BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018

4EXP

CANDIDATE NAME

CLASS

REGISTER NUMBER

SCIENCE (BIOLOGY, CHEMISTRY)

Paper 1 (Biology, Chemistry)

5078/01
6 August 2018

1 hour

Candidates answer on the OMS.
No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on the work you hand in.
Write in dark blue or black ink on both sides of the paper.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **forty** questions in this paper. Answer all questions.
For each question there are four possible answers A, B, C, and D.
Choose the one you consider to be correct and record your choice in soft pencil on the OMS.

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 booklet.

A copy of the Data Sheet is printed on page 18.

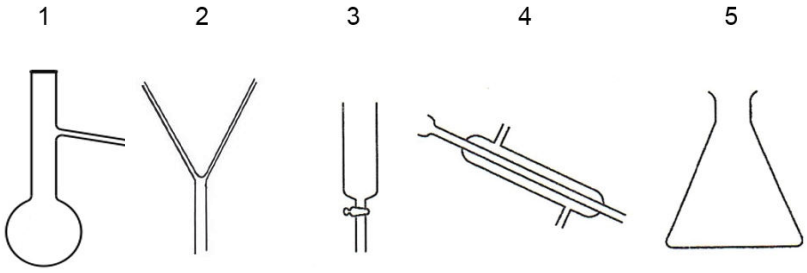
A copy of the Periodic Table is printed on page 19.

Setter: Ms. Cynthia Chong and Ms. Denise Wong

This document consists of **19** printed pages including this cover page.

[Turn Over

1 The diagram shows some laboratory apparatus.



Which apparatus are needed to produce and collect pure water from seawater?

A 2 and 5 **B** 3 and 5

C 1, 2 and 4 **D** 1, 4 and 5

2 Which substance, **A** to **D** undergoes changes in physical states from room temperature to 0°C?

	Melting point/°C	**Boiling point / °C**
A	-2	65
B	-23	4
C	50	250
D	-187	-165

3 Which statements are true about compounds?

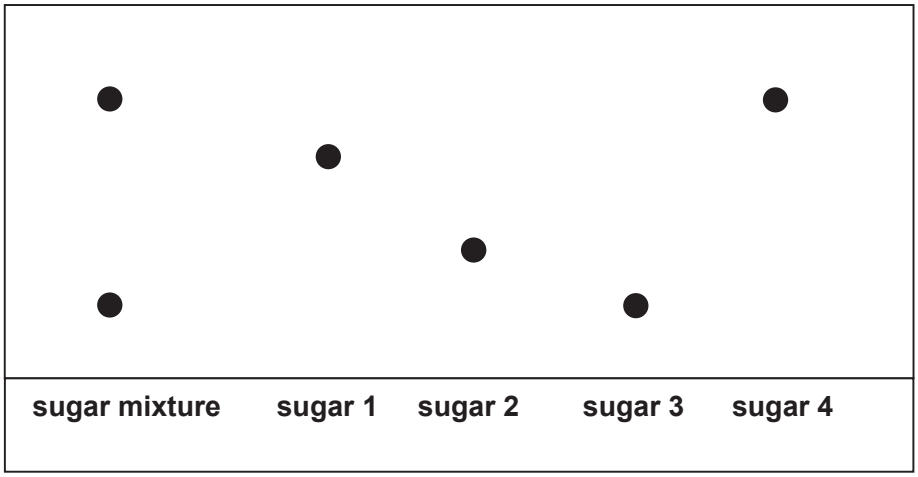
1 They can be made from another compound.
2 They can be made from metals alone.
3 They can be made from non-metals alone.
4 They can be made from a metal and a non-metal.

A 1, 2 and 3 **B** 1, 2 and 4

C 1, 3 and 4 **D** 2, 3 and 4

[Turn Over

4 A sugar mixture was compared with four different simple sugars using chromatography. The results are shown in the diagram below. What types of sugars does the mixture contain?



A sugar 1 and 2 **B** sugar 1 and 4

C sugar 2 and 3 **D** sugar 3 and 4

5 Which compound contains three atoms?

A H_2O **B** HC*l*

C $CaSO_4$ **D** NO

6 Which of the following compounds has the highest percentage of nitrogen by mass?

A NH_4NO_3 **B** $(NH_4)_2CO_3$

C $CO(NH_2)_2$ **D** NH_4Cl

7 A student dissolved 14.9g of potassium chloride, KCl, in 100 cm^3 of water. What is the concentration of the resulting potassium chloride solution in mol/dm^3?

A 0.002 mol/dm^3

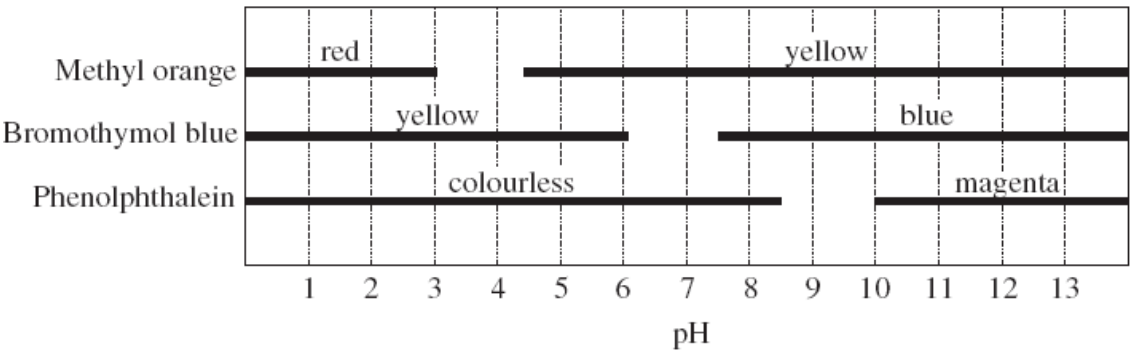
B 0.01 mol/dm^3

C 0.15 mol/dm^3

D 2.0 mol/dm^3

[Turn Over

8 The graph below shows the colour ranges of the acid-base indicators methyl orange, bromothymol and phenolphthalein.



A solution, when placed in the three indicators separately, is yellow in methyl orange, yellow in bromothymol and colourless in phenolphthalein. What is the pH range of the solution?

A 2.5 to 3.5 **B** 4.5 to 5.5

C 7.5 to 8.5 **D** 9.5 to 10.5

9 Which of the following elements burns in air to produce a substance which can react with both hydrochloric acid and sodium hydroxide?

A lead **B** hydrogen

C iron **D** phosphorous

10 Which of the following reagents **cannot** be used to differentiate sodium hydroxide solution from sodium chloride solution?

A Aqueous iron(III) nitrate

B Aqueous copper(II) nitrate

C Aqueous lithium nitrate

D Aqueous ammonium nitrate

[Turn Over

11 Separate samples of hydrogen peroxide are added to aqueous potassium iodide and to acidified potassium manganate(VII). It is known that hydrogen peroxide is both an oxidising agent and a reducing agent.

What colour changes are seen?

	aqueous potassium iodide	acidified potassium manganate(VII)
A	colourless to brown	purple to colourless
B	brown to colourless	purple to colourless
C	colourless to brown	orange to green
D	brown to colourless	orange to green

12 **X**, **Y** and **Z** are elements in the same period of the Periodic Table.

X forms an acidic oxide, **Y** forms a basic oxide and **Z** forms an amphoteric oxide.

If **X**, **Y** and **Z** are placed in increasing order of atomic number (lowest atomic number first), which order is correct?

A **X**, **Y**, **Z** **B** **Y**, **Z**, **X**

C **Y**, **X**, **Z** **D** **X**, **Z**, **Y**

13 Rubidium is in the same group as sodium in the Periodic Table. What is a likely property of rubidium?

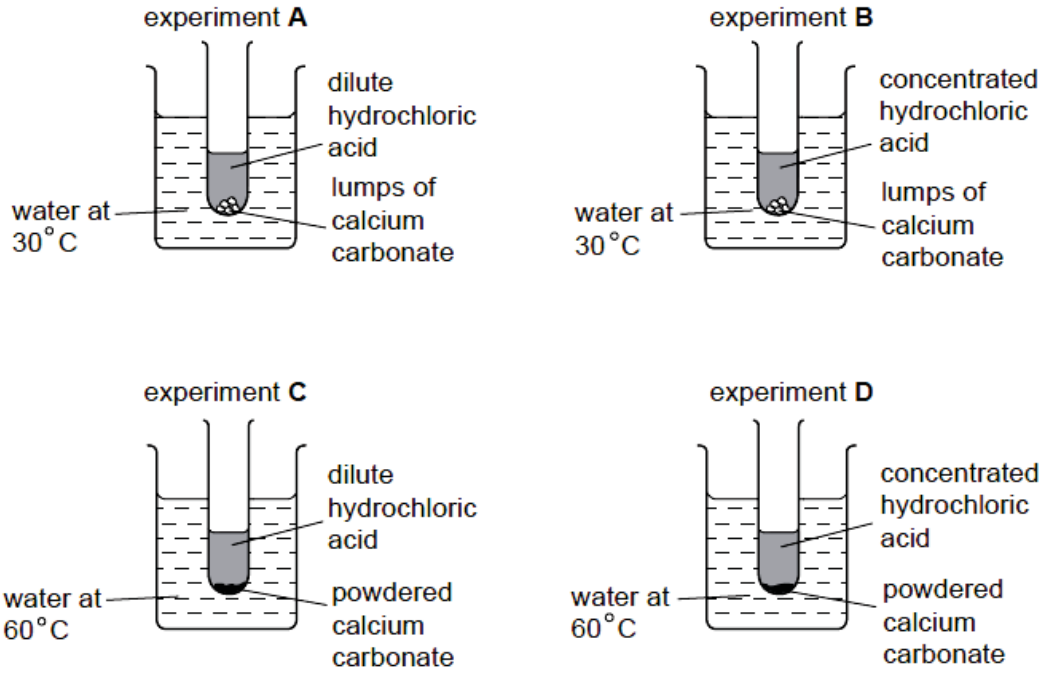
A It reacts with water to form hydrogen gas.

