JUNYUAN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
SECONDARY FOUR EXPRESS

CANDIDATE NAME

CLASS | | | | INDEX NUMBER | | |

BIOLOGY

6093/01

Paper 1

16 Aug 2018

1 hour

Candidates answer on the Multiple Choice Answer Sheet

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

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 Multiple Choice 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.

This document consists of **19** printed pages.

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1 The table identifies the various organelles within the cell by describing the function of membrane surrounding each organelle.

organelle	1	2	3	4	5	6
function of membrane	allows exit of mRNA	protein synthesis	transport enzymes	lipid synthesis	allows oxygen to enter	allows carbon dioxide to enter

Which row correctly identifies the organelles?

	1	2	3	4	5	6
A	chloroplast	vesicle	smooth ER	ribosome	nucleus	mitochondrion
B	nucleus	ribosome	vesicle	smooth ER	golgi bodies	mitochondrion
C	nucleus	ribosome	vesicle	smooth ER	mitochondrion	chloroplast
D	nucleus	smooth ER	golgi bodies	ribosome	vesicle	chloroplast

2 Some processes listed occurs in flowering plants.

1 ion uptake by root hairs
2 water uptake by root hairs
3 ion movement up the xylem in the stem
4 water vapour loss by the mesophyll cells of the leaves

Which processes are controlled by cell surface membranes?

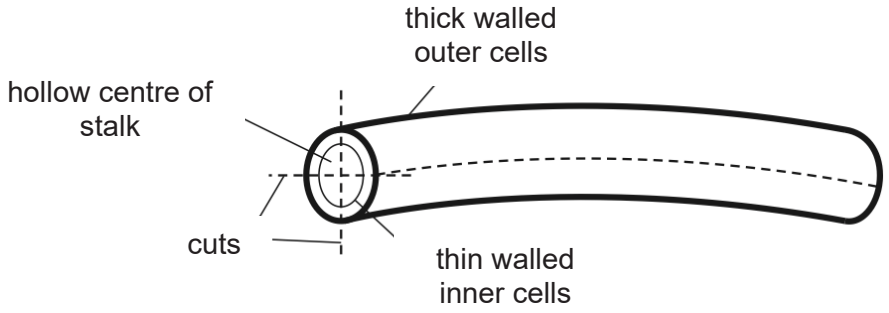
A 1 only
B 1 and 3
C 2 only
D 3 and 4

3 Which statement is true?

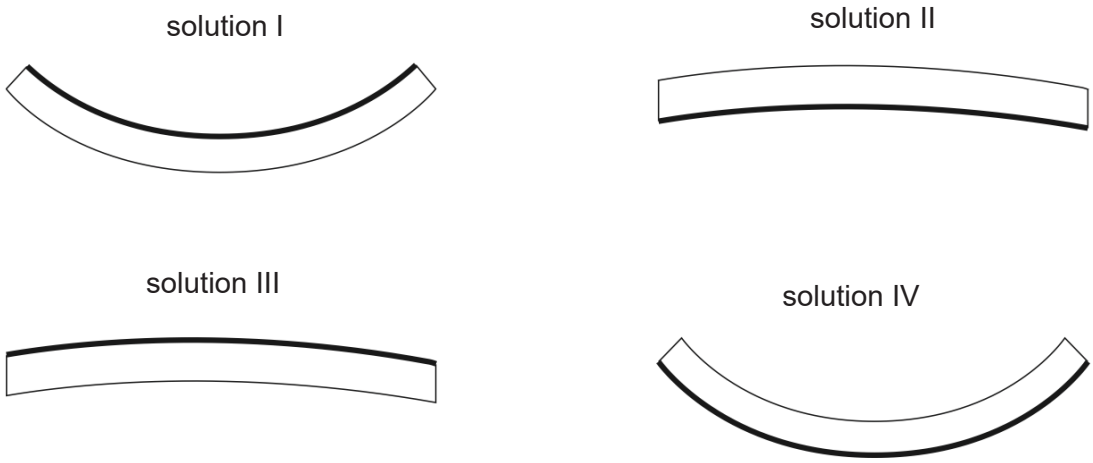
A Crenation occurs in all types of cells occur in a hypertonic solution.
B Plasmolysis of onion cells occurs when cytoplasm shrinks against the cell wall.
C Potato tissues are flaccid when there is a loss of cells.
D Turgidity of cells is dependent on the concentration of cell sap.

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4 The stalk of an *Ipomoea aquatica* (local name: kang kong) is a hollow stem. Pieces of the stem are cut and placed in solutions of different water potential.



The diagram shows how the pieces of stem would look like after soaking in the solutions for 20 minutes.



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

	solution I	solution II	solution III	solution IV
A	pure water	1mol/dm^3 sucrose solution	0.1mol/dm^3 sucrose solution	3mol/dm^3 sucrose solution
B	20% sucrose solution	5% sucrose solution	10% sucrose solution	0.1% sucrose solution
C	pure water	0.5mol/dm^3 salt solution	1.0mol/dm^3 salt solution	5mol/dm^3 salt solution
D	1% salt solution	10% salt solution	5% salt solution	pure water

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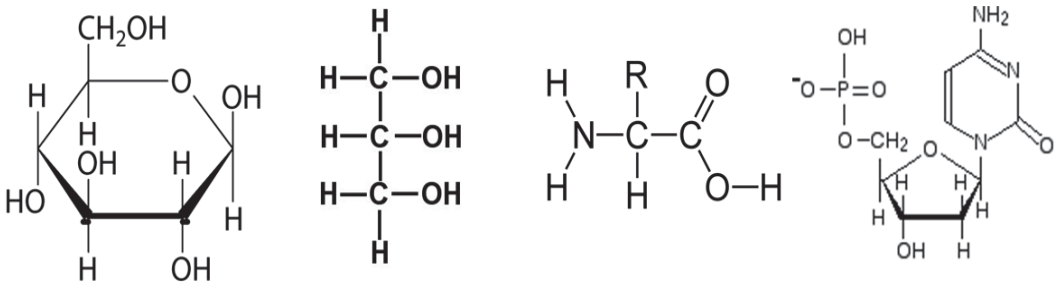
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5 Snake venoms are harmful because they contain enzymes that destroy blood cells and tissues. The damage caused by a snake bite could be slowed down by

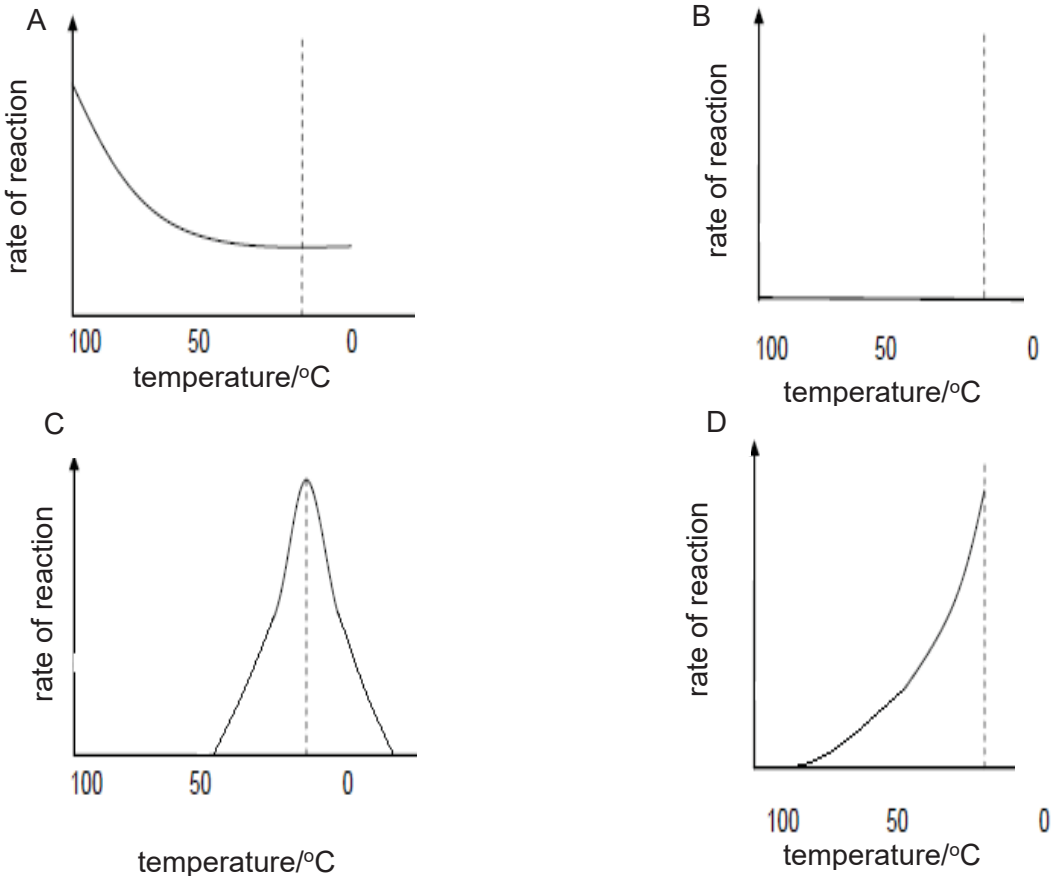
A applying ice to the bite area
B drinking large amounts of water
C increasing blood flow to the area
D inducing vomitting

6 Which of these are basic biological molecules of chromatin threads?



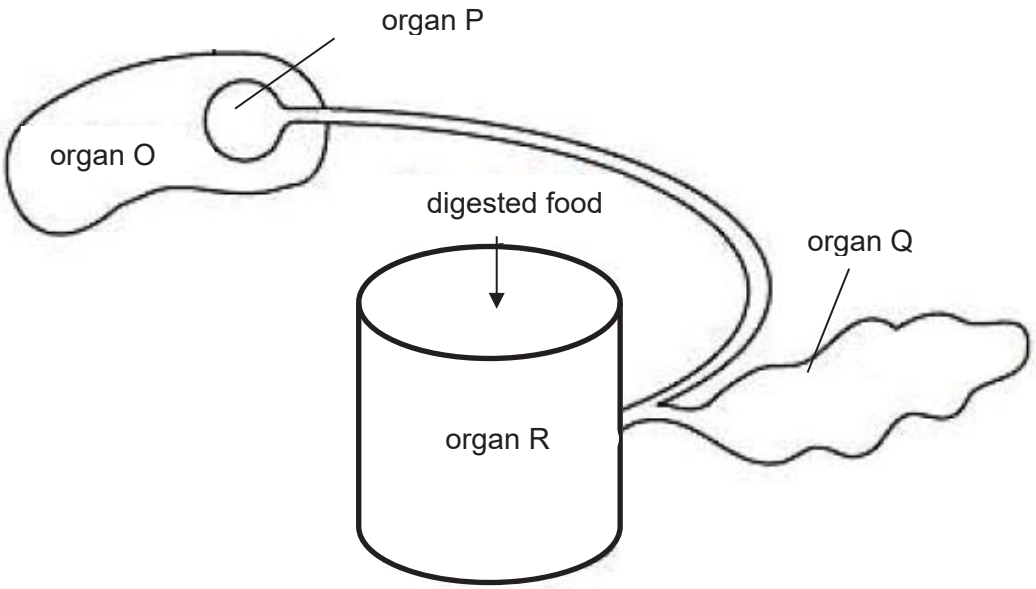
A **B** **C** **D**

7 Which of the following graph shows the rate of reaction when the hot mixture of starch and salivary amylase are cooled down from 100 °C to 0 °C?



