

Class:	Index No.:	Name:	Date:
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PRELIMINARY EXAMINATIONS 2 (2016)
Secondary Four Express

PURE BIOLOGY **5158/01**
 Paper 1 19 September 2016
1 hour

Additional Materials: Optical Answer Sheet (OAS)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil
 Do not use staples, paper clips, glue or correction fluid.
 Write your name, class, and index number on the Answer Sheet in the spaces provided.

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

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
 Any rough working should be done in this booklet.
 The use of an approved scientific calculator is expected, where appropriate.

At the end of the examination, hand in your answers separately.

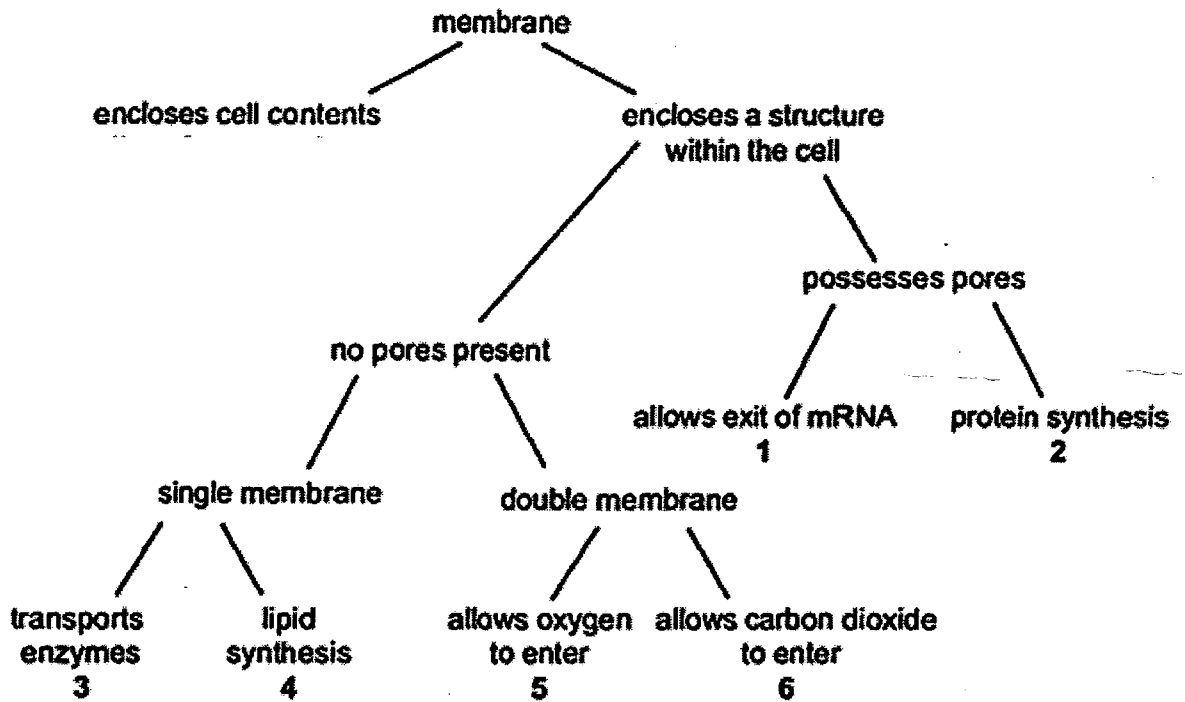
FOR EXAMINER'S USE	
Paper 1	/40

This question paper consists of 21 printed pages, including the cover page.

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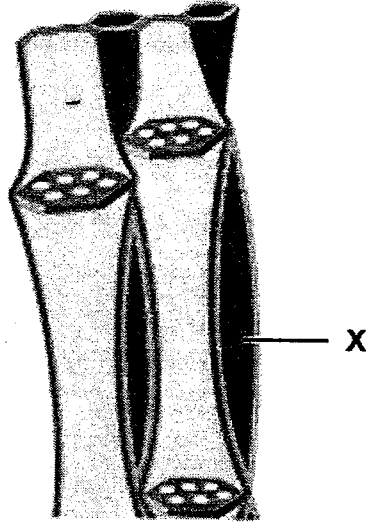
1. The following diagram allows the identification of the various organelles within the cell by describing the membrane structure and function.



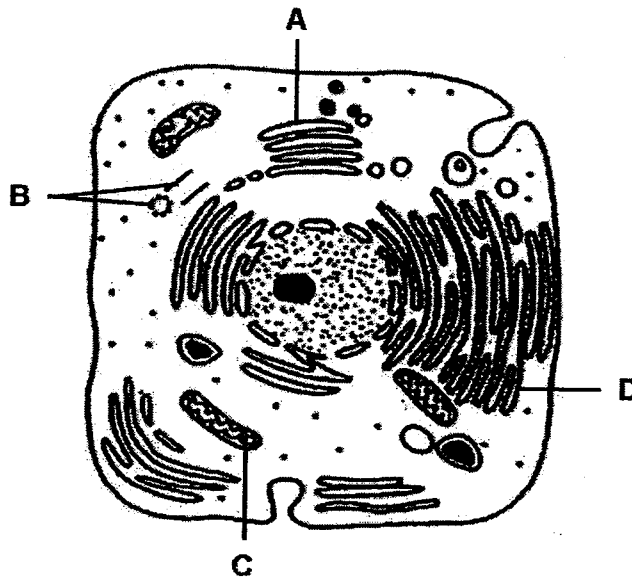
Which row correctly identifies the organelles?

	1	2	3	4	5	6
A	chloroplast	vesicle	smooth ER	ribosomes	nucleolus	mitochondrion
B	nucleus	ribosomes	vesicle	smooth ER	nucleolus	mitochondrion
C	nucleus	ribosomes	vesicle	smooth ER	mitochondrion	chloroplast
D	nucleus	smooth ER	mitochondrion	ribosomes	vesicle	chloroplast

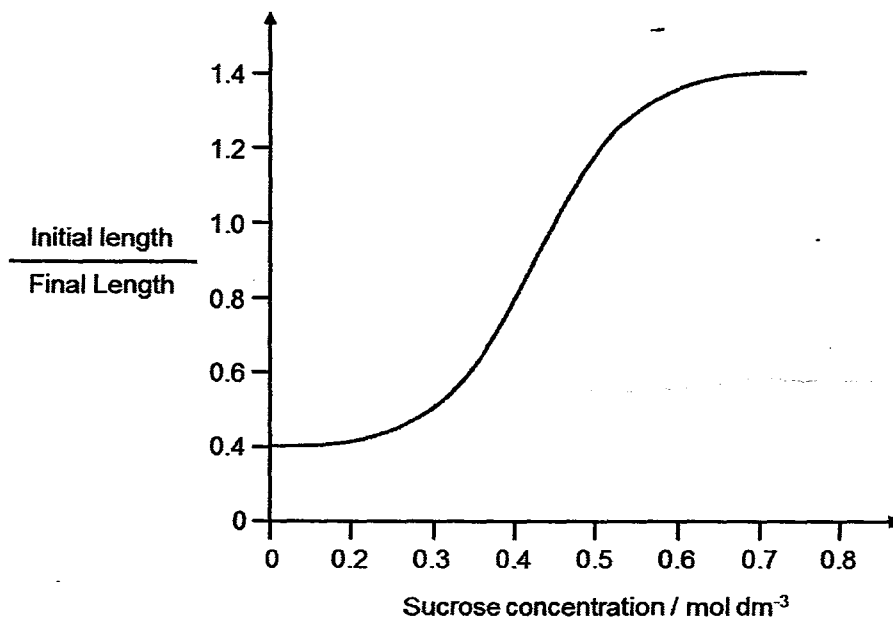
2. The following diagram shows a transport structure found in plants. Cell X is part of the structure.



The diagram below shows a typical cell. Which organelle, A, B, C or D, will be found in abundance in cell X?

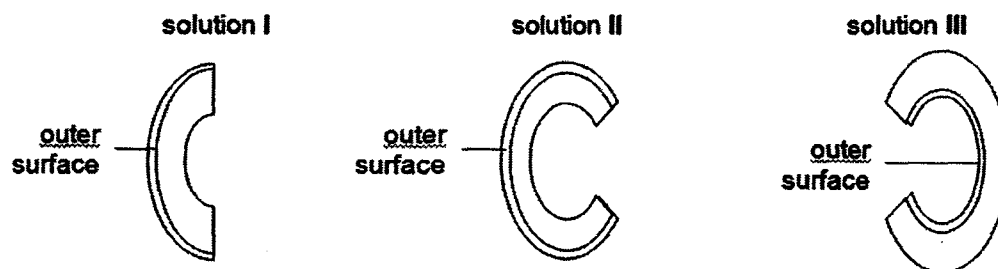


3. Strips of plant tissue were immersed in different concentrations of sucrose solution. Before immersion, lengths of the strips were measured. After 30 minutes, lengths of the strips were measured again. The graph below shows the ratio of initial length to final length.



Which concentration of sucrose solution has the same water potential as the cell sap?

- A 0.01 mol dm⁻³
 B 0.25 mol dm⁻³
 C 0.45 mol dm⁻³
 D 0.60 mol dm⁻³
4. A scape (leafless flower stalk) was cut into quarters and placed in three solutions I, II and III of different concentrations. The diagram below shows how the scape looked like after one hour.



Which of the following correctly identifies the type of solutions I, II and III?

	<i>Solution I</i>	<i>Solution II</i>	<i>Solution III</i>
A	0.1 mol/dm ³ sucrose solution	deionised water	3.0 mol/dm ³ sucrose solution
B	20% sucrose solution	5% sucrose solution	deionised water
C	pure water	1.0 mol/dm ³	0.5 mol/dm ³ salt solution
D	1% salt solution	10% salt solution	pure water

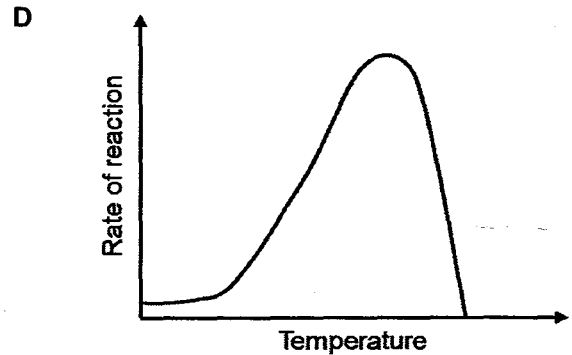
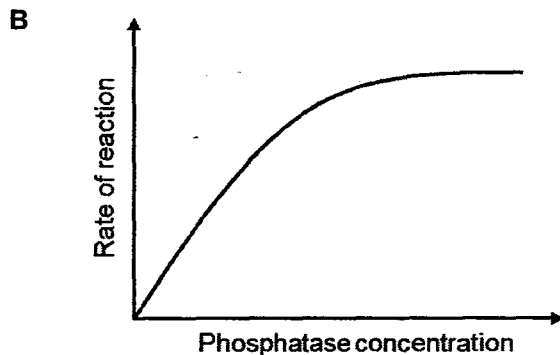
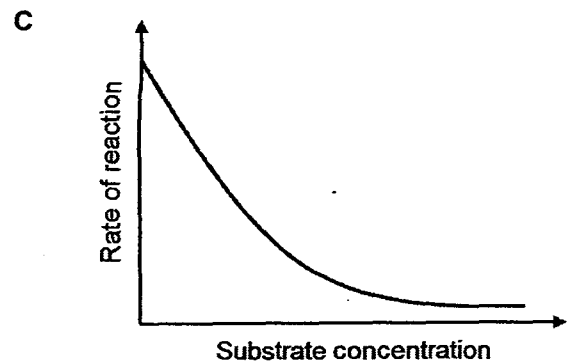
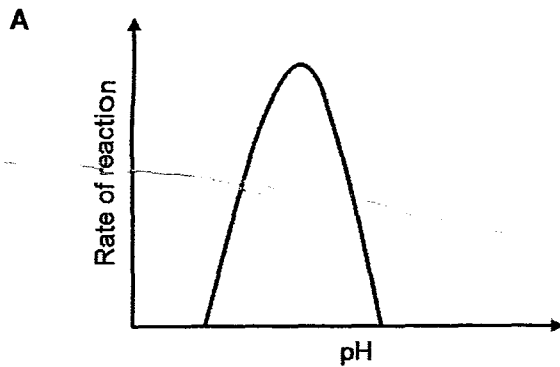
5. A student tested his fluid lunch in the following ways and the results were tabulated below.