B It cannot be cut by knife.

C It reacts with chlorine gas to form a salt with the formula $RbCl_2$.

D It does not conduct electricity in the molten state.

14 Which of the following experiment will have the fastest speed of reaction?

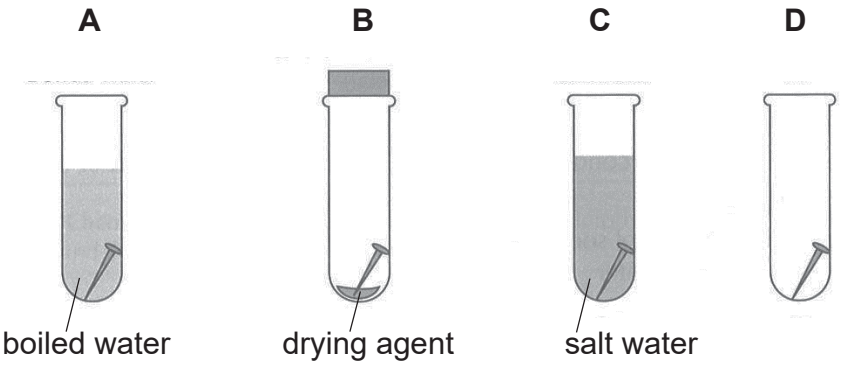


15 The element chromium produces hydrogen from dilute hydrochloric acid but it does not react with cold water. When a piece of chromium is placed in lead(II) nitrate solution, solid of lead appear.

What is the order of **decreasing** reactivity of the metals lead, calcium and chromium?

A	calcium, chromium, lead	**B**	calcium, lead, chromium
C	chromium, calcium, lead	**D**	lead, chromium, calcium

16 In which tube is the iron nail **not** likely to rust?



[Turn Over

17 Which of the following shows the correct percentage composition of oxygen, nitrogen and carbon dioxide found in dry unpolluted air?

	Oxygen	Nitrogen	Carbon dioxide
A	78	21	1
B	1	78	21
C	21	78	1
D	78	21	78

18 Which of the following shows the correct use of the different fractions of petroleum?

	Fraction	**Uses**
A	Petrol	used for making chemical feedstock
B	Bitumen	used for lubricating machine parts
C	Kerosene	used as fuel for aircraft
D	naphtha	used to pave road

19 Which of the following hydrocarbon undergoes substitution reaction?

A C_2H_4 **B** C_2H_6

C C_2H_5COOH **D** C_2H_5OH

20 Which of the following is the same for both ethanol and ethanoic acid?

A empirical formula

B functional group

C number of carbon

D homologous series

[Turn Over

21 The table below shows comparisons of features between a red blood cell and xylem vessel cell.

	feature	red blood cell	xylem vessel cell
1	cytoplasm present	no	no
2	cell wall present	yes	yes
3	nucleus present	no	no
4	chloroplast present	no	yes

Which comparison of features is / are correct?

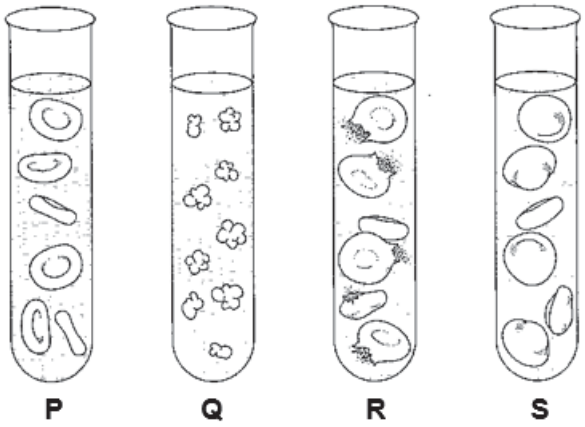
A **1** only

B **3** only

C **2** and **4** only

D **3** and **4** only

22 The diagram below shows red blood cells in four different salt solutions, **P**, **Q**, **R** and **S**.



Which correctly shows the solutions in order of increasing salt concentration?

	lowest	⟶		highest
A	Q	P	S	R
B	Q	S	P	R
C	R	P	S	Q
D	R	S	P	Q

[Turn Over

23 Which substance does not contain the element nitrogen?

A urea

B pepsin

C cellulase

D glycogen

24 Which fluid(s) collected from an individual is likely to give a brick-red precipitate when tested with Benedict's solution?

1 blood
2 saliva
3 secretions from the pancreas
4 secretions from the walls of the large intestine

A **1** only

B **1** and **3** only

C **2** and **4** only

D **1**, **3** and **4** only

25 Digestive juices were collected from three regions of the human alimentary canal. Drops of these digestive juices were added to three wells made in an agar of starch. After an hour, the wells were rinsed with distilled water and flooded with iodine solution. The results are shown below.

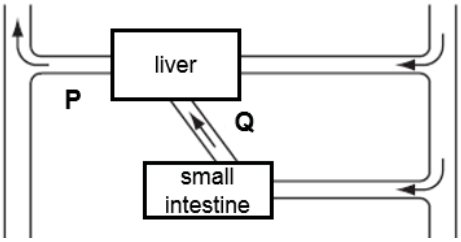
region around well	**1**	**2**	**3**
colour of iodine solution	yellowish-brown	blue-black	yellowish-brown

Which correctly identifies the regions of the alimentary canal that the three digestive juices were obtained from?

	1	**2**	**3**
A	mouth	small intestine	stomach
B	mouth	stomach	small intestine
C	stomach	mouth	small intestine
D	small intestine	mouth	stomach

[Turn Over

26 The diagram below represents some human organs and their associated blood vessels.



Which statement about the concentration of alcohol in the blood vessels **P** and **Q** after a man has consumed an alcoholic drink is true?

A There is no alcohol in both blood vessels.

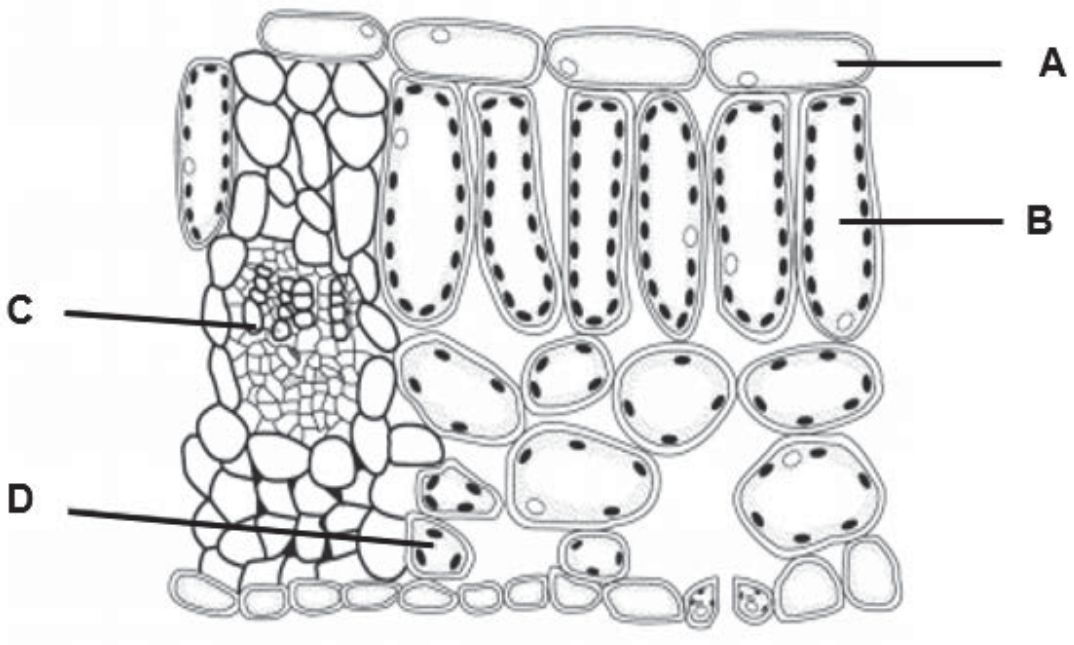
B The concentration of alcohol is higher in **P** than **Q**.

C The concentration of alcohol is lower in **P** than **Q**.

D The concentration of alcohol is equal in both blood vessels.

