Name	Register No.	Class

BENDEMEER SECONDARY SCHOOL
2019 PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS
BIOLOGY
6093/01

DATE : **3 September 2019**

DURATION : **1 hour**

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 OTAS sheet.

Read the instructions on the OTAS sheet very carefully.

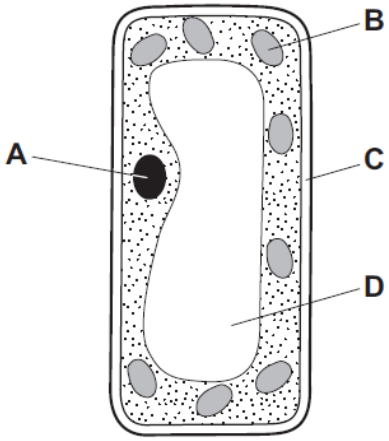
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done on the question paper.

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

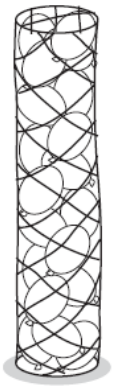
/ 40

1 The diagram shows a palisade cell.

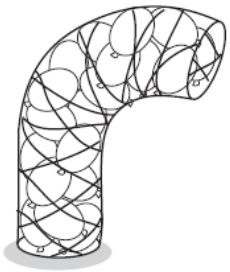
Which structure is the site of photosynthesis?



2 The diagrams show a cylindrical net packed with rubber balloons full of air. The structure is used by a teacher to explain wilting.



all the balloons fully inflated

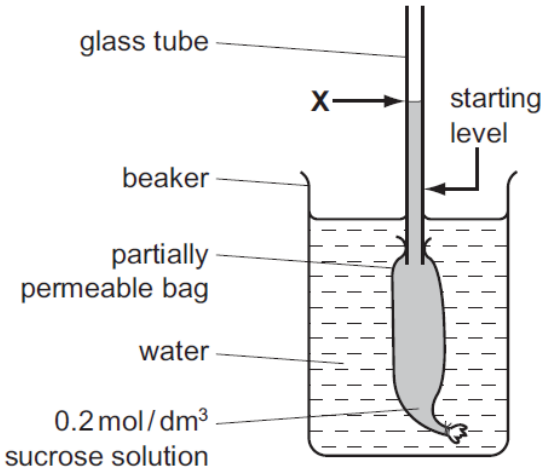


the same number of balloons with some of the air let out

What is represented by the parts of the structure shown?

	air	balloons	net	rubber
A	cells	cell sap	cell walls	epidermis
B	cell sap	cells	epidermis	cell walls
C	cell walls	epidermis	cell sap	cells
D	epidermis	cell walls	cells	cell sap

3 The diagram shows the result of an experiment. The liquid in the glass tube had risen to point X after three hours.



In a second experiment, which change could be made to cause the liquid to rise higher than X?

A a larger beaker

B a smaller bag

C water in the bag

D 0.4 mol / dm^3 sucrose solution in the bag

4 Which process needs energy from respiration?

A movement of carbon dioxide into the alveoli

B movement of oxygen into red blood cells

C uptake of glucose by cells in the villi

D uptake of water by root hair cells

5 Which substance is built up from amino acids?

A glucose **B** glycogen **C** protein **D** urea

6 Which property of enzymes is explained by the lock and key hypothesis?

A All enzymes are proteins.

B Enzymes are inactive at very low temperatures.

C Human enzymes are most active just below 40 °C.

D Most enzymes can only catalyse one reaction.

7 Which is not a function of the liver?

A conversion of glucose to glycogen

B storage of glycogen

C secretion of insulin

D synthesis of proteins from amino acids

8 The surface area of the small intestine is increased by the villi in the intestine wall.

How does the increased surface area help absorption of digested materials?

A It makes peristalsis more efficient.

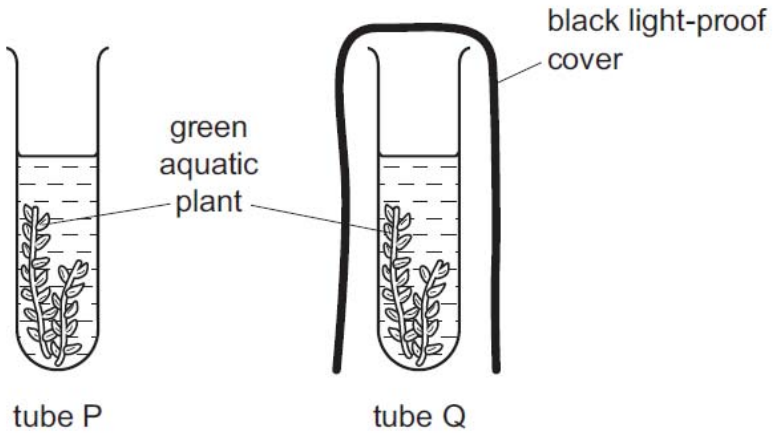
B More mucus is produced for lubrication.

C More starch and protein can be absorbed.

D There is a greater chance of food molecules diffusing into the blood.

9 Two test-tubes, P and Q, were set up, each containing a solution of red hydrogencarbonate indicator. Hydrogencarbonate indicator turns yellow when the carbon dioxide concentration increases and turns purple when the carbon dioxide concentration decreases.

Similar pieces of the same aquatic plant were placed into tubes P and Q. Tube P was uncovered, and tube Q had a black light-proof cover. The tubes were left in a warm room in sunlight for four hours.

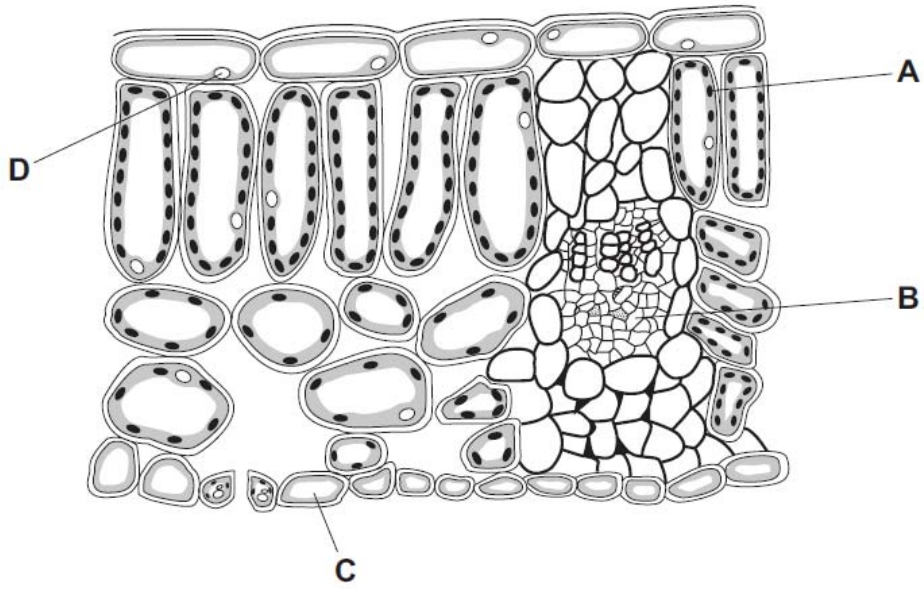


What is the colour of the hydrogencarbonate indicator in the two tubes after four hours?

	tube P	tube Q
A	purple	red
B	purple	yellow
C	red	yellow
D	yellow	red

10 The diagram represents a cross-section of part of a leaf as seen using a microscope.

Where does translocation (movement of sucrose and amino acids) occur?



