Jurong West Secondary School

Preliminary Examinations 2017

SCIENCE (CHEMISTRY/BIOLOGY) 5078/01

Secondary Four Express / Five Normal (Academic) 18 August 2017

Paper 1 Multiple Choice 1030 – 1130

1 hour

Candidates answer on the Multiple Choice Answer Sheet.

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in soft pencil.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet. **Read the instructions on the Answer Sheet very carefully.** Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question paper.

A copy of the Data Sheet is printed on page 19.
A copy of the Periodic Table is printed on page 20.

After checking of answer script		
Checked by Student	**Signature**	**Date**

This document consists of 20 printed pages.

21 Which of the following options correctly classifies the body components?

	Cell	Tissue	Organ	Organ System
A	Blood	Stomach	Neurone	Heart, blood and blood vessels
B	Neurone	Heart, blood and blood vessels	Blood	Stomach
C	Neurone	Blood	Stomach	Heart, blood and blood vessels
D	Blood	Neurone	Stomach	Heart, blood and blood vessels

22 A student placed equal-sized pieces of potato in solutions of different sugar concentrations. She measured the change in length of each piece after 30 minutes. Her results are shown in the table.

sugar concentration (%)	change in length (mm)
0	+4.0
5	+2.2
10	+0.5
15	-1.2
20	-3.0

The student used the results to predict which concentration of sugar would not change the length of a potato strip.

At which concentration would the change in length be 0mm?

A 9%
B 10%
C 11%
D 25%

23 Which statement explains why, even when athletes have finished a race, they still carry on breathing more quickly and deeply than normal for several minutes?

A to remove carbon dioxide produced during anaerobic respiration
B to remove urea produced by breakdown of amino acids
C to replace stored glycogen in muscles
D to take in extra oxygen to breakdown lactic acid

24 The table shows the average daily energy needed for adult males and females involved in different activities.

activities	energy needed in MJ	
	males	females
lying in bed	7	6
watching TV	8	7
light work	11	9
heavy work	15	13

What can be concluded from these data?

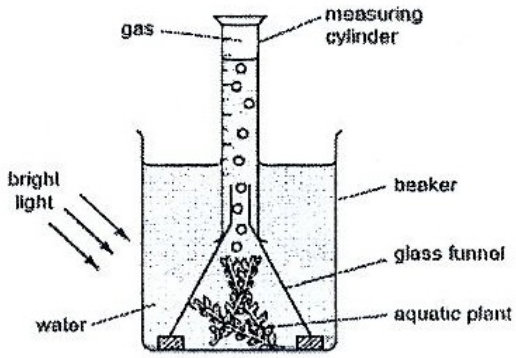
A Males do more work than females.
B Males need more energy than females to do the same activity.
C The energy requirement depends only upon the activity.
D The energy requirement depends only upon the person's gender.

25 An antelope is grazing under a tree. It hears men shouting in the distance.

Which changes take place in the antelope's eyes as it raises its head to look at the men?

	ciliary body	suspensory ligament	lens
A	contracts	becomes taut	becomes more convex
B	contracts	becomes slack	becomes less convex
C	relaxes	becomes taut	becomes less convex
D	relaxes	becomes slack	becomes more convex

26 The diagram shows the apparatus used in an investigation to measure the rate of oxygen production during photosynthesis.



The investigation was repeated several times and the average amount of gas collected was calculated.

Which two factors must be kept constant during this investigation?

A The amount of water in the beaker and the height of the measuring cylinder.

B The size of aquatic plant and the amount of gas in the measuring cylinder.

C The size of aquatic plant and the duration of exposure to light.

D The sizes of the beaker and funnel.

27 Which of the following is likely to form an enzyme-substrate complex?

A amino acids/ protease

B cellulose/ cellulase

C disaccharides/ lipase

D starch/ sucrase

28 Which of the following is not a function of the liver?

A Detoxification

B Excretion of urea

C Production of bile

D Breakdown of alcohol

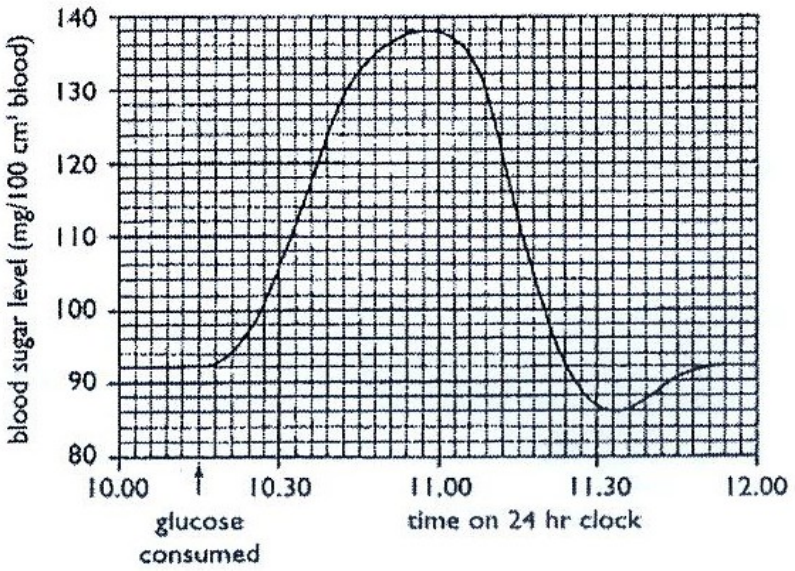
29 Three directions in which nerve impulses can travel in the nervous system are listed.

