Preliminary Examination 2021
Secondary Four Express
Biology Paper 1 (6093/01)

Date of Examination: 1 September 2021 **Duration : 1 hour**

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Name: ..... ( ) **Class:** .....

Instructions to Candidates

Write your name, index number and class on all the work you hand in.
Write in soft pencil.
Do not use staples, 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 Optical Answer Sheet (OAS) provided.

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.

For Examiner's Use	
Total	**/40**

Set by: Mdm Nurul Izzati, Mdm Fiona Tay
Vetted by: Ms Mary Christina, Mdm Fiona Tay and Mdm Hartati

This Paper consists of **22** printed pages, including the cover page.

[Turn Over]

1 Fresh liver tissue was removed and placed in warm isotonic saline solution. Radioactively-labelled amino acids were then added. At fixed time intervals, samples of tissues were removed, sections were cut and the sites of radioactivity were determined.

Which of the following represents the order in which radioactivity appeared in the organelles?

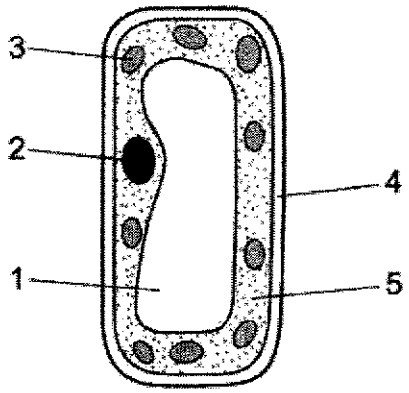
A golgi apparatus → rough endoplasmic reticulum → secretory vesicle

B golgi apparatus → secretory vesicle → rough endoplasmic reticulum

C rough endoplasmic reticulum → golgi apparatus → secretory vesicle

D rough endoplasmic reticulum → secretory vesicle → golgi apparatus

2 The diagram shows the structure of palisade cell.



Which features are also found in a liver cell?

A 1 and 2

B 2 and 5

C 3 and 4

D 4 and 5

3 What are the levels of organisation of the retina and the eye?

	retina	eye
A	cell	organ
B	cell	organ system
C	tissue	organ
D	tissue	organ system

4 Which of the following is an example of diffusion in a plant?

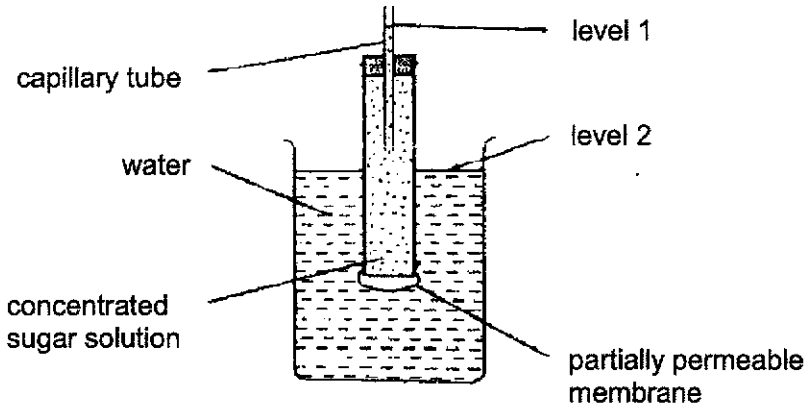
A carbon dioxide from the air moving into a photosynthesising leaf

B ions moving into root hair cells against a concentration gradient

C sugars in phloem moving from leaves to roots

D water in xylem moving from roots to leaves

5 The diagram shows apparatus used to investigate the movement of substances.

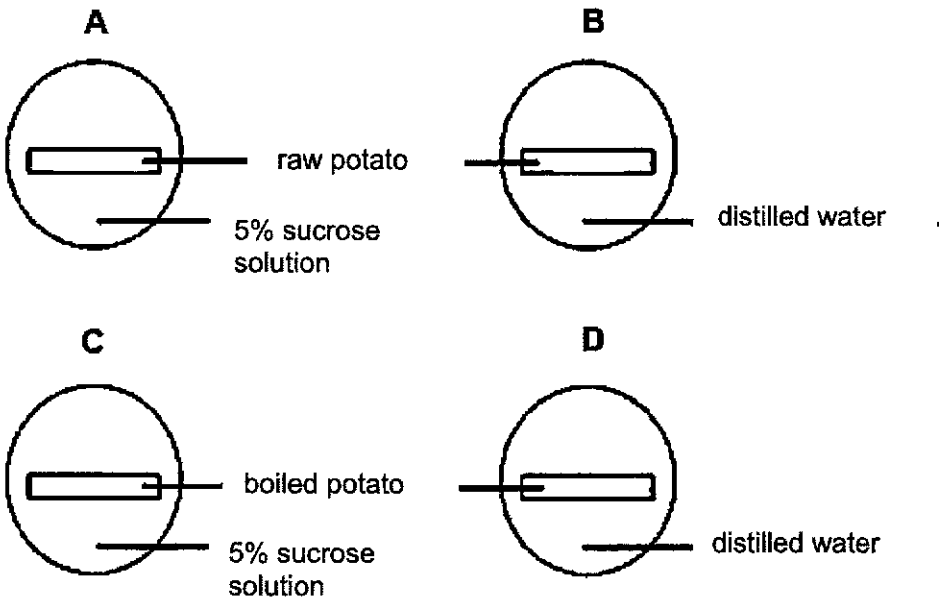


After 4 hours, which changes in levels will occur and which molecules will move across the membrane?

	level 1	level 2	molecules
A	rise	fall	sugar
B	fall	rise	sugar
C	fall	fall	water
D	rise	fall	water

6 Four potato strips were each placed in a petri dish of either 5% sucrose solution or distilled water for 20 minutes.

In which of the following petri dishes would the potato cells be plasmolysed?



7 A sample of food mixed with water was tested to find out its contents. The results are shown in the table.

test	result
iodine solution added	yellow
Benedict's solution added and mixture heated in a boiling water bath	orange-red precipitate
mixture shaken with ethanol and poured into water	white emulsion
dilute sodium hydroxide solution added, followed by a few drops of dilute copper sulfate solution	blue colour

What conclusion can be made from these results?

A Fat and reducing sugar were both present.

B Fat and starch were both present.

C Only starch was present.

D Only reducing sugar was present.

8 Which of the following tests shows the presence of an enzyme in a biological washing powder?

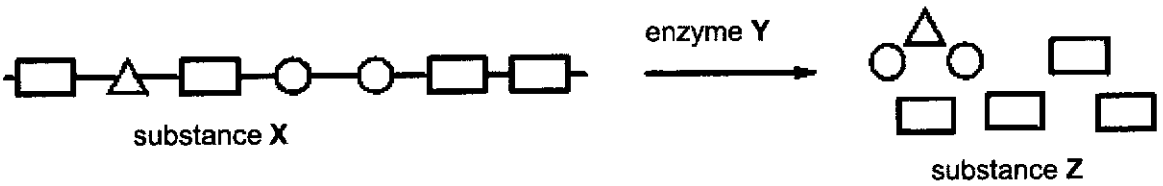
A iodine test

B Biuret test

C Benedict's test

D ethanol emulsion test

9 The diagram shows a large food molecule changing into smaller molecules.



What are the identities of substance X, enzyme Y and substance Z?

	substance **X**	enzyme **Y**	substance **Z**
A	cellulose	cellulase	glucose
B	lipid	lipase	fatty acids and glycerols
C	polypeptide	protease	amino acids
D	starch	amylase	maltose

10 Which of the following samples collected from a random individual may give a brick-red precipitate when tested with Benedict's solution?

1 blood
2 saliva
3 tissue fluid
4 secretions from the walls of the duodenum

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

11 Fig. A is a bar chart showing the average number of chloroplasts in each of three different types of leaf cell. Fig. B shows transverse section of a leaf.

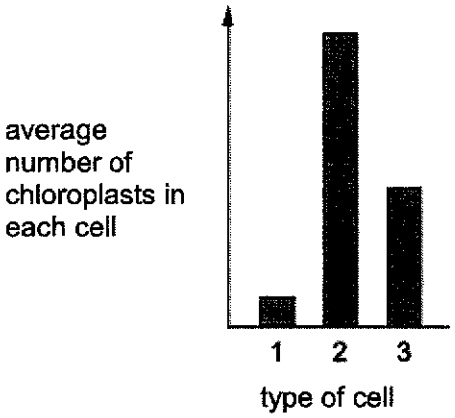


Fig. A

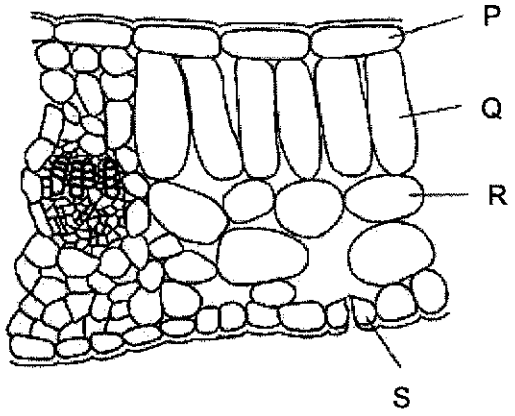
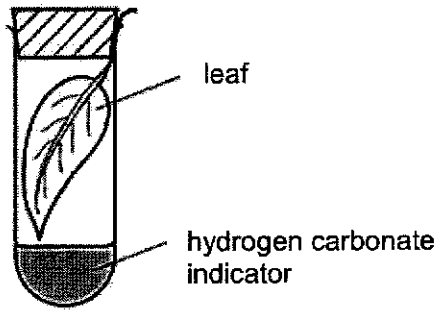


Fig. B

Which row correctly matches cells 1 – 3?

	cell 1	cell 2	cell 3
A	P	Q	R
B	R	P	Q
C	S	Q	R
D	S	P	Q

12 A freshly picked leaf is placed in a sealed test-tube with some hydrogen carbonate indicator solution. The tube is kept in the light during the day. The indicator changes colour as shown.

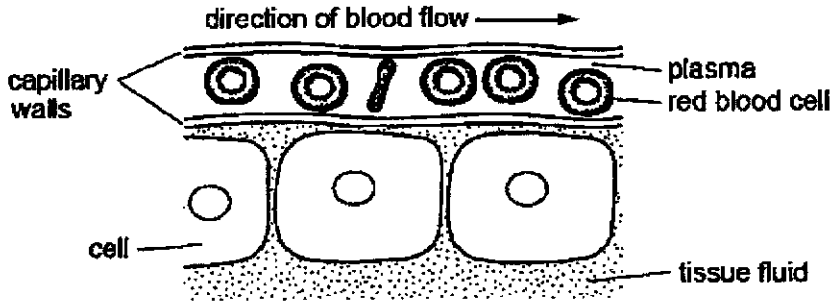


colour	amount of carbon dioxide compared to average atmospheric concentration
purple	less than normal
red	normal
yellow	more than normal

Which colour will the hydrogen carbonate indicator be at midday and at midnight?

	at midday	at midnight
A	purple	yellow
B	red	purple
C	yellow	purple
D	yellow	red

13 The diagram shows a blood capillary close to some tissue cells bathed in tissue fluid, where exchange of materials take place.

