| Name | Class | | | | Index Number | | |
|---|---|---|---|---|---|---|---|

# BROADRICK SECONDARY SCHOOL
## SECONDARY 4 EXPRESS
## PRELIMINARY EXAMINATION 2019

## BIOLOGY 6093/01

Paper 1 Multiple Choice Sep 2019

Additional Materials: Multiple Choice Answer Sheet 1 hour

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid
Write your name, index number and class on the OTAS answer sheet.

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

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.

This question paper consists of **20** printed pages including this page.

**[Turn over**



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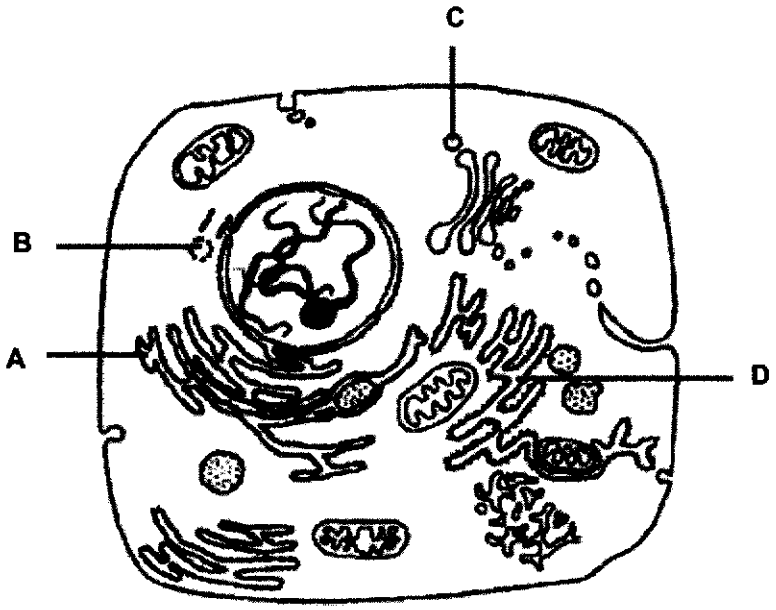
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1. Which of the following is found in all living cells?

   **A** centrioles and nucleus
   **B** chloroplast and protoplasm
   **C** golgi apparatus and cell membrane
   **D** vacuole and cell wall

2. The diagram below shows a general animal cell.
   Which of the structures would be involved in the final secretion of digestive enzymes from this cell?




3. A few leaves of purple cabbage were placed in a beaker of water for 10 minutes. The water remained colourless after the 10 minutes.
   The beaker was then heated to 100°C for 5 minutes. After boiling, the water turned purple.

   Which of the following best explains this observation?

   **A** The pigments gained more kinetic energy upon heating and were able to diffuse out of the leaves quickly, hence the coloured water in just 5 minutes.

   **B** The cell walls were denatured upon heating, allowing the pigment to diffuse into the water.

   **C** During the boiling, the cell membranes were damaged, hence allowing the pigment to diffuse into the water.

   **D** Heating increases the solubility of the pigment, thus colouring the water purple.



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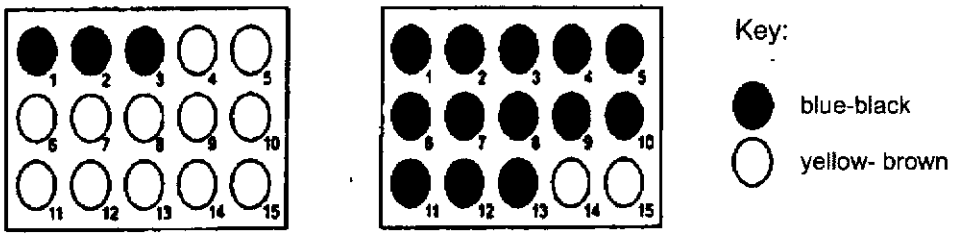
4. Which of these processes require energy from respiration?

| | Diffusion | Osmosis |
|---|---|---|
| A | ✓ | ✓ |
| B | ✓ | × |
| C | × | ✓ |
| D | × | × |

**Key:**
**✓ energy required**
**× energy not required**

5. An experiment was carried out to investigate the digestion of starch using amylase at two different temperatures, $10^0$C and $40^0$C. A sample is taken every 15 seconds and placed into each well as shown below.

Each well contains 2 drops of iodine solution and 15 samples were taken from each temperature condition.
The results are shown below.




Which of the following shows the correct temperatures and times for the complete digestion of starch?

| | Temperature / $^0$C | time/s |
|---|---|---|
| A | 10 | 60 |
| | 40 | 210 |
| B | 10 | 210 |
| | 40 | 60 |
| C | 40 | 45 |
| | 10 | 195 |
| D | 40 | 195 |
| | 10 | 45 |

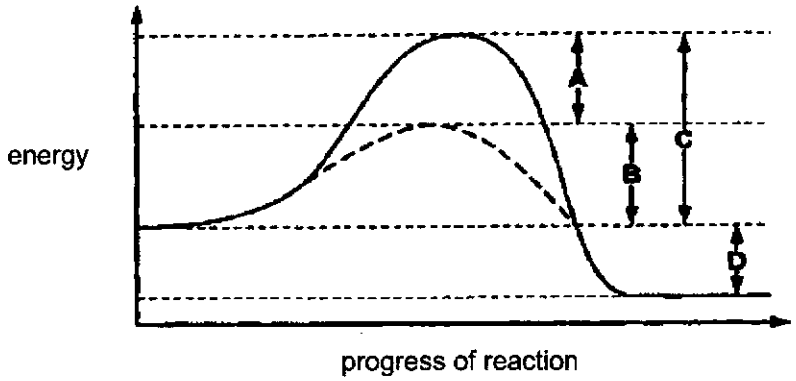


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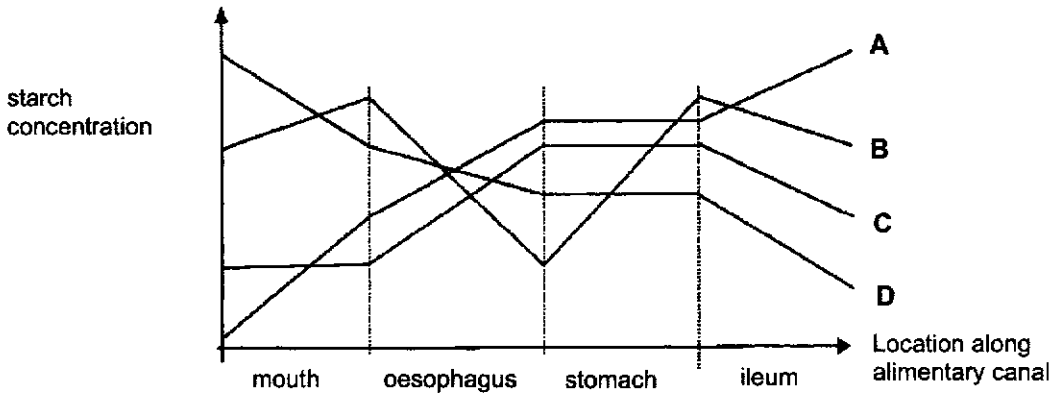
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6. The graph shows changing energy levels during a reaction, with and without the presence of the enzyme specific to this reaction.

What is the activation energy of the reaction without the presence of the enzyme?




7. Which graph represents the activity of amylase in starch digestion?



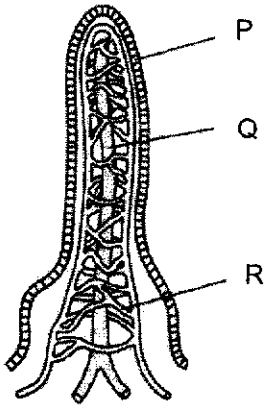



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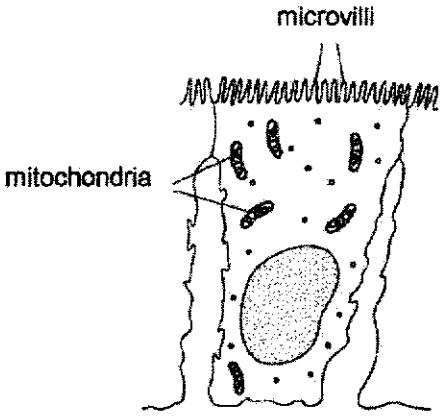
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8. The diagrams show a villus from the small intestine and an enlarged view of a cell from region P.




magnification x110




magnification x2600

Which statement is correct?

**A** Amino acids are absorbed through the microvilli and used by the cell for aerobic respiration.
**B** Fats diffuse into P and enter Q to be distributed.
**C** Mitochondria releases energy for the active transport of proteins into R.
**D** Microvilli increases surface area to volume ratio of P for the absorption of glucose into R.

9. A photosynthetic plant was given the radioactive isotope of oxygen, $O^{18}$.
Where would this isotope be eventually located?