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For questions 8 and 9 refer to the diagram below.



8 When the digested food are present in the organ R, digestive enzymes are released into organ R from organ Q. In addition, organ P contracts and releases bile into the organ R.

Extracts from organ R were tested using food test. Which of the following is likely to represent the results from the food test?

	food tests			
	iodine test	Benedict's test	Biuret test	fat emulsion test
A	blue-black	brick red precipitate	blue	clear
B	brown	blue	blue	white emulsion
C	brown	blue	violet	clear
D	blue-black	brick red precipitate	violet	white emulsion

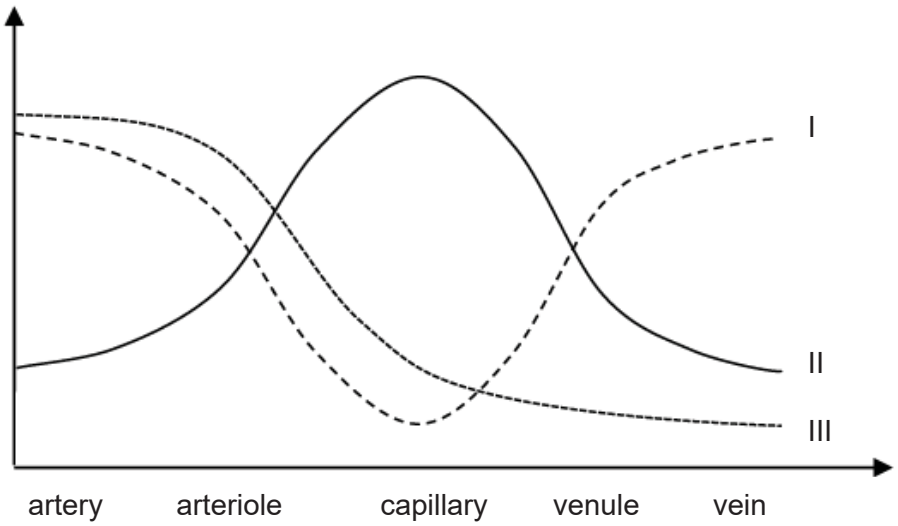
9 A receptor detects the concentration of a digested food absorbed into the bloodstream to be higher than normal, and produces a chemical that triggers a negative feedback by the effector. Which organ is the receptor and the effector?

	receptor	effector
A	O	Q
B	P	R
C	Q	O
D	R	P

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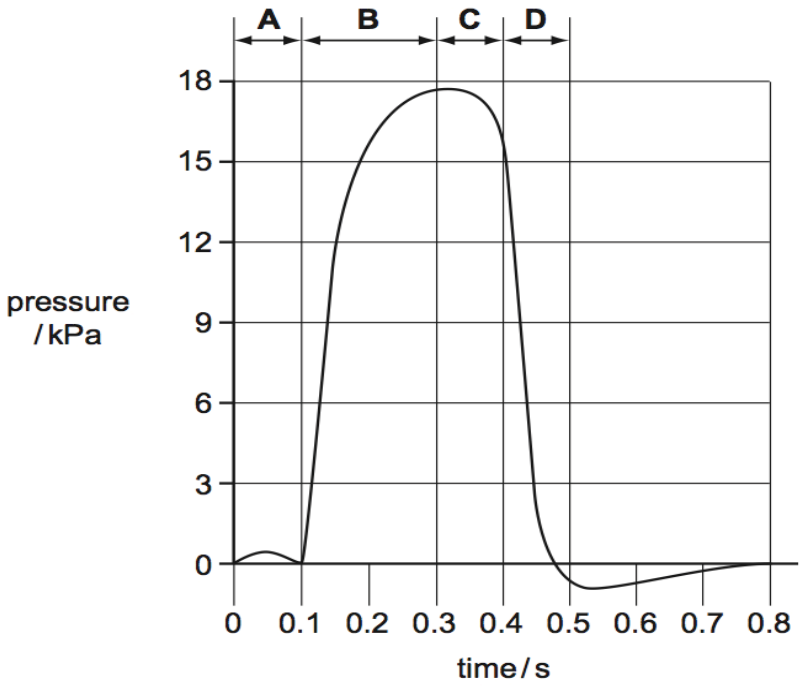
10 The graph represents the cross-sectional area, velocity and blood pressure of five different blood vessels.



Which of the following represents lines I, II and III?

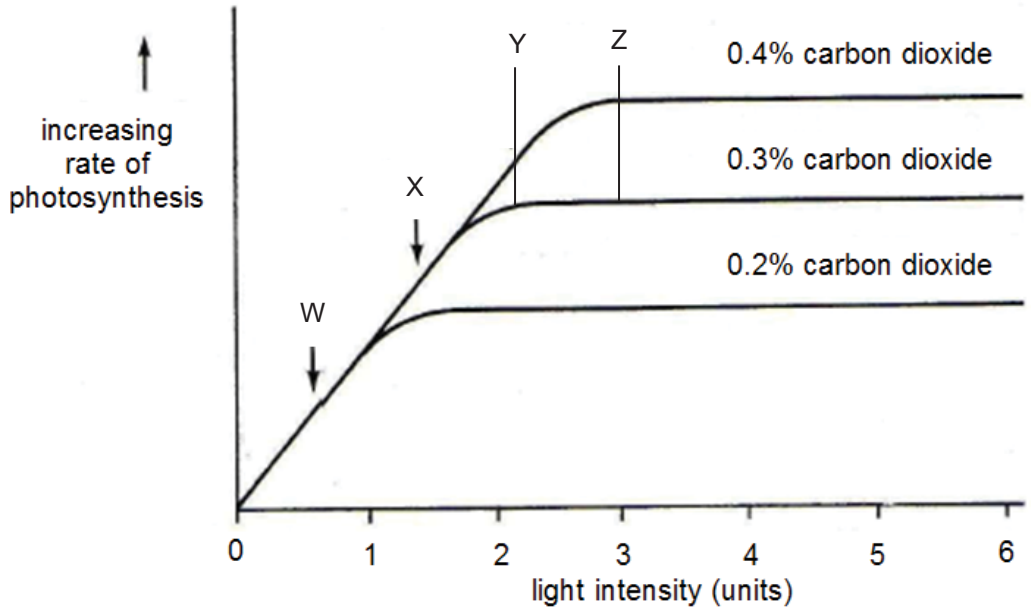
	line I	line II	line III
A	blood pressure	cross-sectional area	velocity
B	velocity	blood pressure	cross-sectional area
C	cross-sectional area	velocity	blood pressure
D	velocity	cross-sectional area	blood pressure

11 The graph shows changes in the blood pressure in the left ventricle of the heart. During which period is the atrio-ventricular valves are forced to close and semi lunar valves opened?



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For questions 12 and 13, refer to the graph below which shows the effect of light intensity on the rate of photosynthesis at three concentrations of carbon dioxide.



12 At which point is light intensity the limiting factor for the three experiments?

A 0 – 1 arbitrary unit
B 1 – 2 arbitrary units
C 2 – 3 arbitrary units
D 3 – 4 arbitrary units

13 At which point on the graph does carbon dioxide concentration start to become the limiting factor for the graph at 0.3 % carbon dioxide?

A W
B X
C Y
D Z

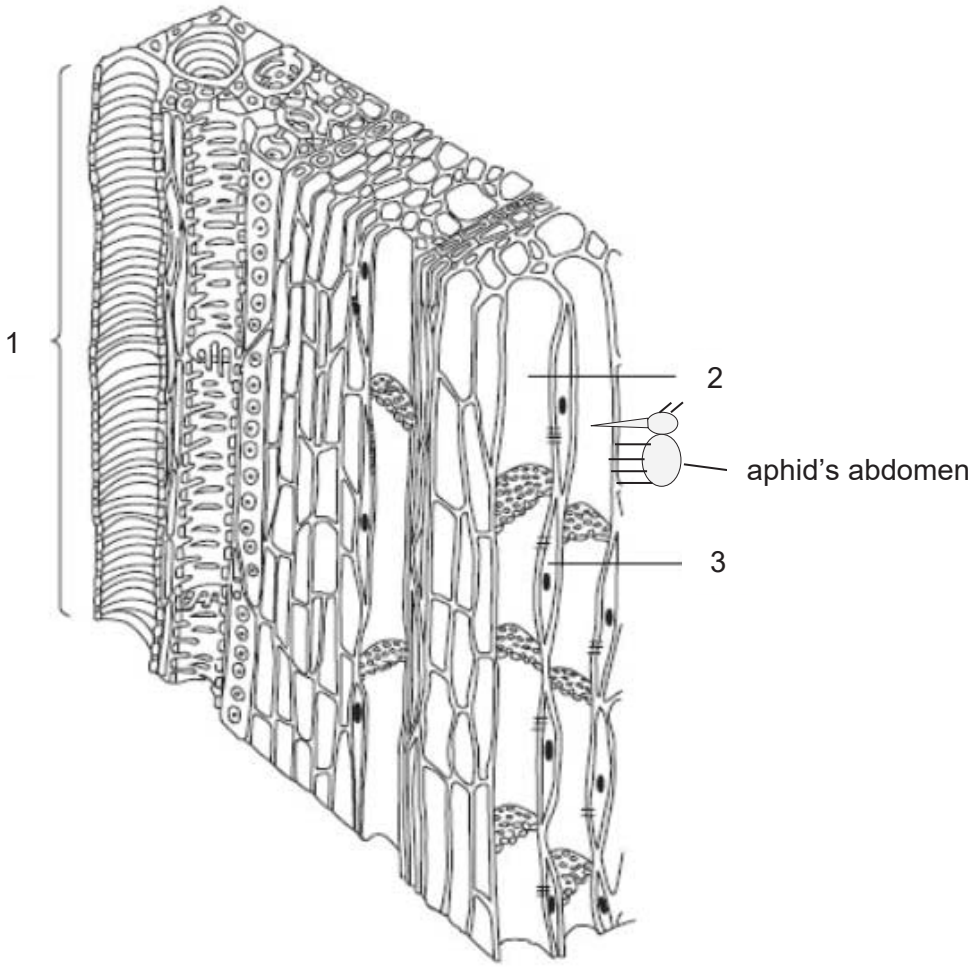
14 A plant is exposed to different environmental conditions. Which set of conditions would cause the plant to wilt the most?

	light intensity / lux	temperature / °C	relative humidity / %
A	150	15.0	70.0
B	250	35.0	60.0
C	400	15.0	50.0
D	800	35.0	30.0

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Question 15 and 16 refers to the diagram that shows some tissue cells of a green plant that was left exposed to radioactive carbon dioxide gas for several hours. Subsequently the plant was left for aphids to feed on it. The radioactive carbon dioxide gas has no effect on the aphids.



