Name: ..... Register no: ..... Class: .....

NGEE ANN SECONDARY SCHOOL

O

PRELIMINARY EXAMINATION

BIOLOGY **6093/01**

18 August 2020

1 hour

Additional Materials: Optical Answer Sheet (OAS)

Instructions to Candidates

Write your index number and name on all the work you hand in.
Write in dark blue or black ink.

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

There are 40 Multiple Choice Questions. 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 OAS provided.

Hand in the question paper and OAS separately.

The total number of marks for this paper is 40.

This document consists of 24 printed pages and 0 blank pages.

Mutiple Choice Questions (40 marks)
Shade your answers in the Optical Answer Sheet (OAS) provided.

1 A strain of the African clawed toad, *Xenopus laevis*, is able to survive with only one nucleolus in the nucleus of each cell instead of the usual two. When these toads are mated, approximately one quarter of the offsprings have two nucleoli per nucleus, one half have one nucelolus per nucleus, and one quarter with no nucleoli at all.

Tadpoles without nucleoli die about four days after hatching because they lack _____.

A mitochondria and are unable to obtain energy

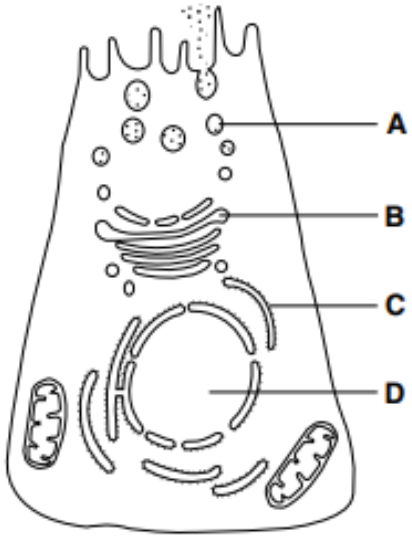
B centrioles and are unable to undergo cell division

C smooth endoplasmic reticulum and are unable to synthesize fats

D ribosomes and are unable to manufacture proteins

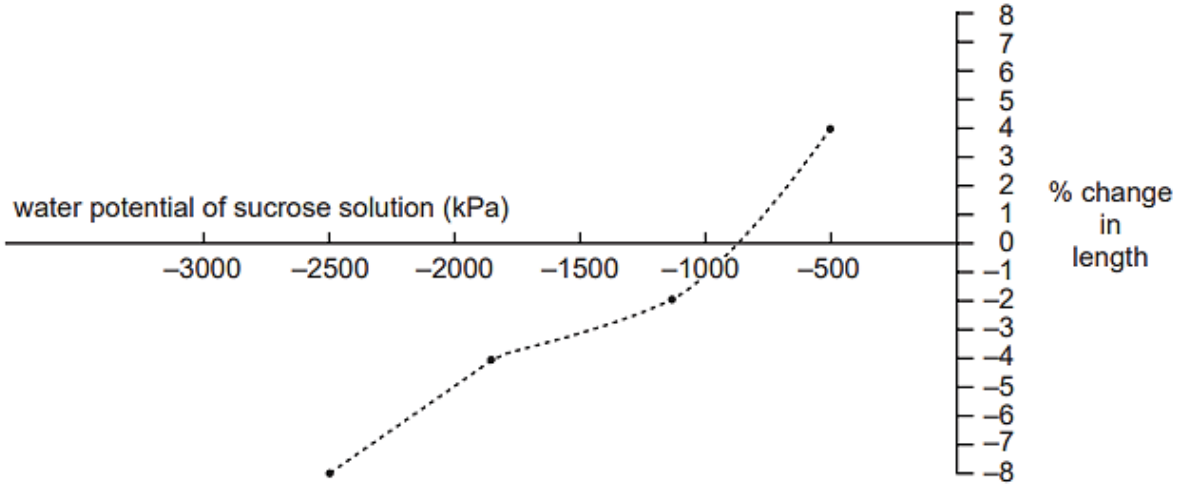
2 The diagram is taken from an electron micrograph of a cell which secretes digestive enzymes.

Where are these enzymes made?



3 Freshly cut potato chips are immersed for 30 minutes in four sucrose solutions of various water potentials.

The graph shows the percentage change in their length.



What is the water potential of the potato cells in the freshly cut chips?

A 0 kPa

B - 500 kPa

C - 875 kPa

D - 2500 kPa

4 The results in the table below were obtained by the analysis of the vacuolar sap of a freshwater alga and of the pond water in which it was growing.

Ion	Sap concentration / mg ions dm^{-3}	Pond water concentration / mg ions dm^{-3}
Ca^{2+}	26.0	2.6
Mg^{2+}	21.6	6.0
Na^{+}	49.9	1.2
K^{+}	49.3	0.51

Which one of the following processes accounts for ions in the alga?

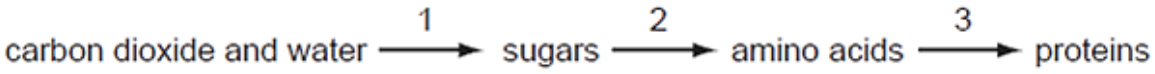
A diffusion

B osmosis

C plasmolysis

D active transport

5 The diagram shows some chemical reactions that occur in plants.



Which stage or stages depend on the use of nitrate ions as a raw material?

A 1 only

B 2 only

C 1 and 3 only

D 2 and 3 only

6 Food tests are carried out on four solutions.

Which solution contains only sucrose and protein?

solution	Benedict's test	iodine in potassium iodide solution	biuret test
A	x	x	√
B	√	x	√
C	x	√	x
D	√	√	x

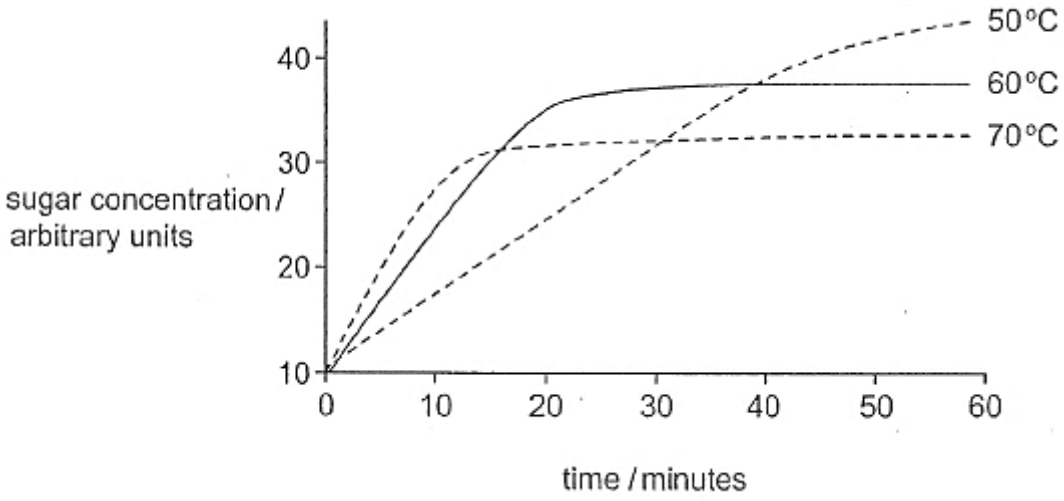
7 Four sugar solutions were tested with a standard Benedict's solution. The table shows the colour of the solutions after testing.

solution	colour
1	green
2	blue
3	brick red
4	yellow

What is the best interpretation of the results?

	solution 1	solution 2	solution 3	solution 4
A	0.05 % reducing sugar	0.5 % non-reducing sugar	1.0 % reducing sugar	0.1% reducing sugar
B	0.5 % non-reducing sugar	0.05 % reducing sugar	0.1 % reducing sugar	1.0% reducing sugar
C	1.0 % reducing sugar	1.0 % non-reducing sugar	1.5 % reducing sugar	0.5 % reducing sugar
D	1.0 % non-reducing sugar	0.5 % reducing sugar	0.5 % non-reducing sugar	0.1 % non-reducing sugar

8 In beer-making, enzymes present in malting barley hydrolyse starch into sugar, ready for fermentation. The graph shows the production of sugar at three different temperatures over a period of 60 minutes. All other conditions were controlled.



What does the graph show?

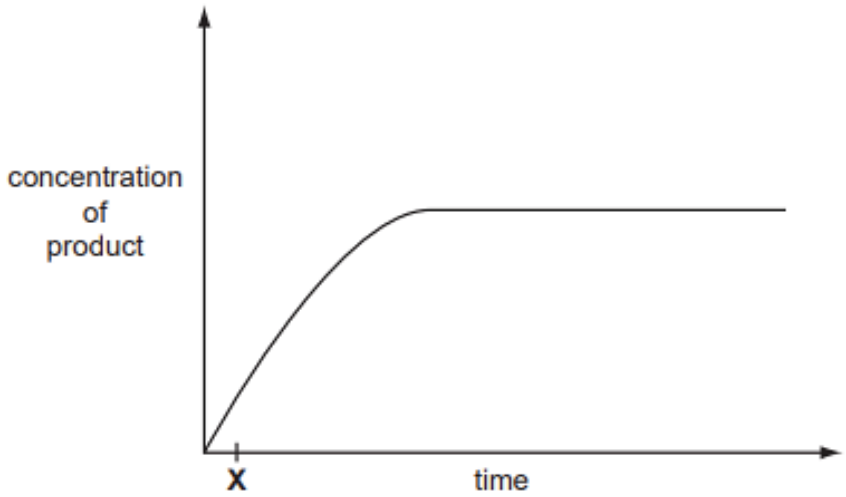
A At 60°C, all the starch is hydrolysed within 30 minutes.