**A** the starch grains in the mesophyll cells
**B** the oxygen gas given out by photosynthesis
**C** the carbon dioxide formed in respiration
**D** the glucose made from photosynthesis

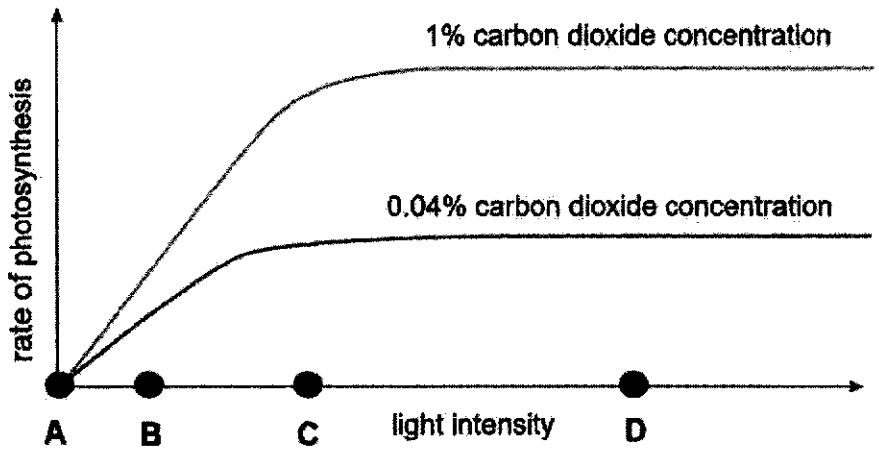


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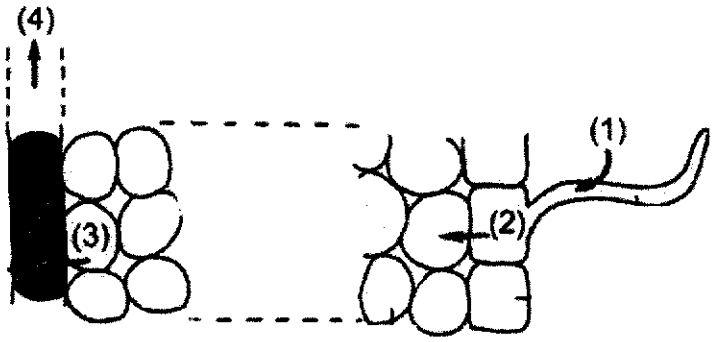
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**10.** The graph below shows how the rate of photosynthesis in a plant varies with light intensity at two different carbon dioxide concentrations. The temperature is kept constant at 20°C.

At which light intensity is light **not** a limiting factor at both 0.04% and 1% carbon dioxide concentration?




**11.** The diagram below shows the pathway of water movement from the soil into the root of a plant.




Osmosis occurs in _____.

**A** (1) and (2) only

**B** (1) , (2) and (3) only

**C** (2) , (3) and (4) only

**D** (1), (2), (3) and (4)

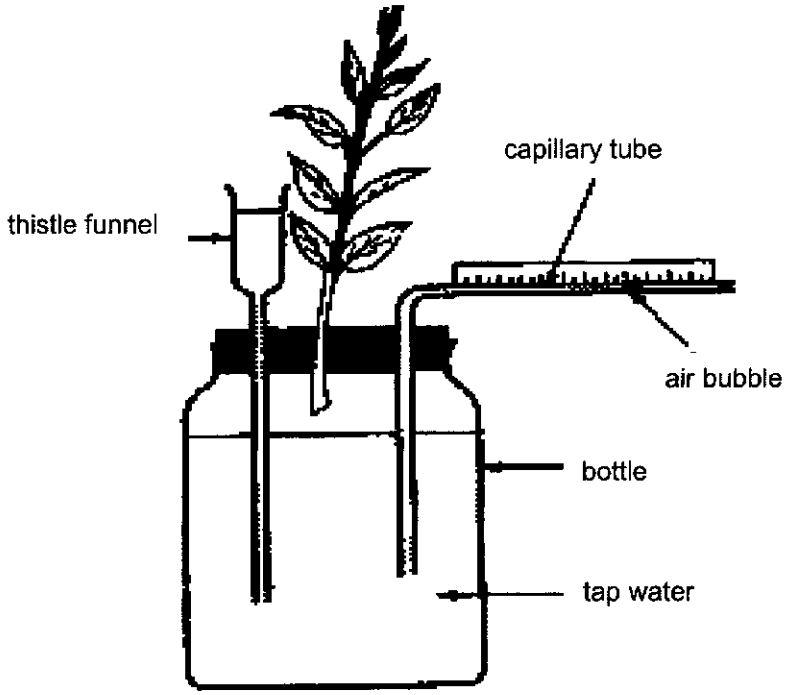


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**12.** The diagram below shows an experiment set-up to measure the rate of transpiration of a shoot.




There were several mistakes in the above experimental set-up.
Which of the following are the corrections that have to be made?

I The bottle should be completely filled with water.
II A tap funnel should be used instead of a thistle funnel.
III The end of the shoot should be completely immersed in water.
IV Dilute hydrogencarbonate solution should be used instead of tap water to provide a source of carbon dioxide to the shoot.

**A** I and III
**B** II and III
**C** I, II and IV
**D** II, III, IV



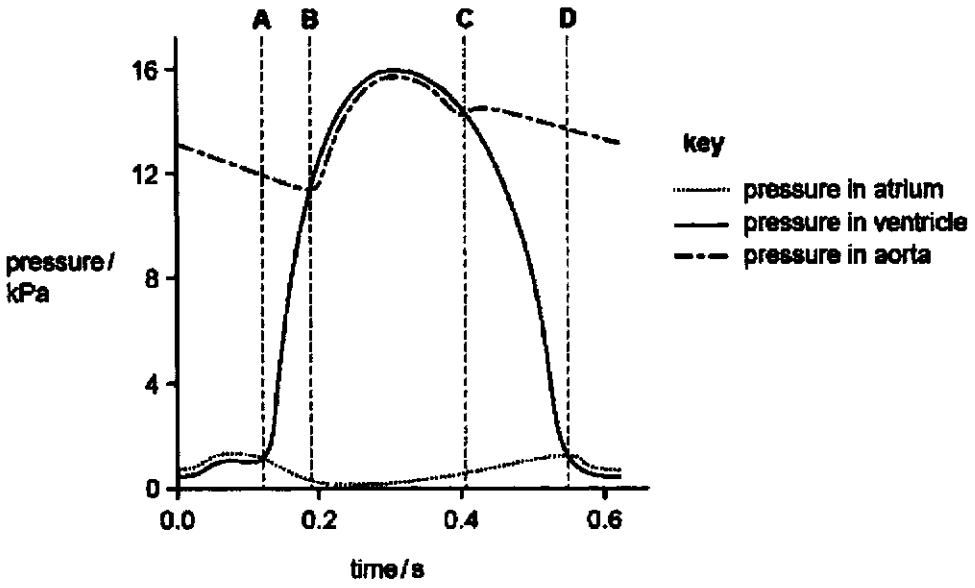
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**13.** The graph below shows the pressure changes in the left side of the heart during a single heartbeat.

At which point A to D, is the atrioventricular/bicuspid valve pushed close?




**14.** A certain genetic disease results in the inability to produce prothrombin.
Which symptoms will the patients suffering from this disease most likely have?

**A** aching muscles and insomnia
**B** fatigue and breathlessness
**C** headaches and chronic diarrhoea
**D** nosebleeds and blood in urine

**15** Which reaction is catalyzed by carbonic anhydrase when red blood cells pass through the lungs?

**A** $CO_2 + H_2O \rightarrow H_2CO_3$
**B** $HCO_3^- + H^+ \rightarrow H_2CO_3$
**C** $H_2CO_3 \rightarrow CO_2 + H_2O$
**D** $H_2CO_3 \rightarrow HCO_3^- + H^+$



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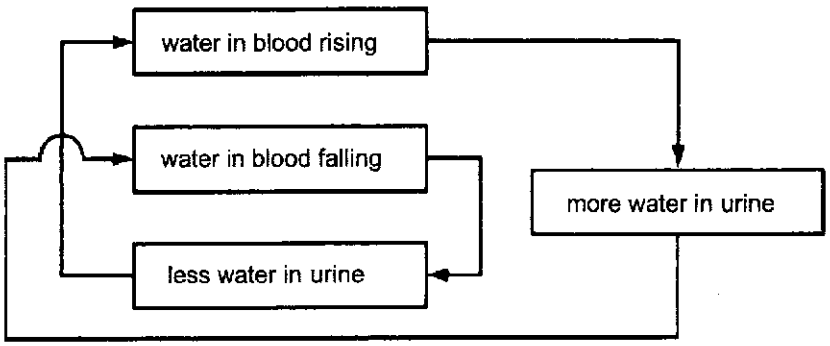
**16.** Some effects of tobacco smoking are listed below.

1 Bronchitis
2 Uncontrolled division in some cells
3 Increase in alertness
4 Increase in heart rate
5 Increase in mucus production
6 Increase in blood pressure

Which effects are caused by nicotine and tar respectively?

| | nicotine | tar |
|---|---|---|
| **A** | 1, 2 and 5 | 4 and 6 |
| **B** | 3 and 6 | 1 and 5 |
| **C** | 3, 4 and 6 | 1, 2 and 5 |
| **D** | 1, 2 and 4 | 3, 5 and 6 |

**17.** The diagram refers to the control of water potential in blood.
Which statement best explains why this is a negative feedback system?



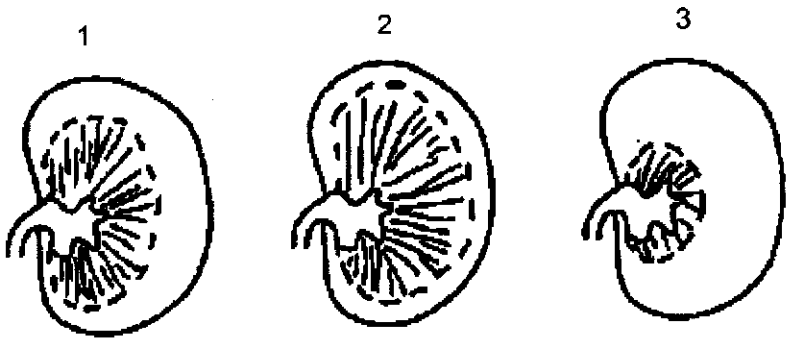

**A** It decreases the amount of water in blood.
**B** It increases any change in the amount of water in blood.
**C** It increases the amount of water in blood.
**D** It reverses any change in the amount of water in blood.



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18. The diagrams show vertical sections of kidneys of coypu, brown rat and kangaroo rat, showing the relative sizes of cortex and medulla.