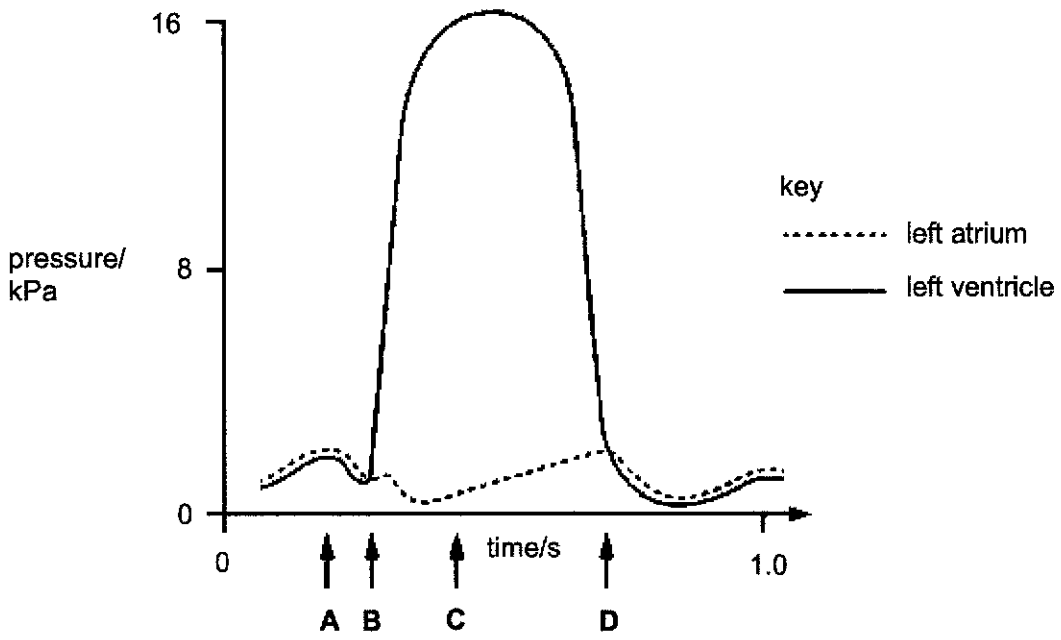


Which row correctly shows the type of nutrient in the plasma and in the tissue fluid, and the mode of material transfer?

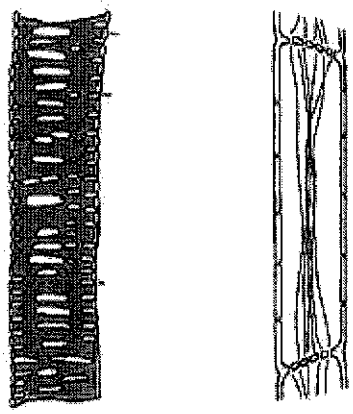
	plasma	tissue fluid	mode of transfer
A	amino acid	amino acid	diffusion
B	amino acid	protein	diffusion
C	protein	amino acid	digestion
D	protein	protein	active transport

14 The graph shows the pressure changes in the left atrium and the left ventricle while the heart is beating.

When does the atrio-ventricular (bicuspid) valve start to close?



15 The diagram shows two plant cells, X and Y, drawn to different scales.



X Y

Samples of the contents of X and Y were tested.

What results are expected?

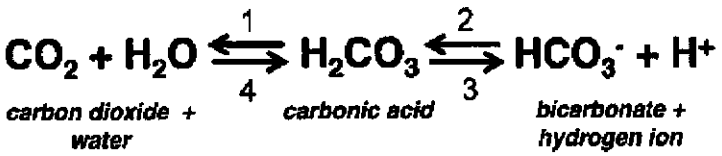
	X		Y	
	Benedict's reagent	iodine	Benedict's reagent	iodine
A	+	+	+	+
B	+	-	+	-
C	-	+	-	+
D	-	-	-	-

key

– : negative result

+ : positive result

16 Which processes are catalysed by carbonic anhydrase in a red blood cell?



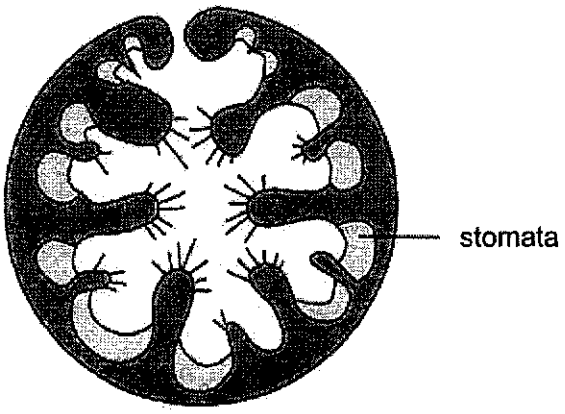
A 1 and 2

B 1 and 4

C 2 and 3

D 3 and 4

17 The following diagram shows the cross-section of a leaf from Marram grass, a xerophytic plant adapted to dry conditions.



How does the structure of the leaf reduce water loss in this plant?

A The leaf is curled.

B Stomata are sunken and located on only one side of the leaf.

C Hairs along the epidermis trap water vapour.

D All of the above.

18 The table shows the death rates from lung cancer amongst smokers and non-smokers.

average number of cigarettes smoked per day	deaths from lung cancer per year per 100 000 people
0	10
1-14	78
15-25	127
26 or more	251

What can be concluded from the data?

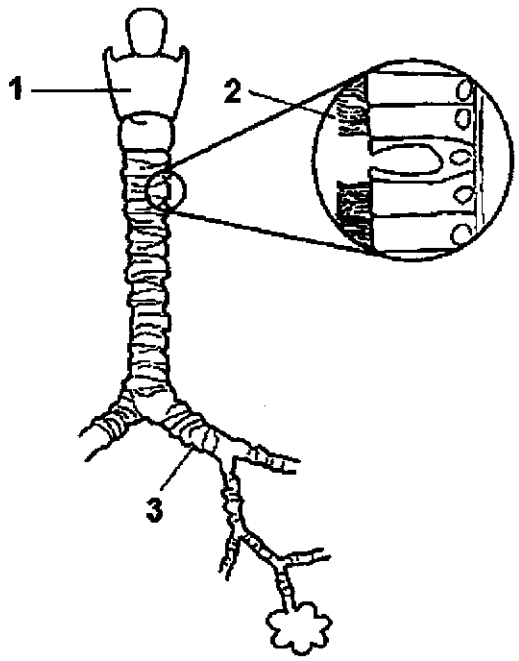
A People who get lung cancer are likely to be smokers of 26 or more cigarettes per day.

B People who do not smoke will not get lung cancer.

C People who smoke have a higher chance of getting lung cancer.

D Smoking causes lung cancer.

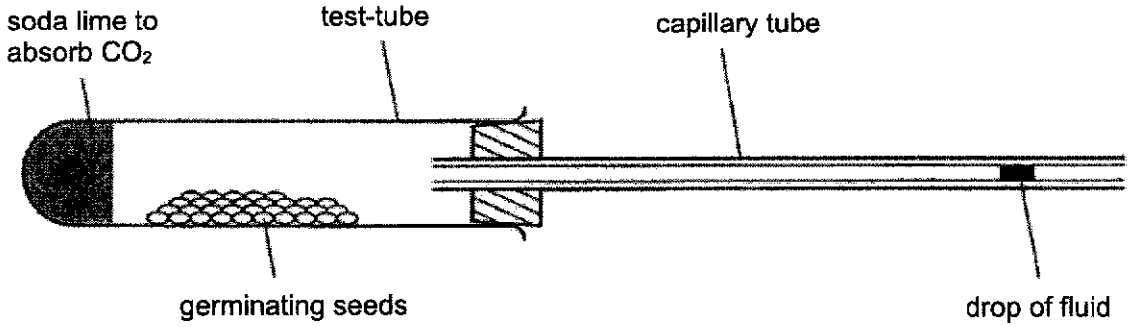
19 The diagram shows some structures in the thorax.



Which row in the table identifies the structures labelled 1, 2 and 3?

	1	2	3
A	larynx	cilia	bronchus
B	larynx	bronchus	bronchiole
C	trachea	bronchus	bronchiole
D	trachea	cilia	bronchus

20 The apparatus shown below was set up for a respiration experiment.



Which of the following describes the movement of the indicator fluid in the capillary tube?

A moves away from the test-tube because of oxygen output by the seeds

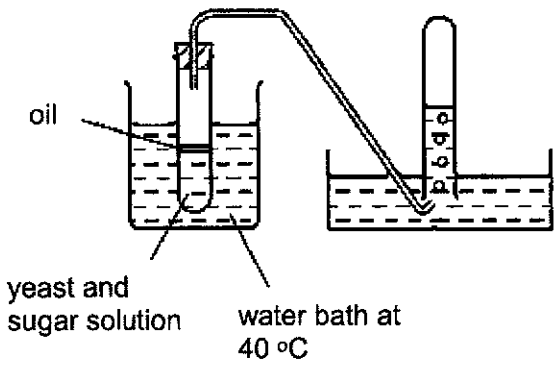
B moves towards the test-tube because of oxygen intake by the seeds

C moves towards the test-tube because of carbon dioxide intake by the seeds

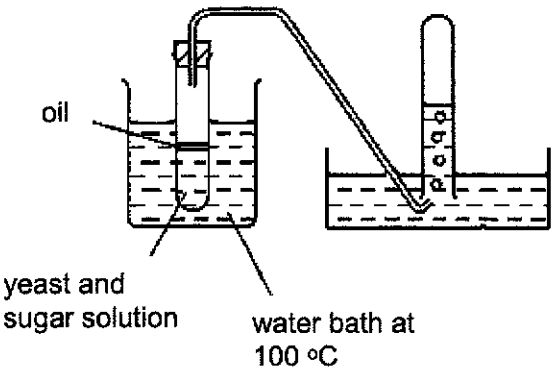
D does not move because carbon dioxide intake and oxygen output are equal

21 Which apparatus can be used to investigate the production of carbon dioxide by anaerobic respiration of yeast?

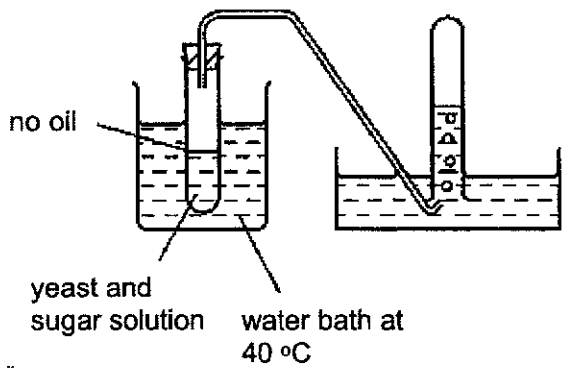
A



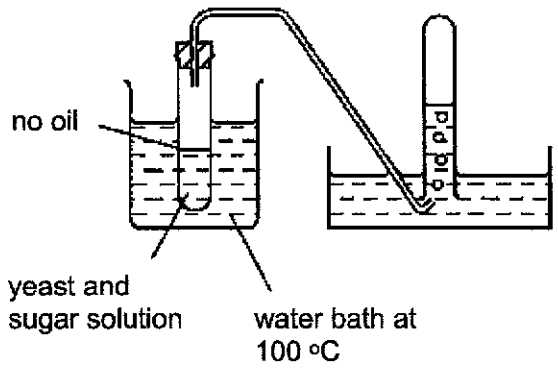
B



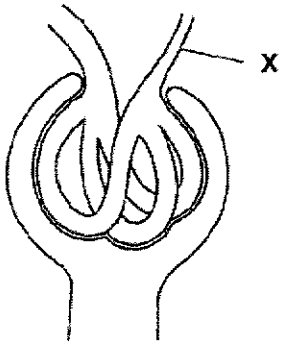
C



D



22 The diagram below shows a glomerulus and Bowman's capsule of a mammalian nephron.



Which of the following describes what would happen if the diameter of the blood vessel is enlarged at X?

