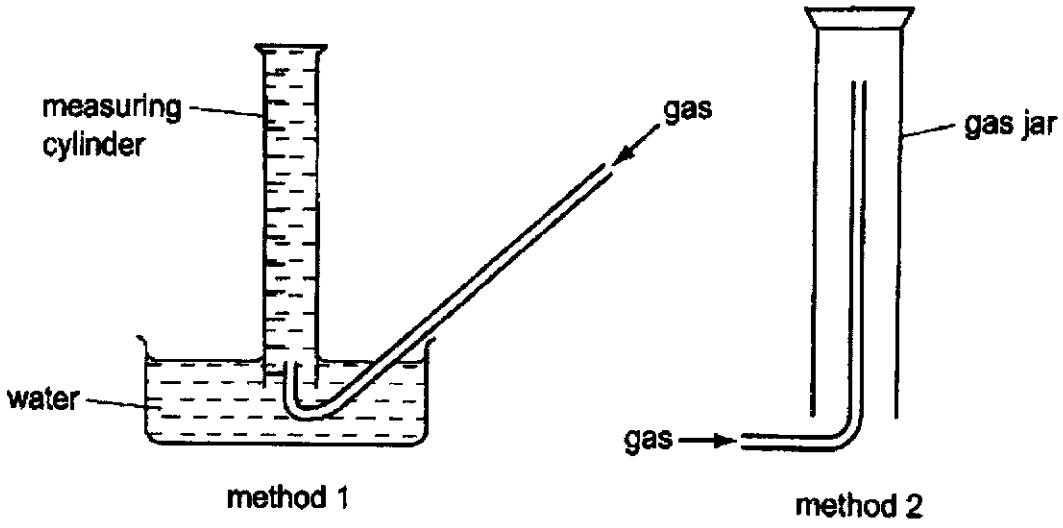
1 The diagrams show two methods of collecting gases.



Which row gives the properties of a gas which can be collected by both methods?

	property 1	property 2
A	soluble in water	less dense than air
B	soluble in water	denser than air
C	insoluble in water	less dense than air
D	insoluble in water	denser than air

2 Which two gases each change the colour of damp red litmus paper?

A ammonia and chlorine
B ammonia and sulfur dioxide
C carbon dioxide and chlorine
D carbon dioxide and nitrogen dioxide

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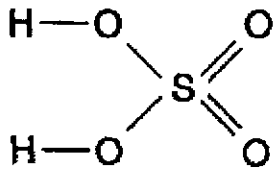
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3 An atom of element ***Z*** is represented by $^{7}_{3}Z$.
Which statement about an atom of ***Z*** is correct?

A It is in Group III of the Periodic Table.
B It is in Group VII of the Periodic Table.
C The total number of protons and electrons is 6.
D The total number of protons and neutrons is 10.

4 The bonding in sulfuric acid can be represented by the structure shown.



What is the **total** number of electrons in the covalent bonds surrounding the sulfur atom?

A 4
B 6
C 8
D 12

5 $20cm^3$ of oxygen are reacted with $20cm^3$ of carbon monoxide.

The equation for the reaction is shown.

$$O_2\,(g) + 2CO\,(g) \rightarrow 2CO_2\,(g)$$

All volumes are measured at room temperature and pressure.

What are the volumes of the gases remaining, at the original temperature and pressure?

	oxygen / cm^3	carbon monoxide / cm^3	carbon dioxide / cm^3
A	0	0	20
B	0	0	40
C	10	0	20
D	10	10	20

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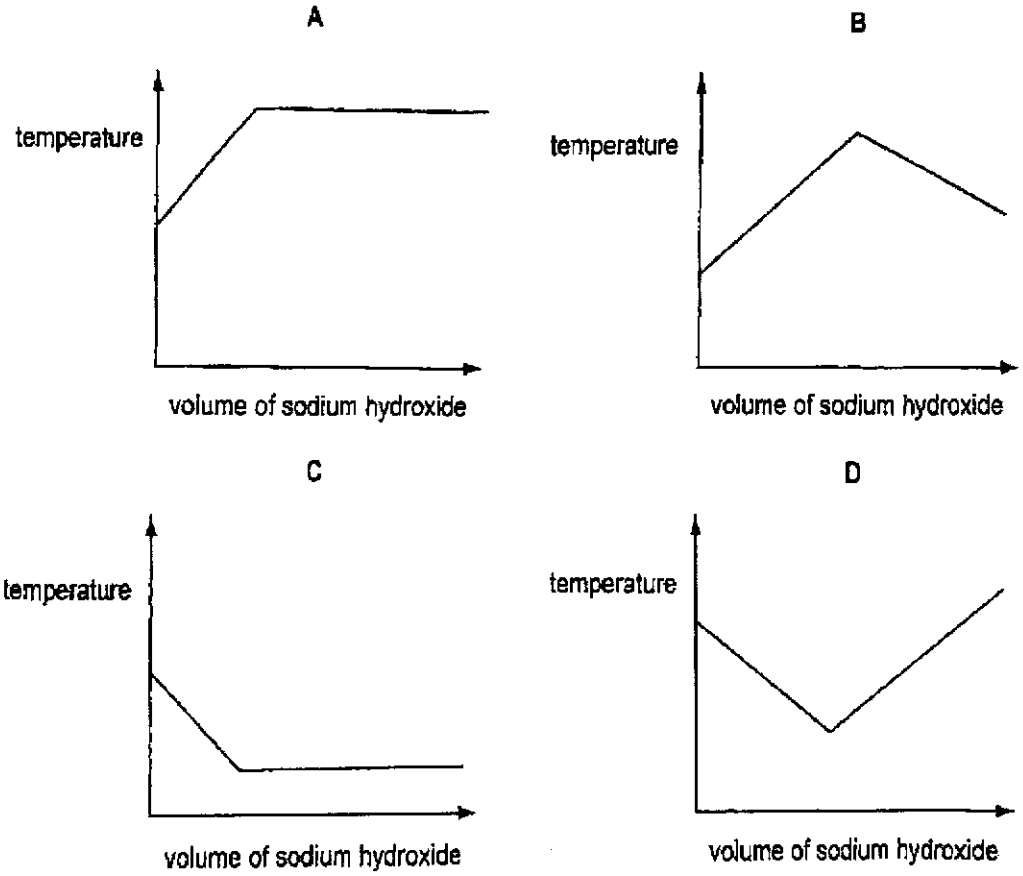
6 The formula of copper(I) oxide is Cu_2O.

How many grams of oxygen are combined with 64g of copper in this compound?

A 8
B 16
C 32
D 64

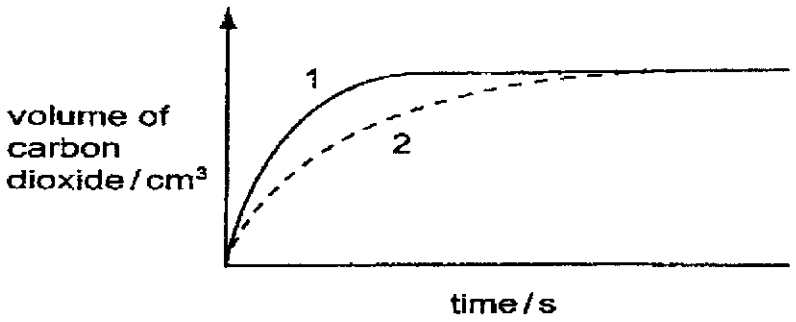
7 The reaction between aqueous sodium hydroxide and hydrochloric acid is exothermic.

Which graph shows the change in temperature when aqueous sodium hydroxide is added to hydrochloric acid until the alkali is present in excess?