Procedure	Results
1 cm ³ of ethanol was added to an equal volume of the food sample and the mixture was shaken. Then, 1 cm ³ of distilled water was added.	White emulsion formed.
1 cm ³ of Biuret solution was added to an equal volume of the food sample and the mixture was shaken.	Mixture turned purple in colour.
1 cm ³ of Benedict's solution was added to an equal volume of the food sample and the mixture was shaken. Then, the mixture was heated in a beaker of boiling water for 3 minutes.	Brick red precipitate formed.
3 drops of dilute Iodine solution was added to an equal volume of the food sample and the mixture was shaken.	The mixture turned brown

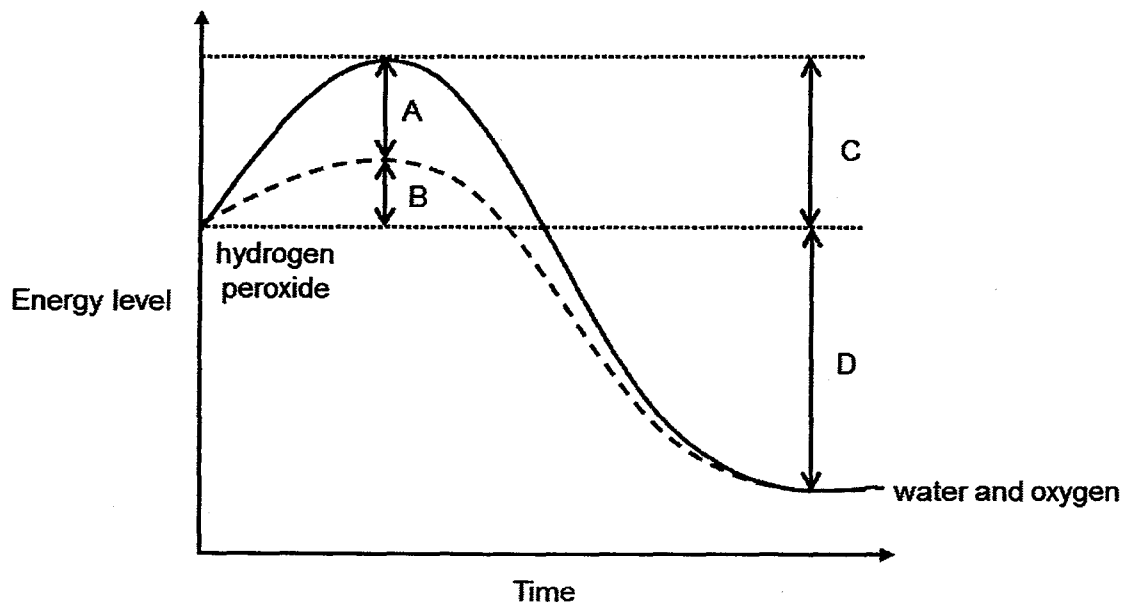
From the results, what were the nutrients present in the student's fluid lunch?

- A reducing sugars and proteins only
 - B reducing sugars, proteins and fats only
 - C reducing sugars, starch and proteins only
 - D starch, proteins and fats only
6. Which of the following is made up of only carbon, hydrogen and oxygen?
- A fibrinogen
 - B glycerol
 - C haemoglobin
 - D peptidase

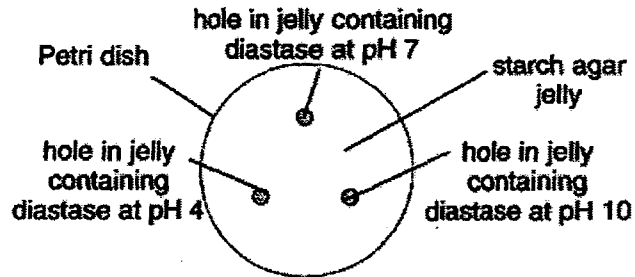
7. Phosphatase is an enzyme that removes phosphate groups from various substances. When it acts on phenyl phosphate it produces phenol and the reaction is seen as a colour change. A student studying enzymes investigated the conditions under which phosphatase works best. The results are drawn below. Which of the graphs is incorrect?



8. The graph below shows the energy level during the breakdown of hydrogen peroxide into water and oxygen, in the presence and absence of catalase. What is the difference in activation energy of the reaction when catalase is present and when it is absent?



9. Diastase (plant amylase) has the same characteristics and function as human salivary amylase. The following diagram shows a petri dish containing starch agar which was set up to investigate the effect of pH on the activity of diastase.



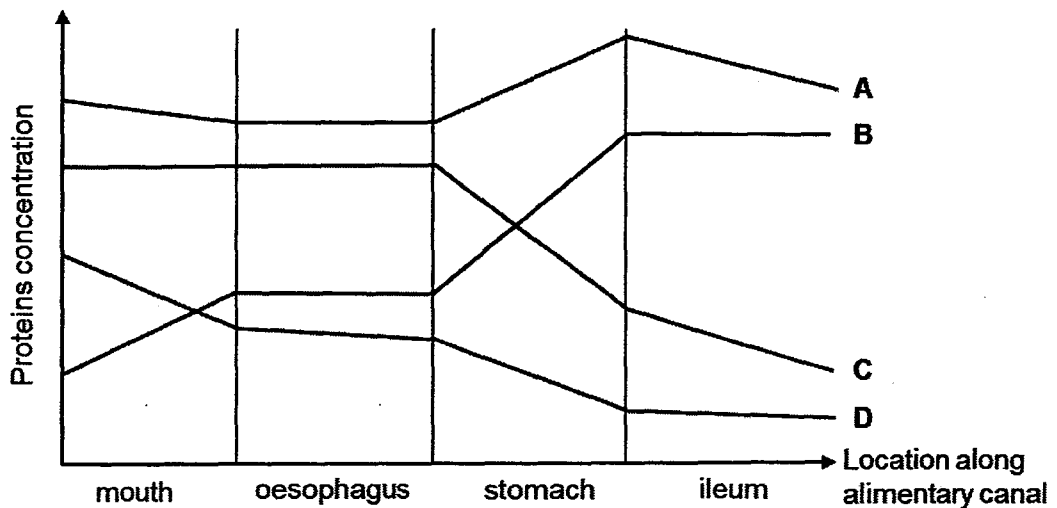
After 24 hours at room temperature, the petri dish was flooded with iodine solution. Which of the following diagrams shows the most probable result of the experiment?

A **C**

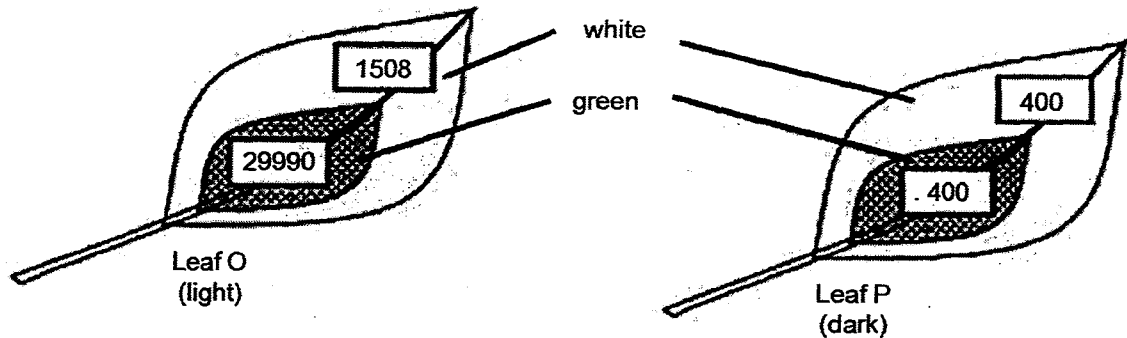
B **D**

KEY
 = blue-black

10. Which of the graphs represents the activity of protease in protein digestion?

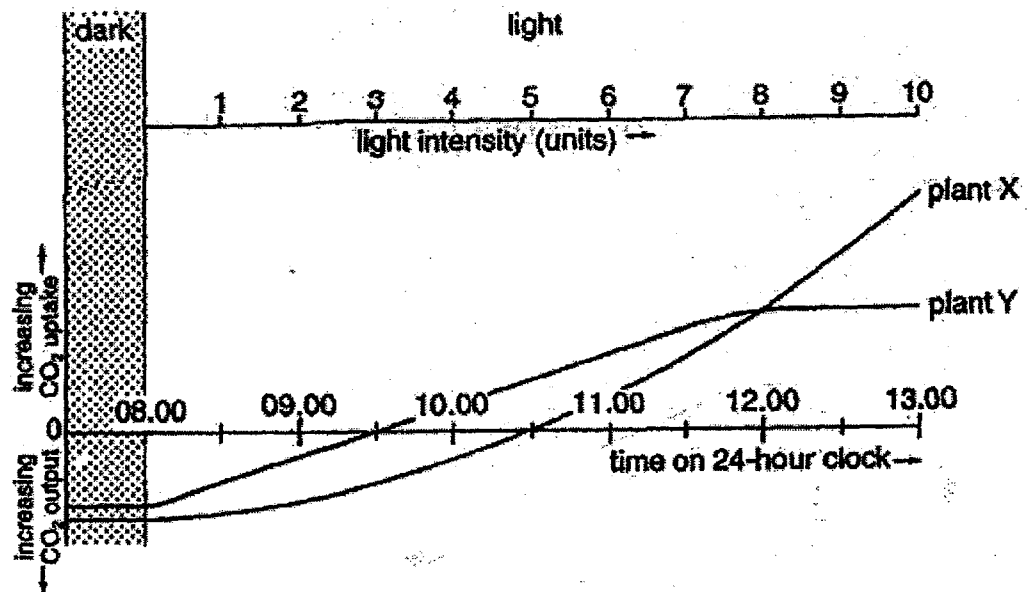


11. Variegated leaves of a plant were supplied with radioactive carbon dioxide ($^{14}\text{CO}_2$) during an experiment. Leaf O was kept in the light while leaf P was kept in the dark. At the end of the experiment, the radioactivity in the leaves was measured and the results (in arbitrary units) are shown in the boxes in the diagrams.



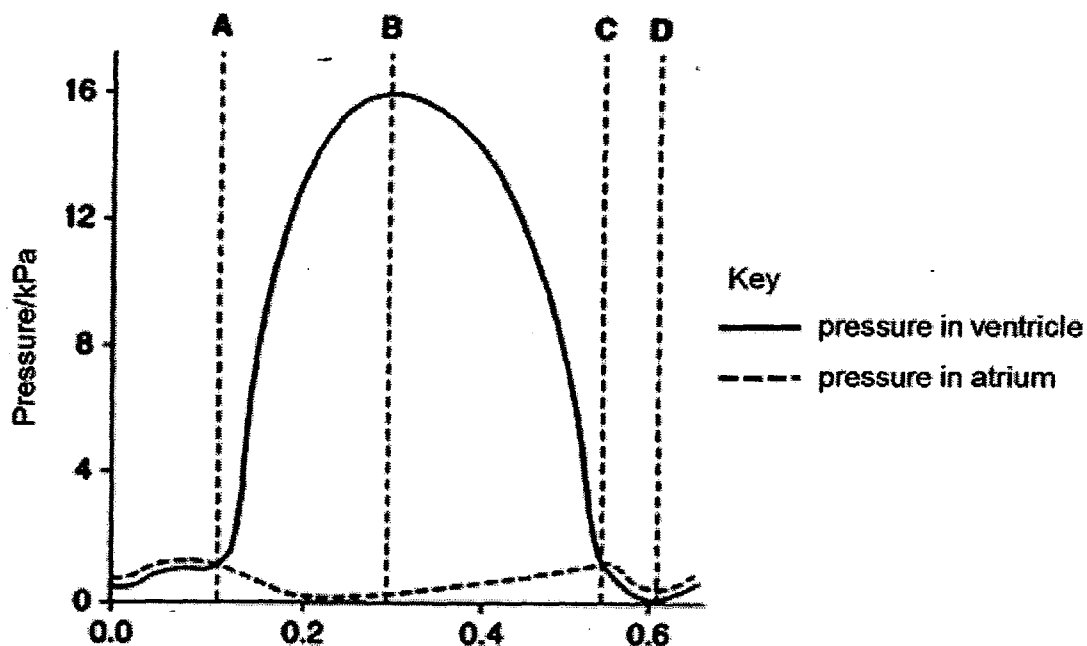
What is the most likely explanation for the level of radioactivity found in the white regions of leaf O?

- A Photosynthesis occurs but no storage of starch occurs in the white region.
 B Photosynthesis proceeds slowly in the absence of chlorophyll.
 C Products of photosynthesis were transported into the white region.
 D Radioactive carbon dioxide diffuses into the leaf and accumulates there.
12. A sun plant that grows under direct sunlight and a shade plant that grows under shade are used in an experiment. With reference to the graph below, which of the following statements is correct?