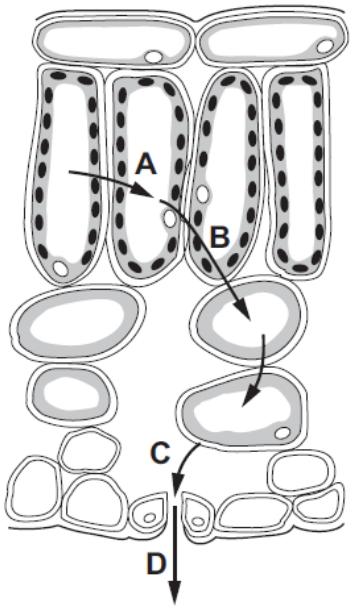
11 Water and ions can reach the xylem of a plant root through cell walls, without passing through a cell membrane.

How do these substances move through the cell walls?

	water	ions
A	diffusion	diffusion
B	diffusion	osmosis
C	osmosis	diffusion
D	osmosis	osmosis

12 The diagram shows the pathway of water molecules through part of a leaf, seen under a microscope, in transverse section.

Where does water evaporate?



13 Which blood vessel transports blood into the liver?

A hepatic portal vein

B hepatic vein

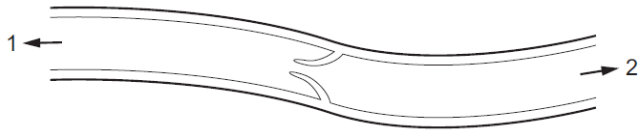
C pulmonary vein

D renal vein

14 What is a difference between plasma and tissue fluid?

	plasma	tissue
A	dissolved glucose	no dissolved glucose
B	less dissolved glucose	more dissolved glucose
C	more protein molecules	fewer protein molecules
D	no white blood cells	white blood cells

15 The diagram shows a section through part of a vein.



What could be the first organs found in directions 1 and 2?

	1	2
A	heart	brain
B	intestine	liver
C	kidney	heart
D	lung	heart

16 The table shows the effect of exercise on the rate and depth of breathing.

	breathing rate / breaths per minute	volume of each breath / cm^3
at rest	12	500
after exercise	24	1000

What is the increase in the volume of air exchanged per minute after exercise, compared to at rest?

A 1000 cm^3 **B** 6000 cm^3 **C** 18 000 cm^3 **D** 24 000 cm^3

17 Two people of equal body mass do the same amount of exercise.

One person is in good health. The other person has emphysema.

The rate of oxygen entering each person's blood in the lungs is measured.

The results are shown in the table.

	healthy person	person with emphysema
oxygen entering blood in cm^3 per minute	22	12

Which statement explains these results?

A The healthy person has a faster breathing rate.

B The healthy person has a smaller lung volume.

C The person with emphysema has damaged alveoli.

D The person with emphysema has larger alveoli.

18 Which is produced during anaerobic respiration in muscles?

A carbon dioxide and water

B carbon dioxide and lactic acid

C carbon dioxide only

D lactic acid only

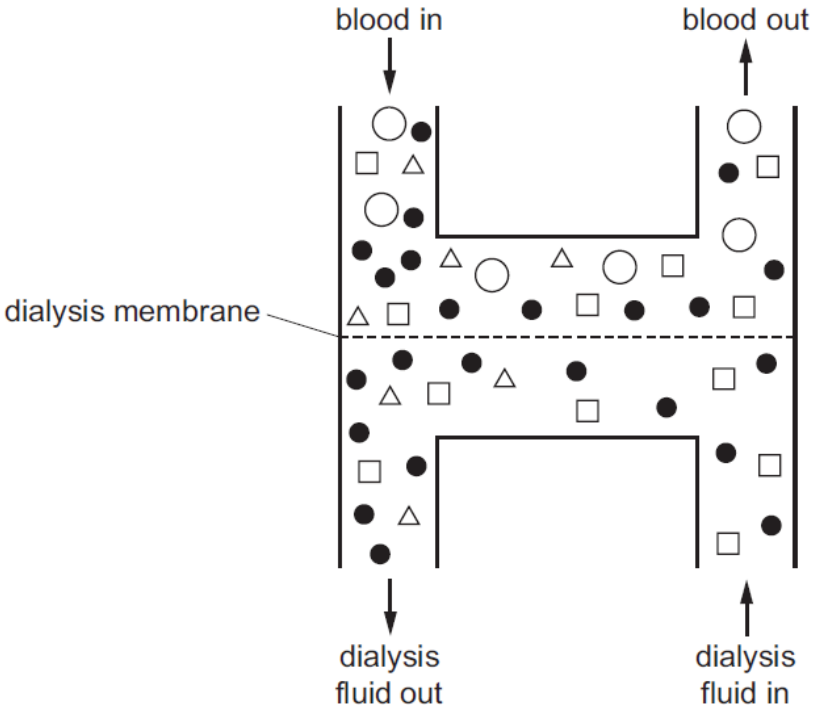
19 An analysis of the composition of expired air is shown.

gas in expired air	% of expired air
carbon dioxide	4.1
oxygen	16.4
nitrogen and other gases	79.5

Using only data from the table, what percentage of the expired air is excreted material?

A 0% **B** 4.1% **C** 83.6% **D** 100%

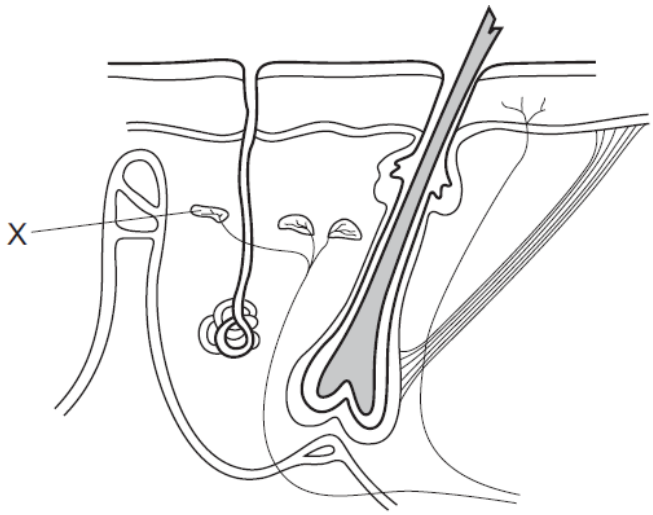
20 The diagram shows how a kidney dialysis machine works. Each shape represents a molecule found in blood or dialysis fluid.



Which shape represents urea?

A ○ **B** ● **C** □ **D** △

21 The diagram shows some of the structures seen in a section through human skin.



What is the function of structure X?