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8 Curve 1 shows the volume of carbon dioxide given off when 5g of calcium carbonate lumps react completely with an excess of hydrochloric acid at 40°C.



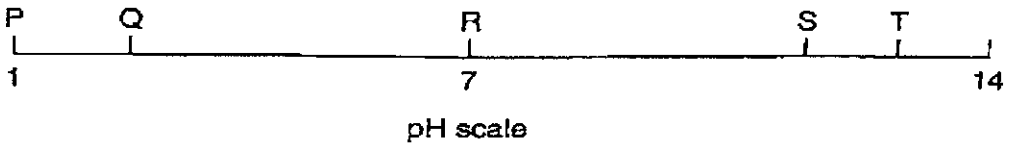
What change could produce curve 2?

A use a lower temperature
B use a more concentrated solution of the acid
C use 4g of calcium carbonate lumps
D use 5g of calcium carbonate powder

9 Which change represents reduction?

A $Na \rightarrow Na^+$
B $Mg \rightarrow MgO$
C $Fe^{2+} \rightarrow Fe^{3+}$
D $Cl_2 \rightarrow 2Cl^-$

10 The pH values of five aqueous solutions P, Q, R, S and T are shown.



What could the aqueous solutions be?

	ammonia	ethanoic acid	hydrochloric acid	sodium chloride	sodium hydroxide
A	Q	S	T	R	P
B	R	P	Q	S	T
C	R	T	S	Q	P
D	S	Q	P	R	T

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11 Element X forms a basic oxide.
What is X?

A a halogen
B a noble gas
C a metal
D a non-metal

12 A data book gives the following information about an element.

appearance	silver-grey
melting point	60°C
density	0.79g/cm^3
reaction with water	vigorous reaction with cold water

Where is the element likely to be found in the Periodic Table?

A Group 0
B Group I
C Group II
D Group VII

13 Experiments are carried out to arrange metals X, Y and Z in order of reactivity.
The table shows the results.

experiment	X	Y	Z
Does the metal liberate hydrogen from dilute hydrochloric acid?	yes	no	yes
Is the metal oxide reduced by heating with carbon?	yes	yes	no

What is the order of reactivity of the metals?

	most reactive → least reactive		
A	X	Z	Y
B	Y	X	Z
C	Z	X	Y
D	Z	Y	X

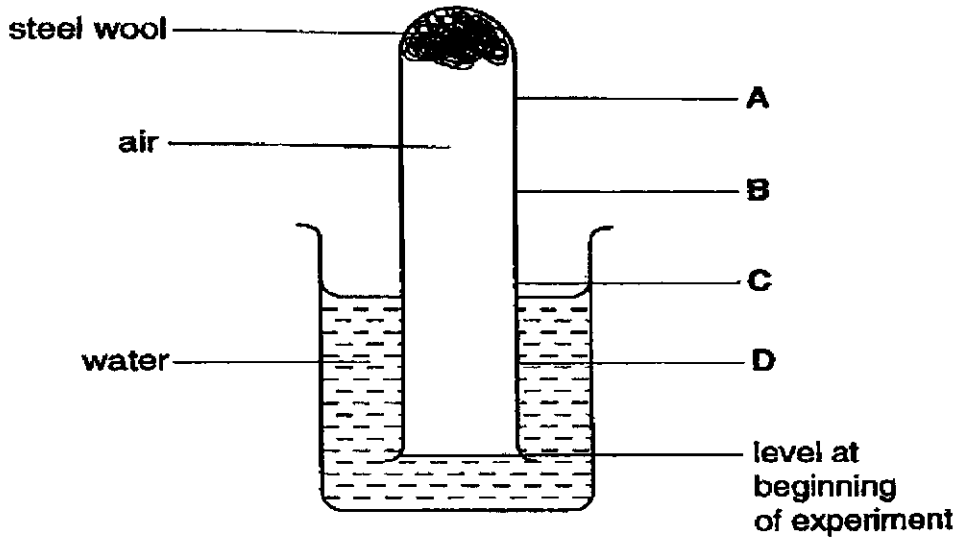
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14 Which statement about the production of iron from haematite is correct?

A Coke is used to oxidise the slag.
B Limestone is used to produce oxygen for the coke to burn.
C Molten iron floats on slag at the furnace base.
D The haematite is reduced by carbon monoxide.

15 The diagram shows steel wool inside a test-tube. The test tube is inverted in water, trapping air inside.

What will be the water-level after several days?

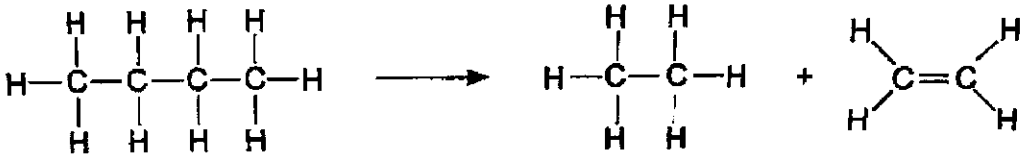


16 Which poisonous gas is formed when natural gas is burned in a limited supply of oxygen?

A carbon monoxide
B carbon dioxide
C nitrogen dioxide
D methane

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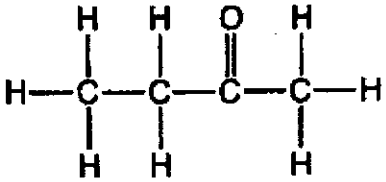
17 The equation represents a reaction in which butane is converted into smaller molecules.



This reaction is an example of

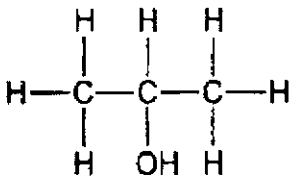
A addition
B cracking
C polymerisation
D substitution

18 The structure of a molecule, **X**, is shown.

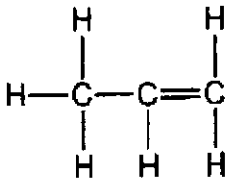


Which compound is in the same homologous series as **X**?

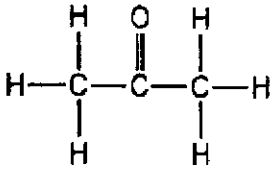
A



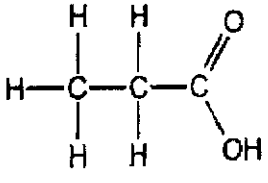
B



C



D

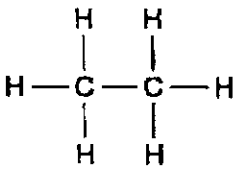
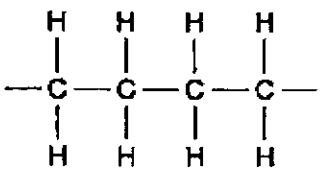
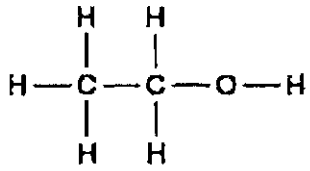
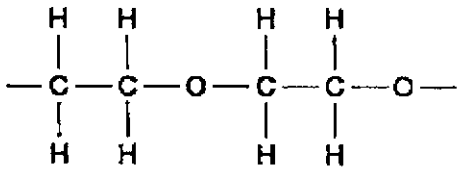
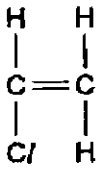
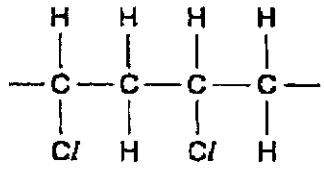
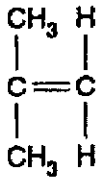
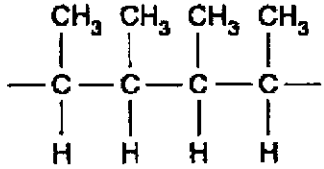