Coypu are found in fresh water and are never short of water to drink. Brown rats are able to go some days without drinking. Kangaroo rats are able to live in deserts without drinking at all.

Which kidney 1, 2 or 3 is suitable for coypu, brown rats and kangaroo rats in order for them to adapt to their living environment?

| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | brown rat | coypu | kangaroo rat |
| **B** | brown rat | kangaroo rat | coypu |
| **C** | kangaroo rat | brown rat | coypu |
| **D** | kangaroo rat | coypu | brown rat |

19. Which factors are controlled by homeostasis?

| | Temperature in the stomach | pH in the duodenum | Glucose concentration in blood | Water content in the ileum |
|---|---|---|---|---|
| **A** | √ | × | √ | × |
| **B** | √ | × | × | √ |
| **C** | × | √ | √ | √ |
| **D** | × | × | √ | × |

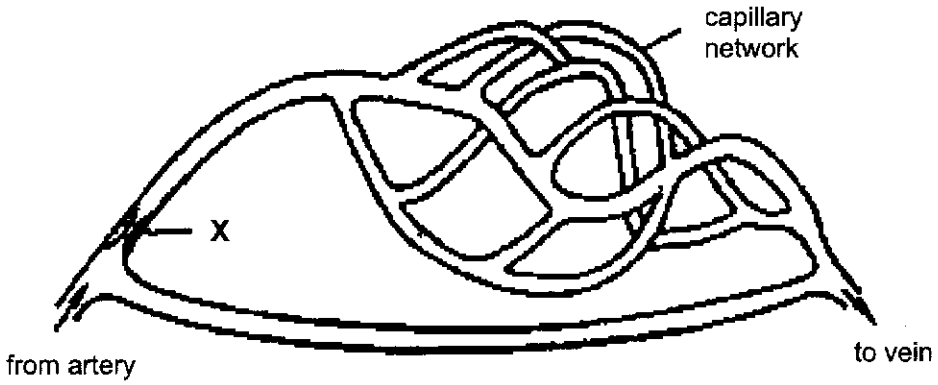


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**20.** The diagram below shows a capillary network in the dermis of the skin.




Which one of the following would be the direct result of the relaxation of the muscle labelled **X**?

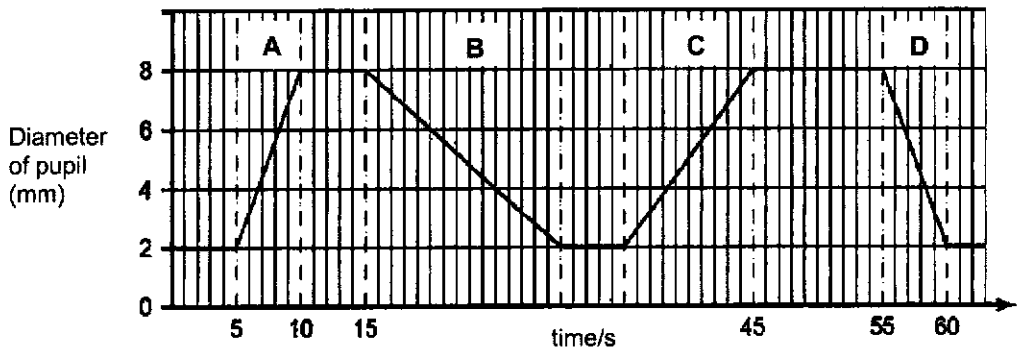
**A** greater heat loss

**B** shivering

**C** raising of skin hair

**D** raising the body temperature

**21.** The diameter of a person's pupil is measured as the light intensity is varied. During which time period does the light intensity increase fastest?

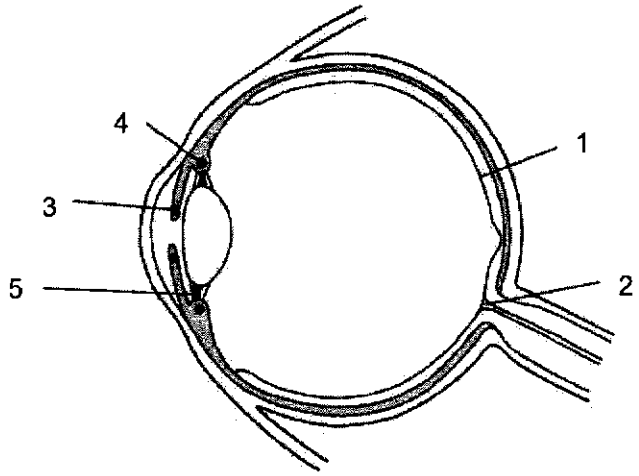





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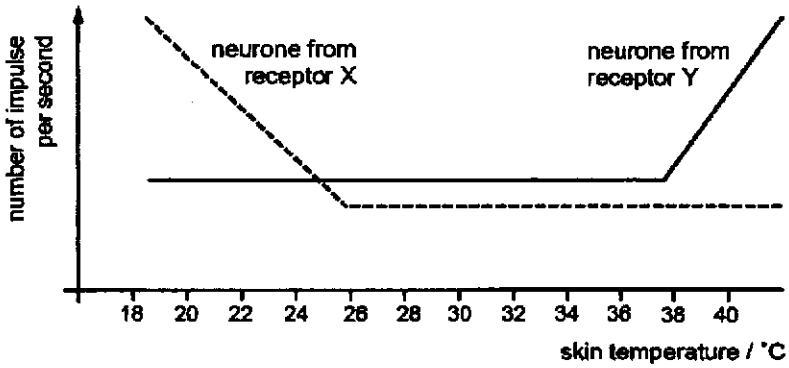
**22.** The diagram shows a section through the eye.




Which labelled structures are effectors and which are receptors?

| | effectors | receptors |
|---|---|---|
| **A** | 1 | 4 |
| **B** | 3 | 2 |
| **C** | 5 | 3 |
| **D** | 4 | 1 |

**23.** The graph shows the number of nerve impulses per second travelling along two sensory neurones from the skin to the brain, labelled as receptors X and Y, at different skin temperatures.




Which of the following statements best illustrates the graph?

**A** Receptor X responds most strongly to temperatures above 18°C.

**B** Receptor Y responds most strongly to temperatures above 38°C.

**C** Receptor X and Y respond most strongly outside the range of 26°C to 38°C.

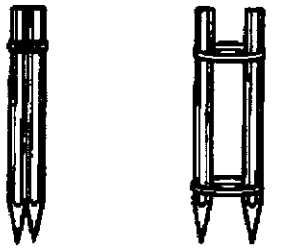
**D** Receptor X and Y respond most strongly at temperatures between 26°C to 38°C.



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**24.** During an experiment, a student was blindfolded.
The skin on his fingertip, the palm of his hand and his forearm were then touched several times by two pencil points, either one centimeter or two centimetres apart.



1 cm apart  2 cm apart

During the record of results, there were instances when he inaccurately said he had only been touched by one point.
The table below shows the number of times he accurately said that he had been touched by two points.

| distance between pencil points / cm | % number of times he felt two pencil points | | |
|---|---|---|---|
| | fingertip | palm | forearm |
| 1 | 100 | 5 | 20 |
| 2 | 100 | 75 | 30 |

Which of the following conclusions could be made from the above results?

**A** Only a few touch receptors were present in the skin of the palm.

**B** No touch receptors were present on the skin of the forearm.

**C** Touch receptors were the furthest apart in the skin of the forearm.

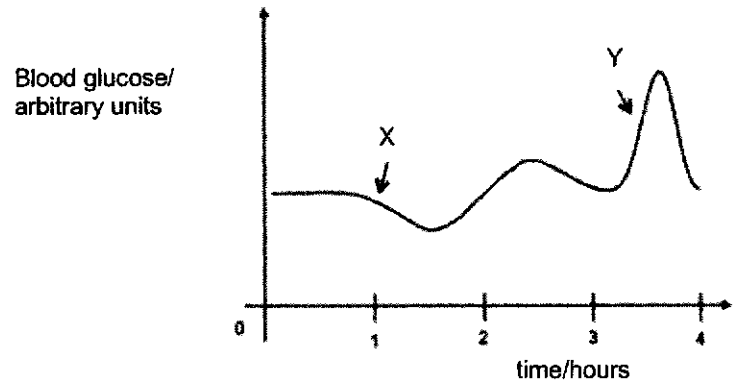
**D** Touch receptors were closest together in the skin of the fingertip.



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25. The graph below shows changes in a person's blood glucose concentration over a four-hour period.




What causes the changes at X and Y?

| | X | Y |
|---|---|---|
| **A** | decreased insulin | Increased adrenaline |
| **B** | increased insulin | decreased adrenaline |
| **C** | increased insulin | Increased glucagon |
| **D** | increased insulin | Increased adrenaline |

26. Dentists inject the drug procaine into gums so that they can drill into teeth without causing pain.
What is the most probable reason for procaine preventing pain?

**A** It prevents the brain from interpreting impulses from the teeth.

**B** It prevents impulses passing along the sensory neurones to the brain.

**C** It blocks the synapses between the sensory neurones and motor neurones.

**D** It makes the tissues of the gums numb.

27. Which of the following statements about a hormone is correct?

I It is transported in the blood.
II It is secreted by an endocrine gland.
III It is under both voluntary and involuntary control.