27 The diagram below shows a section through a leaf as seen under the microscope.

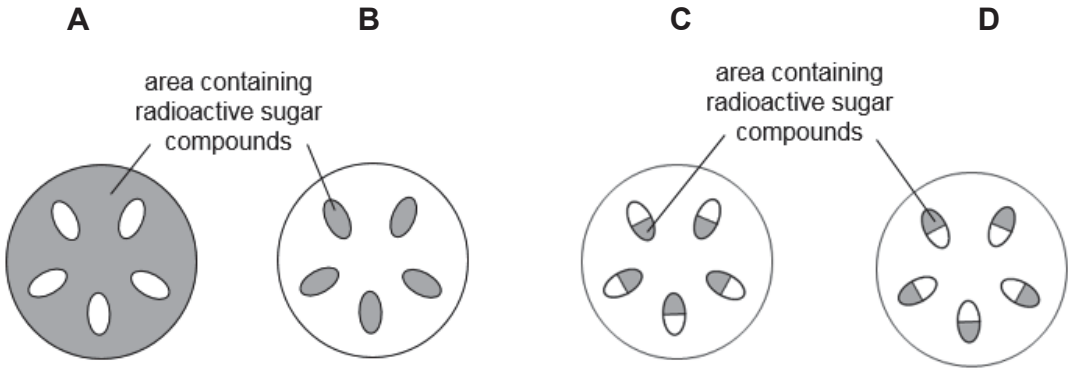
Which part of the plant has the lowest concentration of carbon dioxide on a warm, sunny day?



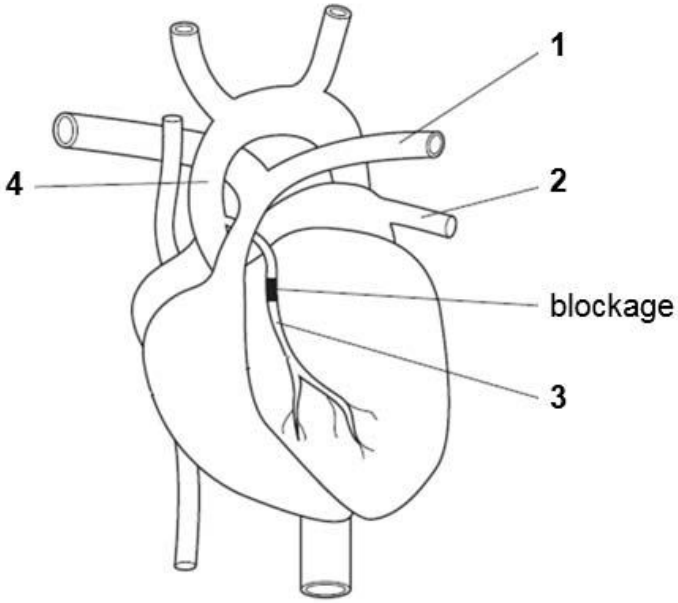
[Turn Over

28 A plant shoot was exposed to radioactive carbon dioxide and sunlight for a few hours before sections of the stem were tested for the presence of radioactive sugar compounds.

Which correctly identifies the part of the stem that would contain the radioactive sugar compounds?



29 The diagram below shows an external view of the heart of a patient with a blockage of the coronary artery. This could be treated by inserting a tube to by-pass the blockage.



Which two blood vessels would be joined by this tube?

A **1** and **2**

B **1** and **4**

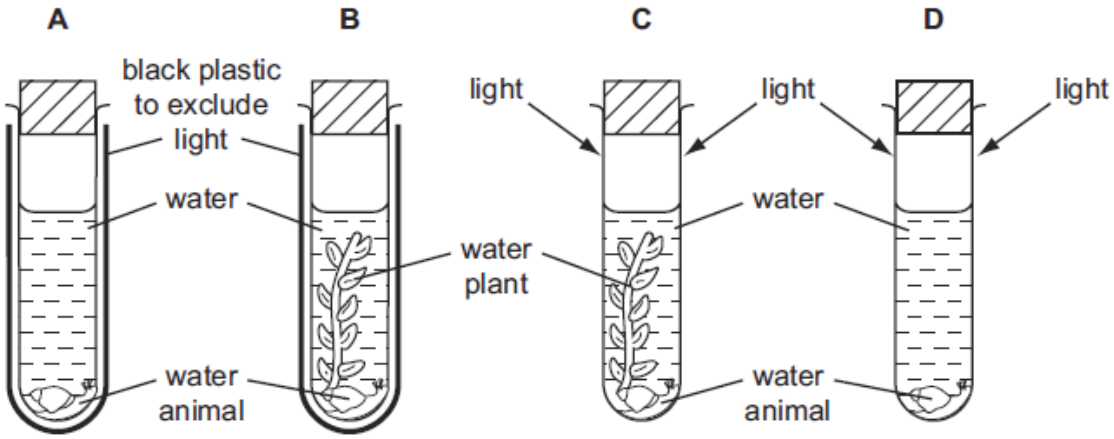
C **2** and **4**

D **3** and **4**

[Turn Over

30 Four test tubes are set up as shown in the diagram below.

In which tube will the water animal survive for the longest period of time?



31 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

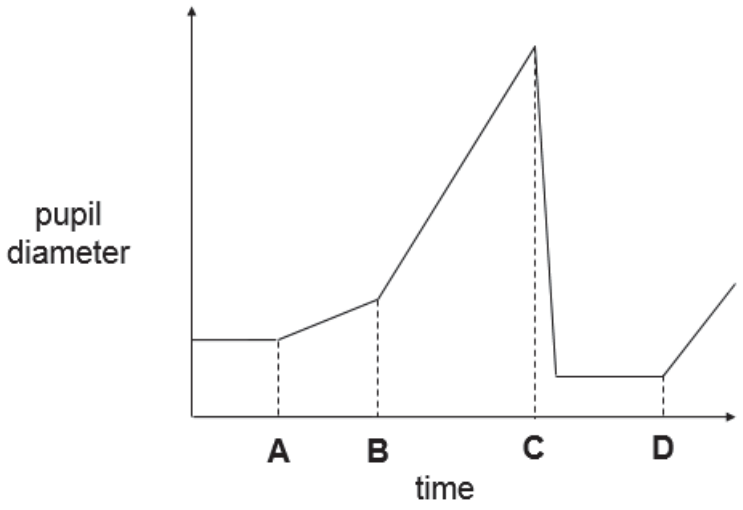
Which correctly identifies the direction of the nerve impulse in motor and relay neurones?

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

[Turn Over

32 A man was wearing sunglasses on a bright sunny day. The graph below shows the change in diameter of the pupils of his eyes.

At which point in time did he remove his sunglasses?

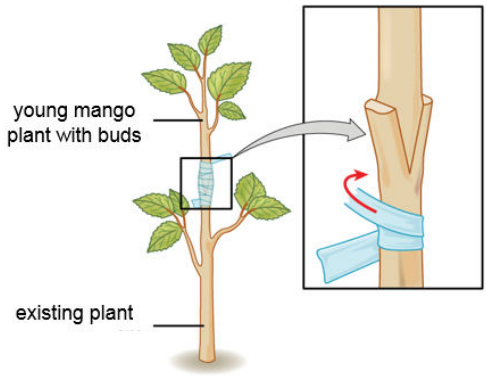


33 Which difference between the endocrine and nervous system is **not** correct?

	endocrine system	**nervous system**
A	rapid response	delayed response
B	involves hormones	involves nerve impulses
C	always involuntary	may be voluntary or involuntary
D	usually affects more than one target organ	affects one target organ

[Turn Over

34 A mango tree can be grown by planting a mango seed directly into the soil or by asexual reproduction as shown in the diagram below. Trees produced by each of these methods produce mango fruits.



Which statement is true?

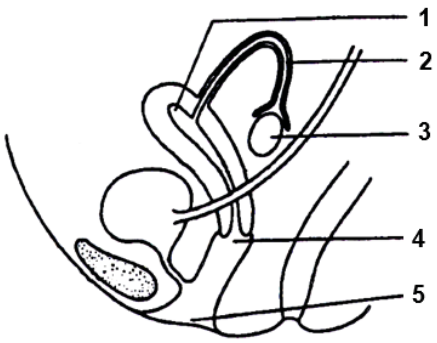
A Mangoes from trees grown from seeds and by grafting are genetically identical.

B Mangoes from trees grown from seeds have different characteristics while mangoes from trees grown by grafting have identical characteristics.

C Growing mango trees from seeds produces mangoes faster than growing mango trees by grafting.

D Growing mango trees from seeds requires only one parent plant but growing trees by grafting requires two parent plants.

35 The diagram shows a side view of the structures in the lower abdomen of a woman.

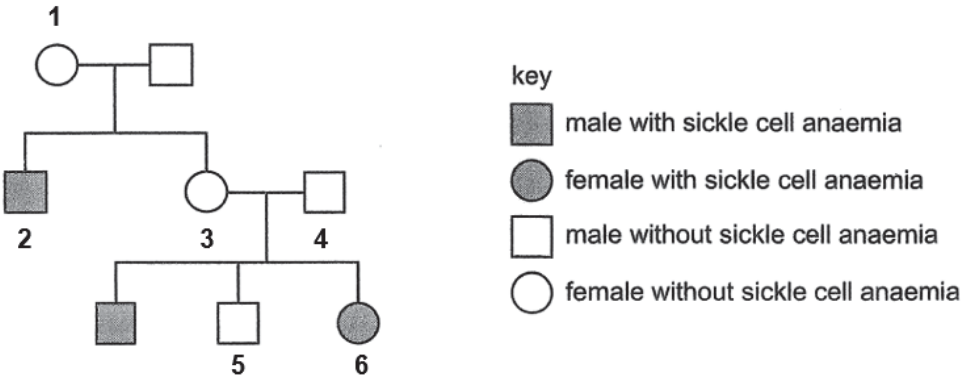


Which correctly identifies the structures in which fertilisation and implantation occur in?

	fertilisation	implantation
A	1	3
B	3	2
C	2	1
D	5	4

[Turn Over

36 The diagram below shows a family tree in which some members have sickle cell anaemia. Sickle cell anaemia is a recessive condition.