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19 The taste of wine changes after contact with air because some of the alcohol in the wine

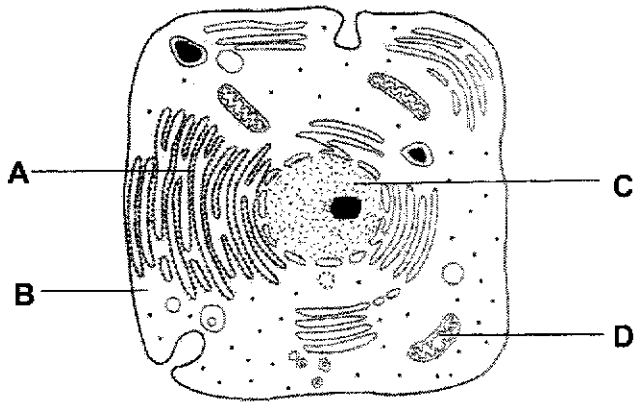
A reacts with carbon dioxide.
B reacts with ethanol.
C reacts with water.
D reacts with oxygen.

20 Which of the following shows the correct monomer for making the polymer?

	monomer	polymer
A		
B		
C		
D		

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21 The diagram shows a cell as it appears in an electron micrograph.
Which organelle carries out aerobic respiration?



22 Which mature structure contains a nucleus?

1	red blood cell	**3**	root hair cell
2	xylem vessel	**4**	sensory neurone

A **1** and **2** only

B **2** and **3** only

C **3** only

D **3** and **4** only

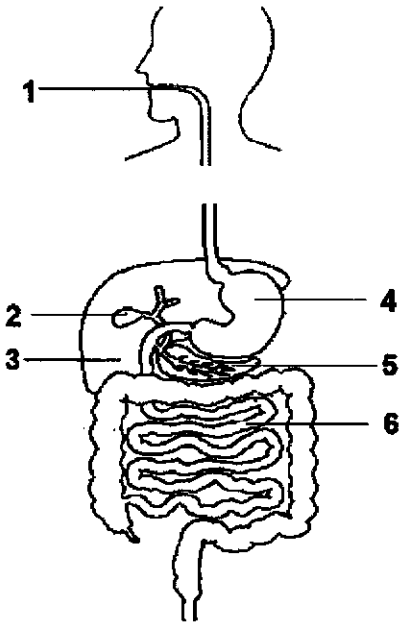
23 Which function of the liver is correctly paired with the chemical involved?

	Function	Chemical
A	Deamination	Glycogen
B	Detoxification	Alcohol
C	Excretion	Urea
D	Storage	Amino acids

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24 The diagram shows the digestive system.



Which of the following produces substances that aid the digestion of lipids?

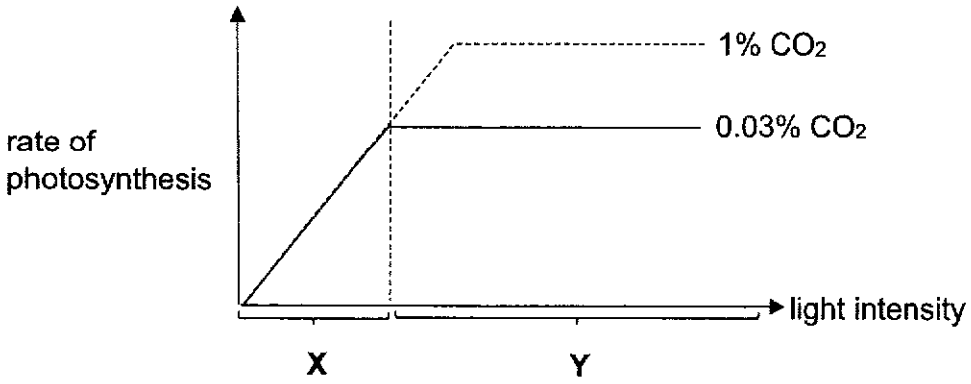
A 1, 2, 5

B 2, 3, 6

C 2, 4, 6

D 3, 5, 6

25 The graph shows the effects of varying the carbon dioxide concentration at different light intensities on the rate of photosynthesis.



What conclusion can be drawn from the graph?

A At **X**, CO_2 concentration limits the rate of photosynthesis.

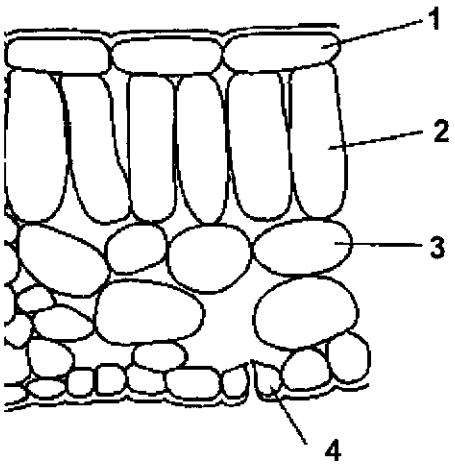
B At **X**, temperature limits the rate of photosynthesis.

C At **Y**, CO_2 concentration limits the rate of photosynthesis.

D At **Y**, light intensity limits the rate of photosynthesis.

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26 The diagram shows part of a transverse section of a leaf.



Which cells contain chloroplasts?

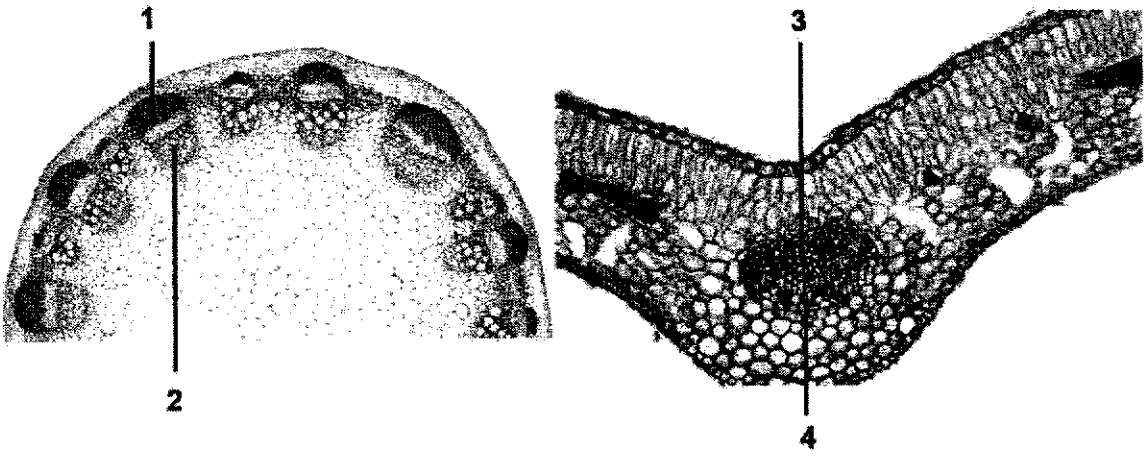
A **1** and **2** only

B **2** only

C **3** and **4** only

D **2**, **3** and **4** only

27 A plant was exposed to radioactive carbon dioxide for 24 hours and the tissues were examined afterwards.



Which of the following numbered tissues examined were radioactive?

A **1** and **3**

B **1** and **4**

C **2** and **3**

D **2** and **4**

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28 When the ventricles contract, blood pressure in the ventricles are higher than in the arteries and atria. Which of the following describes the correct action of the valves?