1 away from the central nervous system
2 towards the central nervous system
3 within the central nervous system

In which direction do impulses in motor neurones and relay (intermediate) neurones travel?

	motor neurone	relay neurone
A	1	2
B	1	3
C	2	1
D	2	3

30 The graph below shows the blood sugar level of a person who has consumed 50g of glucose at the time indicated.

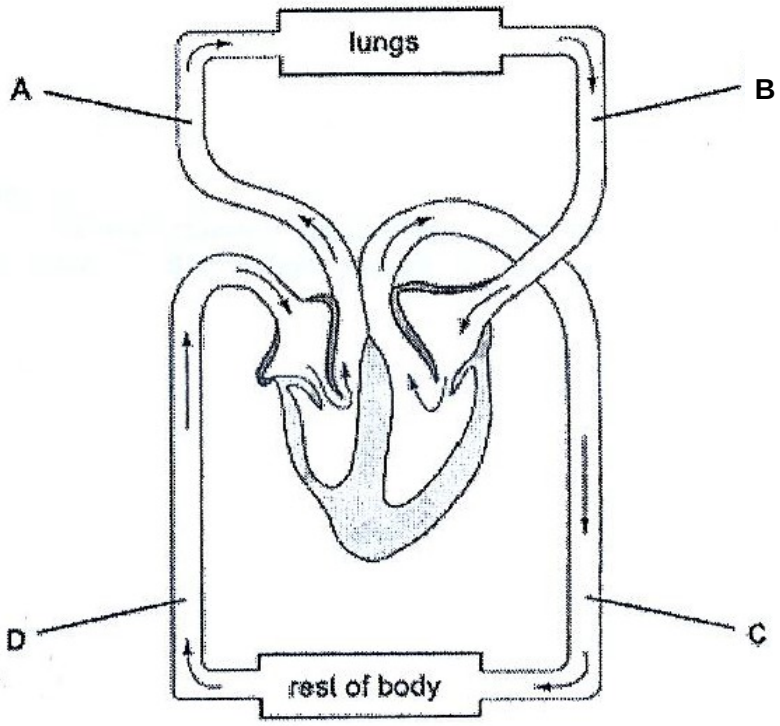


At which time would insulin and glucagon be produced, respectively?

A 10.00, 11.00
B 10.45, 11.30
C 11.00, 10.30
D 11.30, 11.00

31 The diagram shows the circulatory system.

In which vessel is the blood pressure highest?



32 How many chromosomes are there in a zygote which develops into a Down's syndrome baby?

A 23

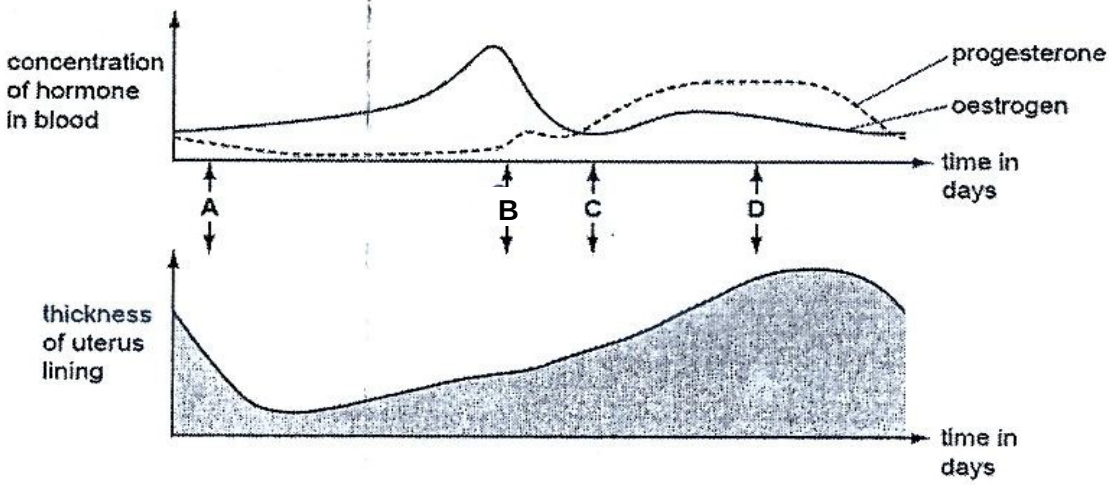
B 24

C 46

D 47

33 The diagram shows the thickness of the uterus lining and the concentrations of oestrogen and progesterone, throughout one menstrual cycle.

On which day does ovulation occur?

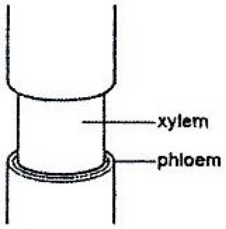


34 A mango tree can reproduced by seed and by asexual reproduction. Trees produced by each of these methods produce mango fruits.

When comparing these fruits genetically, what is the correct result?

	Fruits of trees grown from seeds	Fruits of trees produced by asexual reproduction
A	Identical	Identical
B	Identical	Non-identical
C	Non-identical	Identical
D	Non-identical	Non-identical

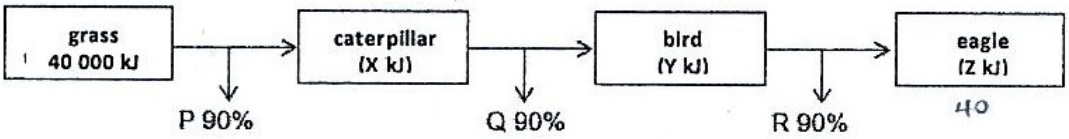
35 The diagram shows the stem of a plant. A strip of the outer tissue including the phloem has been removed.