**A** I and II only

**B** II and III only

**C** I and III only

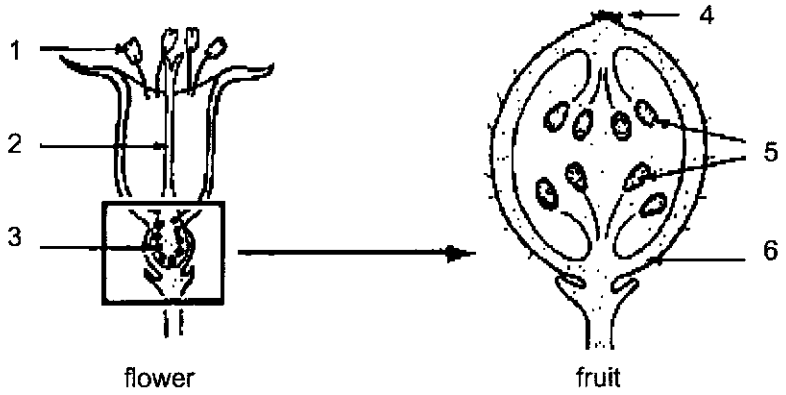
**D** I, II and III



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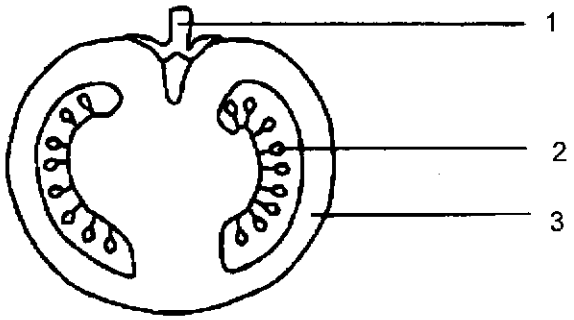
**28.** The diagram shows the development of a flower into a fruit.




Where does meiosis occur?

**A** 5 only
**B** 1 and 3 only
**C** 2 and 4 only
**D** 5 and 6 only

**29.** The diagram shows a vertical section of a tomato fruit.




Which of the following correctly identifies the floral parts from which structures 1, 2 and 3 have developed?

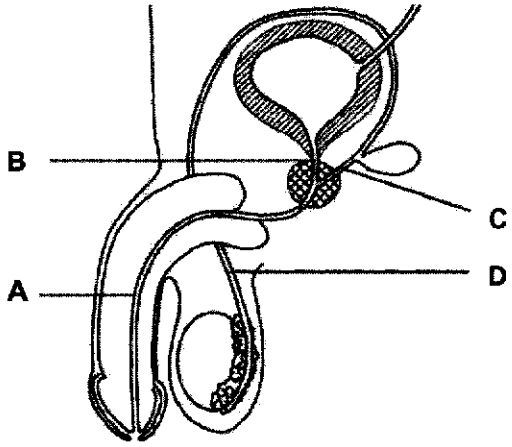
| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | style | ovary | ovule |
| **B** | style | ovule | ovary |
| **C** | pedicel | ovule | ovary |
| **D** | pedicel | ovary | ovule |



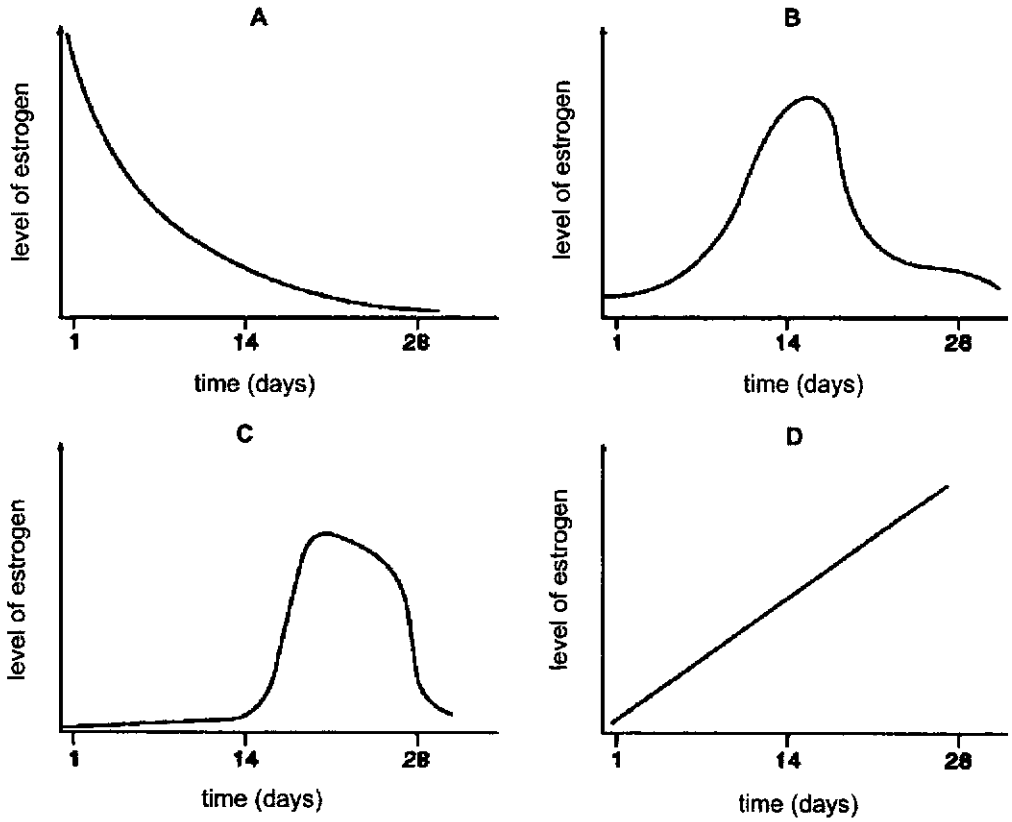
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**30.** A surgical method of birth control involves cutting some of the tubes through which sperm pass.
At which point does the surgeon make the cuts?




**31.** The level of estrogen in the blood of a woman changes during a normal menstrual cycle. Which graph shows these changes?



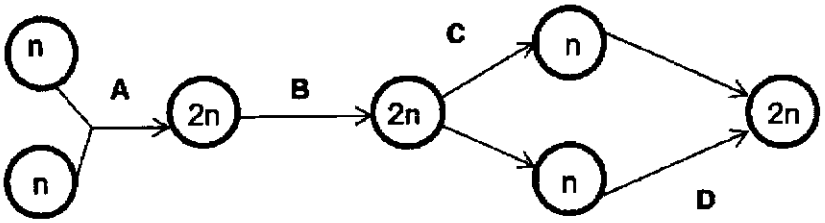



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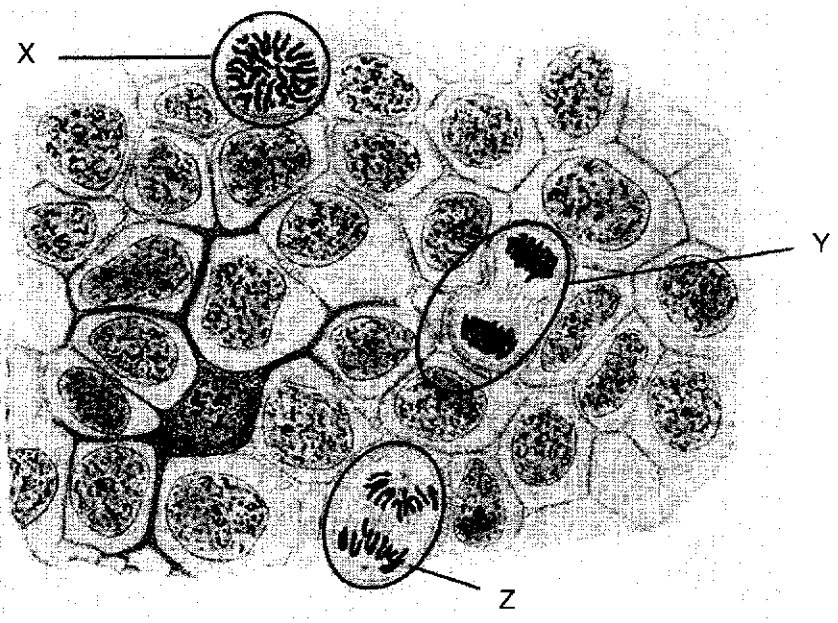
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**32.** The diagram below shows the life cycle of an animal. At which stage in the life cycle does mitosis occur?




**33.** The diagram shows some animal cells undergoing various stages of mitosis.




Which stages of mitosis are occurring in the cells X, Y and Z?

| | X | Y | Z |
|---|---|---|---|
| **A** | anaphase | metaphase | interphase |
| **B** | interphase | telophase | anaphase |
| **C** | metaphase | anaphase | prophase |
| **D** | prophase | telophase | anaphase |



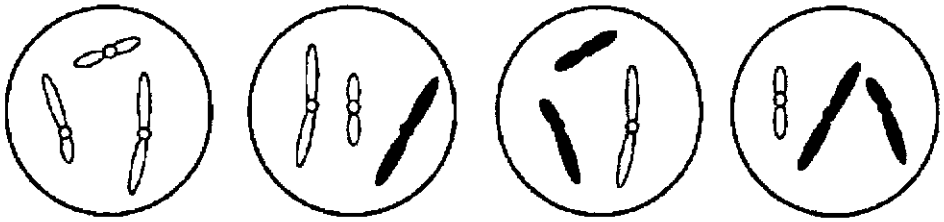
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**34.** The diagram below represents the nucleus of a body cell from an organism.



Which diagram does **not** represent a possible gamete nucleus produced by the organism?




**35.** A DNA molecule consists of 4000 nucleotides, of which 20% contain the base adenine.
How many of the nucleotides in this DNA molecule will contain guanine?

**A** 800
**B** 1000
**C** 1200
**D** 1600

**36.** Bacteria are used in genetic engineering. A plasmid is used to transfer the required DNA into the bacterium.
What is the term used to describe the role of plasmid in this technology?

**A** recombinant
**B** transgenic
**C** host
**D** vector

**37.** Huntington's Disease is an inherited condition in humans caused by a dominant allele. A woman's father is heterozygous for the condition. Her mother is not affected by the condition.
What is the chance of the woman being affected by the condition?