	Bicuspid Valve	Aortic valve
A	Close	Close
B	Close	Open
C	Open	Close
D	Open	Open

29 Which of the following describes the conditions in the muscles that causes it to cramp during exercise?

	Oxygen concentration	Lactic acid concentration
A	High	High
B	High	Low
C	Low	High
D	Low	Low

30 Cigarette smoke contains harmful substances that can cause diseases. Which of the following is correct?

	Cancer	Emphysema	Heart disease
A	Nicotine	Tar	Carbon monoxide
B	Nicotine	Carbon monoxide	Tar
C	Tar	Tar	Carbon monoxide
D	Tar	Nicotine	Nicotine

31 Which statement about reproduction is correct?

A Asexual reproduction only occurs in plants.

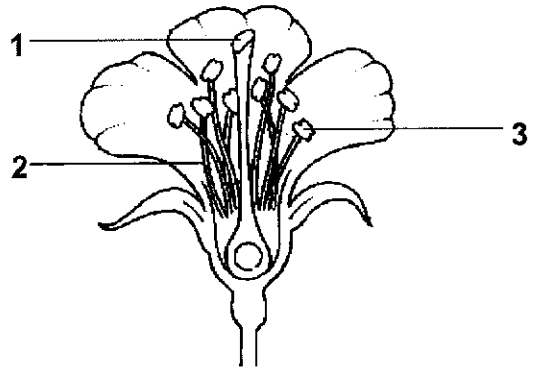
B Offspring formed by asexual reproduction have identical genotypes.

C Offspring formed by sexual reproduction have identical phenotypes.

D Pollination is always required for reproduction in plants.

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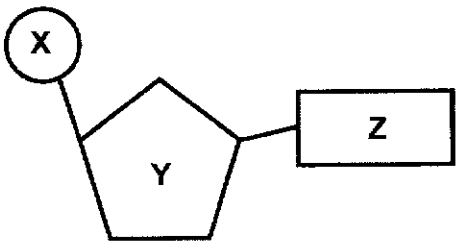
32 The diagram shows a section of a flower.



What are the numbered parts?

	1	2	3
A	Anther	Filament	Stigma
B	Anther	Style	Stigma
C	Stigma	Filament	Anther
D	Stigma	Style	Anther

33 The diagram shows a nucleotide.



What are the components **X**, **Y** and **Z**?

	X	Y	Z
A	sugar	phosphate group	base
B	phosphate group	sugar	base
C	base	sugar	phosphate group
D	sugar	base	phosphate group

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34 What are the changes to the eye when a person reading a book looks at a faraway object?

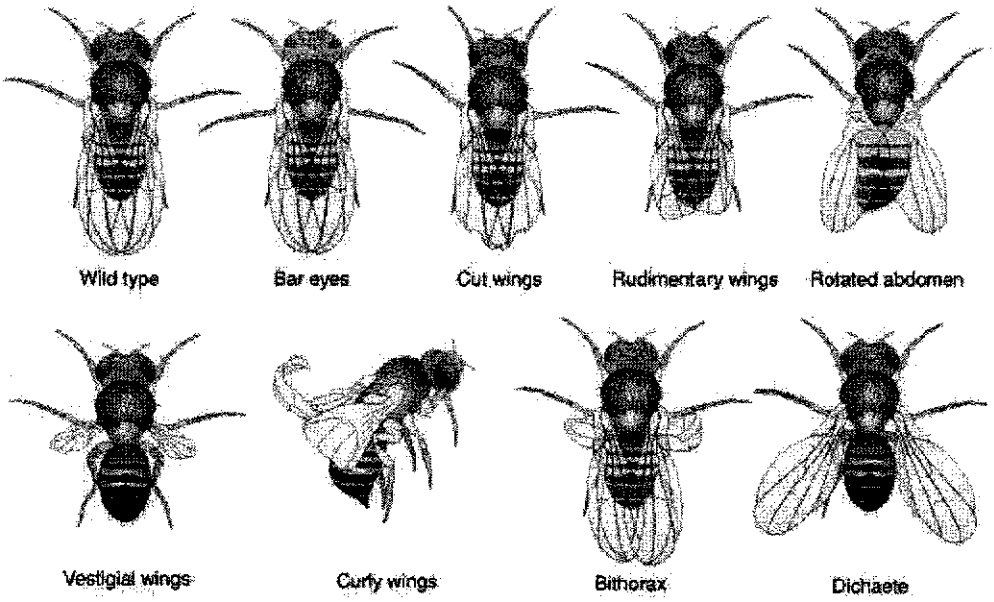
A Ciliary muscles contract and suspensory ligament becomes taut

B Ciliary muscles contract and suspensory ligament becomes slack

C Ciliary muscles relax and suspensory ligament becomes taut

D Ciliary muscles relax and suspensory ligament becomes slack

35 The diagram shows some types of variation in the common fruit fly, *Drosophila*



Which row describes the variation shown in the diagram?

	Vestigial wings	*Rotated Abdomen*	*Body Length*
A	Continuous	Continuous	Continuous
B	Continuous	Continuous	Discontinuous
C	Discontinuous	Discontinuous	Continuous
D	Discontinuous	Discontinuous	Discontinuous

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36 A gene contains 900 phosphate groups. How many amino acids does the polypeptide contain when the mRNA is translated?

A 150

B 300

C 900

D 2700

37 In mice, the allele B, for black fur is dominant over the allele b, for white fur. When a black mouse was mated with another black mouse, the offspring produced in the same litter consisted of six black and two white.
What are the parent genotypes?

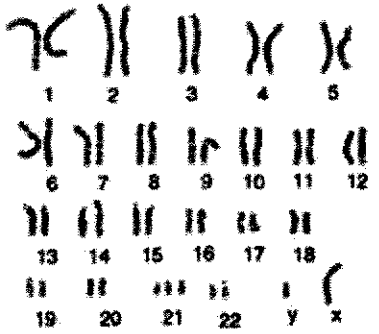
A BB X bb

B Bb X Bb

C Bb X bb

D bb X bb

38 The diagram shows the chromosomes belonging to an offspring.



Which of the following descriptions about the offspring is correct?

A female with Down syndrome

B female with sickle cell anaemia

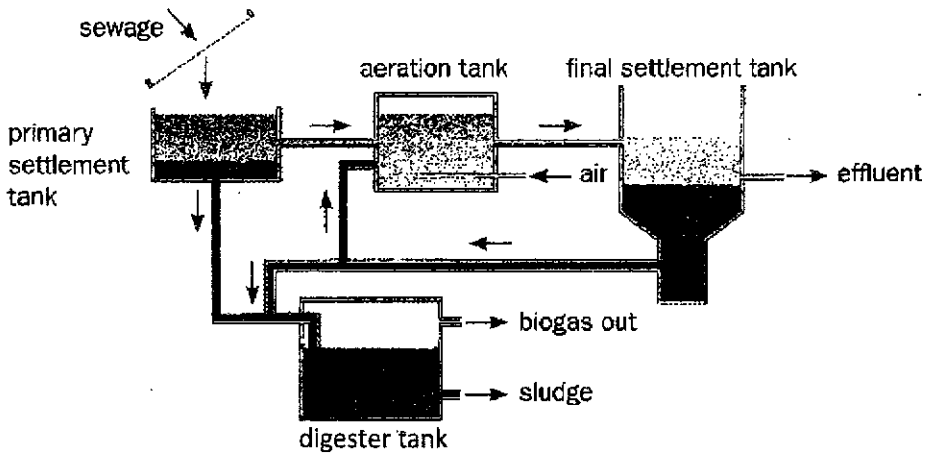
C male with Down syndrome

D male with sickle cell anaemia

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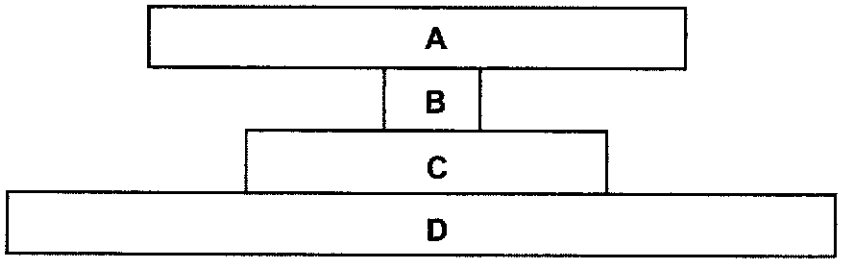
39 The diagram shows how sewage is treated at a water reclamation plant.