A to cause capillaries to constrict

B to detect changes in temperature

C to receive impulses from the central nervous system

D to stimulate sweat glands to release sweat

22 Which of these is a reflex action?

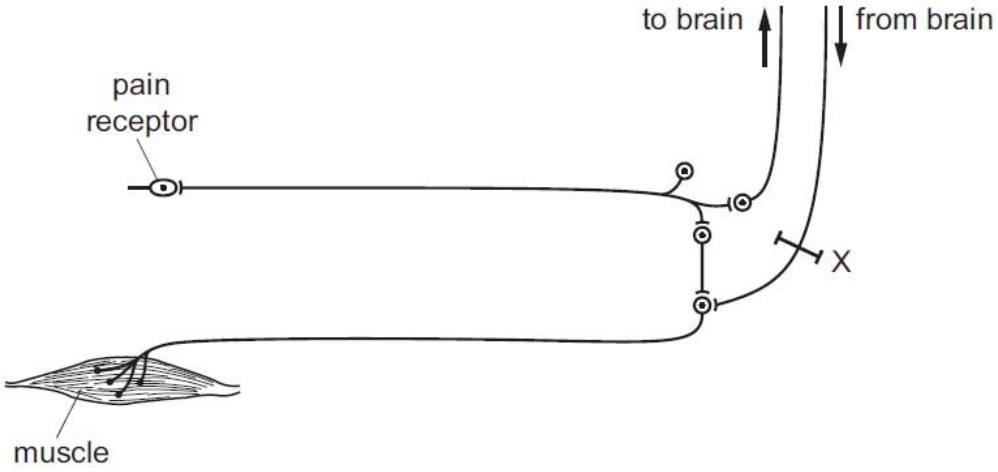
A increasing the blood glucose level by eating rice

B lifting a book off the table by contracting your arm muscles

C preventing an insect from flying into your eye by blinking

D using your brain to work out the answer to a problem

23 The diagram shows some of the nerve pathways associated with a reflex action.



If the pathway at X is damaged, how does this affect the reflex?

A The person will not be aware that the reflex is occurring.

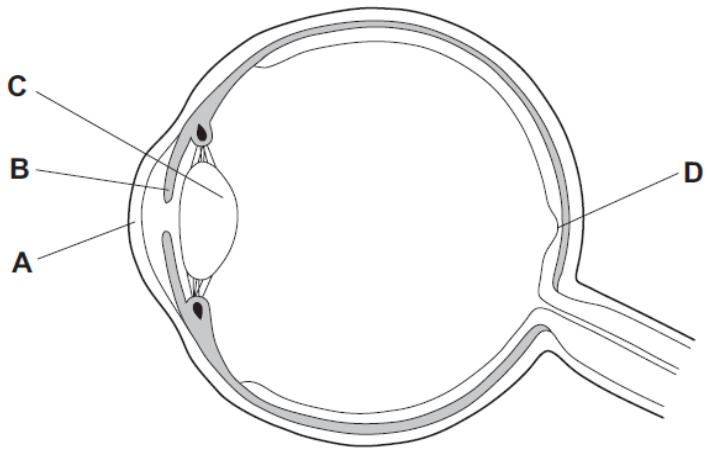
B The reflex cannot be controlled consciously.

C The response will occur without any stimulus.

D There is no response to the stimulus.

24 The diagram shows a section through an eye.

Which part is the receptor for the stimulus that results in a change in the size of the pupil?



25 A person looks at some hills far away.
Which row shows the state of the lenses, ciliary muscles and suspensory ligaments in her eyes?

	thick lenses	contracted ciliary muscles	suspensory ligaments under tension
A	✓	✓	✓
B	✓	**X**	**X**
C	**X**	✓	**X**
D	**X**	**X**	✓

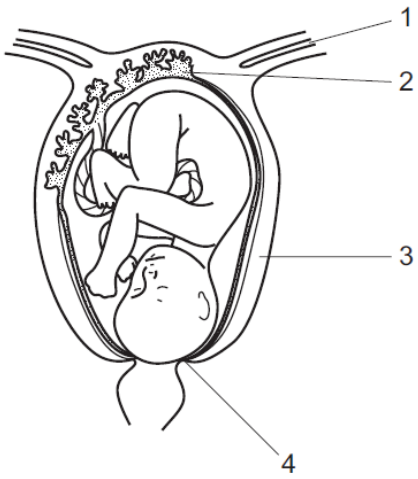
26 What are characteristics of hormones?

	affect target organs	carried by the blood	produced by glands
A	✓	✓	✓
B	✓	✓	**X**
C	✓	**X**	✓
D	**X**	✓	✓

27 In which part of the human female reproductive system does a zygote start to divide to form a ball of cells?

A cervix
B ovary
C oviduct
D uterus

28 The diagram shows a baby about to be born.



Which labelled structures are the cervix and uterus?

	cervix	uterus
A	1	2
B	2	1
C	3	4
D	4	3

29 Which plants are most likely to adapt successfully to a climate change in their environment?

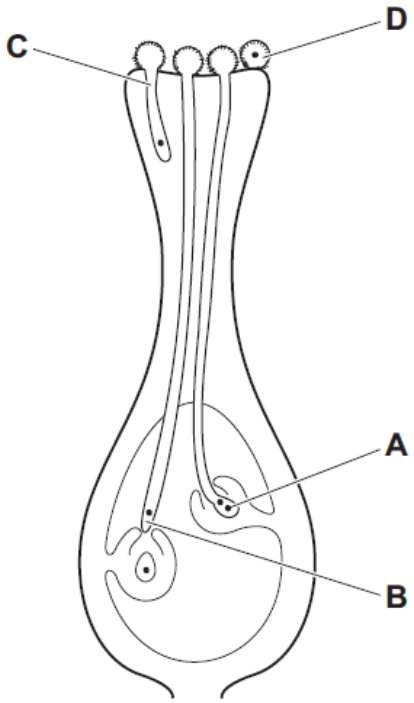
A plants that are cross-pollinated

B plants that do not rely on wind-pollination

C plants that grow rapidly

D plants that reproduce asexually

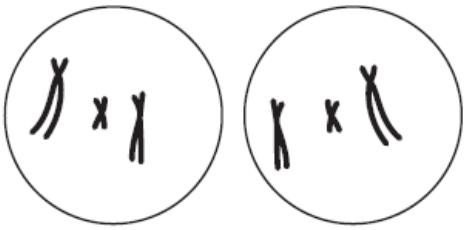
30 The diagram shows the stigma, style and ovary of a flower.
Where does fertilisation take place?



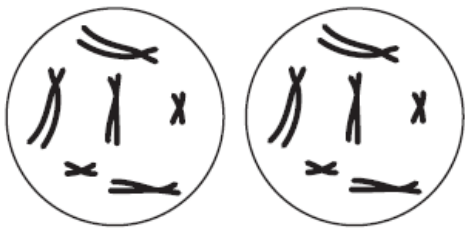
31 The diagram shows the chromosomes in a cell.

Which diagram shows the product of one division of the cell by mitosis?