B At 70°C, the enzymes are denatured before hydrolysis is complete.

C Sugar is absent from the barley before malting.

D The optimum temperature for the enzymes is 50°C.

9 The graph shows the course of an enzyme-catalysed reaction at 30°C.



Which statement is true at time **X**?

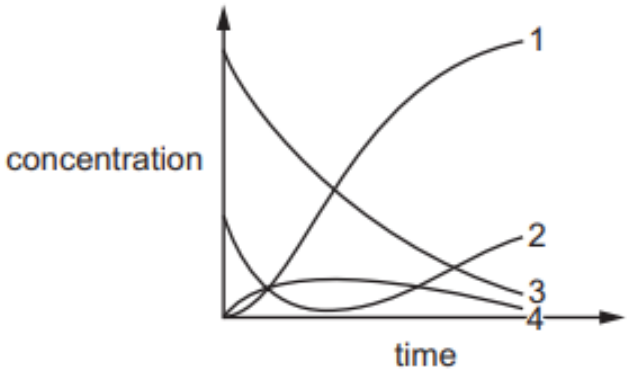
A Most enzyme molecules will have free active sites.

B The number of available substrate molecules is high.

C The number of enzyme-substrate complexes is low.

D The rate remains the same if more enzyme is added.

10 The graph shows how the concentration of components,1, 2, 3 and 4, of an enzyme-catalysed reaction changes with time.



Which row identifies the components of this reaction?

	component 1	component 2	component 3	component 4
A	enzyme-substrate complex	unbound enzyme	product	substrate
B	enzyme-substrate complex	product	substrate	unbound enzyme
C	product	enzyme-substrate complex	unbound enzyme	substrate
D	product	unbound enzyme	substrate	enzyme-substrate complex

11 Four tubes containing 10 cm^3 of 1% starch solution were treated in different ways and then mixed with saliva. After 30 minutes, 1 cm^3 of iodine in potassium iodide solution was added to each tube.

In which tubes were the contents a yellow-brown colour?

	tube incubated at 35 °C	tube incubated at 75 °C	tube incubated at pH 2.5	tube incubated at pH 6.9
A	✓		✓	
B	✓			✓
C		✓		✓
D		✓	✓	

key

✓ = yellow-brown colour

12 Olestra is a fat substitute that was first used in the 1990s in the preparation of chips, meat pies and biscuits. It is made by attaching 6 to 8 fatty acid molecules to a sucrose molecule. Olestra passes through the gut without being absorbed.

Based on this information, a student made these conclusions:

(i) Olestra and lipid contain carbon, hydrogen and oxygen atoms.
(ii) Olestra and lipid contain glycerol.
(iii) Olestra has less fatty acid chains than lipids.
(iv) Olestra has a different shape from lipid.
(v) Olestra is not digested by lipase.

Which conclusions are probably true of Olestra?

A (i), (ii), (iv), and (v) only

B (i), (iii), and (iv) only

C (i), (iii), and (v) only

D (i), (iv), and (v) only

13 A certain disease in cows causes their small intestines to become completely smooth. Which of the following is a likely consequence of this disease?

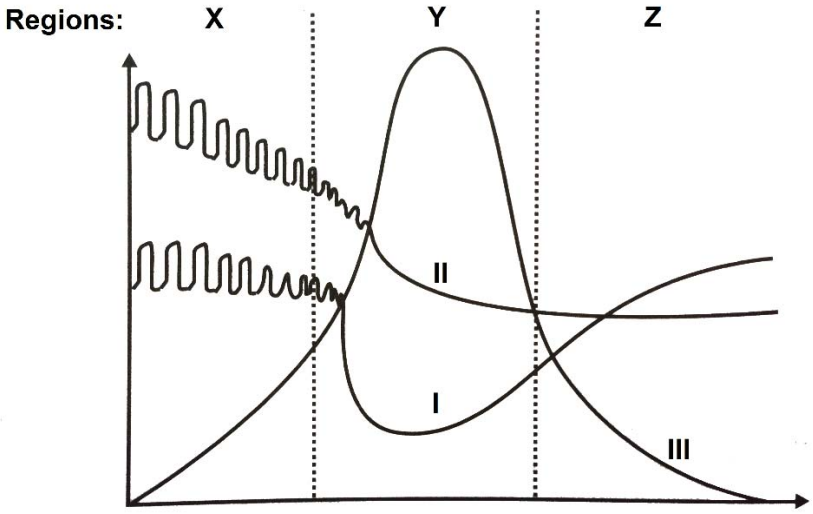
A constipation

B increased protein digestion

C increased absorption of digested food

D malnutrition

14 The diagram below shows the characteristics of three types of blood vessels.

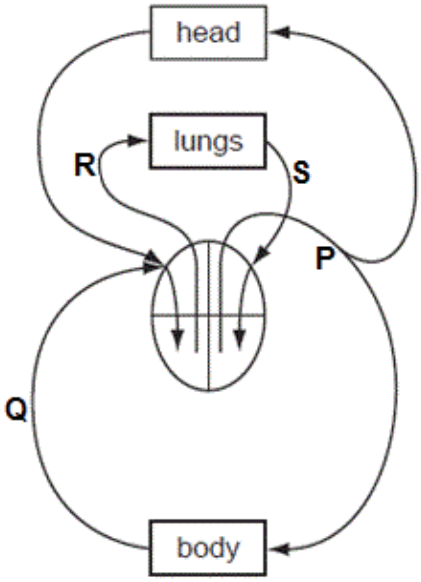


Graph **I** shows the speed of blood flow. Graph **II** shows blood pressure. Graph **III** shows the total cross-sectional areas of blood vessels.

Which of the following about regions **X**, **Y** and **Z** is correct?

	X	**Y**	**Z**
A	veins	capillaries	arteries
B	capillaries	arteries	veins
C	arteries	capillaries	veins
D	arteries	veins	capillaries

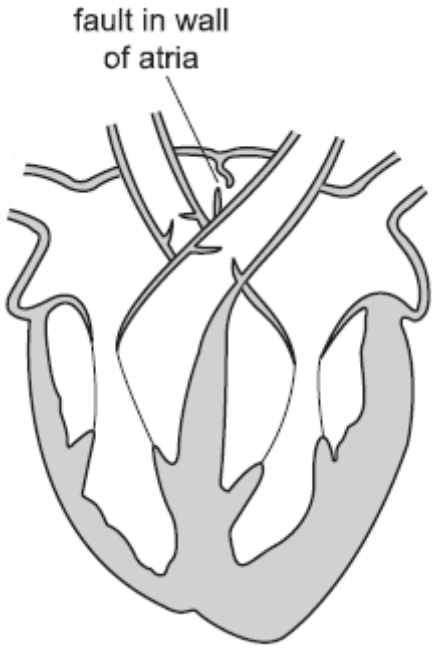
15 The diagram represents the heart and some major blood vessels of an individual who has been fasting for 10 hours.



Which are possible blood pressures (in kPa) for the vessels shown on the diagram?

	P	Q	R	S
A	1	4	2	16
B	4	16	2	1
C	16	2	4	1
D	16	4	1	2

16 The diagram shows a defect in the walls between the atria.



What effect would this defect have on the blood circulatory system?

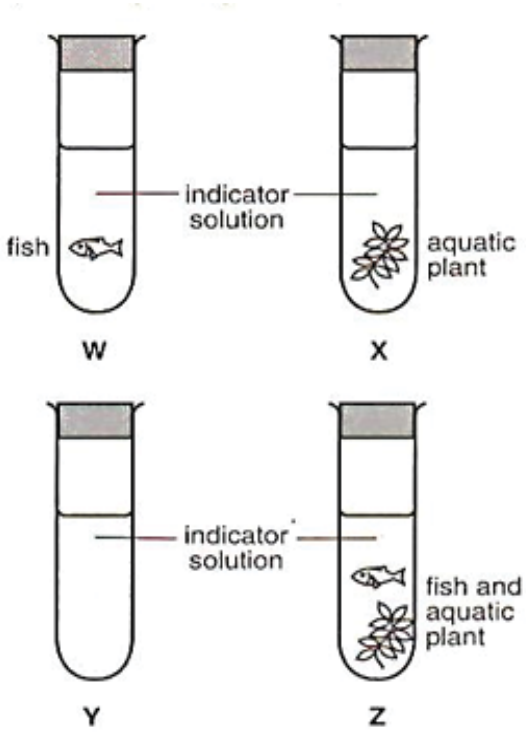
A increased pressure in the pulmonary artery

B irregular heartbeat

C reduced oxygen saturation of haemoglobin

D ventricular systole is delayed

17 Study the diagrams given below.



Each boiling tube was given the same amount of sunlight.

colour of indicator solution	% of carbon dioxide	
purple	0.01	less than normal
red	0.04	normal
yellow	0.10	more than normal

Which one of the following correctly shows the colour change of the indicator solution in boiling tubes W, X, Y and Z after two hours?