15 Which tissue will detect traces of radiation upon diagnosis?

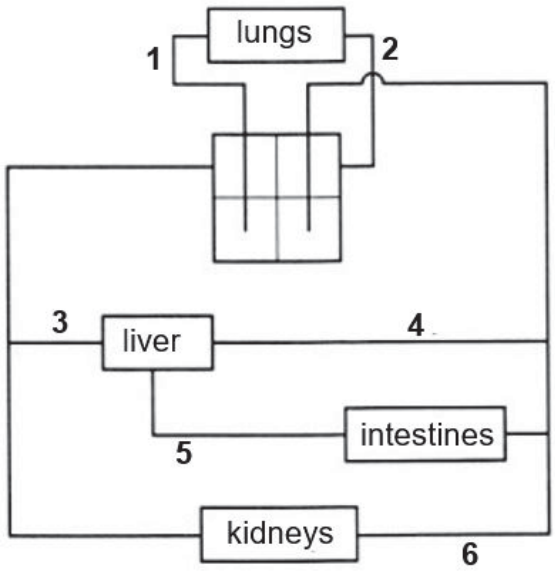
A 1 and 2
B 1 and 3
C 2 and 3
D 3 only

16 As the aphid feeds on the cell sap, droplets of undigested sap exits from its abdomen as a result of high turgor pressure from the cells. Which statement is incorrect?

A Plants infested with aphids suffer from stunted growth rates and low yields.
B The cell sap is rich in sucrose and amino acids.
C The undigested cell sap is a product of egestion and not excretion.
D The high turgor pressure is a result of transpiration pull.

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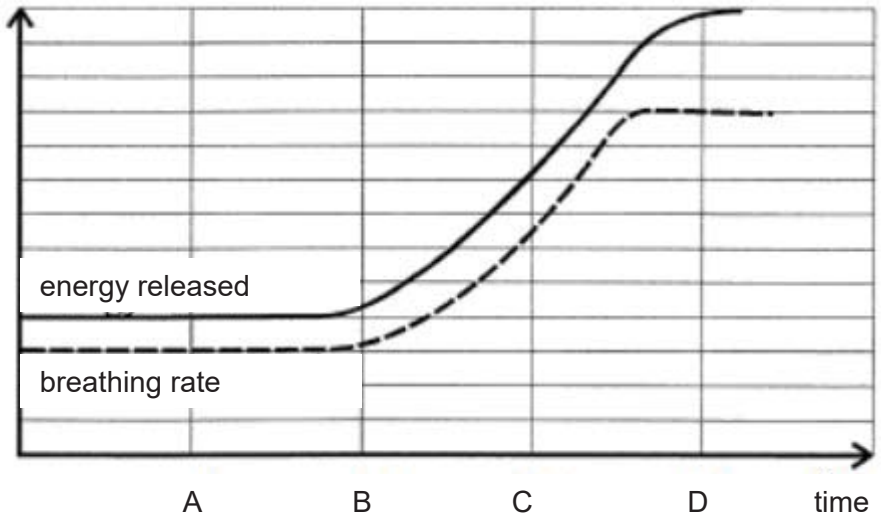
17 The diagram shows a simple illustration of the human circulatory system. The parts labelled 1, 2, 3, 4, 5 and 6 represent the blood vessels.



Which one of the following statements is correct?

A 1 contains more urea than 2.
B 2 contains more glucose than 5.
C 4 contains more oxygen than 5.
D 6 contains more carbon dioxide than 3.

18 The graph shows the breathing rate and energy released during a period of exercise.

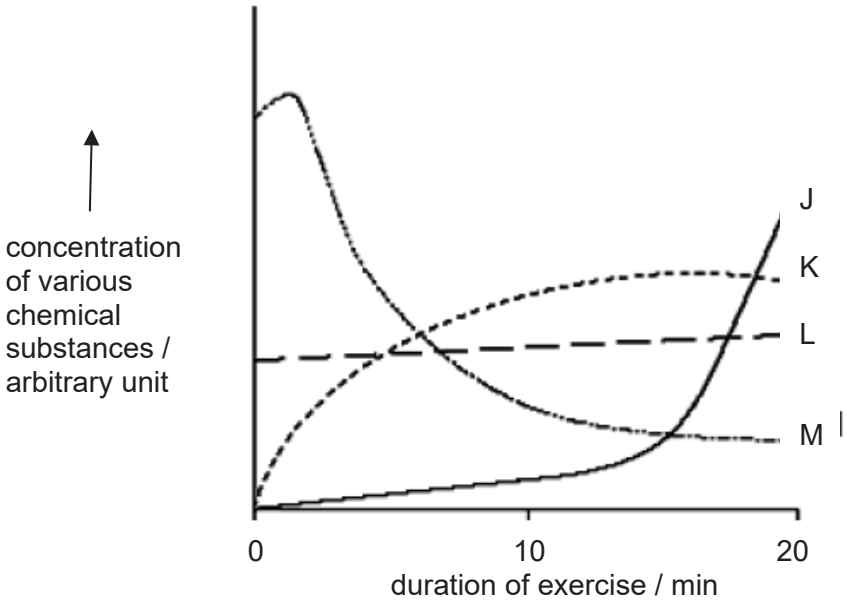


At which point in time is an oxygen debt incurred?

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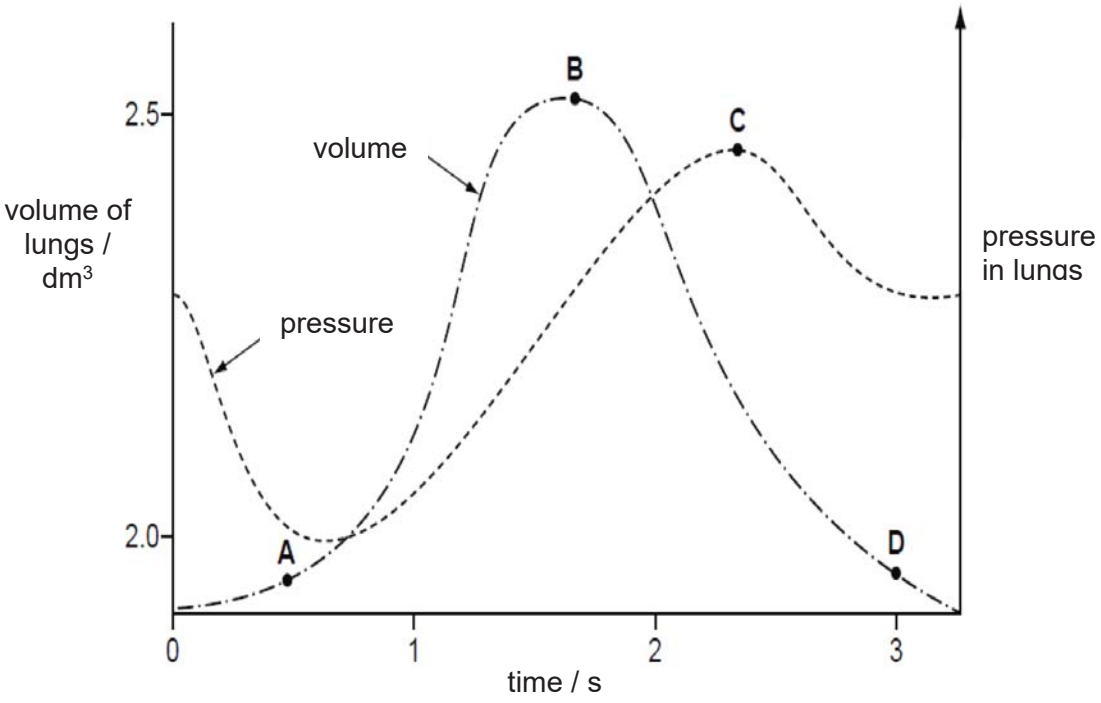
19 The graph shows changes in the concentrations of various chemical substances in the thigh muscles of a person running vigorously on a threadmill.



Which of the following is true?

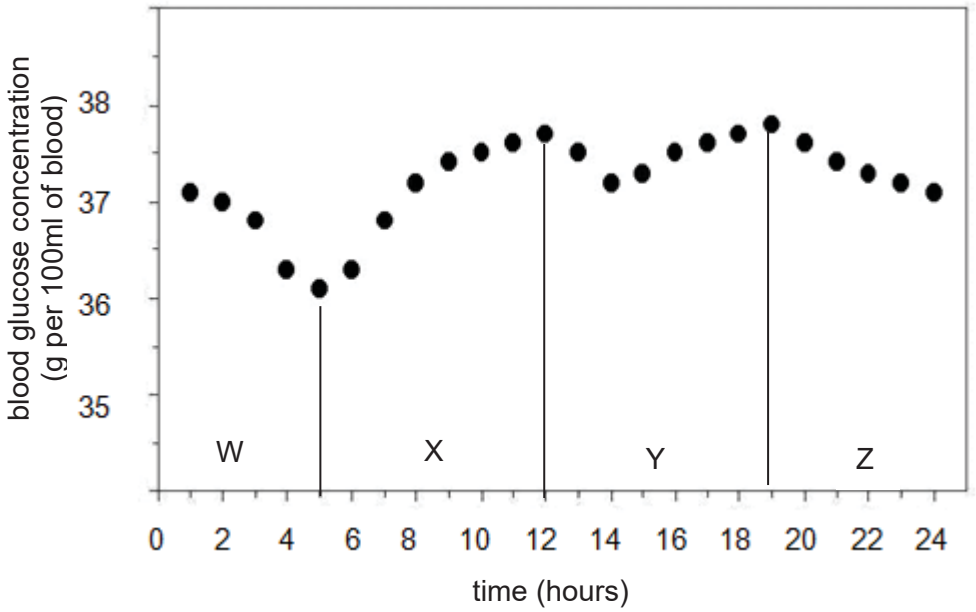
A Line J represents glycogen
B Line K represents carbon dioxide
C Line L represents oxygen
D Line M represents lactic acid

20 The graph shows how the pressure and volume inside the lungs change during one complete breath. At which point are the muscles of the diaphragm starting to contract?



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21 The graph shows the changes in a person's blood glucose concentration over a 24-hour period.



Which time shows a period of fasting that might trigger the secretion of glucagon into the blood stream?

A W only
B W and Y
C X and Y
D Z only

22 John injures his hand in a car accident. Shortly after that, he can feel the objects he touches with his hand but is unable to move his hand away from them. What could have caused this?

A Receptors in his hand are damaged.
B Relay neurones in his hand no longer function.
C The nerve connection is cut only between the receptors in his hand and his central nervous system.
D The nerve connection is cut only between his central nervous system and the effectors in his arm.

23 Our eyes feel strained when we read small prints for a long period of time. Which of the following is the correct explanation for the incident described above?

A The suspensory ligaments become stretched.
B The retina will no longer record clear images.
C The optic nerve will no longer transmit impulses to the brain.
D The ciliary muscles become fatigued.

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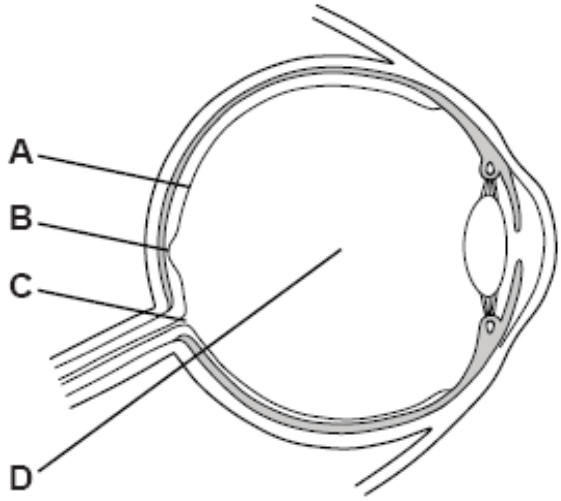
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24 A student draws a dot and a cross as shown.