How is transport in the plant affected?

A Water cannot pass to the roots.
B Water cannot pass to the leaves.
C Dissolved salts cannot pass to the leaves.
D Amino acids and sucrose cannot pass to the roots.

36 The diagram shows the total energy transferred through four trophic levels.



The arrows P, Q and R show the percentage of energy lost from the organism to the environment. Calculate the energy value of z.

A 40 kJ
B 360 kJ
C 720 kJ
D 800 kJ

37 A recessive allele in cats causes kittens to develop six toes instead of the normal five. A cat heterozygous for this gene was crossed with a homozygous recessive individual.

What is the chance of any of their kittens having six toes?

A 25%
B 50%
C 75%
D 100%

38 A DNA molecule consists of two strands in which

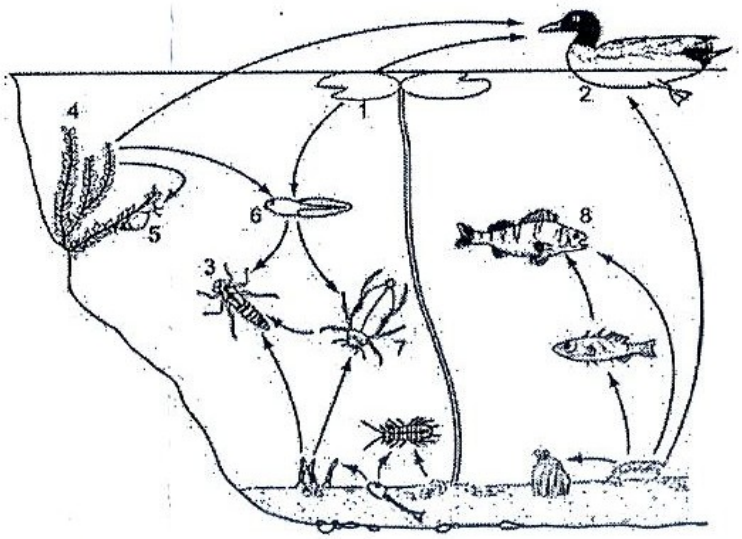
A the percentage of adenine is the same in each strand.

B the percentage of adenine is the same as that of thymine in each strand.

C the percentage of adenine is the same as that of thymine in the whole molecule.

D the percentage of the sum of adenine and thymine is the same as that of the sum of cytosine and guanine in the whole molecule.

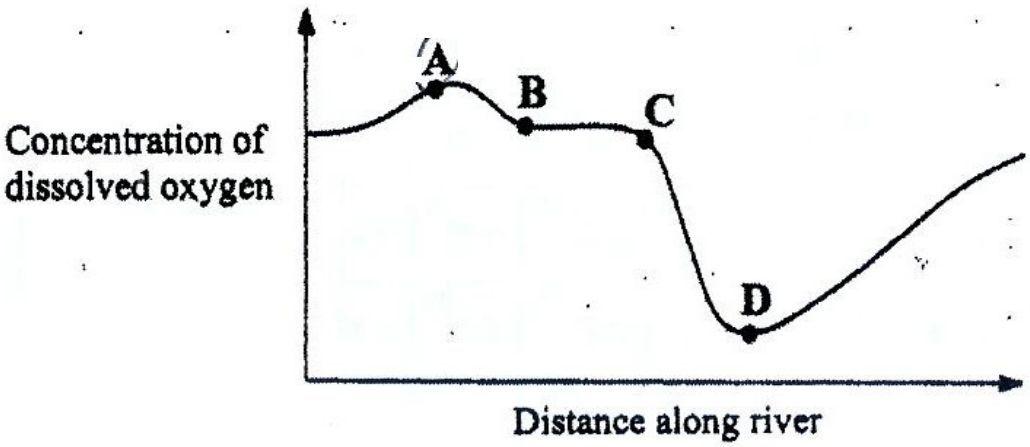
39 The diagram shows a food web in a freshwater pond.



Which of the organisms is a producer, a herbivore or a carnivore?

	producer	herbivore	carnivore
A	1	6	7
B	2	4	5
C	4	2	6
D	7	3	8

40 The graph shows the concentration of dissolved oxygen along a river. At which point is sewage emptied into the river?



END OF PAPER

Section A (45 marks)

Answer **all** the questions in this section in the spaces provided.

Fig. 1.1 shows the human respiratory system.

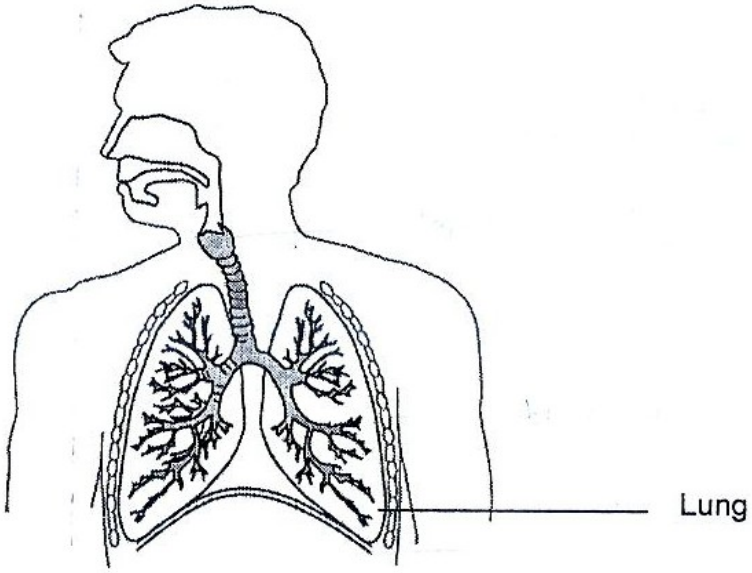


Fig. 1.1

(a) On Fig. 1.1 use label lines to identify:

a bronchiole;

the larynx;

the diaphragm. [3]

(b) Fig. 1.2 shows a section through a group of gas exchanging surfaces (alveoli) in a lung.
Part of the wall of an alveolus and the capillary next to it has been magnified.

