BENDEMEER SECONDARY SCHOOL
2024 PRELIMINARY EXAMINATION
SECONDARY FOUR EXPRESS

CANDIDATE NAME

CLASS

INDEX NUMBER

BIOLOGY
Paper 1

6093 / 01

27 August 2024
1 hour

READ THESE INSTRUCTIONS FIRST

Write in 2B pencil.
Write your name, class and register number on the work you hand in.
Do not use paper clips, 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 2B pencil on the Answer sheet.

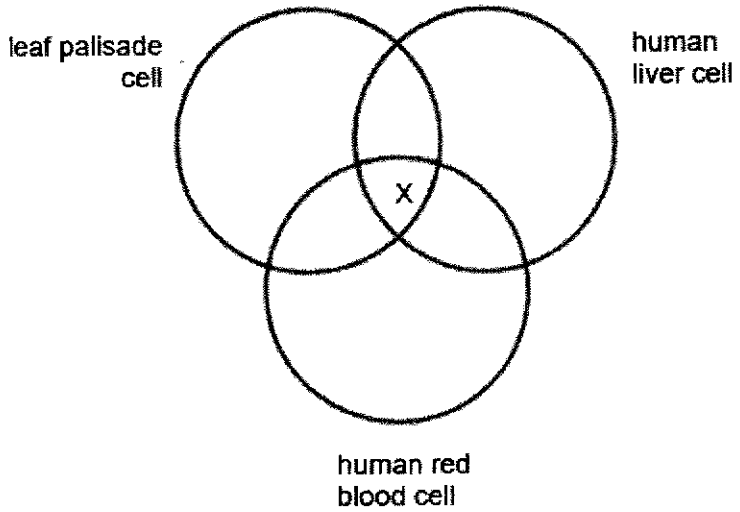
Read the instructions on the Answer sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done on the question paper.

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

FOR ASSESSMENT USE
40

1 The diagram represents the cell structures of a human liver cell, a leaf palisade and a human red blood cell.



What is cell structure X?

A cell wall
B chloroplast
C cytoplasm
D nucleus

2 Four students (**A**, **B**, **C** and **D**) were asked to match the function with the appearance of some cell structures in an animal cell.

The functions were listed below.

I detoxifies harmful substances
II mRNA passes through to the ribosome
III stores and packages hydrolytic enzymes

The appearances were listed by letter.

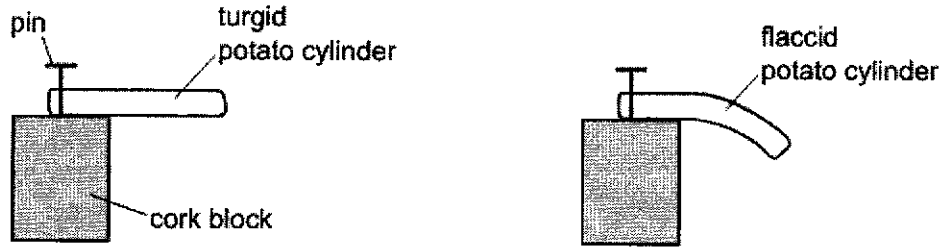
V a double membrane interspersed with pores
W a double membrane with highly folded inner layer
X membrane-bound sacs, arranged as a flattened stack
Y membrane-bound, network of tubular spaces
Z non-membrane bound, spherical structures

Which student correctly matched the function with the appearance of the cell structure?

	I	II	III
A	V	W	Y

B	V	Y	Z
C	Y	V	X
D	Y	W	Z

3 Four freshly cut potato cylinders were soaked for one hour in different salt solutions. The potato cylinders were then pinned to cork blocks. Two of the potato cylinders are shown.

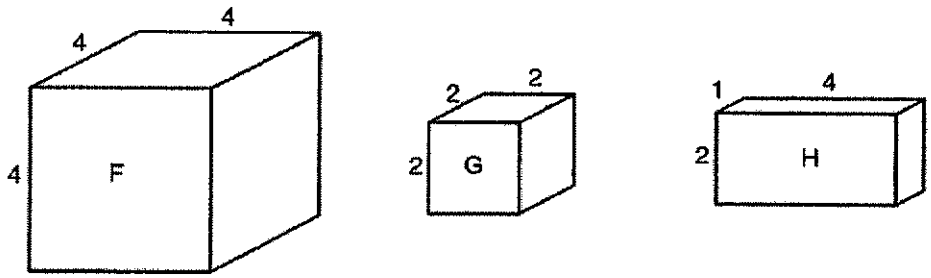


Which solution would cause the potato cylinder to be the most flaccid?

A 0.1 mol per dm^3 salt solution
B 0.3 mol per dm^3 salt solution
C 0.7 mol per dm^3 salt solution
D 1.0 mol per dm^3 salt solution

4 An experiment was carried out to investigate the effect of surface area to volume ratio on diffusion.

A block of agar containing sodium hydroxide solution and Universal Indicator solution was cut into three smaller blocks of different sizes, as shown. All dimensions are in centimetres.



The block were placed in a solution of 0.1 mol/dm^3 hydrochloric acid. As the hydrochloric acid diffused into each block, a colour change was observed. The time taken for each block to change its colour completely was recorded.

Which statement is correct?

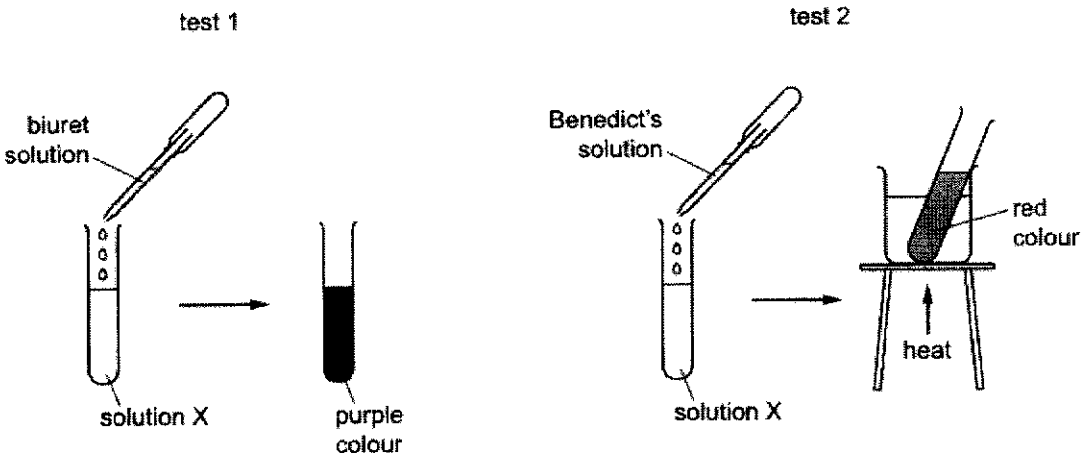
A Although H and G have equal volumes, it will take less time for G to change colour completely.