Which person(s) is / are likely to be carriers?

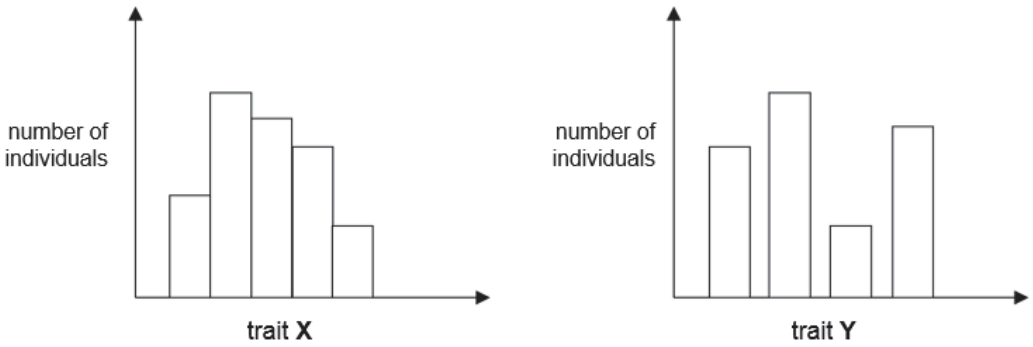
A **5** only

B **2** and **6** only

C **3** and **4** only

D **1**, **3** and **4** only

37 The diagram below shows the two types of variation in humans.



Which could trait **X** and trait **Y** represent?

	trait X	**trait Y**
A	weight	blood group
B	eye colour	hair colour
C	blood group	height
D	fingerprint pattern	intelligence

[Turn Over

38 The diagram below shows part of the sequence of nucleotides taken before and after the DNA in the cells was treated.

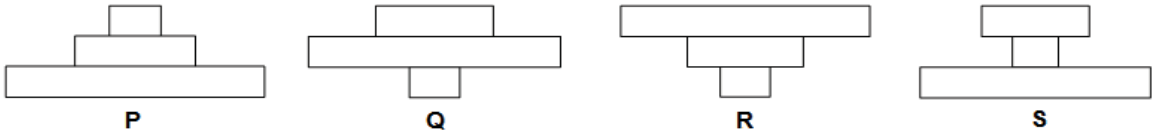
original DNA strand before treatment: A – G – **T** – **C** – C – A – T – T

mutated DNA strand after treatment: A – G – **A** – **G** – C – A – T – T

Which correctly identifies the type of mutation shown and cause of the mutation?

	type of mutation	**cause of mutation**
A	gene	exposure to heat
B	gene	exposure to UV light
C	chromosome	exposure to UV light
D	chromosome	exposure to mustard gas

39 The diagrams below show four ecological pyramids. In a food chain, a papaya tree provides food for caterpillars, and these caterpillars in turn become food for a few birds.



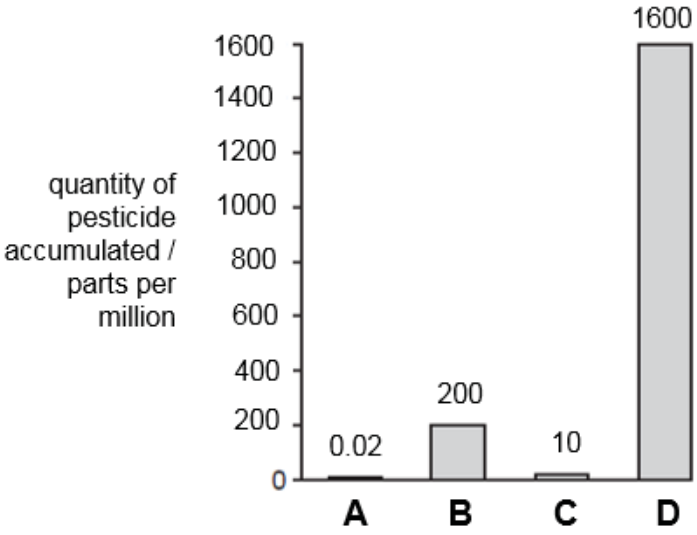
Which correctly represents the pyramid of numbers and biomass for the food chain?

	pyramid of numbers	**pyramid of biomass**
A	P	Q
B	Q	P
C	R	S
D	S	R

[Turn Over

40 The graph shows the quantities of pesticide that accumulate in four populations, **A**, **B**, **C** and **D**, each at different trophic levels in a food chain.

Which population is most likely to be herbivores?



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DATA SHEET

Colours of some common metal hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

Group																	
I	II										III	IV	V	VI	VII	0
							1 H hydrogen 1									2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key proton (atomic) number atomic symbol name relative atomic mass								5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24										13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018

4EXP

CANDIDATE NAME

CLASS

REGISTER NUMBER

SCIENCE (BIOLOGY, CHEMISTRY)

Paper 4 Biology

5078/04

2 August 2018

1 hour 15 minutes

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

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on the work you hand in.
Write in dark blue or black ink on both sides of the paper.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A (45 marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B (20 marks)
Answer any **two** questions. Write your answers on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

Setter: Ms. Denise Wong

For Examiner's Use	
Paper 1	
P4 Section A	
P4 Section B	
Paper 5	
Total	

This document consists of **16** printed pages including this cover page.

[Turn Over

For Examiner's Use

SECTION A (45 marks)

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

1 **(a)** Fig. 1.1 shows part of the human digestive system.

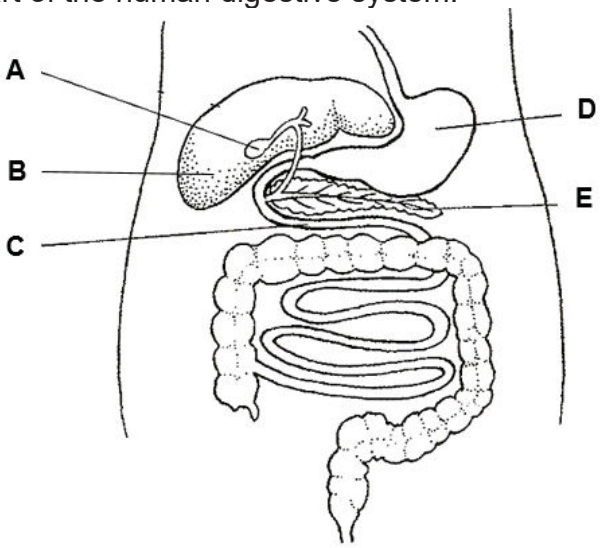


Fig. 1.1

(i) Table 1.1 lists some processes that occur in the human body. Complete the table by using letters from Fig. 1.1 to show where each process occurs.

Table 1.1

process	where process occurs
protein is first digested	
bile is stored	

[2]

(ii) A patient had surgery to remove part of organ **C**. Explain why the patient experienced weight loss in the weeks after the surgery.

……

……

……

…… [2]

[Turn Over

For Examiner's Use

(b) Fig. 1.2 shows the blood vessels associated with organs **B** and **C**.

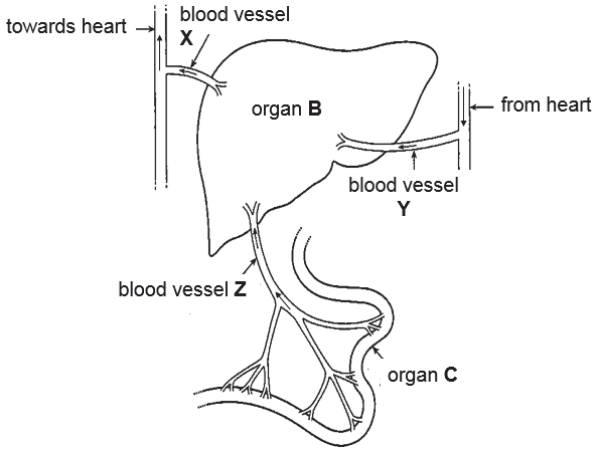


Fig. 1.2

(i) Identify blood vessels **Y** and **Z**.

Y ……

Z …… [2]

(ii) Describe **one** structural difference between blood vessel **Y** and blood vessel **Z**. Explain how this difference helps blood vessel **Y** to perform its functions.

……

……

……

…… [2]

(iii) Explain why the concentration of glucose varies in blood vessel **Z** throughout the day while the concentration of glucose remains relatively constant in blood vessel **X**.

……

……

……

……

……

…… [3]

[Total: 11]

[Turn Over

For Examiner's Use

2 Rennin is an enzyme found in the human alimentary canal that curdles milk by converting soluble milk proteins into insoluble milk proteins. An experiment was carried out to determine the effect of pH on the activity of rennin at 30 ºC. Table 2.1 shows the results of the experiment.