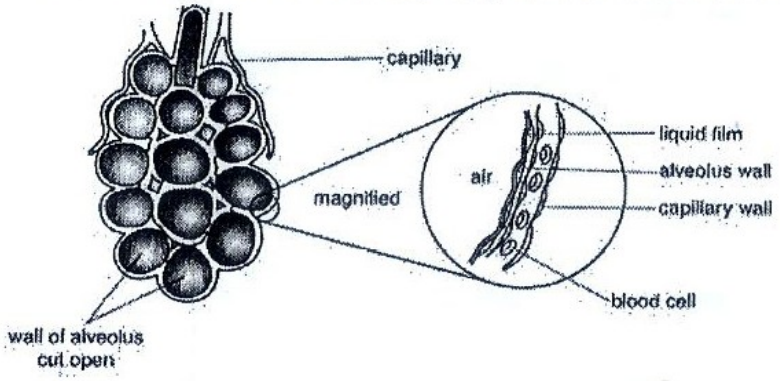


Fig. 1.2

Use Fig. 1.2 to describe three adaptations of the gas exchange surfaces in animals.

1. .....

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2. .....

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3. .....

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..... [3]

(c) In an experiment, the volume of air taken in at each breath and the number of breaths per minute were measured whilst a teenager was performing a number of activities. The results are shown in Table 1.3

Activity	Volume of air per breath (cm3)	Breaths per minute
Sleeping	500	20
Standing	550	22
Walking	700	28
Running	1000	40

Table 1.3

Why does the volume of air breathed per minute need to increase when a person changes from walking to running?

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..... [2]

2 An experiment is carried out to investigate the effect of changing light intensity on the rate of photosynthesis. The light intensity is changed by changing the distance between the lamp and the plant. The apparatus is shown in Fig. 2.1

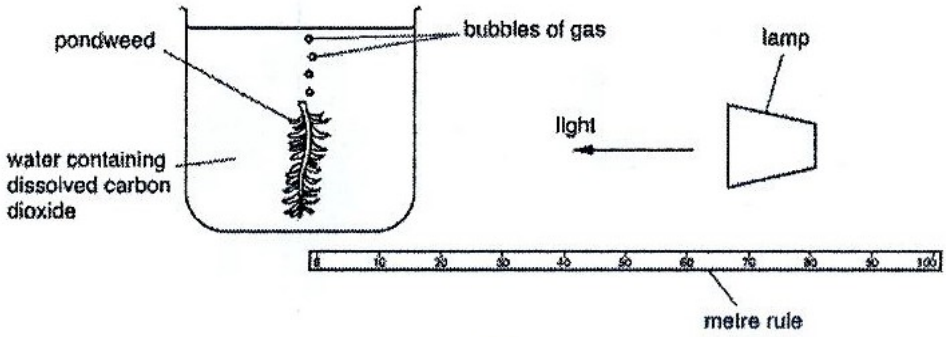


Fig. 2.1

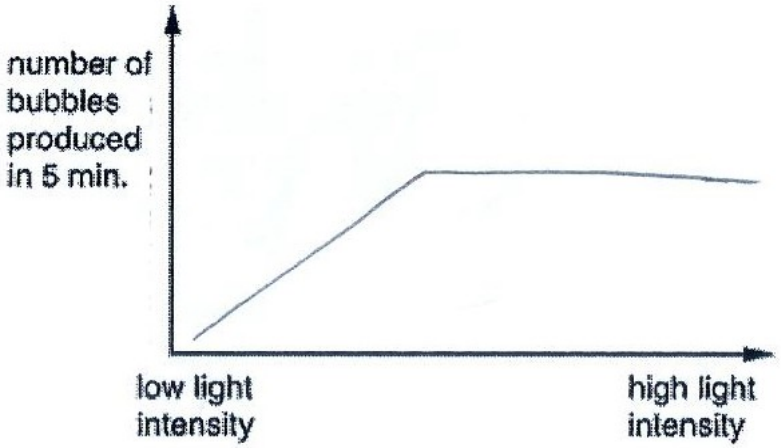
(a) (i) Suggest one condition that should be kept constant in this experiment.

..... [1]

(ii) Suggest a way to measure the rate of photosynthesis.

..... [1]

(b) (i) On the axes below, sketch a curve to show the results expected from this experiment.



[1]

(ii) Explaining why changing light intensity has this effect on the amount of oxygen given off by the pondweed.

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..... [2]

(c) The concentration of carbon dioxide was kept constant during the investigation.

Predict and explain the effect of increasing carbon dioxide concentration has on the rate of photosynthesis.