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

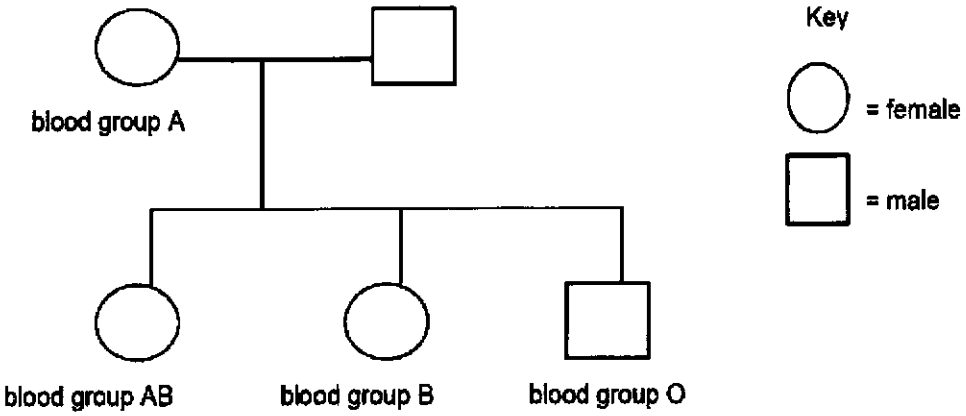


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38. The diagram below shows the blood group phenotypes of some members of a family.




What are the blood group genotypes of the parents?

| | father's genotype | mother's genotype |
|---|---|---|
| **A** | $I^BI^B$ | $I^AI^B$ |
| **B** | $I^BI^O$ | $I^AI^A$ |
| **C** | $I^BI^O$ | $I^AI^B$ |
| **D** | $I^BI^O$ | $I^AI^O$ |

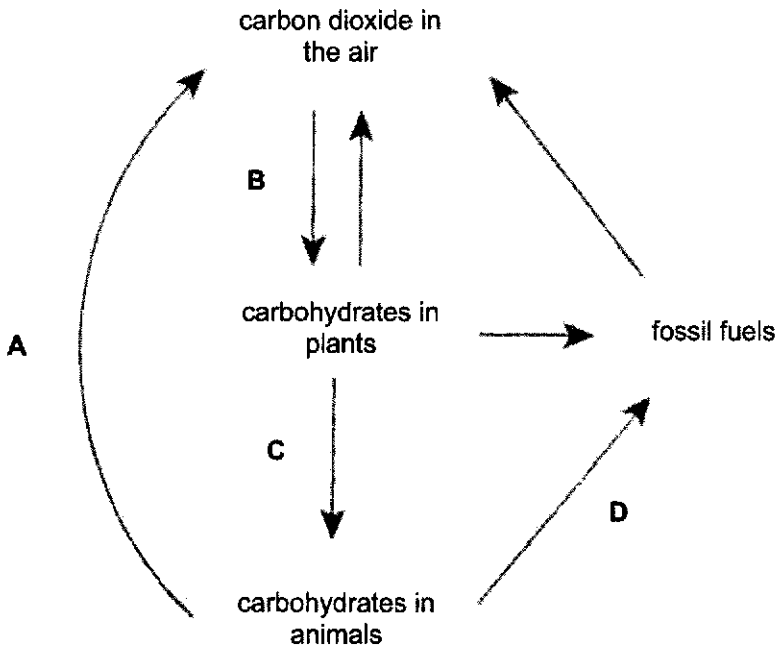


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**39.** The diagram shows some of the processes which take place during the carbon cycle.

Which labelled part of the cycle may involve bacteria and fungi?




**40.** The table shows the results of a field study of four species in a food chain in an area of woodland.

| species | number of individuals | biomass of one individual (arbitrary units) |
|---|---|---|
| R | 10,000 | 0.1 |
| S | 5 | 10.0 |
| T | 500 | 0.002 |
| U | 5 | 300 000.0 |

What is the energy flow in the chain?

**A** R → T → S → U
**B** R → T → U → S
**C** U → S → R → T
**D** U → R → S → T

**End of Paper 1**



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# BROADRICK SECONDARY SCHOOL
## SECONDARY 4 EXPRESS
## PRELIMINARY EXAMINATION 2019

**BIOLOGY** **6093/02**

Paper 2 Theory

Sep 2019

Candidates answer on the Question Paper

No Additional Materials are required.

1 hour 45 minutes

**READ THESE INSTRUCTIONS FIRST**

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

**Section A**
Answer **all** questions.

**Section B**
Answer all the questions. Question 9 is an Either/Or question.
Write your answers in the spaces provided on the Question Paper.
You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

Candidates are reminded that **all** quantitative answers should include appropriate units.
The use of an approved scientific calculator is expected, where appropriate.

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

| For examiner's use | |
|---|---|
| P2 | / 80 |

This question paper consists of **19** printed pages including this page.

**[Turn over**



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## Section A (50 marks)

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

1 **(a)** Define the term *translocation.* [2]

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**(b)** The figure below shows a scanning electron micrograph of a type of vascular tissue found in plants.

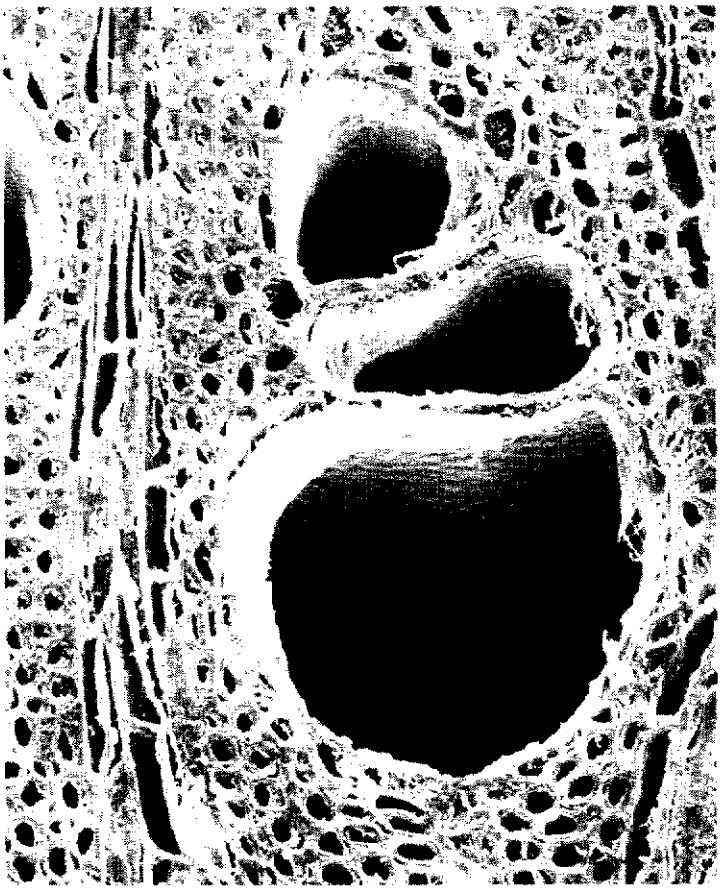


**Fig 1.1**



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**(i)** Name the vascular tissue. [1]

.....

**(ii)** With reference to **Fig. 1.1**, describe two ways that these vascular tissues are adapted to their functions. [2]

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**(c)** Some weedkillers stop the plant from photosynthesising. These are often applied to the soil where the weeds are growing. [4]

Explain how the weedkiller reaches its site of action in the leaves.

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[Total:9m]

**2** **(a)** State what is meant by the term 'activation energy'. [1]

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**(b)** Fig 2.1 shows a section of photographic film.

The top layer is made of silver particles embedded in a layer of gelatine which is a type of protein.

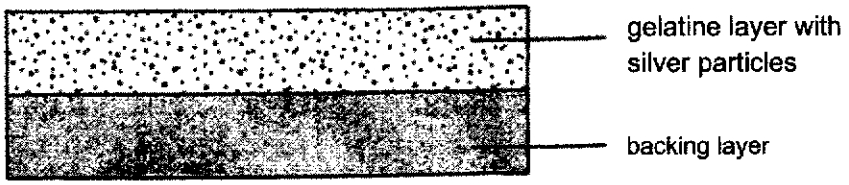



**Fig 2.1**

In an investigation, a 20 mm length of photographic film was placed in each of three boiling tubes.

- The film was immersed in 20cm$^3$ water.
- 1 cm$^3$ of liquid at different pH values was added to the boiling tubes.
- 1 cm$^3$ of protease solution was added to each boiling tube.
- Each boiling tube was shaken gently to mix the contents.
- Each boiling tube was kept at 37$^0$C for 1 hour.

Fig 2.2 shows the apparatus and the results of the investigation.

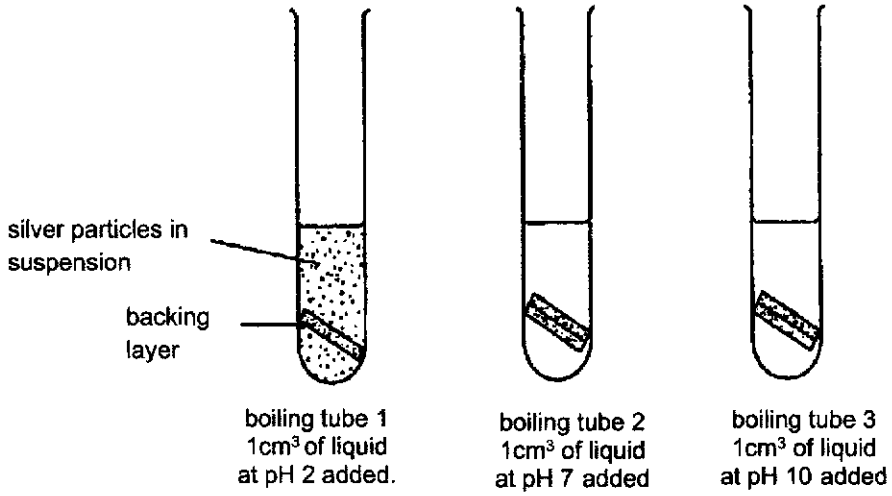



**Fig 2.2**



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**(i)** Explain the difference in results obtained between boiling tube 1 and boiling tubes 2 and 3. [3]

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**(c)** Carbon dioxide is released during respiration in all living cells in the human body. [3]
Describe the role of carbonic anhydrase in the excretion of carbon dioxide from the lungs.