B H will take more time than G to change colour completely, as H has a larger surface area for each unit of volume.

C The length, width and breadth of F are double that of G. Compared to G, this halves the surface area to volume ratio and increases the time taken for F to change colour completely.

D The smaller the surface area of a block, the longer the time taken to change colour completely.

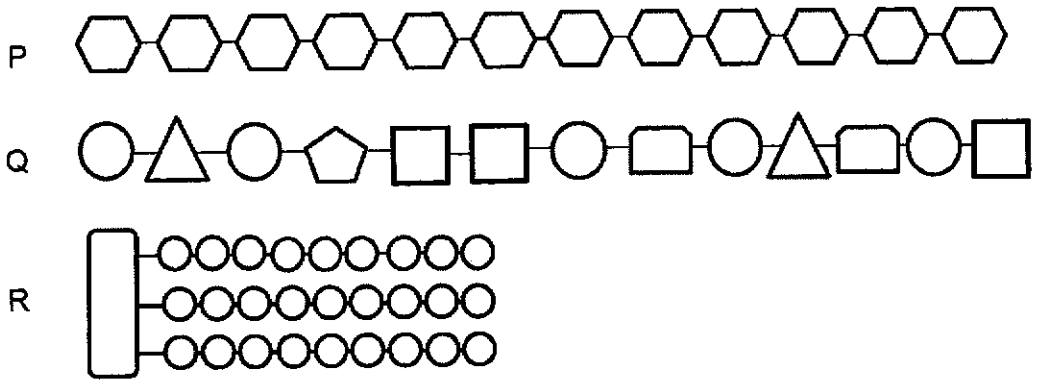
5 The diagram shows two food tests being caried out on solution X.



Which nutrients are present in solution X?

A protein and starch
B protein and sugar
C starch and fat
D starch and sugar

6 The diagrams are models representing three different biomolecules, P, Q and R (not drawn to scale).



Which statements about P, Q and R are correct?

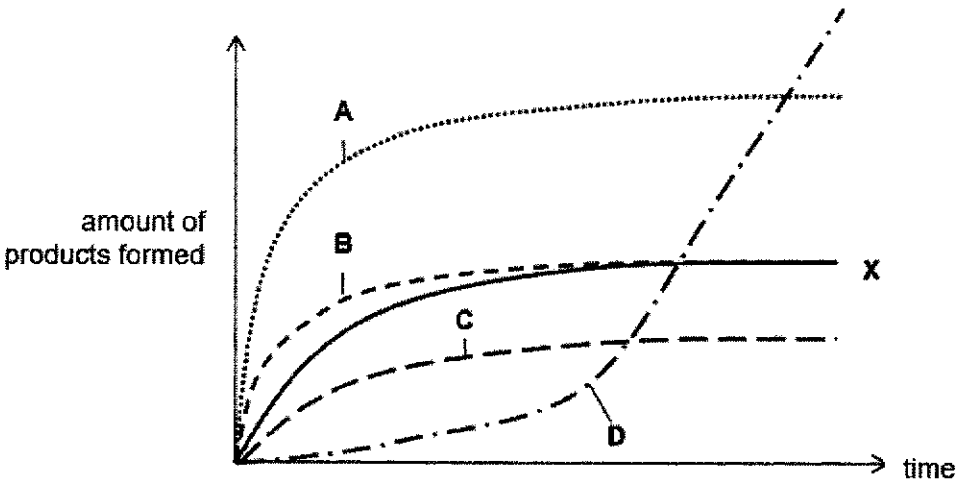
I P is similar to glycogen as it contains glucose as its basic units.
II P and Q are similar as they both contain the elements C, H and O only.

III R belongs to a group of biomolecules that always contain the elements C, H, O and N.
IV R is synthesised from basic units glycerol and fatty acids.

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

7 The graph shows curve X which represents the activity of an enzyme at 20°C.

Which curve represents the activity when the temperature is raised to 30°C and with more enzymes added?



8 Four statements about the active site of an enzyme in the human body are given.

I The shape of the active site changes when the temperature falls to 10°C and does not return to its original shape when the temperature returns to 37°C.
II The active site of an enzyme has the same shape as the substrate molecule.
III The specificity of the enzyme depends on the shape of its active site.
IV The shape of the active site changes when the enzyme is heated to 60°C and does not return to its original shape when the temperature returns to 37°C.

Which statements are correct?

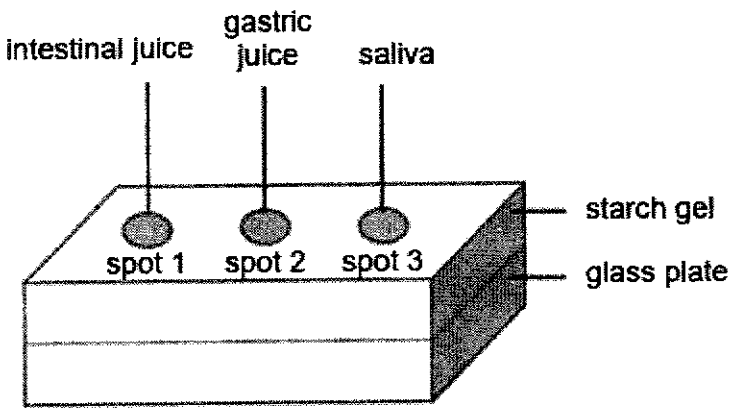
A I, II and III only
B I and IV only
C II and III only
D III and IV only

9 A student is fasting.

What effect will this have on the composition of the blood in the hepatic portal vein, hepatic vein and hepatic artery?

	hepatic portal vein	hepatic vein	hepatic artery
A	high in glucose	high in glucose	low in glucose
B	high in glucose	low in glucose	high in glucose
C	low in glucose	high in glucose	low in glucose
D	low in glucose	low in glucose	high in glucose

10 Digestive juices were collected from different regions of the alimentary canal. Drops of these juices were added to a glass plate coated with starch gel as shown in the diagram. After 1 hour, the starch gel was rinsed with distilled water and iodine solution was added to each spot.