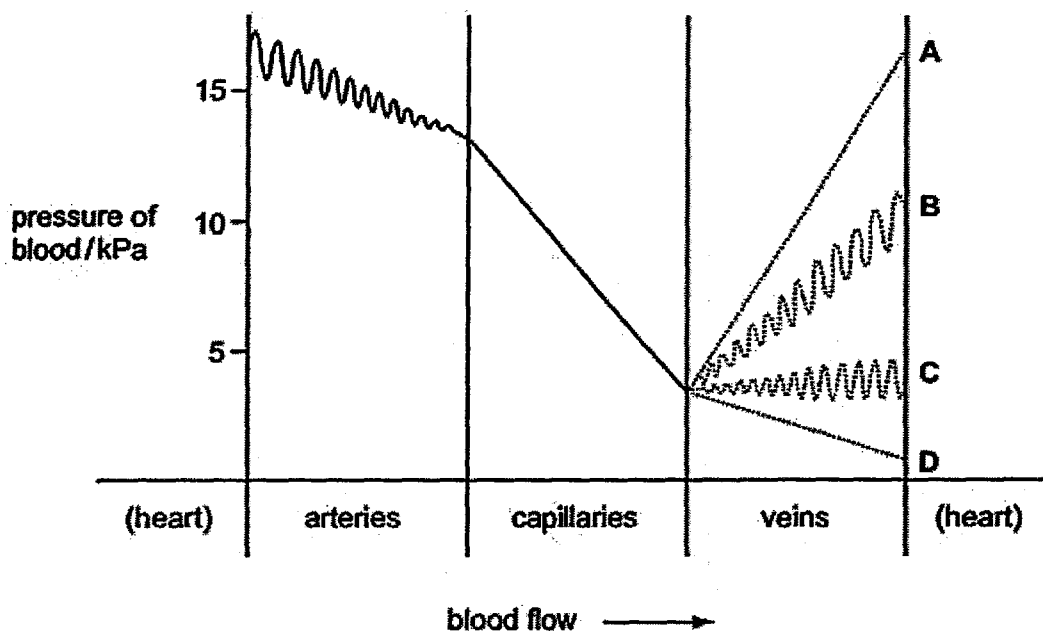


- A X is the sun plant and its compensation point occurred at 3 units of light intensity.
 B X is the shade plant and its compensation point occurred at 5 units of light intensity.
 C Y is the sun plant and its compensation point occurred at 5 units of light intensity.
 D Y is the shade plant and its compensation point occurred at 3 units of light intensity.

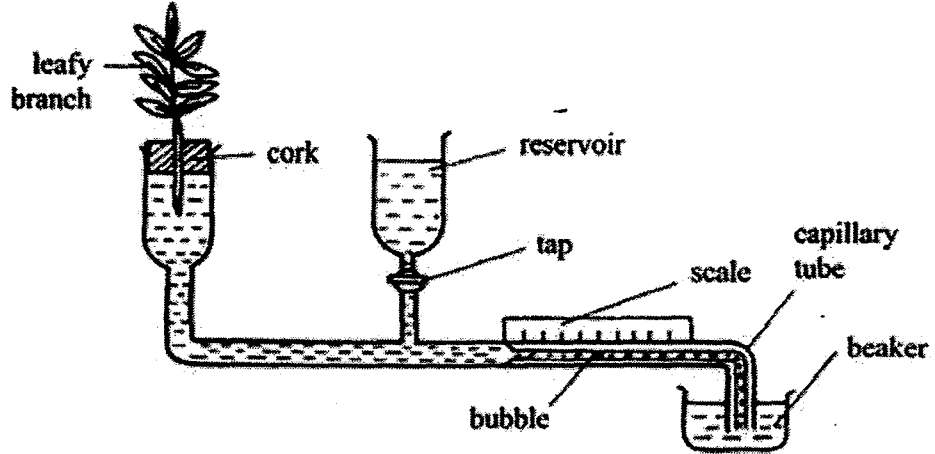
13. The graph shows pressure changes in the left side of the heart, during a single heartbeat. At which point does the bicuspid valve close?



14. The diagram shows the blood pressure of a person at rest as the blood leaves the heart and passes through arteries and then capillaries. Which graph (A, B, C or D) shows the pressure of blood as it flows through veins before returning to the heart?



15. The diagram below shows a simple potometer.

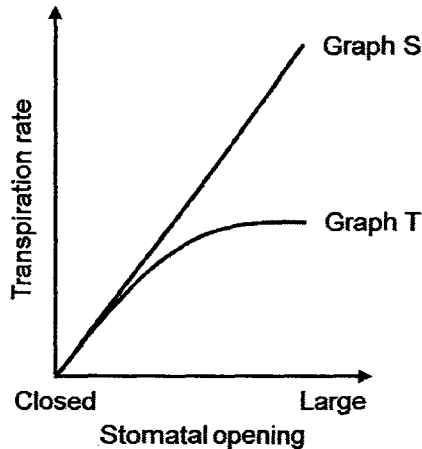


Which of the following is/are limitation(s) of the potometer?

- (1) It can only measure water uptake rate but cannot directly measure actual transpiration rate.
- (2) The apparatus cannot be applied to large plants.
- (3) The rate measured is slower than normal due to absence of root system.

- A (1) only
- B (1) and (2) only
- C (2) and (3) only
- D (1), (2) and (3)

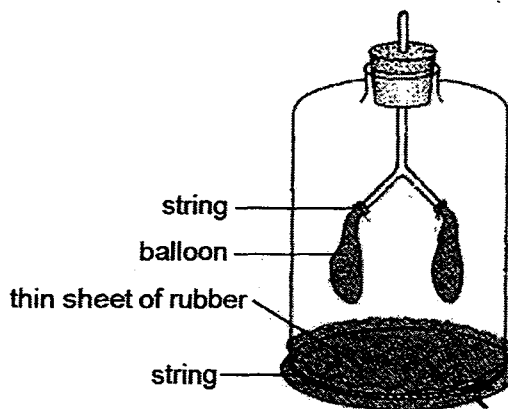
16. The diagram shows how the transpiration rate of a leaf changes as its stomatal size increases.



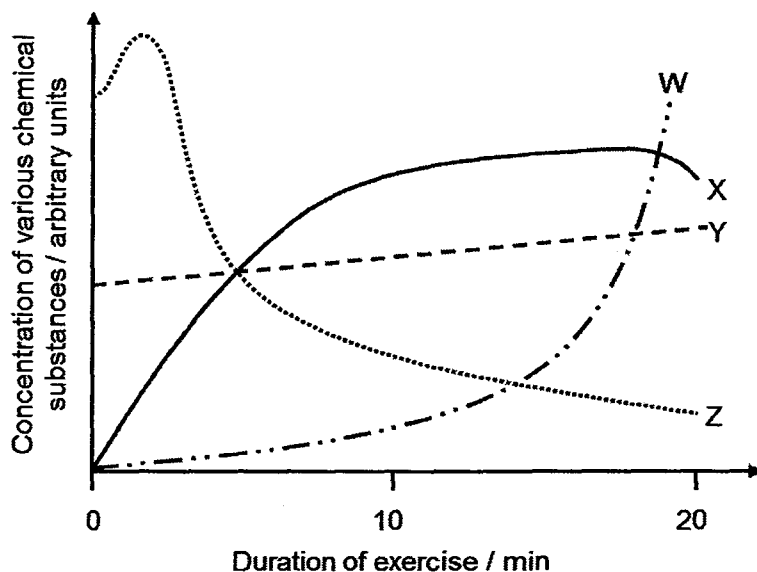
A change in an external factor can result in the two graphs, S and T. Which of the following changes is the most likely cause?

	<i>Graph S</i>	<i>Graph T</i>
A	day	night
B	fast moving air	slow moving air
C	high humidity	low humidity
D	high temperature	low temperature

17. When the rubber diaphragm is stretched by pulling it downwards, what is the effect on the pressure inside the balloons?



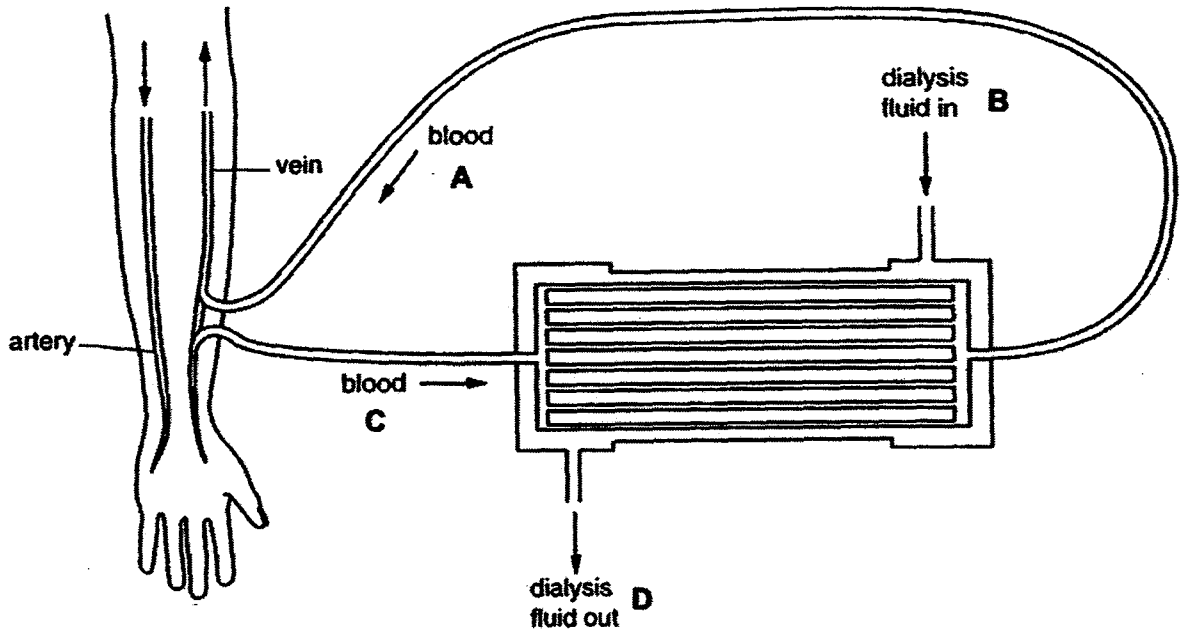
- A Pressure in the balloons does not change.
 B Pressure in the balloons is equal to atmospheric pressure.
 C Pressure in the balloons is higher than atmospheric pressure.
 D Pressure in the balloons is lesser than atmospheric pressure.
18. The diagram below shows four graphs, W, X, Y and Z, which present the changes in the concentrations of four chemical substances in the arm muscles of a person who is carrying weights.



Which of the following statements is correct?

- A Graph W represents glycogen.
 B Graph X represents carbon dioxide.
 C Graph Y represents oxygen.
 D Graph Z represents lactic acid.

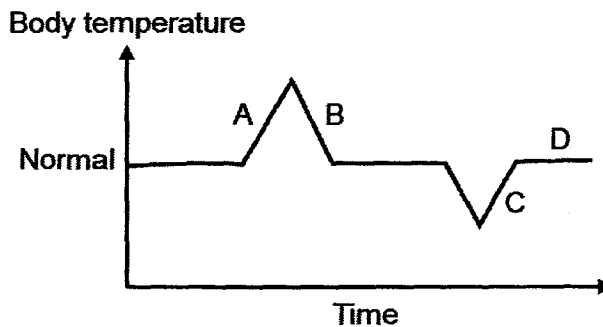
19. The diagram shows the flow of blood and dialysis fluid through a kidney machine. Where would the concentration of urea be the lowest?



20. A woman runs a marathon, sweats profusely and drinks little fluid. Which line in the table correctly summarises the events that result from this behaviour?

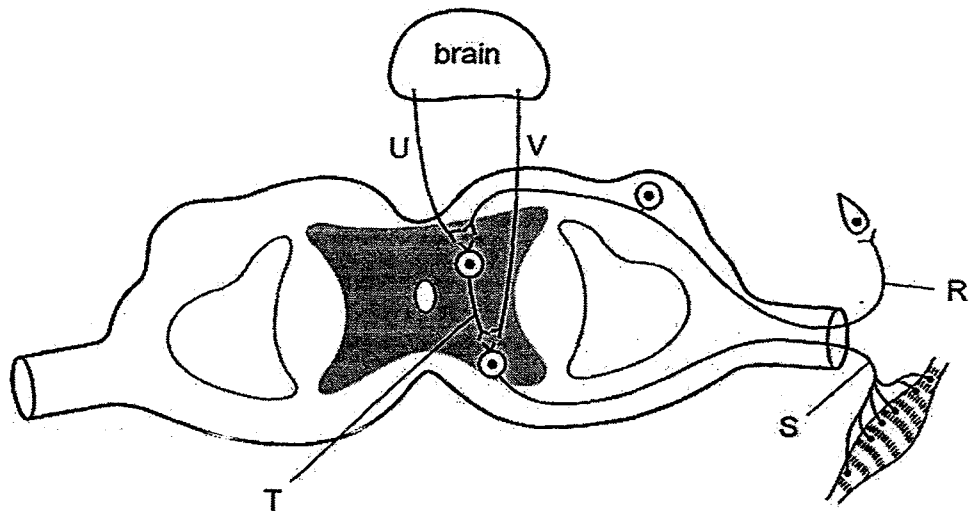
	<i>ADH production</i>	<i>Water reabsorption</i>	<i>Urine output</i>
A	increases	increases	decreases
B	increases	decreases	decreases
C	decreases	decreases	increases
D	decreases	increases	increases

21. The graph shows temperature changes in a healthy person's body.



At which time (A, B, C or D) would the person be shivering?