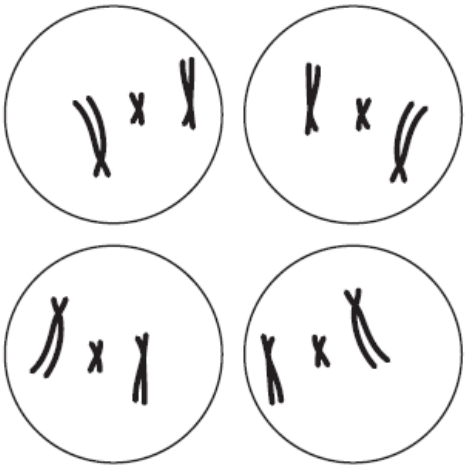
A



B

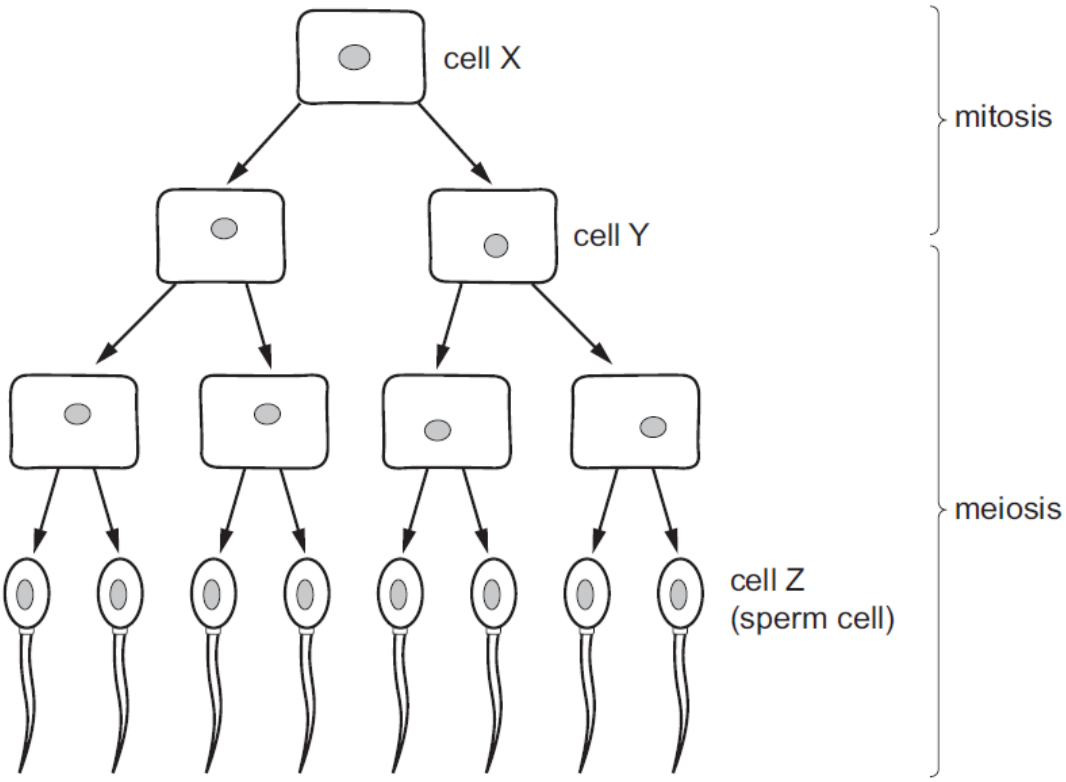


C



D

32 The diagram shows some stages in cell division in a fruit fly.

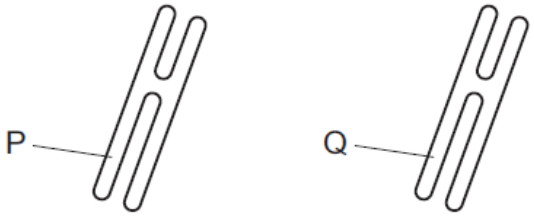


Cell X contains 8 chromosomes.

How many chromosomes are in cell Y and in cell Z?

	cell Y	cell Z
A	4	4
B	4	8
C	8	4
D	8	8

33 The diagram shows a pair of chromosomes from the same cell.



A gene is found at the point labelled P.

In a heterozygous individual, what will be found at the equivalent position labelled Q?

A a different allele of a different gene

B a different allele of the same gene

C a different gene of the same allele

D the same gene of the same allele

34 Which statements about genes and chromosomes are correct?

	A chromosome carries a molecule of DNA.	A gene is a section of DNA.
A	true	true
B	true	false
C	false	true
D	false	false

35 The table shows the variation in foot length in a number of students.

foot length/ cm	number of students
20.0–20.9	0
21.0–21.9	5
22.0–22.9	12
23.0–23.9	15
24.0–24.9	17
25.0–25.9	8
26.0–26.9	0

Which row identifies this type of variation and states its cause?

	type of variation	cause
A	continuous	genes and the environment
B	continuous	genes only
C	discontinuous	environment only
D	discontinuous	genes and the environment

36 The colour of the fruit of tomato plants is determined by alleles of the same gene.
A tomato plant with red fruit was crossed with a tomato plant with yellow fruit. Of the offspring, 26 plants had red fruit and 24 had yellow fruit.
Three explanations were suggested.

1 Both parents were homozygous.
2 One parent had two recessive alleles.
3 One parent was heterozygous.

Which explanations are correct?

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

37 Diabetes may be treated using insulin from genetic engineering.
Where is this insulin produced?

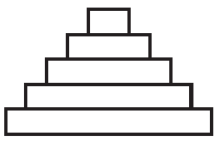
A bacterial cytoplasm
B bacterial nucleus
C human liver
D human pancreas

38 A food chain is shown.

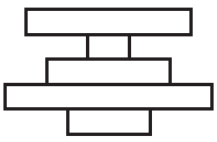
grain → insects → small birds → owls → lice

What is the pyramid of numbers for this food chain?

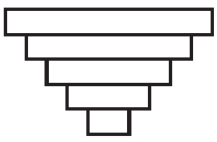
A



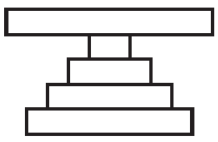
B



C



D



39 In the carbon cycle, which process returns carbon to a food chain?

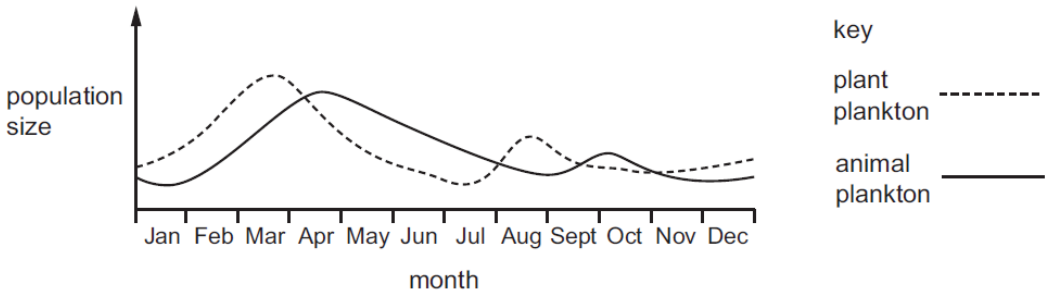
A combustion

B decomposition

C photosynthesis

D respiration

40 The graph shows changes in the populations of plant and animal plankton in a lake.



Consider the following statement in relation to the data provided by the graph.

'Population changes in animal plankton lag behind similar changes in plant plankton because the animals feed on the plants.'

Into which category does the statement fall?

A It is a reasonable interpretation of the data.

B It is a restatement of the data, not an interpretation.

C It is contradicted or not supported by the data.

D More data is required in order for this interpretation to be made.

END OF PAPER

Register No.	Class

Name ____________________

BENDEMEER SECONDARY SCHOOL
2019 PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS
BIOLOGY
6093/02

Date : 28 August 2019

Duration: 1 h 45 min

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on the work handed in.
Write in dark blue or black pen.
You may use a 2B pencil for any diagrams or graphs.
Do not use paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A (50 marks)
Answer **all** questions. Write your answers in the spaces provided on the question paper.

Section B (30 marks)
Answer **all** questions. Write your answers in the spaces provided on the question paper.
Question 10 is in the form of an **Either/Or** question. Only one part should be answered.

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

/ 80

This document consists of **20** printed pages.

[Turn over

Section A

Answer **all** questions.