Table 2.1

pH	time taken for milk to curdle / min	rate of reaction / min^{-1}
1	4	0.25
2	2	0.50
3	3	0.33
4	7	0.14
5	13	

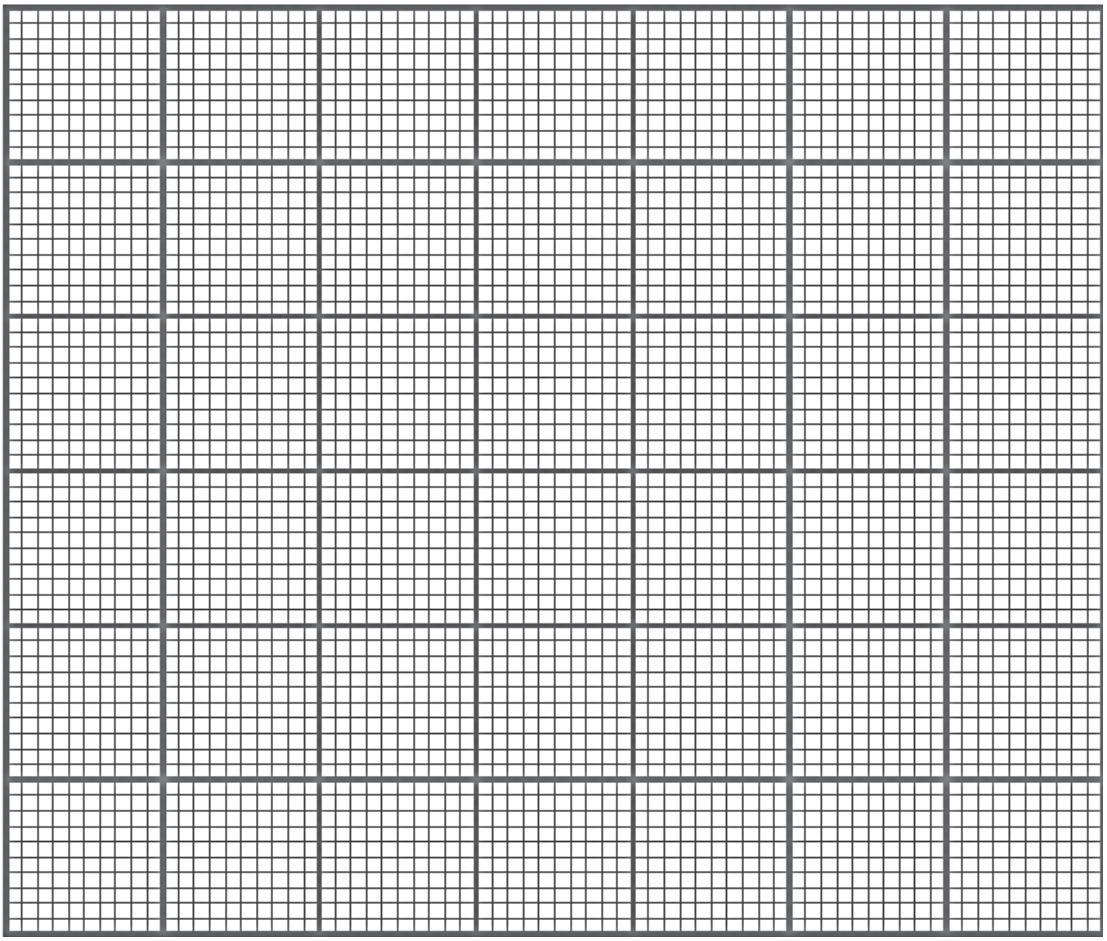
(a) (i) Calculate the rate of reaction for pH 5. Show your working.

rate of reaction = …… min^{-1} [1]

(ii) On the grid provided on the next page, plot a graph of rate of reaction against pH. Use the results in Table 2.1 and your answer to **(ai)**.

On your graph, use appropriate scales, label the axes and draw a line of best fit. [3]

[Turn Over



For Examiner's Use

(iii) From your graph, state the pH where rennin is the most active.

……..... [1]

(b) Describe the test that can be done to conclusively prove that rennin is protein in nature. State the results of the test.

……..

……..

……..

……..... [2]

[Turn Over

For Examiner's Use

(c) In another experiment, rennin was boiled and cooled down to 30 ºC before it was added to milk. Using your knowledge of the lock and key hypothesis, explain why the milk did not curdle.

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.....

.....

..... [3]

[Total: 10]

3 Fig. 3.1 shows an experiment set up to investigate the change in the mass of plants **A** and **B** potted in damp soil over a period of time.

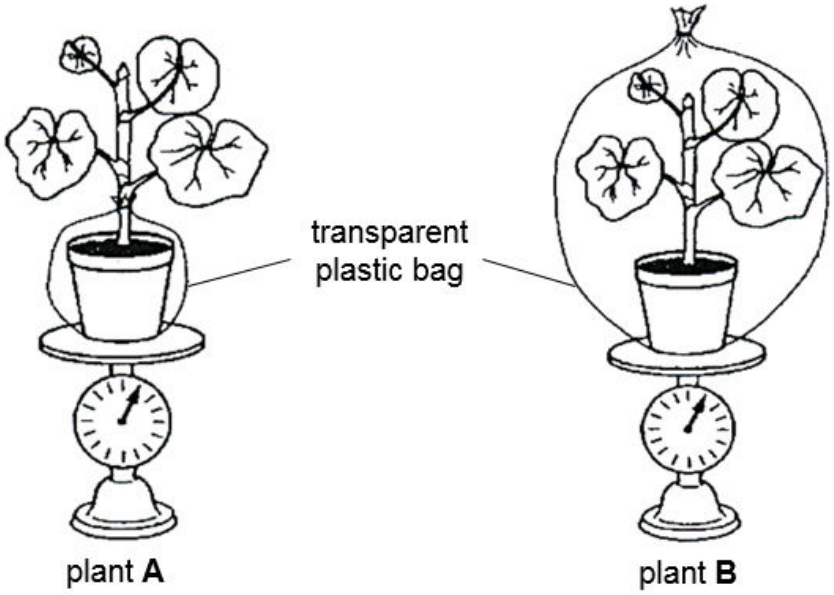

Fig. 3.1

The loss in mass was measured over a period of five days and the results are shown in Fig. 3.2.

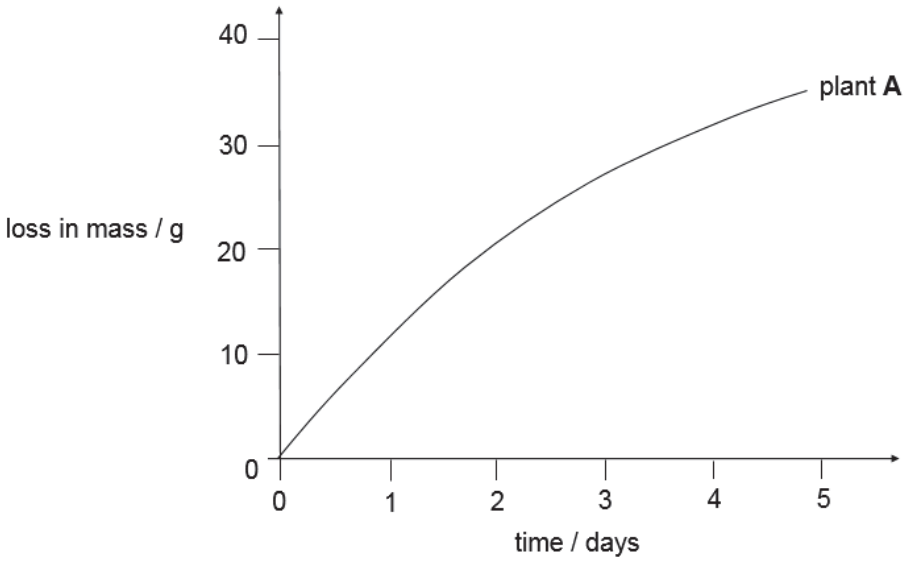

Fig. 3.2

(a) Define the process that caused the loss in mass observed in plant **A**.

.....

..... [1]

(b) **(i)** On Fig. 3.2, sketch a curve to show the results obtained for plant **B**. [1]

(ii) Explain the curve drawn in **(bi)**.

.....

.....

.....

..... [2]

(c) Explain why the rate of photosynthesis in plant **B** was found to decrease after 3 days.

.....

.....

.....

..... [2]

[Total: 6]

[Turn Over

For Examiner's Use

4 Fig. 4.1 shows the pressure changes in the aorta and chambers **X** and **Y** on the left side of the heart during one cardiac cycle in a healthy person.

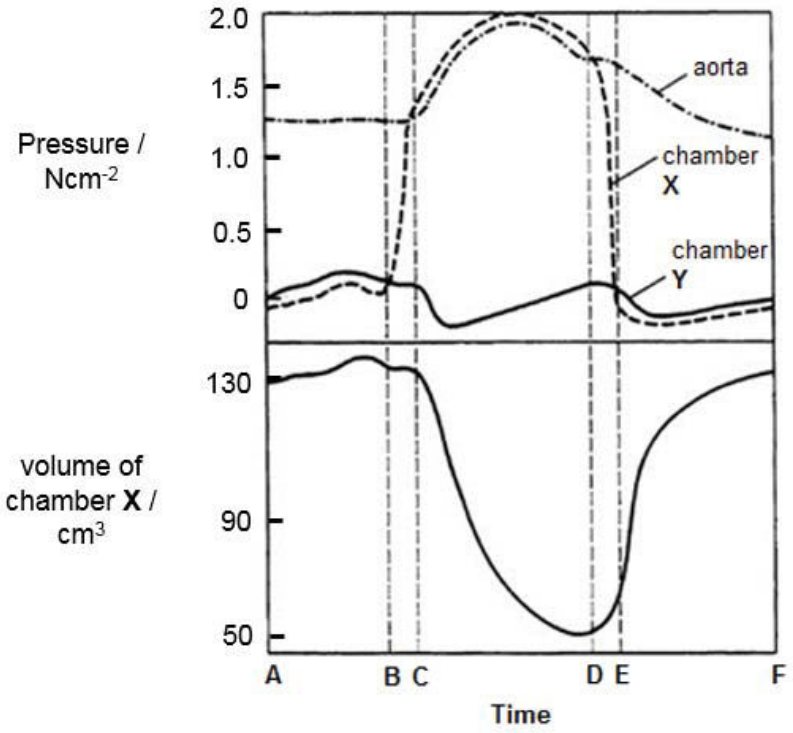

Fig. 4.1

(a) Identify chamber **X**. Explain how you arrived at your answer.