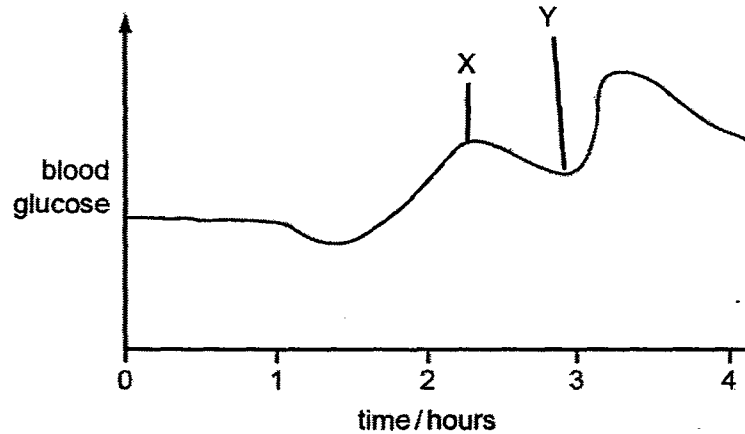
22. The diagram shows possible routes for transmission of nerve impulses.



What is the direction taken by an impulse during a spinal reflex action?

- A $R \rightarrow T \rightarrow S$
 B $S \rightarrow T \rightarrow R$
 C $U \rightarrow R$
 D $V \rightarrow S$
23. During an accident, a person had an injury that damages only the left side of his spinal cord. As a result, there is loss of feeling on the right side of the body below the damaged area. Which of the following conclusions can be made from this statement?
- A Sense organs below a damaged spinal cord would not be able to function normally.
 B Sensory neurones can only carry nerve impulses down the spinal cord.
 C Sensory neurones from the right side of the body travels up the left side of the spinal cord.
 D The perception of pain on the right side of the body is done by the left side of the brain.

24. The graph shows changes in a person's blood glucose concentration over four hours.



What might cause the change at X and Y?

	X	Y
A	decreased insulin	decreased adrenaline
B	decreased insulin	increased adrenaline
C	increased insulin	decreased adrenaline
D	increased insulin	increased adrenaline

25. A student was reading the fine print of news articles on her smartphone for a long time before she felt a strain in her eyes. Which of the following best explains what happened in her eyes?

- A Ciliary muscles became fatigued.
- B Optic nerves were unable to transmit impulses to the brain.
- C Radial muscles contracted for too long.
- D Suspensory ligaments became stretched.

26. The following investigation was carried out using flower buds growing on three plants of the same species:

Plant 1 – The anthers were carefully removed and the buds left open to the air.

Plant 2 – The anthers were left untouched and a paper bag was tied tightly around each bud.

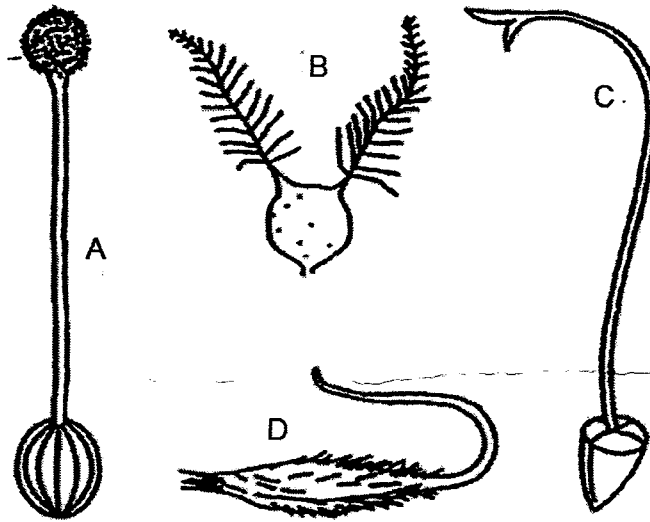
Plant 3 – The anthers were carefully removed and a paper bag was tied around each bud.

Although all flowers later opened normally, only those on plant 1 produced seeds.

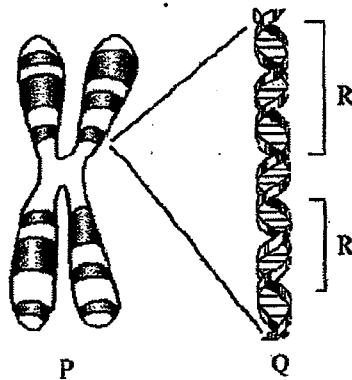
Which statement best explains how reproduction is carried out in the species?

- A Both self-pollination and cross-pollination can occur.
- B Only cross-pollination can occur.
- C Only insect-pollination can occur.
- D Only wind-pollination can occur.

27. The diagrams below shows carpels from four different flowers.
Which carpel is adapted for wind pollination?



28. The diagram below illustrates the relationship between DNA, genes and chromosomes.



Which of the following statements describes the relationship correctly?

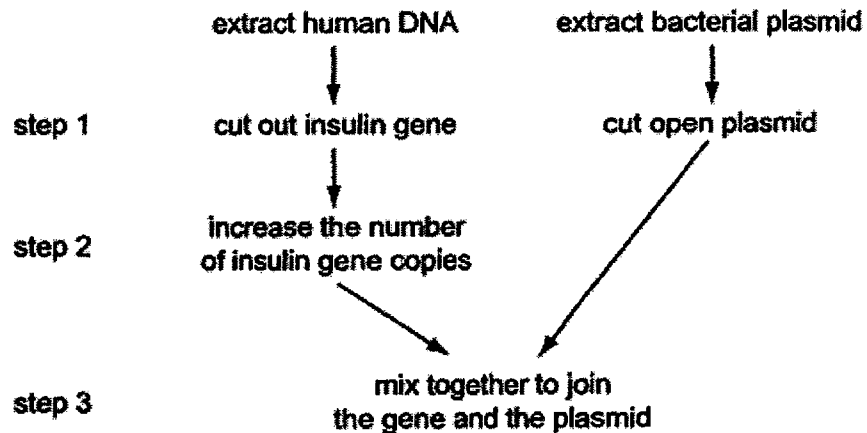
- A P contains hereditary information in the sequence of Q and Q is made up of tightly coiled R.
- B P contains many Q and each Q can contain two R.
- C P contains tightly coiled Q and each R always codes for one protein.
- D P contains two replicated copies of Q and R is a segment of Q.

29. A student obtained a sample of DNA. mRNA was transcribed from this DNA and the two samples were subsequently purified. He then separated the two strands of the DNA sample. The base compositions of each strand and that of the mRNA were analysed. The results of the analysis are shown in the table below.

	A	G	C	T	U
DNA strand 1	19.1	26.0	31.0	23.8	0.0
DNA strand 2	24.2	30.8	25.7	19.3	0.0
mRNA	19.0	25.9	30.8	0.0	24.3

Which of the following statements correctly shows the relationship between DNA strands and mRNA?

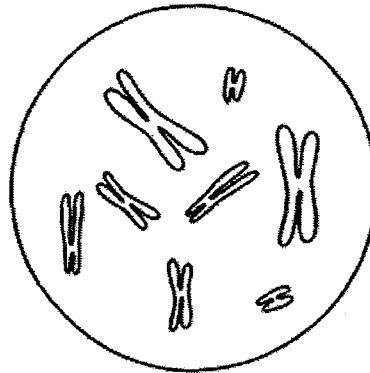
- A DNA strand 1 is the coding strand for mRNA synthesis.
 B DNA strand 2 is the coding strand for mRNA synthesis.
 C mRNA is complementary to DNA strand 1.
 D mRNA is the template for DNA synthesis.
30. The diagram outlines part of the process to produce recombinant DNA that will synthesise human insulin. At steps 1, 2 and 3, enzymes have to be used.



Which row correctly identifies the enzyme in each step?

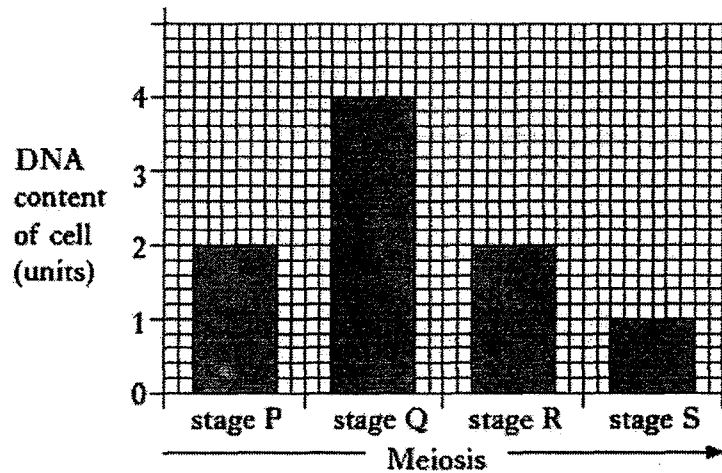
	<i>Step 1</i>	<i>Step 2</i>	<i>Step 3</i>
A	polymerase	ligase	restriction
B	polymerase	restriction	ligase
C	restriction	ligase	polymerase
D	restriction	polymerase	ligase

31. The diagram shows a cell nucleus in prophase of mitosis.



Which statement describes the chromosomes found in each daughter nucleus immediately following cell division of this cell by mitosis?

- A 8 chromosomes, each consisting of 2 molecules of DNA
 - B 8 chromosomes, each consisting of 1 molecule of DNA
 - C 4 chromosomes, each consisting of 4 chromatids
 - D 4 chromosomes, each consisting of 2 chromatids
32. The bar graph below shows changes in the DNA content per cell during stages of meiosis.

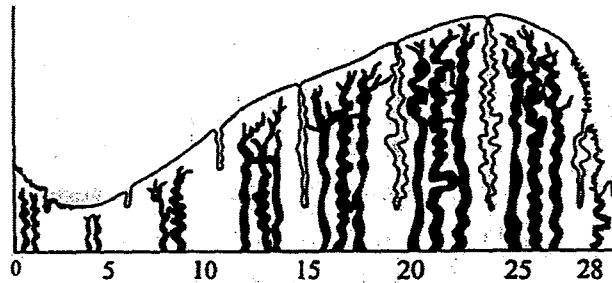


- I Four cells are formed at the end of stage S.
- II. There is separation of chromatids between stages R and S.
- III. There is interphase at stage R.

Which of the statements above can be concluded based on the bar graph?

- A I only
- B I and II
- C II and III
- D I, II and III

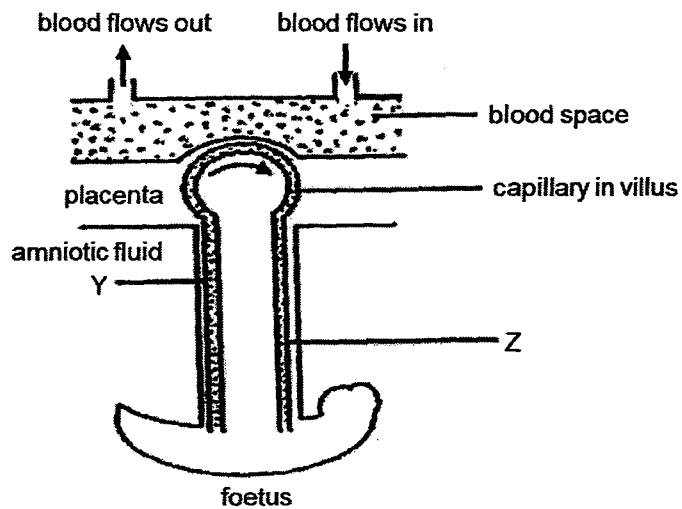
33. The diagram shows the variation in thickness of the endometrium throughout a menstrual cycle of a healthy female.



During which stage of the menstrual cycle would the levels of oestrogen and progesterone surge?

	<i>Surge in oestrogen</i>	<i>Surge in progesterone</i>
A	days 1 to 5	days 15 to 20
B	days 5 to 10	days 1 to 5
C	Days 5 to 15	days 15 to 25
D	days 15 to 25	days 5 to 15

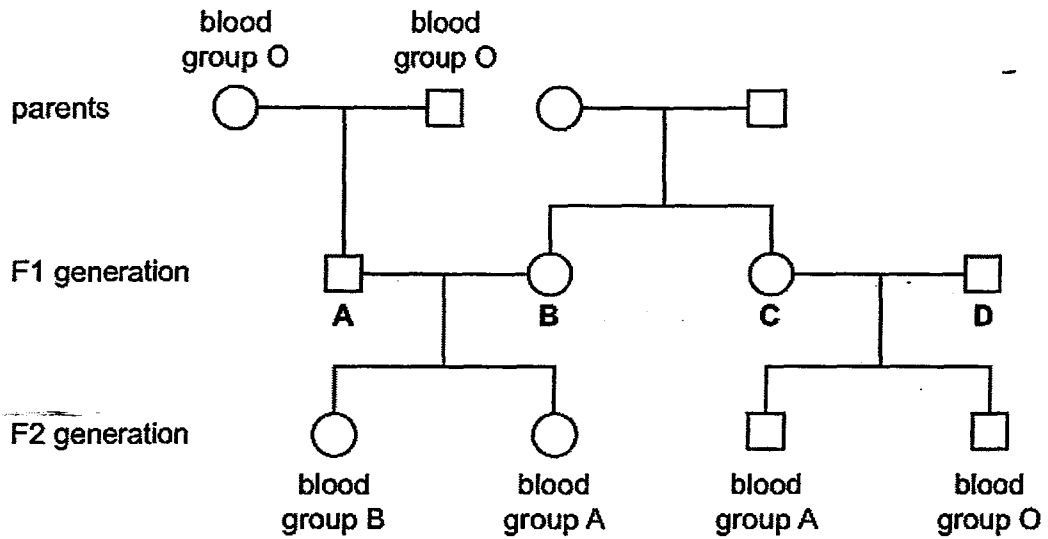
34. The diagram shows the relationship between the blood systems of the foetus and that of the mother. Y and Z are blood vessels in the umbilical cord.