	W	X	Y	Z
A	yellow	purple	red	red
B	purple	yellow	red	yellow
C	yellow	yellow	purple	purple
D	red	yellow	red	yellow

18 Which one of the following is an adaptation of a leaf to absorb light energy most efficiently?

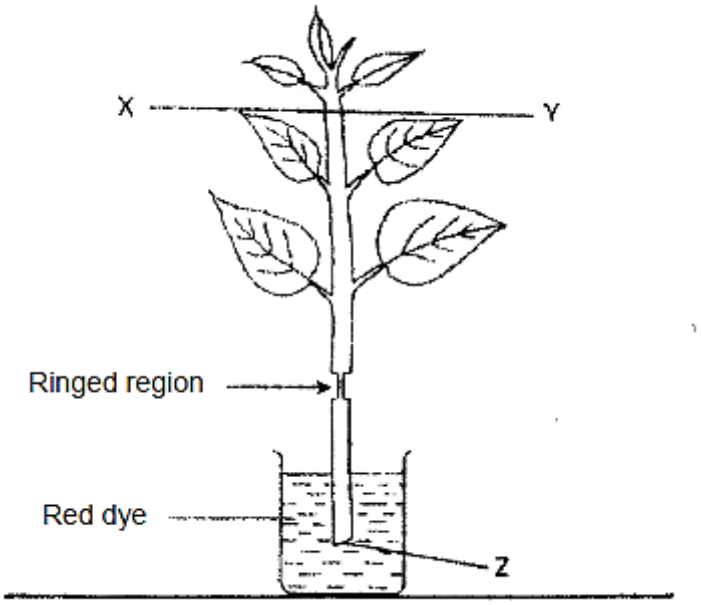
A distribution of chloroplasts

B green colour

C large surface area

D waxy cuticle

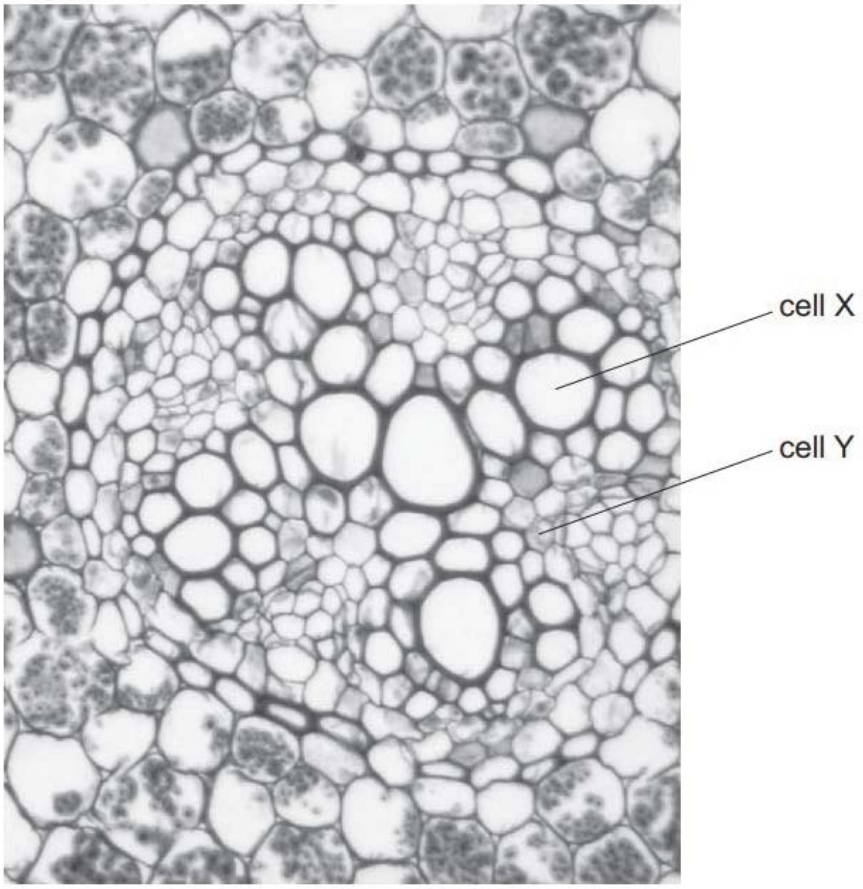
19 Wax was applied at Z and light was shone on the shoot for 2 hours.



Which option correctly predicts the result and deduction?

	result	deduction
A	The leaves remain upright while the stem drooped.	The xylem had been removed at the ringed region.
B	The leaves wilted.	The leaves were supported by the turgidity in the cells.
C	Water exuded out of the ringed region	Water was transported from the leaves to the ringed region.
D	Swelling occurred at the upper part of the ringed region.	Sugars in the leaves was translocated away.

20 The photomicrograph shows part of a section through a stem.

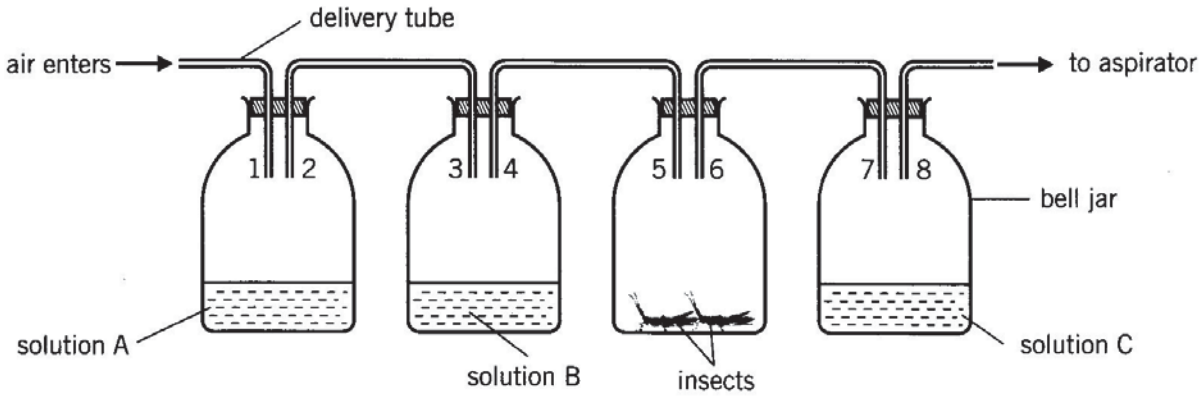


The contents of cell X and the contents of cell Y are each tested with Benedict's reagent and with iodine solution.

What results are expected?

	Cell X		Cell Y	
	Benedict's reagent	**Iodine solution**	**Benedict's solution**	**Iodine solution**
A	+	+	-	-
B	+	-	+	-
C	-	+	-	+
D	-	-	-	-

For questions 21 and 22, refer to the experimental setup in the diagram below. The setup is to investigate respiration using living insects. Positions 1 to 8 indicate the end part of the delivery tube.



21 There is a mistake in the experimental setup. Which of the following is the best suggestion to rectify the mistake?

A Air should enter from tube 8 instead of tube 1.

B The insects should be replaced with freshwater fish as it is a more effective organism to study respiration.

C The end part of delivery tubes at 2 and 4 should be dipped into the solution to let the air flow through solutions A, B and C.

D The end part of delivery tubes at 1, 3 and 7 should be dipped into the solution to let the air flow through solutions A, B and C.

22 Assuming that the experimental setup has been rectified, which of the following correctly identifies solution A and its purpose?

A Bicarbonate solution. To detect carbon dioxide released by living organism during respiration.

B Sodium hydroxide solution. To remove atmospheric carbon dioxide.

C Potassium hydroxide solution. To detect carbon dioxide released by living organism during respiration.

D Bicarbonate solution. To remove atmospheric carbon dioxide.

23 Space shuttles have a closed ventilation system. One particular space shuttle was provided with 100% oxygen and it was found that many of the astronauts blacked out.

Which of the following would best explain this?

A The lungs are unable to expand completely due to the lack of gravity.

B Too much oxygen can damage haemoglobin.

C The high level of oxygen caused oxidative damage to their brain tissues.

D There is insufficient carbon dioxide gas.

24 In a mammal, the osmotic concentration of certain body fluids must be kept more or less constant. Which of the following refer to these fluids?

1. Sweat 2. tissue fluid 3. blood plasma 4. urine

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 2 and 4 only

25 In a dialysis machine, protein molecules are not lost from the blood.

How is loss of protein prevented?

A Membranes prevent protein molecules diffusing out of the blood.

B Proteins are actively transported back into the blood.

C Proteins do not enter the dialysis machine.

D The dialysis fluid contains protein, so there is no diffusion gradient.