Write your answer in the spaces provided.

1 Fig. 1.1 shows the bud of an insect-pollinated flower and a magnified transverse section through the same flower bud. The transverse section was taken at the position shown by the dotted line.

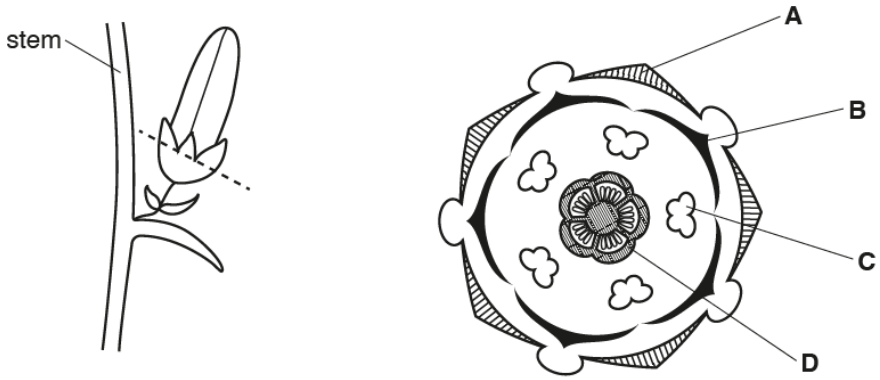


Fig. 1.1

(a) Write the name of each of the structures **A** to **D**.

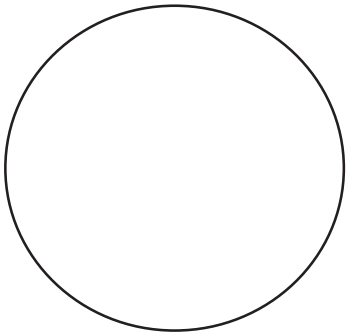
A: ……..

B: ……..

C: ……..

D: …….. [4]

(b) The diagram shows an incomplete transverse section through the stem of this plant.



(i) Complete the diagram by drawing and labelling the positions of each of the following tissues:

- xylem,
- phloem. [2]

(ii) State one function of xylem tissue.

……

…… [1]

[Total: 7]

2 Fig. 2.1 shows a person about to lift the handle of a bucket from position **A** to position **B**.

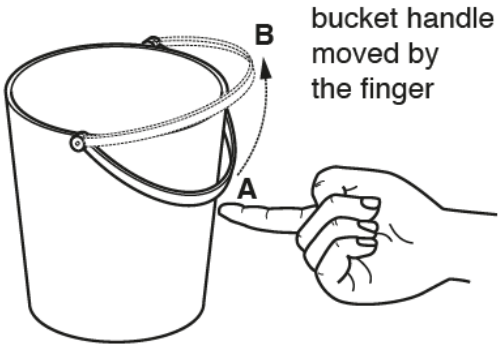


Fig. 2.1

The movement of the bucket handle, as shown, illustrates some features of the movement of a person's chest while breathing in.

(a) State two similarities between the movement of a person's chest while breathing in and the movement of the handle.

1 .....

2 .....
[2]

(b) Explain the differences between the movement of a person's chest and the movement of the handle.

…….....

…….....

…….....

…….....

…….....

…….....

…….....

……..... [5]

[Total: 7]

[Turn over

3 Fig. 3.1 shows a Bengal tiger.

Fig. 3.1

Fur colour in the Bengal tiger is controlled by a single gene. The dominant allele of the gene results in orange fur. A single change in this gene produces a recessive allele, which results in white fur in tigers with the homozygous recessive genotype.

(a) Define the term *gene*.

……

……

…… [3]

(b) Using the letters **T** (orange) and **t** (white) to represent the alleles that control fur colour, draw a labelled genetic diagram to show how two tigers with orange fur may give rise to offspring with white fur.

[4]

[Total: 7]

4 Fig. 4.1 shows cells from a plant tissue which have been mounted on a slide with distilled water and viewed using a microscope.

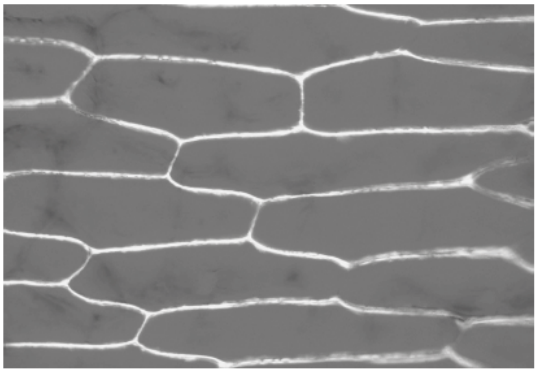


Fig. 4.1

Fig. 4.2 shows cells taken from the same plant tissue when mounted on a slide with concentrated salt solution.

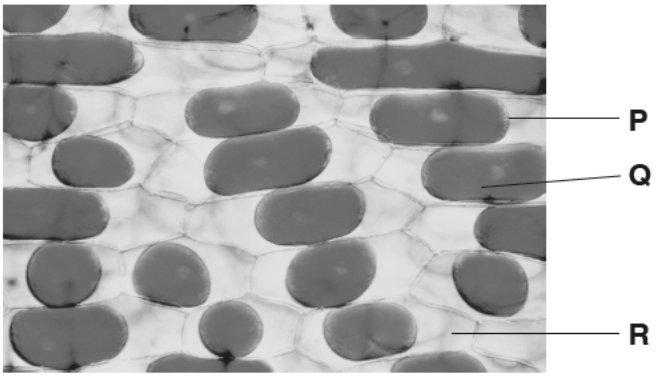


Fig. 4.2

(a) Explain the appearance of the cells in Fig. 4.2.

……

……

…… [3]

(b) Identify structures **P** and **Q** in Fig. 4.2.

P ..... **Q** ..... [2]

(c) State the contents of location **R** in Fig. 4.2.

…… [1]

[Total: 6]

5 Ivy is a plant with green leaves that vary in size. A student noticed that ivy leaves were different in width on plants growing in shady positions compared with plants growing in bright, sunny positions.

To investigate this further, she collected a sample of 10 leaves from plants growing in shady positions and 10 leaves from plants growing in sunny positions.

Some of these leaves are shown in Fig. 5.1.

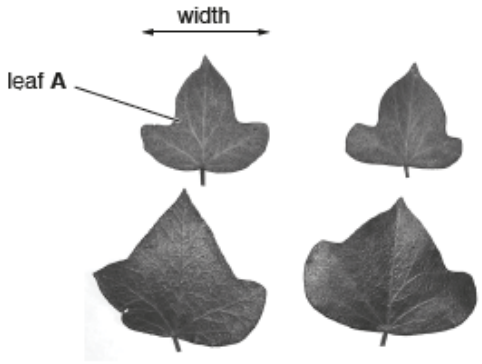


Fig. 5.1

The student measured the maximum width of the 20 leaves she collected. The results are shown in Table 5.1.

Table 5.1

leaf number	maximum width of leaf from shady position/ mm	maximum width of leaf from sunny position/ mm
1	38	43
2	48	35
3	49	29
4	54	39
5	43	34
6	46	30
7	40	29
8	47	35
9	43	31
10	54	22
mean maximum width/ mm		

(a) Complete Table 5.1 by calculating the mean maximum width of leaves from a shady and sunny position respectively. [2]

(b) State two conclusions that can be made from the results in Table 5.1.

1 ……...

……..

2 ……...