Identify the blood vessels and their contents.

	<i>Umbilical artery</i>	<i>Umbilical vein</i>	<i>High concentration of excretory products</i>	<i>High concentration of nutrients and oxygen</i>
A	Y	Z	Z	Y
B	Y	Z	Y	Z
C	Z	Y	Z	Y
D	Z	Y	Y	Z

35. The diagram shows the blood phenotypes of some members of a family. Which member of the F1 generation must have a codominant genotype?



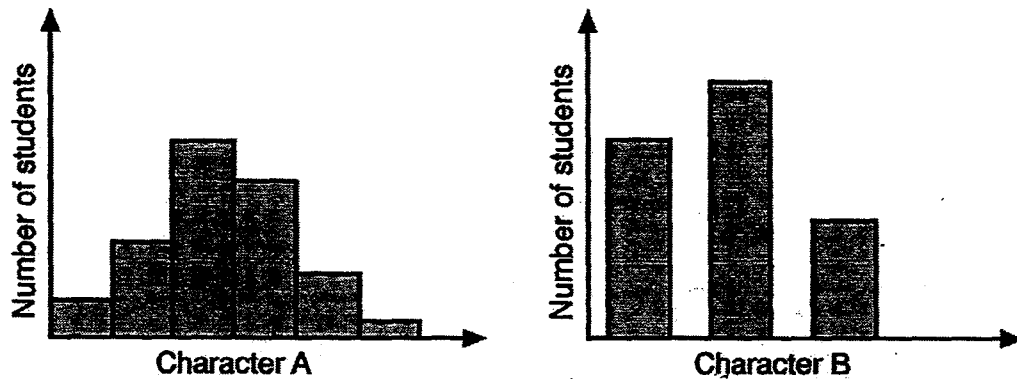
36. In fruit flies, the gene for wing shape has two alleles, R for straight wings and r for curled wings. The following phenotypes are observed for each genotype:

Genotype	Phenotype
RR	Normal, straight wings
Rr	Curled wings
rr	Unable to hatch from the eggs

Which of the following crosses would produce live offspring from 75% of the eggs?

- A RR x Rr
- B Rr x Rr
- C RR x rr
- D Rr x rr

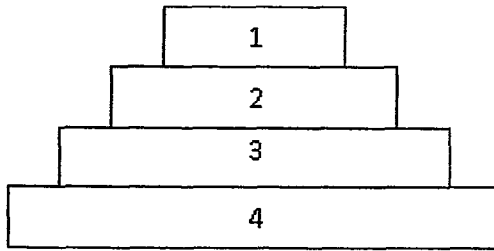
37. Two phenotypes of a class of students were measured. The results obtained were recorded in the graphs below.



Which of the following statements is true?

- A Ability to roll the tongue is an example of character A while blood group is an example of character B.
 - B Character A is determined by dominant alleles while character B is determined by recessive alleles.
 - C Character A is determined by the additive effect of many pairs of alleles while character B is determined by one or a few pairs of alleles.
 - D Character A is not influenced by environmental factors while character B is.
38. Which of the following is a valid example of evolution by means of natural selection?
- A birth of a liger that results when a male lion is mated with a female tiger in an enclosure
 - B breeding of Black Angus cattle for production of premium beef
 - C discovery of a hermit crab with a sea anemone attached on its shell
 - D discovery of disease-causing bacteria which are resistant to the antibiotic medicine vancomycin

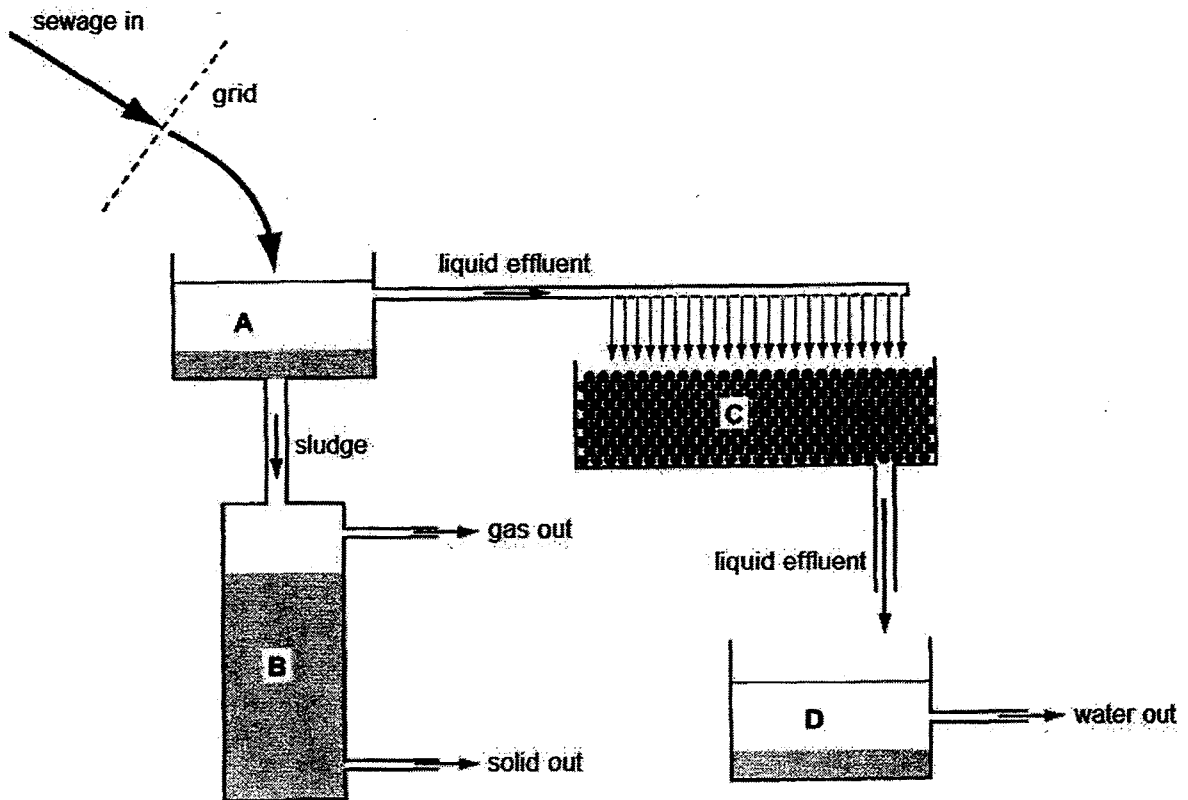
39. The following diagram shows an ecological pyramid.



Which of the following statement is always true?

- A Cumulative toxins become more concentrated from level 1 down to level 4.
- B Energy flow is upwards from level 4 to 1.
- C Level 1 is occupied by photosynthesising organisms.
- D Numbers in level 4 exceed those in level 3.

40. The diagram below shows a sewage treatment process.



Which stage involves anaerobic bacteria?

End of Paper 1

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Class:	Index No.:	Name:	Date:
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PRELIMINARY EXAMINATIONS 2 (2016)
Secondary Four Express

PURE BIOLOGY
 Paper 2

5158/02
 14 September 2016
 1 hour 45 minutes

No Additional Materials are required

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
 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, paper clips, glue or correction fluid.

Section A

Answer **all** questions. Write your answers in the spaces provided on the Question Paper.

Section B

Answer **all** questions. Write an E (for Either) or an O (for Or) next to the number 11 in the grid below to indicate which question you have answered.

Electronic calculators may be used.
 At the end of the examination, fasten all your work securely together.
 The number of marks is given in brackets [] at the end of each question or part question.

FOR EXAMINER'S USE	
Section A	
Section B	/
6	
7	
8	
Total	

This question paper consists of **18** printed pages, including the cover page.

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Section A

Answer **all** questions.

Write your answer in the spaces provided.

1. Fig. 1.1 shows the human eye in longitudinal section.

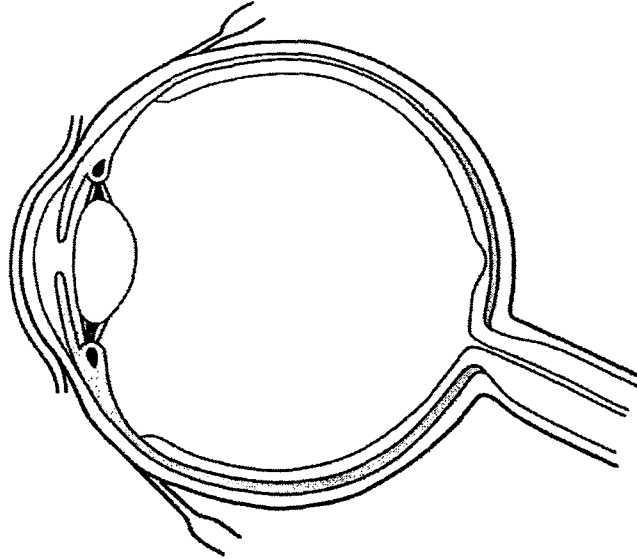


Fig. 1.1

- (a) On Fig. 1.1, label and identify the structure in the human eye
- (i) that responds to the action of hormone adrenaline, and [1]
 - (ii) where nerve impulses are sent to the brain. [1]

- (b) You wake up in a dark room, and pull open the curtains to see bright daylight.

- (i) Describe how your brain receives this information.
-
-
-
-
- [2]

- (ii) Describe the appropriate response taken to protect the light-sensitive layer of the eye.
-
-
-
-
- [2]

- (c) A dog barks and frightens a boy. The boy's heart rate increases, he starts to sweat profusely and has an increased awareness of his surroundings. List two ways in which this response in (c) is similar to that in (b), and one way in which they differ.

Similarities:

(i)
 [1]

(ii)
 [1]

Differences:

.....
 [1]

- (d) Fig. 1.2 shows the changes in curvature of the lens in the eyes of a girl who looked at four different objects at four periods of time within 12 seconds.

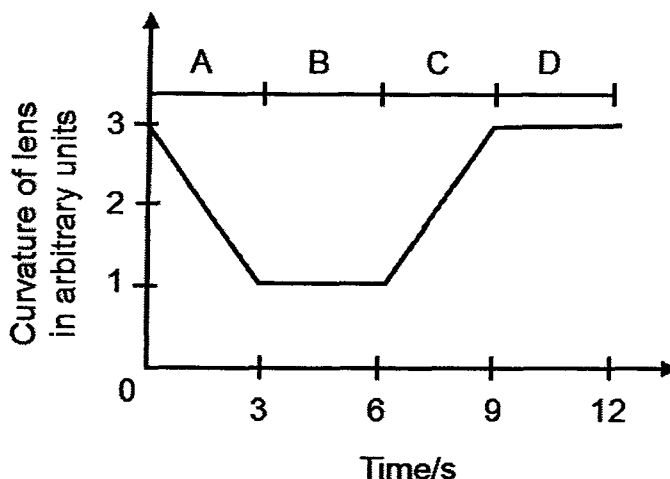


Fig. 1.2

- E: An old couple walking towards her G: Her wristwatch
 F: A kid running away from her H: A bird perching on a branch of a tall tree

Using the letters E, F, G and H, indicate which object is watched by the girl during periods A, B, C and D in the table below.

	Letter		Letter
Period A		Period C	
Period B		Period D	

[1]

[Total: 10]

2. An experiment is set up to prove that carbon dioxide is necessary for photosynthesis. However, the apparatus is not set up properly. Fig. 2.1 shows the set-up for this experiment.