Which row shows the correct results?

	spot 1	spot 2	spot 3

A	blue-black	blue-black	brown
B	brown	blue-black	blue-black
C	brown	blue-black	brown
D	brown	brown	blue-black

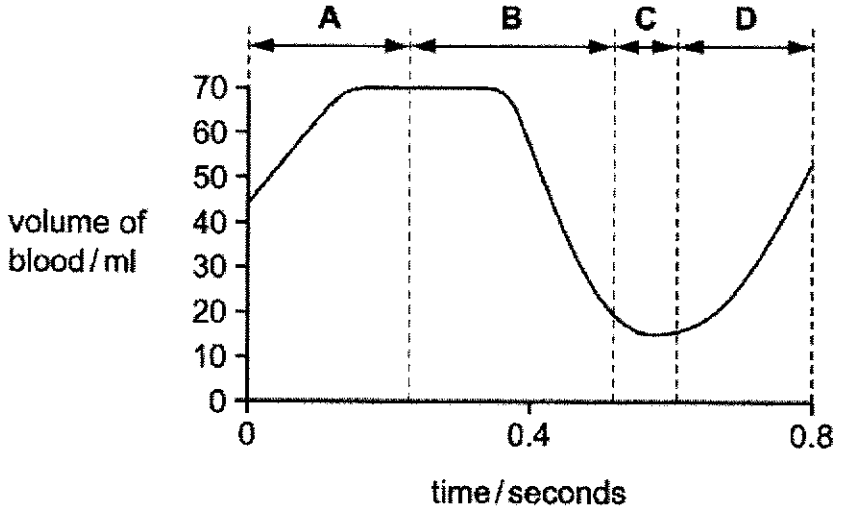
11 The pressure of blood flowing through the heart changes during the cardiac cycle. The table shows some values for the pressure in the chambers of the right side of the heart and the pulmonary artery.

Which row shows the correct values when the atrioventricular valves are opened, and the semilunar valves are closed?

	pressure in right atrium/ mmHg	pressure in right ventricle/ mmHg	pressure in pulmonary artery/ mmHg
A	2	25	25
B	8	5	25
C	2	25	5
D	8	5	5

12 The diagram shows how the volume of blood in the left ventricle of a human heart changes during one heartbeat.

When is the left ventricle contracting?



13 Reactions X and Y take place within the human body.

$$CO_2 + H_2O \overset{X}{\rightleftharpoons} H_2CO_3 \overset{Y}{\rightleftharpoons} HCO_3^- + H^+$$

Which row correctly matches X and Y to the site where each occurs, and whether an enzyme is needed?

	reaction X		reaction Y	
	enzyme needed	location	enzyme needed	location
A	yes	alveoli	yes	red blood cell
B	no	plasma	no	alveoli
C	no	red blood cell	yes	red blood cell
D	yes	red blood cell	no	plasma

14 The table shows the concentration levels of different substances present in the blood of a blood vessel found in the human body.

oxygen concentration	carbon dioxide concentration	glucose concentration
low	high	high

What could be the identity of this blood vessel?

A aorta
B hepatic portal vein
C pulmonary vein
D vena cava

15 Asthma is a lung disease triggered by the inhalation of an allergen such as pollen or dust. The allergen triggers the following responses:

- bronchi and bronchioles become inflamed and narrow
- excess mucus is secreted

What effects will the responses have on the gases exchange system?

I diffusion gradient for oxygen in the lungs becomes less steep
II increase in diffusion distance from the alveoli into blood
III increased risk of developing a lung infection

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

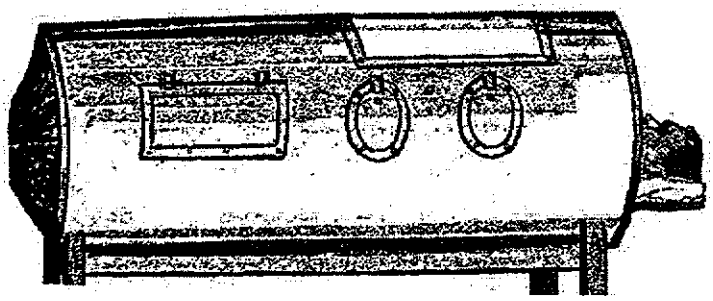
16 Electronic cigarettes are a cigarette substitute allowing nicotine to be inhaled without the other components found in cigarette smoke.

Which effects of cigarette smoking will also be the effects of using electronic cigarettes?

A Smoking increases heart rate, narrows the arterioles, and increases blood pressure.
B Smoking irritates the airways and increases mucus production.
C Smoking reduces oxygen carried by red blood cells and reduces oxygen delivered to the tissues.
D Smoking narrows the airways and increases coughing.

17 The diagram below shows an 'iron lung'.

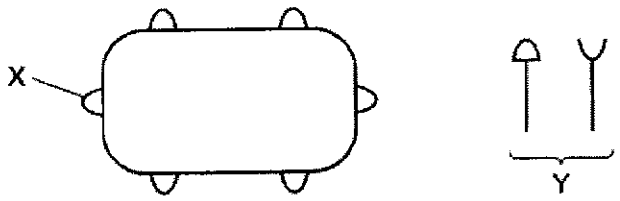
This is an airtight chamber inside which the air pressure can be varied. It is designed to help patients who have lost the ability to breathe. The chamber encloses the whole body of the patient except the head, and there is no leakage of air.