Which of the following shows the correct application of microbes in the sewage treatment process?

	Aerobic bacteria	*Anaerobic bacteria*
A	Aeration tank	Digester tank
B	Digester tank	Aeration tank
C	Digester tank	Primary settlement tank
D	Aeration tank	Final settlement tank

40 The diagram shows a pyramid of numbers in an ecosystem on land.
Which organism has the smallest body size?



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Section A

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

1 A student cut six pieces of potato to the same length and width. The potato pieces were submerged in salt solutions of different concentration for 30 min. After 30 min, the potato pieces were then removed from the salt solutions and the length was measured. Table.1.1 shows the results.

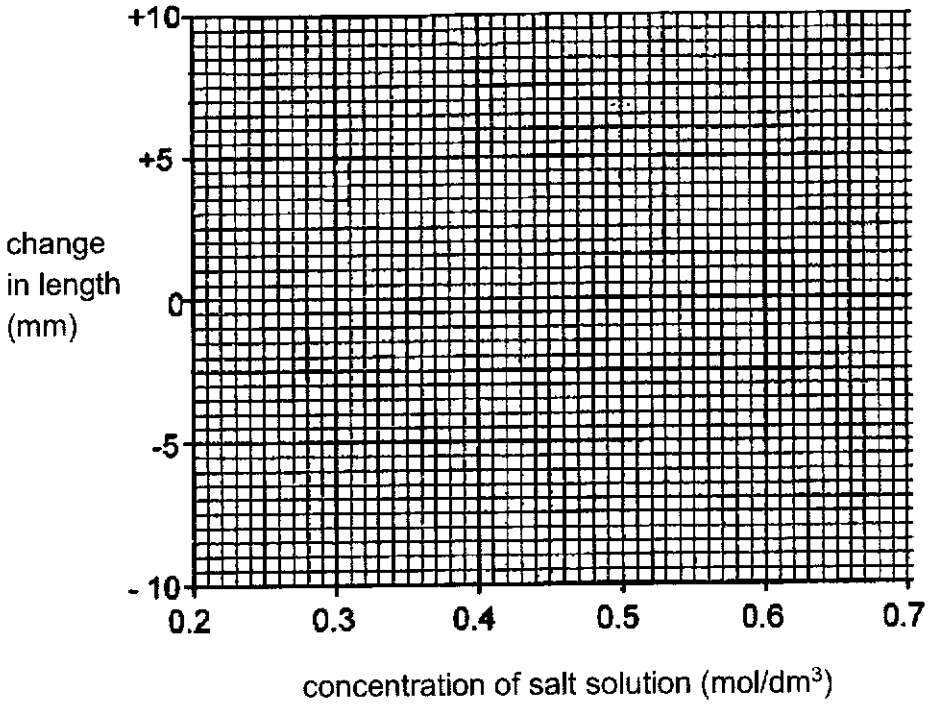
Table.1.1

concentration of salt solution / mol per dm^3	change in length (mm)
0.20	+4
0.30	+1
0.40	-1
0.50	- 2
0.60	-4
0.70	-7

(a) On the grid

(i) Plot the points in Table.1.1. [2]

(ii) Draw a best fit line. [1]



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(b) **(i)** Use your graph to find the concentration of salt solution where there is no change in length.

..... [1]

(ii) How is this concentration related to the concentration of the cell sap of potato cells?

.....

..... [1]

(c) Explain why the potato increased in length when placed in salt solution of 0.2 mol/dm^3.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(d) Suggest one way the student can make the results more accurate.

.....

..... [1]

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2 Fig.2.1 shows two test-tubes **A** and **B**, each containing an Elodea plant, aerated water and bicarbonate indicator.

Test-tube **A** was covered with black paper.

Both tubes were placed in the sunlight for 12h.

The bicarbonate indicator turns yellow when carbon dioxide is added and purple if carbon dioxide is removed.

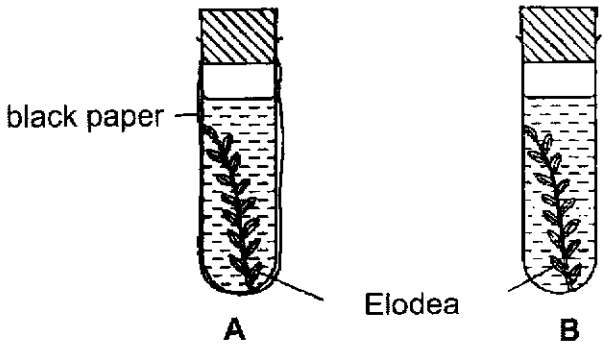


Fig.2.1

(a) **(i)** Predict the colors of the solution in **A** and **B** after 12h.

A: ..... **B**: ..... [1]

(ii) Explain your answer for test-tube **A**.

.....

.....

.....

.....

..... [2]

(iii) Explain your answer for test-tube **B**.

.....

.....

.....

.....

..... [2]

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(b) Write a suitable aim for the experiment in Fig.2.1.

.....

..... [1]

3 A person touches a hot object and immediately pulls away his hand. Fig.3.1 shows this reflex action.

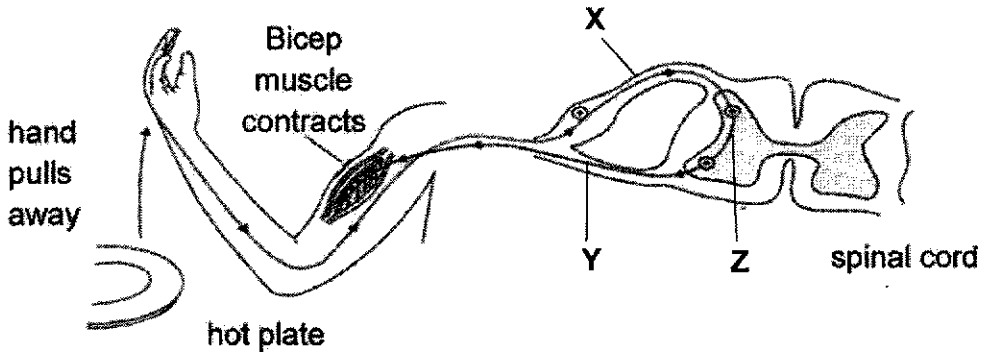


Fig.3.1

(a) Identify the following parts of the reflex arc:

X: ..... **Y**: .....

Z: ..... [2]

(b) State how reflex action help prevent injuries.

.....

..... [1]

(c) A student has been injured in an accident. When he touched the hot plate, no reflex occurs. However, he can move his fingers when told to do so.

(i) Which part(s) of the reflex arc (**X**, **Y** and **Z**) in Fig.3.1 is/are injured?