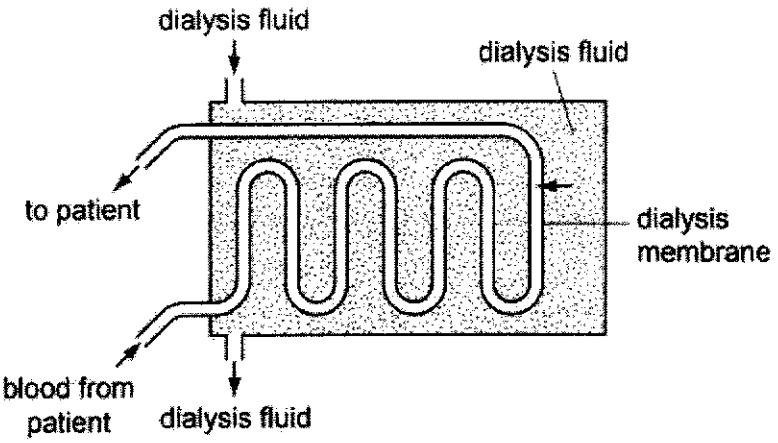
A More sodium will appear in the urine.

B Less glucose will appear in the urine.

C Water reabsorption will decrease.

D The rate of urine production will be reduced.

23 In a kidney dialysis machine, which substance cannot diffuse through the dialysis membrane?



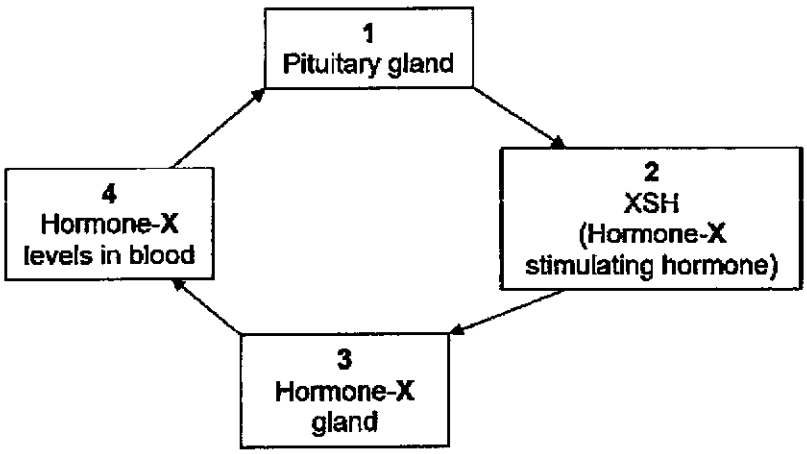
A blood cells

B amino acids

C sodium

D urea

24 The diagram shows a simplified homeostatic system in the human body.



Which of the following happens in the negative feedback system?

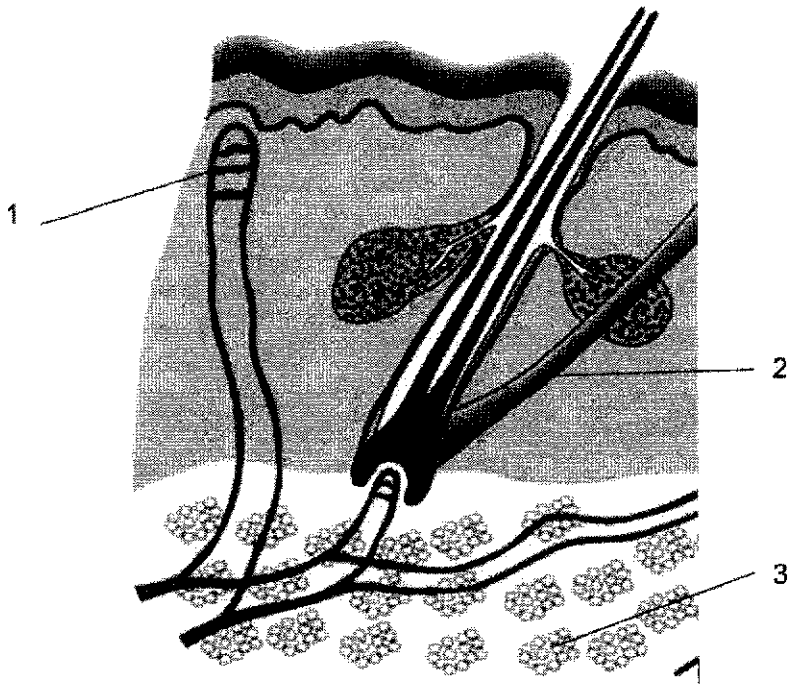
A Higher levels of 4 induces 1 to produce more 2.

B Higher levels of 4 induces 1 to produce less 2.

C Higher levels of 2 induces 3 to produce more 4.

D Higher levels of 4 induces 3 to produce less 2.

25 The diagram shows a section of the human skin.



Which of the following correctly describes the immediate responses of the different structures of the skin when a person enters a cold room?

	structure 1	structure 2	structure 3
A	dilates	relaxes	no change
B	constricts	contracts	no change
C	dilates	contracts	becomes thicker
D	constricts	relaxes	becomes thicker

26 The trigerminal nerve in humans connects the brain with the teeth and with the skin of the face. When the dentist administers a local anaesthetic by injection, you can no longer feel pain and you cannot smile properly.

Which of the following concludes the above statement?

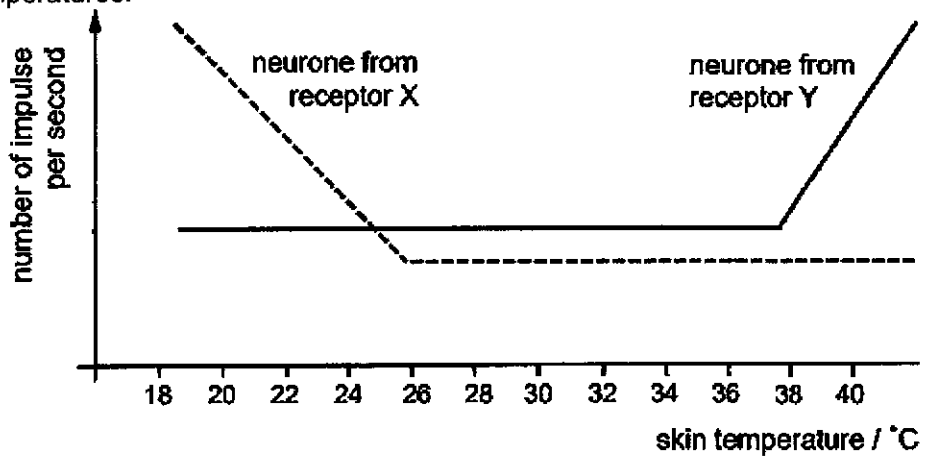
A the trigerminal nerve carries impulses from the brain to the teeth and back to the brain

B the trigerminal nerve contains only sensory neurons

C the trigerminal nerve contains only motor neurons

D the trigerminal nerve contains both sensory and motor neurons

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



Which of the following statements best illustrates the graph?

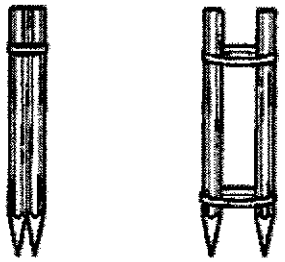
A Receptor X responds most strongly to temperatures above 22°C.

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

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

D Receptors X and Y respond most strongly at temperatures between 26°C and 38°C.

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



1 cm apart 2 cm apart

During the recording of results, there were instances when he inaccurately said he had only been touched by one point.

The table below shows the number of times he accurately said that he had been touched by two points.

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

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

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

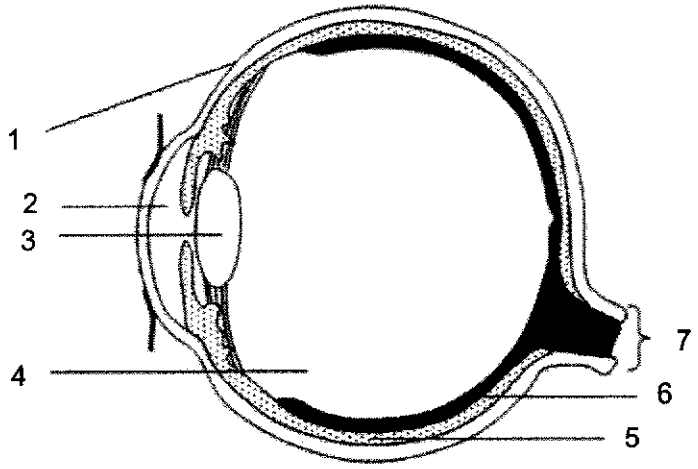
B No touch receptors were present on the skin of the forearm.

C Touch receptors were the closest together in the skin of the forearm.

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

29 The diagram below shows the cross-section of a human eyeball.

In which structures does the refraction of light take place?



A 1, 2and 4

B 2, 3 and 4

C 2, 4 and 6

D 4, 5 and 6

30 A man stands 10 metres away from a sign and can see it clearly. He walks towards the sign and stops 0.5 metres from it.

Which changes occur in his eyes so that the sign is still in focus?

	ciliary muscle	suspensory ligament	lens
A	contract	slacken	thicker
B	contract	tighten	thinner
C	relax	slacken	thinner
D	relax	tighten	thicker

31 Which of the following are the effects of releasing adrenaline into the bloodstream?

1 An increase in the rate of heart beat.
2 A decrease in blood coagulation.
3 The contraction of hair muscle.
4 The constriction of pupil in eyes.

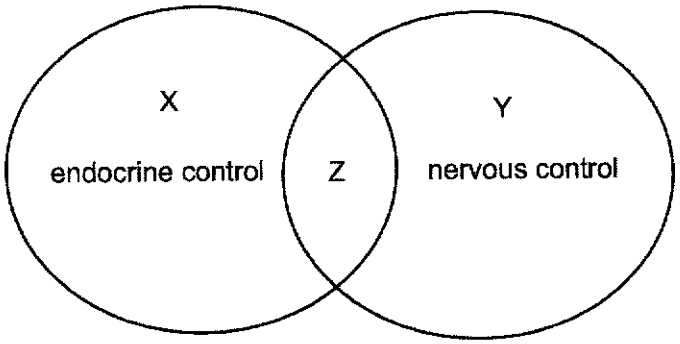
A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 3 and 4 only

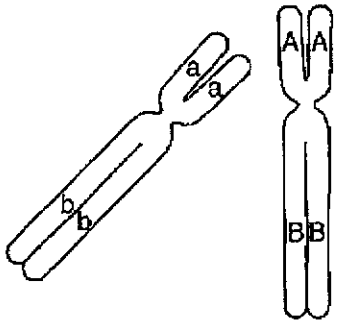
32 The diagram shows the comparison between nervous control and endocrine control in a human body.