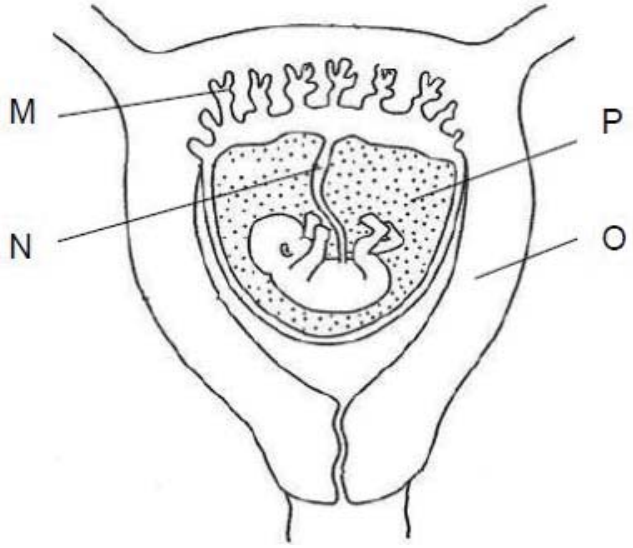


With his right eye closed, the student looks hard at the cross with his left eye. He brings the drawing towards him until the dot disappears.

On which point inside his eye does the image of the dot fall, when it disappears?



25 The diagram shows part of the womb of a pregnant woman.

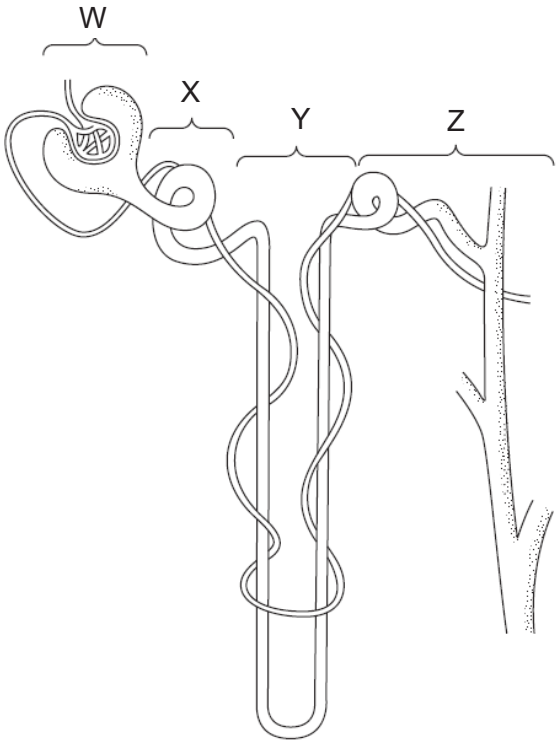


Which of the following statements is correct?

A Progesterone is needed to maintain structure M.
B Structure O only protects the foetus from fluctuations in temperature.
C Structure P contains the gaseous water products of the foetus.
D The artery in N transports glucose and amino acids to the foetus.

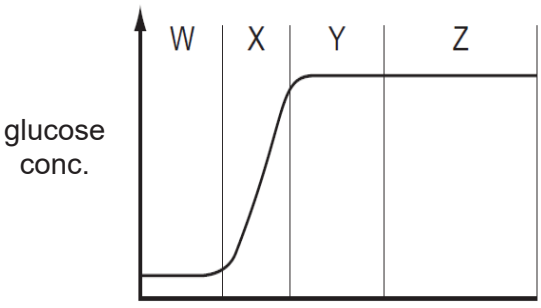
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26 The diagram shows a nephron and associated blood vessels.

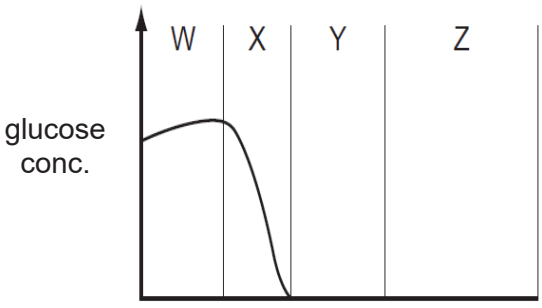


Which graph shows the concentration of glucose present in each part of the kidney tubule?

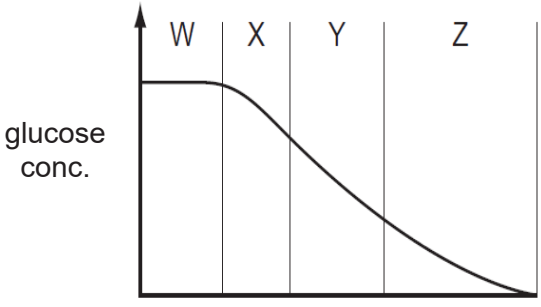
A



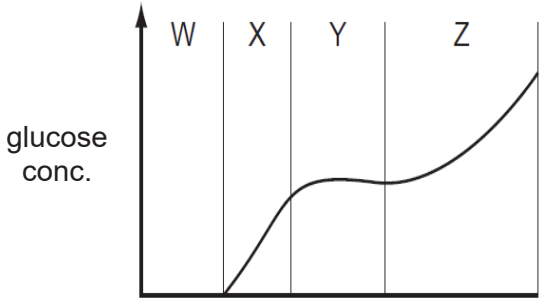
B



C



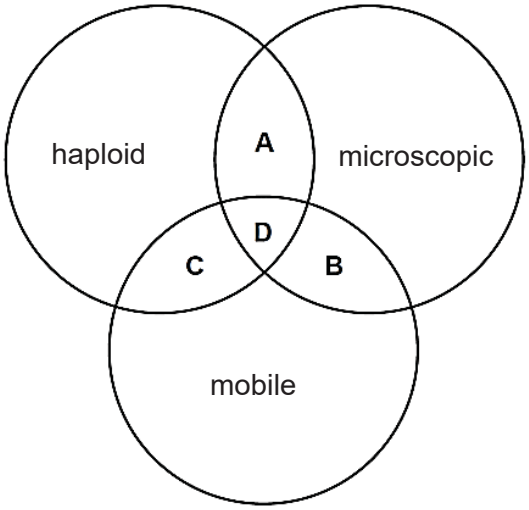
D



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27 The diagram represents three properties of gametes. Which area describes all male gametes of both plants and animals?



28 The following data regarding two different plant species was obtained.

plant	average diameter of pollen grain/mm	average mass of pollen grain/mm	texture of pollen grain
X	15	200	smooth,dry
Y	45	1800	spiky, sticky

The following conclusions were made from the data above.

1 Plant X is more likely to be cross-pollinated.
2 Plant Y is more likely to be self-pollinated.
3 Plant X is more likely to have stigmas which have a larger surface area than those of plant Y.
4 Plant Y is more likely to produce a larger number of pollen per unit time to achieve the same efficiency of pollination as plant X.

Which conclusion(s) is/are valid?

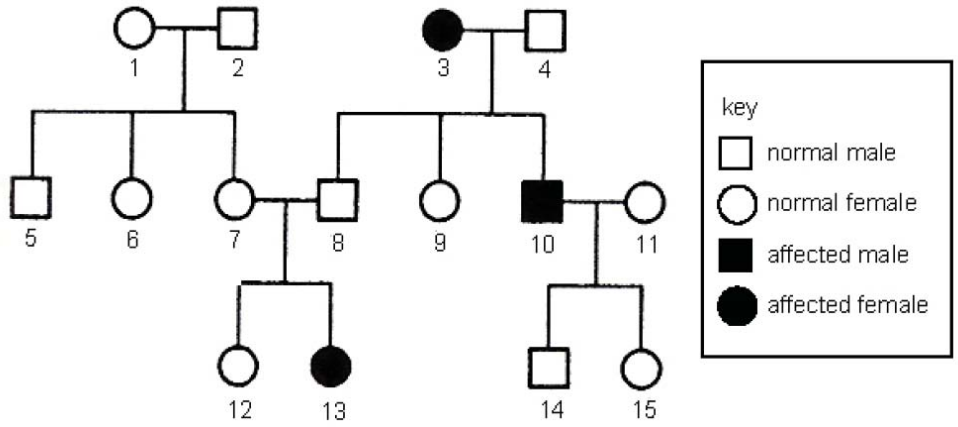
A 1 and 3 only
B 2 and 4 only
C 3 only
D 3 and 4 only

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29 A plant is heterozygous for a pair of alleles that are codominant. This plant is self-pollinated and the resulting seeds are germinated and allowed to grow. Which ratios are expected in the offspring?

	Ratio of phenotypes	Ratio of genotypes
A	1:2:1	1:2:1
B	1:2:1	3:1
C	3:1	1:2:1
D	3:1	3:1

30 The family tree shows the inheritance of a genetic disease. This disease is caused by a recessive allele, b.



Which females have the Bb genotype?

A 1, 6 and 7 only.

B 1, 7 and 12 only.

C 7, 9 and 15 only.

D 9, 12 and 15 only.

31 A gene containing 600 bases is transcribed and translated to produce a functional protein in the cell. Which of the following correctly represents the numbers of the respective structures?

	number of nucleotides	number of mRNA formed	number of codons on the mRNA	number of polypeptide formed
A	300	1	200	1
B	300	600	600	600
C	600	600	600	600
D	600	1	200	1

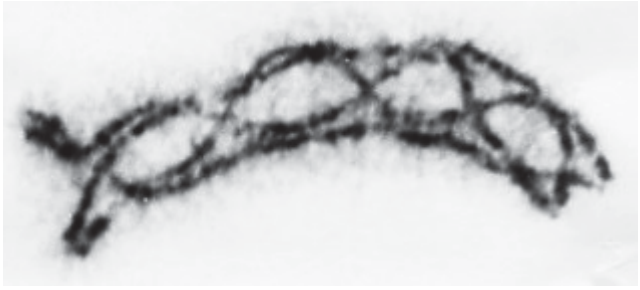
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32 A diploid cell contains two pairs of homologous chromosomes. Each pair is heterozygous for a pair of alleles Aa and Bb respectively. After meiosis, how many different combinations of these alleles could be produced in the haploid daughter cells?

A 2
B 4
C 8
D 16

33 The figure shows an event that occurs during synapsis of two homologous chromosomes.



Which of the statements is not true to describe the figure above?

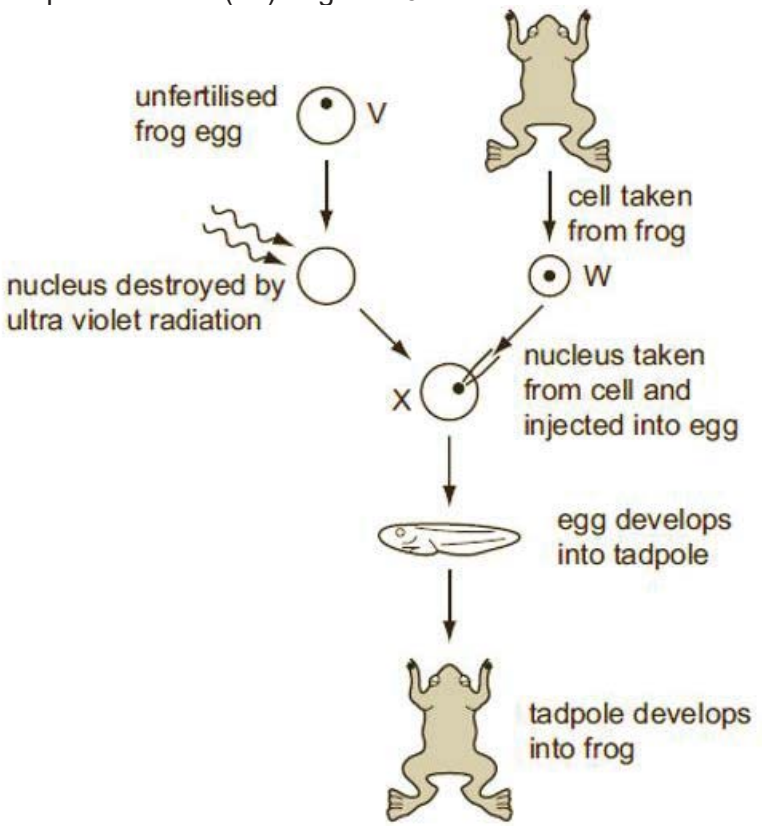
A Crossing over occurs between 2 chromatids at the centromere.
B Crossing over occurs between homologous chromosomes from a male and another from a female.
C Crossing over occurs forming 5 chiasmata.
D Crossing over produces new combinations of alleles along its chromosomes.

