*, usually lives in pond water which has less negative water potential to the cell. The *P. caudatum* does not burst as it contains a contractile vacuole that pumps out water as fast as it gets in. **Figure 1e** shows an electron micrograph of a *P. caudatum*.

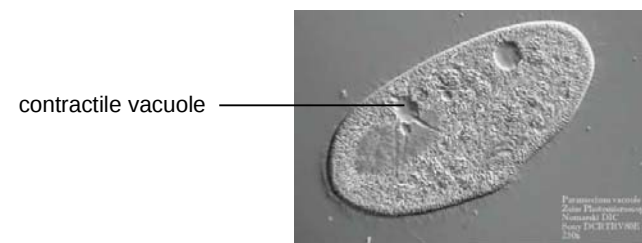


Figure 1e

Source: <http://www.magniscience.com/paramecium-lab/>

If a *P. caudatum* swims from a hypotonic environment to an isotonic environment, how will the activity of the contractile vacuole change? Explain your answer.

[2]

Total [11]

- A2 (a) **Figure 2a** below shows the energy graph of a catalysed chemical reaction, $\text{C} + \text{D} \rightarrow \text{A} + \text{B}$.

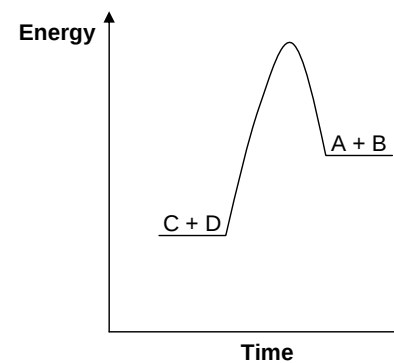


Figure 2a

- (i) On **Figure 2a**, draw an arrow (using coloured ink) to label clearly the activation energy of the reaction with the symbol E_a .

[1]

- (ii) With reference to the activation energy of the reaction, explain how the addition of an enzyme affects the rate of reaction. [2]

- (b) Ginger milk curd is a Chinese dessert prepared using the following recipe.

Recipe:

1. Grind the ginger to obtain some ginger juice.
2. Boil the milk.
3. Wait for the temperature to drop to about 65 °C.
4. Pour 220 cm³ of milk into 15 cm³ of ginger juice.
5. Ginger milk curd is formed as the milk coagulates.

Jamie conducted an investigation. See followed the steps in the recipe with the use of raw ginger juice for one set-up and boiled ginger juice in another set-up.

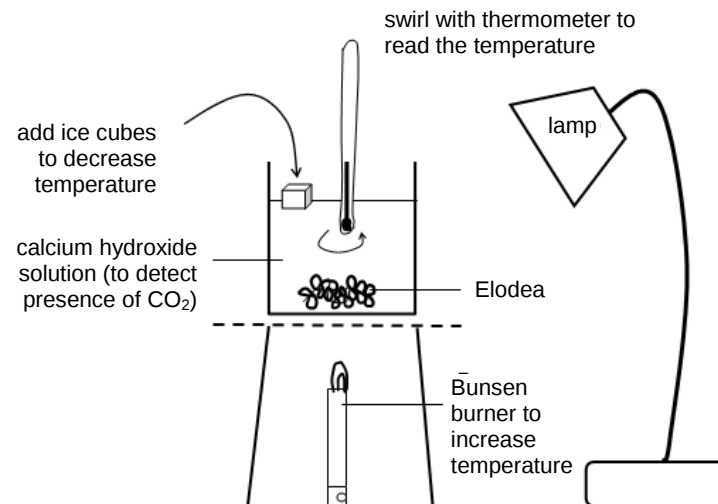
- (i) Predict the results of her investigation. [1]

- (ii) Explain your predicted results in b(i). [2]

Total [6]

- A3 (a)** Describe how the structure of chloroplast is related to its function. [3]

- (b) Shu Shan wanted to investigate the effect of temperature on the rate of photosynthesis. Her experimental plan is shown in **Figure 3b** below.