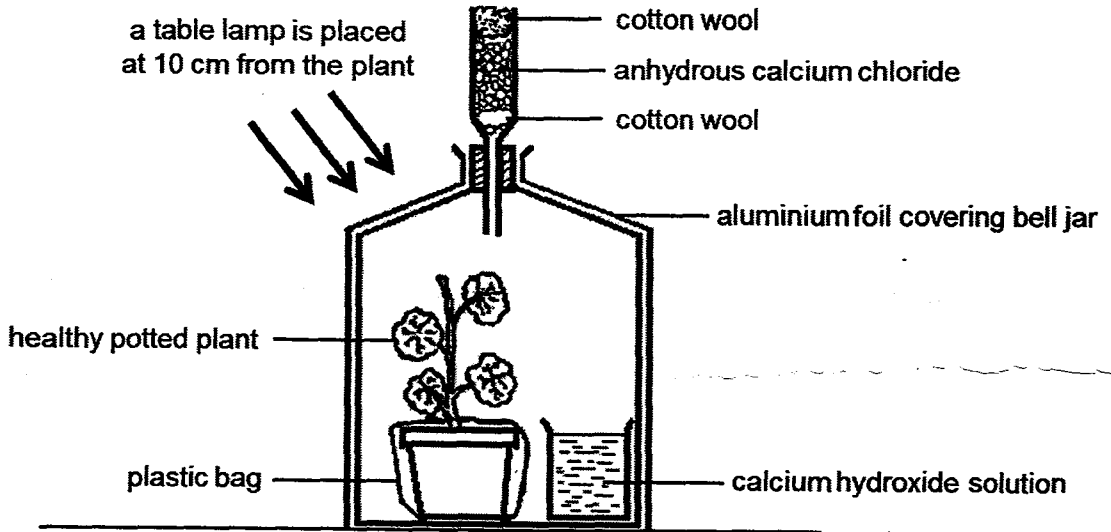


Fig. 2.1

The anhydrous calcium chloride absorbs water from the environment, while the calcium hydroxide solution absorbs carbon dioxide from the environment.

- (a) (i) State the function of the plastic bag.

.....
..... [1]

- (ii) Suggest and explain one way to improve the set-up of the experiment.

.....
.....
.....
.....
..... [2]

- (iii) Results of the experiment are deemed inconclusive because the potted plant was not destarched prior to its use in the experiment. Explain why this step is important.

.....
.....
.....
..... [2]

(iv) State the equation for photosynthesis, in symbols.

[1]

(b) Fig. 2.2 shows cross-sections of leaves from three different plants.

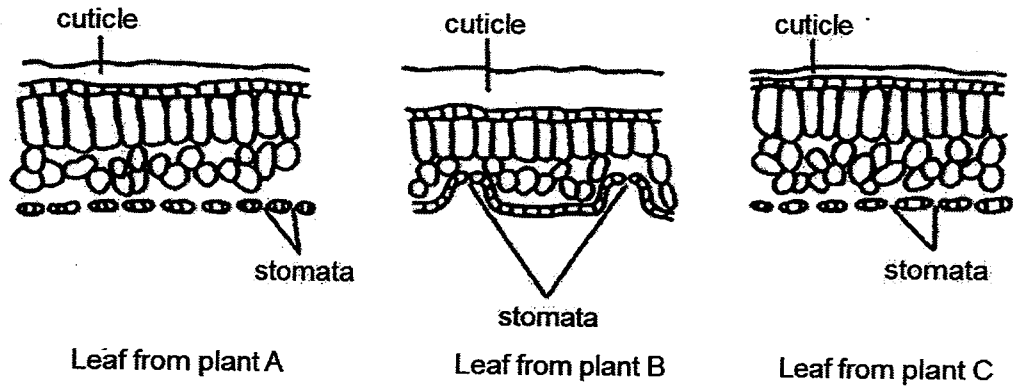


Fig. 2.2

(i) Which of the plants A, B or C is most suited for hot and dry conditions? Explain your answer.

.....
.....
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.....
.....
..... [3]

(ii) Define the term "transpiration".

.....
..... [1]

[Total: 10]

[Turn over

3. Fig. 3.1 shows two graphs, A and B, that present the oxygen uptake (Graph A) and lactic acid concentration (Graph B) in a person's blood before, during and after a short period of physical exercise.

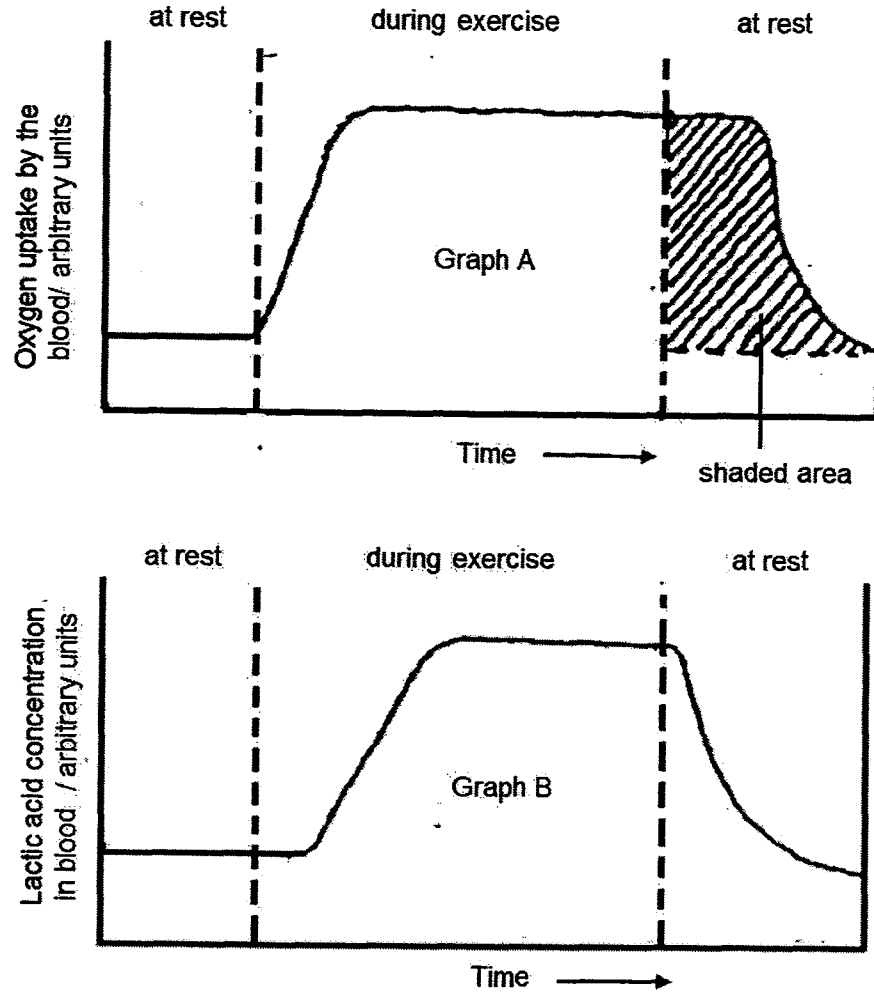


Fig. 3.1

- (a) (i) Explain the increase in lactic acid concentration in the blood at the beginning of exercise.

.....

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(ii) State the biological term used to represent the shaded area on Graph A. Explain how the volume of oxygen in the shaded region is related to the lactic acid concentration in the blood

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.....
.....
.....
..... [2]

(iii) Describe the effect of lactic acid during exercise.

.....
..... [1]

(b) State the equation, in symbols, for aerobic respiration.

[1]

(c) Describe how the surface of the alveoli is adapted for gaseous exchange.

.....
.....
.....
.....
..... [2]

[Total: 10]

4. (a) The following information was printed on washing powder labels.

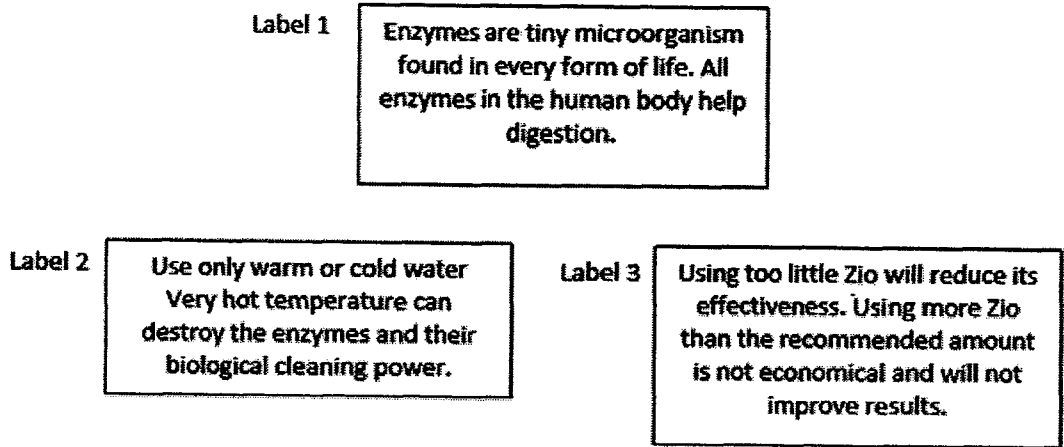


Fig. 4.1

(i) Label 1 contains misleading information. Rewrite this information so that it is biologically correct.

.....

.....

.....

.....

..... [2]

(ii) You are instructed to design an experiment to confirm the accuracy of Label 2. Name **two** variables that should be kept constant in the experiment.

.....

.....

..... [2]

(iii) Label 3 claims that using more than the recommended amount of Zio will not improve the results. Do you agree with the claim? Explain your answer.

.....

.....

.....

.....

..... [2]

- (b) The effect of pH on the activity of two protease enzymes, pepsin and trypsin, was investigated. An enzyme solution, adjusted to the required pH, was placed on a hole made in the middle of a layer of gelatine in a Petri dish. Gelatine is a jelly made of protein. After an hour the activity of the enzymes was estimated by measuring the area of gelatine digested by the enzyme.

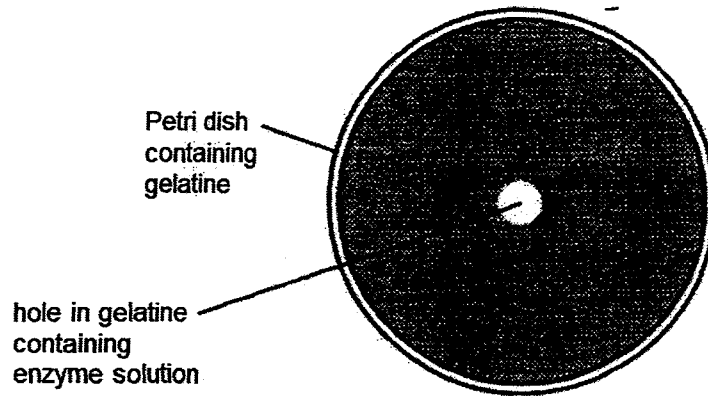


Fig. 4.2

The results are shown in the graph below.

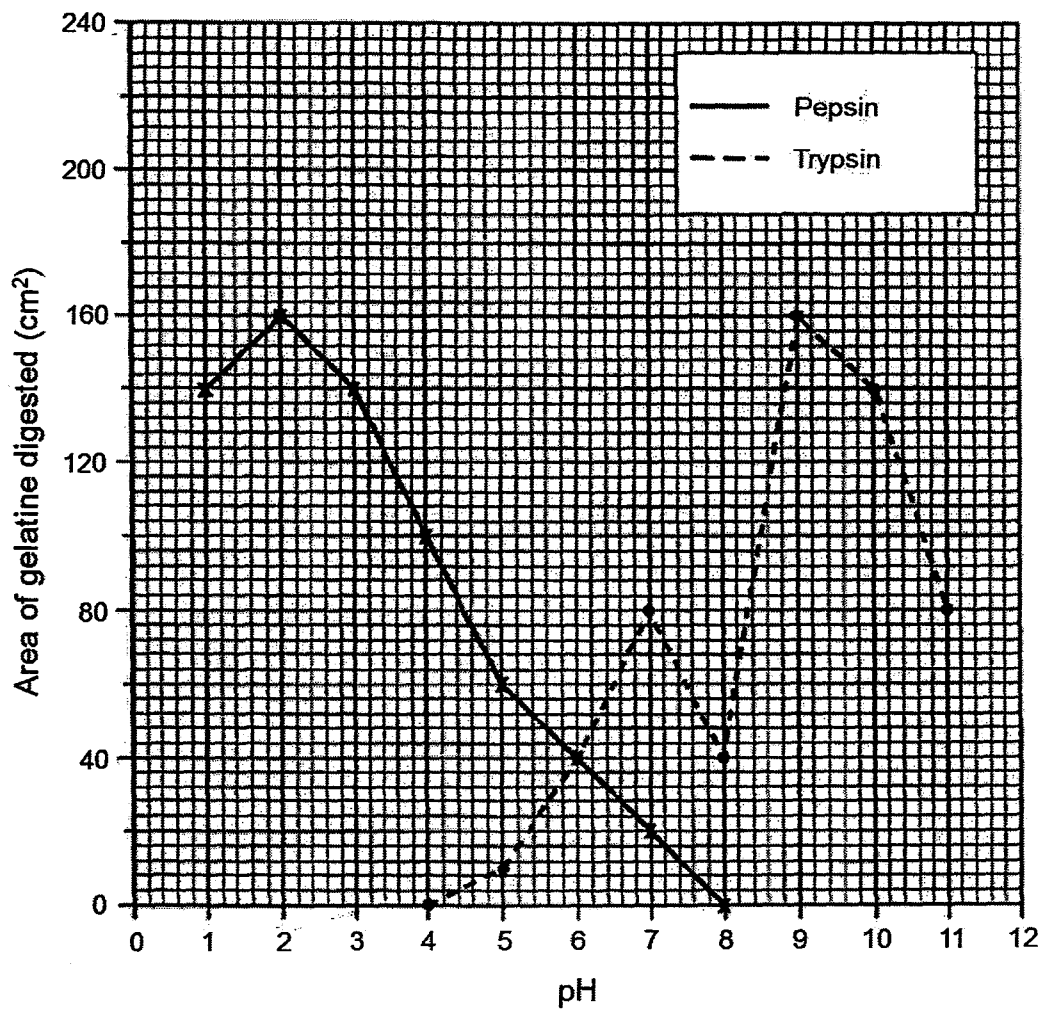


Fig. 4.3

(i) Identify the pH at which both enzymes were equally active.