.....

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.....

..... [2]

(b) Describe and explain how the volume of the chamber **X** changes with pressure in chamber **X** from time **B** to **D**.

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.....

.....

..... [2]

[Turn Over

For Examiner's Use

(c) State the function of the valve that closes at **D**.

……

…… [1]

(d) It was observed that the increase in pressure in chamber **X** was greater in smokers than in healthy persons. By naming a component in cigarette smoke, explain this observation.

component ……

explanation ……

…… [2]

[Total: 7]

For Examiner's Use

5 Colour blindness is controlled by a pair of alleles. The allele for normal vision (B) is dominant to the allele for colour blindness (b).

Fig. 5.1 shows the chromosomes found in the normal cells of a father and mother.

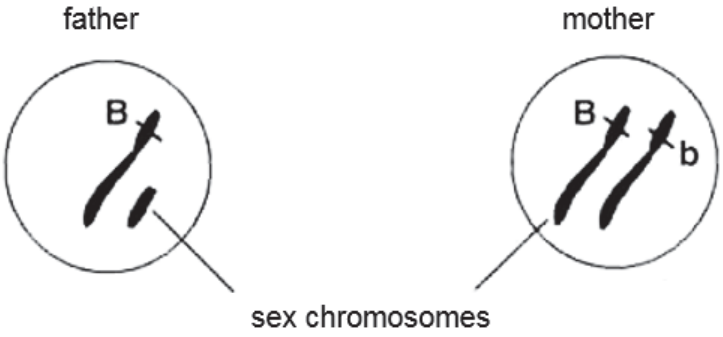

Fig. 5.1

(a) The genotype of the father is X^BY and that of the mother by X^BX^b. Use the genetic diagram in Fig. 5.2 to explain why colour blindness occurs more frequently in males than females.

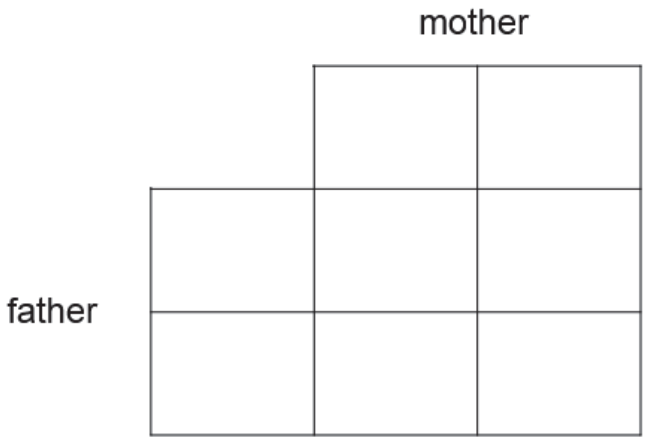

Fig. 5.2

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..... [4]

(b) Fig. 5.3 shows part of the nucleotide sequence of alleles B and b.

allele B GGA TCG ***TC***T AGC

allele b GGA TCG ***GT***T AGC

Fig. 5.3

Using your knowledge of how protein synthesis occurs in cells, explain why the differences in nucleotide sequence results in different phenotypes observed.

……

……

……

…… [2]

[Total: 6]

6 Fig. 6.1 shows the flow of energy through a food chain.

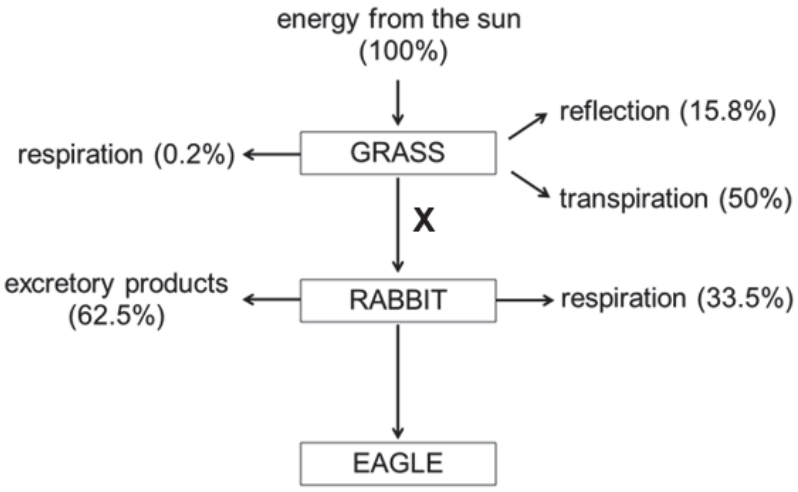


Fig. 6.1

(a) The arrow **X** represents the percentage of energy transferred from the grass to the rabbit.

Calculate the value of **X**. Show your working clearly.

[1]

For Examiner's Use

(b) With reference to Fig. 6.1, explain why the flow of energy in the food chain is non-cyclical.

……

……

……

…… [2]

(c) Explain why most food chains are unable to support more than four trophic levels.

……

……

……

…… [2]

[Total: 5]

- End of Section A -

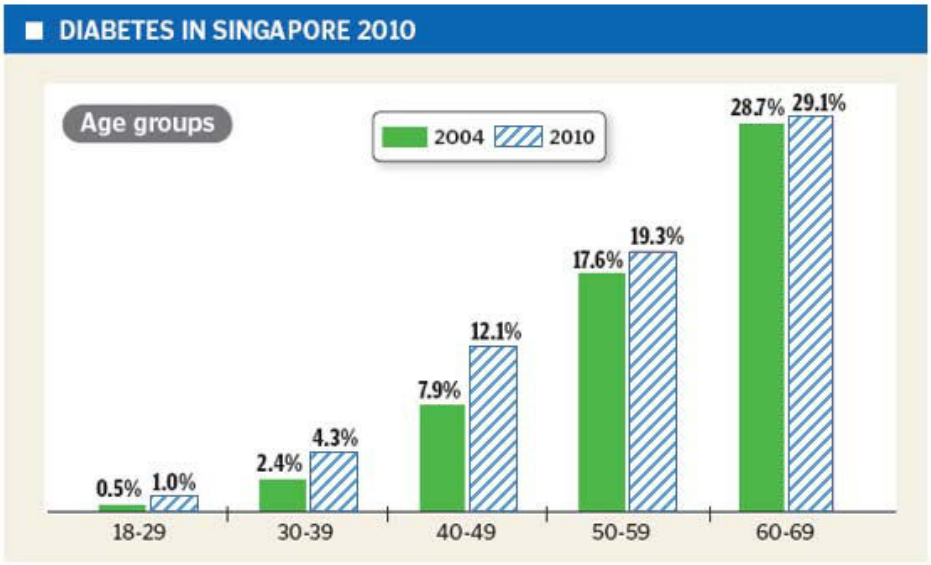
[Turn Over

SECTION B (20 marks)

Answer any **two** questions in this section. Each question carries 10 marks.
Write your answers on the spaces provided.

For Examiner's Use

7 Fig. 7.1 shows some statistics on the incidences of diabetes in Singapore in 2004 and 2010.



Adapted from The Straits Times, 24 February 2012

Fig. 7.1

(a) Use the data shown in Fig. 7.1 to describe the trends shown in the data.

Briefly suggest a reason to account for these trends.

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..... [6]

[Turn Over

For Examiner's Use

(b) Diabetes can be treated by introducing the protein insulin into the body.

(i) Explain why insulin cannot be administered as an oral medication that is consumed.

……

…… [1]

(ii) A nasal spray containing insulin has been recently developed as an alternative way of administering insulin. Insulin is inhaled into the lungs as a spray before it is absorbed into the bloodstream. Outline the pathway the insulin spray would take from the nose till it enters the bloodstream.

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…… [3]

[Total: 10]

[Turn Over

For Examiner's Use

8 **(a)** Outline the sequence of events that take place in the uterus in a typical 28-day menstrual cycle in a woman who is not pregnant. Include the roles of the hormones oestrogen and progesterone in your answer.

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…… [6]

(b) Compare and contrast the process of fertilisation in flowering plants and in humans.

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…… [4]

[Total: 10]

[Turn Over

For Examiner's Use

9 With reference to the organelles in plant cells and events in the carbon cycle, explain
(a) why most life forms are dependent on living plants.

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…… [5]

(b) Destruction of the world's forests are increasing. Explain how this has affected the ecosystem and suggest reasons why it is important to conserve our forests.