26 In the tropics, large animals compensate for their relatively small surface area to volume ratio by

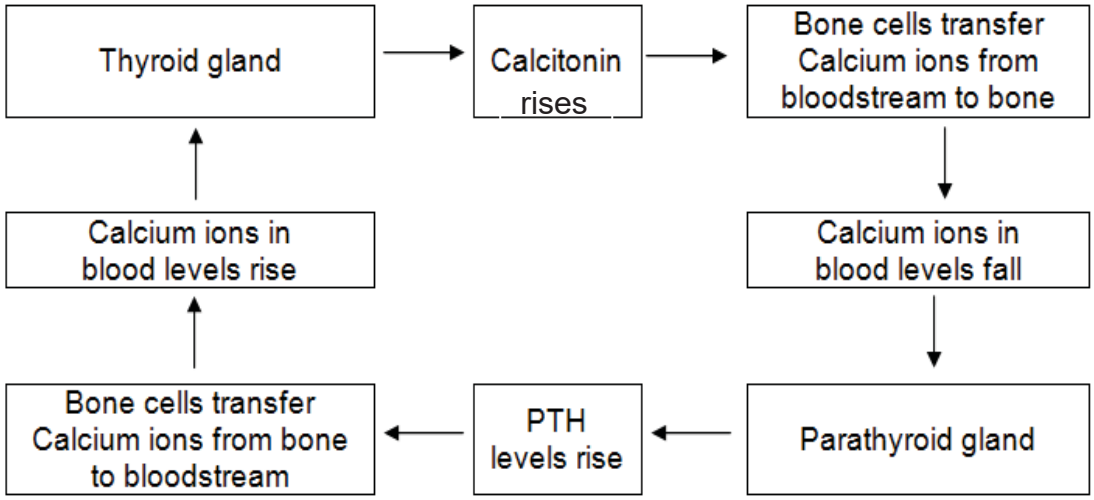
A having reduced hair

B having a thick skin

C increasing their metabolic rate

D being more active at night

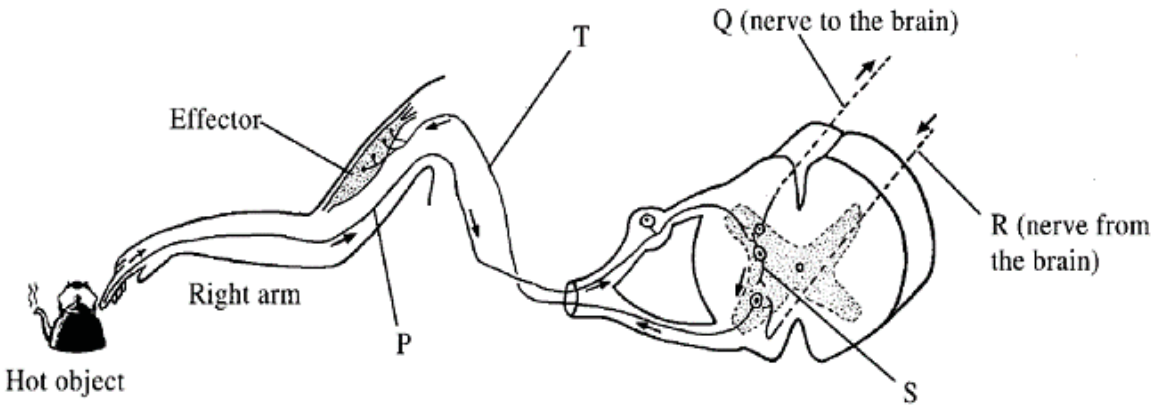
27 The diagram shows mechanisms for regulating level of calcium ions in blood. Calcitonin and PTH are hormones.



Which combination of answers is correct?

	Stimulus	Receptor	Effector	Response
A	High levels of calcium ions in blood	Bone cells	Parathyroid gland	Calcium ions transferred from bloodstream to bone
B	Low levels of calcium ions in blood	Bone cells	Thyroid gland	Levels of PTH rise
C	High levels of calcium ions in blood	Thyroid gland	Bone cells	Levels of Calcitonin rise
D	Low levels of calcium ions in blood	Parathyroid gland	Bone cells	Calcium ions transferred from bone to bloodstream

28 The diagram below shows the nervous pathway of a withdrawal reflex when a person touches a hot object. What would happen to the voluntary movement, reflex movement and sensation on the forearm if nerve Q was cut?



	Voluntary movement	Reflex movement	Sensation
A	remains	lost	lost
B	lost	lost	remains
C	remains	remains	lost
D	lost	remains	remains

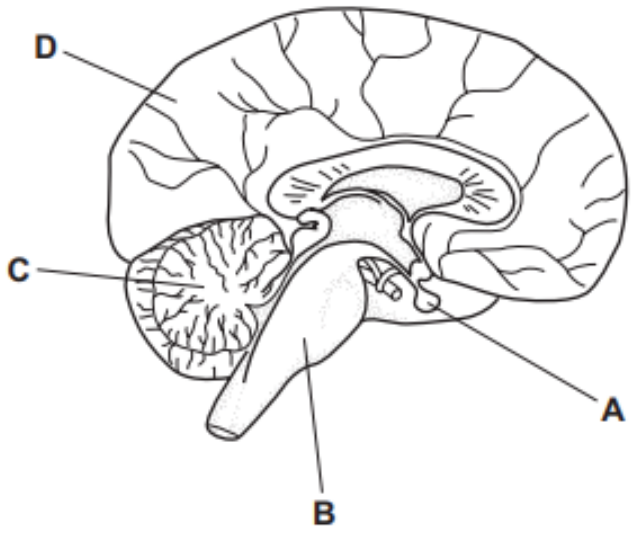
29 Which statements describe the pupil reflex in bright light?

1 ciliary muscles contract
2 ciliary muscles relax
3 circular muscles contract
4 circular muscles relax
5 lens becomes rounder
6 lens becomes thinner
7 pupil constricts
8 pupil dilates
9 radial muscles contract
10 radial muscles relax

A 1, 6 and 9
B 2, 5 and 10
C 3, 7 and 10
D 4, 8 and 9

30 The diagram shows the brain in vertical section.

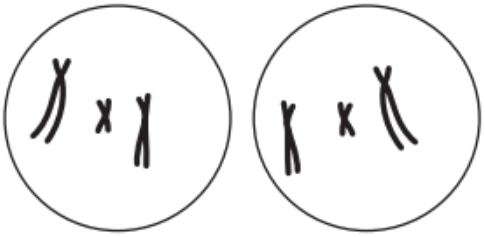
Which structure co-ordinates the menstrual cycle?



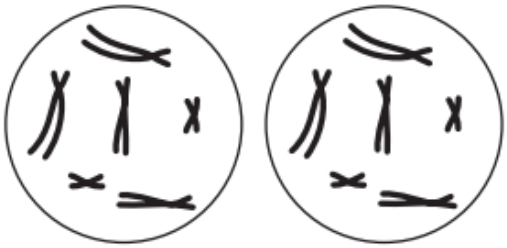
31 The diagram shows the chromosomes in a cell.

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

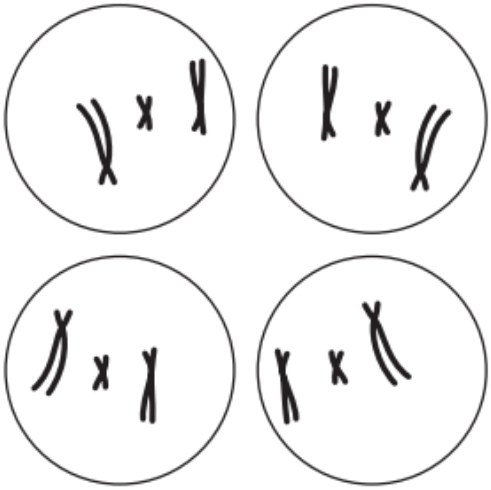
A



B

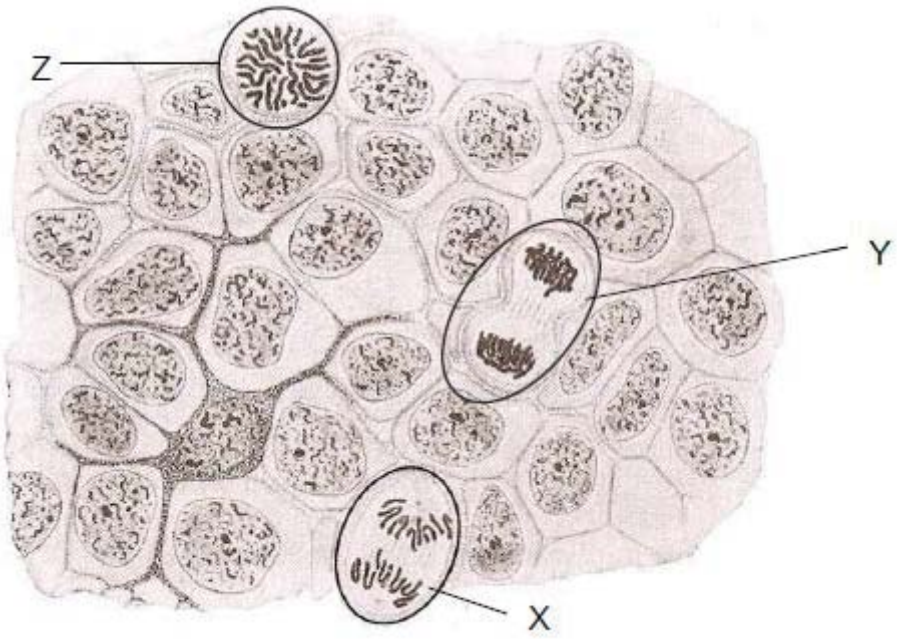


C



D

32 The diagram below shows animal cells undergoing various stages of mitosis.



Identify the stages of mitosis occurring in the cells labelled X, Y and Z.

	X	**Y**	**Z**
A	anaphase	prophase	interphase
B	anaphase	telophase	prophase
C	prophase	metaphase	telophase
D	prophase	anaphase	telophase

33 The table below shows information about the flowers of three different plants.

flower characteristics	plant **A**	plant **B**	plant **C**
petal colour	white	purple	bright yellow
aroma	none	pungent smell	sweet smell
petal size	0.3 cm	10.0 cm	4.0 cm
nectar volume	none	medium amount	large amount

Which inference is valid concerning the method of pollination for plants **A**, **B** and **C**?

