Class	Index Number	Name

PEI HWA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2017

Secondary Four Express

BIOLOGY

5158/01

Paper 1 Multiple Choice

11 August 2017

1 hour

Additional Materials :

Optical Answer Sheet (OTAS)

READ THESE INSTRUCTIONS FIRST

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

This booklet consists of only questions for MCQs.

1. Write your name, class and index number on the OTAS. Shade your index number in the boxes provided.

2. There are **40** 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 correct and record your choice in **soft pencil** on the separate OTAS provided.

3. Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

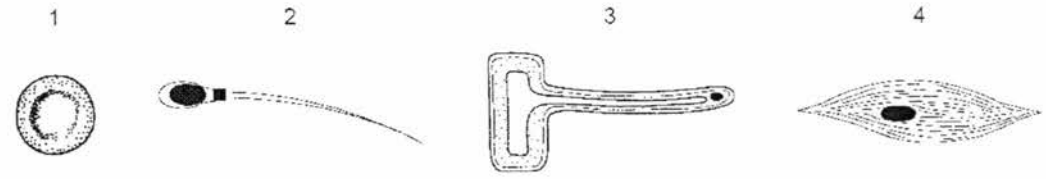
   Any rough working should be done on this booklet

Hand in the OTAS separately from the answer booklet.

This question paper consists of **22** printed pages, inclusive of this cover page.

Multiple choice questions (40 marks)

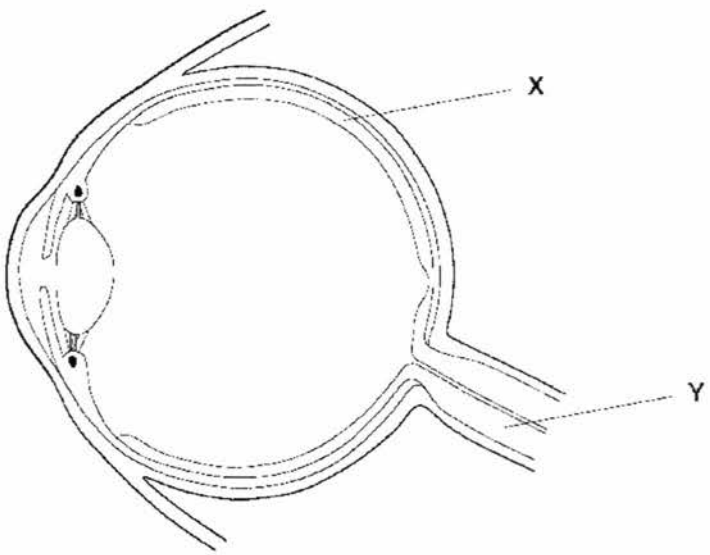
1 The diagrams show four different cells (not drawn to scale).



Which cells provide a large surface area for absorption?

A 1 and 2
B 1 and 3
C 2 and 4
D 3 and 4

2 The diagram shows a section through an eye.



What are structures **X** and **Y**?

A organs in an organ system
B organs in a tissue
C organ systems in an organ
D tissues in an organ

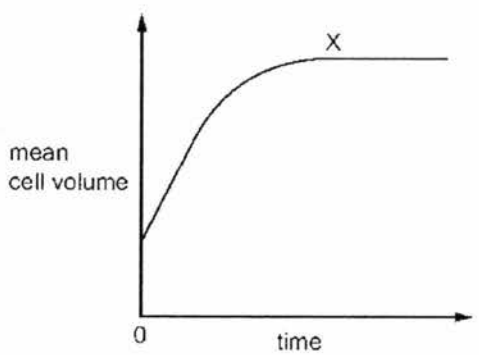
3 A student carried out four tests for biological molecules on a solution. The observations are shown in the table.

test for biological molecules	observation
iodine solution	orange
biuret	purple
Benedict's	orange
emulsion	cloudy

Which molecules may be present in this solution?

A glucose, starch, protein
B lipid, protein, glucose
C protein, starch, sucrose
D starch, protein, lipid

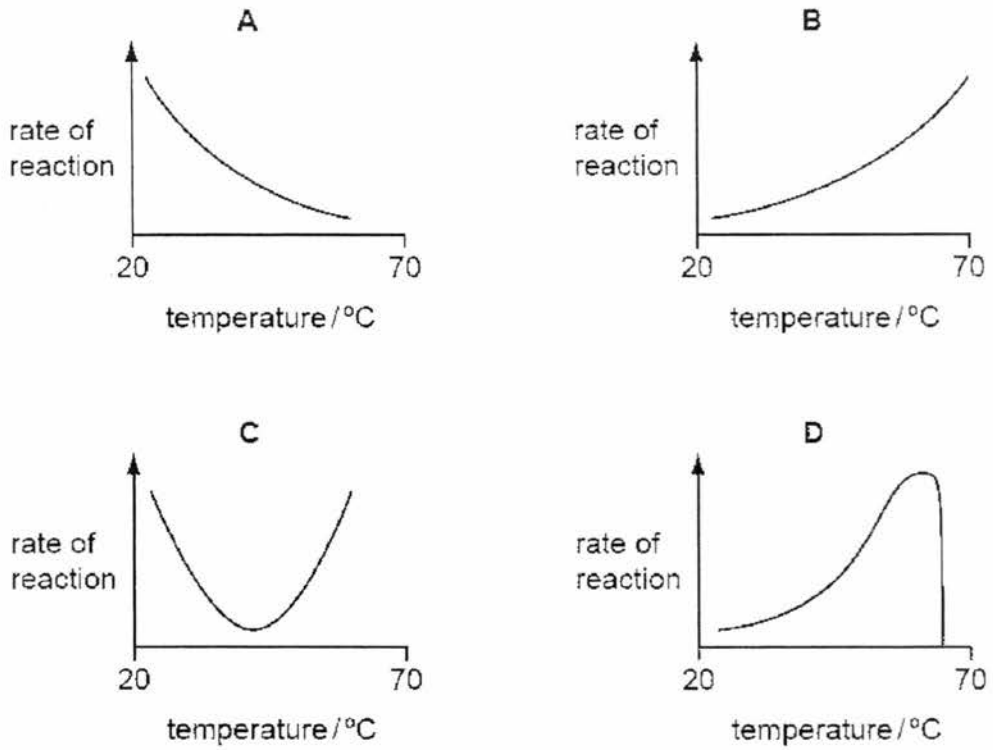
4 A tissue composed of plasmolysed plant cells was put into distilled water. The graph shows how the mean cell volume changes with time.



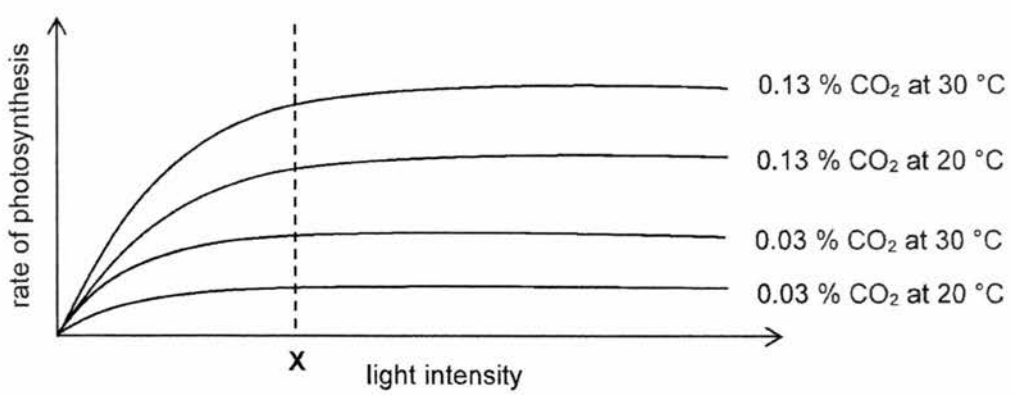
What is the cause of the plateau at **X**?
1 water potential in the plant cell has become more negative
2 cells have become fully turgid
3 no net movement of water into cells

A **1**, **2** and **3**
B **1** and **2** only
C **1** and **3** only
D **2** and **3** only

5 Which graph shows the effect of temperature on the activity of a human digestive enzyme?



6 The graph below shows four experiments conducted on a leafy shoot under different conditions.



Which of the following is the most likely effect of increasing temperature on the rate of photosynthesis?

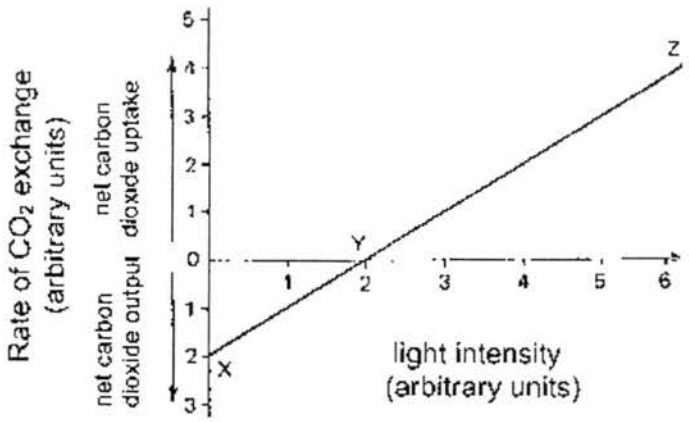
A Higher temperatures will always result in increased rate of photosynthesis.

B Increasing temperature does not have an effect on the rate of photosynthesis beyond **X**.

C Temperature becomes a limiting factor only at higher levels of light intensity.

D Temperature is a limiting factor of photosynthesis between 20 °C and 30 °C.

7 The graph below shows the effect of changing light intensity on the carbon dioxide absorbed or released by green plants.