..... [1]

(ii) Explain your answer above.

.....

.....

.....

..... [2]

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(d) State **two** ways in which nervous and hormonal coordination are different.

.....

.....

.....

.....

..... [2]

4 Fig.4.1 shows some changes during a menstrual cycle.

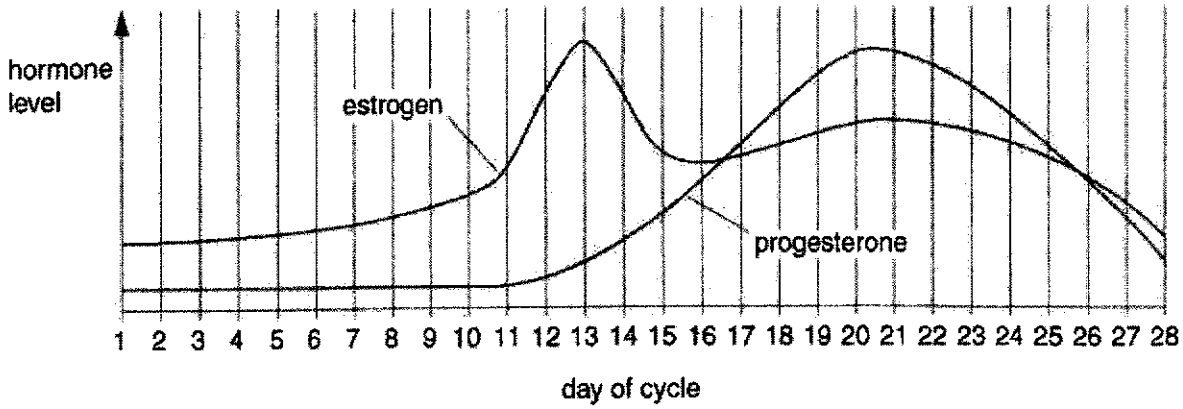


Fig.4.1

(a) On Fig.4.1, mark and label to indicate the following events

(i) menstruation lasting for five days

(ii) ovulation [2]

(b) **(i)** With reference to Fig,4.1, describe the changes in the oestrogen levels between day 5 to 14.

.....

..... [1]

(ii) State the effects of these changes on the female reproductive system.

.....

..... [2]

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(c) Progestin is a synthetic (manufactured) form of progesterone found in birth control pills. Suggest the effect of progestin on the uterus lining.

.....

..... [1]

(d) Some couples use in vitro fertilization to increase their chances of having a baby where the fertilization process happens outside the body.

(i) Define fertilization.

.....

..... [1]

(ii) Suggest must happen after successful in vitro fertilization to ensure pregnancy and birth of a baby after nine months.

.....

..... [1]

(e) Sperm cells are very much smaller than ovum. Suggest how this might be beneficial.

.....

..... [1]

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5 Sickle cell anaemia is an inherited disease of the blood. The allele for sickle cell anaemia was formed as a result of a mutation.

(a) **(i)** Describe the mutation that causes sickle cell anaemia.

.....

..... [1]

(ii) Define the term **allele**.

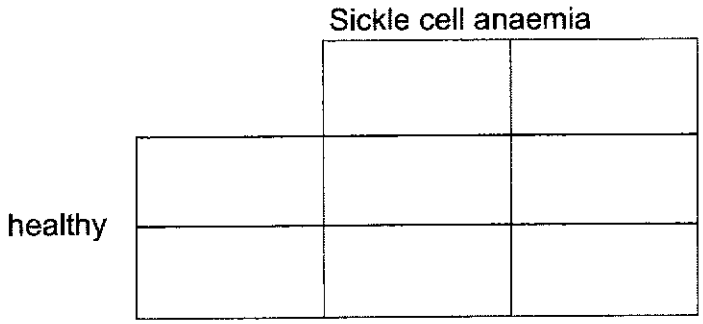
.....

..... [1]

(b) Sickle cell anemia is a recessive condition.

(i) Carry out a cross between a heterozygous healthy person and a person suffering from sickle cell anemia.

Use the Punnett square to work out your answer.
Use the symbols **H** for the allele for healthy and **h** for the allele for sickle cell anaemia.



[2]

(ii) State the phenotype ratio from this cross.

..... [1]

(iii) In reality, the couple described in the cross had four children but only one suffers from sickle cell anemia. State why the observed ratio was different from the expected ratio.

.....

..... [1]

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(c) Fig.5.1 shows the blood cells of a person who suffers from sickle-cell anaemia.



Fig.5.1

With reference to Fig.5.1, suggest and explain how the change in shape affects the functioning of red blood cells.

.....

.....

.....

.....

..... [2]

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6 Fig.6.1 shows part of the carbon cycle.
The numbers represent the mass of carbon flow (arbitrary units) between the different parts of the cycle each year.

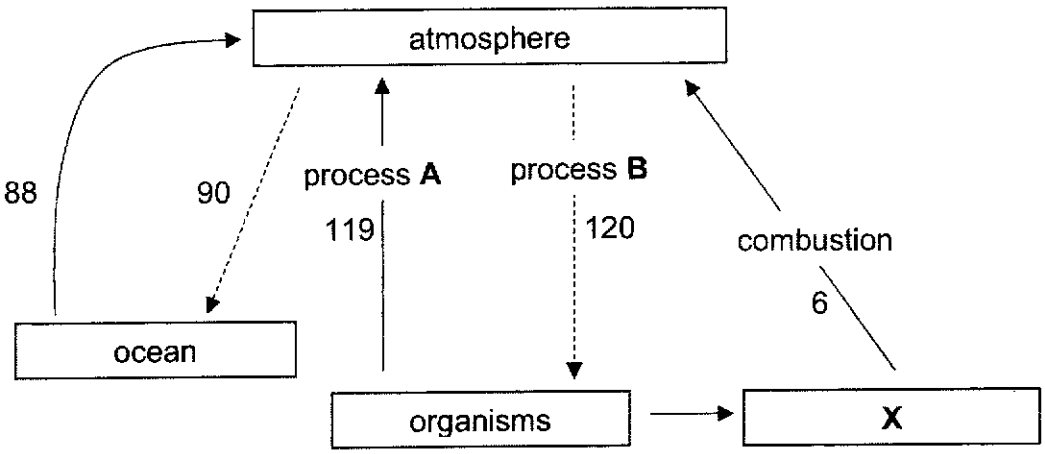


Fig.6.1

(a) Name process **A** and **B** in Fig.6.1.

A:..... **B**:..... [2]

(b) What could be **X**?

..... [1]

(c) **(i)** Calculate the net change in mass of carbon in the atmosphere each year.

..... [1]

(ii) Suggest how such a change in atmospheric carbon affects the Earth.

.....

..... [1]

(d) **(i)** Define the term **carbon sink**.

.....

..... [1]

(ii) Describe one human activity that is compromising the effectiveness of the ocean as a carbon sink.

.....

..... [1]

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Section B

Answer **any two** questions in this section.
Write your answers in the spaces provided.

7 Fig.7.1 shows the result of a study, investigating the effects of temperature on blood clotting time.
The skin temperature was maintained by cooling and warming the forearm. A small pin-prick was make on the index finger and the bleeding time was recorded.