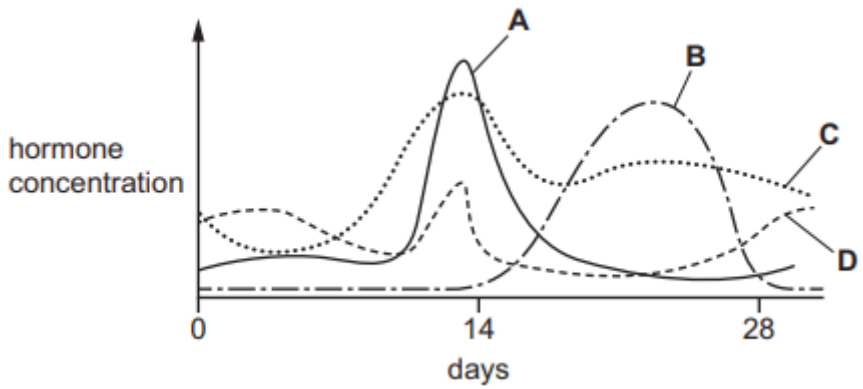
A All three plants are wind pollinated.

B All three plants are insect pollinated.

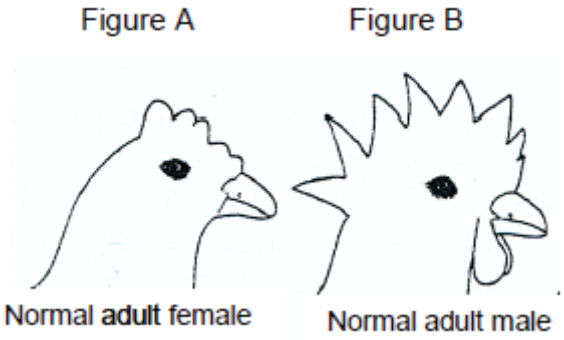
C Plant **A** is wind pollinated but plants **B** and **C** are insect pollinated.

D Plants **A** and **B** are insect pollinated but plant **C** is wind pollinated.

34 The graph shows changes in the concentrations of hormones during a menstrual cycle. Which curve represents progesterone?



35 The heads of normal adult male and female chickens are shown in the diagram.



In an experiment, testes were removed from young male birds. They then developed in the way shown in Figure A.

In some males, the testes were transplanted to a new position in the neck; the birds then developed normally as shown in Figure B.

What do these experiments suggest?

A All operations on male chickens prevent male characteristics from developing.

B In the absence of a testis, a chicken develops into a female.

C The testis controls the development of certain typically male characteristics.

D The testis is concerned with sperm production.

36 Sickle cell anaemia is caused by a mutation in an allele of the gene that codes for the β-globin polypeptide of haemoglobin.

The diagram shows the sequence of bases in a small section of the coding strand of DNA for both the Hb^A (normal) and Hb^S (sickle cell) β-globin alleles.

Hb^A CTGACTCCTGAGGAGAAGTCT

Hb^S CTGACTCCTGTGGAGAAGTCT

How will the mutation in the allele result in the production of an altered version of the β-globin polypeptide?

A A tRNA molecule with the anticodon GUG will hydrogen bond to the altered codon on mRNA.

B All the amino acids coded for after the mutation will differ from those in the Hb^A protein.

C mRNA transcribed from the Hb^S allele will contain the codon CAC instead of the codon CTC.

D The ribosome will be unable to continue translation of the Hb^S mRNA after the altered codon.

37 Following translation, the alpha polypeptide chain of haemoglobin, α-globin, undergoes modification. During this modification, the first amino acid is removed, leaving 141 amino acid residues.

How many nucleotides does the gene coding for α-globin contain?

A 417 **C** 423

B 420 **D** 426

38 Which statement is correct?

A Evolution is natural selection.

B Evolution results in natural selection.

C Natural selection and evolution are independent of each other.

D Natural selection results in evolution.

39 A species of snails has an inherited condition that affects its shell. The table shows the phenotypes and genotypes of this species:

genotype	phenotype
S^NS^N	Snails with hard shells.
S^AS^N	Snails with brittle shells.
S^AS^A	No embryo formed.

Two heterozygous snails were crossed. Which proportion of their offspring will have hard shells?

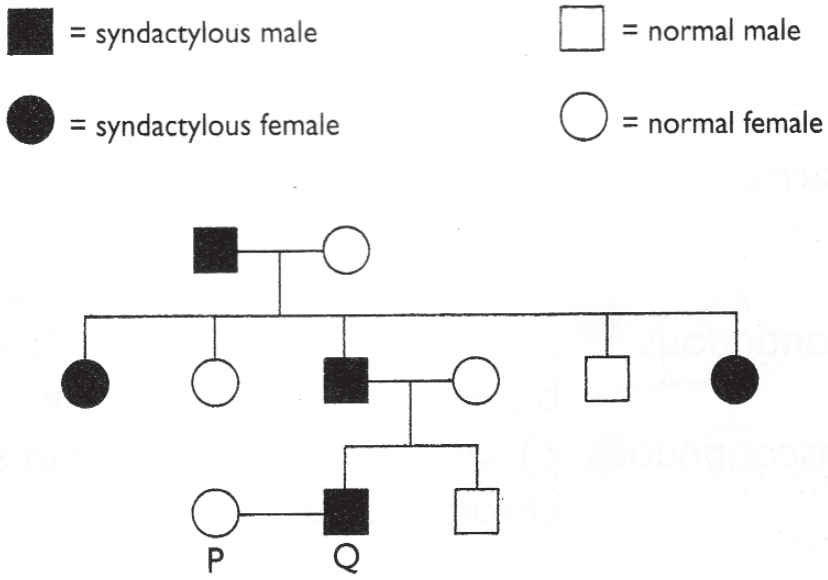
A 0%

B 25%

C 33%

D 75%

40 Syndactyl is a genetically inherited condition in humans involving the fusion of two or more fingers by a web of skin and muscles. It is determined by the presence of a dominant allele. Below is a diagram to show how this condition is passed down in the Han family.



What are the chances of individuals P and Q having a child with syndactyly?

A 1 in 1

B 1 in 2

C 1 in 3

D 1 in 4

End of Paper

Name: ..... Register no: ..... Class: .....

NGEE ANN SECONDARY SCHOOL **O**

PRELIMINARY EXAMINATION

Pure Biology

6093/02

Paper 2

24 August 2020

1 hour 45 min

Additional materials: Nil

Instructions to Candidates
Write your name, register number and class on all the work that you hand in.
Write in dark blue or black pen.
You may use pencil for any diagrams, graphs, tables or rough working.
The use of an approved scientific calculator is expected, where appropriate.

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

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

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.

For Examiner's Use

Section A	**/50**
Section B	**/30**
Total	**/80**

This document consists of 18 of printed pages and 0 blank pages

Section A: Structured Questions [50 marks]
Answer all the questions in the space provided.

1 (a) Aphids are small insects that feed directly on the sugars present in plant sap. The salivary glands of aphids have secretory cells that make and release a variety of proteins that assist in feeding.
Fig. 1.1 is a transmission electron micrograph of a small area of a salivary gland cell of an aphid.

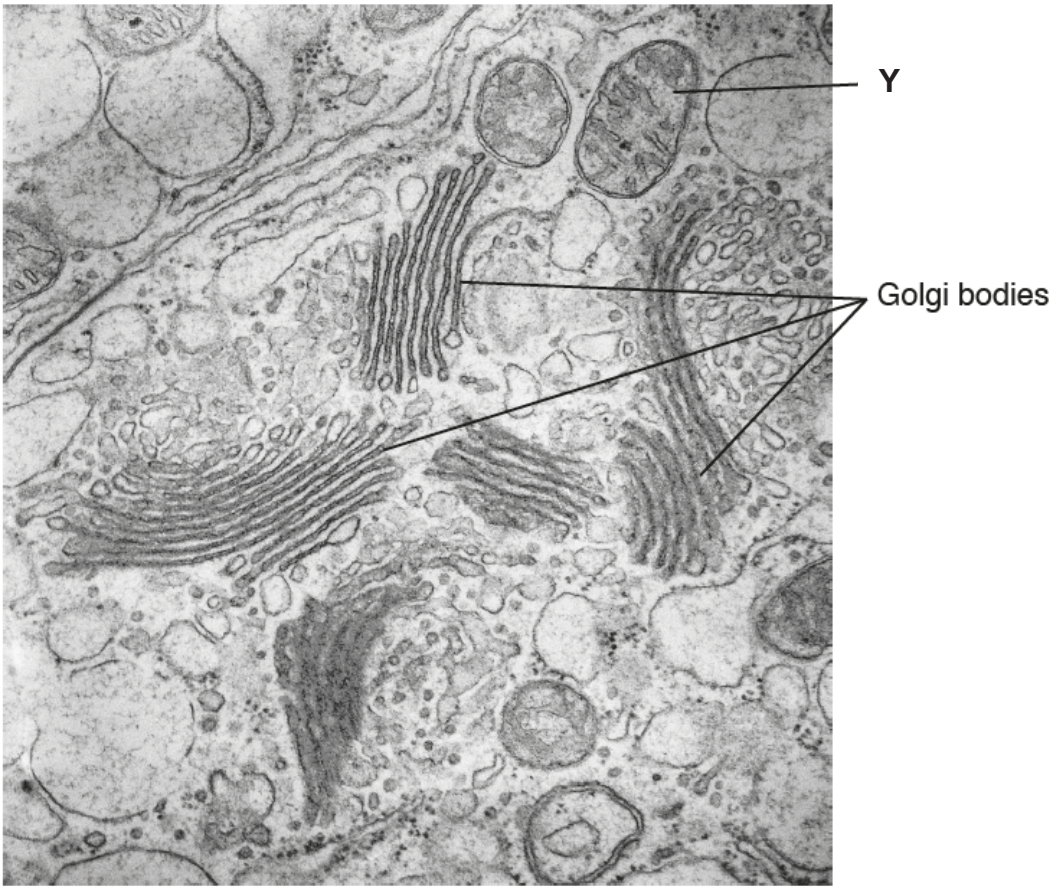


Fig. 1.1

(i) Identify structure Y.