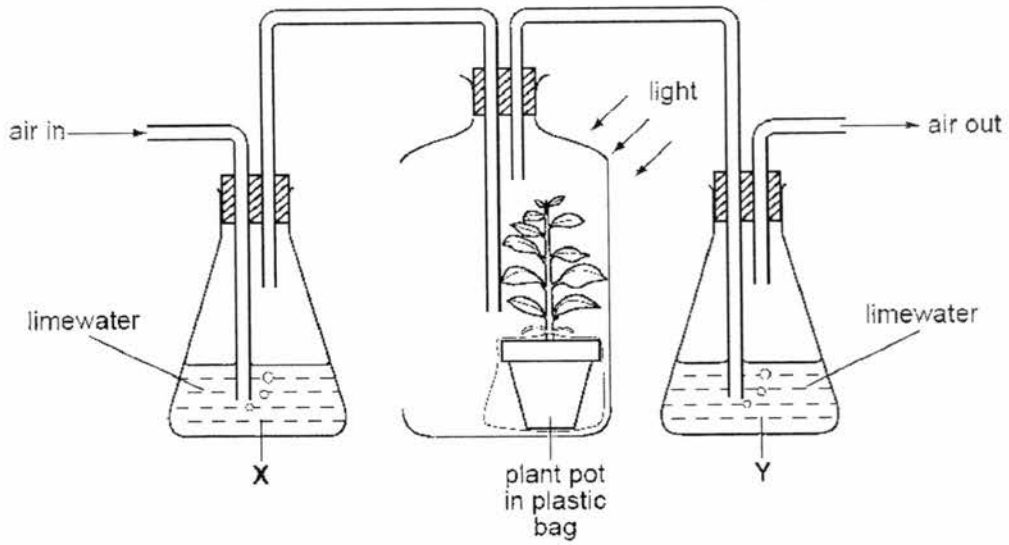


Which of the following statements is/are incorrect?

I Between **X** and **Y**, the rate of respiration is higher than the rate of photosynthesis.
II Between **Y** and **Z**, the rate of photosynthesis is higher than the rate of respiration.
III At **Y**, there is no respiration taking place.

A **I** only
B **III** only
C **I** and **II** only
D All of the above

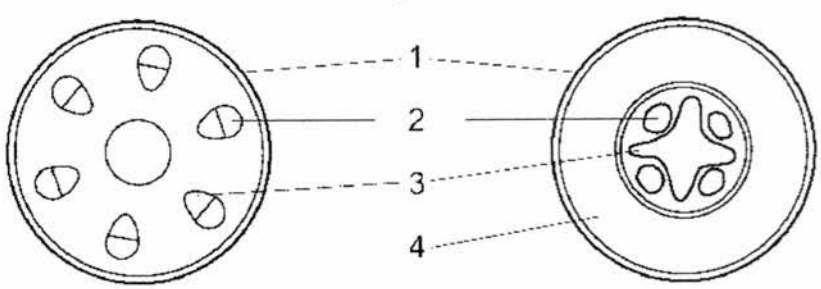
8 The apparatus shown in the diagram is used to investigate the effect of a green plant on carbon dioxide in the air.



Limewater goes cloudy if carbon dioxide is bubbled through it.
What happens to the limewater in **X** and in **Y**?

	X	Y
A	goes cloudy	goes cloudy
B	goes cloudy	stays clear
C	stays clear	goes cloudy
D	stays clear	stays clear

9 The diagram shows transverse sections of two plant structures



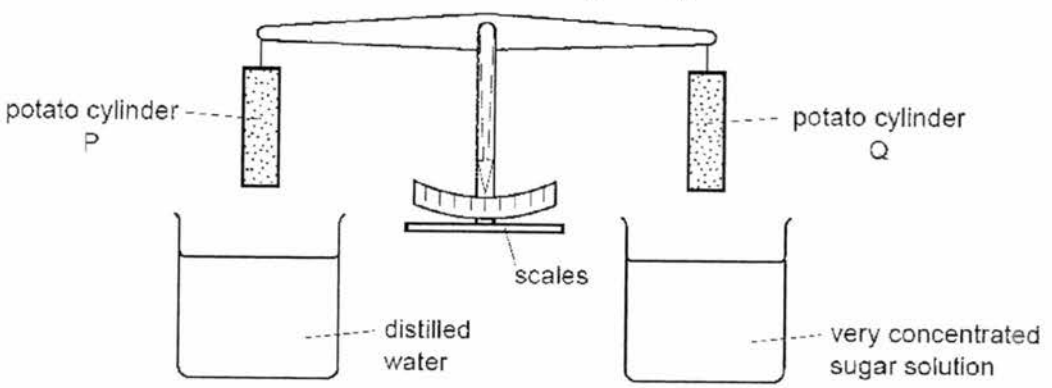
Which row shows the correct labels?

	1	2	3	4
A	cuticle	phloem	xylem	pith
B	cuticle	xylem	phloem	cortex
C	epidermis	phloem	xylem	cortex
D	epidermis	xylem	phloem	pith

10 How is the rate of transpiration affected by decreasing temperature and by decreasing light intensity?

	decreasing temperature	decreasing light intensity
A	slower	slower
B	slower	faster
C	faster	slower
D	faster	faster

11 A student investigated osmosis in potatoes. He set up the apparatus shown.

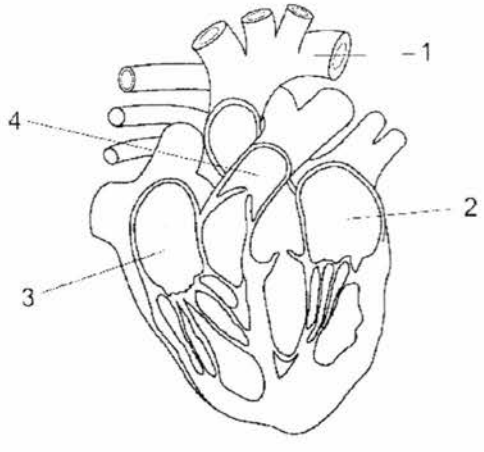


At the beginning, the potato cylinders were exactly balanced. He immersed the cylinders into the liquids for 4 hours, after which the cylinders were lifted out of the liquids. Cylinder **P** was now heavier than cylinder **Q**.

Which statement explains what happened?

A Water moved into both cylinders.
B Water moved out of both cylinders.
C Water moved into the cylinder in the distilled water and out of the cylinder in the sugar solution.
D Water moved out of the cylinder in the distilled water and into the cylinder in the sugar solution.

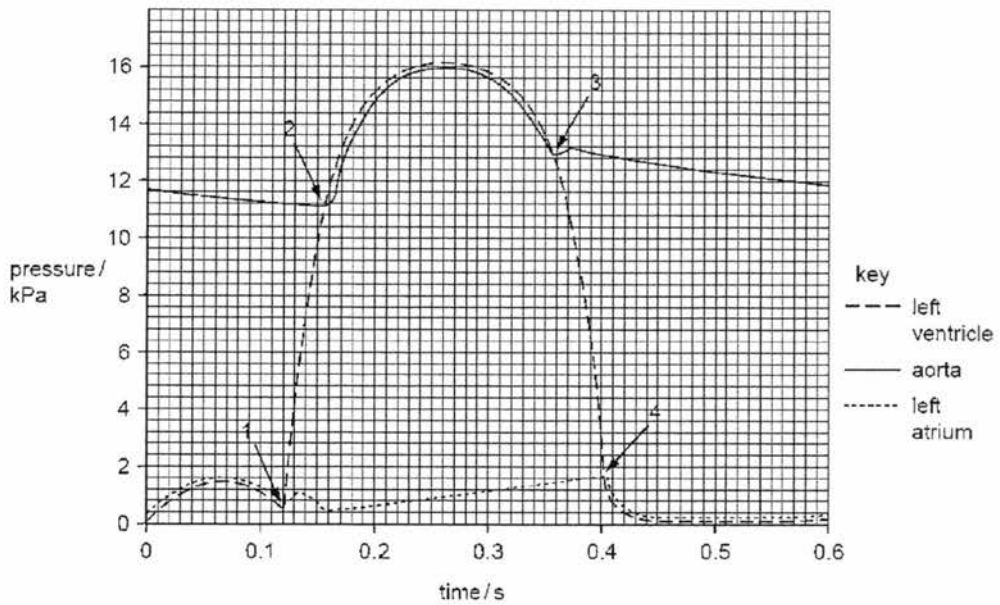
12 The diagram shows a section through the heart and the associated blood vessels.
What is correct for the flow of blood through the heart?



A 1 → 2 → 3 → 4
B 2 → 1 → 3 → 4
C 3 → 4 → 1 → 2
D 4 → 3 → 2 → 1

13 The diagram shows human blood as seen under a microscope.
A person's blood is unable to clot.
Which component of the blood is not functioning properly?

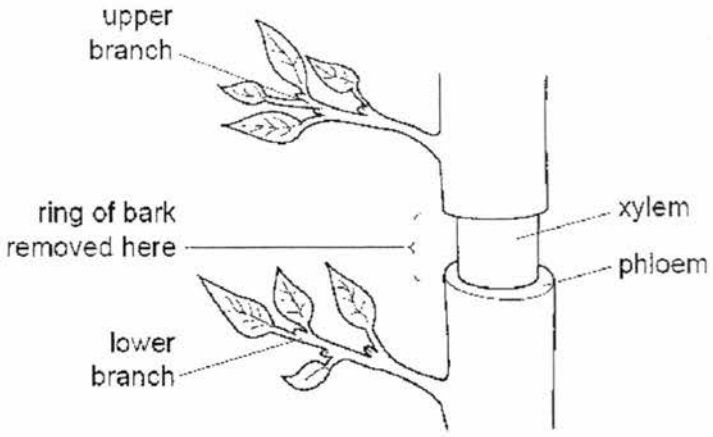
14 The diagram shows pressure changes in the left side of the heart and aorta over time. The length of this cardiac cycle is 0.6 s. Points **1, 2, 3** and **4** indicate when atrio-ventricular valves and semilunar valves either open or close.



What is the total time during one cardiac cycle that the atrio-ventricular valves and the semi-lunar valves are both closed at the same time?

A 0.03 s
B 0.04 s
C 0.07 s
D 0.21 s

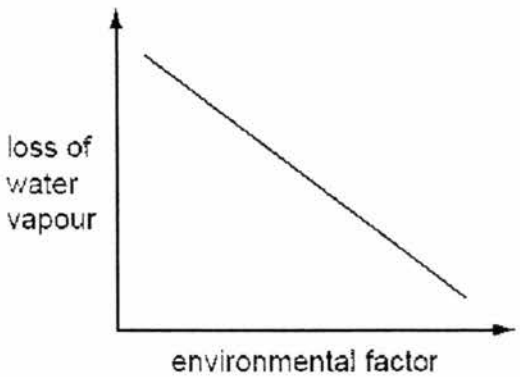
15 The diagram shows part of the trunk of a small tree with a ring of bark removed. Removing the ring of bark takes away phloem but leaves the xylem intact.