Procedure:

1. Set up the experiment as shown above.
2. Add ice cubes and / or turn on flame to achieve correct temperature.
3. Count number of bubbles the plant produces over 1 hour for temperatures of 10, 20, 30, 40, 50 and 60°C.
4. Record data and plot graph.

Figure 3b

- (i) State why the lamp does not contribute a major source of error in the experiment. [1]

- (ii) Describe **four** ways to remove the sources of error in the experiment. [4]

(c) **Figure 3c** shows a photomicrograph of the cross section view of an Elodea leaf.

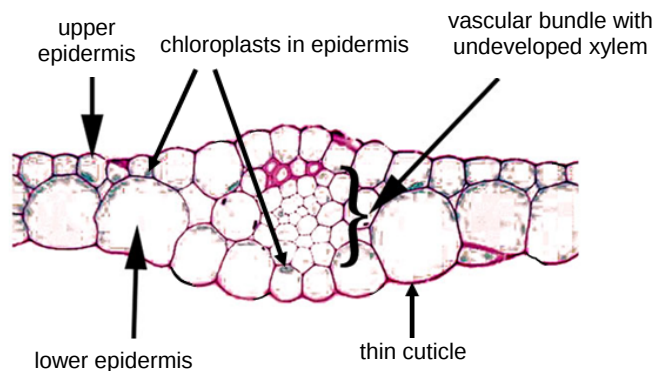


Figure 3c

With reference to the photomicrograph, explain **three** features of the leaf that allows the Elodea to be adapted to an aquatic (submerged) habitat. [3]

Total [11]

A4 (a) Figure 4a shows a section of the human heart. Draw arrows (using coloured ink) to show the path of deoxygenated blood into and out of the heart. [1]

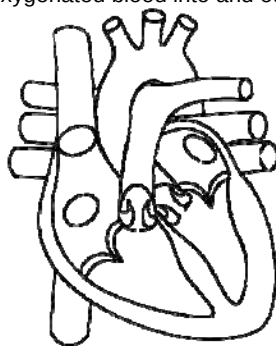


Figure 4a

(b) **Figure 4b** shows some components of blood.

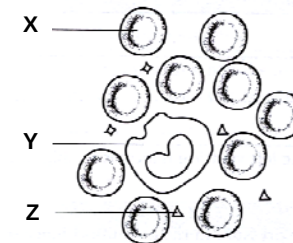


Figure 4b

(i) Name the components labeled **X** and **Z**. [1]

X: _____

Z: _____

(ii) It was observed that after a patient underwent a bone graft surgery, there was an increase in the number of component **Y**. Suggest a possible cause, and explain your answer. [2]

Total [4]

A5 (a) You are given the following materials to build a model to demonstrate how the lungs work during inhalation and exhalation.

Balloons	Plastic bottle
Rubber bands	Straws
String	Toothpicks
Glass jar	Ruler
Rubber sheet	Scissors
Plastic bag	Sticky tape

(i) In the space on the next page, draw a labeled diagram to show your model. Label each part clearly to show the materials you are using, and what each part represents in the real human body. [3]

Section B

Answer all three questions from this section.

The last question is in the form of either/or and only **one** of the alternatives should be attempted. Each question carries **ten** marks.

B6 (a) Explain the importance of digestion. [2]

(b) Read the following paragraphs taken from <http://www.articlesbase.com/medicine-articles/helicobacter-pylori-and-acid-reflux-5539793.html>

"*Helicobacter pylori* is a type of bacteria identified in the stomach and upper gastrointestinal tract. In the last twenty years, scientists have acknowledged that *H. pylori* is accountable for most peptic stomach ulcers.

Before this link was recognized, doctors and scientists believed that peptic ulcers were induced by factors like stress or eating spicy foods which increases acid production in the stomach. Scientists Barry Marshall and Robin Warren, however, suggested that ulcers were in fact caused by *H. pylori*. When the rest of the scientific community was reluctant to accept this hypothesis, Marshall decided to make his point by consuming a beaker of *H. pylori* culture. He quickly became ill with symptoms of a peptic ulcer. This led to widespread acceptance of the *H. pylori* hypothesis, as well as a Nobel Prize for Marshall and Warren in 2005."