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…… [5]

[Total: 10]

- END OF PAPER -

BEDOK SOUTH SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
Secondary 4 Express
Science (Biology) 5078/1 and 5078/4
Marking Scheme

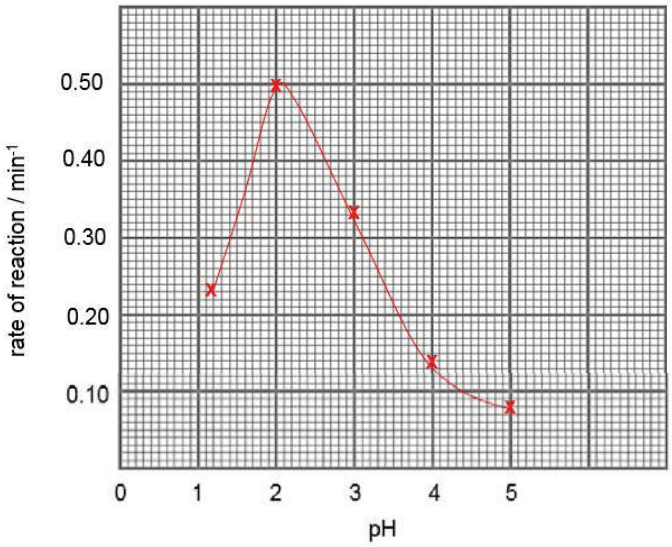
Paper 1

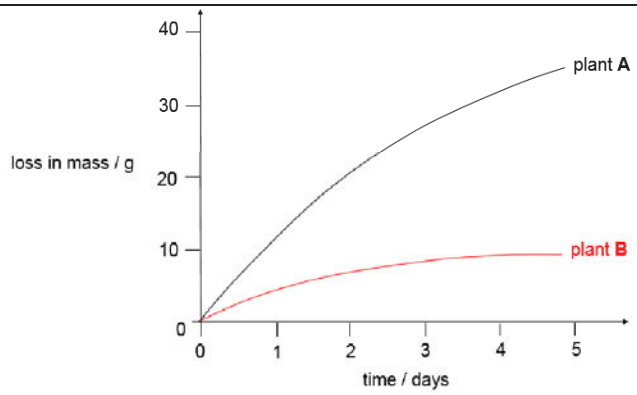
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
B	D	D	A	B	C	B	D	D	C
Q31	**Q32**	**Q33**	**Q34**	**Q35**	**Q36**	**Q37**	**Q38**	**Q39**	**Q40**
B	C	A	B	C	D	A	B	B	C

Paper 4

Qn no.		Suggested answer	Comments to markers	Marks
1	a (i)	**process** / **where process occurs** protein is first digested – **D** [1] bile is stored – **A** [1]		2
		• *Many chose liver (B) for storage of bile*		
	a (ii)	**Max 2 marks:** • There will be less secretion of intestinal juice that contains digestive enzymes, reducing the efficiency of digestion. [1] • The digested food substances also cannot be efficiently absorbed by the villi in the small intestine. [1] • Thus, without absorption, assimilation of digested food substances to build new cells cannot occur effectively, resulting in weight loss. [1]	[1] less efficient digestion [1] less efficient absorption	2
		• *Many could not interpret the question in terms of functions of the small intestine – digestion and absorption* • *While those who answered in terms of function, many left out digestion and focused on absorption only* • *Common errors: writing that C was for transport of food to small intestine and not recognizing that C is the small intestine, writing about absorption of food (should be digested food), faster food digestion as length of intestine is shorter*		
	b (i)	• **Y**: hepatic artery [1] • **Z**: hepatic portal vein [1]	*A: minor spelling errors*	2
		• *Names of the blood vessels were not well learnt with many writing aorta / veins / capillaries or leaving out the term 'hepatic'*		
	b (ii)	**Any 1 structural point + correct comparison:** • Blood vessel **Y** (hepatic artery) has thicker, more muscular walls than blood vessel **Z** (hepatic portal vein). [1] • This allows the hepatic artery to withstand the high pressure of the blood being pumped out of the heart. [1]	*R: thicker walls* *No ECF (should be able to tell artery / vein as*	2

		• Blood vessel **Y** (hepatic artery) has elastic walls than blood vessel **Z** (hepatic portal vein). [1] • This allows the hepatic artery to stretch and recoil, helping to push the blood along the artery in spurts through further distances away from the heart. [1]	*direction was given)*	
		• *Many students write in terms of 'need to' but should take note that structure leads to effects which determines function (and not the other way round)* • *Explanation for the effect of muscular was not well crafted* • *Common error: writing that blood vessel is one cell thick focusing explanation on what Z has (valves) when question focus is on Y.*		
	b (iii)	**Max 3 marks:** • Glucose is absorbed into the blood capillaries at the ileum and transported by blood vessel **Z** (hepatic portal vein) to the liver [1]. • When carbohydrates are consumed and digested, more glucose will be absorbed and transported by the hepatic portal vein / When no carbohydrates are consumed, the level of glucose in the hepatic portal vein will decrease. [1] • However, the concentration of glucose remains constant in blood vessel **X** (hepatic vein) because of the action of insulin and glucagon. [1] • When glucose concentration is high, insulin is released to stimulate the conversion of excess glucose into glycogen / When glucose concentration is low, glucagon is released to stimulate the conversion of glycogen into glucose. [1]	*A: varies depending on glucose intake*	3
		• *Many students gained 1m for the concept that glucose concentration varies depending on food digested / absorbed* • *Most did not identify that glucose if absorbed into the blood at the villi* • *Some also did not explain that the glucose concentration remains constant due to the action of the hormones* • *Students to note that glucose concentration does not only increase due to glucose intake.*		
2	**a (i)**	• Rate of reaction = 1 / 13 = 0.08 min^{-1} [1]	R: fractions No [½] mark	1
		• *Common error: round of errors (not following 2 dp given in table)*		

	a (ii)	 • Accurate data points [1] • Correct axes labels [1] • Line of best fit [1]	[1] penalty for accuracy if graph does not occupy more than half the given graph space A: one inaccurate / missing data point / missing units on axes Cannot award best fit line if points are missing	3
		• Most were penalised for best fit line (straight line / extrapolate) • Common error: plotting time taken instead of reaction rate (not reading question), interchanging axes		
	a (iii)	• pH 2 [1]	A: ECF	1
		• *Generally well-answered*		
	b	• Add 2 cm^3 of Biuret solution to 2 cm^3 of rennin solution and shake well to mix. [1] • If Biuret solution turns from blue to violet, protein is present. [1]	A: equal volume / purple	1
		Common errors: not describing test but stating name of test, missing out 'equal volume', Benedict's test		
	c	• Enzymes (lock) have a specific shape of the active site such that only a substrate (key) with the complementary shape can bind to it. [1] • Boiling rennin (lock) would denature it so that the active site shape is altered. [1] • Hence, the milk protein substrates (key) that have a complementary shape to the active site cannot bind to it to cause curdling. [1]	[1] enzyme (lock) + substrate (key) + complementary [1] denaturation changes complementary active site shape [1] binding of enzyme to substrate	3
		• Most could explain denaturation and subsequent inability to bind well but did not identify the lock and key		

3	a	• Transpiration is the loss of water vapour from the aerial parts of the plant, especially through the stomata. [1]		1
		• *Many did not define but wrote the name of the process* • *A few also wrote photosynthesis* • *Definition also not well learnt with many leaving out key terms such as 'water vapour' or 'stomata'*		
	b (i)			1
		• *Many drew the graph such that the different between A and B was not significant even though plant B had a slower rate of mass loss*		
	b (ii)	• The transparent plastic bag increases the humidity of the air around the leaves of plant **B**. • Increasing the humidity of the air will decrease the water vapour concentration gradient between the intercellular air spaces in the leaf and the atmosphere. [1] • Rate of transpiration decreases so leaves of plant **B** lose less water vapour than leaves of plant **A**. [1]		2
		• *Most students could not give clear explanations based on the concept of water vapour concentration gradient and linking it to the reduced transpiration rate* • *Conceptual understanding of factors affecting transpiration is weak* • *Some students thought that the loss of mass will not be significant since water loss is trapped in the bag (but the bag is porous and some vapour will still escape)*		
	c	• A reduced transpiration rate results in less transpiration pull [1], hence less water absorbed for photosynthesis. [1]		2
		• *Most students wrote about the lack of availability of carbon dioxide the bag directly limits the plant from obtaining carbon dioxide (which is not true as it can be produced by the plant during respiration)* • *Some identified the lack of water but were unable to explain exactly why it is limiting (conceptual understanding of how water is absorbed by the plant is lacking – thinking that the bag directly limits the plant from obtaining water)*		
4	a	• Left ventricle [1] • The ventricular pressure is higher than atrial pressure [1] as the thicker more muscular walls of the ventricles generate a larger force to push blood out of the heart over a longer distance to the rest of the body.	A: ventricle A: ventricle pressure follows aorta pressure	2
		• *Many were able to identify highest / higher pressure but need to realise to avoid*		

		writing that ventricle 'needs' to have higher pressure. Structure leads to effect which leads to function		
	b	• As the pressure in chamber **X** increases from 0 to 2.0 Ncm^{-2} from **B** to **D**, the volume in chamber **X** decreases from 130 to 50 cm^3. [1] • As the left ventricle contracts during systole, the increase in left ventricular pressure forces blood out of the left ventricle into the aorta, decreasing the volume within the ventricle. [1]	R: if no figures are quoted	2
		• *Descriptions were provided without quotes* • *Many also did not know how to express the relationship between pressure and volume and thus wrote from memory irrelevant points about the action of the valves*		
	c	• It prevents the backflow of blood from the aorta back into the left ventricle. [1]	*A: prevent backflow of blood (even if direction or ID of valve is incorrect)*	1
		• *Most could not deduce that the valve closing is the semilunar valve and did not state the direction of backflow*		
	d	**Any 1 component + correct explanation:** • Carbon monoxide [1] • Carbon monoxide reduces the oxygen-carrying ability of red blood cells / increases the risk of atherosclerosis such that the heart compensates by pumping harder with greater force. [1] • Nicotine [1] • Nicotine increases risk of blood clots in blood vessels / increase rate of fatty deposits in blood vessels / diameter reduction of blood vessel such that the heart compensates by pumping harder with greater force. [1]		1
		• *Most could name a correct component of cigarette smoke but could not clearly link the effects of the component to an increase in PRESSURE e.g. writing about nicotine causing increased heart rate* • *Common error: tar (carcinogen, cilia paralysis)*		
5	**a**	mother / father X^B X^b / X^B $X^B X^B$ $X^B X^b$ / Y $X^B Y$ $X^b Y$ • Punnett square: correct separation of allele in parental gametes [1], correct combination [1] • Males have the Y chromosome that doesn't carry the allele for	A: X chromosome carries the alleles	4