What are the air pressures in the chamber, as compared with atmospheric pressure, during inhalation and exhalation of the person?

	air pressure in the chamber as compared with atmospheric pressure	
	during inhalation	during exhalation
A	equal	higher
B	higher	equal
C	higher	lower
D	lower	higher

18 The diagram with the structure labelled X shows a bacterium with proteins on its surface. The diagram labelled Y shows proteins made by the human body.



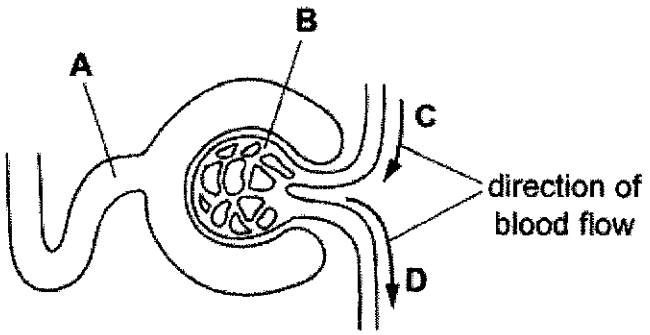
Which row shows the correct combination for destroying the bacterium?

	name of X	name of Y	correct shape of Y
A	antigen	antibody	
B	antibody	antigen	
C	antigen	antibody	

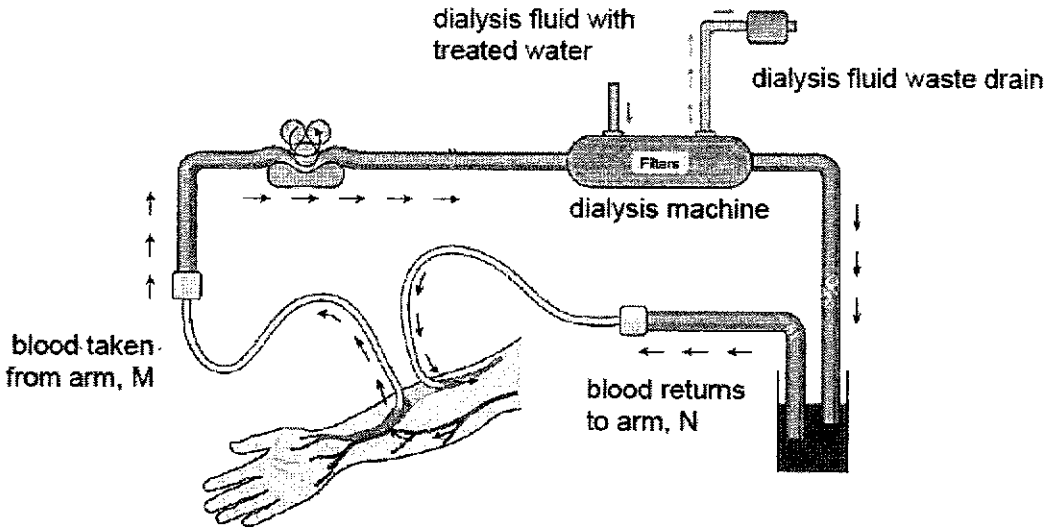
D	antibody	antigen	↑

19 The diagram shows the first part of a kidney nephron and its blood supply. During filtration, protein molecules do not pass through the wall of the glomerulus.

Which part contains the highest concentration of protein?



20 A patient undergoing dialysis has blood samples taken at point M and N.



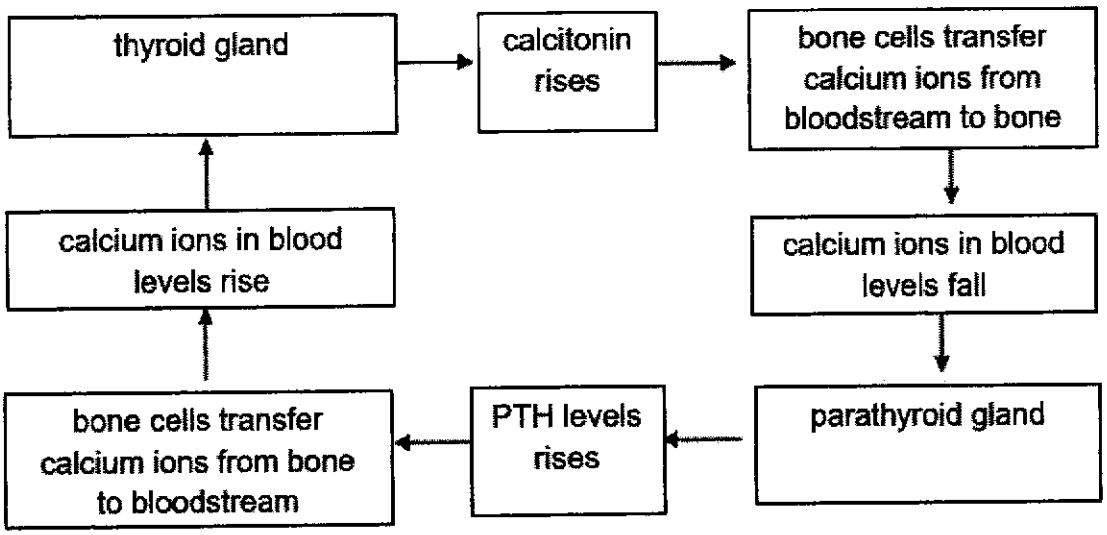
Biuret and Benedict's test were carried out on the dialysis fluid and blood samples, M and N. The results are as follows:

sample	biuret test result	Benedict's test result
M	violet colour solution	orange-red precipitate
N	violet colour solution	orange-red precipitate
dialysis fluid	blue colour solution	orange-red precipitate

Which of the following best explains the results?

A Most protein molecules have been removed from the patients' blood after dialysis.
B The dialysis fluid contains glucose and proteins.
C The partially permeable dialysis tubing allows proteins to pass through but not glucose.
D Proteins are too big to pass through the partially permeable dialysis tubing.