What effect will removing the bark have on the two branches?

	lower branch		upper branch	
	growth	**leaves**	**growth**	**leaves**
A	normal	normal	normal	wilted
B	normal	wilted	normal	normal
C	reduced	normal	normal	normal
D	reduced	wilted	reduced	wilted

16 The graph shows the relationship between the loss of water vapour through stomata and an environmental factor.



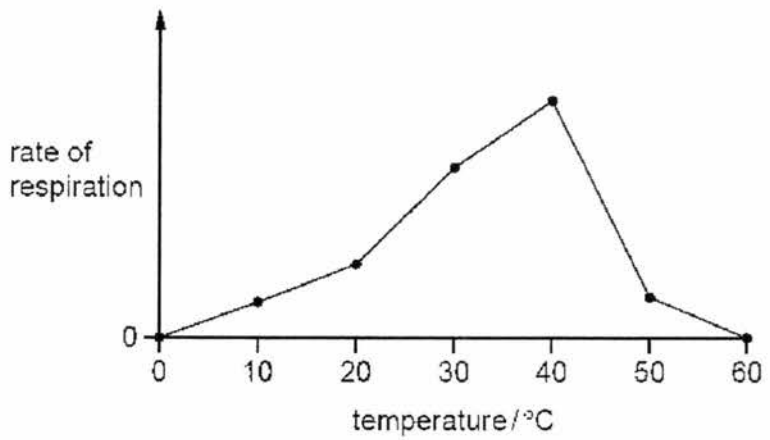
What is the environmental factor?

A air temperature
B atmospheric humidity
C light intensity
D wind velocity

17 What is responsible for the movement of water up xylem vessels in plants?

A active loading of water against the water potential gradient in the roots and osmosis in the vessels
B increasing water potential at the top of xylem vessels, and osmosis in the roots
C decreasing water potential at the top of the xylem vessels, with cohesion of water in the vessels
D translocation in the leaves, with capillarity in the xylem vessels

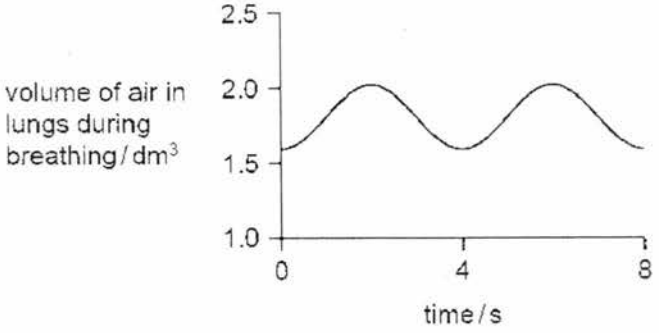
18 The graph shows the results of an experiment to investigate the rate of respiration of an organism at different temperatures.



What explains the difference between the rate of respiration at 50 °C and that at 30 °C?

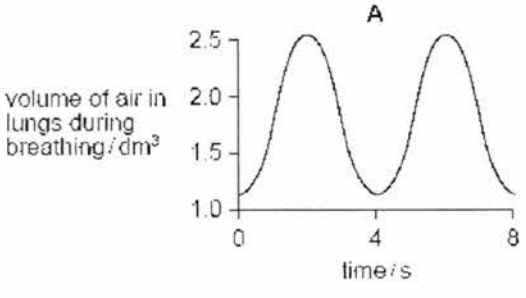
A enzymes working faster at 50 °C
B enzymes working more slowly at 50 °C
C less oxygen available at 50 °C
D more oxygen available at 50 °C

19 The graph shows the rate and depth of breathing in a person before exercise.

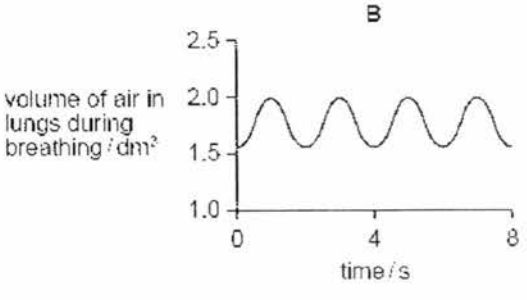


Which graph shows the rate and depth of breathing of the same person immediately after a period of exercise?

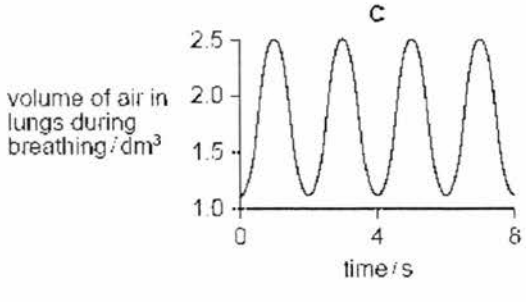
A



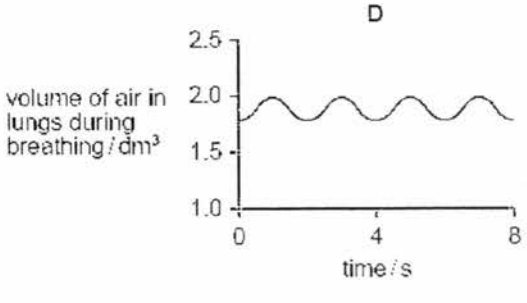
B



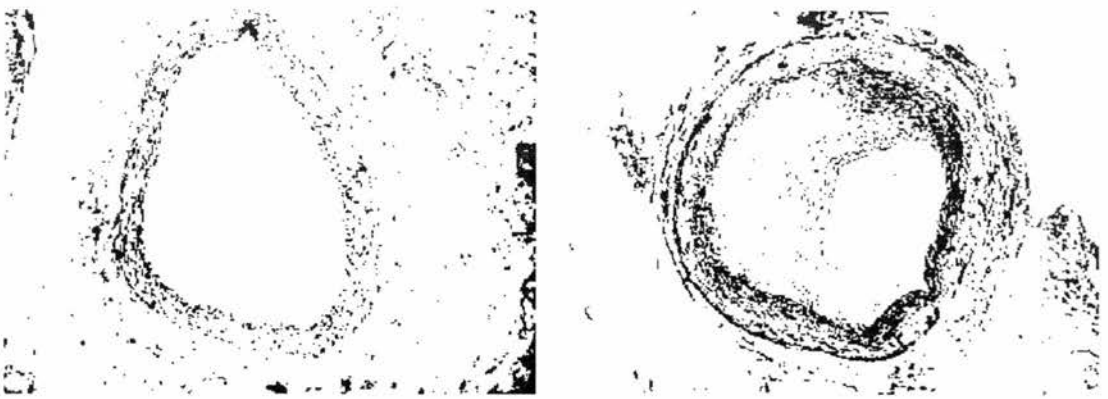
C



D



20 The photomicrographs show an artery from a non-smoker and a smoker.

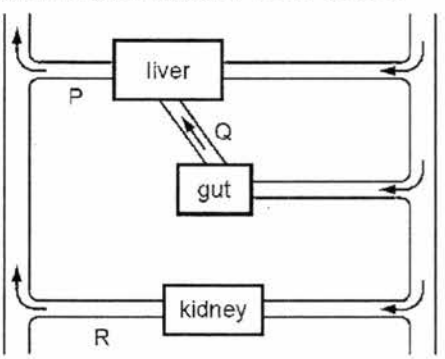


non-smoker smoker

What is the reason that the smoker's artery looks like this?

A A cancerous tumour has formed and is blocking the lumen.
B Nicotine has damaged the artery endothelium causing a plaque.
C Tar has stuck to the artery wall forming a blockage.
D The artery has become constricted due to carbon monoxide.

21 The diagram represents some human organs and their blood vessels.



Immediately after taking an alcoholic drink, how would the levels of alcohol compare in blood vessels **P**, **Q** and **R**?

	P	Q	R
A	very high	some	very high
B	some	very high	very low
C	very low	very low	some
D	very high	very low	very low

22 The table shows a student's water losses on a cool day.

water loss	/ cm^3
in urine	1500
in faeces	100
in expired air	400
in sweat	800
total	2800

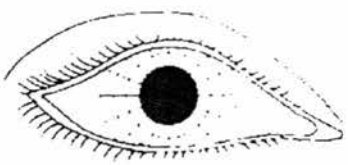
On a hot day, the student's water intake was the same as on the cool day.
On the hot day, which water losses would increase and which would decrease?

	increase	decrease
A	in sweat	in expired air
B	in sweat	in urine
C	in urine	in faeces
D	in urine	in sweat

23 Capillaries near the surface of the skin become wider after drinking large amounts of alcohol.
Why does this cause the body temperature to drop?

A It allows heat to be lost rapidly from the skin.
B It causes vasoconstriction.
C It prevents vasodilation.
D It stops the person from sweating.

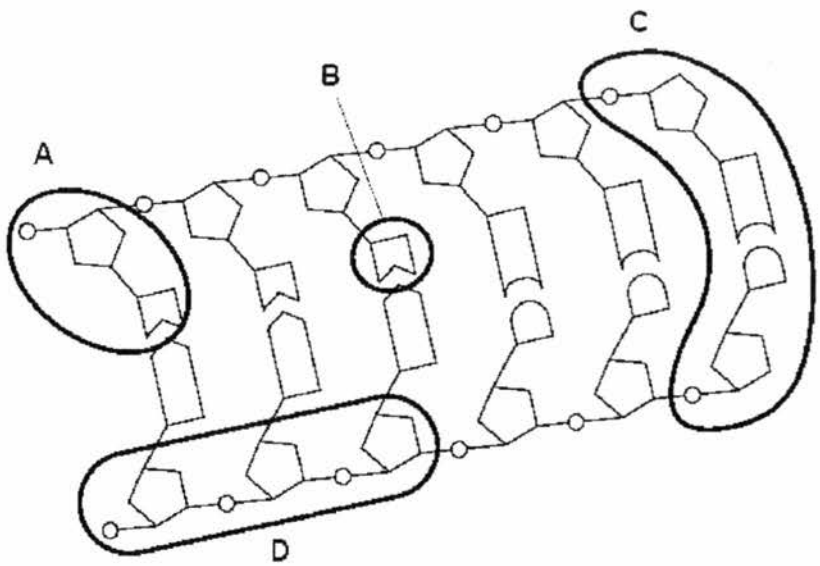
24 The diagram below shows the front view of an eye of a student in a dark room.