Which of these process are correctly classified?

	secretion of adrenaline	pupil reflex	increasing blood glucose level
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	Y	X

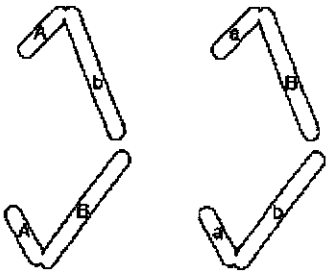
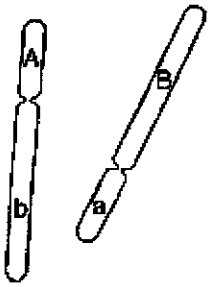
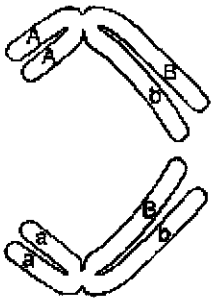
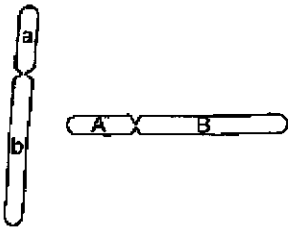
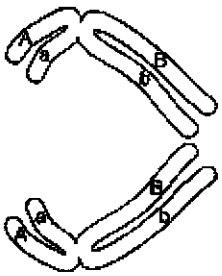
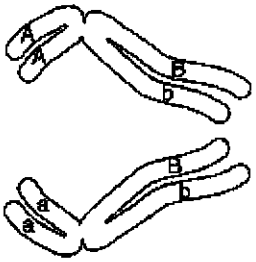
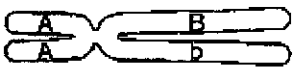
33 The diagram shows two homologous chromosomes in early prophase I of meiosis in an animal cell. Two genes, A/a and B/b, whose loci occur on the homologous chromosomes, are shown.



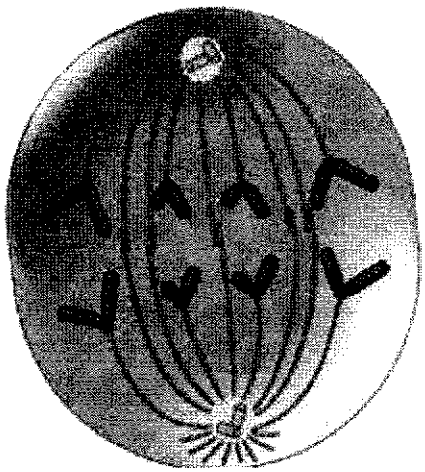
[Qn 33 continues on page 18]

18

Which row identifies these chromosomes as they progress from anaphase I to prophase II?

	anaphase I	prophase II
A		
B		
C		
D		

34 The following diagram shows an animal cell undergoing mitosis.

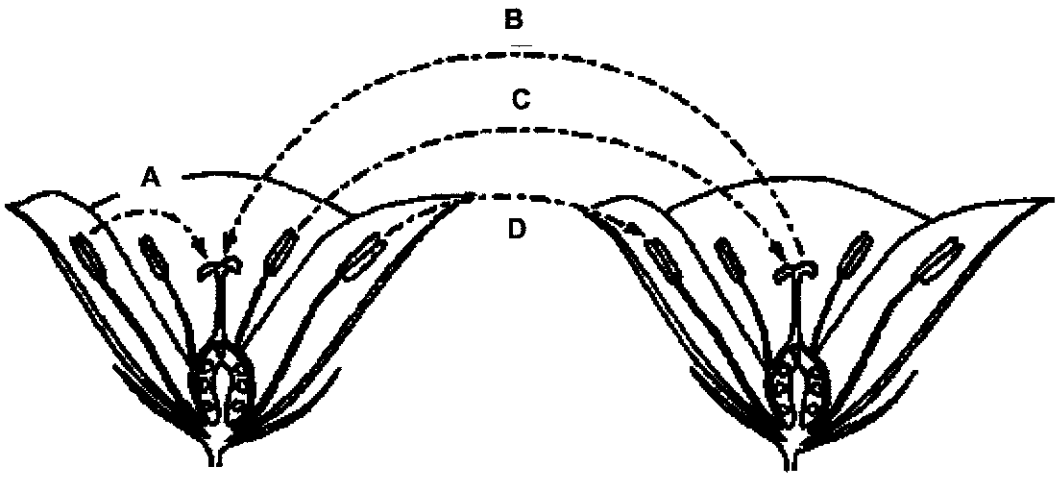


What is the diploid number of chromosomes in the parent cell, and the subsequent daughter cells that are produced?

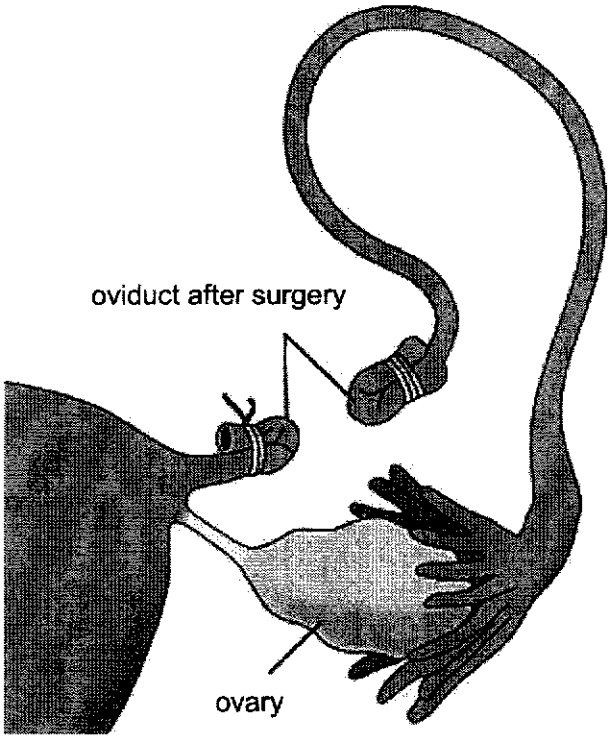
	parent cell	daughter cell
A	8	8
B	8	4
C	4	4
D	4	2

35 The diagram shows two flowers from different plants of the same species.

Which labelled pathway will result in the transfer of pollen grains that will eventually produce the most genetically diverse offspring?



36 The diagram illustrates a certain procedure carried out in a woman's reproductive system to prevent pregnancy.



Which of the following is the intention of the operation?

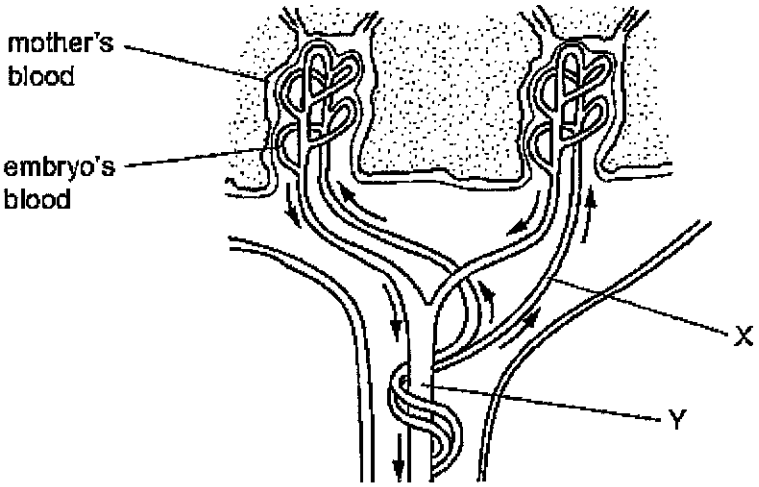
A to prevent ovulation

B to prevent zygote formation

C to reduce progesterone secretion

D to stop egg maturation

37 The diagram shows how the blood of a human embryo flows close to the mother's blood in the placenta.



Which substances are present at X in higher concentrations than at Y?

A carbon dioxide and glucose

B carbon dioxide and urea

C glucose and oxygen

D glucose and urea

38 Some fruit flies have orange eyes and others have red eyes.

If two orange-eyed fruit flies are crossed, their offspring always have orange eyes.

If two red-eyed fruit flies are crossed, their offspring sometimes include both orange-eyed and red-eyed flies.

What can be concluded from these observations?

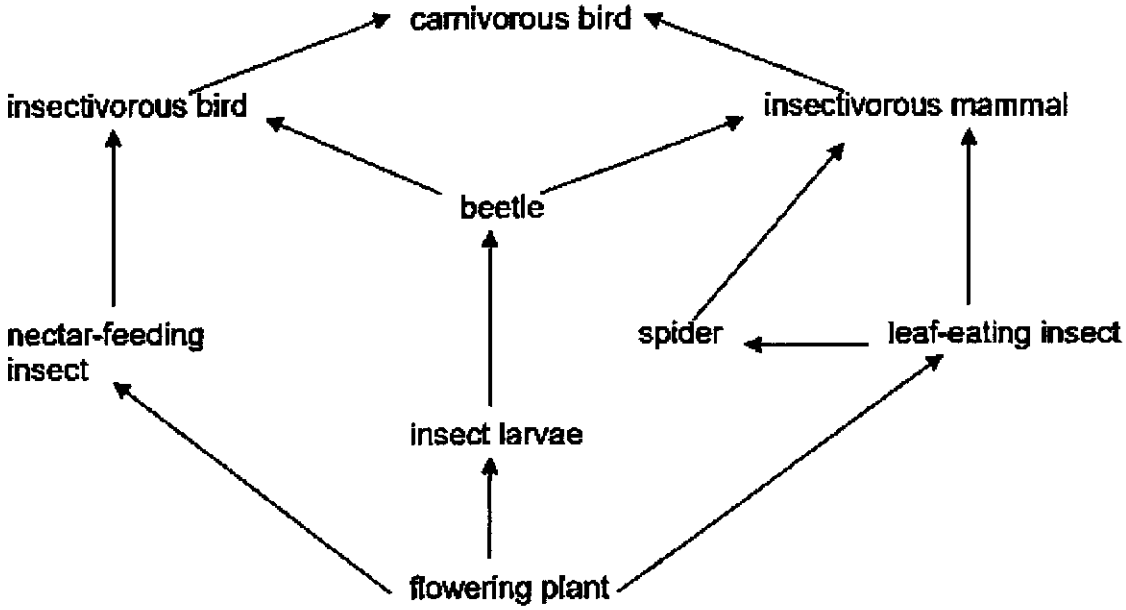
A Crossing an orange-eyed fly with a red-eyed fly will produce a 1 : 1 ratio in the offspring.

B There are more orange-eyed fruit flies in the population.

C The allele for red eyes is dominant.

D We could determine which allele is dominant only by doing a cross that produces a 3 : 1 ratio.

39 The diagram shows a food web.



Which of the following statements about the food web is incorrect?

A The beetle, spider and leaf-eating insect belong to the same trophic level.

B Spraying insecticide on the plant will cause a drop in the number of insectivorous birds.

C If all the carnivorous birds are killed, the number of nectar-feeding insects, beetles and spiders will drop.

D The combined biomass of the nectar-feeding insect, leaf-eating insect and insect larvae will be greater than that of insectivorous bird, beetle and spider.

40 The rate of absorption of the light energy measured in a field is 8900 kJ m^{-2} day^{-1}. Only 1% of this energy is converted into new plant production. 10% of the net plant production at one trophic level is transferred to the next trophic level.