.....
..... [1]

(ii) It is suspected that one of the enzyme graphs has a result which may have been due to experimental error. Identify the enzyme graph and state the name of the enzyme and pH at which the error occurred.

.....
..... [1]

(iii) A pepsin solution that was kept at pH 8 is taken through another experiment. The pepsin solution has its pH adjusted to pH 2 and then added into the hole in the gelatine. Would this pepsin solution produce the same result at pH 2 as shown in Fig. 4.3? Explain your answer.

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..... [2]

[Total: 10]

5. Fig. 5.1 shows a river and its surrounding areas.

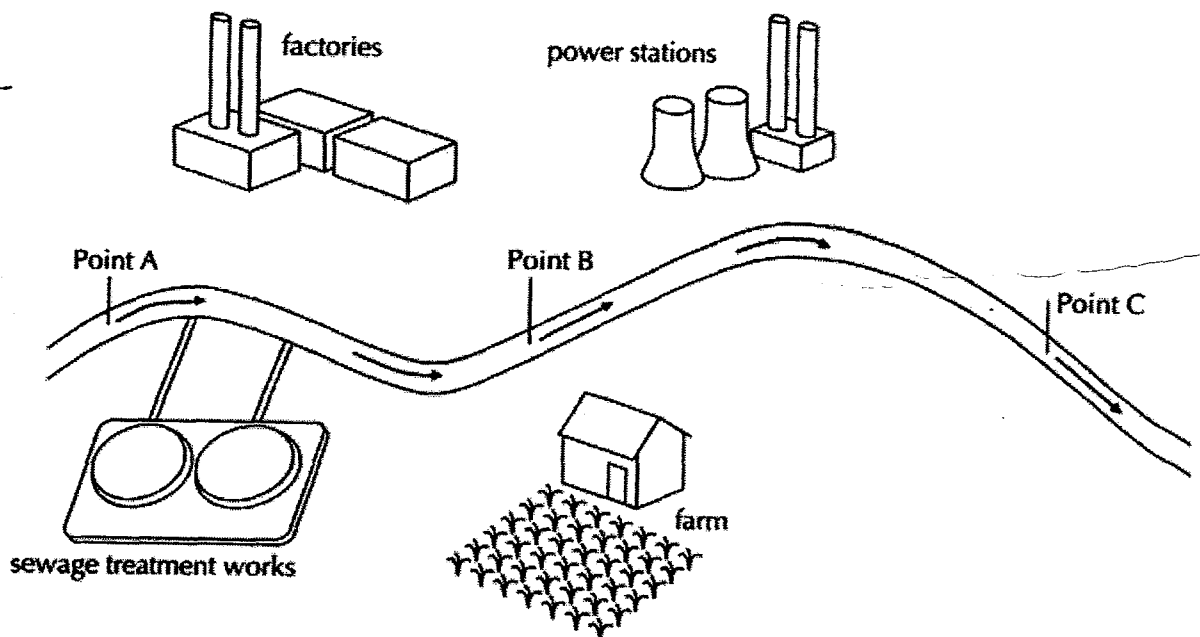


Fig. 5.1

(a) Fishermen preferred to catch fish at point A rather than at point B. Suggest a reason for the fishermen's preference.

.....[1]

(b) One day, the sewage treatment works broke down and untreated sewage entered the river. Explain how this could become a health hazard.

.....

[2]

(c) In order to increase growth of plants, the farmer used fertilisers which are high in nitrates. Soon, the river at point C turned green and many dead fishes were spotted floating on water.

(i) State the cause for the river to turn green in colour.

..... [1]

(ii) State the cause for the death of many fishes in the river.

..... [1]

(iii) State the importance of nitrates in plant growth.

..... [1]

- (d) The graph in Fig. 5.2 below shows the distribution of three different types of organism at different depths of the river at point A where they form a food chain.

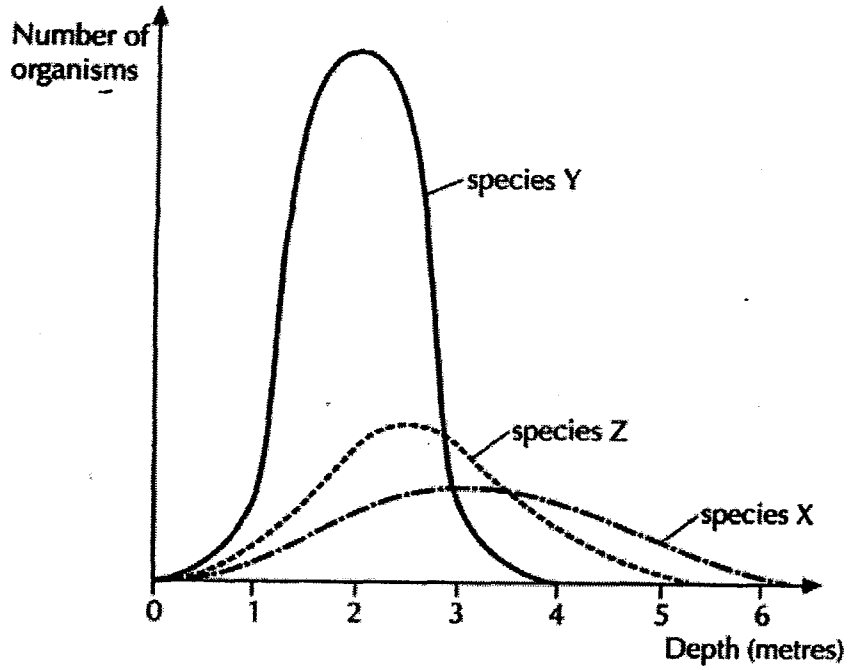


Fig. 5.2

- (i) Identify the producer and explain your choice.

.....

.....

.....

.....

..... [2]

- (ii) In the space below, draw a labelled pyramid of biomass for the three organisms shown in Fig. 5.2.

[2]

[Total: 10]

Section B

Answer all questions.

Write your answer in the spaces provided.

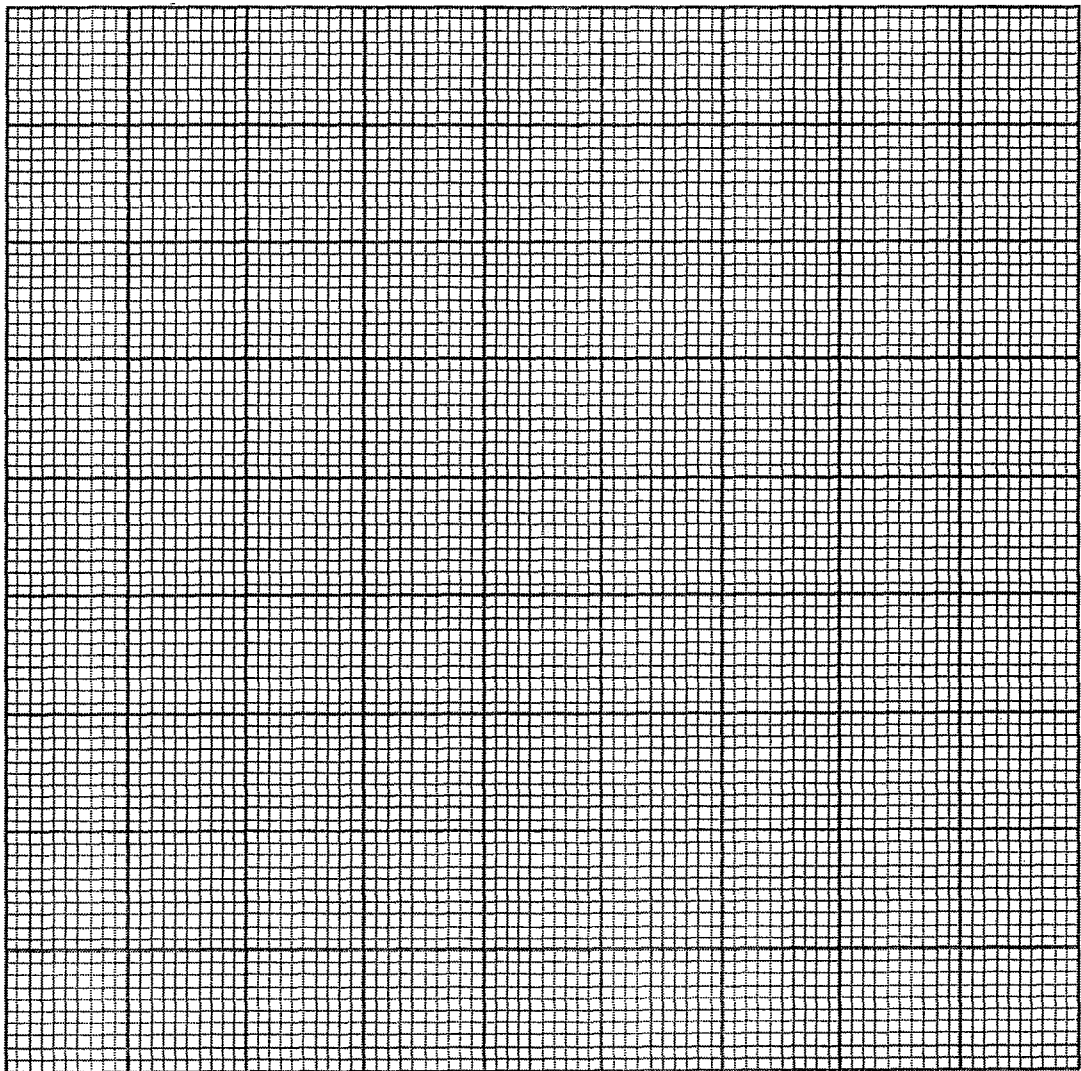
6. The human body has many means to protect and overcome bacterial infection. Pyrogens are chemicals produced by phagocytes during a bacterial infection. These chemicals affect the hypothalamus and cause the body temperature to increase beyond $37.5\text{ }^{\circ}\text{C}$, thus causing fever. The increased body temperature is one of the means by which the body fight the infection.

The following table shows the effect of increasing body temperature on the rate of multiplication of two different bacteria Y and Z.

Body temperature ($^{\circ}\text{C}$)	36.5	37.5	38.5	39.5	40.5
Number of times bacteria Y multiplied in a 20-minute cycle	7	10	5	2	1
Number of times bacteria Z multiplied in a 20 min cycle	13	15	14	15	12

- (a) Plot the graphs of number of times of bacterial multiplication against body temperature for bacteria Y and Z on the same axes.

[4]



7. A green maize plant was pollinated with another green maize plant. A total of 1340 grains were collected. Half of the grains were germinated in ultraviolet (UV) fluorescent light, while the remaining half were germinated in the dark. After a few days, the seedlings were examined and the results were shown in the table below.

Germinating conditions	Number of seedlings grown		
	Green	Yellow	Albino
UV Fluorescent light	501	159	3
Darkness	493	162	0

- (a) Using the letter **G** to represent the dominant allele and the letter **g** to represent the recessive allele, construct a genetic diagram to explain the results of the green and yellow seedlings that germinated under fluorescent light. [4]

- (b) Suggest how the albino seedlings could have been formed when the seeds were germinated in ultraviolet (UV) fluorescent light.

.....