…… [2]

(c) Suggest how having different sized leaves in shady and sunny positions might be an advantage to the ivy plant.

……

……

……

……

…… [3]

[Total: 7]

6 Fig. 6.1 shows the human male reproductive organs and associated structures.

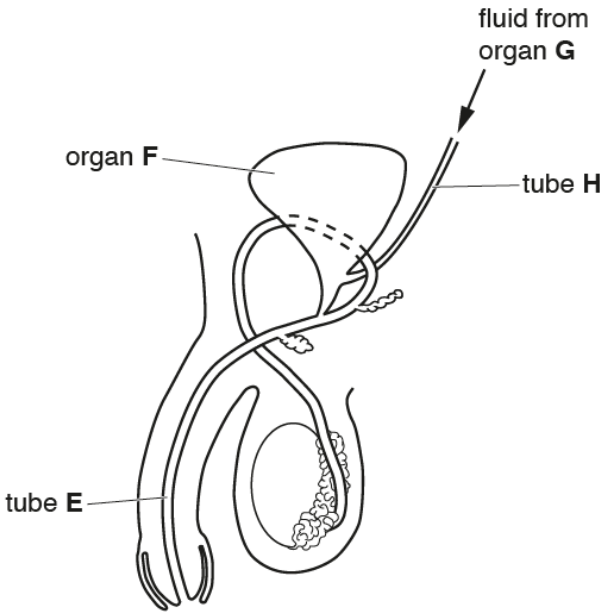


Fig. 6.1

(a) Identify each of the following:

(i) tube **E** .....

(ii) organ **F** .....

(iii) organ **G** .....

(iv) tube **H** .....

[4]

(b) State one difference between the fluids carried by tube **E** and tube **H**.

.....

..... [1]

(c) State one way in which the fluid from organ **G** may be different in a person with diabetes compared to a person without diabetes.

.....

..... [1]

[Total: 6]

7 Fig. 7.1 shows the relationships between a number of organisms living together in a South American rainforest.

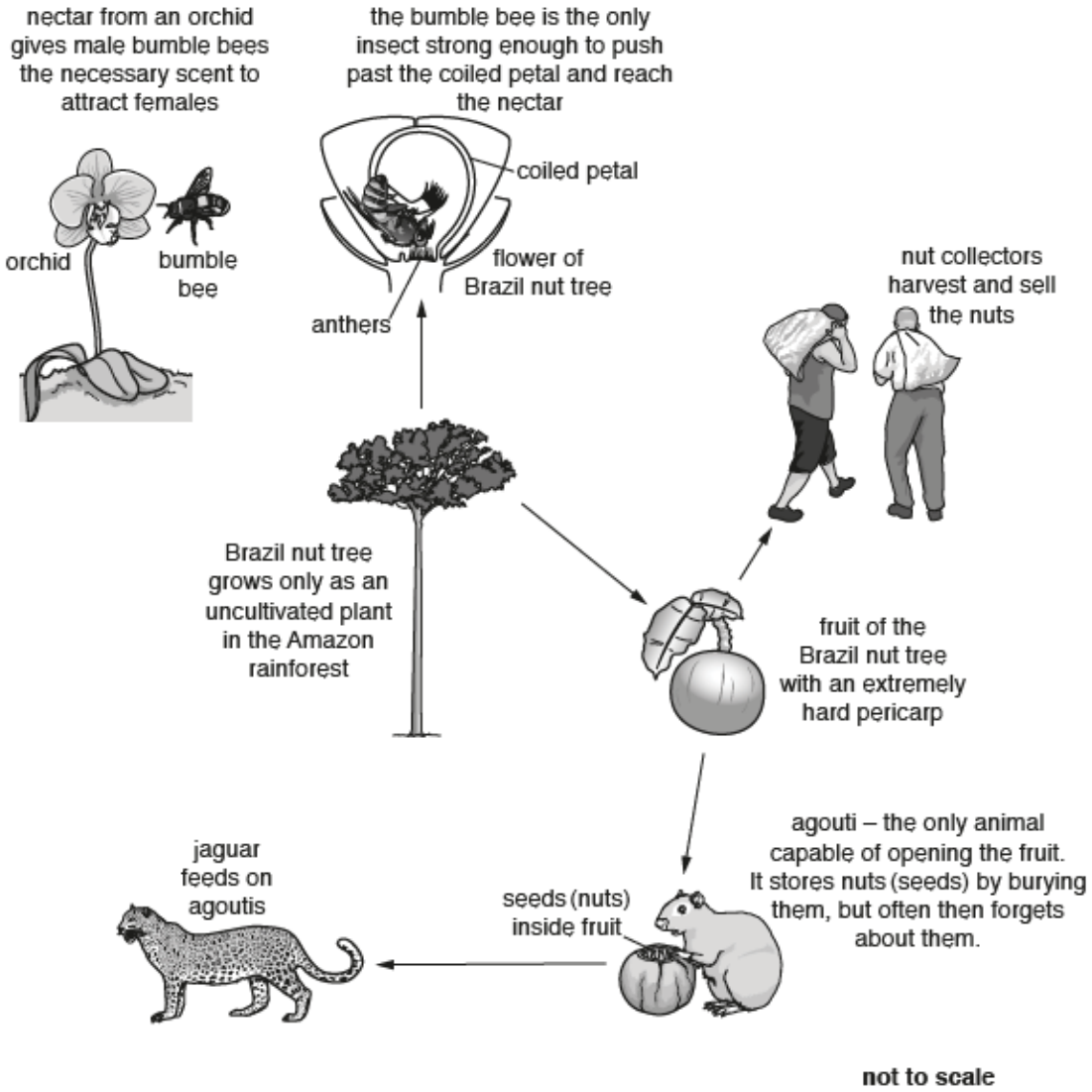
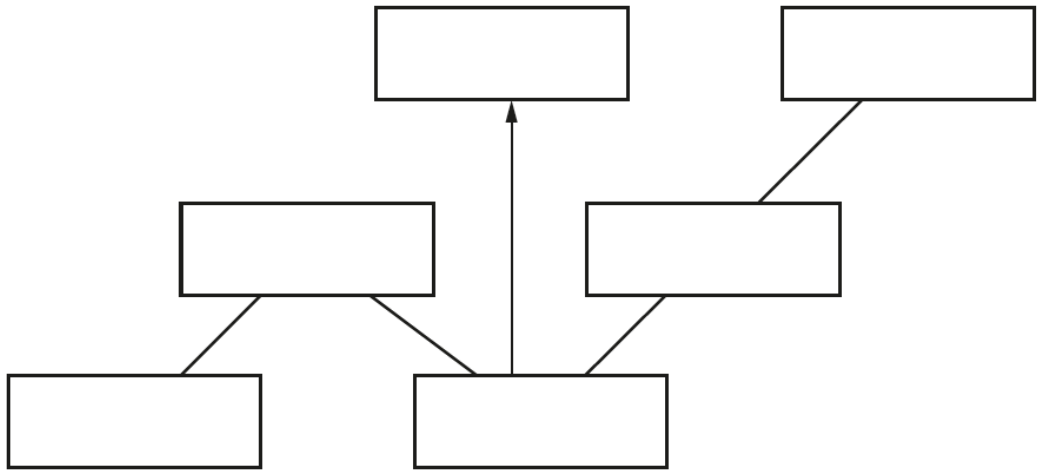


Fig. 7.1

(a) Fig. 7.2 is an incomplete food web for these organisms.