(i) Peptic (stomach) ulcer can sometimes lead to stomach cancer. Patients with stomach cancer will need to have their stomach surgically removed. Discuss the effects on the digestive function and changes to the lifestyle of such patients. [4]

(ii) Discuss how Marshall and Warren's new idea had an impact on the treatment of stomach ulcers. [4]

Total [10]

(ii) Compare and contrast your model with the human respiratory system. Your answer must include one similarity and one difference and you should write in full sentences. [2]

	Your model	Human respiratory system
Similarity		
Difference		

(c) Imagine you are a doctor and your patient, Mr. Tan, presents the following symptoms: shortness of breath and fatigue (tiredness).

Explain to your patient why his shortness of breath may lead to him experiencing fatigue. [3]

"Mr. Tan you are feeling tired because ...

Total [8]

- B7 (a)** At an altitude of 4000 metres, the pressure which forces oxygen into the blood is reduced by approximately 33%. A person moves from sea level to live at this altitude for 24 days. **Figure 7a** shows the effect of reduced oxygen availability on the number of red blood cells in the person's blood.

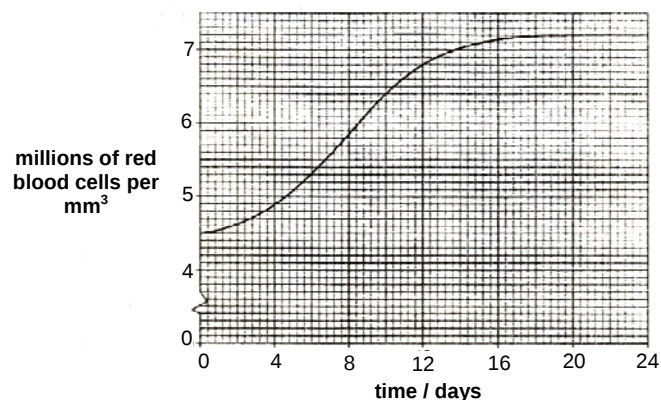


Figure 7a

- (i) Calculate the percentage increase in the number of red blood cells over the 24 days. Show your working clearly. [2]
- (ii) In the past, athletes used to 'live high and train high' prior to their competitions. Suggest how training at 4000m above sea level could improve an athlete's performance at normal sea level. [2]
- (b) Bar-headed geese fly at up to 9000 m elevation during their migration over the Himalayas, sustaining high metabolic rates in the severe hypoxia (low oxygen environment) at these altitudes. Compared with low-altitude geese (pink-footed geese and barnacle geese), the bar-headed geese have certain adaptations that allow them to survive the harsh conditions during migration.

Table 7c and **Figure 7c** show the results obtained and adapted from a research study that compared various physiological traits of the three species of geese.

Table 7c. Comparison of organs masses

Organ masses/ g kg ⁻¹ body mass	Bar-headed geese	Pink-footed geese	Barnacle geese
Heart mass	8.8	10.4	9.9
Lung mass	14.3	11.5	11.5

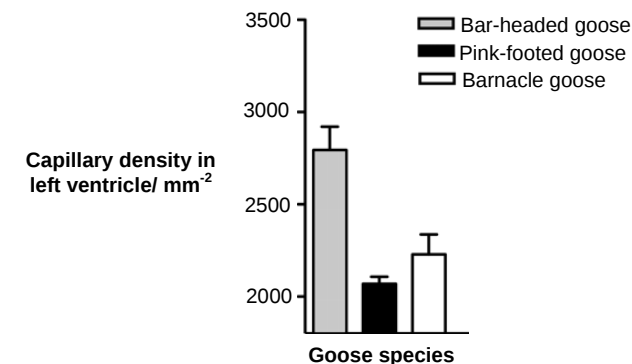


Figure 7c

Source: G.R. Scott et al. (2011). Molecular evolution of cytochrome c oxidase underlies high-altitude adaptation in the bar-headed goose, *Molecular Biology & Evolution* 28: 351.