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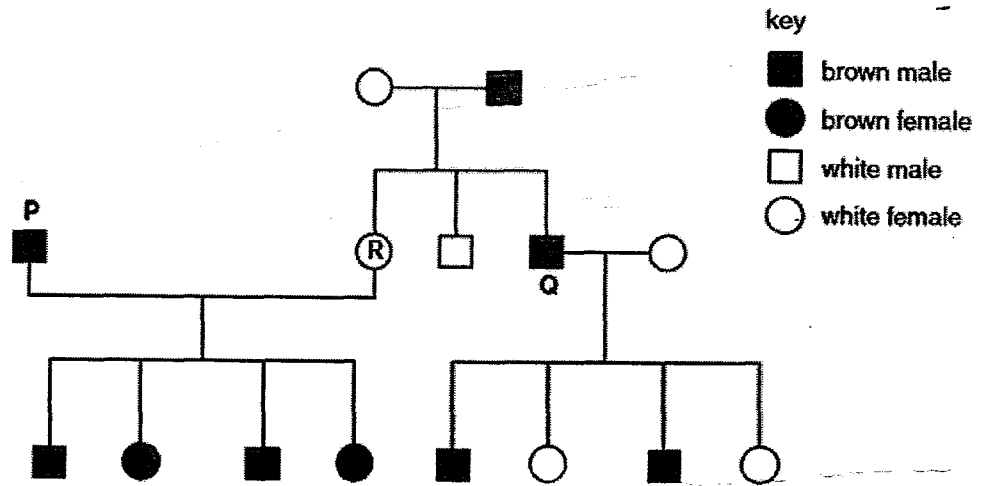
.....

.....

.....

..... [2]

- (c) The figure shows the inheritance of a coat colour in a family of rats, which is determined by two alleles. The allele that codes for brown coat is represented by **B**, and is completely dominant over the allele that codes for white coat, which is represented by **b**.



Determine the genotype of Q and explain your answer.

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.....

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.....

.....

[2]

[Total: 8]

8 Either.

(a) Describe how carbon dioxide produced by respiring tissue is transported to the lungs.

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[6]

(b) Increasing content of carbon dioxide in the atmosphere contributes to the rate of global warming. Describe how carbon sinks help to reduce the rate of global warming.

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[4]

[Total: 10]

8 Or.

(a) Explain what is meant by the term negative feedback.

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.....
..... [2]

(b) A patient was admitted to a hospital accident and emergency ward and was diagnosed with SIADH (Syndrome of Inappropriate Antidiuretic Hormone Secretion). She was suffering from hyponatremia, a condition where the water potential of blood remains abnormally high. Based on your knowledge of antidiuretic hormone (ADH), explain how hyponatremia comes about in a patient suffering from SIADH.

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..... [3]

(c) Describe and explain how the dialysis machine is designed to remove metabolic waste from the blood.

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..... [5]

[Total: 10]

PRELIMINARY EXAMINATIONS 2 (2016)
Secondary Four Express

PURE BIOLOGY
Paper 1 & Paper 2 (ANSWERS)

5158
September 2016

This question paper consists of 5 printed pages, including the cover page.

PAPER 1 : MULTIPLE-CHOICE QUESTIONS

[40 MARKS]

Answer **all** the questions in the table provided below.

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

PAPER 2 - SECTION A

[50 MARKS]

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

1. (a) Label the 'iris' on Fig. 1.1

Label the 'optic nerve' on Fig. 1.1

(b) (i) **Photoreceptors on retina are stimulated by light rays and nerve impulses are generated.**

Nerve impulses are transmitted from **the photoreceptors/retina along the optic nerve to the brain** for interpretation.

(ii) **Circular muscles of the iris contract while radial muscles of the iris relax.**

Diameter of the pupil decreases / pupil constricts.

(c) Similarities:

(i) Both responses require **stimulus / change in the environment.**

(ii) Both responses **cannot be controlled by the will / are involuntary actions / are reflex actions.**

Differences: *(any 1 of the following)*

Response in (b) is regulated by the **nervous system**, while response in (c) is regulated by the **endocrine/hormonal system.** OR

Response in (b) is regulated by **electrical signals** called **nerve impulses**, while response in (c) is regulated by **chemical substances** called **hormones.** OR

Response in (b) is **usually localised**, while response in (c) **affects more than one target organ** OR

Response in (b) is **quicker** than response in (c)

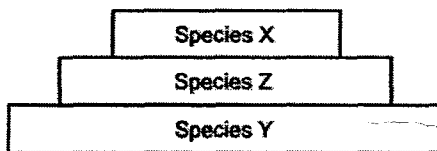
1
1
1
1
1
1
1
1
1
1

(d)

	Letter		Letter
Period A	F	Period C	E
Period B	H	Period D	G

2. (a) (i) To prevent carbon dioxide from soil organisms/bacteria/microbes from entering the air in the bell jar. 1
- (ii) Remove the aluminium foil that covers the bell jar 1
because light is essential for photosynthesis to occur. 1
- OR
- Replace the anhydrous calcium chloride with a substance that can absorb carbon dioxide from the air 1
entering the bell jar
because the air in the bell jar must not contain carbon dioxide to prove that photosynthesis cannot occur in 1
its absence.
- (iii) Presence of starch in leaf cells indicates the occurrence of photosynthesis. 1
- If starch is not removed from the leaf cells before the experiment, the presence of starch in leaf cells 1
after the experiment cannot be an indication of the occurrence of photosynthesis.
- (iv)
$$6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{light energy}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$$
- OR
- $$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{light energy}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$
- (b) (i) Plant B. 1
- It has the thickest cuticle to prevent excessive loss of water most effectively. OR 1
- Its stomata are placed in depressions where air humidity can be high due to limited access to wind. OR 1
- It has the least number of stomata, so less water vapour can be lost. 1
- (Any 2)
- (ii) The loss of water vapour from the aerial parts of a plant, mainly/usually through the stomata in the 1
leaves. OR
- The loss of water vapour from a plant, mainly/usually through the stomata in the leaves.
3. (a) (i) During exercise, muscle cells require more energy. 1
- Oxygen cannot be supplied to the muscle cells fast enough to meet the demand. 1
- Muscle cells carry out anaerobic respiration which produces lactic acid. 1
- Lactic acid accumulates in the cells and diffuses into the blood eventually. 1
- (ii) Oxygen debt. 1
- The shaded area indicates the volume of oxygen required to oxidise lactic acid and convert it to glucose 1
in the liver.
- (iii) As lactic acid accumulates in the body, muscular pain, cramps and fatigue can occur. 1
- (b)
$$6\text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6 \longrightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}$$
- (c) Alveolar wall is one-cell thick to allow rapid diffusion of gases. 1
- The internal surfaces of the alveolar wall is covered by a thin film of moisture to allow gases to dissolve 1
before diffusing across the alveolar wall.
- The alveoli are supplied with a dense network of blood capillaries to maintain the concentration gradient 1
between gases in blood and in alveolar air.
- The alveoli have a large surface area to volume ratio for faster exchange of gases. 1
- (Any 2)
4. (a) (i) Enzymes are biological catalysts made of proteins found in every form of life. 1

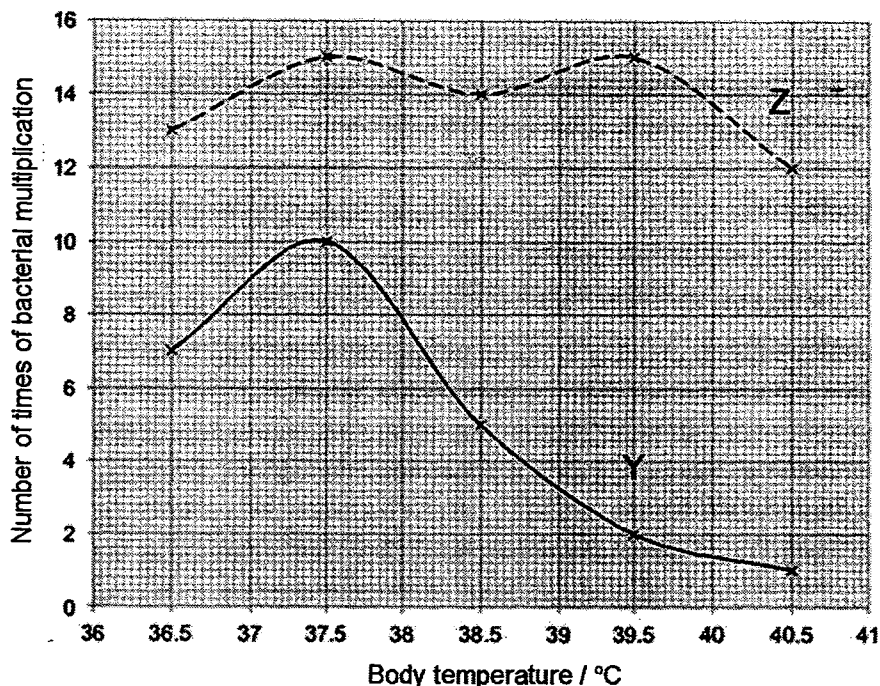
- | | | |
|--|---|--|
| Some/not all (reject: most) enzymes in the human body help digestion. | 1 | |
| (ii) Volume of water used / size of stain / time taken for the experiment / type of cloth used / type of stain / pH / amount of washing powder / concentration of enzyme / concentration of substrate
(Any 2) | 2 | |
| (iii) Yes. | 1 | |
| Concentration/amount of substrate/stain is the limiting factor OR
Concentration/amount of Zio/enzyme is not a limiting factor | 1 | |
| (b) (i) pH 6 | 1 | |
| (ii) trypsin; pH 8 | 1 | |
| (iii) No. | 1 | |
| The pepsin enzymes are denatured when kept at pH 8. | 1 | |
| 5. (a) The water at point A is cleaner/unpolluted/less polluted. OR
The water at point B is dirtier/polluted/more polluted than point A. | 1 | |
| (b) Untreated sewage contains bacteria/viruses/pathogens/disease-causing microorganisms.
The use of contaminated river water will lead to diseases. | 1 | |
| (c) (i) Algae/eutrophication | 1 | |
| (ii) Dissolved oxygen in the river is depleted/used up/insufficient. | 1 | |
| (iii) Source of nitrogen OR for synthesis of amino acids/proteins | 1 | |
| (d) (i) Species Y. | 1 | |
| It is nearest to the surface of the river where it can receive sunlight for photosynthesis. | 1 | |
| (ii) | 2 | |



(1 mark for shape; 1 mark for labels)

Answer both questions in the spaces provided.

6. (a)



axes are labelled correctly with titles and units

points are plotted accurately

graph occupies at least half of the grid

both graphs are labelled and drawn smoothly

(b) Infection by bacteria Z is more severe.

As the body temperature increased from 37.5 °C to 40.5 °C, bacteria Z's rate of multiplication decreased slightly from 15 to 12 while bacteria Y's rate of multiplication decreased tremendously from 10 to 1.

At higher body temperatures, bacteria Z's population remains high while bacteria Y's population is reduced.

(c) Phagocytes can engulf and ingest the bacteria.

Lymphocytes can release antibodies which can puncture/rupture the walls of the bacteria and neutralise the bacterial toxins.

7. (a) Parental phenotype: Green x Green
 Parental genotype: Gg x Gg
 Gametes: (G) (g) (G) (g)
 F1 generation:
 genotype: GG Gg Gg gg
 phenotype: Green Green Green Yellow
 Phenotypic ratio: Green : Yellow
 3 : 1

Correct parental phenotype and genotype – [1]

Gametes are circled separately – [1]

Correct F1 genotype and phenotype – [1]

Correct phenotypic ratio – [1]

(b) Ultraviolet (UV) light is a mutagen/agent of mutation OR The albino seedlings could have resulted from a mutation . In the allele/gene that is responsible for pigment production.	1 1 1
(c) Genotype of Q: Bb Q has a brown coat , so it has at least one B allele . Since the Q's mother has a white coat, it has a homozygous recessive genotype. As a result, Q will inherit one b allele from its mother .	1 1
8E (a) As blood passes through respiring/oxygen-poor tissues , carbon dioxide diffuses into blood and enters the red blood cells . In the red blood cells, carbon dioxide reacts with water to form carbonic acid , with the help of carbonic anhydrase . The carbonic acid is converted into hydrogencarbonate ions , which diffuse out into the plasma . Most of the carbon dioxide is carried as hydrogencarbonate ions in plasma , while a small amount of carbon dioxide is dissolved and carried in the red blood cells . In the lungs, the hydrogencarbonate ions diffuse into the red blood cells and converted back into carbonic acid , and then into water and carbon dioxide . The carbon dioxide diffuses out of the red blood cells and blood capillaries into the alveoli to be expelled during exhalation .	1 1 1 1 1 1 1 1 1 1
(b) Carbon sinks are areas that store more carbon compounds than they release for an indefinite period of time . Oceans and forests are carbon sinks. Carbon dioxide is removed from the atmosphere by photosynthesis in plants and phytoplanktons. Carbon dioxide also dissolves in the ocean water .	1 1 1 1 1
8Q (a) corrective mechanism / process; reverses the effect of the stimulus / reverse changes to the norm	1 1
(b) high secretion of ADH increased permeability of the walls of the collecting ducts in the kidneys to water OR the walls of the collecting ducts in the kidneys become more permeable to water large amount of water / more water is reabsorbed into the bloodstream	1 1 1 1 1
(c) Dialysis solution/fluid has the same composition of glucose / amino acids as healthy blood; so that essential substances would not diffuse out of the blood into the dialysis solution/fluid. Dialysis solution/fluid flow in opposite directions to the flow of blood Dialysis solution/fluid does not contain urea to maintain concentration gradient to remove urea by diffusion	1 1 1 1 1 1 1

End of Answers