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..... [3]

3 Fig. 3.1 shows some of the top ten causes of death in parts of the world during 2014.

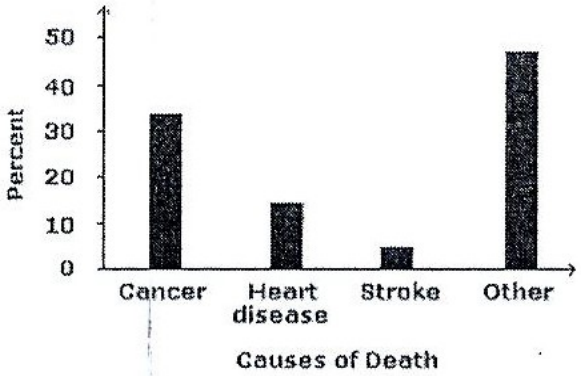

Fig. 3.1

(a) Calculate the percentage of people dying from other causes. Show your working.

.....% [1]

(b) Being overweight is a contributory factor to the development of heart disease.

(i) Describe coronary heart disease.

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..... [2]

(ii) Use data from Fig. 3.1 to suggest the occurrence of heart disease in the human population.

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..... [2]

(c) According to Fig. 3.1, close to 30% of the people die from cancer. Leukemia is the cancer of the blood. Fig. 3.2 shows a diagram of the difference in normal blood and diseased blood (leukemia).

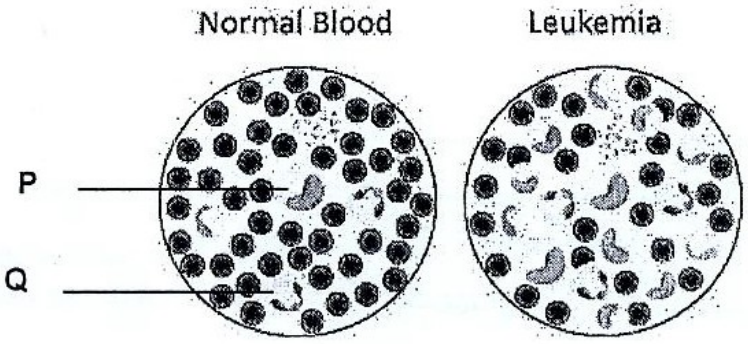

Fig. 3.2

(i) Describe the difference observed in normal blood and blood with Leukemia as seen in Fig. 3.2.

.....

..... [1]

(ii) Identify P and Q.

P: .....

Q: ..... [2]

(iii) State the role P and Q play in protecting the body.

.....

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..... [2]

4 Fig. 4.1 shows an experiment conducted to investigate the osmosis process.

At the beginning, the potato cylinders were exactly balanced. A student immersed the cylinders into the liquids for 4 hours, after which the cylinders were lifted out of the liquids.

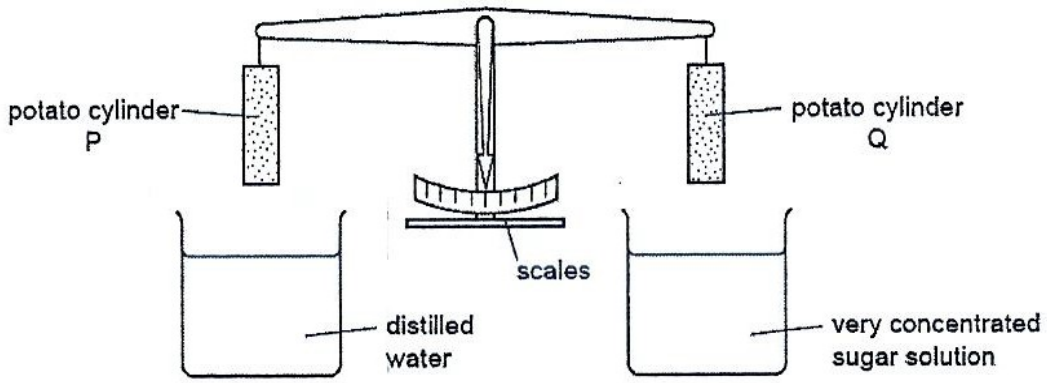

Fig. 4.1

(a) Define osmosis.

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..... [2]

(b) (i) Predict the results of this investigation.

..... [1]

(ii) Use ideas about osmosis to suggest an explanation for the results predicted in (b) (i).

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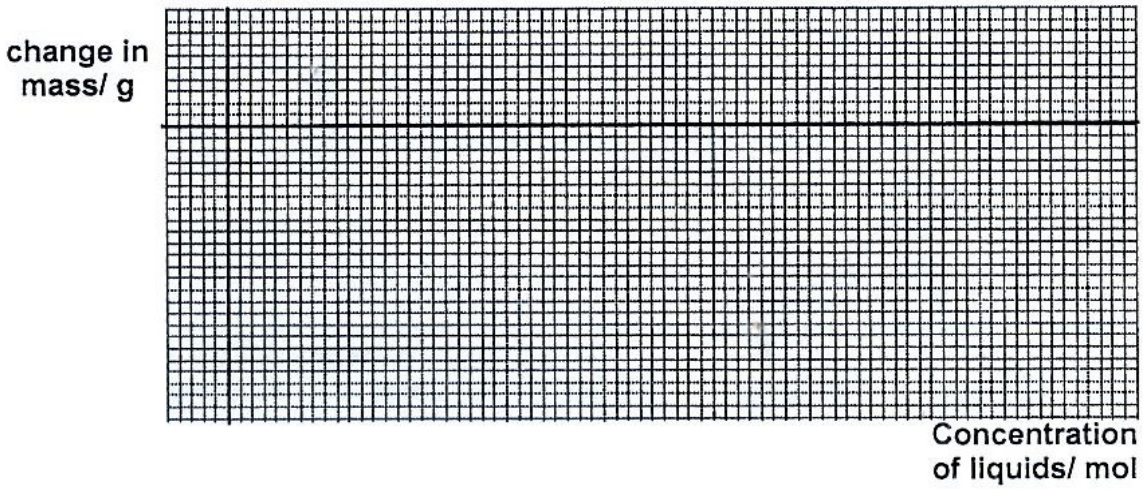
..... [3]

(c) Table 4.2 shows the results of the above experiment that was extended to investigate the concentration of the potato cylinder by inserting them into solutions of different concentrations.