How much of energy is entering the primary consumer?

A 0.089 kJ

B 0.89 kJ

C 8.9 kJ

D 89 kJ

End of Paper 1

Preliminary Examination 2021
Secondary Four Express
Biology Paper 2 (6093/02)

Date of Examination: 26 August 2021 **Duration: 1 h 45 min**

Chua Chu Kang Secondary School Chua Chu Kang Secondary School Chua Chu Kang Secondary School
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Name: _____( ) Class: _____

Instructions to Candidates

Write your name, index number and class in the spaces provided on the question paper.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, 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** the questions, the last question is in the form either/or.
Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Section	Marks
A	/50
B	/30
Total	/80

Set by: Mdm Fiona Tay and Mdm Nurul Izzati
Vetted by: Ms Mary Christina , Mdm Fiona Tay and Mdm Hartati

This Paper consists of **20** printed pages, including the cover page.

Section A

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

1 Biological washing powders contain enzymes. A student carried out an investigation with a biological washing powder as follows.

Four square pieces of cloth were stained with egg which is mainly protein and fat. Then the pieces of cloth were soaked in a solution of biological washing powder separately. Each piece of cloth was left to soak at different temperatures for 15 minutes. Fig. 1.1 shows the appearance of the four pieces of cloth before and after the investigation.

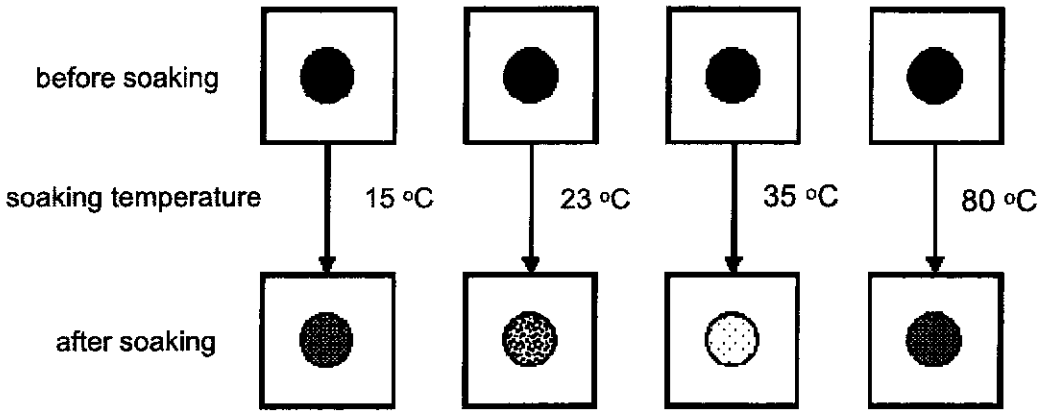

Fig. 1.1

(a) State two factors, other than time, which should be kept constant in this investigation.

.....

..... [2]

(b) From the results, state the temperature at which the washing powder should be used.

..... [1]

(c) In a follow-up investigation, the student soaked a similar square piece of cloth which had been stained with egg in a solution of **non-biological** washing powder and left it to soak at the temperature stated in **(b)**. The egg stain started to become lesser after 40 minutes of soaking.

Explain how enzymes in the **biological** washing powder reduces the time taken for breakdown of the egg stain from 40 minutes to 15 minutes.

.....

.....

.....

..... [2]

(d) In a different investigation, the student added 2 cm^3 of bile into a test-tube containing 3 cm^3 of cooking oil and shook the mixture. After 15 minutes, the student tested the mixture using ethanol emulsion test. White emulsion was formed.

Explain the results for the above investigation.

.....

..... [1]

[Total: 6]

2 Fig. 2.1 shows two human organs and their associated blood vessels.

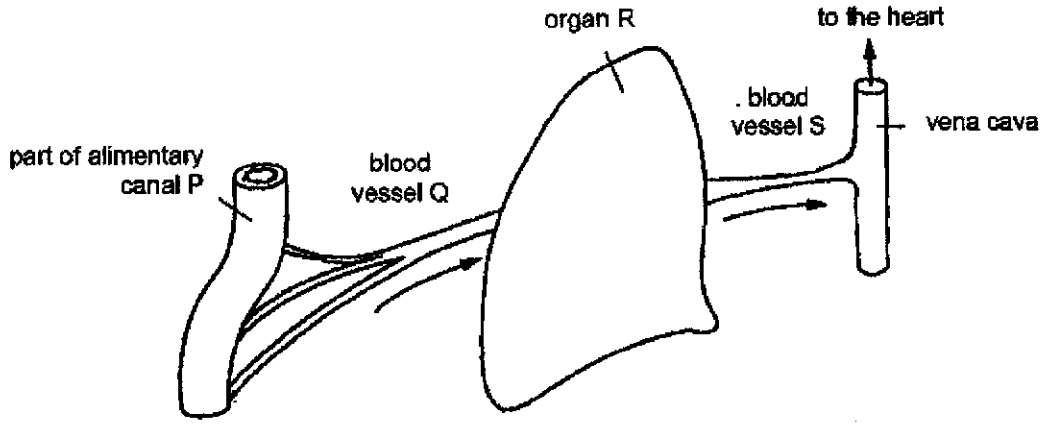

Fig. 2.1

(a) Identify organs P and R shown in Fig. 2.1.

P: .....

R: ..... [1]

(b) Explain why the blood glucose concentration in blood vessel Q fluctuates, while the blood glucose concentration in blood vessel S is relatively constant.

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..... [3]

(c) Coeliac disease is caused by a reaction to a protein called gluten which is commonly found in food made from grains. Fig. 2.2 shows the cross-section of the walls of the organ P in a normal person as well as in a patient suffering from coeliac disease.

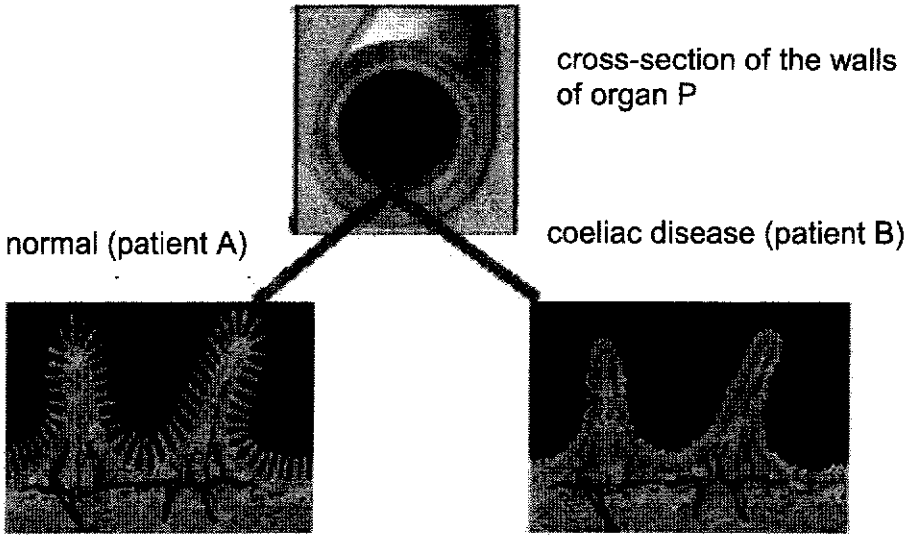

Fig. 2.2

Explain how the change in the cross-section of the walls of organ P in coeliac patients will affect its function.

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.....

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..... [2]

[Total: 6]

3 Fig. 3.1 shows changes in the volume of blood in the left ventricle.

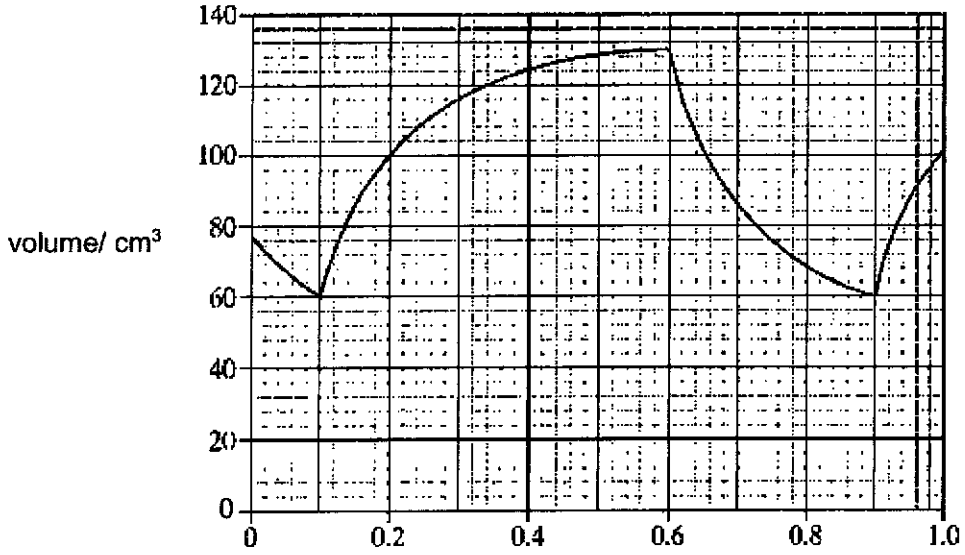

Fig. 3.1

(a) State the period of time the muscles of the left atrium are contracting.

..... [1]

(b) Use the graph to calculate the heart rate per minute. Show your working clearly.

[1]

Fig. 3.2a and Fig. 3.2b show the relative proportions of blood flow to various parts of the body at rest and during a period of vigorous exercise.

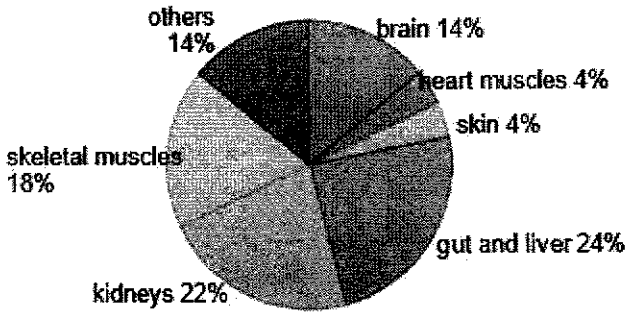

Fig. 3.2a : Total blood flow = 5 dm^3 per min

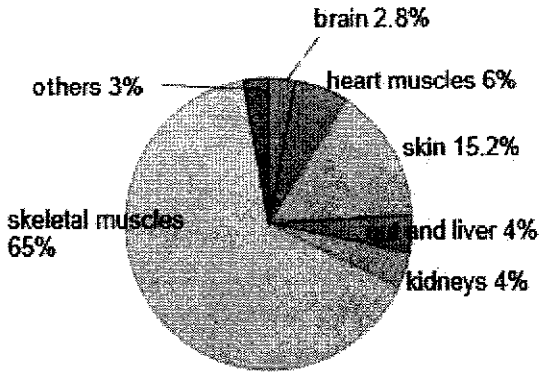

Fig. 3.2b : Total blood flow = 25 dm^3 per min

(c) Use Fig. 3.2a and Fig. 3.2b to explain the rate of blood flow to the brain at rest and that during vigorous exercise. Show your working clearly.

.....

.....

.....

.....