34 The wall of a pollen grain is made of chemically stable materials. Because of this, pollen grains have the ability to remain well preserved for thousands of years in soil and sediment. What is the key advantage to the plant for having such pollen grain walls?

A It allows pollen to serve as a valuable fossils record for the study of ancient plants.
B It prevents the pollen tube from growing out before the pollen grain reaches the stigma of a compatible species.
C It protects the vital genetic material in the pollen grain.
D It provides weight to the pollen grain, allowing it to cling easily to the surfaces of the insect pollinators

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35 The diagram shows how genetically identical frog can be developed from unfertilized frog eggs. The diploid number (2n) frogs is 26.



Which combination of numbers correctly identifies the number of chromosomes in each of the type of cells in the diagram?

	V	W	X
A	13	13	26
B	13	26	13
C	13	26	26
D	26	26	13

36 Changes in the climate may lead to the melting of sea ice and the thawing of ice on the land in the Antarctic that has been frozen for a very long time. What could lead to evolution in this situation?

A Animals adapt their features to suit the new environment.
B Previously advantageous features may become disadvantageous.
C Seed dormant for thousands of years could germinate.
D There would be less competition for space to live.

[Turn over

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37 The statements refer to natural selection.

1 Competition between organisms alters their genes.
2 More organisms are produced than reach maturity.
3 Organisms inherit characteristics from their parents.
4 Organisms vary in their adaptations.
5 Only one species can occupy an ecological niche.
6 Well-adapted organisms survive and reproduce.

Which four statements summarise the theory of evolution by natural selection?

A 1, 2, 3 and 5
B 1, 2, 4 and 5
C 2, 3, 4 and 6
D 2, 3, 5 and 6

38 The following list gives some features of the processes of artificial selection and genetic engineering.

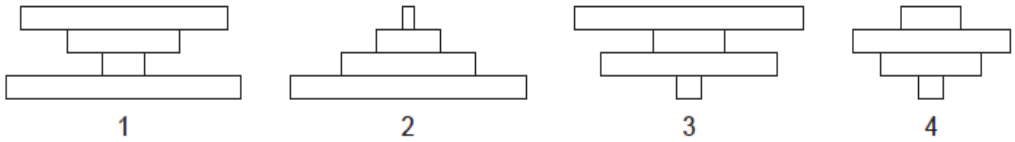
I The organism's genotype is altered.
II The new variety can make a substance previously only made by a different species.
III The process involves working with many generations of the organism over a long period of time.
IV The gene for the useful characteristic is transferred from one species to another.

Which of the above features refer to genetic engineering and artificial selection?

	genetic engineering	artificial selection
A	I, II, IV	III
B	I, III, IV	I and II
C	II and IV	II and III
D	I, II, III and IV	I, II and III

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39 A tree has insect larvae burrowing in the leaves. The emerging insects are eaten by birds and have parasitic fleas living amongst their feathers.

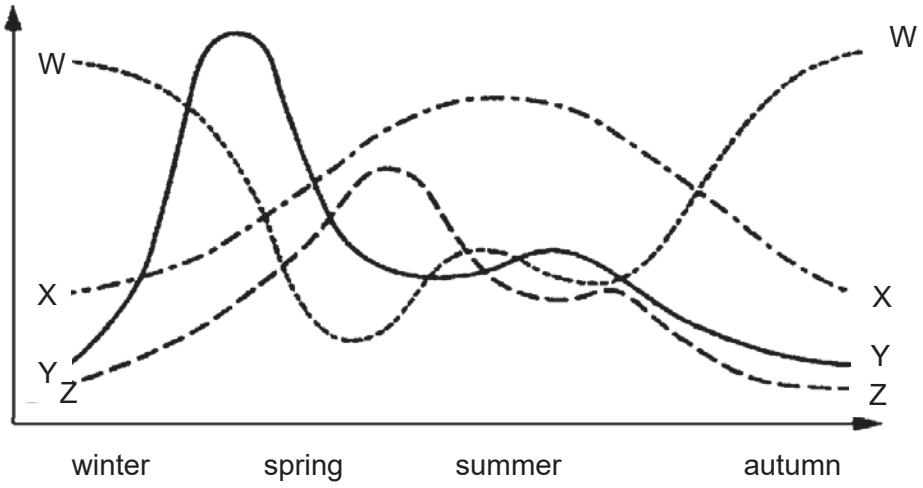


Which represents the correct pyramid of biomass, energy and numbers for this food chain?

	pyramid of biomass	pyramid of energy	pyramid of numbers
A	2	1	4
B	1	2	3
C	2	2	3
D	1	2	4

40 The graph shows the annual changes in a lake of the following factors:

- number of producers
- number of primary consumers
- quantity of nutrients
- intensity of light



Which of the following graph correctly matches the factors listed?

A W represents the quantity of nutrients
B X represents the intensity of light
C Y represents the number of producers
D Z represents the number of primary consumers

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JUNYUAN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2018
SECONDARY FOUR EXPRESS

CANDIDATE NAME

CLASS | | | | INDEX NUMBER | | |

BIOLOGY

6093/02

Paper 2

16 August 2018

1 hour 45 mins

Candidates answer on the Question Paper.

No Additional materials are required

READ THESE INSTRUCTIONS FIRST

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

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

Section B
Answer **all** questions.
Question **8** is in the form of **Either/Or** question. Only one part should be answered.
Write your answers in the spaces provided on the Question Paper.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
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.
The total of the marks for this paper is **80**.

This document consists of **17** printed pages.

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Section A

Answer all questions

1 Figs 1.1 and 1.2 show photomicrographs of transverse sections through a leaf and the lining of the trachea of a mammal respectively.

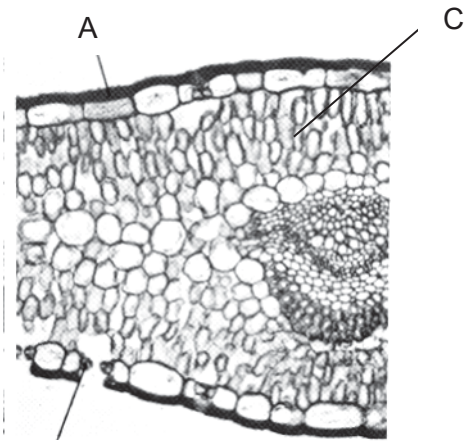


Fig 1.1

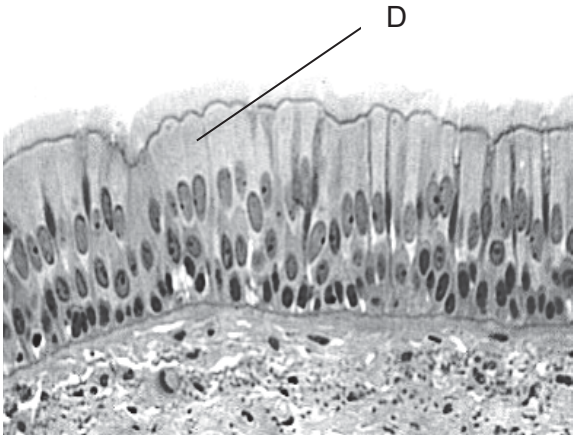


Fig 1.2

(a) Identify A and state the main function. [1]

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(b) Identify B and explain how the carbon dioxide concentration at B would vary over a 24-hour period. [3]

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(c) Explain why Fig 1.1 is thin, flat and well-supplied with veins. [2]

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(d) Label on Fig 1.1, the two functional structures that constitutes the vein. [1]

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(e) **(i)** State the similarity in the way C and D are arranged. [1]

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(ii) With reference to their functions, explain why it is advantageous for the cells to be arranged this way. [2]

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[10 marks]

2 Fig 2.1 represents a model of the biological control system involved in body temperature regulation.

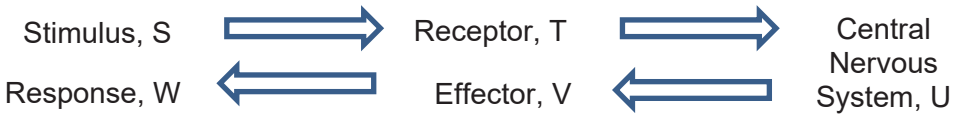


Fig 2.1

(a) If stimulus, S was an external environmental temperature 20°C lower than the human body, name the location in the body where you would find receptor, T. [1]

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(b) Name and describe how two effectors would bring about a physiological response that would alter the stimulus, S. [2]

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[Turn over

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(c) If the Fig 2.1 now represents the nervous system where the effector, V is a gastric gland in the stomach. Describe the reflex action resulting in the release of gastric juice in the stomach after food is being tasted in the mouth. [4]

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[7 marks]

3 Fig 3.1 shows two graphs on transpiration rate of leaves and water potential of leaf cells of cotton plants during three hours of daylight respectively.

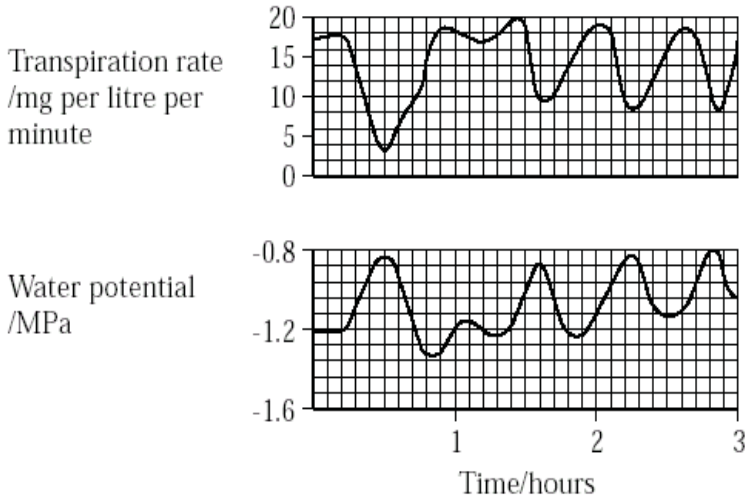


Fig 3.1

(a) Describe the relationship between the transpiration rate and water potential of leaf cells of cotton leaves from 0 to 0.5 hour. [2]

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(b) Describe what happens to the leaf cells when there is an increase rate of transpiration. [1]

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[3 marks]

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4 An ecologist is studying the warm freshwater ecosystem in Cambodia. The table 4.1 shows a part of her report on the ecosystem.

trophic level	examples of organisms	dry mass (g/m^2)	energy (kJ/m^2)
tertiary consumers	fish, crocodiles	2	35
secondary consumers	birds, frogs, insects, turtles	11	220
primary consumers	snails, tadpoles, small fish	93	630
producers	algae, aquatic plants	198	14600

Table 4.1

(a) The dry masses and energy contents of the organisms at each trophic level has been measured and recorded.