21 The diagram shows mechanisms for regulating level of calcium ions in blood. Calcitonin and PTH are hormones.

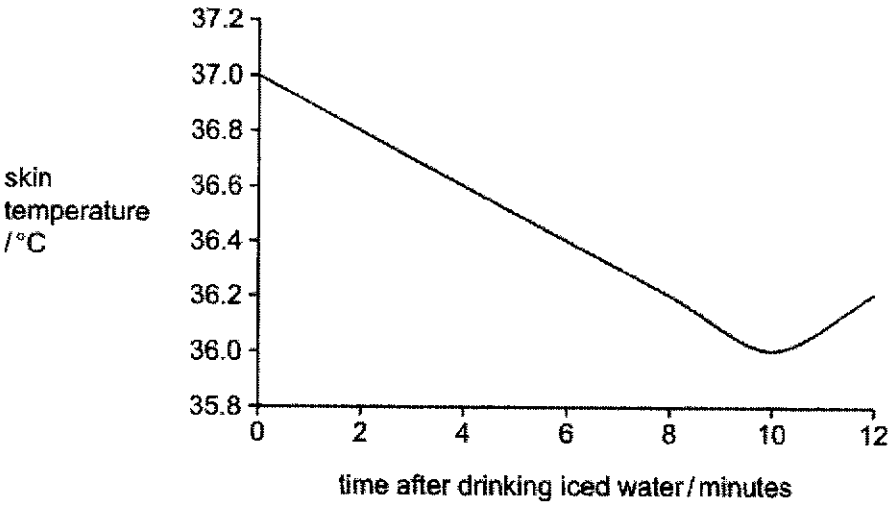


Which combination of answers is correct?

	stimulus	receptor	effector	response
A	high levels of calcium ions in blood	bone cells	parathyroid gland	calcium ions transferred from bloodstream to bone
B	low levels of calcium ions in blood	bone cells	thyroid gland	levels of PTH rise
C	high levels of calcium ions in blood	thyroid gland	bone cells	levels of calcitonin rise
D	low levels of calcium ions in blood	parathyroid gland	bone cells	calcium ions transferred from bone to bloodstream

22 A scientist investigated the effect of drinking iced water on skin temperature. They drank a large volume of iced water and monitored the temperature of their skin.

The results are shown on the graph.



Which explanation of the change in skin temperature during the first 10 minutes is correct?

A Vasoconstriction occurred increasing blood flow to the skin.
B Vasoconstriction occurred reducing blood flow to the skin.
C Vasodilation occurred increasing blood flow to the skin.
D Vasodilation occurred reducing blood flow to the skin.

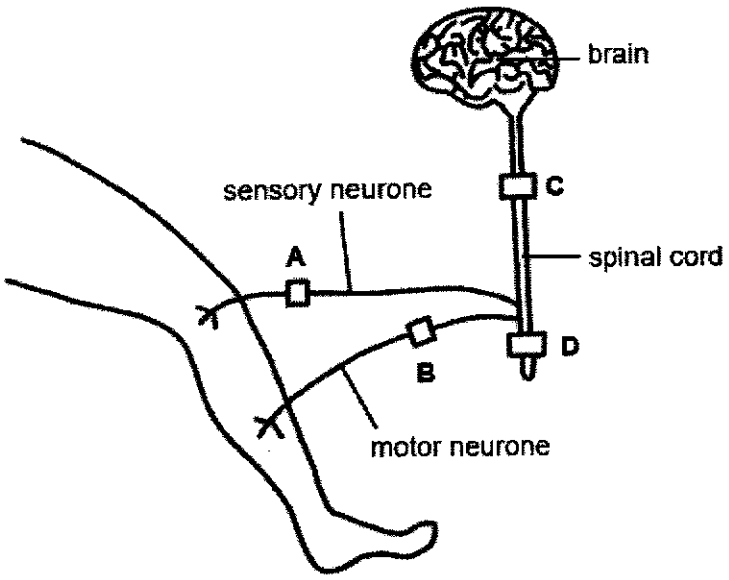
23 In myopia, distant objects appear blurred while near objects are clear.

1 The ciliary muscles cannot relax sufficiently.
2 The lens is unable to become thinner.
3 The suspensory ligaments cannot become sufficiently taut.

Which of the following would result in myopia?

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

24 Anaesthetic blocks can be applied to various parts of the nervous system to prevent nerve impulses from travelling along neurones. The diagram shows the different sites, **A**, **B**, **C** and **D** where the anaesthetic can be applied.



Which option correctly shows the effect of the anaesthetic block at **A**, **B**, **C** or **D** respectively?

	pin prick can be felt on the leg	involuntary movement of leg	voluntary movement of leg
A	√	√	X
B	√	X	X
C	X	X	√
D	X	X	X

25 Diabetics who are on rapid-acting insulin are advised not to wait more than 20 minutes to eat after taking an insulin shot.

Which of the following best explains this?

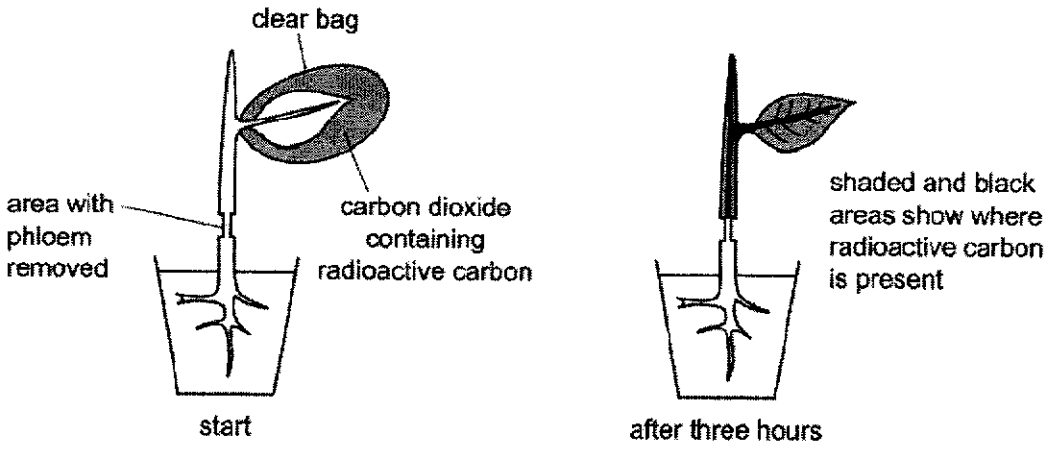
A The insulin injected will serve as negative feedback to prevent the body from producing more insulin necessary to maintain blood glucose concentration.