..... [3]

[Total: 5]

4 Robin suffered an injury to a small portion of his spinal cord which resulted in the paralysis of his right leg. He is able to feel sensation on his right leg but is unable to move his right leg.

Outline the pathway of electrical impulses that took place in Robin when his right leg touches a hot object.

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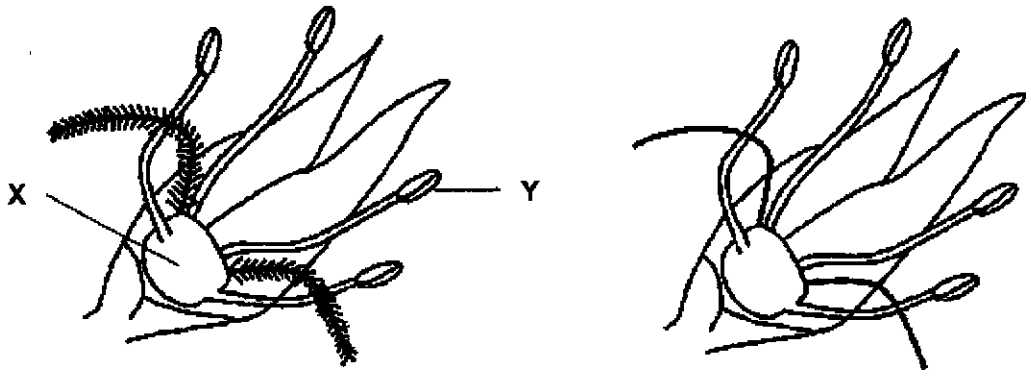
..... [4]

[Total: 4]

5 Fig. 5.1 shows the structure of flowers A and B of two closely related species of plants.



Flower A Flower B

Fig. 5.1

(a) Identify structures X and Y.

X: .....

Y: ..... [1]

(b) Scientists discovered that plant A produced a larger number of offspring compared to plant B.

With reference to Fig. 5.1, suggest an explanation for this observation

.....

.....

..... [3]

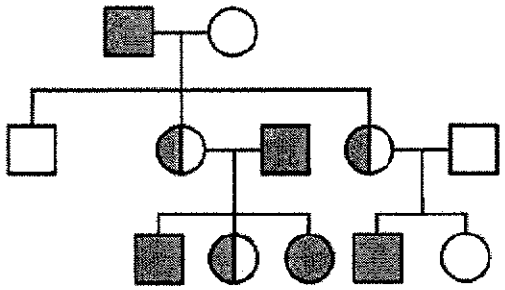
[Total: 4]

6 Colour-blindness is a sex-linked characteristic. It is caused by a recessive allele inherited only on the X chromosome.

There are two alleles of this gene:

- **B** is the allele for normal colour vision,
- **b** is the allele for colour blindness.

Fig. 6.1 is a pedigree chart showing the inheritance of colour blindness in a family. The key shows the sex chromosomes and the alleles of the gene for colour vision.



Key

male with normal colour vision	X^BY
colour-blind male	X^bY
female with normal colour vision	X^BX^B
carrier female with normal colour vision	X^BX^b
colour-blind female	X^bX^b

Fig. 6.1

8

(a) (i) Describe evidence from Fig. 6.1 that shows colour blindness is a sex-linked characteristic.

.....

.....

..... [2]

(ii) A man with normal colour vision and a woman who is colour blind have a baby. If they have a baby boy, use a genetic diagram to predict the probability that the baby boy is colour-blind.

[5]

[Total: 7]

7 Fig.7.1 describes the process of producing herbicide-resistant crop plants by using transgenic bacteria (E. coli) which carry the desired gene into the root cells of the plant.

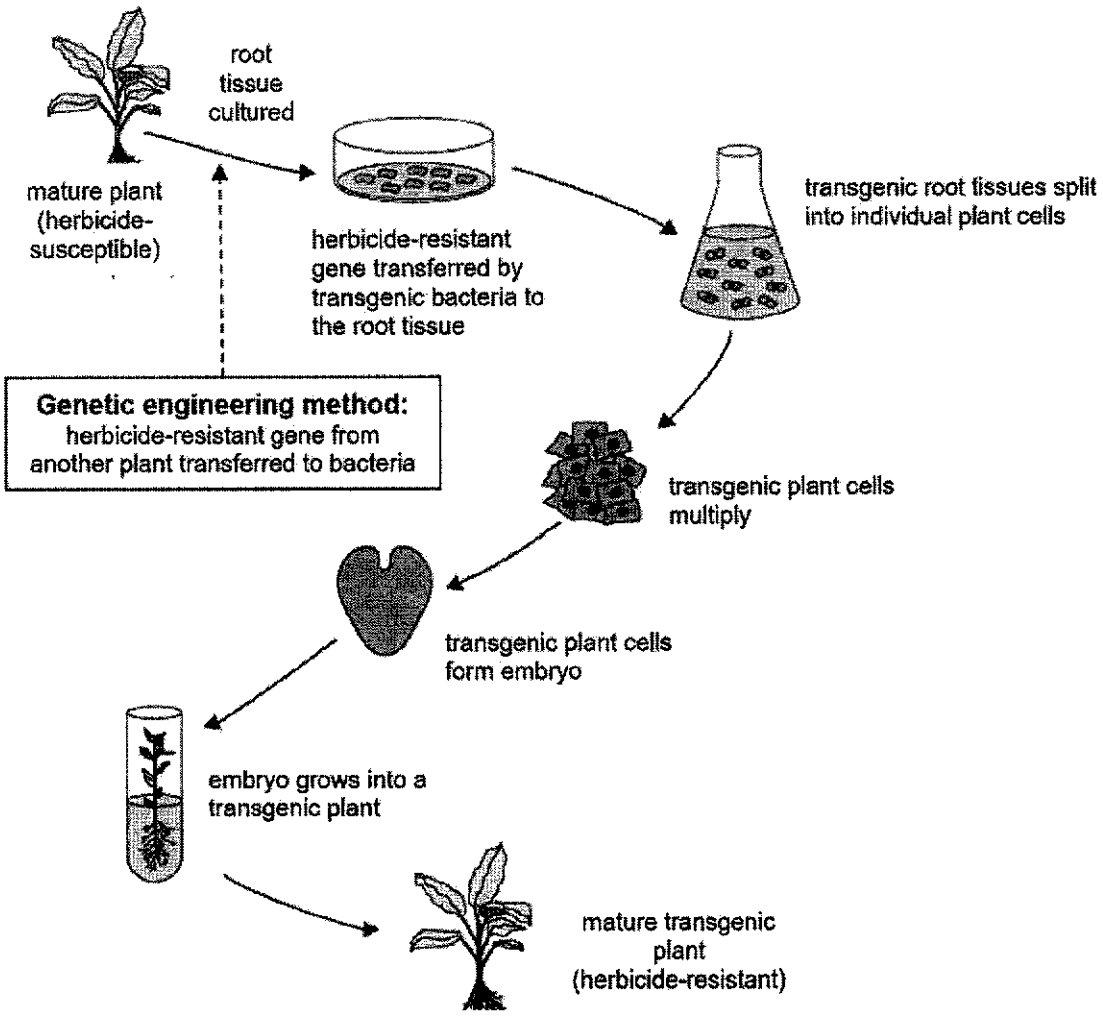


Fig. 7.1

(a) Describe how genetic engineering techniques can be used to produce the transgenic bacteria, which carry the herbicide-resistant gene.

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..... [4]

[Total: 4]

8 Fig. 8.1 shows part of a DNA molecule.

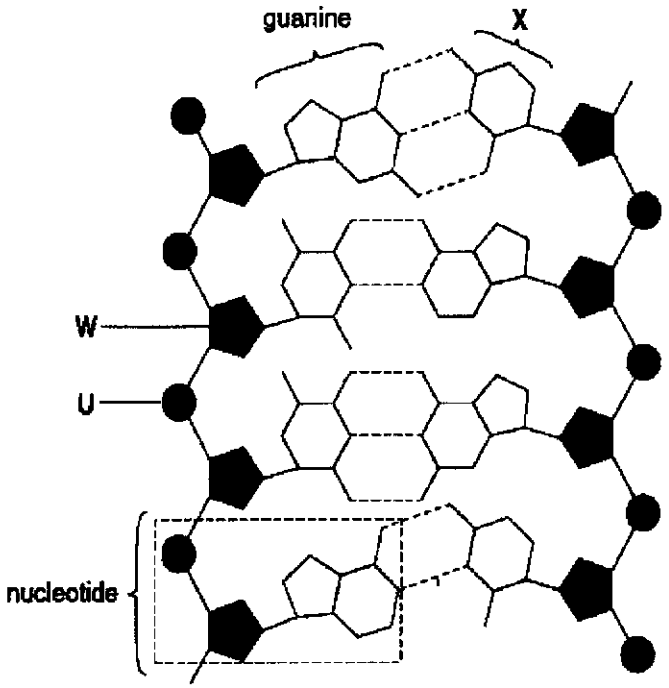


Fig. 8.1

(a) Identify **U**, **W** and **X**.

U: .....

W: .....

X: ..... [2]

(b) Explain the significance of the sequence of nitrogenous bases in the DNA molecule.

.....

.....

..... [2]

(c) Bone marrow contains stem cells that divide by mitosis to form blood cells. Each time the cell divides, it forms a replacement stem cell and a cell that develops into a blood cell.

Fig. 8.2 shows changes in the mass of DNA in a human stem cell from the bone marrow during three cell cycles.

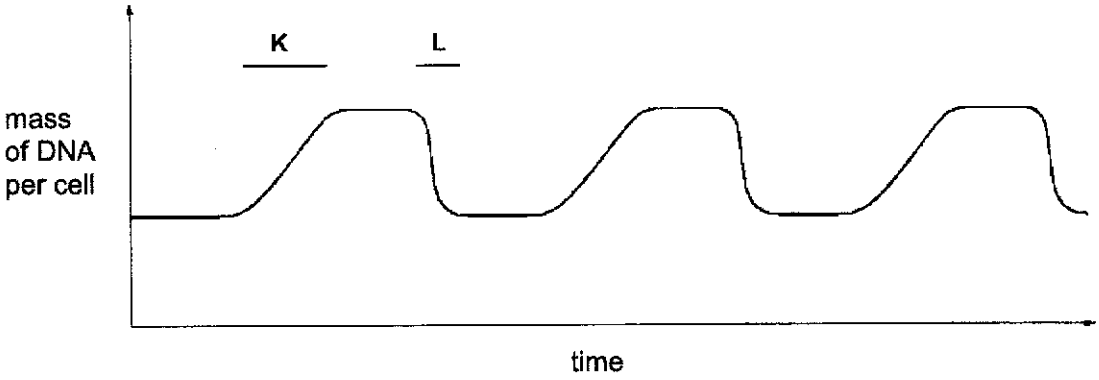


Fig. 8.2

With reference to Fig. 8.2,

(i) state what happens to bring about the changes in the mass of DNA per cell at K and at L.

.....

.....

..... [2]

(ii) State the number of blood cells formed from the stem cell in the time shown.

..... [1]

(iii) State what happens to the number of chromosomes in the daughter stem cell as compared to the parent stem cell.

..... [1]

[Total: 8]

9 Scientists investigated a food chain in a wheat field immediately after the wheat had been harvested.

Red kites are birds of prey.

(a) Table 9.1 shows the data the scientists collected.

Complete the table by calculating the total biomass of red kites and of field mice.