(i) State one advantage of analysing dry masses and energy contents over the counting of organisms numbers at each trophic level. [1]

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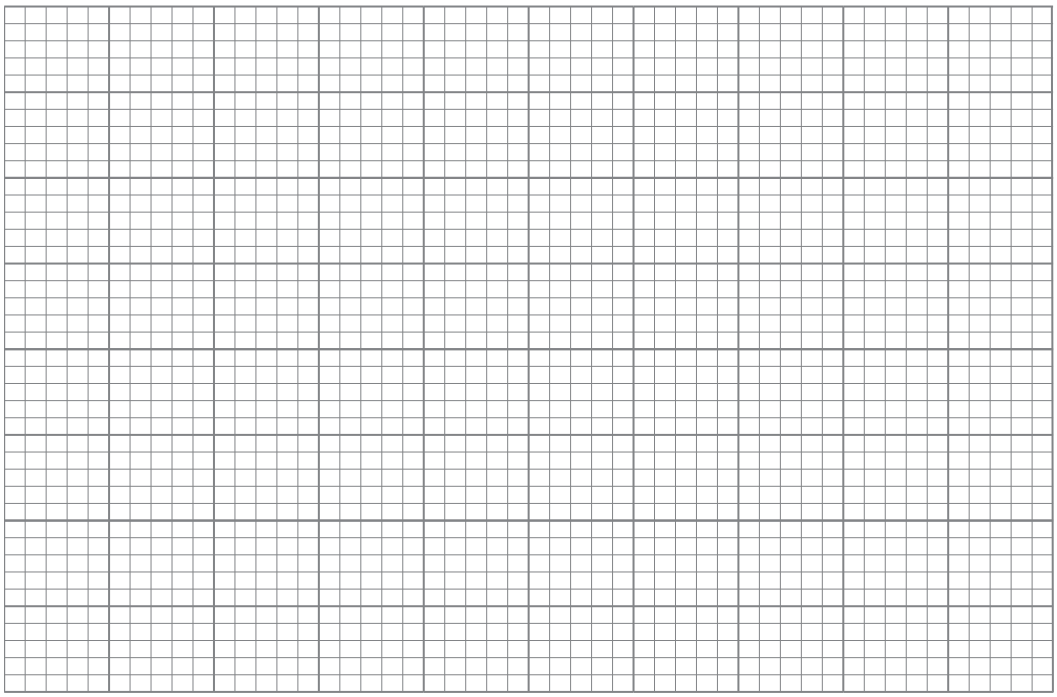
……

(ii) Suggest a difficulty faced by the ecologies in order for her to obtain the data for the table 4.1. [1]

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(b) For this ecosystem in Cambodia, draw on the graph below a pyramid of biomass. An accurate diagram of the scale $1cm^2 = 20\ g/m^2$ should be drawn. [2]



[Turn over

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(c) One of the primary consumers, *Rhabdostyla* became a subject of interest in this ecological study. It thrives very well in the freshwater habitats with very low concentration of solutes. This is due to the presence of a contractile vacuole that helps it to expel excess water (as show in Fig 4.1).

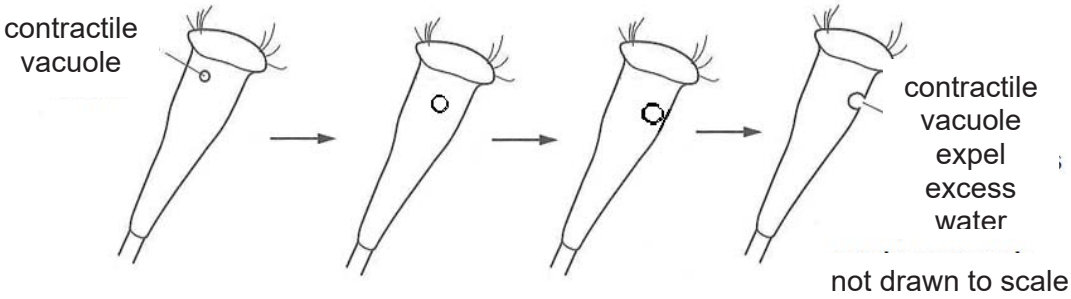


Fig 4.1

(i) Explain, using the term water potential, why *Rhabdostyla* needs to expel excess water? [2]

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In an investigation, individual *Rhabdostyla* were placed into different concentrations of solute in water. The rate of water excreted by the contractile vacuole of each organism were determined as tabulated in the results shown in table 4.2.

% concentration of solute in water	0	4	8	12	16
rate of water excreted /$\mu m^3 s^{-1}$	17.0	10.5	3.0	0.5	0.1

Table 4.2

(ii) Describe and explain the relationship shown in the table. [3]

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(d) In another study, the ecologist focuses on turtle population. Data of energies associated with one turtle over a period of a year is recorded in table 4.3.

Energy associated with one turtle	Energy (Kj/year)
• energy available to the turtle	20935
• energy in the undigested waste	1065
• energy found in the excreted waste	53
• energy released to the environment as heat	20400
• energy used for growth in the turtle	482

Table 4.3

(i) Describe how the energy is 'made available' and subsequently 'used for growth' in the turtle'? [2]

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(ii) Calculate the total amount of energy available for decomposers from this turtle in one year. Show your working in the given space below. [1]

(e) Upon analysing the carcass of the turtle when it died, the ecologist found an unusually high amount of nanoplastics in its body. Explain why it is possible for a high amounts of nanoplastics found in the turtle's body? Use examples of organisms in table 4.1 to illustrate your answer. [3]

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[15 marks]

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5 Fig 5.1 shows a tray of tobacco seedlings. The seedlings are all grown from the seeds of a plant. Some of the seedlings appear very pale in the photograph because their leaves contain no chlorophyll. These seedlings are called 'albino seedling'. The rest of the seedlings with dark leaves have chlorophyll in them and are normal.

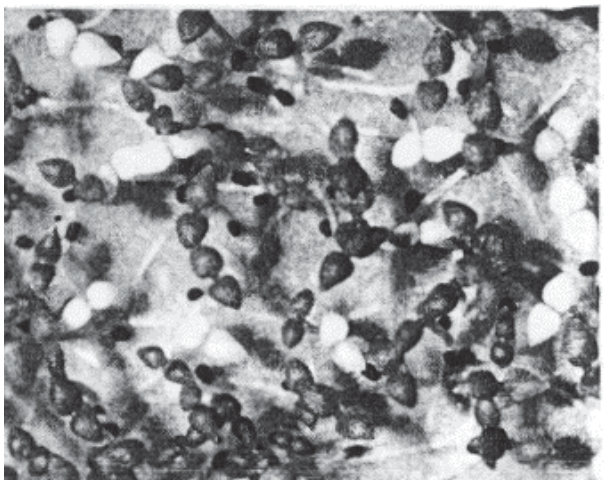


Fig 5.1

(a) Count the numbers of normal seedlings and albino seedlings. Record your results in a suitable table below. [2]

(b) Determine the approximately ratio of normal to albino seedlings and draw the variation graph to show the type of variation this represents. [2]

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(c) The seedlings in Fig 5.1 is the F1 generation from two parent tobacco plants. A single gene, C, controls chlorophyll production, draw a genetic diagram to predict the genotypes and phenotypes of both parent plants. [3]

(d) Explain why these albino seedlings is less advantaged when compared to the normal seedlings? [3]

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(e) Albinism occurs in humans too and is known to be caused by an autosomal recessive genetic condition that results in the body's inability to make the pigment, melanin which gives in the skin, hair and eyes its colour. The allele A represents the normal condition while the allele a represents the albino condition. Fig. 5.2 shows the homologous pair of chromosomes during a stage in meiosis in a carrier.

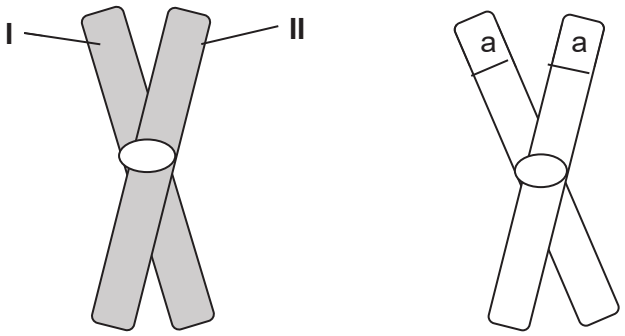


Fig 5.2

(i) State the identity of alleles I and II. [2]

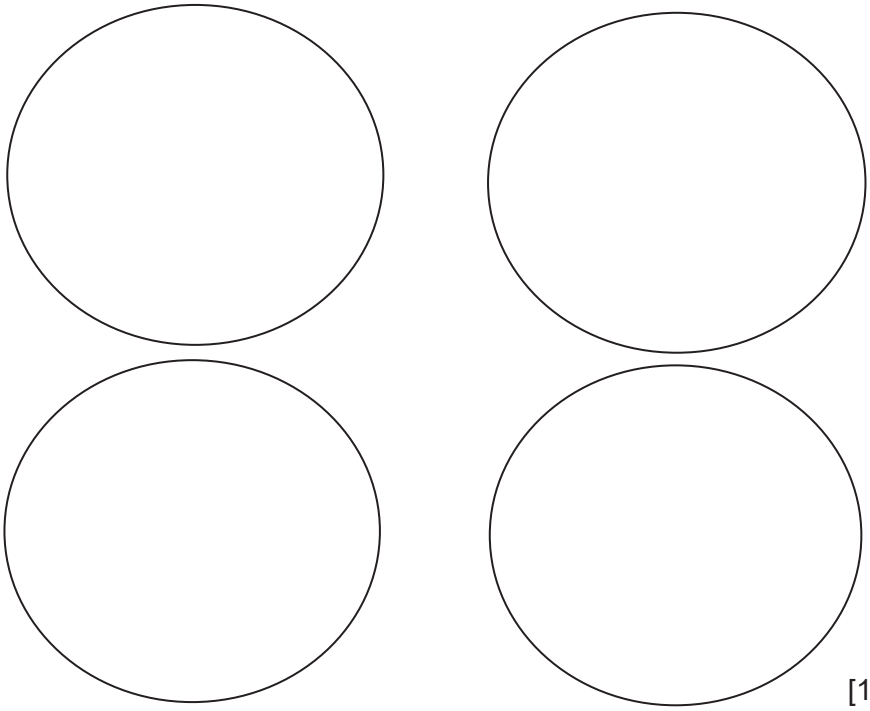
I……

II……..