B The injection of insulin can cause a dangerously low blood glucose concentrations.

C Insulin is required for increased absorption of glucose in the small intestine.

D The liver and muscles will be stimulated to convert stored glycogen to glucose.

26 A ring of phloem tissue was removed from the stem of a plant, as shown in the first diagram. Carbon dioxide containing radioactive carbon was supplied to the leaf of the plant. The second diagram shows where radioactive carbon was present after three hours.



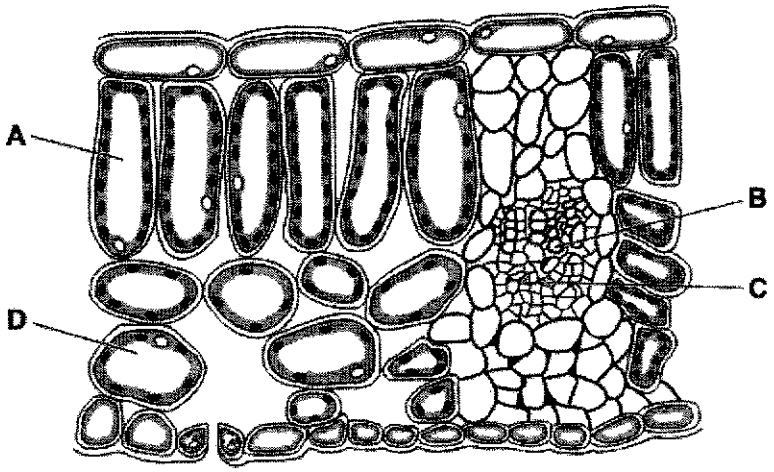
Which statement does the experiment support?

I Translocation of sugar only occurs in one direction.
II Translocation occurs in the phloem.
III Translocation requires energy.

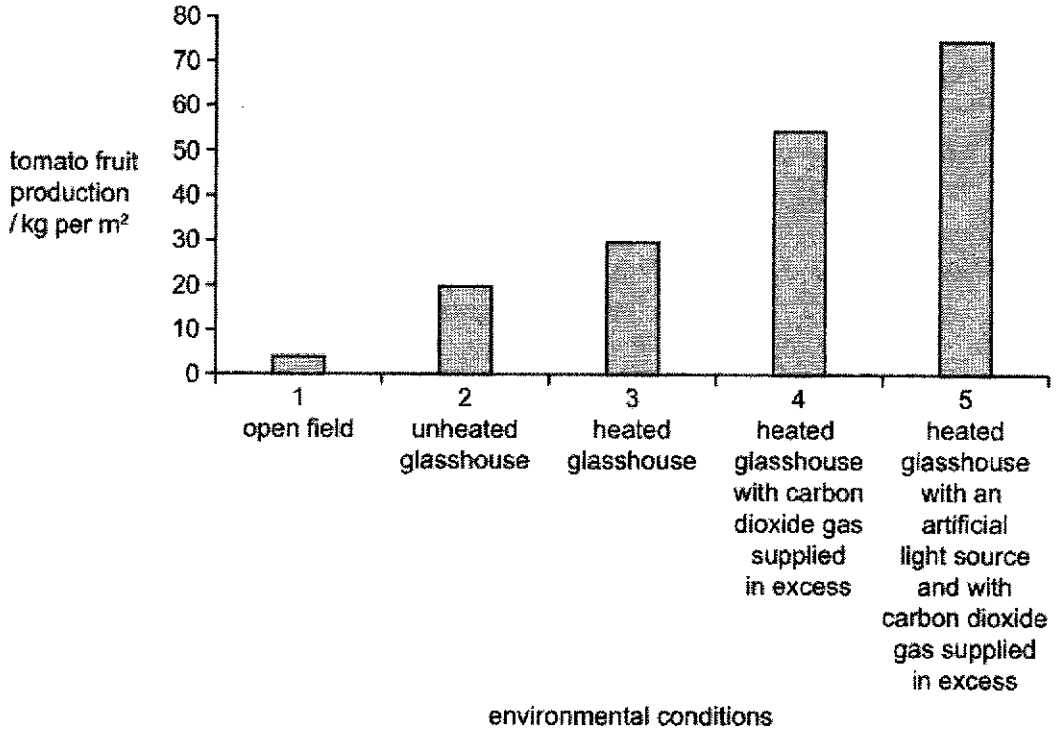
A I only
B I and II only
C II only
D II and III only

27 The diagram shows a cross-section through a leaf.

From which cell will most water evaporate during transpiration?



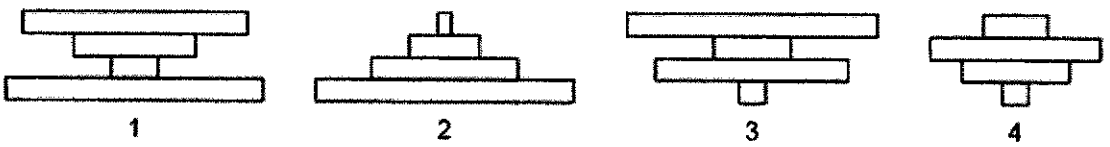
28 Tomato fruit production was measured in five different environmental conditions.



What is a correct conclusion for the data shown in the graph?

A There are no limiting factors in 1, so tomato fruit production is the lowest.
B Temperature is the limiting factor in 3.
C Carbon dioxide is the limiting factor in all five environmental conditions.
D Light is the limiting factor in 4.

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



Which is the pyramid of biomass and pyramid of numbers of this food chain?

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

30 The statements describe some of the events that occur during eutrophication.

What is directly responsible for the increase in decomposers?