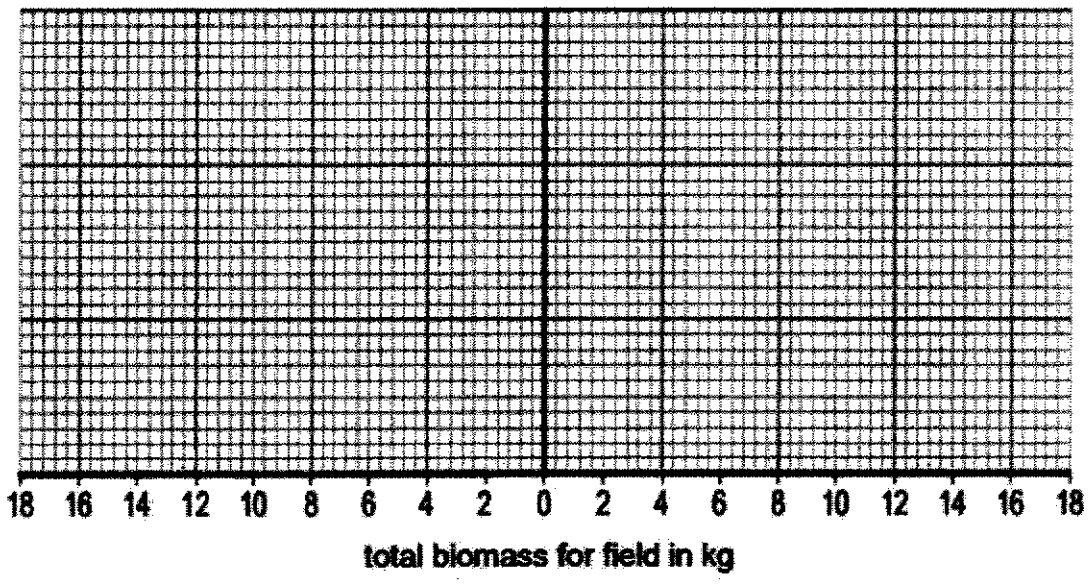
Write your answers in the table. [1]

Table 9.1

organism	Estimated number in the field	Biomass in one organism/ kg	Total biomass for field/ kg
Fallen wheat grain	40000	0.0006	24.0
Red kites	2	1.0	
Field mice	200	0.04	

(b) Use data from your completed table to draw a pyramid of biomass for the food chain shown in the table.

You should label each layer of your pyramid. [1]



(c) Account for the shape of the pyramid of biomass that you have drawn for **(b)**.

.....

.....

.....[1]

[Total: 3]

10 Describe how the following events affect the carbon dioxide level in the carbon cycle.

(a) the eutrophication of rivers

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.....[2]

(b) deforestation through burning trees

.....

.....[1]

[Total: 3]

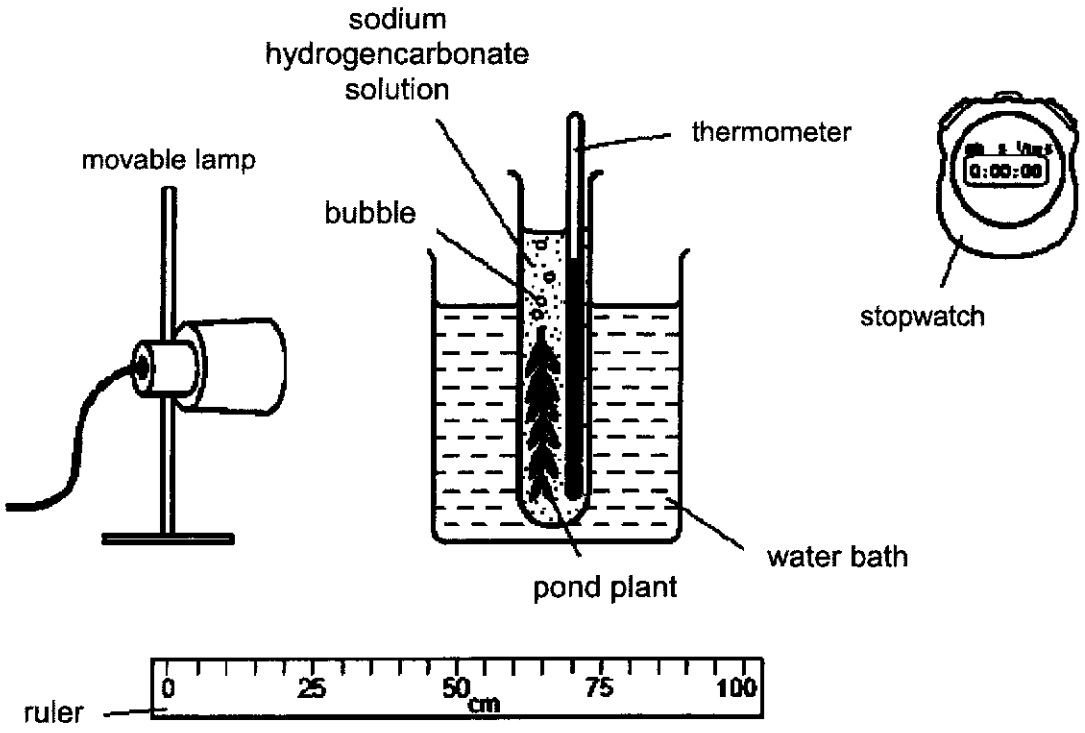
Section B

Answer **three** questions.
Question 13 is in the form of an **Either/ Or** question.
Only one part should be answered.

11 Leaves exposed to light photosynthesise and produce oxygen gas.

A student measured the rate at which the leaves of a pond plant produced bubbles of oxygen gas when exposed to different intensities of light.

The apparatus used is shown in Fig. 11.1.



not drawn to scale

Fig. 11.1

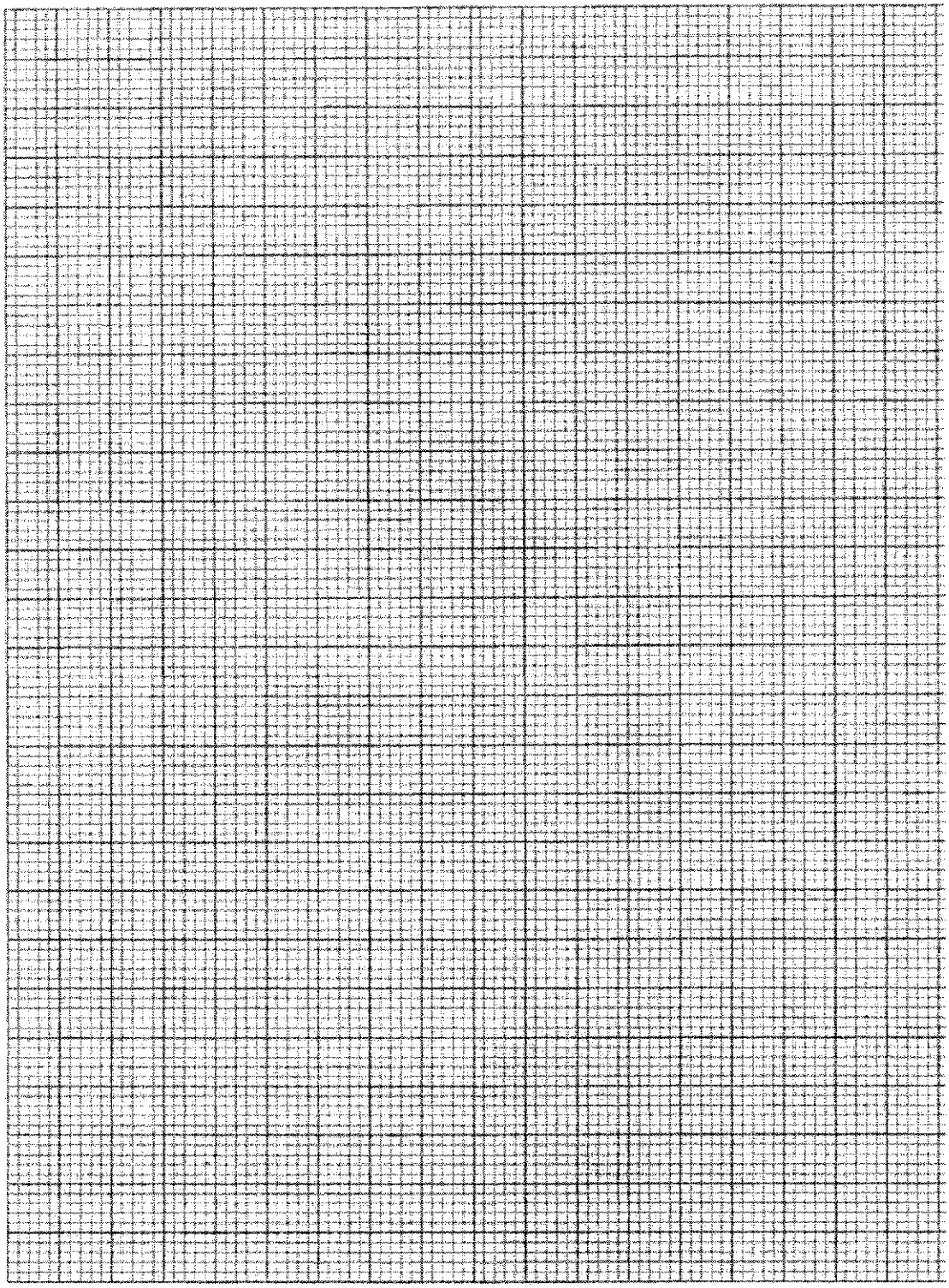
The investigation was carried out in a dark laboratory. The only light source was the lamp, as shown in Fig. 11.1. The student placed the lamp at different distances from the plant.

The results are shown in Table 11.1.

Table 11.1

distance of lamp from plant / cm	numbers of bubbles of oxygen produced per minute
20	29
40	16
60	8
80	3
100	1

(a)(i) On the grid below, plot a graph of the data in Table 11.1 and draw a line of best fit.



[4]

(a)(ii) Use your graph to estimate the distance of the lamp from the plant when six bubbles of oxygen per minute would be produced.

..... [1]

(b) Suggest why the student used a water-bath in the investigation shown in Fig. 11.1.

.....

..... [1]

Aphids are used by researchers to discover how plants transport sucrose.

Fig. 11.2 shows an aphid with its mouthparts inserted into a plant stem to feed on the liquid in the phloem.

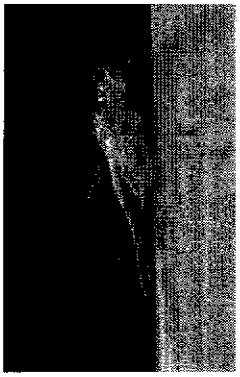


Fig. 11.2

A plant was put in a dark cupboard for several days.

Four aphids, A, B, C and D, were then placed on the plant in the dark cupboard as shown in Fig. 11.3.