.....

[1]

(ii) Describe the role of Golgi bodies in secretory cells, such as the salivary gland cells of aphids.

.....

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.....

.....

[2]

(b) Fig. 1.2 is a longitudinal section of part of a *Cucurbita* (squash) stem.

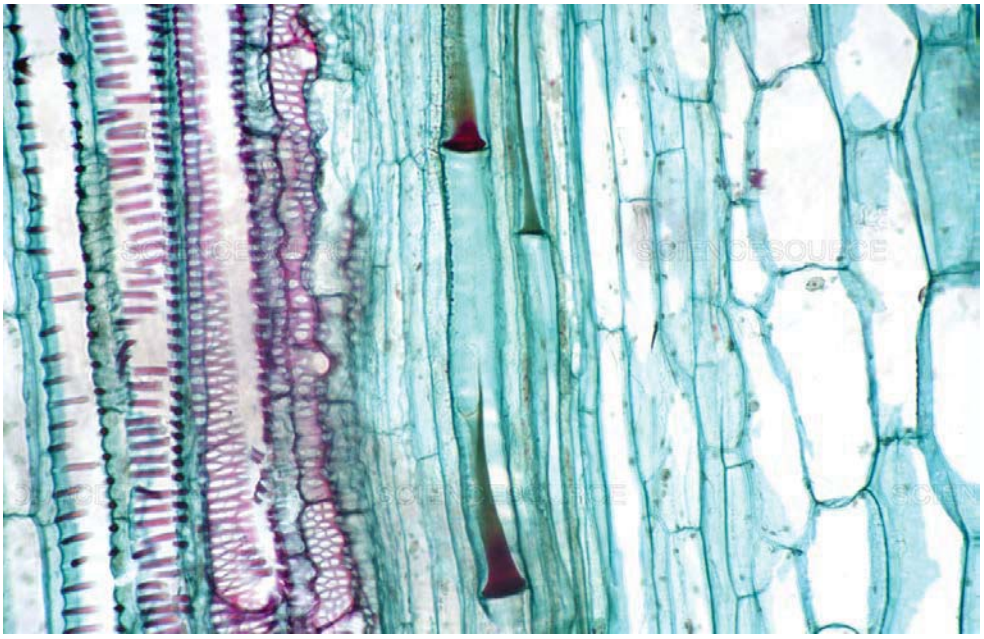


Fig. 1.2

Use label lines and labels to identify the position and name of the tissue on Fig. 1.2 where:

(i) the aphids would feed from
(ii) water can travel to the leaves. [2]

(c) Leaves are the source of sugars and the site where there is an exchange of the gases oxygen, carbon dioxide and water vapour with the environment. Explain how two structural features of the leaf help in the exchange of gases.

.....

.....

.....

..... [2]

[Total: 7]

2 Half an hour after Peter completed eating a protein-rich meal, a sample of the contents of his stomach was taken. This sample was divided into three equal parts in separate tubes. Each tube was incubated at a different temperature for 10 hours. After that time, each tube's contents was tested to determine the undigested polypeptide concentration. Fig. 2 shows the result for the sample incubated at 37°C.

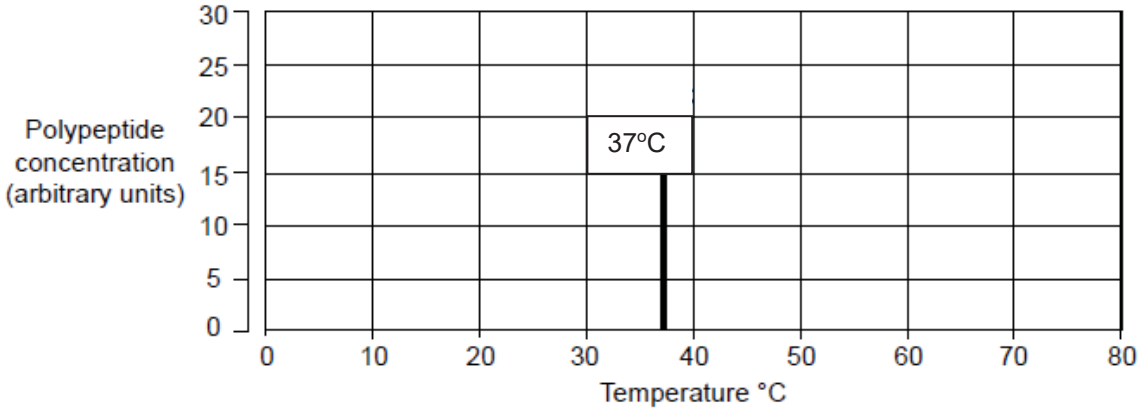


Fig. 2

(a) On Fig. 2, draw the results you would expect for the samples incubated at 10°C and 80°C. [2]

(b) Explain your predicted results for the polypeptide concentrations at temperatures of 15 °C and 75 °C.

15°C .....

..... [1]

75°C .....

..... [1]

(c) An epidemic of an acute respiratory syndrome caused by the SARS-CoV-2 virus (now known as the disease COVID-19) has attracted an intense amount of attention worldwide. As the natural history and variety of clinical presentations of COVID-19 unfolds, extra pulmonary symptoms of the disease have emerged, especially in the digestive system. While the respiratory mode of transmission is well known and is probably the principal mode of transmission of this disease, a possibility of the fecal-oral route of transmission has also emerged in various case series and clinical scenarios.

The most common presentations (symptoms) of COVID-19 include fever and respiratory symptoms, such as cough and shortness of breath. However, concurrent gastrointestinal symptoms, mainly diarrhoea and vomiting, have also been reported in some studies of the recent outbreak.

Adapted from Journal of Digestive Diseases, Volume21, Issue 4 April 2020 Pages 199-204.

(i) Suggest a location in the alimentary canal where the virus attacks and provide a reason for your choice.

--- [2]

(ii) If the infected person is not able to see the doctor, explain the body's natural response to a fever.

--- [4]

[Total: 10]

3 Two tubes were set up, each containing 20ml of a dilute glucose solution. A number of single-celled organisms were added to **Tube A** and the same number of a different single-celled organism added to **Tube B**. The tubes were bubbled with air, sealed and maintained under bright light.
Small samples of solutions were extracted from each tube at 15-minute intervals for 3 hours. The samples are tested for levels of dissolved oxygen (O_2) and carbon dioxide (CO_2). The lights were then turned off for the next 3 hours.

The measurements for the first 3 hours are plotted in Fig.3.1 and Fig 3.2.

Fig. 3.1 – Tube A

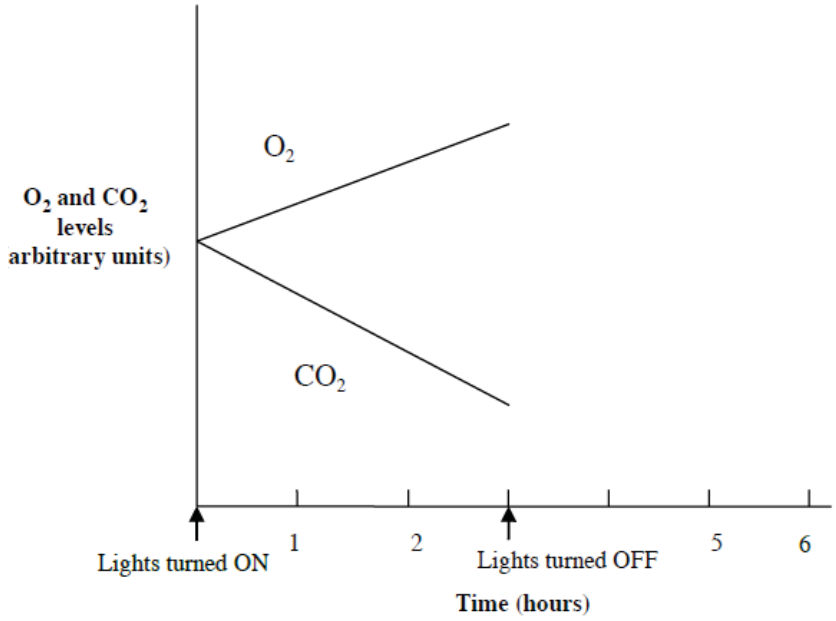
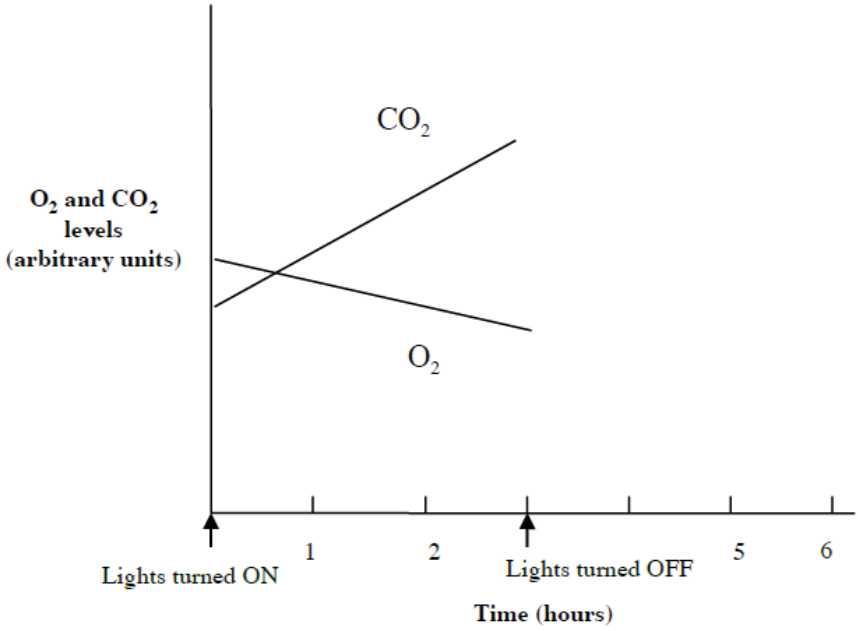


Fig. 3.2 – Tube B



(a) State the colour of the organism in Tube A. Explain your answer.