Concentration of liquids/ mol	Initial mass (g)	Final mass (g)	Change in mass/ g
0.2	1.6	1.8	+0.2
0.4	1.7	1.2	-0.5
0.6	1.6	1.5	-0.1
0.8	1.6	1.2	-0.4
1.0	1.6	0.9	-0.7

Table 4.2

(i) Plot the results from Table 4.2 on the grid provided. Draw a curve of best fit.



[2]

(ii) From the graph, predict the concentration of the potato cell sap. Explain your answer.

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..... [2]

5 A doctor tapped the knee cap of his patient as shown in Fig. 5.1 to test his response.

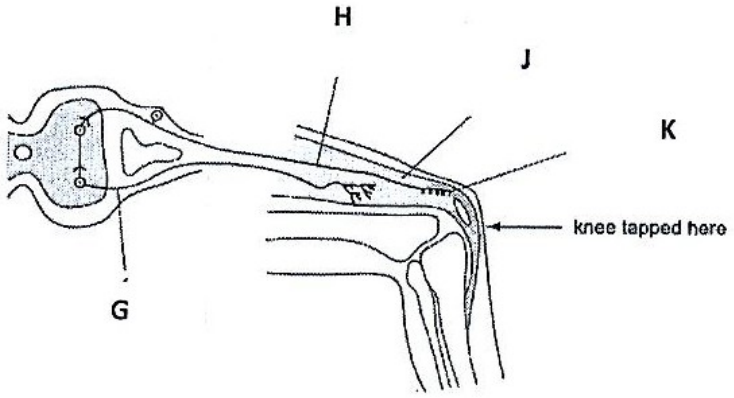

Fig. 5.1

(a) State the role of structures G, H, J and K to enable a response by completing the blanks.

Letter	Name of the part corresponding to the letter	Function
G		
H		
J		
K		

[3]

(b) Fig. 5.2 shows the blood glucose concentration of a boy over 14 hours.

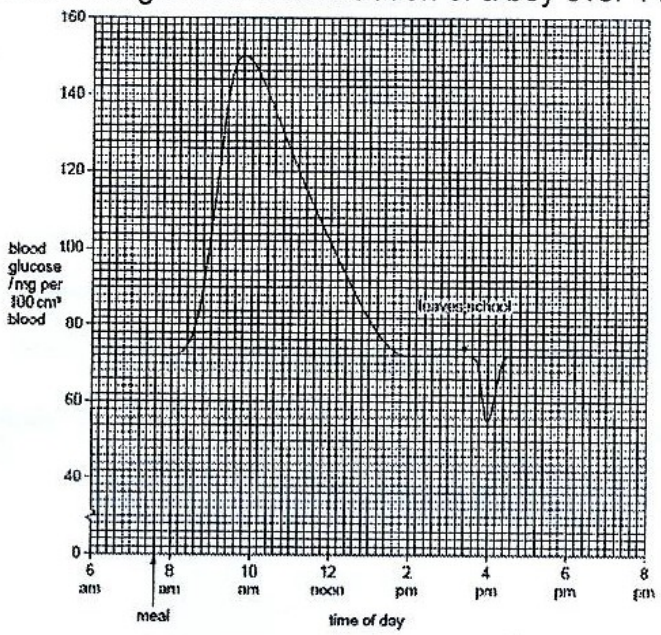

Fig. 5.2

(i) What is a hormone?

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..... [2]

(ii) Use information from the figure to help you describe and explain what happened to the blood glucose concentration from 8 a.m. and 2 p.m..

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..... [4]

Section B (20 marks)

Answer any **TWO** questions in this section in the space provided.

6 Fig. 6.1 shows a food web that is part of an ecosystem in the Amazon rainforest.

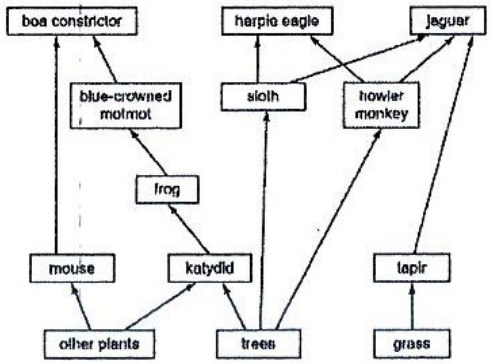

Fig. 6.1

(a) Explain why the whole food web depends on the producers such as the grass and trees.

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..... [4]

(b) In the 1970s, the American ecologist Paul Colinvaux investigated the energy flow between katydid and boa constrictors.

Explain why the number of boa constrictors in the Amazon rainforest has never risen above 50 while the highest number of katydid recorded is 2450.

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..... [6]

7 (a) Describe how temperature and air humidity affect the rate of transpiration.