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[Total:7m]



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3 The figure below shows the relationship between air temperature and the body temperature of an insect.

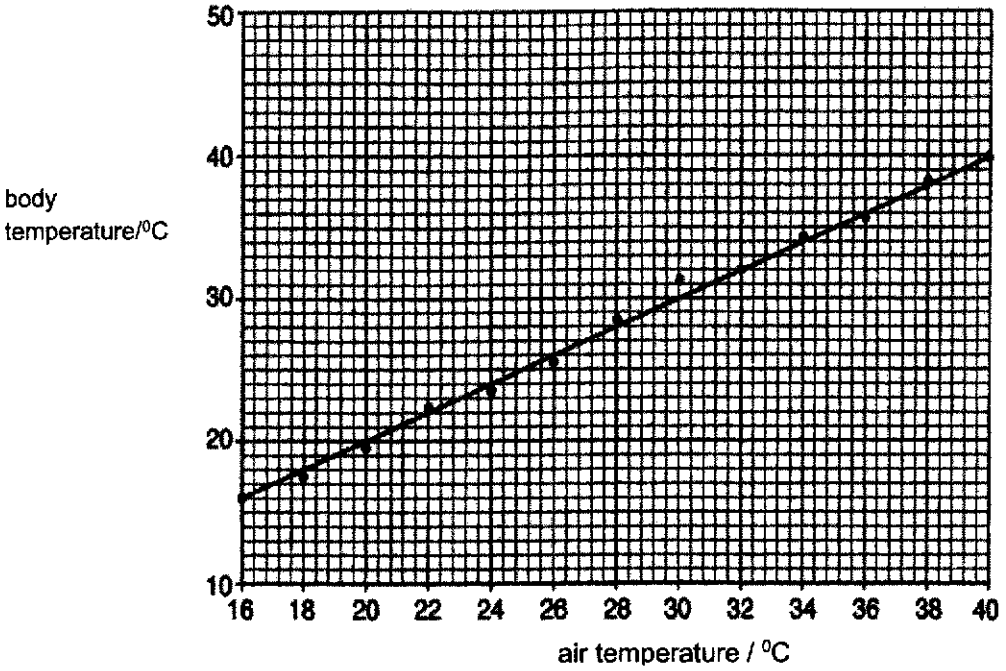



**Fig. 3.1**

**(a)** State the change in the body temperature of the insect as air temperature changes from 16$^0$C to 40$^0$C, as shown in Fig 3.1 [1]

.....

**(b)** State two conclusions which may be drawn from Fig 3.1. [2]

1 : .....

.....

2 :.....

.....

**(c)** Sketch a line on Fig 3.1 to show the body temperature of an adult human between air temperatures of 20$^0$C and 36$^0$C. [2]

Show answer on the graph of Fig. 3.1.



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**(d)** Describe the role of insulin in regulating blood glucose concentration in the human body. [3]

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[Total:8m]

**4** **(a)** Define the term *excretion* and explain its importance. [2]

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**(b)** Fig 4.1 shows a kidney tubule and its blood supply.

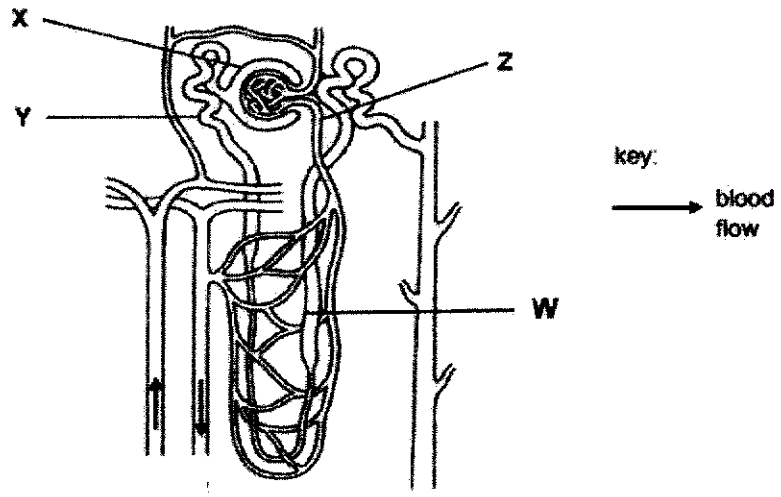



**Fig 4.1**

**(i)** Name the structure labelled Z on Fig 4.1. [1]

.....



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(ii) Using an **'A'**, indicate on the structure(s) in Fig 4.1, where the anti-diuretic hormone (ADH) act(s) on during homeostasis. [1]

(c) Table 4.1 below shows the composition of a liquid taken from part X and W of the kidney nephron above.

| substance | composition/ g per $100cm^3$ | |
|---|---|---|
| | X | W |
| glucose | 0.100 | |
| urea | 0.100 | 0.500 |

**Table 4.1**

(i) Complete Table 4.1 to show the glucose content at region W. [1]

(ii) Explain your answer to c(i). [2]

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(iii) Explain the difference in the urea concentration between regions X and W. [2]

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(d) Anti-diuretic hormone (ADH) is involved in the prevention of dehydration. [3]
Explain how ADH reduces water loss from the body.

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[Total:12m]



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**5** Fig 5.1. shows the transfer of energy through a food web in a pond ecosystem.

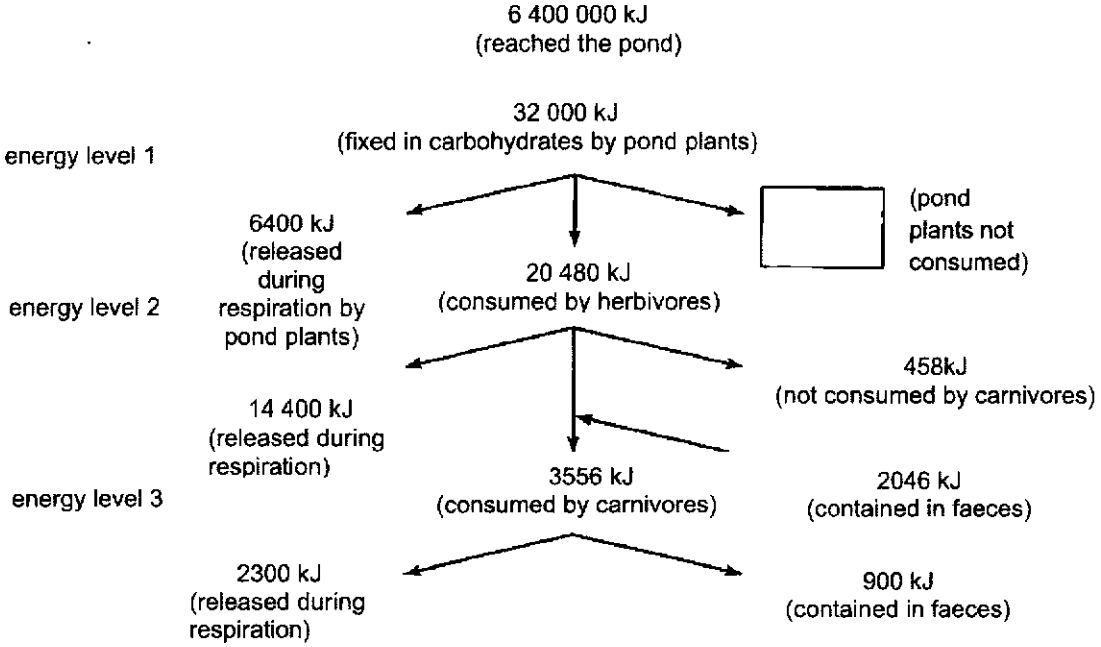



**Fig. 5.1**

**(a)** State the process that converts the energy from sunlight into carbohydrates. [1]

.....

**(b)** Calculate the percentage of energy from sunlight that was eventually fixed into carbohydrates. Show your working. [2]

..... %

**(c)** Calculate the amount of energy in the pond plants that remained unconsumed by herbivores. Show your working. [2]

..... kJ



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(d) Explain why food chains and food webs rarely exceed five trophic levels. [3]

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[Total: 8]

6 (a) The diagram below shows a pair of homologous chromosomes during meiosis. P and Q show points where crossing over ***may*** occur. The other letters show the positions of the alleles of four genes.

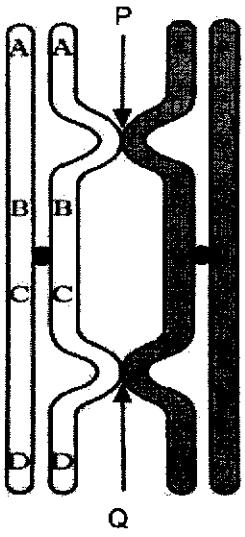



**Fig 6.1**

(i) What evidence confirms that these chromosomes are homologous? [2]

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**(ii)** What name is given to points P and Q? [1]

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**(iii)** State the importance of crossing over in meiosis. [1]

.....

.....

**(b)** State two places in plants where meiosis takes place. [2]

1. .....
2. .....

[Total:6m]

**-End of Section A**



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## Section B (30 marks)

Question **7** and **8** are compulsory questions.
Question **9** is in the form of an **Either/Or** question.
Only one part should be answered.