.....

.....

..... [2]

(b) Complete the two graphs to show what would happen to the dissolved oxygen and carbon dioxide levels in the three hours after the light is turned off. [2]

(c) Provide a reason for the tubes to be tightly sealed.

.....

.....

..... [1]

(d) State the function of the glucose solution in tube B and describe how it is taken up by the cells.

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

4 Table 4 shows information about kidney function.

Fluid	Component (g per 100 ml)				
	Urea	Glucose	Amino acids	Salts	Proteins
Blood plasma	0.03	0.1	0.05	0.9	8.0
Glomerular filtrate	0.03	0.1	0.05	0.9	None
Urine	1.75	none	none	0.9-2.2	none

Table 4

(a) Name the organ where urea is produced?

.....[1]

(b) Use the information provided in the table above to answer the following questions:

(i) Name two components in Table 4 that can pass through the wall of the glomerulus.

.....[1]

(ii) Explain what happens to amino acids in the glomerular filtrate.

.....

.....[1]

(iii) Give two reasons to explain why the urea in the urine is more concentrated than in the glomerular filtrate.

.....

.....

.....

.....[2]

(c) Fig. 4 shows a cross section of part of the coiled tubule of a nephron with a capillary attached.

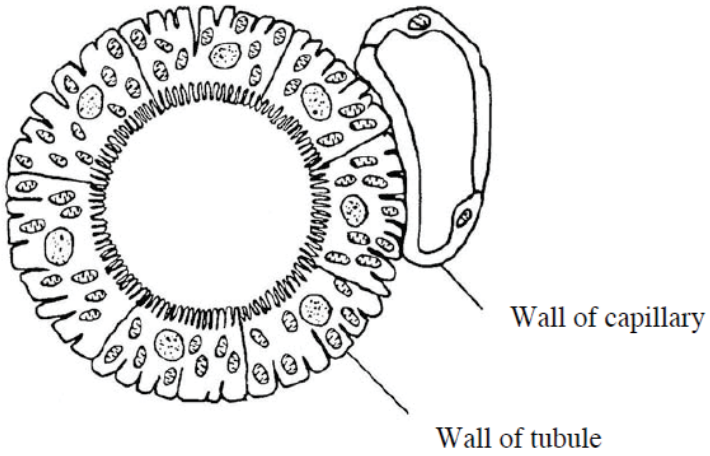


Fig. 4

Explain how three features shown in Fig. 4 are important to the functioning of the tubule.

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

5 **(a)** Fill in the blanks in Table 5 to show how the actions of glucagon and adrenaline on the human body are different.

	Glucagon	Adrenaline
Stimulus that trigger its release		
Organ/gland released from		

Table 5

[2]

(b) In an experiment, Jane looked at the same light source from various different distances. The diameter of her pupil was measured at each position. Fig. 5 shows how the diameter varied.

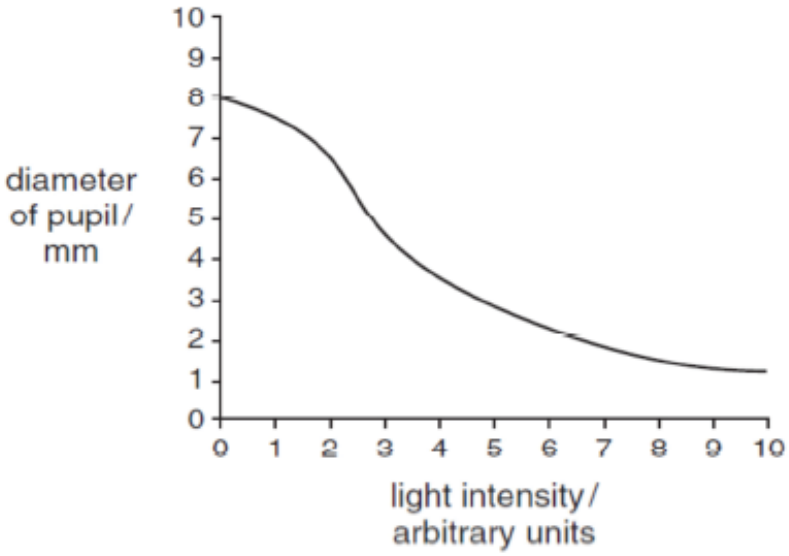


Fig. 5

Explain how the response is brought about as the light intensity is increased from 2 to 4 arbitrary units.

[4]

[Total: 6]

6 **(a)** Complete Fig. 6.1 to show the process by which gametes are formed.

[3]

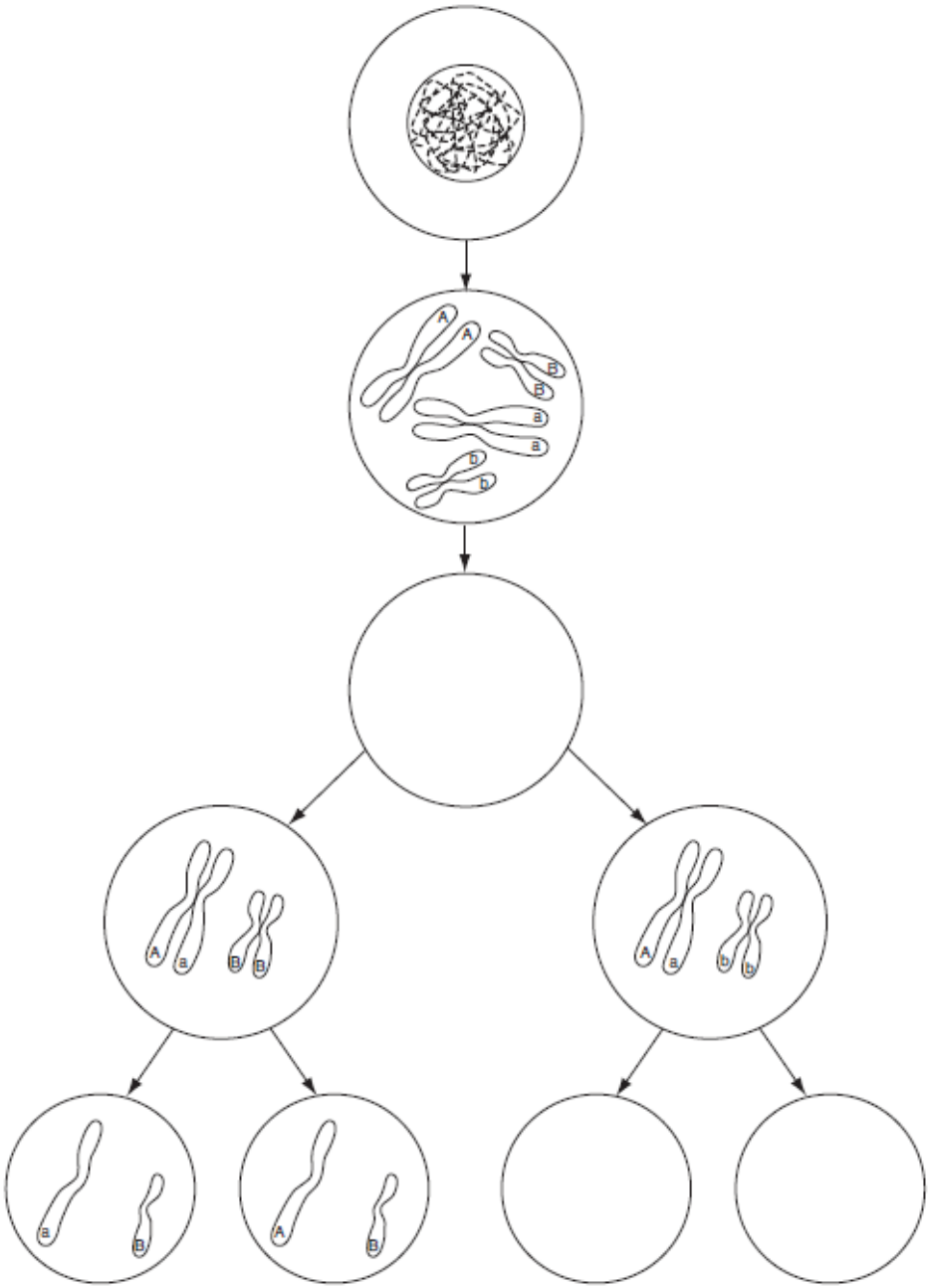


Fig. 6.1

(b) How does the segregation of chromosomes during meiosis lead to a wide variety of gametes being produced?

.....

.....

.....

..... [2]

(c) Fig. 6.2 shows a 12-week-old foetus, which resulted from the successful fertilisation of one of the gametes.