A a decrease in dissolved oxygen concentration
B an increase in nitrate concentration
C an increase in the population of algae
D an increase in the death of producers

31 Pure-breeding black-feathered chickens are mated with pure-breeding white-feathered chickens. All of the offspring (F1 generation) have black feathers and white feathers.

When two of the F1 generation chickens are crossed, what will be the ratios of offspring phenotypes?

A 1 black: 1 white
B 1 black: 2 black and white: 1 white
C 3 white: 1 black
D 3 black: 1 white

32 A man marries a woman who has a different blood group from him. They have two children. The children have different blood groups from each other and different blood groups from their parents.

What are the genotypes of the parents' blood groups?

A I^AI^A and I^AI^B
B I^AI^A and I^OI^O
C I^AI^B and I^BI^B
D I^AI^B and I^OI^O

33 The table shows the percentage of nucleotides found in a rat and a turtle.

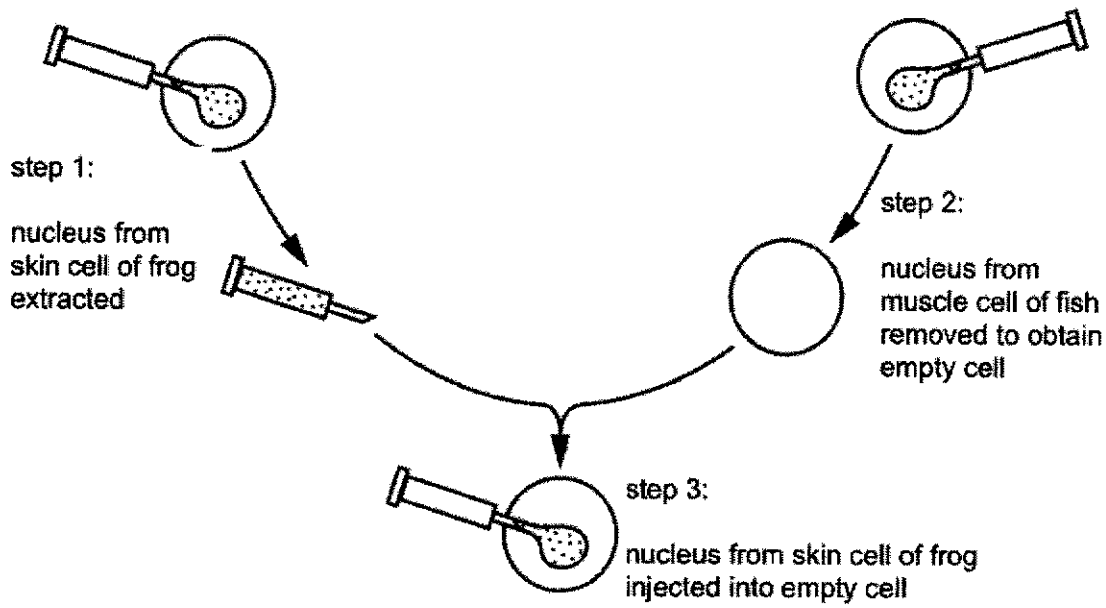
source of DNA	guanine %	thymine %	cytosine %	adenine %
rat	22	28	22	28
turtle	22	28	22	28

Which statement best explains why the rat and the turtle are different animals despite both having same percentages of each nucleotide?

A Amino acids are used to produce different proteins in rats and turtles.

B The deoxyribonucleic acid (DNA) of the rat uses deoxyribose while the DNA of the turtle uses ribose.
C The rules of complementary base pairing are different in rats and turtles.
D The sequence of nucleotides is different and therefore code for different proteins.

34 The diagram shows a process carried out by a scientist in a laboratory.



The empty cell which contains the injected nucleus from the frog skin cell is subsequently allowed to multiply to produce more cells.

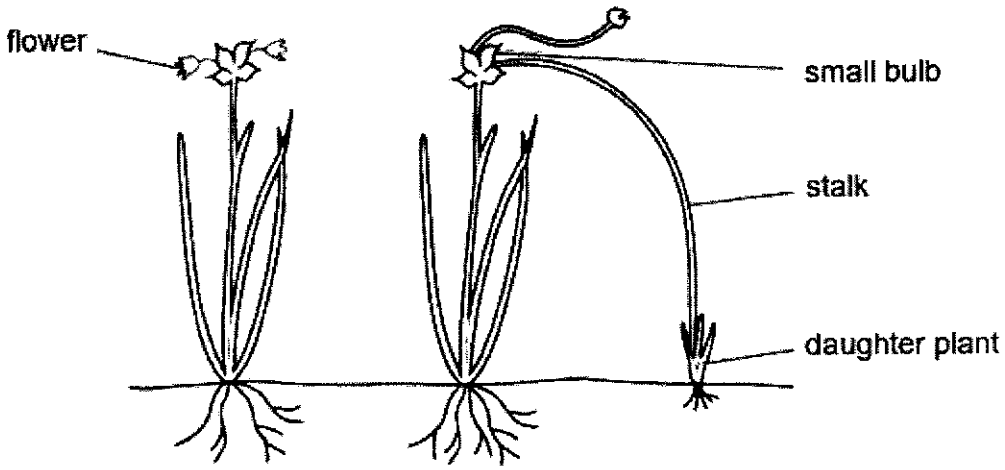
What would the cluster of cells most likely form?

A fish muscle
B fish skin
C frog muscle
D frog skin

35 Which statements about natural selection are correct?

	natural selection can lead to better adapted species surviving	natural selection can lead to extinction of a species	natural selection can lead to gene mutations occurring
A	√	√	√
B	√	√	x
C	√	x	√
D	x	√	√

36 The diagram shows two onion plants.



Which statement about these onion plants is correct?

A Daughter plants are produced from the small bulb by meiosis.

B Daughter plants produced are genetically identical to the parent plant.

C The plants can reproduce sexually and asexually.

D Two parent plants are required for reproduction.

37 Three different experiments were conducted on three separate newly-opened flowers growing on three plants of the same species. The experiments are summarised below.

flower on plant 1	Anthers of the flower were removed and the flower was left open to air.
flower on plant 2	Anthers were left untouched and a paper bag was tied tightly around the flower.
flower on plant 3	Anthers were carefully removed and a paper bag was tied around each flower.