**7** Germination is the process by which the plant grows from a seed. It results in the formation of a seedling. Germination of seeds requires both external and internal conditions such as temperature, water, light and air. Cells of germinating seeds were found to have high levels of enzymatic activity.

The experiment in Fig. 7.1 is used to measure the changes in the volume of gases confined inside a flask of seeds that are germinating.

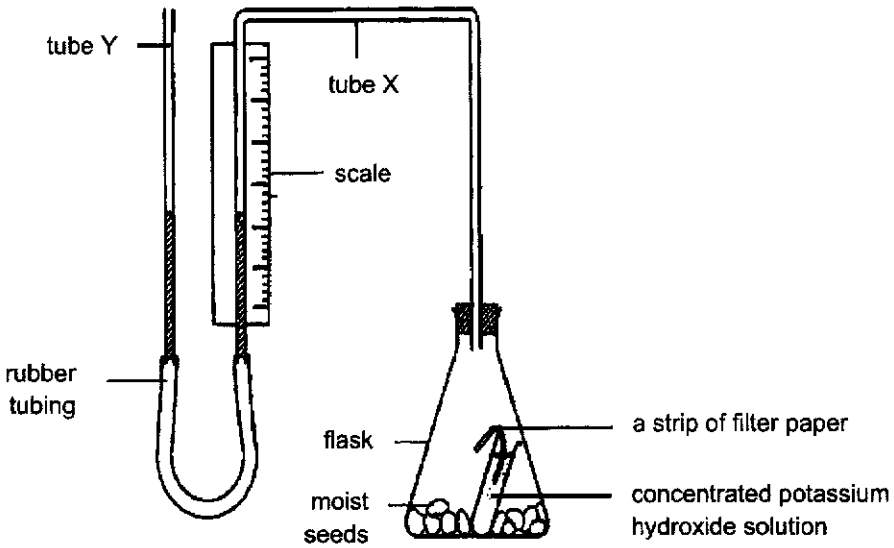



**Fig 7.1**

At half hour intervals, the liquid level in tube X is measured on the scale.



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The result is recorded in Table 7.2.

**Table 7.2**

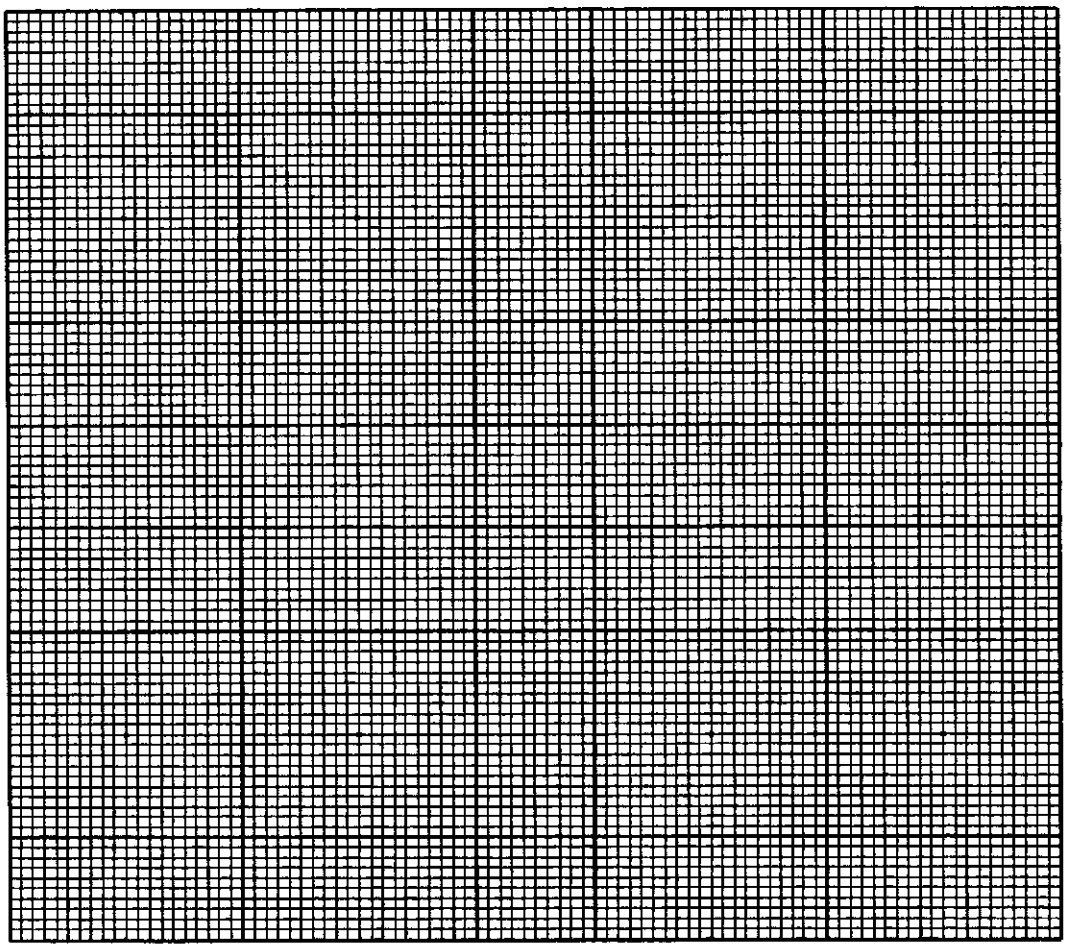
| time (h) | reading on scale that shows liquid level in tube X/ cm | volume changes of gases in flask/ arbitrary units |
|---|---|---|
| 0 | 2.3 | 0 |
| 0.5 | 3.1 | -0.8 |
| 1.0 | 3.9 | -1.6 |
| 1.5 | 4.8 | -2.5 |
| 2.0 | 5.6 | -3.3 |
| 2.5 | 6.4 | -4.1 |
| 3.0 | 7.0 | -4.7 |
| 3.5 | 7.3 | -5.0 |
| 4.0 | 7.3 | -5.0 |



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**(a)** Plot and draw a graph to show the volume changes of gases in flask against time taken. [4]



**(b)** Describe the relationship between the reading on the scale and the volume changes of gases in the flask. [1]

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**(c)** Describe and explain the volume changes occurring in the flask. [2]

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**(d)** Describe and explain the changes in the graph from the 3rd to 4th hour. [2]

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**(e)** A control is set up to show that the seeds undergoing germination cause the volume changes of gases in the flask. [1]

Suggest what could be done to stop the seeds from germinating.

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[Total:10m]

**8** **(a)** Describe the events that occur after a human egg cell is fertilised which enable it to develop and survive in the uterus. [5]

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**(b)** In humans, the ability to taste PTC paper, (paper impregnated with phenylthiocarbamide), is controlled by a dominant allele (T) and the inability to taste it is controlled by the recessive allele (t). [5]

Using a fully labelled genetic diagram, explain how, in a family with three children, only the mother and one child are unable to taste PTC.

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[Total:10m]



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**9 Either**

**9 (a)** Outline the relationship between gene, DNA and chromosome. [6]

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**(b)** Explain how meiosis and reproduction gives rise to new variations in offsprings. [4]

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[Total : 10m]



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**9 Or**

**(a)** Fig 9.1 shows a vertical section of the human heart.

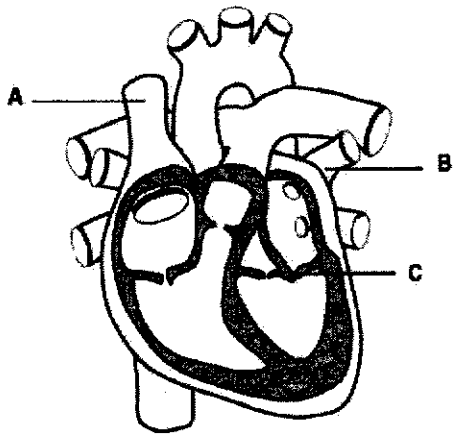



**Fig 9.1**

**(i)** Name the blood vessels: [2]

A: ..... B: .....

**(ii)** Describe the function of the part labelled C. [1]

.....

.....

**(iii)** Describe and explain how blood entering the heart from the body organs reaches the lungs. [5]

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**(b)** Explain, using a named example, what is meant by an endocrine gland. [2]

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[Total : 10m]

**-End of Paper-**



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# BROADRICK SECONDARY SCHOOL
## SECONDARY 4 EXPRESS
## PRELIMINARY EXAMINATION 2019

**BIOLOGY** **6093/02**

Paper 2 Theory Sep 2019

Candidates answer on the Question Paper 1 hour 45 minutes

No Additional Materials are required.

# ANSWERS

**Section A (50 marks)**

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

Paper 1(mcq)

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

1 (a) Translocation is the **transport** of food, such as **sugars and amino acids**(1m), [2]
synthesised by plants

Food is transported from leaves to **all parts of the plant**, in the **phloem tubes.**

( 1m)



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**(bi)** Xylem [1]

**(ii)** 1. lack of cross walls - allows continuous flow of water and mineral salts [2]

2. empty with no cytoplasm - allows continuous flow of water and mineral salts

3. lignin deposited on inner walls of xylem walls - provides mechanical support /strengthens wall to prevent collapse

award one mark for each feature plus its adaptation. (max 2 points)

**(c)** -weedkiller dissolves in water found in soil solution. [4]
-The root hair cells of the plant absorb water and the dissolved weedkiller by osmosis and diffusion respectively.
-Water and dissolved weedkiller move into xylem vessels in the roots down a concentration gradient.
-Xylem vessels transport water and weedkiller to all parts of plant, including leaf.
-In the leaf cells, weedkiller move from cell to cell by diffusion and exerts its effect. Plant stops photosynthesising.