What changes would happen in his eye if the light is switched on?

	size of pupil	radial muscles	circular muscles
A	increases	relax	contract
B	decreases	relax	contract
C	increases	contract	relax
D	decreases	contract	relax

25 The diagram shows part of a DNA molecule.
Which part is a nucleotide?



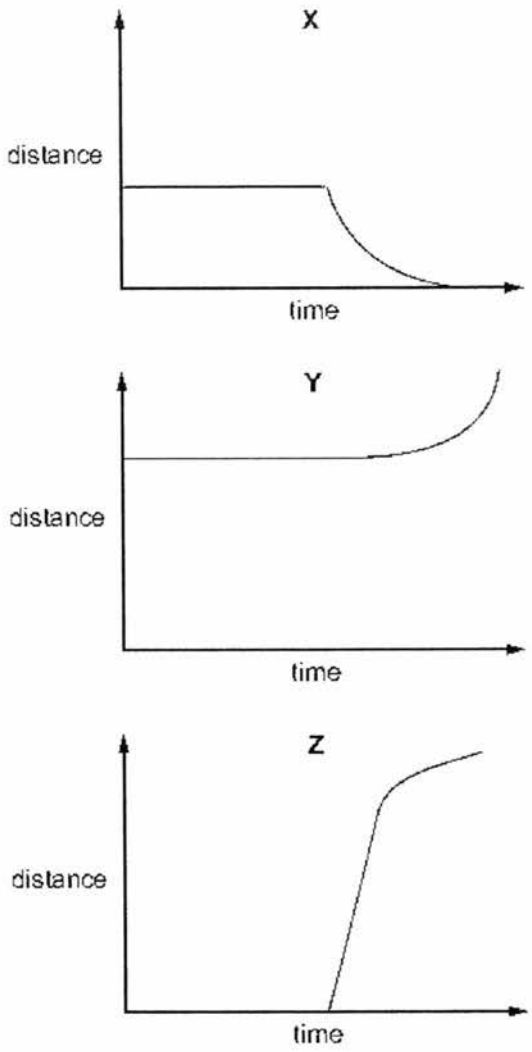
26 Which of these statements is correct for the structure of DNA?

A single-stranded with the base pairs AG and CT
B double-stranded with the base pairs AG and CT
C single-stranded with the base pairs AT and CG
D double-stranded with the base pairs AT and CG

27 Which cell activity must occur before prophase of mitosis can begin?

A breakdown of the nuclear envelope
B increased production of mRNA
C migration of centrioles to opposite poles
D replication of DNA

28 The graphs show various measurements taken from metaphase of mitosis onwards. The graphs are to scale when compared to one another.



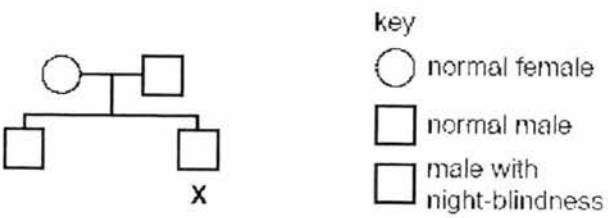
Which row correctly identifies each graph?

	X	Y	Z
A	distance between poles of spindle	distance between sister chromatids	distance of centromere from pole of spindle
B	distance between poles of spindle	distance of centromere from pole of spindle	distance between sister chromatids
C	distance of centromere from pole of spindle	distance between poles of spindle	distance between sister chromatids
D	distance of centromere from pole of spindle	distance between sister chromatids	distance between poles of spindle

29 A scientist counted 22 chromosomes in each of the root cells of a xerophytic plant.
What is the diploid and haploid number of chromosomes for this species?

	diploid number	haploid number
A	11	22
B	22	11
C	22	44
D	44	22

30 Night-blindness is an inherited condition, caused by a dominant allele.
The chart shows how this condition was passed on in one family.



Person **X** marries someone with normal sight.
What is the chance that their first child will have night-blindness?

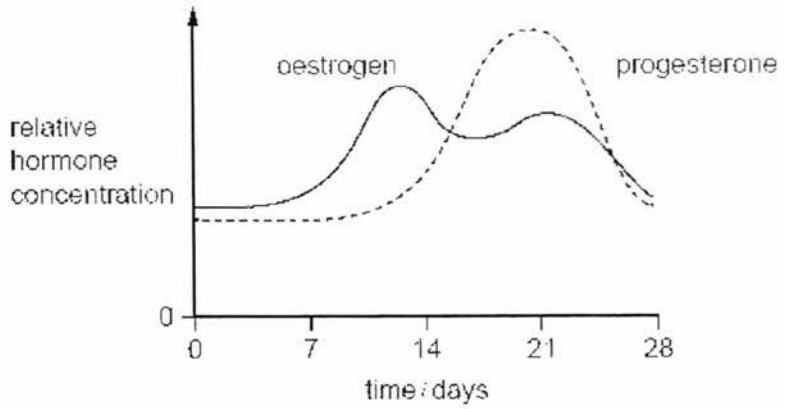
A 0 %
B 50 %
C 75 %
D 100 %

31 Some fruit flies have orange eyes and others have red eyes.
If two orange-eyed fruit flies are crossed, their offspring always have orange eyes.
If two red-eyed fruit flies are crossed, their offspring sometimes include both orange-eyed and red-eyed flies.

What can be concluded from these observations?

A Crossing an orange-eyed fly with a red-eyed fly will produce a 1 : 1 ratio in the offspring.
B The allele for orange eyes is dominant.
C The allele for red eyes is dominant.
D We could determine which allele is dominant only by doing a cross that produces a 3 : 1 ratio.

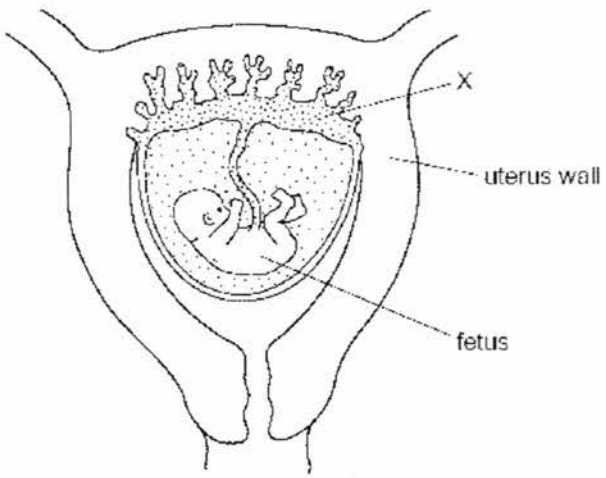
32 The diagram shows some changes which take place during a woman's 28-day menstrual cycle.



What is occurring at the time of ovulation?

A a fall in the levels of oestrogen and progesterone
B a fall in the level of progesterone only
C a rise in the level of oestrogen
D a rise in the level of progesterone and fall in the level of oestrogen

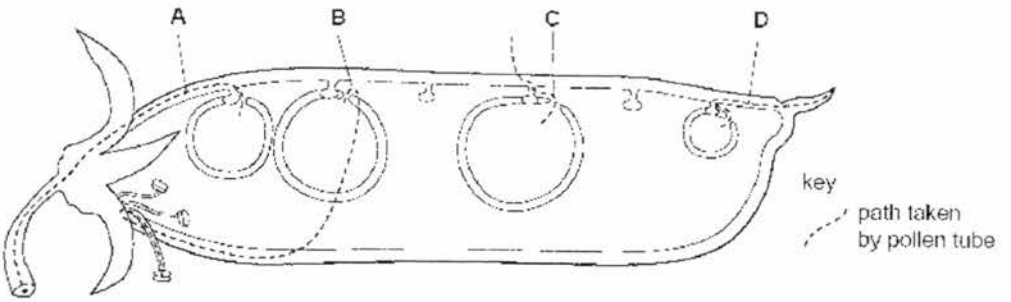
33 The diagram shows a developing human fetus within the uterus.



What is a main function of **X**?

A passing faeces to the mother
B passing oxygen to the fetus
C passing the mother's blood to the fetus
D protecting the fetus from knocks

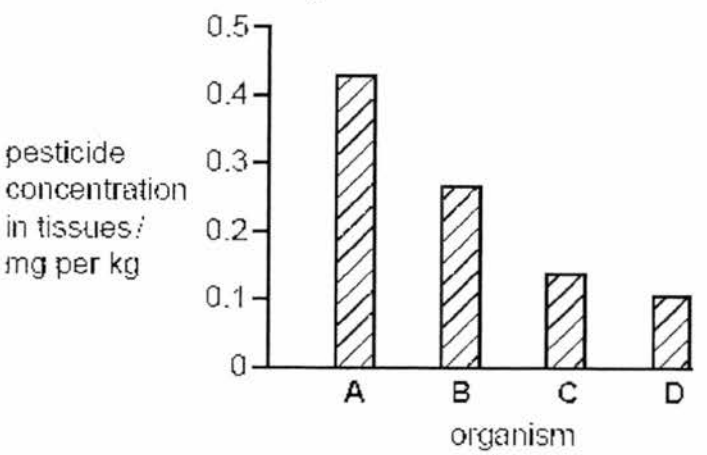
34 The diagram shows a pod from a pea plant.
Which line correctly shows the path that was taken by a pollen tube to an ovule?



35 The concentration of a pesticide in the tissues of the organisms in the following food chain was measured.

plants → small fish → large fish → bird of prey

Which organism on the bar chart is the large fish?



36 Which process does not involve an increase in dry mass?

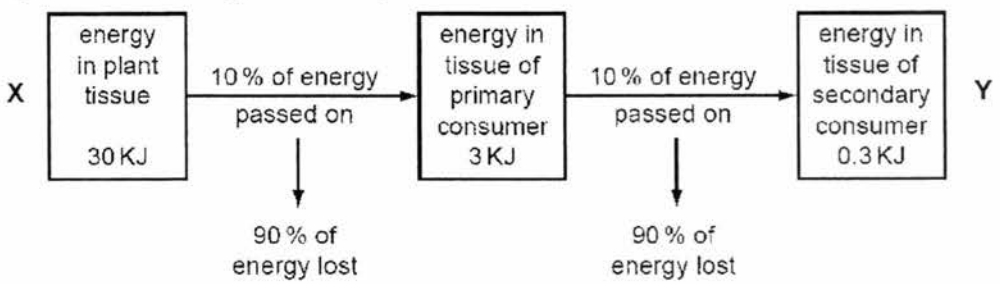
A a bacterium getting larger before it divides
B a fetus developing inside the uterus
C a green shoot growing towards light
D a seed germinating under the ground

37 Two species of animal are found in the same area of forest and grassland. In the spring and summer they eat the same plant food. However, in the autumn and winter one eats nuts in the forest and the other eats roots on the grassland.
Both species are preyed upon by the same predator. Numbers of root-eating animals are reduced most by this, but they recover faster since they reproduce faster.
What can be concluded about these two species of animals?