(ii) Name the stage of meiosis shown in Fig. 5.2. [1]

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(iii) In the outline of the four gametes shown below, draw the chromosomes containing the albino gene found in the nuclei of the four gametes formed. Include the positions and identity of the alleles for the albino gene on the chromosomes. [2]



[15 marks]

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Section B

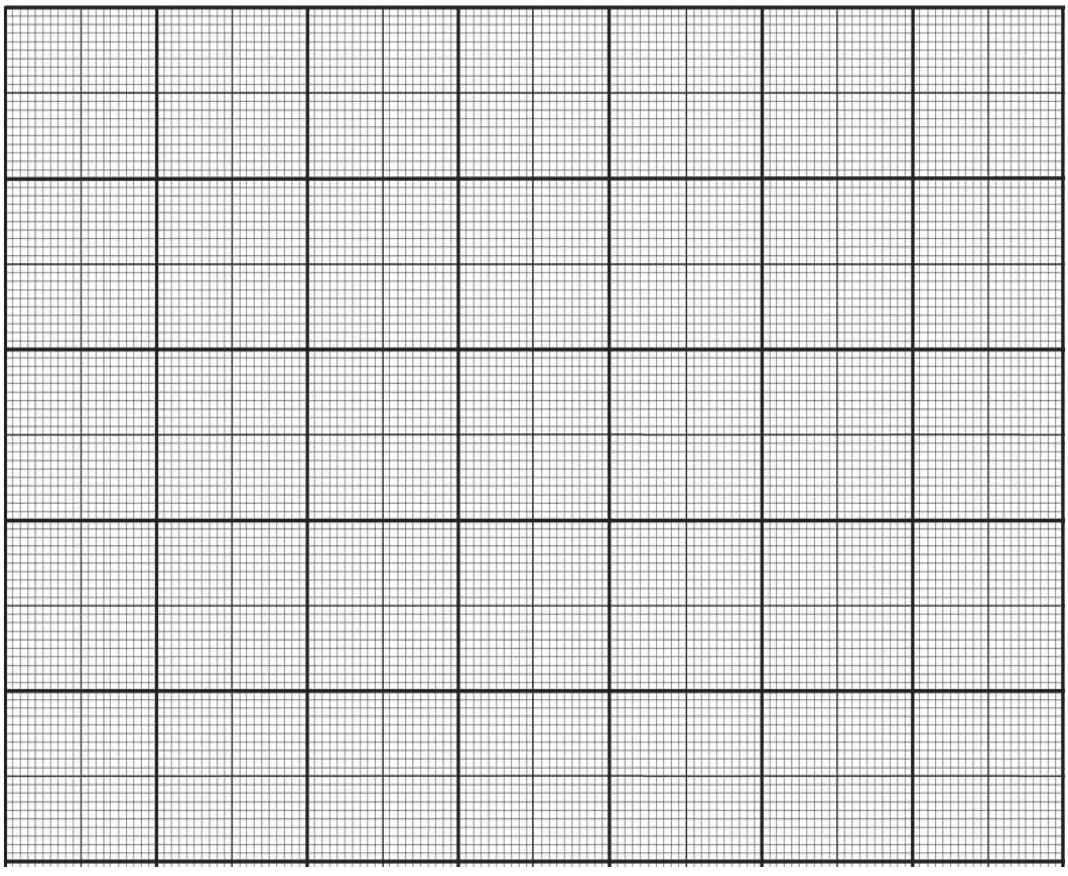
Answer all three questions.
Question 8 is in the form of Either / Or question.
Only one part should be answered

6 Two experiments were carried out to find the effect of removal of the liver and kidneys from 2 different rabbits of the same species.
Experiment A: The kidneys were removed at time 0 and blood urea concentration was recorded. Eight hours later, the liver was removed and blood urea concentration was recorded.
Experiment B: The liver was removed at time 0 and the kidneys were removed eight hours later. In both, blood urea concentration was recorded after the organs were removed respectively
The blood urea concentration of the rabbits was measured from 0 to 16 hours. The results were tabulated in table 6.1.

time (hours)	blood urea concentration (mg per 100cm^3 of blood)	
	experiment A	experiment B
0	10	10
4	17	5
8	22	3
12	22	3
16	21	3

Table 6.1

(a) Plot a graph to compare the trends of results between experiments A and B. [3]



[Turn over

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(b) Describe and explain the change in blood urea concentration of the rabbits used in experiment B. [4]

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(c) Which rabbit will die first? Give a reason to support your answer. [2]

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(d) A human patient suffers from damaged kidneys. What advice would you give to the patient? Explain. [1]

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[10 marks]

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7 Fig 7.1 shows the concentration of two reproductive hormones, X and Y in the blood of an adult human female.

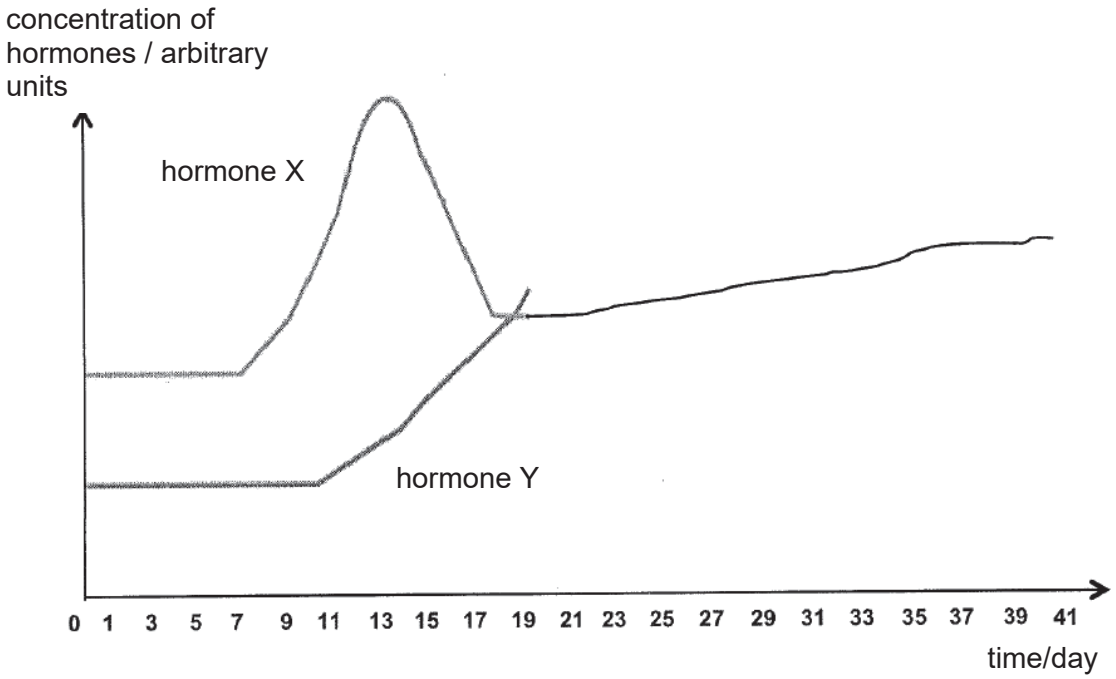


Fig 7.1

(a) With reference to Fig 7.1, describe how the concentration of hormone X and Y affects the thickness of the endometrium from

(i) day 1 to 7 [2]

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(ii) day 11 to 19 [2]

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(b) On the day 15, the ovum was fertilized and the resultant zygote developed into an embryo. By day 20, the embryo was implanted into the endometrium. Complete and explain the graph in Fig 7.1 for hormone Y from day 19 to 41. [3]

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(c) In the first 8 weeks of pregnancy, the ovary is responsible for regulating of hormone Y. After the 8th week, the placenta takes over this role. Describe three other functions of the placenta. [3]

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[10 marks]

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EITHER

8E Bacteria plays an important role in biotechnology eg. in biomedical (mass production of insulin) and in sewage treatment plants, However it is also a cause for concern such as massive eutrophication in many parts of the world. Discuss. [10]

[10 marks]

[Turn over

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OR

8O **(a)** Compare the importance of chloroplasts and mitochondria and how living things are dependent on them. [5]

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(b) Both photosynthesis and respiration are enzyme-based reactions. Discuss the properties of enzyme. [5]

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End of Paper

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Pure Biology Preliminary Examination Marking Scheme

Section A

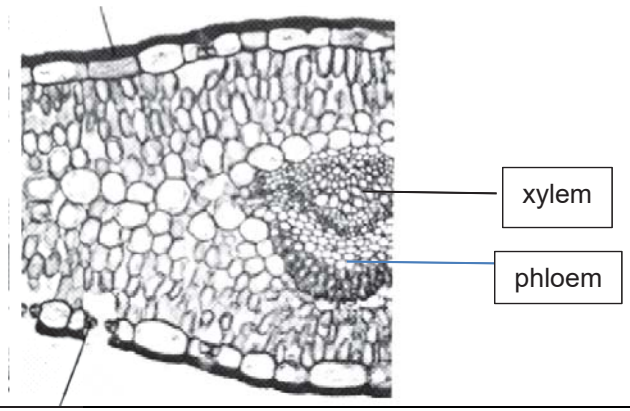
Question	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40
Answers	C,A,D, C,A	D,B,D, C,D	B,A,C D,C	D,C,D, B,A	A,D,D C,A,	B,A,C, A,C	D,B,A, C,A	B,C,A, C,B

Section B

No.	Answers		Remarks
1a	A: Cuticle Protects the inner parts of leaf	1	Upper epidermis
1b	B: Guard cell o In day / light, CO_2 conc is low in intercellular air space o CO_2 diffuse into mesophyll cells (raw material) from atmosphere for photosynthesis o In night / dark, CO_2 conc is high so CO_2 diffuse out of cells to intercellular air space	1 1 1	
1c	Thin and flat o Light can easily reach all mesophyll / photosynthetic cells o Short diffusion distances for gases (e.g. O_2 and CO_2) Well supplied with veins o Water and minerals readily conducted to all cells Translocation of simple sugars away from leaves	1 1	

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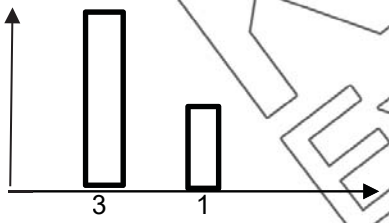
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<table>
<tr><td>1d</td><td>
</td><td>1</td><td>ok</td></tr>
<tr><td>1ei</td><td>The cells are closely packed</td><td>1</td><td>ok</td></tr>
<tr><td>1eii</td><td>For palisade cells,
The arrangement maximised the area that is able to trap sunlight
For epithelial cells,
The arrangement maximised the area that is able to trap foreign particles that enter the trachea</td><td>1

1</td><td></td></tr>
<tr><td>2a</td><td>Thermoreceptors in the skin</td><td>1</td><td></td></tr>
<tr><td>2b</td><td><table>
<tr><td>Skin arterioles</td><td>Vaso constrict – less blood flow to the skin</td></tr>
<tr><td>Sweat glands</td><td>become less active – less sweat</td></tr>
<tr><td>Hair erector muscle</td><td>Contract – hair stand</td></tr>
<tr><td>Skeletal muscles</td><td>Shivering</td></tr>
</table></td><td>2</td><td></td></tr>
<tr><td>2c</td><td>S- food detected by T – taste receptor in tongue
Impulses generated and transmitted to U – brain via sensory neurone
In the brain, impulse sent to relay neurone and then to motor neurone
To V – gastric gland, secretes gastric juice.</td><td>1
1
1
1</td><td></td></tr>
<tr><td>3a</td><td>From 0 to 0.5 hours, the transpiration rate decreases from 17.5mg per litre per minute to 2.8mg per litre per minute, the water potential will increase -1.2MPa to -0.75MPa.</td><td>1
1</td><td>1 mark citing data.</td></tr>
<tr><td>3b</td><td>Increase rate of transpiration will reduce the water potential in the leaf cells resulting in cells being plasmolysed / flaccid</td><td>1</td><td></td></tr>
<tr><td>4ai</td><td>It is more accurate as it shows that biomass / energy is lost from one trophic level to the next</td><td>1</td><td></td></tr>
</table>