At the end of the experiment, only plant 1 produced seeds.

What is the best explanation for this?

A This species of plant is pollinated by insects and wind.

B This species of plant reproduces asexually.

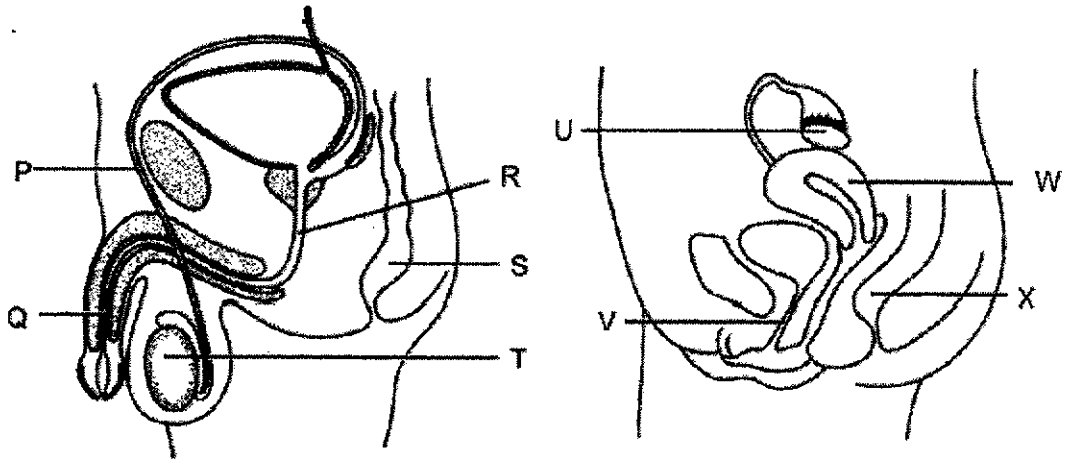
C Only self-pollination takes place in this species.

D Both self-pollination and cross-pollination takes place in this species.

38 Which is an example of sexual reproduction?

A one bacterial cell dividing to produce two daughter bacterial cells
B one banana plant being divided into two banana plants
C one pollen grain nucleus fusing with one ovule nucleus in a flower
D one yeast cell producing buds which separate to become new yeast cells

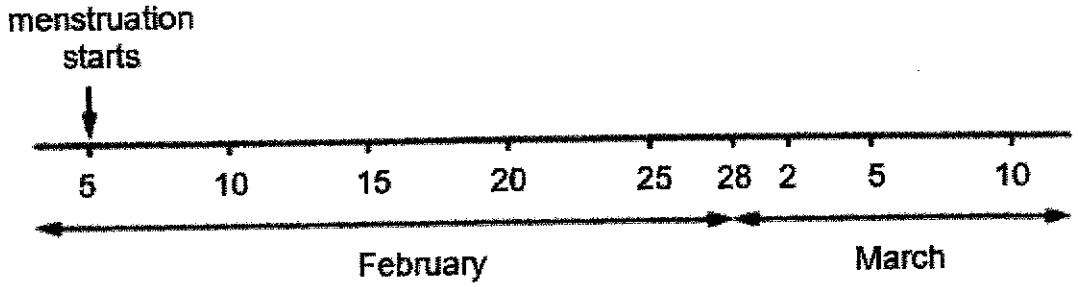
39 The diagram shows the side view of the male and female reproductive structures.



Which structures have similar functions?

A S and X, T and U
B R and V, T and W
C Q and U, S and X
D T and W, R and X

40 The diagram shows a calendar for 33 days in February and March. A girl with a regular menstrual cycle of 28 days, begins menstruation on 5 February.



During which dates would the progesterone concentration in her blood rise most rapidly?

A 5 – 12 February
B 13 – 19 February
C 20 – 26 February
D 27 February – 5 March

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Answer Key
Paper 1

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

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Paper 2

No	Answers	Marks
1a	**E** rough endoplasmic reticulum **F** mitochondrion **G** nucleus 2 correct 1m, 3 correct 2m	3
1b	Chemical substance produces by endocrine gland; transported in the bloodstream to its target organs where it exert its effect;	1 1
1c	• Increased blood glucose concentration above set point stimulates (β cells of) islets of Langerhans of the pancreas to increase insulin secretion; • Insulin travels in bloodstream to liver / muscles; • Stimulating increased uptake of glucose & conversion of glucose to glycogen; • Decreasing blood glucose to set point (A: 70-100 mg/dm^3)	1 1 1
1d	Spray is less invasive that skin injections / doesn't have to pierce through the skin; Spray is faster acting than tablets + diffuses directly into blood; Proteins in the tablets might be denatured from proteases in the digestive system;	Any 1
2a	cellulase	1
2b	ensure no **net** movement of water molecules into the cells/AW; prevent the cells from increasing in volume and bursting/ AW;	1 1
2ci	As light intensity increases at first, rate of photosynthesis increases as light intensity is the limiting; at high light intensities, rate of photosynthesis remains constant/reaches maximum/no longer increases; **showing that light intensity is no longer limiting**;	1 1
2cii	(651-394)/394 x 100%; minus 1m if not 2sf (65.22);	2
2ciii	enzymes involved in photosynthesis denature; photosynthesis to stop/ wilting / leaves fold up / stem droops;	1 1
3ai	- Wall is made up of a single layer of cell to reduce diffusion distance, so that gases exchange between the alveoli and the bloodstream can take place quickly - Close proximity of the alveoli to the blood capillary to reduce diffusion distance for faster rate of gases exchange	1 1
3aii	- Biconcave in shape, increasing surface area to volume ratio for faster diffusion of oxygen into the cell - No nucleus to have more space to contain more haemoglobin to carry more oxygen	1 1 (max 1)
3bi	- Thick layer of mucus (smoker) - Cilia paralysed (smoker) - Smaller air space (smoker)	1 1 1 (max 2)
3bii	Irritants/ Tar	1
3biii	Unable to remove the bacteria trapped in the mucus; Mucus build up and result in persistent coughing and breathing difficulties and lung infections	1 1