1 They are part of the same community.
2 They are at different trophic levels.
3 They occupy different habitats.
4 They have different niches.

A **1**, **2** and **4**
B **2**, **3** and **4**
C **1** and **2** only
D **1** and **4** only

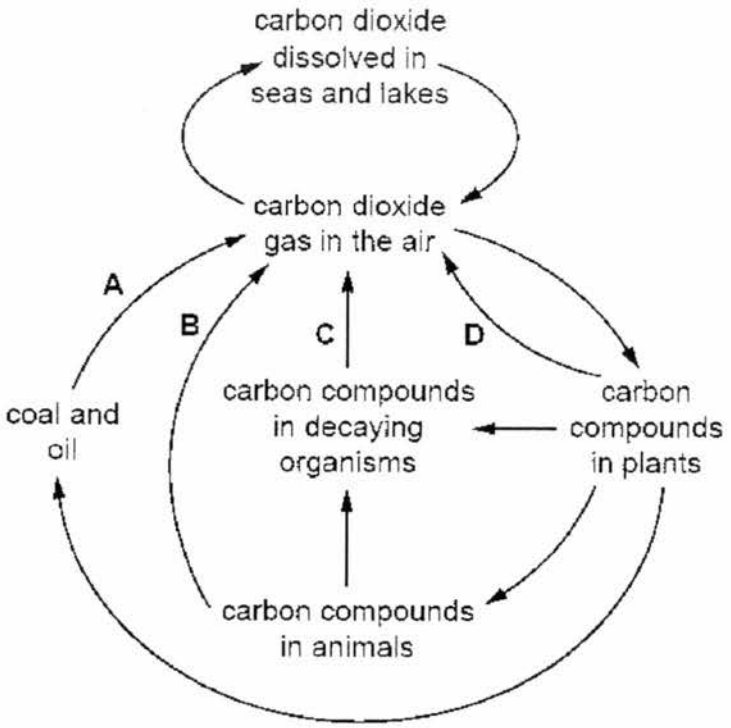
38 The diagram shows energy flow through a food chain.



By which processes is energy lost between **X** and **Y**?

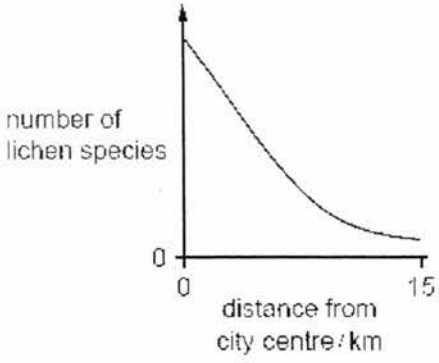
A digestion and excretion
B digestion and photosynthesis
C excretion and respiration
D photosynthesis and respiration

39 The diagram shows the carbon cycle.
Which process produces carbon dioxide from substances made by photosynthesis millions of years ago?

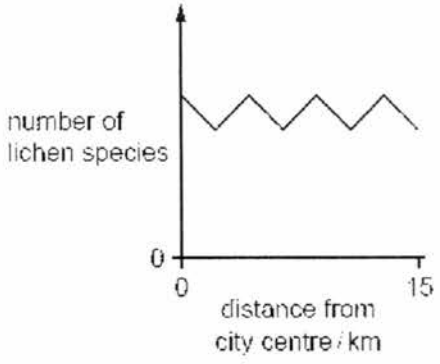


40 Lichens are organisms that do not grow well in air containing sulfur dioxide.
Which graph shows the change in number of lichen species from the centre of an industrial city to the countryside 15 km away?

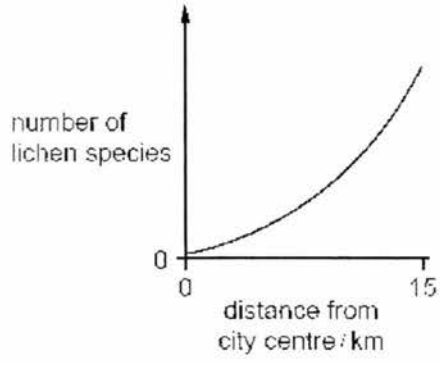
A



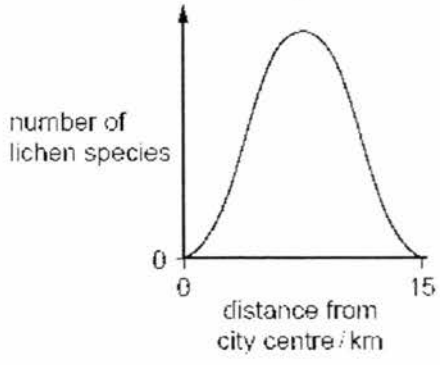
B



C



D



Class	Index Number	Name

PEI HWA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2017

Secondary Four Express

BIOLOGY **5158/02**

Paper 2 Theory 16 August 2017

1 hour and 45 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

Write your name, class and index number CLEARLY in the spaces provided above.

Write in dark blue or black pen on both sides of the paper.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paperclips, highlighters, glue or correction fluid.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer **all** the questions.

Write your answers in the spaces provided on the Question Paper.

The use of an approved scientific calculator is expected, where appropriate.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

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

Section	Mark
P1	/40
P2 Section A	/50
P2 Section B	/30
Total	/120

This question paper consists of **18** printed pages, inclusive of this cover page.

SECTION A: Structured questions (50 marks)
Answer all questions

1 Collagen is found in the extracellular matrix of muscles, tendons, ligaments and bones. A fibroblast cell synthesizes the extracellular matrix and collagen, the structural framework for animal tissues, and plays a critical role in wound healing. Fibroblast cells in these tissues make collagen by synthesising polypeptides that form molecules with a triple helix shape. These are secreted from fibroblasts into the extracellular matrix where enzymes assemble them into collagen fibres.
Fig. 1.1 is a diagram summarising these events.

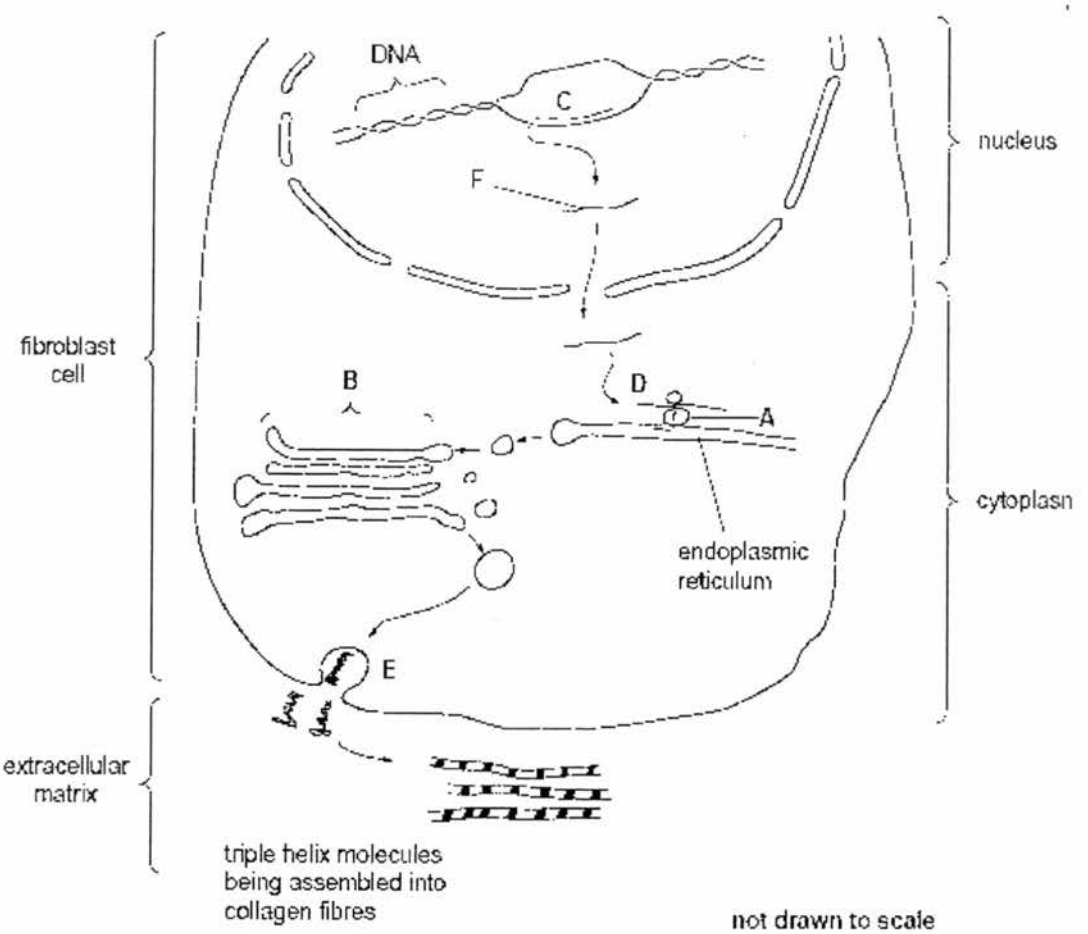


Fig 1.1

(a) (i) Name structures **A** and **B**.

A : .....

B : ..... [2]

(ii) Describe the function of structure **B**.

.....

..... [1]

(iii) Name the processes occurring at **C** and **D**.

C : .....

D : ..... [2]

(iv) Name molecule **F**.

..... [1]

(v) State one difference between the molecule **F** and a DNA molecule.

..... [1]

(b) Collagen is continuously broken down in the extracellular matrix by the enzyme collagenase, which catalyses the hydrolysis of the peptide bond between two amino acids, glycine and isoleucine.

Suggest how collagenase is only able to act on the peptide bond between glycine and isoleucine and not on peptide bonds between any other amino acids.

.....

.....

.....

..... [2]

[Total: 9 marks]

2 The liver is involved in processing chemicals in the body. Fig. 2.1 shows the liver receiving chemicals from and sending chemicals to some other organs involved in the excretion of the chemical(s).