- (i) From the results of the study, identify and explain **two** adaptations that are beneficial to the migrating bar-headed geese. [4]
- (ii) If the mitochondria content in the muscles of the three species of geese was compared, predict and explain the results that you would expect. [2]

Total [10]

B8 Either

- (a) Describe **two** ways in which the phloem is adapted to its function. [2]
- (b) Mr. Wong did not water his plant for 4 months. The results are shown in **Figure 8a**.

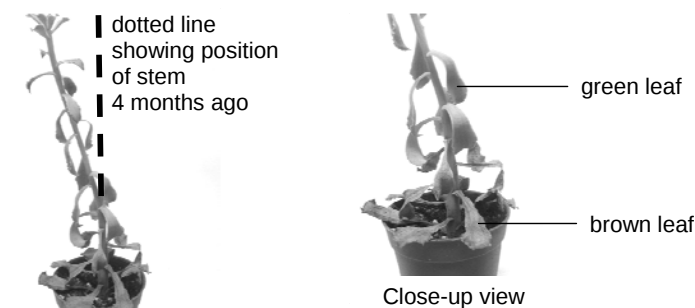


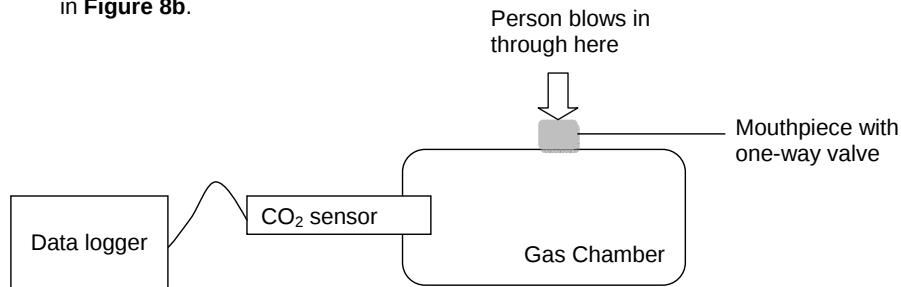
Figure 8a

Suggest and explain what Mr. Wong should do to revive his plant. [8]

Total [10]

B8 Or

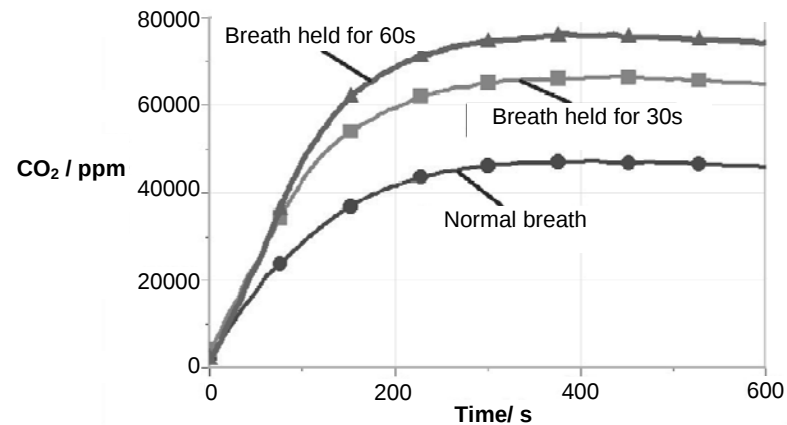
An experiment was conducted in which a person was asked to blow into a gas chamber, which was connected to a CO₂-sensor and data logger. The set-up is shown in **Figure 8b**.

**Figure 8b**

The experiment was repeated two more times. But with the same person holding her breath for 30 and 60 seconds respectively before blowing into the chamber.

The data logger recorded the concentration of carbon dioxide over time.

The results are shown in the graph in **Figure 8c**.

**Figure 8c**

- (a) With reference to the results, describe and explain the trends in the graphs. [6]
You should explain in terms of respiratory physiology.
- (b) Predict and explain the trend and changes (if any) in the graphs if the person was to run 2.4 km before blowing into the gas chamber. [4]

Total [10]**END OF PAPER**