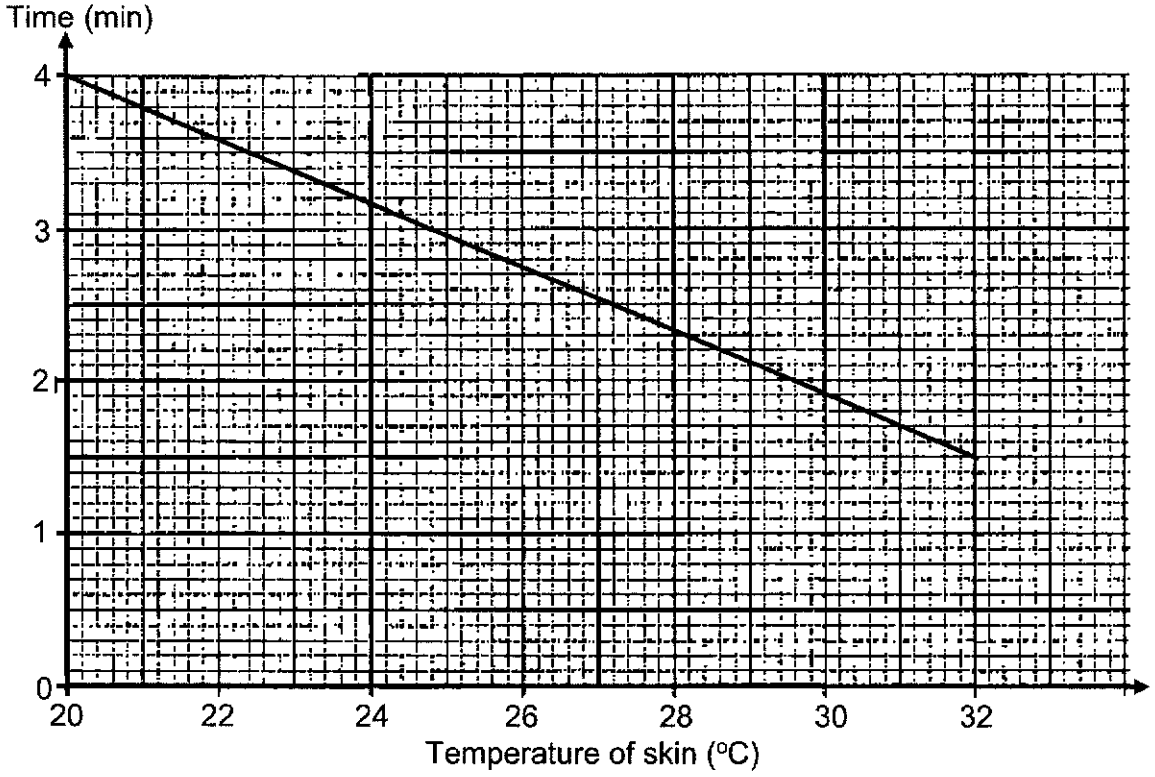


Fig.7.1

(a) Describe and explain the relationship between the temperature of skin and the time taken for bleeding to stop as shown in Fig.7.1.

.....

.....

.....

.....

.....

.....

..... [3]

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(b) Describe how a blood clot is formed when the skin is broken.

.....

.....

.....

.....

.....

.....

..... [3]

(c) Predict the time taken for bleeding to stop at skin temperatures 40°C and above. Explain your answer.

.....

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.....

.....

..... [2]

(d) Blood clotting prevent foreign bodies from entering our blood stream. Describe two other ways our body protects us from foreign bodies.

.....

.....

.....

.....

..... [2]

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8 Fig.8.1 shows the blood glucose concentration of a healthy person **X** and a diabetic **Y** over a 24h period.

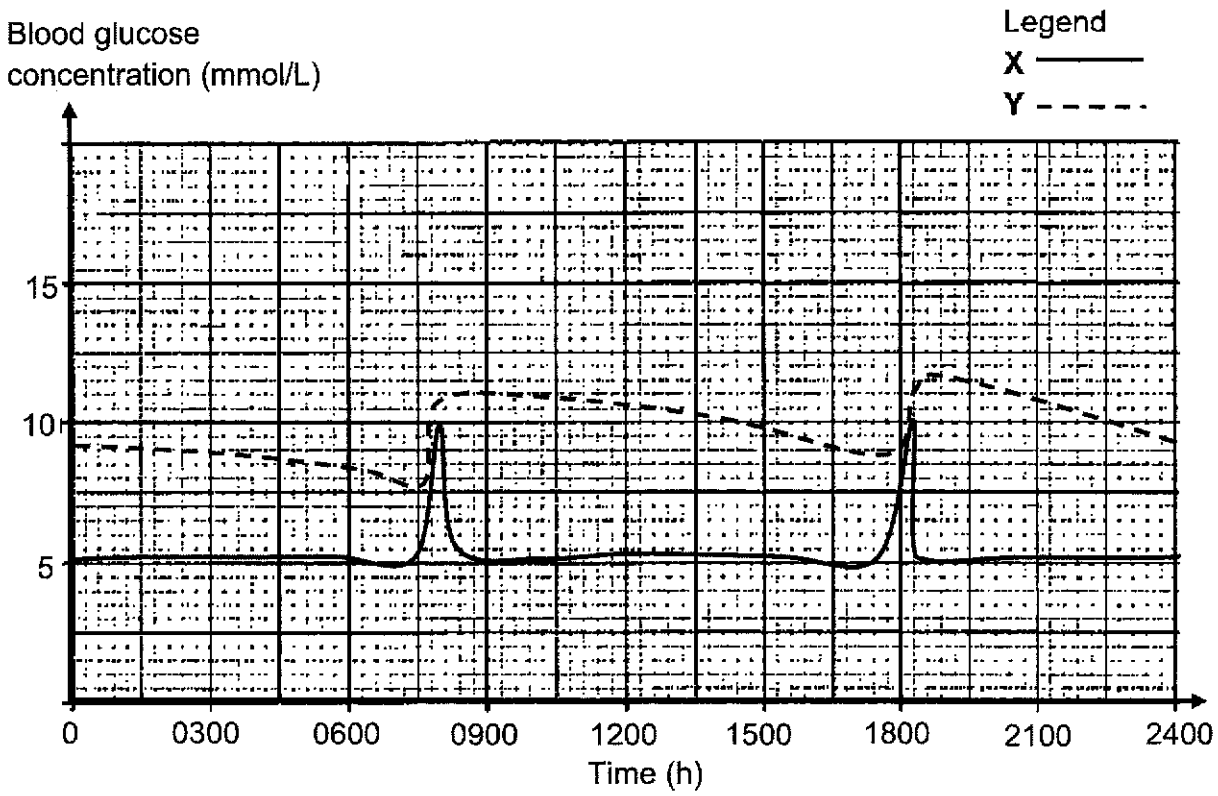


Fig.8.1

(a) Explain the increase in blood glucose concentration at 0730h and 1700h.

.....

..... [1]

(b) Describe **two** differences in blood glucose concentration between **X** and **Y** over the 24h period.

.....

.....

.....

.....

..... [2]

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(c) Explain the differences between blood glucose concentration between **X** and **Y** over the 24h period.

.....

.....

.....

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..... [5]

(d) Some diabetic require insulin injections for treatment. Suggest and explain why it is dangerous to receive insulin injection without consuming any food.

.....

.....

.....

.....

..... [2]

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9 Fig.9.1 illustrates some possible sources of pollution.