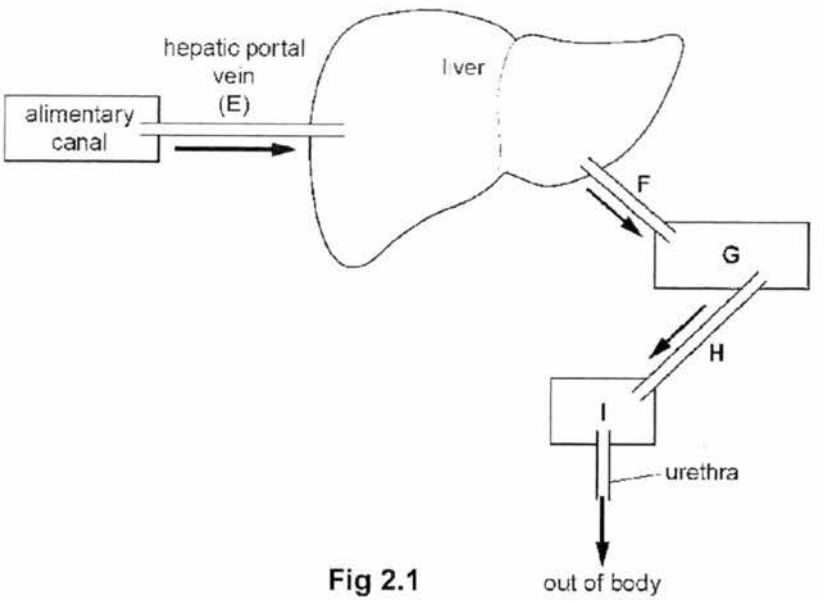


Fig 2.1

(a) Identify organs **G** and **I**.

G : .....

I : ..... [2]

(b) Name the carbohydrate travelling in the hepatic portal vein **(E)**, and explain how, on arrival in the liver, it is converted into a storage compound.

Named carbohydrate: .....

Explanation: .....

..... [2]

(c) Describe how the composition of the contents of **F** and **H** differ in a healthy person.

.....

.....

.....

..... [2]

[Total: 6 marks]

3 Fig. 3.1 shows the percentage of blood that flows to some body organs at rest and during heavy exercise.

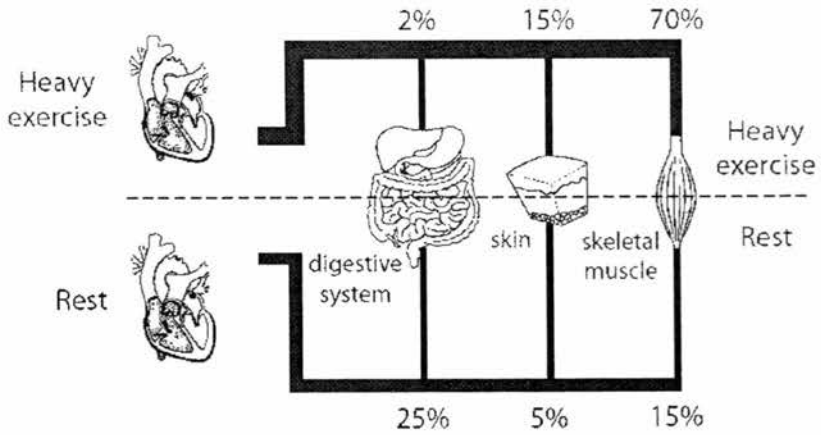
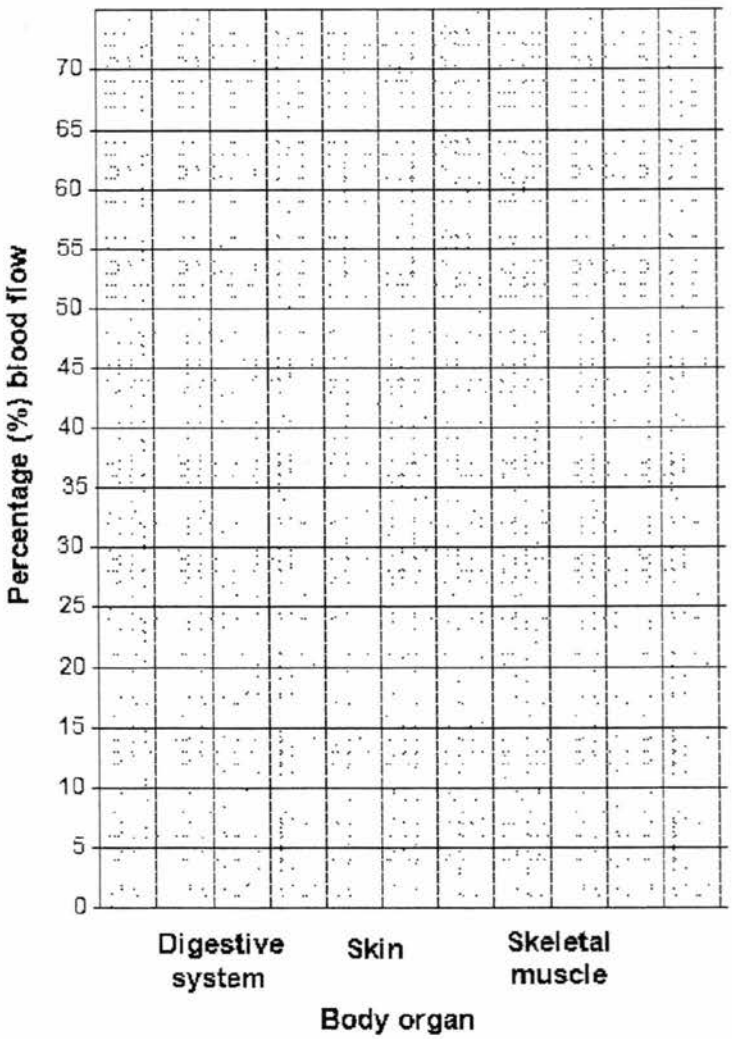


Fig 3.1

(a) Plot a bar chart comparing the two sets of data for each body organ in the diagram.



[2]

(b) Explain the difference in the percentage blood flow to skeletal muscles at rest and during heavy exercise.

.....

.....

.....

..... [2]

(c) Explain the difference in the percentage blood flow to the skin at rest and during heavy exercise.

.....

.....

..... [2]

[Total: 6 marks]

4 Fig. 4.1 shows a garden pea plant with one flower enlarged and cut in half.

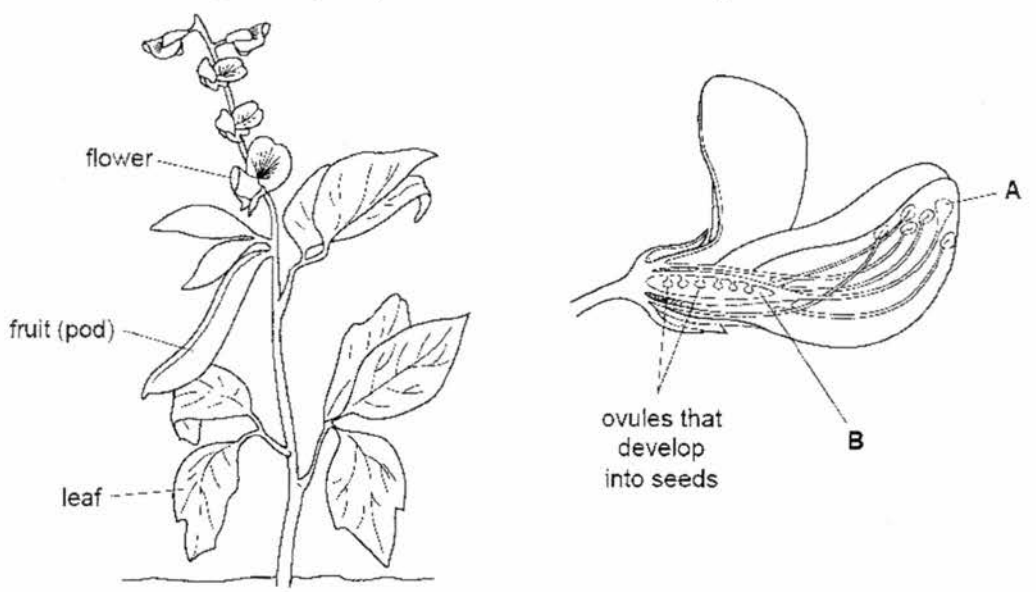


Fig 4.1

(a) (i) Name the parts of the flower labelled **A** and **B**.

A : .....

B : ..... [2]

(ii) Describe how the plant is pollinated.

.....

..... [1]

(b) Describe the processes that take place after pollination, leading to fertilisation.

.....

.....

.....

.....

.....

..... [3]

(c) As the seeds form, they use sugars made in the leaves.

(i) Where, in leaves, are most of these sugars made?

..... [1]

(ii) State two factors that affect the rate of sugar production in leaves.

.....

..... [2]

(iii) Explain how the sugar is carried to the developing seeds from the leaves.

.....

.....

.....

..... [2]

(c) Explain how artificial selection can be used to improve the quality of the yield of garden pea.

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..... [3]

[Total: 14 marks]

5 Fig. 5.1 shows changes in the population of bacteria that take place in a river when untreated sewage is added to it.

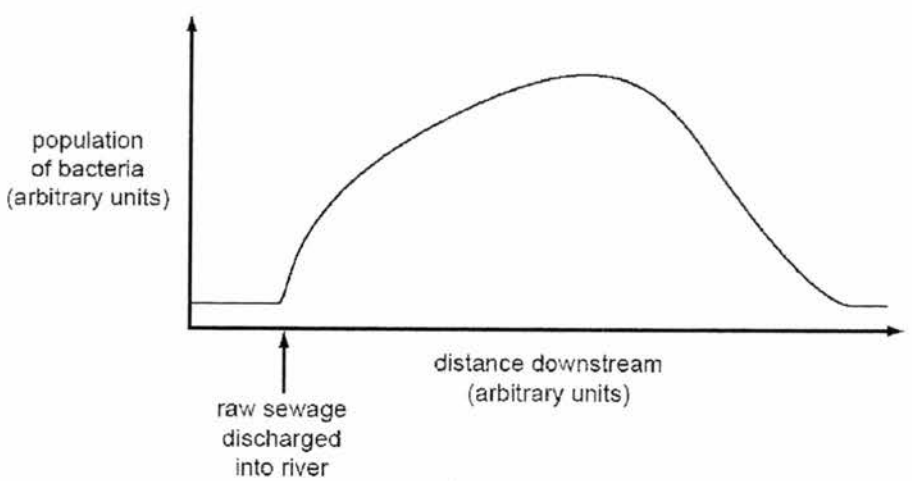

Fig. 5.1

(a) Describe the changes in the population of bacteria that take place in this river.

.....

.....

.....

..... [2]

(b) Suggest an explanation for these changes in the population of bacteria.