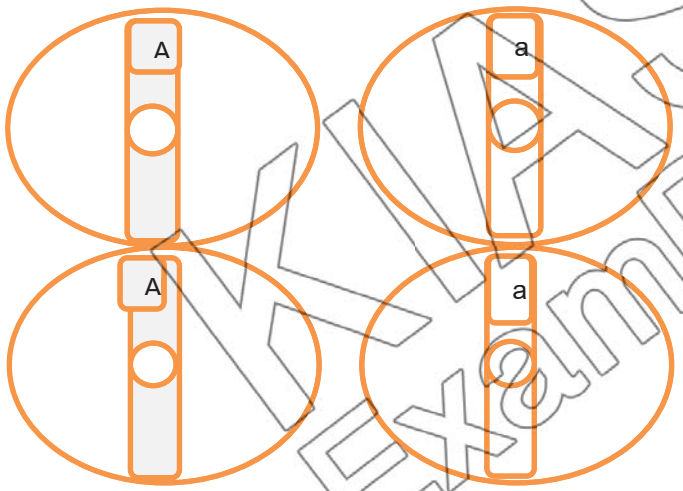
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4aii	It is tedious to weigh / calculate energy contents of all the organisms at each trophic level	1	
4b	Tertiary consumers 0.1 cm^2 Secondary consumers 0.55 cm^2 Tertiary consumers 4.65 cm^2 Tertiary consumers 9.9 cm^2	2	1 mark for correct drawing of pyramid/ drawn to scale 1 mark for correct values written
4ci	Water potential inside the cell is lower than water potential in fresh water; water molecules enter the cell by osmosis leading to expansion and bursting of cell	1 1	
4cii	When % concentration of solute in water increases from 0-16%, rate of water excreted decreases from 17-0.1 $\mu m^3 s^{-1}$. This is because as % concentration of solute in water increases, water potential deceases, leading to water potential become almost the same as the water potential in the cell, rate of excretion becomes minimal to maintains the integrity of the cell	1 1 1	Minus 1 mark without the data
4di	Energy comes from the organisms / food it eats [1] Cells divide during growth and this requires energy obtain during cellular respiration [1]	2	
4dii	1065 + 53 =1118 kJ/year	1	To include calculation
4e	Nanoplastics are non-biodegrable and are absorbed by the algae/aquatic plants When these algae are eaten by the snails, is not excreted from bodies of snails, rather it is stored in their adipose / fat tissues. As the snails are being consumed by frogs and then to fish, it is passed up the food chains, increasing in the concentration of nanaplastics stored in bodies of organisms. This is called bioaccumulation	1 1 1	
5a	<table><tr><td></td><td>normal seedlings</td><td>albino seedlings</td></tr><tr><td>Number of seedlings</td><td>57(51-63)</td><td>19 (17-21)</td></tr></table>		1 mark for proper /neat/labelled table drawn 1 mark for right count
5b	3:1 Discontinuous variation 		1 mark for correct ratio 1 mark for graph

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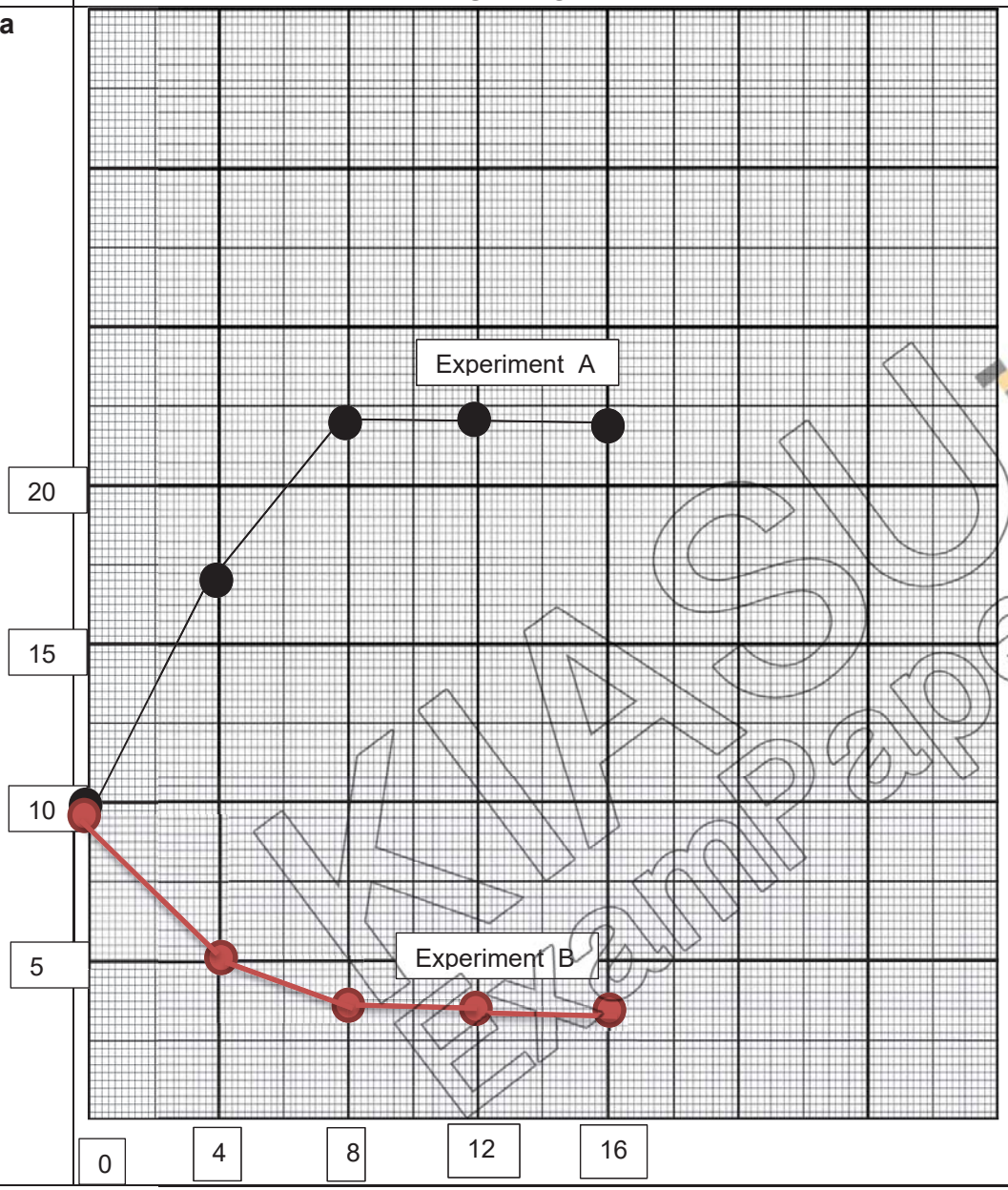
5c	<table><tr><td>Parental phenotype</td><td colspan="2">normal</td><td></td><td colspan="2">normal</td></tr><tr><td>Parental genotype</td><td colspan="2">Cc</td><td></td><td colspan="2">Cc</td></tr><tr><td>Gametes</td><td>C</td><td>c</td><td></td><td>C</td><td>c</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>F1 genotype</td><td>CC</td><td>Cc</td><td></td><td>Cc</td><td>cc</td></tr><tr><td>F1 phenotype</td><td>normal</td><td>normal</td><td></td><td>normal</td><td>albino</td></tr><tr><td colspan="6">Parental phenotype: Both normal Parental genotype: Both Cc</td></tr></table>	
5d	Albino seedlings are unable to photosynthesise and therefore will not be able to grow and develop into adulthood to reproduce and pass down their genes to the next generation	1 1 1
5ei	I – A; II – A;	1 1
5eii	Prophase I;	1
5eiii		2

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SECTION B

6a



1	Correct X and Y axis label
1	Title, appropriate scale and size
1	Points plotted correctly, allow for 1 error

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6b	This is because when the liver is removed first, the organ responsible for the production of urea is absent Since the kidney is still present at first, being the excretory organ responsible for the removal of urea/formation of urine the urea concentration present in the blood is continuously removed. blood urea concentration is decreases steeply. With the kidney's removal 8 hours later, the blood urea concentration remains low at 3 mg per 100cm^3 of blood as there is no more excretion and production of urea. .	1 1 1 1	Minus 1 mark with no data
6c	The rabbit in experiment A will die first because the amount of urea in the blood will be at toxic levels to kill the rabbit and without the kidneys to remove it, the urea concentration will remain at high levels	1 1	
6d	Reduce intake of proteins As proteins digested to excess amino acids Formation of more urea	1 1	
7ai	Low level of hormone Y causes the breakdown of endometrium / uterine lining Menstruation occurs	1 1	
7aii	Increased concentration of hormone X causes the repair of endometrium Endometrium thickens with blood vessels	1 1	
7b	Graph drawn should show gradual increase of hormone Y all the until Day 41 and level above hormone X Progesterone continues to be secreted by ovary/ progesterone level increases Caused thickening of uterine lining / endometrium to support growth of embryo [reject foetus]	1 1 1	
7c	Allows oxygen and dissolved food substances (name 2) to diffuse fom mother's blood to foetal blood Allows metabolic waste (name 2) to diffuse from foetus blood to mother's blood Allows protective antibodies to diffuse from mother's blood into foetal blood.	1 1 1	
EITHER			
8E	• Bacteria plasmids were used to insert the human insulin gene • Becomes a recombinant plasmid • Enters into the bacteria upon mixing • Bacteria will use the new gene to mass produce insulin. • Aerobic bacteria decompose biodegradable organic matter in the waste water in the aeration tanks • Anaerobic microbes act on the sludge to break down the organic matter in the digester.	1 1 1 1 1	

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	• Bacteria secrete enzymes to digest the solid matter into simpler, soluble one, thus reducing the mass of sewage. • Leeching of nitrogenous waster cause profuse growth and multiplication of the algae and weeds • Blocking sunlight and the lack of sunlight causes submerged algae and plants die • Bacterial numbers increase sharply, due to the decomposition of the dead organisms • Oxygen content of water decreases leading to the death of other marine life, such as fishes	1 1 1 1 1
OR		
8O(a)		

Respiration	Photosynthesis	
Energy is released	Energy is stored as carbohydrates	1
Oxygen is used, carbon dioxide and water is given off	Oxygen is given off, carbon dioxide and water is used	1
A catabolic process, breakdown of glucose molecule	A anabolic process, buildup of glucose molecule	1
Occurs all times, independent of light and chlorophyll	dependent of light and chlorophyll	1
Results in the loss of biomass	Results in the gain in biomass	1

8O(b)	Enzymes are proteins and are biological catalysts by lowering the activation energy. They are specific in their actions. They can only act on specific substrate because of the presence the active sites. They form temporary enzyme-substrate complex to form products. Enzymes are reusable because they remain chemically unchanged and therefore minute amounts is needed for a reaction to take place. Enzymes are sensitive to changes to temperature and Ph. At low temperatures enzymes are inactive, rate of enzymes are slow As temperature increases, enzymes increases kinetic energy, increasing frequency of molecule collisions increasing chances of enzyme –substrate formation At optimum temperature, rate of enzymes activity is fastest.	1 1 1 1 1

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	After optimum temperature, enzymes denature and no longer react with substrate. Rate of enzyme activity decreases.		

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