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..... [6]

(b) Fig. 7.1 shows the cross-section of a leaf that lives in a hot and dry environment.

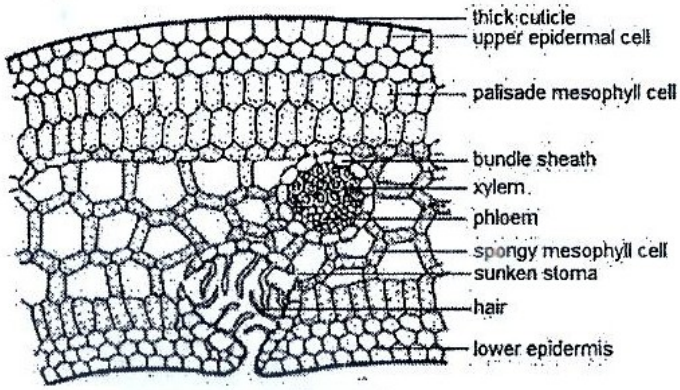

Fig. 7.1

Referring to Fig. 7.1, describe and explain **three** ways that this plant is adapted to live in a hot and dry environment.

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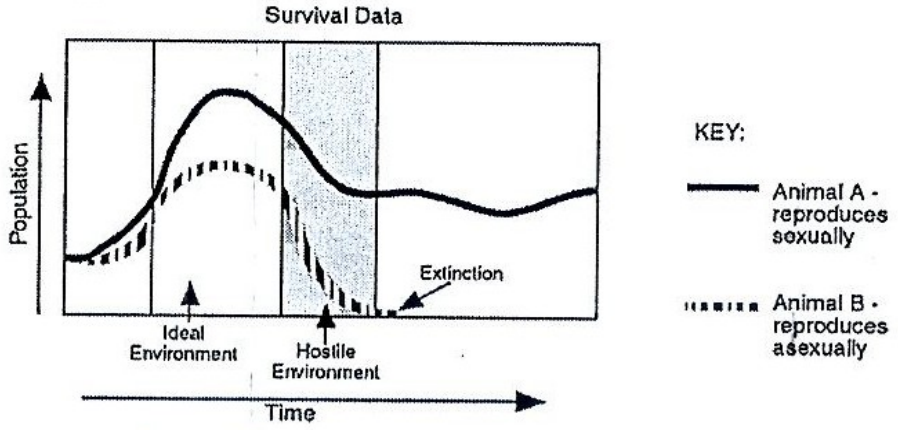
..... [4]

8 Fig. 8.1 shows the survival data shown by animals, A (Silkie) and B (Bantam) which reproduces sexually and asexually.



Source: http://www.ectolearning.com/Page.aspx?p=jysnllhpuy

Fig. 8.1

(a) Describe the trends shown in Fig. 8.1 for animal **A** and **B**.

Use these to explain the fate of Animal **B** at hostile environment.

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..... [5]

(b) Silkie, shown in Fig. 8.2 inherited its thick feathers from its parents. The feathers helped it survive in hostile environment. Thick feather is determined by the recessive allele.

Show, using a genetic diagram, how Silkie inherited this phenotype from both parents which are bald.

Use **H** to represent dominant allele and **h** to represent recessive allele. [5]

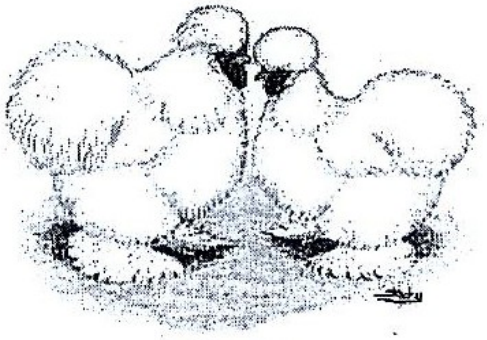
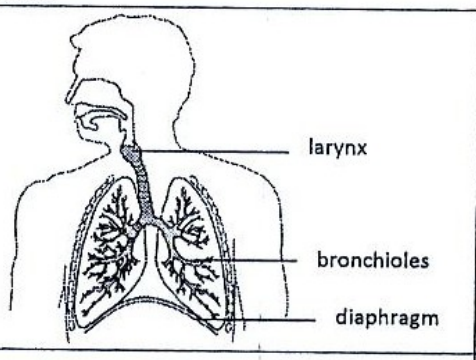


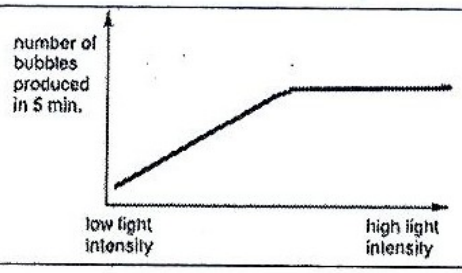
Fig. 8.2

End of Paper

JURONG WEST SECONDARY SCHOOL
Preliminary EXAMINATIONS 2017
SECONDARY 4E5NA SCIENCE BIOLOGY
Answer Scheme_With MR

Q21	C	Q29	B	Q37	B
Q22	C	Q30	B	Q38	C
Q23	D	Q31	B	Q39	C
Q24	B	Q32	D	Q40	A
Q25	C	Q33	C		
Q26	C	Q34	C		
Q27	B	Q35	D		
Q28	B	Q36	A		