		colour vision. [1] • Hence, inheriting one copy of the recessive allele X^b from the mother is sufficient to result in colour blindness. [1]		
		• *Some were unable to complete the Punnett square with the correct symbols even though genotype was given to them (unable to transfer knowledge)* • *Most also could not explain clearly that inheritance of one copy in males is more detrimental and hence more common (focus on the answer should be on males not females)* • *To remind students that alleles (recessive / dominant) are found on chromosomes (entire chromosomes cannot be recessive / dominant)*		
	b	• Differences in nucleotide sequence between the alleles results a difference in the codons that code for one amino acid. [1] • Hence, during translation, a difference in the codons would result in a different sequence of amino acids that result in the formation of a different protein responsible for the phenotype. [1]		2
		• *Many could not explain that difference in codon sequence results in different sequence of amino acids and hence different protein (phenotype)* • *Many mentioned what genes are which is irrelevant to this question* • *Many also just simply rewrote what was given in the question – that different in nucleotide sequence results in different phenotypes (conceptual understanding is weak)* • *Usage of imprecise terms e.g. each protein consists of 3 nucleotides*		
6	**a**	• **X** = 100 – 15.8 – 0.2 – 50 = 34 % [1]		1
		• *Many made calculation errors e.g. using 10 % rule (3.4%)*		
	b	• As energy flows from the Sun to the producers and consumers, some of the energy is lost to the environment in e.g. the form of heat released during respiration (0.2 % or 33.5 %) / reflection (15.8 %) / transpiration (50 %) / excretory products (62.5 %). [1] • This energy lost as heat cannot be recycled / used again by the producers or consumers. [1]		2
		• *Most did not quote the figures as required by the question (with reference to 6.1)* • *Many also did not remember how to explain the non-cyclical flow and wrote about less energy available*		
	c	• About 10 % of the energy stored at one trophic level is transferred to the next trophic level in the form of biomass / About 90 % of energy is lost to the environment. [1] • Hence, there will not be enough energy available to support the final consumers in long food chains. [1]		2
		• *Common errors: not quoting the percentage of energy lost / transferred, not writing about the FINAL consumers*		

SECTION C: Free Response Questions (20 marks)

Qn no.	Suggested answer	Comments to	Marks

			markers	
7	a	**Max 2 descriptions with correct quoting of figures [4]:** • Number of incidences of diabetes has increased in each age group from 2004 to 2010 [1] • E.g. In people aged 50 – 59, number of incidences of diabetes has increased from 17.6 % in 2004 to 19.3 % in 2010. [1] • For any particular year, number of incidences of diabetes is higher in older people than in younger people. [1] • E.g. In 2010, 1 % of people aged 18 – 29 had diabetes while 29.1% of people aged 60 – 69 had diabetes. [1] • The onset of diabetes is occurring earlier. [1] • E.g. In 2004, 7.9 % of those aged 40 to 49 had diabetes while in 2010, the number had risen to 12.1 %. [1] **Max 2 marks for reasons:** • Lack of exercise / less active [1] • Diet high in carbohydrates / sugar [1] • Obesity / more affluent so can eat more [1] • Slowing down of metabolism / less responsive to insulin / less healthy liver in older people [1]		6
		• *Most are weak at identifying the trends or accurately articulating the trends and quoting appropriate figures to substantiate the trend observed* • *Many were able to give 1 reason for trend observed (slowing of metabolism)* • *Common error: liver produces insulin (not penalised)*		
	b	• Insulin will be digested in the stomach by the pepsin into polypeptides and will not function. [1]	A: will be digested	1
		• *Most could not make the connection given in the question that insulin is a protein and extend the understanding to the fact that it would be digested* • *Common errors: it would take a long time for insulin to be digested / longer time to absorb, cannot go to the site of action in the liver, no glucose in mouth to react with insulin*		
	c	• The insulin spray would move from the nasal cavity into the pharynx and then trachea. [1] • From the trachea, the spray would move into the bronchus, bronchiole and alveoli. [1] • The spray would then diffuse across the alveolar wall into the plasma in the blood capillaries. [1]		3
		• *Understanding of the structures in the respiratory system was weak* • *Irrelevant responses include the movement throughout the circulatory system till the liver*		
8	a	**Max six marks:** • From day 1 – 5, menstruation occurs due to the decrease in the levels of progesterone in the last few days of the previous cycle. [1] • During menstruation, the uterine lining breaks down and is	For each time period: [1] description of event	6

		discharged out of the vagina together with the unfertilized egg and blood. [1] • From day 6 to 13, the increase in oestrogen levels [1] stimulates the uterine lining to thicken / grow / repair and becomes vascularized. [1] • From day 15 to 24, the increase in progesterone levels [1] due to the presence of the corpus luteum maintains the thickness of / further thickens the uterine lining to prepare for possible implantation of the embryo. [1] • From day 24 to 28 (when no fertilisation occurs), the decrease in progesterone levels due to the breakdown of the corpus luteum stimulates the uterine lining to break down at the onset of menstruation. [1]	[1] explanation of role of hormone	
		• *Days of the cycle were not always included in the answers (penalised)* • *Common irrelevant responses include mention of ovulation (question's focus is on events in the uterus)* • *Common errors: writing that day 15 – 28 is when progesterone levels increases, writing in a non-chronological order*		
	b	**Similarities:** • In both plants and humans, the haploid male gamete fuses with the female gamete to form a diploid zygote. [1] **Differences (point to point, both sides of comparison):** • The site of fertilisation in plants is the ovule [1] while the site of fertilisation in humans is in the fallopian tube / oviduct. [1] • Two male gametes fuse with two nuclei during double fertilisation [1] in plants while only one male gamete fuses with the ovum to form the zygote in humans. [1] • In plants, it is possible for self-fertilisation to take place where the gametes are produced from the same parent [1] while in humans, self-fertilisation is not possible. [1]		4
		• *Question was challenging to most who could not find the common similarity or suitable points of comparison for differences about the event of fertilisation itself* • *Common irrelevant responses include writing about events leading to fertilisation e.g. pollination or writing about asexual reproduction* • *Writing that plants can self-pollinate and hence self-fertilize*		
9	**a**	**Max 5 marks:** • Plants are the only organisms that can convert carbon dioxide in the atmosphere into chemical energy in the form of glucose. [1] • During photosynthesis, the chloroplasts in plant cells trap light energy from the sun and use it to convert carbon dioxide into glucose. [1] • Glucose is used by the plants to form new cells and is thus converted into biomass. [1] • During feeding, energy in the form of biomass is transferred to consumers. [1]	[1] photosynthesis	5

		• In the mitochondria of living organisms, glucose is oxidized during respiration [1] to release the energy required for the organisms to carry out their activities and grow. [1]		
		• *Question was challenging to most to integrate processes in the carbon cycle to explain that plants are the only source of glucose for most other life forms* • *Irrelevant responses include production of oxygen (question's focus is on the carbon cycle)*		

	b	**Max 3 points:**
		• During photosynthesis, plants remove carbon dioxide from the atmosphere and convert it into glucose. [1]
		• With increasing deforestation, there will be fewer trees to remove carbon dioxide from atmosphere. [1]
		• This will lead to an overall increase in the amount of carbon dioxide remaining in the atmosphere. [1]
		• Organisms living in the forests lose their habitats and source of food and shelter. [1]
		• This can cause imbalances to the food chain. [1]
		• Organisms may eventually not survive and species become extinct. [1]
		
		Max 1 key point with elaboration:
		• To maintain biodiversity by preventing the extinction of species [1]
		  ○ A large gene pool is important as many wild plants and animals possess favourable genes. [1]
		  ○ Plants with better resistance to diseases and drought can be produced by crossing domestic species with wild species. [1]
		  ○ Many tropical plants are of great importance as they are sources of medicinal drugs. [1]
		• To allow for species diversity [1]
		  ○ This means to have a wide variety of different species of organisms living in a given area. [1]
		  ○ Each species has its role to play in maintaining the balance in the ecosystem. [1]
		• To maintain a stable and balanced ecosystem [1]
		  ○ This prevents disruption of natural cycles such as the carbon cycle, and also prevents global warning. [1]
		• For economic purposes [1]
		  ○ Tropical plants provide raw materials for industries. [1]
		  ○ Tropical rainforests also provide food for example, rice, pineapple and banana [1]
		• For scientific research [1]
				5

		○ The study of wildlife provides useful information to humans. [1]	
		• *A number of students completely left out reasons why conservation is important* • *Writing about soil erosion instead of the direct impact of deforestation or explaining how erosion impacts the ecosystem (not able to understand the term 'ecosystem')* • *Explaining that removal of trees removes oxygen for other organisms*	

- END OF PAPER -