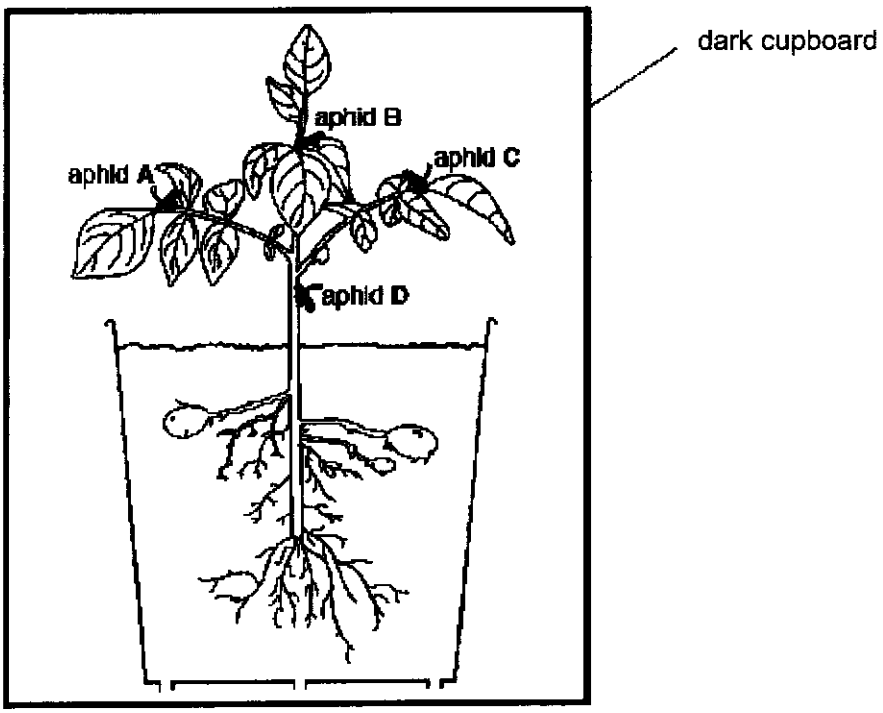


Fig. 11.3

(c) Immediately after the aphids were placed on the plant it was observed that:

- all the aphids ingested the same volume of liquid from the phloem
- aphid D ingested the highest concentration of sucrose.

Explain why aphid D ingested the highest concentration of sucrose.

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..... [4]

[Total: 10]

12 (a) Define homeostasis. Explain how the human body regulates its level of amino acids and water after a meal of salty food. (Include the excretion process in the kidney.)

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.....[8]

(b) State two conditions needed for ultrafiltration to take place.

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.....[2]

[Total:10]

13 Either

(a) Hormones perform certain important functions within our body. Define hormones.

Using insulin as an example, explain how this hormone performs its function within our body.

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.....[5]

(b) Explain the following:

(i) In some people's eyes, the retina becomes completely detached from the tissues and this affects their ability to see.

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.....[3]

(ii) As people get older, cloudy (opaque) patches sometimes form in the lens of the eye. These are called cataracts. This affects the ability of the lens to carry out its functions.

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.....[2]

[Total: 10]

13 OR

(a) Outline the ways genetic variation is increased in an offspring.

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.....[4]

(b) Describe the changes in oestrogen and progesterone levels after fertilization has taken place, and their effect on the pregnancy.

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.....[6]

[Total: 10]

-End of Paper-

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

1a	• Concentration of washing powder solution • Mass of washing powder • Size of stain/ volume of egg used to stain the pieces of cloth • pH of biological washing powder solution • Type of egg used • Volume of water used to dissolve washing powder • Material of cloth	Any 2, 1m each
1b	35 °C	1
1c	By forming enzyme-substrate complex for the reaction to occur and lowering the activation energy of the reaction	1 1
1d	Fats are present in the mixture as bile does not digest fat	1
2a	P: Small intestine / ileum R: Liver	Both correct, 1m
2b	The blood glucose concentration in blood vessel Q (hepatic portal vein) increases each time after a meal rich in carbohydrates (reject: food) due to absorption by the small intestine (reject: digestion). It will be low if the person has a diet low in carbohydrates. Blood glucose concentration in vessel S (hepatic vein) is relatively constant due to the actions of insulin and glucagon, which helps to keep the concentration constant. [State one example to explain how it is restored/kept constant] For example, when the blood glucose concentration increases above the norm (after a heavy meal in carbohydrate) This will lead to the production of insulin which will stimulate the liver cells to convert excess glucose to be stored as glycogen. or when blood glucose level is below norm, glucagon which will signal the liver to convert glycogen into glucose and release glucose back into the blood, thus allowing blood glucose levels to be relatively constant in blood vessel S (hepatic vein).	1 1 1
2c	Wall of the small intestine in patient B has less folds/ less microvilli/shorter protruding microvilli / less finger-like protrusion. This results in smaller surface area to volume ratio for the absorption of nutrients, hence leading to slower rate of absorption.	1 1
3a	0.1s to 0.6 s	1
3b	Duration of 1 beat = 0.9s – 0.1s = 0.8s Heart rate per minute = 60s / 0.8s = 75 beats per minute	1
3c	At rest = 0.14 x 5 = 0.7 dm^3 per min Exercise = 0.028 x 25 = 0.7 dm^3per min	1 1

	No change in rate of blood flow to the brain / rate of blood flow remains the same as the brain has to coordinate many activities;	1
4	Heat sensed by **thermoreceptors** in skin, nerve impulse produced; Nerve impulse is transmitted along the sensory neurone to the spinal cord; At spinal cord (grey matter), impulse transmitted to relay neurons, which then transmit impulses up to the brain; Brain interprets the feeling of hotness; relay neurons also transmit impulses across a synapse to motor neurons; But, motor neurons are damaged, no impulses transmitted to muscles for muscles to contract	Max 4
5a	X - ovary Y - anther	2 correct, 1m
5b	Feathery stigma of flower A has a larger surface area to volume ratio than the stigma of flower B/ Plant A has stigmas that are more feathery than plant B. Increases chance of pollen grains landing on it thus more fertilisation events resulting in larger number of offspring.	1 1 1
6ai	more males affected than females only females are carriers / males are affected once they have a recessive allele	1 1
6aii	1. X^BY x X^bX^b 2. correctly shown gametes + random fertilisation drawn using pencil and clearly shown ; 3. (genotype ratio) X^BX^b X^BX^b X^bY X^bY 1 : 1 4. (phenotype ratio) 1 : 1 carrier female with normal colour vision : colour-blind male 5. probability that the baby boy is colour blind = 100% [-1m for no proper headings – e.g. parental phenotype, parental genotype, gametes, offspring genotype, offspring phenotype]	
7a	Use a restriction enzyme to cut the herbicide-resistant gene from the chromosome of a cell in the herbicide-resistant plant Use the same restriction enzyme to cut the plasmid of the vector E.coli to produce sticky ends complementary to the ends of the herbicide-resistant gene The herbicide-resistant gene will bind to the plasmid by complementary base pairing. Add DNA ligase to form a recombinant plasmid. Using heat shock or electric shock to open pores on the cell surface membrane of E.coli cell for the plasmid to enter, forming a transgenic bacterium.	1 1 1 1

8a	U: phosphate group W: deoxyribose sugar X: cytosine (rej: nitrogen-containing base)	3 correct, 2m. 2 correct, 1m
8b	The sequence of bases determines the sequence of amino acids in a polypeptide. 3 bases code for one amino acid in a triplet code / codon.	1 1
8ci	At K, the mass of DNA doubles due to DNA replication in interphase. At L, the mass of DNA halves / returns to original mass due to cytokinesis where the contents of the cell were divided into two cells.	1 1
8cii	3 blood cells	
8ciii	Remains the same at 46 chromosomes	
9a	2.0, 8.0	Both correct- 1m
9b	3 layers of decreasing size when they go up, labelled wheat grain, field mice, red kites in order of food chain	1m
9c	Not all parts of eaten mice are digested and absorbed into the red kites/ lost in the form of carbon dioxide due to respiration	1m
10a	Carbon dioxide level in the rivers decreases in the beginning because rapid growth of algae uses up large amount of carbon dioxide to carry out photosynthesis; Afterwards, the level of carbon dioxide in rivers increases as eutrophication leads to the death of submerged algae and marine life, so the decay/decomposition of the dead matter releases carbon dioxide in the rivers;	2m
10b	Deforestation leads to an increase in the carbon dioxide level in the atmosphere because less trees absorb carbon dioxide to carry out photosynthesis; / burning of trees releases a large amount of carbon dioxide into atmosphere through the process combustion;	1m
11ai	correct scale, axis axis labelled with units (x-axis: distance of lamp from plant / cm, and y-axis: number of bubbles per min) correct plotting of all points line of best fit without extrapolation	1 1 1 1
11aii	line drawn from 6 bubbles to trend line, and then to the distance axis; AND correct reading from their graph ecf for wrong trend line in 10(a)(i) Reject if wrong units	1
11b	prevents lamp from heating up the plant / maintains temperature of the plant as water absorbs heat	
11c	aphid D is nearer the root / tuber / is before the branching of the plant no photosynthesis in the dark, hence no / less glucose is produced in the leaves / stem	1 1

	plant converts stored starch in the root / tuber into sucrose sucrose moves by translocation up the plant	1 1
12a	Maintenance of constant internal/body environment; Amino acids brought to cells to form proteins/protoplasm (assimilation); Excess are deaminated in liver; To form urea; Excreted by kidneys; Decrease in water potential of blood; Detected by hypothalamus; Pituitary gland releases more ADH into bloodstream; Kidney nephrons reabsorb more water, cells in walls of collecting duct become more permeable to water; So less water is lost in concentrated urine.	Max 8m
12b	Force: high hydrostatic pressure due to the difference in size of the afferent and efferent arterioles; Filter: basement membrane around glomerular blood capillaries is partially permeable and acts as a filter;	2
Either 13a	1. Hormones are chemical substances produced in minute quantities by endocrine glands. 2. Hormones are transported by blood to one or more specific target organs <u>Effects of Insulin</u> 3. Insulin hormone decreases blood sugar concentration. 4. It increases the rate of glucose uptake by cells by making the cell membranes more permeable to glucose. 5. Insulin also stimulates the liver and muscle cells to convert excess glucose into glycogen for storage. 6. Presence of insulin increases the oxidation of glucose during tissue respiration.	Max 5m
13b	(i) Photoreceptors/ rods and cones are not in contact with optic nerve; No impulses can be transmitted along the optic nerve to the brain; No image formed/ unable to see/ blindness; (ii) Fail to focus (all) light rays/ passage of light rays being impaired (refraction); blurred image/ possible change in elasticity of lens and its ability to accommodate;	Max 3m Max 2m
Or 13a	Crossing over of homologous chromosomes at prophase I of meiosis I; Independent assortment of homologous chromosomes at metaphase I of meiosis I; Random fertilization of gametes, where each gamete has different combination of alleles; Gene mutation results in new alleles of genes;	1 1 1 1

	Accept: cross pollination in flowering plants	
13 b	- The zygote develops into an embryo which implants itself in the uterine lining. {Not necessary} - The embryo secretes a hormone [not in syllabus: hCG hormone] which prevents the corpus luteum from degenerating. {Not necessary}	
	- The corpus luteum continues to secrete oestrogen and progesterone until the placenta is formed;	1
	- After formation of the placenta, the placenta takes over the production of oestrogen and progesterone;	1
	-Progesterone maintains the uterine lining by causing it to thicken and be supplied with blood capillaries;	1
	- ready for implantation of the embryo/ to nourish the embryo;	1
	- High levels of oestrogen inhibits FSH production by pituitary gland, preventing the maturation and development of more follicles;	1
	- High levels of progesterone inhibits FSH and LH production.	1