Possible Answers			Marks	MR
1	a		3	
	b	large surface area (per volume) ; thin / small diffusion distance ; moist / wet / liquid film ; (alveolar) wall permeable ; well ventilated / diffusion gradient maintained ; well supplied with capillaries / diffusion gradient maintained ;		
	c	More energy is required; Volume of air increased to supply more oxygen for respiration to supply the energy;	2	
2	ai	The size of the pond weed/ The amount of carbon dioxide/ The voltage of the lamp/ The location of the experiment	1	
	aii	By counting the number of bubbles given off in 1 minute (stated time)	1	

	bi		1	
	bii	Light intensity affects rate of photosynthesis;/ As the light intensity increase, the rate of photosynthesis increase; More oxygen is release;		
	c	Carbon dioxide is a raw material for photosynthesis; As the carbon dioxide concentration increase, the rate of photosynthesis increases until CO2 concentration is no longer a limiting factor; More oxygen is release;	3	
3	a	100 – 30 – 15 – 5 = 50%	[1] accept +/- 5 % 45% or 55%	
	bi	Coronary heart disease occurs when the arteries that supply blood to the heart muscle, the coronary arteries become hardened and narrow; This results in a reduced supply of oxygen to the cardiac muscles.	2	
	bii	The occurrence of heart disease is 15%; This may be due to the lack of exercise/ the intake of junk food/ stress	2	
	ci	P is the lymphocyte – IT engulf and digest foreign particles Q is the phagocytes which is responsible for the production of antibodies for the destruction of foreign particles.	Correct identification [1] [1] each for function	
	cii	Too many WBC in the blood may result in reduction in the number of RBC, the amount of oxygen may be insufficient to keep the person alive.	1	

<table>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>a</td><td>Osmosis is the net movement of <u>water molecules</u> from a region of higher water potential to a region of lower water potential across a <u>partially permeable membrane.</u></td><td><u>[1]</u>

[1]</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>bi</td><td>P will get heavier/ The scale will tilt towards P;</td><td>[1]</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>bii</td><td>Distilled water has higher water potential than the cell sap of potato;
Water molecules moves into the cell sap from a region of higher water potential to a region of lower water potential;
P gain mass; The scale tilts.</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>ci</td><td>Correct plots;
Correct scales;
Best fit line;</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>cii</td><td>At this concentration, there is no net gain in water molecules as the solution is isotonic to the cell sap of the potato.</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>a</td><td><table><tr><th>Letter</th><th>Name of the part corresponding to the letter</th><th>Function</th></tr><tr><td>G</td><td>Motor neurone</td><td>Nerve impulses is transmitted along motor neurones to the effector</td></tr><tr><td>H</td><td>Sensory neurone</td><td>Nerve impulses generated and is transmitted along sensory neurons to the spinal cord</td></tr><tr><td>J</td><td>Muscle</td><td>Is the effector which will respond</td></tr><tr><td>K</td><td>Receptor</td><td>It is on skin to detect the pressure (stimulus) at the knee;</td></tr></table></td><td>3</td><td>Any 3 pairs of answer correct, 3 marks</td></tr>
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</table>

	bi	Hormones are chemical substances produce by the endocrine glands; They alter the activities of one or more target organs and is destroyed in the liver;	2	
	bii	Describe: The blood glucose /mg per 100cm3 blood increases from 72 mg at 8 a.m. to 150 mg by 10a.m; By 2p.m. the level decreases back to normal at 72 mg; Explain: When the blood glucose level increase, this acts as a stimulus for islet of Langerhans in pancreas to release insulin; Insulin causes the conversion of excess glucose to glycogen to be stored in liver and muscles/ It also causes higher uptake of glucose in the cells for respiration. This reduces the blood glucose back to norma;	4	
6	a	1 (only) organisms that can photosynthesise; 2 incorporate / trap energy into system; 3 convert light energy into chemical energy; 4 provide energy / food for all other species / rest of food chain / web		
	b	energy is lost, between/within, trophic levels/along food chain ; A from katydid to boa energy lost, in respiration/as heat/in metabolism; energy used in maintaining body temperature ; energy lost in movement; energy used in muscle contraction ; energy in food, not eaten/egested/passed out in faeces; energy lost in, excretion/urine; wolves not very successful at catching prey; more energy available for katydid (than for boa) ; no other source of	6	

		food for boa;		
7	a	increase in temperature will lead to faster evaporation within the leaf; water vapour molecules moves out of the stomata faster down a concentration gradient; hence increasing the rate of transpiration; increasing air humidity will decrease the concentration gradient; of water vapour between the intercellular air spaces and the surrounding air; hence decreasing the rate of transpiration;	6	
	b	sunken stomata; & hairs near the stomata; both increase humidity in the confined space near the stomata; together with the thick cuticle; which is waterproof; all these help prevent excessive water loss from the leaves		
8	a	Over time, the population increases very quickly for animal which reproduces sexually with the peak of the population when the environment is ideal. The population of A the starts to decline very quickly in hostile environment but they are still able to maintain quick a stable population with minor ups and downs. B on the other hand, because it reproduces asexually, its population declined very quickly when the environment turned hostile and eventually it became extinct. Sexual reproduction results in production of genetically dissimilar offspring which can help in survival in hostile environment. Since B reproduces asexually, it is unable to	5	

		survive in hostile environment.		
	b	Parental phenotype: bald x bald	1	
		Parental genotype: Hh x Hh	1	
		Gametes: H h H h	1	
		F1 genotype: HH Hh Hh hh	1	
		F1 phenotype: Bald 75% Feathers 25%	1	
		Phenotypic Ratio: 3:1		