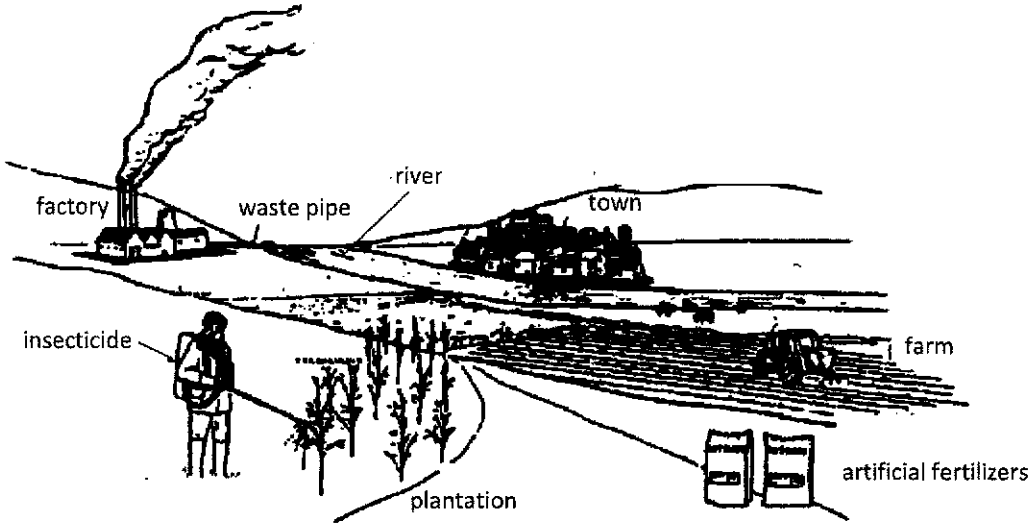


Fig.9.1

(a) Explain how the extensive use of artificial fertilizers in the farms and improper treatment of sewage from the factories impact the health of the river.

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..... [6]

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(b) 'Since the discovery of dead eagles near the town area, the town folk in Fig.9.1 began to fall ill and experience symptoms such as vomiting, tremors and seizure.' Explain what might be the cause.

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..... [4]

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1 C
2 A
3 C
4 D
5 C
6 A
7 B
8 A
9 D
10 D
11 C
12 B
13 C
14 D
15 D
16 A
17 B
18 C
19 D
20 C

21	**D**	(C)	26	**D**	(K)	31	**B**	(C)	36	**A**	(C)
22	**D**	(K)	27	**B**	(A)	32	**C**	(K)	37	**B**	(A)
23	**B**	(K)	28	**B**	(C)	33	**B**	(K)	38	**C**	(K)
24	**D**	(C)	29	**C**	(C)	34	**C**	(C)	39	**A**	(K)
25	**C**	(A)	30	**C**	(K)	35	**C**	(A)	40	**A**	(C)

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Answer Scheme: 2019 Sec 4E/5N Science Biology Prelim

1(a)(i)	Plot points correctly: two mistake - 1m, more than three mistake -2m	(A)	[2]
1(a)(ii)	Line of best fit	(A)	[1]
1(b)(i)	0.38/0.39 mol/dm^3;	(A)	[1]
1(b)(ii)	both have the same water potential;	(A)	[1]
1(c)	salt solution has a higher water potential of sap of potato cells; water molecules move across partially cell membrane into cells by osmosis; turgor pressure increases + cells become turgid;	(C)	[1]
1(d)	do replicates and find average change in length;	(A)	[1]
2(a)(i)	A: yellow + B: purple;	(A)	[1]
2(a)(ii)	no sunlight + no photosynthesis; Carbon dioxide released + plant carry out aerobic respiration;	(A)	[2]
2(a)(iii)	rate of photosynthesis faster than rate of respiration; Plant absorb carbon dioxide;	(A)	[2]
2(b)	light is needed for photosynthesis;	(A)	[1]
3(a)	X: sensory neurone, Y: motor neurone; Z: relay neurone; X and Y correct 1m, Z correct 1m	(K)	[2]
3(b)	immediate/faster response + without thinking/ automatic/conscious control	(K)	[1]
3(c)(i)	X injured;		
3(c)(ii)	nerve impulses from receptor cannot reach relay neurone; Nerve impulses are transmitted from brain to relay neuone to motor neurone to muscles;	(C)	[3]
3(d)	electrical vs chemical message; localized vs many target organs; Transported by blood vs neurones; effect usually shortlived vs longer lasting; faster vs slower response;	any 2 (C)	[2]
4(a)(i)	mark and label menstruation 1 to 5 days;		
4(a)(ii)	mark and label ovulation day 14;	(K)	[2]

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4(b)(i) increase until day 13 then decreases/highest on day 13;

4(b)(ii) uterine lining repairs and thicken;
Stimulate ovulation; (K) [3]

4(c) prevent menstruation; (C) [1]

4(d)(i) fusion of nuclei of sperm and ovum/egg to form a zygote; (K) [1]

4(d)(ii) implantation; (K) [1]

4(e) save resource/energy (C) [1]

5(a)(i) change in structure of gene coding for haemoglobin/betaglobin; (C) [1]

5(a)(ii) Alternative form of the same gene that occupy the same relative position on homologous chromosomes; (K) [1]

5(b)(i)

		h	h
health	H	Hh	Hh
	h	hh	hh

Parent genotype;
Offspring geneotype; (A)[2]

5(b)(ii) 1:1; (A)[1]

5(b)(iii) small number of offspring/genetic ratio based on probability observed
When number of outcomes large; (C)[1]

5(c) decrease transport of oxygen;
Sharp edges clog small blood vessels or decreases in surface area + decrease rate of diffusion; (C)[2]

6(a) A: respiration; B: photosynthesis; (C)[1]

6(b) fossil fuel; (K)[1]

6(c)(i) 3; (A)[1]

6(c)(ii) global warming; (C)[1]

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6(d)(i) area that store carbon indefinitely, store more than release; (K)[1]

6(d)(ii) remove fossil fuel from the seabed
Or burning fossil fuel + rising sea temperatures; (C)[1]

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Section B

7(a) As temperature of the skin increases bleeding time decreases;

As temperature increases + enzyme and substrate gain kinetic energy;

Rate of collision increases + rate of enzyme substrate formation increases;(C)[3]

7(b) platelets stick to wound + release clotting factor/enzyme/thrombokinase;

Fibrinogen converted to fibrin;

Fibrin form a mesh and trap blood cells; (K)[3]

7(c) time increases;

enzyme denatured + lose active site/cannot form enzyme substrate complex;

(C)[2]

7(d) Phagocytosis + white blood cells surround, ingest and release enzymes to destroy;

Release antibody that bind to antigen + agglutination; (K)[2]

8(a) glucose diffuse into wall of small intestine/across villi + into capillaries; (C)[1]

8(b) diabetic blood glucose higher than X;

diabetic blood glucose remain high after meal, normal person blood glucose return to normal quickly; (C)[2]

8(c) diabetic lack insulin;

Normal person + pancreas/islet of Langerhans releases insulin when blood glucose level rises;

Glucose transported to blood to liver;

Liver cells absorb glucose from the blood;

Liver cells convert glucose to glycogen and stores glycogen;

Insulin eventually destroyed in liver; max 5 (C)[5]

8(d) person might faint/fall into a coma

the blood glucose concentration becomes too low + cells lack glucose for aerobic respiration; (A)[2]

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9(a) Fertilizers washed into rivers by rain;

fertilizers and sewage rich in nitrate and phosphate;

Cause eutrophication /algae bloom;

Lack of sunlight and oxygen + submerged plants die;

Dead plants cause bacteria to reproduce/multiply quickly;

Sewage released into rivers rich in dead organic material + bacteria multiply;

Bacteria use up oxygen during aerobic respiration; max 6 (C)[6]

9(b) Insecticide washed into rivers by rain/mercury from factory waste dumped into rivers;

Plankton absorb the insecticide/mercury and do not excrete + bioaccumulation;

Insecticide/mercury passed along food chain in increasing concentration + biomagnification/bioamplification;

Highest concentration of insecticide/mercury in eagle and man + at the top of the food chain cause poisoning; (C)[4]

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