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..... [4]

[Total: 6 marks]

6 Fig. 6.1 shows part of a food web for the South Atlantic Ocean.

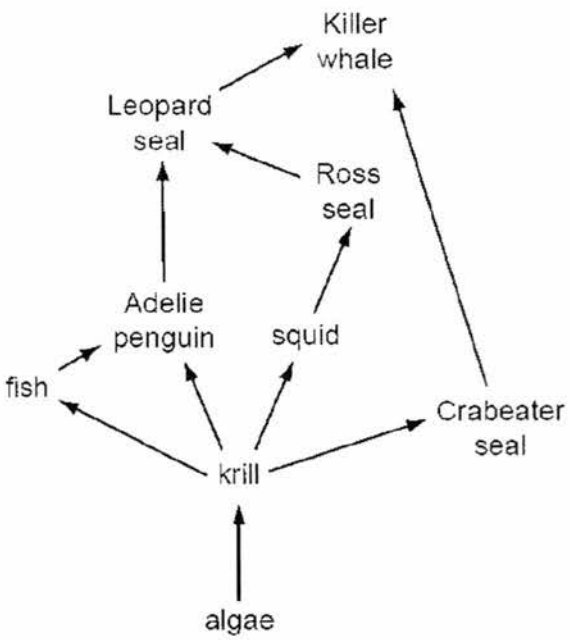

Fig. 6.1

(a) **(i)** Name the top carnivore in this food web.

..... [1]

(ii) Name a member of this food web that is both a secondary and a tertiary consumer.

..... [1]

(b) Use the information from the food web to derive a food chain with five links.

..... [1]

(c) In the future, the extraction of mineral resources in the Antarctic might occur on a large scale. This could destroy the breeding grounds of the Ross seal.

(i) State and explain what effects this might have on the population of Leopard seal

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.....

.....

..... [2]

(ii) State and explain what effects this might have on the population of fish.

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..... [4]

[Total: 9 marks]

SECTION B: Free Response Questions (30 marks)
Answer **three** questions.
Question **9** is in the form of **an Either / Or question**. Only one part should be answered.

7 Darren carried out an investigation into the digestion of fat using lipase.
10 cm^3 of olive oil, adjusted to pH 8.0, was added to a test-tube, which was then put in a water bath at 37 °C for ten minutes.
1 cm^3 of lipase solution was incubated at the same temperature in a separate test- tube before being added to the olive oil.
The initial pH of the reaction mixture was measured using a pH meter. The pH was recorded at ten minute intervals for 60 minutes.
Table 7.1 shows the results of the investigation

Table 7.1

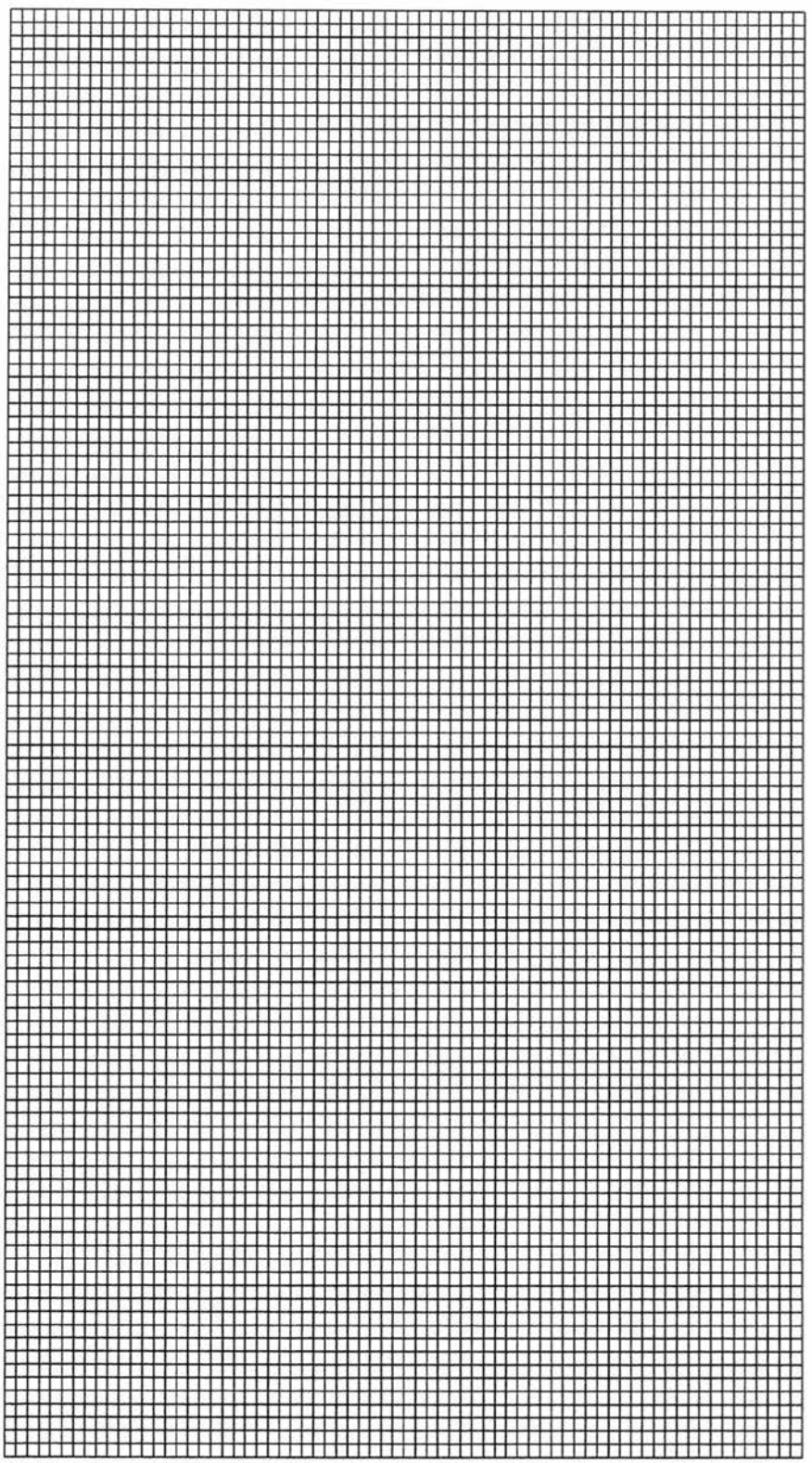
Time/min	pH
0	8.0
10	7.1
20	6.8
30	6.6
40	6.5
50	6.4
60	6.4

(a) Suggest why the olive oil was adjusted to pH 8.0 before the lipase was added.

.....

..... [1]

(b) Plot a graph of the data in Table 7.1, on the graph paper.



[4]

(c) (i) With reference to Table 7.1 and to the graph drawn in **(b)**, describe the results of the investigation.

.....

.....

.....

..... [2]

(ii) Explain the results of the investigation.

.....

.....

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.....

.....

..... [3]

[Total: 10 marks]

8 Fig. 8.1 shows the reflex arc involved in a simple reflex action.

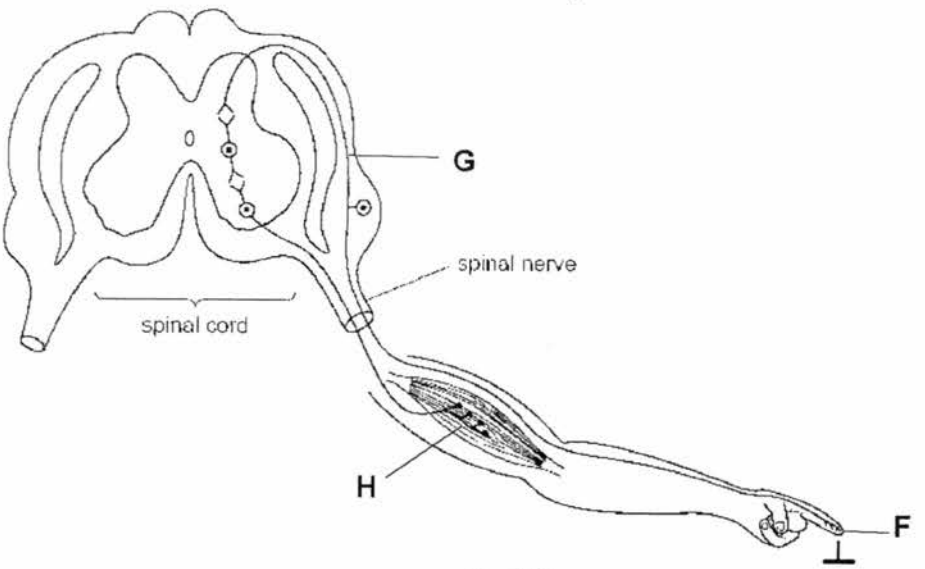

Fig 8.1

(a) A reflex is an involuntary action. Explain what is meant by the term involuntary action.

.....

..... [1]

(b) With reference to Fig. 8.1, describe how nerve impulses are transmitted in the reflex arc shown. State clearly the roles of the labelled parts **F**, **G** and **H**.

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.....

..... [3]

(c) Suggest the advantages of having reflexes. You may refer to an example to illustrate your answer.

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.....

.....

..... [3]

(d) In dangerous situations there is an increase in the secretion of adrenaline from the adrenal glands.
Describe three ways in which this increase in adrenaline prepares the body for action.

.....

.....

.....

.....

.....

..... [3]
[Total: 10 marks]

9 **Either**

Haemoglobin is a large protein molecule. The structure of each haemoglobin molecule is controlled by a gene that has two alleles:

- Hb^A codes for the normal form of haemoglobin,
- Hb^S codes for an abnormal form of haemoglobin.

Red blood cells containing only the abnormal form of haemoglobin become a stiff, sickle shape in conditions of low oxygen concentration. This gives rise to sickle cell anaemia.

(a) Describe the harmful effects on the body of having red blood cells which become sickle-shaped

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..... [5]

People who are heterozygous for the gene for haemoglobin produce both the normal and abnormal forms of haemoglobin. These people show no symptoms or have very mild symptoms known as sickle cell trait.

(b) **(i)** Draw a genetic diagram to show how a couple who are both heterozygous may have a child with sickle cell anaemia.

[3]

(ii) What is the chance of a child born to this couple having sickle cell anaemia?

..... [1]

In some parts of the world, up to 25% of the population have sickle cell trait.

(c) Explain why there is an advantage of having the sickle cell trait.

.....

..... [1]

[Total: 10 marks]

9 Or

(a) State the chemical substances released by a plant to the environment.