Complete Fig. 7.2 by:

- writing the name of an organism in each box,
- completing the arrows to show the flow of energy.



[4]

Fig. 7.2

(b) Suggest the possible effects on the community in the rainforest if the orchids were killed by disease.

……

……

……

……

……

……

……

…… [6]

[Total: 10]

Section B

Answer **three** questions.

Question **10** is in the form of an **Either/Or** question. Only one part should be answered.

8 Catalase is an enzyme found in many tissues. Catalase breaks down hydrogen peroxide, forming water and oxygen.

Fig. 8.1 shows the apparatus used by a student to investigate the effect of pH on the activity of catalase. The gas syringe was used to measure the volume of oxygen produced at each pH.

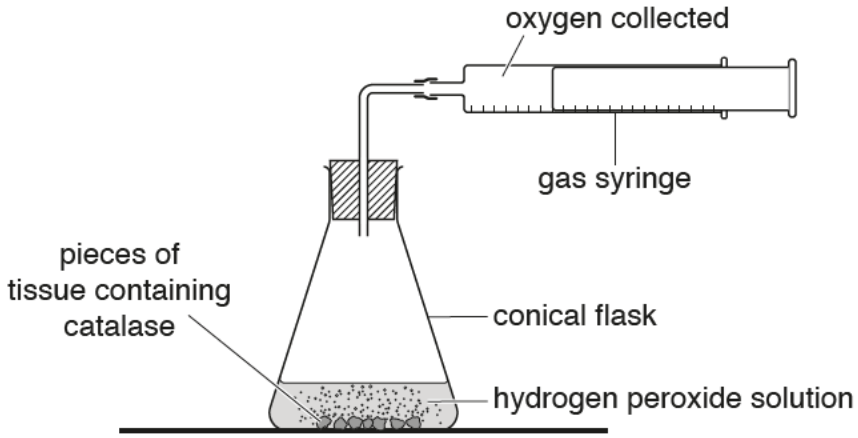


Fig. 8.1

The student carried out the experiment at a pH of 7.0 and measured the volume of oxygen produced during a period of five minutes.

He then mixed fresh samples of tissue containing catalase, and hydrogen peroxide solution at pH values of 5.0, 6.0, 8.0 and 9.0 and measured the volume of oxygen produced during the five minutes for each pH.

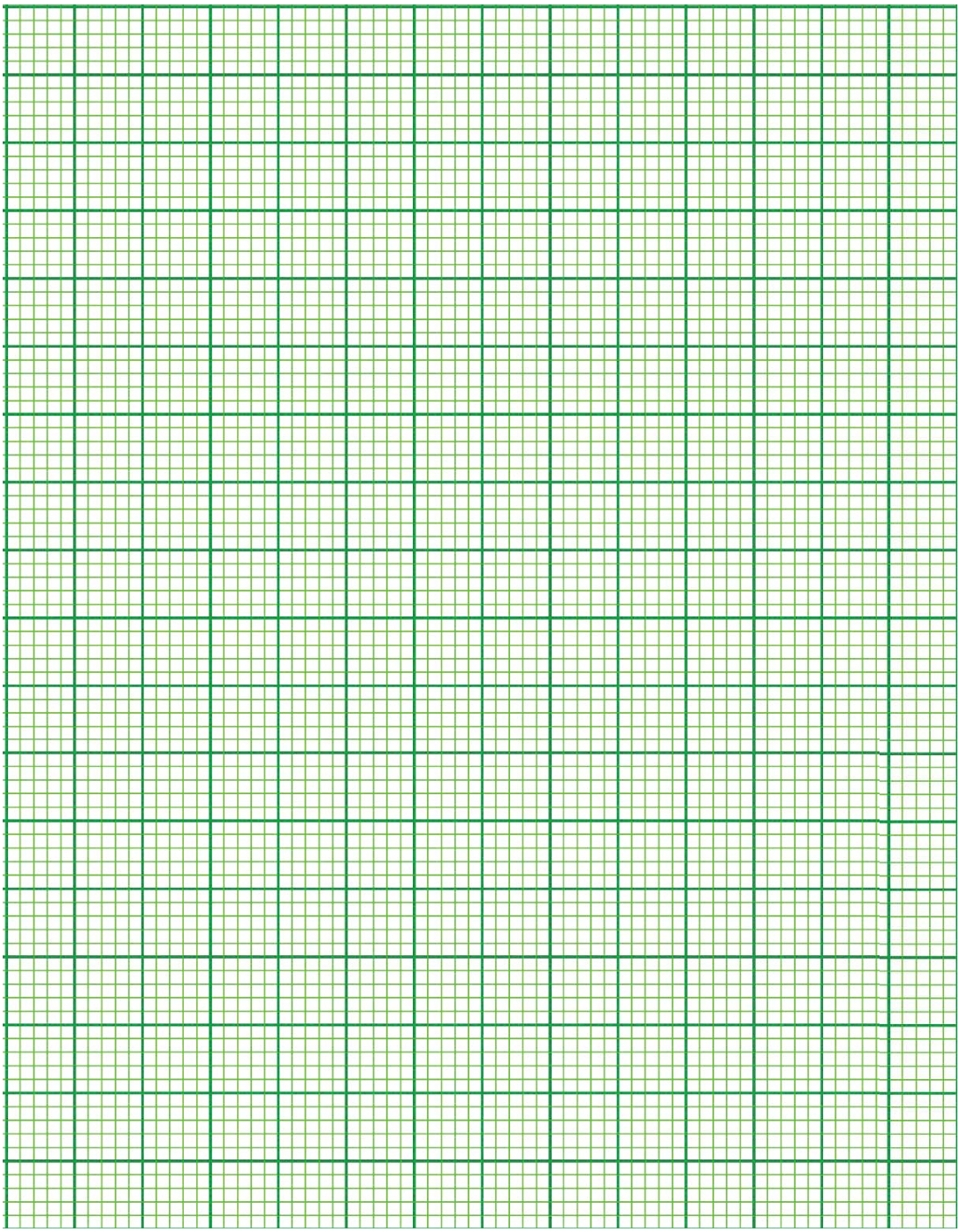
The results are shown in Table 8.1.

Table 8.1

pH	volume of oxygen produced during five minutes/ cm^3
5.0	12
6.0	45
7.0	88
8.0	57
9.0	8

(a) Using the data in Table 8.1, plot a line graph to show the effect of pH on the activity of catalase.

Join the points on your graph with ruled, straight lines.



[4]

(b) Using the information in Table 8.1 and your graph, describe the effect of pH on the activity of catalase.

……..

……..

……..

……..

…… [3]

(c) The enzyme Savinase® is a protease used in many biological detergents. Biological detergents are used to wash clothes. Fig. 8.2 shows the effect of temperature on the activity of Savinase®.