(maximum 4 points)

[Total:9m]

**2** **(a)** The energy needed to start a chemical reaction [1]

**bi** In boiling tube 1, pH 2 is the optimum pH for protease to digest protease. (1m) [3]
This releases silver particles into suspension.(1m)
In boiling tubes 2 and 3,protease denatured at higher temperatures, pH 7 and pH 10,Protease does not digest gelatine (type of protein) (1m)

**(c)** Carbon dioxide produced by respiration diffuses into the blood. [4]
Carbonic anhydrase in red blood cells catalyse reaction between carbon dioxide and water to form carbonic acid.(1m)
The carbonic acid dissociates to form hydrogencarbonate ions which diffuse out of red blood cells into plasma.(1m)
In the lungs , hydrogencarbonate ions diffuse back into red blood cells.(1m)
They are converted to carbon dioxide and water by carbonic anhydrase.(1m)
Carbon dioxide produced diffuses into alveoli and is excreted.(1m)

Max 3 points.

[Total:7m]

**3** **(a)** (40-16=24$^{o}$C) [1]

**(b)** 1 : When the air temperature increases, the body temperature of the insect [2]



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increases linearly

2 :The insect is cold-blooded as the body temperature changes with the surrounding temperature/ Insect unable to maintain constant body temperature.

**(c)** To draw a straight horizontal line at 37 $^{0}$C. [1]

**(d)** Increasing permeability of cell membranes to glucose thereby increasing the rate of glucose uptake by cells (1m) [3]

Increase tissue respiration so that glucose is broken down faster(1m)

Stimulating the liver and muscle cells to convert excess glucose into glycogen (1m)

Insulin thus helps to decrease blood glucose concentration back to normal.

[Total:7m]

**4** **(a)** Processes by which metabolic waste products and toxic substances are removed from the body( 1m) [2]

It prevents accumulation of waste products which can damage the body by interfering in important metabolic processes. (1m)

**(b)** **(i)** Efferent Arteriole [1]

**(ii)** -label collecting duct [2]

**(ci)** 0 [1]

**(ii)** [2]

Glucose is present in structure X (Bowman's capsule) Glucose is small enough(1m) to be forced out into the Bowman's capsule during ultrafiltration.

All glucose molecules are selectively reabsorbed (1m) at the proximal convulated tubule into the surrounding blood capillaries . Thus glucose is absent in structure W (distal convulated tubule).

**(iii)** [2]

Water has been selectively reabsorbed at the proximal convulsed tubule, loop of Henle, distal convoluted tubule and collecting duct. (1m)
Urea a waste product is not reabsorbed. Hence concentration of urea increase.(1m)



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**(d)** When the pituitary gland secretes more ADH, [3]

Cells of the collecting duct (R) become more permeable to water.(1m)

More water is reabsorbed from the collecting duct into the blood capillaries. (1m)

The volume of urine passing through the collecting duct decreases.(1m)

Urine becomes more concentrated.(1m)

Max – 3m

[Total:12m]

5 (a) Photosynthesis [1]

(b) Total energy = 6400000kJ [2]
Total energy fixed by pond plants = 32000kJ

(32000/6400000) X 100% (1m)
= 0.5% (1m)

(c ) [2]
(32000 – 6400 – 20480) [1]
= 5120kJ(1m)

(d) Any 3 of the following: [3]

-At each trophic level, 90% of energy is lost through heat in respiration, undigested food, uneaten body parts and excretory waste products.

-Energy is also used for growth and movement.

-Only 10% of energy is passed from one trophic level to the next.

-As a result, in a food chain with 5 trophic levels, the energy passed along from the third and fourth trophic levels will not be sufficient to sustain the last trophic level for survival.

Take note: students must make reference to 'trophic levels' and 'energy passed from one level to the next'.

Max 3 points

[Total: 8]

**6 (ai)** -same shape and size of chromosomes (1m) [2]

-same gene loci (1m)



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**(ii)** chiasmata [1]

**(iii)** -increases variation / allows for new combinations of alleles to form [1]

**(b)** Pollen grain(1m) and egg(1m) [2]

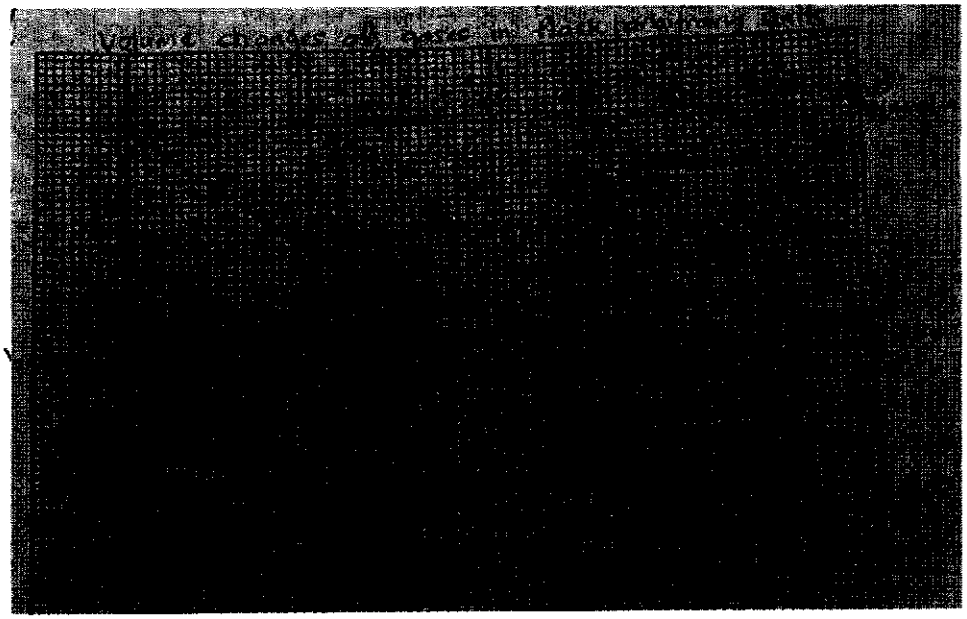
[Total:6m]

**-End of Section A-**

**Section B (30 marks)**

Question **7** and **8** are compulsory questions.
Question **9** is in the form of an **Either/Or** question.
Only one part should be answered.

**7** **(a)** [4]



axes labelled with correct units;(1m)

suitable linear scales using more than half the graph paper;(1m)

accurate plotting of points on a single set of axes;(1m)

best fit line connecting all points;(1m)

**(b)** As the reading on the scale increases, the volume changes of the gases in the flask also increases; [1]

**(c)** **Oxygen is used up** when the seeds undergo germination, carrying out **aerobic respiration;**(1m) [2]



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**Carbon dioxide released** during respiration is absorbed by potassium hydroxide, thus lowering the volume of gases;(1m)

**(d)** The decrease in the volume of gases in the flask slows down and becomes constant; (1m) [2]

Aerobic respiration has stopped since oxygen is completely used up;(1m)

**(e)** Boiling, adding strong acid/ alkali ( any 1) [1]

[Total:10m

**8 (a)** After a human egg cell is fertilised, it takes 5-7 days to reach the uterus.(1m) [5]
-The cilia on the oviduct helps to push the fertilised egg towards the oviduct.(1m)
-Peristalsis of oviduct walls also help to move the fertilised egg towards the uterus.(1m)
-The fertilised egg divides, by mitosis.(1m)
-It forms a ball of cells which implant into the uterine lining.(1m)
-Placenta provides oxygen and nutrients to the growing embryo and remove carbon dioxide and waste products from the embryo. (1m)

Any 5 points

**(b)** Mother and child unable to taste PTC are homozygous recessive ie. genotype 'tt' [5]

| | Father | Mother |
|---|---|---|
| Parental phenotype | Taster | Non-taster (1m) |
| Parental genotype | Tt | tt (1m) |
| Gametes | T t | t t |
| F1 genotype | Tt Tt | tt tt |
| F1 phenotype | Tasters | Non-tasters (1m) |
| F1 phenotypic ratio | 1 Taster : 1 Non-taster (1m) | |

Thus, the father must be heterozygous for this case to occur. (1m)

**9 Either**

**9 (a)** -DNA molecule is a macromolecule that is made up of two polynucleotide strands t(1m)wisted together to form a double helix structure. (1m)] [6]

-A gene is a small segment of DNA (1m)which contains a specific sequence of



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nucleotides (1m)that controls the production of a polypeptide. [1]

-Chromosome is made of DNA and proteins(1m). It is condensed and coiled tightly (1m)

**(b)** Independent arrangement and assortment of homologous chromosomes during metaphase I and anaphase I (1m) [4]

Pairing and Crossing over of non sister chromatids of homologous chromosomes during Prophase 1 of meiosis to form new combinations of alleles.(1m)

Independent arrangement and assortment of chromatids during metaphase II and anaphase II(1m)

Random fertilization (fusion of gametes) leads to new combinations of zygotes(1m)

- Any 4 points

[Total : 10m]

**9 Or**

**9 a(i)** A:vena cava B: pulmonary vein [2]

**(ii)** Prevent backflow of blood from left ventricle into left atrium, when the muscles of the left ventricle contract. [1]

**(iii)** -deoxygenated blood returns from the body organs through the vena cava into the right atrium. [5]

- as blood is returning, blood pressure within the right atrium increases.

-when pressure in right atrium is greater than right ventricle, tricuspid valve pushes open and blood flows into right ventricle

-muscles of right atrium contract and push blood into right ventricle

-muscles of right ventricle contract and push blood into pulmonary artery

-increase in pressure in right ventricle pushes the tricuspid valve closed

Pressure in right ventricle is greater than pulmonary artery. This causes semilunar valves to push open



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-Semilunar valves push open and blood leaves right ventricle to the lungs.

(max 5 points)

[Total : 10m]

**-End of Paper-**



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