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..... [3]

(b) For each of the substances, state its origin and how it is removed from the plant.

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..... [7]

[Total: 10 marks]

PEI HWA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2017

Secondary Four Express

BIOLOGY(SPA) 5158/01

PAPER 1: ANSWER KEY

1. B	2. D	3. B	4. D	5. D
6. D	7. B	8. B	9. C	10. A
11. C	12. B	13. C	14. C	15. C
16. B	17. C	18. B	19. C	20. B
21. B	22. B	23. A	24. B	25. A
26. D	27. D	28. C	29. B	30. B
31. C	32. D	33. B	34. D	35. B
36. D	37. D	38. C	39. A	40. C

PEI HWA SECONDARY SCHOOL
PRELIMINARY YEAR EXAMINATION 2017
Secondary 4 Express
BIOLOGY(SPA) 5158

PAPER 1: ANSWER KEY

1. B	2. D	3. B	4. D	5. D
6. D	7. B	8. B	9. C	10. A
11. C	12. B	13. C	14. C	15. C
16. B	17. C	18. B	19. C	20. B
21. B	22. B	23. A	24. B	25. A
26. D	27. D	28. C	29. B	30. B
31. C	32. D	33. B	34. D	35. B
36. D	37. D	38. C	39. A	40. C

PAPER 2: ANSWER KEY

Section A

1ai	A:(sub unit of) ribosome B: Golgi apparatus/body;	2
1aii	The Golgi body sort and process proteins synthesized in the rough endoplasmic reticulum to be sent throughout the cell or transported outside the cell.	1
1aiii	C: transcription; (ignore mRNA synthesis) D: translation [max 2]	2
1aiv	F mRNA	1
1av	Sugar unit in DNA is deoxyribose. Sugar unit in RNA is ribose. Nitrogen-containing bases in DNA are adenine (A), thymine (T), guanine (G) and cytosine (C). Nitrogen-containing bases in RNA are adenine (A), uracil (U), guanine (G) and cytosine (C). DNA has a fixed ratio of A:T and G:C is 1:1. RNA has no fixed ratio between A and U and between G and C. DNA is a large insoluble molecule. RNA is a small soluble molecule. (any one: max 1)	1
1b	active site; (is) specific shape; A complementary/other amino acids are the wrong shape to fit, R same shape only accepts R groups of these two amino acids; R accepts peptide bond	2
	Total	9
2a	G kidney ; I bladder (R gall bladder) ;	2
2b	glucose ; insulin from pancreas into blood stimulate liver to convert glucose to glycogen ;	6
2c	Any two from: more urea in H, more toxins in H, glucose only in F, amino acids only in F, qualified salt concentration in either ; H + urine ; Ref. O2/CO2 differences ;	2
	Total	6
3a	**B:** two sets of bars clearly displayed to compare two sets of data with correct size of bars: 2,25/15,5/70,15 OR 25,2/5,15/15,70; **K:** key to show at rest/heavy exercise/bars labelled; Must refer to correct bars;	2
3b	An explanation including two of the following: • more blood flow to muscles during exercise to remove carbon dioxide; • more blood flow to muscles during exercise to supply oxygen and glucose; • more oxygen needed by muscles to release energy from (aerobic) respiration; Accept reverse argument for all marking points with manipulation of data	2

3c	A explanation including two from: • in heavy exercise more heat generated (by muscles/aerobic respiration); • vasodilation of arterioles resulting in greater blood flow nearer skin's surface; • heat lost from blood/radiated from skin's surface; body temperature decreases/cooling effect;	2
	Total	6
4ai	A stigma; B ovary	2
4aii	insect carries pollen to stigma A self-pollination [1]	1
4b	Pollen grain germinate and pollen tube is formed; growing down the style towards ovule; enter micropyle; gametes released and fusion; of male and female gametes; gametes/male and female nuclei; fuse/join;	3
4ci	palisade layer;	1
4cii	temperature/light intensity/CO2 concentration any 2 R: water concentration	2
4ciii	Sugar converted to sucrose (dissolved) in water/in solution; actively transported to phloem / carried in phloem carried as sucrose/sugar translocation; high to low conc./from source to sink (developing seed); max 2	2
4d	high quality parents selected and crossed; named quality; yield; disease/pest resistance; climate tolerance; offspring plants having qualities of both parents selected; cross repeat over generations [max. 3]	3
	Total	15
5a	(following sewage release) bacteria population rises; downstream/later on it falls; (a) is a description	2
5b	(large number of) bacteria present in sewage; bacteria feed on materials in the sewage; bacteria reproduce/population increases/numbers go up; bacteria grow (downstream) sewage/organic remains all broken down/food runs out; therefore bacteria die/decrease in numbers; (b) is an explanation and not transfer points from the latter to the former	4
	Total	6
6ai	(killer) whale;	1
6aii	(Adelie) penguin;	1
6b	algae → krill → (Adelie) penguin → Leopard seal → killer whale; algae → krill → fish → (Adelie) penguin → Leopard seal; algae → krill → squid → Ross seal → Leopard seal; any 1 max 1	1
6ci	because less Ross seals/food for Leopard seal; population decrease; A – explanation based on Leopard seals eating more/only penguins and thus population only falling a little or not at all population falls;	2
6cii	A less Ross seal eating squid; squid population rises; squid eat more krill; causes fall in krill population; less food for fish; fish population falls; OR B less Ross seals as food for Leopard seals; Leopard seal population falls; less Adelie penguins eaten; Adelie penguin population rises; more fish eaten by Adelie penguins; fish population falls; OR C less Ross seals as food for Leopard seals; Leopard seals eat more Adelie penguins;	4

	so Leopard seal population stays the same; Adelie penguin population falls; so less fish eaten by Adelie penguins; fish population rises; OR D less Ross seals as food for Leopard seals; Leopard seals eat more Adelie penguins; Adelie penguin population falls; so less krill eaten by Adelie penguins; so more food for fish; fish population rises; any four – 1 mark each prediction of rise or fall of fish population – 1 mark...can gain this without any further explanation no prediction of rise or fall of fish population – MAX 2 for logical sequence in explanation rest of explanation must be supporting evidence for their prediction to gain further marks if there is a mix of 2 different explanations give mark consistent with the best single explanation	
	Total	9

SECTION B

7a	optimum pH or pH at which lipase/enzyme works best;	1
7b	axes correctly orientated and labelled (x-axis time/min and y–axis pH); suitable scale to fill more than ½ of printed grid; points plotted correctly; best fit curve;	4
7c	pH decreases over time ; decrease faster/steep in first 5 mins; slower/less steep in next 50 min and levels out; correct comparative data quote (ref. to both axes) e.g. pH 8 – 7.1 from 0 – 10 min, pH 7.1 – 6.4 from 10 – 50 min;	2
7d	oil digested to produce fatty acids, lowers pH; increasing amount of fatty acids formed, decreases pH; *explanation for steep decrease:* initially high concentration of substrate, more collisions between enzyme + substrate/more enzyme-substrate complexes formed; *explanation for less steep/levelling/plateau:* substrate being used up/limiting, fewer enzyme substrate collisions/fewer enzyme-substrate complexes formed;	3
	Total	10
8a	A response to a stimulus that occurs without conscious control detect / sense / feel, changes / stimuli ; make response(s) / react / AW ; ignore specific example of response	1
8b	The sensory receptor **F** in the skin detects the pin prick and coverts it to nerve impulse; Nerve impulse is transmitted via **G** the sensory neurone to the relay neurone in the spinal cord Nerve impulses is transmitted across the synapse to the motor neurone to the effector **H** the biceps ;	3
8c	automatic ; no thought required / not a conscious action ; stimulus always leads to the same response ; ignore refs to speed of response A no (higher centres in) brain involved A fixed rapid response ; protective / AW e.g. prevent mechanical damage / injury ; already present immediately after birth ; max 3 i.e. before learning can take place max 3	3
8d	• increased rate and depth of breathing; trachea / bronchi / bronchioles / airways, dilate / widen to supply more oxygen and remove carbon dioxide • vasoconstriction / AW, less blood flow in gut / skin vasodilation / AW, more blood flow in muscles ;	3

	• heart beats faster and increase blood pressure so that oxygen and glucose are carried faster to the muscles • stimulates breakdown of glycogen to glucose in the liver to increase blood glucose • concentration ; • increase metabolic rate; more energy is release in tissue respiration; • dilate pupils to enhance vision ; heightened sensitivity / increased mental awareness / A sharper senses / more alert / AW; max 3 A increase pulse (rate) A more oxygen to muscles R 'adrenaline breaks down glycogen'	
	Total	10
9Ea	fewer normal red blood cells ; less elastic / less flexible, red blood cells ; less haemoglobin / blood, less efficient at transporting oxygen ; less respiration ; less energy / fatigue / exhaustion / less active / feeling faint / breathlessness ; capillaries are blocked ; increased chance of thrombosis ; pain ; death of tissues linked to oxygen supply ; slow / poor, growth ; reduced life span ; AVP ; e.g. susceptible to infections / kidney damage max 5 R no oxygen R no respiration	5
9Ebi	Parental genotype Hb^AHb^S × Hb^AHb^S Gametes Hb^A Hb^S Hb^A Hb^S Offspring genotype Hb^AHb^A Hb^AHb^S Hb^AHb^S Hb^SHb^S. Offspring phenotype: 1 normal: 2 sickle cell trait : 1 sickle cell anaemia ; allow ecf following a mistake in the genetic diagram after the parental genotypes, but 'mistake' must be worked correctly do not allow genotypes for parents or children that are single alleles phenotypes must match genotypes, i.e. must be in the same sequence R 1:4 or 4:1	3
9Ebii	1 in 4 / 25% / 0.25	1
9Ec	idea that both alleles / Hb^A and Hb^S, are expressed ; both alleles make two different forms of haemoglobin in heterozygous people ; resistance to / less chance of getting malaria ; R immunity to malaria / stops you from getting malaria	1
	Total	10
9Oa	water carbon dioxide; oxygen; chlorophyll degradation products/CHOs/proteins/toxins; [max 3]	3
9Ob	water + soil/environment; water + respiration; to leaves/stomata*; evaporates; during transpiration; CO2 + from respiration; in cells; oxygen + from photosynthesis; in named photosynthetic cell or tissue/chloroplast; diffusion (once, anywhere); through stomata*; other substances + ref. manufacture within plant cells; ref leaf fall/food for herbivores; [max 7] (* Once only)	7
	Total	10