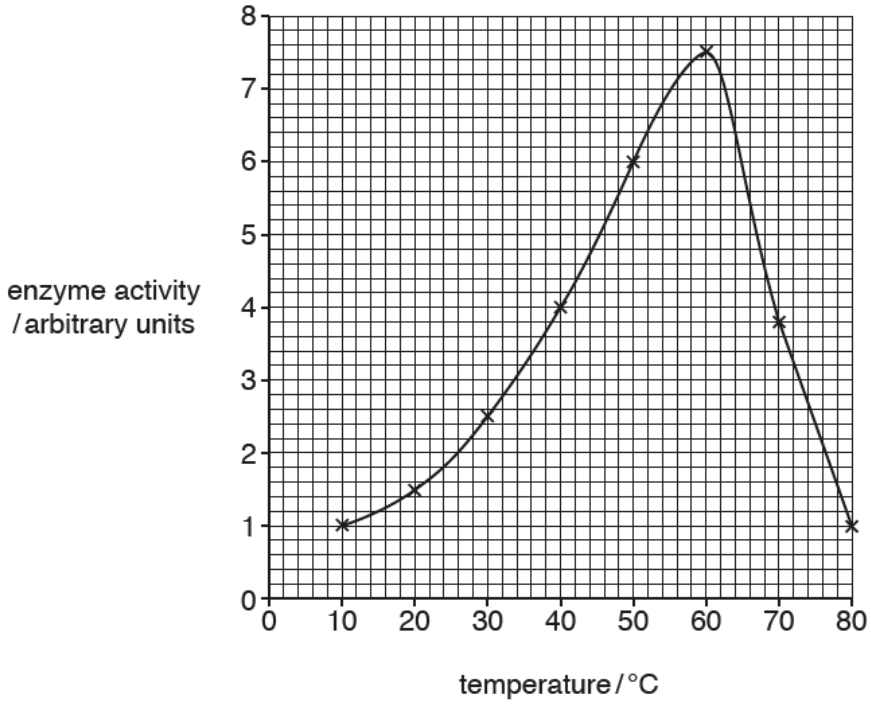


Fig. 8.2

(i) Use Fig. 8.2 to find the optimum temperature for Savinase® activity.

…… [1]

(ii) Suggest why Savinase® is added to biological detergents.

……..

……

…….. [2]

[Total: 10]

9 Fig. 9.1 shows the stages in the process of genetic engineering to produce the hormone insulin.

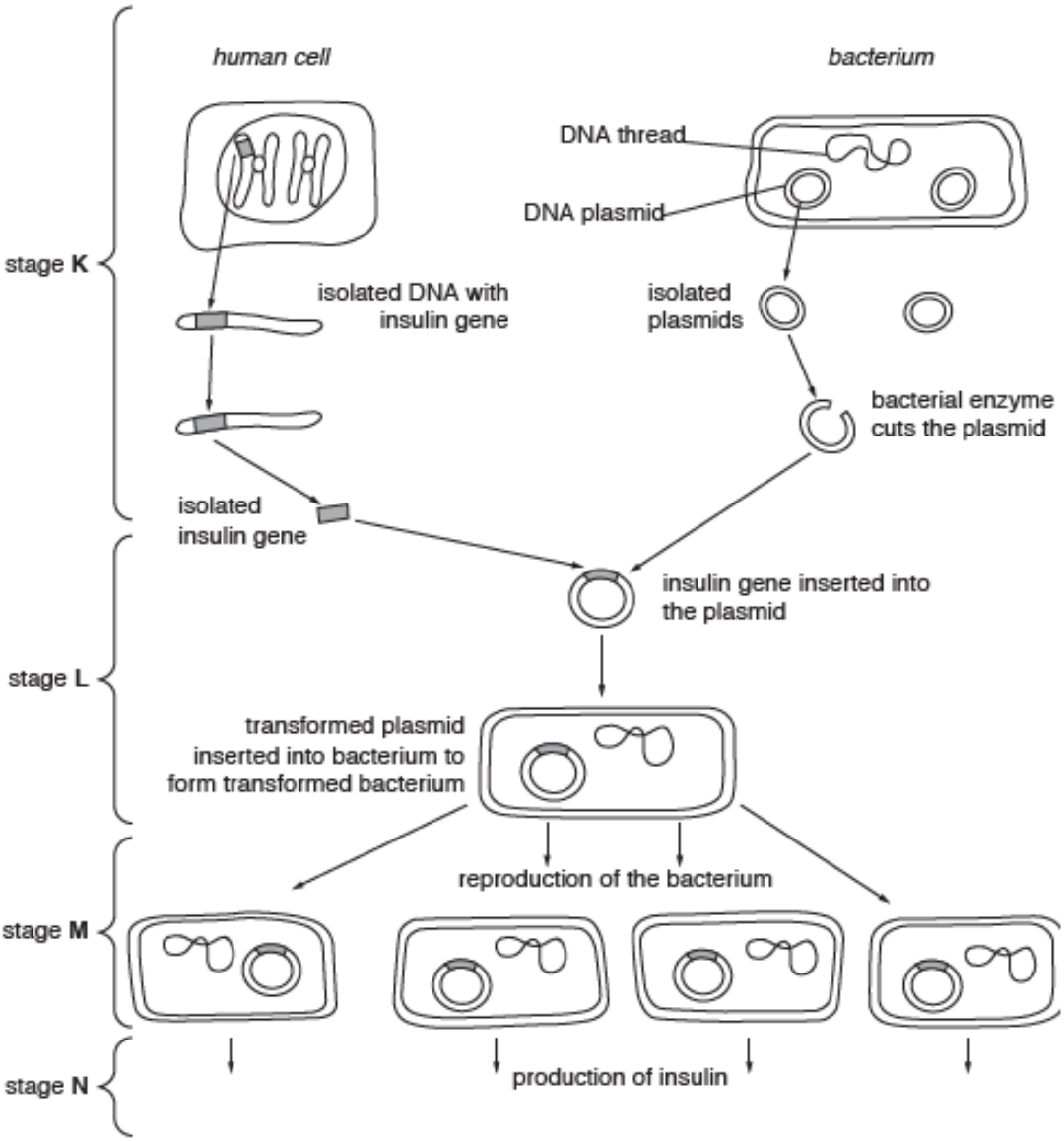


Fig. 9.1

(a) Describe how the location and organisation of genetic material in the human cell shown in stage **K** of Fig. 9.1 is different from that in the bacterial cell shown.

……

……

……

…… [2]

(b) Use your knowledge of bacterial cells to name two structures that the transformed plasmid must pass through to form a transformed bacterium in stage **L** of Fig. 9.1.

…… and …… [2]

(c) State the type of reproduction that takes place in stage **M** of Fig. 9.1. Use your knowledge of the process of cell division to explain why it is important that this type of reproduction occurs.

type of reproduction .....

explanation ……

……

…… [2]

(d) Genetic engineering can also be used to produce crop plants for humans to eat.

Discuss the potential advantages and dangers of using genetic engineering to produce crop plants for humans to eat.

advantages ………………………………………………………………………....

……………………………………………………………………………………......

……………………………………………………………………………………..

……………………………………………………………………………………..

dangers …...……………………………………………………………………....

……………………………………………………………………………………......

……………………………………………………………………………………..

……………………………………………………………………………….… [4]

[Total: 10]

10 Either

Although skin is a waterproof structure, a few chemicals are able to pass through the tissues of the skin. When a person places a finger in a solution of one of these chemicals, it is possible for that chemical to enter the circulatory system and be carried to the tongue. The person then experiences the sensation of taste.

(a) Describe the pathway followed by this particular chemical from the finger until it reaches the tongue.

……

……

……

……

……

……

……

……

……

……

…… [7]

(b) Describe the part played by the nervous system to enable the person to experience the sensation of taste.

……

……

……

……

…… [3]

[Total: 10]

10 Or

(a) Explain the importance of haemoglobin to a human being.

……

……

……

……

……

……

……

…… [4]

(b) Explain the importance of villi to a human being.

……

……

……

……

……

……

……

……

……

…… [6]

[Total: 10]

END OF PAPER