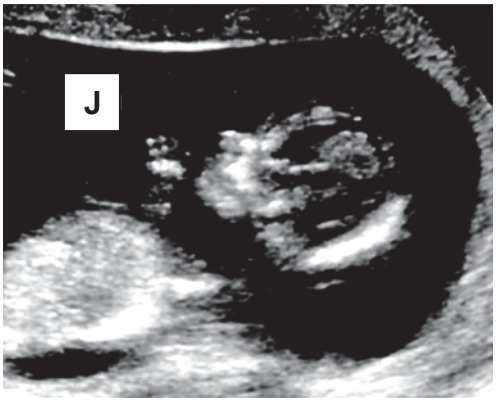


Fig. 6.2

(i) Identify region J.

.....[1]

(ii) Fig. 6.3 shows the karyotype was prepared from cultured skin cells of the baby taken from region J.

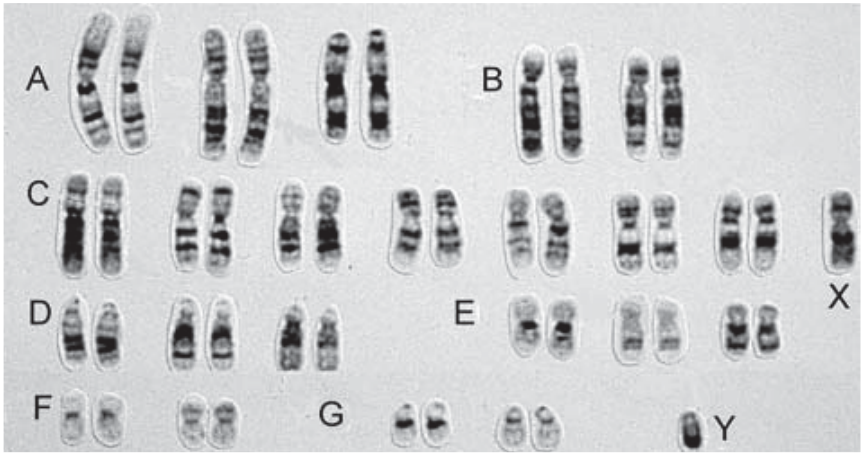


Fig. 6.3

State the number of autosomes observed in Fig. 6.3.

.....[1]

[Total: 7]

7 Spiders produce silk to make webs to catch their prey. Spider silk can also be used to make clothes.

Scientists have produced transgenic goats that have spider silk in their milk.
Fig. 7 shows the stages needed to produce these transgenic goats.

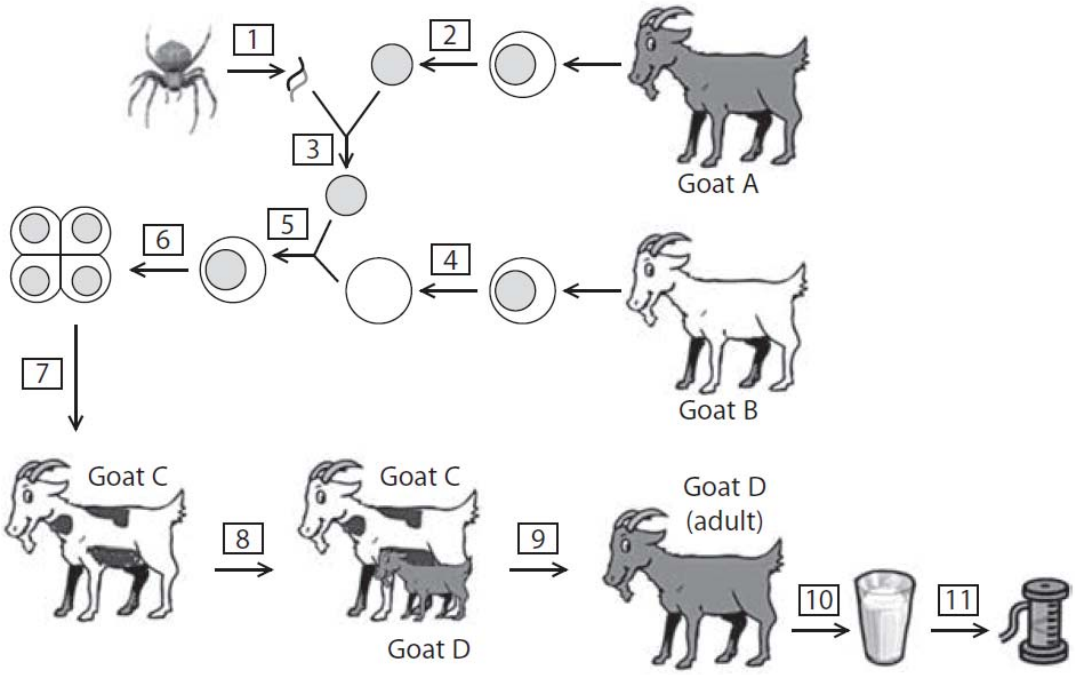


Fig. 7

(a) Briefly describe what happens at **1**.

.....

..... [1]

(b) Identify the stage where electric shock is used.

..... [1]

(c) Explain how the spider silk is obtained from goat D.

.....

.....

.....

..... [2]

[Total: 4]

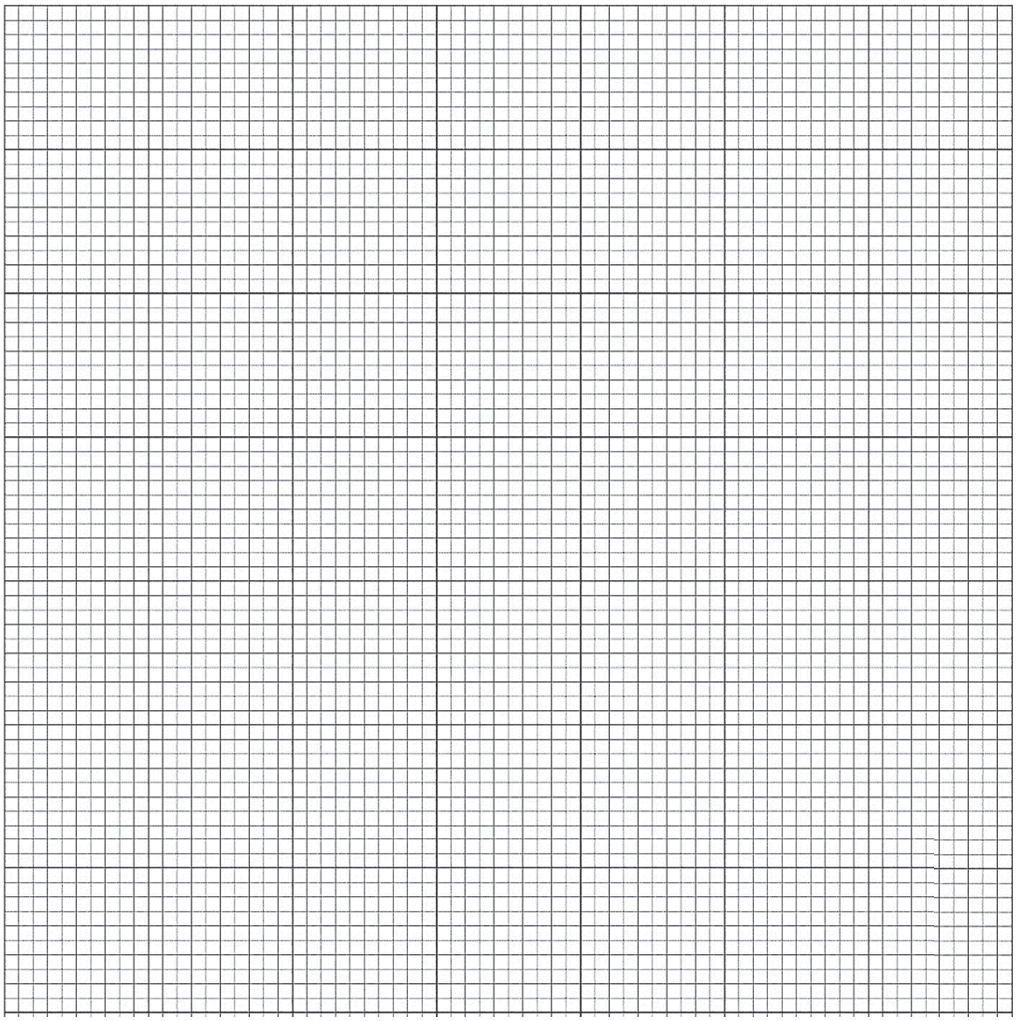
Section B: Open-Ended Questions [30 marks]
Answer all the questions in the space provided.

8 An athlete pedaled on an exercise bicycle at three different workloads from light, A to heavy, C. At each workload, the athlete cycled until he is exhausted and was then given plenty of time to recover before starting at the next workload.
During the course of each exercise, small pieces of leg muscle tissue were removed by muscle biopsy and the glycogen content measured. The removal of tissue did not appear to reduce the athlete's performance.
The results of the muscle biopsies at each workload are shown in Table 9.

	Muscle glycogen content /g kg^{-1} muscle mass			
Time/ minutes	0	20	60	120
Workload **A**	32	29	24	18.5
Workload **B**	28	17.5	11.5	7
Workload **C**	26	5	0	0

Table 8

(a) Plot and label the results for workload **A** and **B** in the grid provided. [3]



(b) Using the information in the text, Table 8 and the graphs plotted, compare and contrast the effect of the different workloads.

[4]

(c) As a coach for the athlete, suggest a diet for him to follow and provide the rationale for it.

[3]

[Total: 10]

9 Fig. 9.1 and 9.2 show the internal structure of the heart and its associated circulatory system in a simplified form. Fig. 9.1 represents the circulatory system of a mammal and Fig. 9.2 shows that of a frog (amphibian).

capillaries in lungs

capillaries in lungs

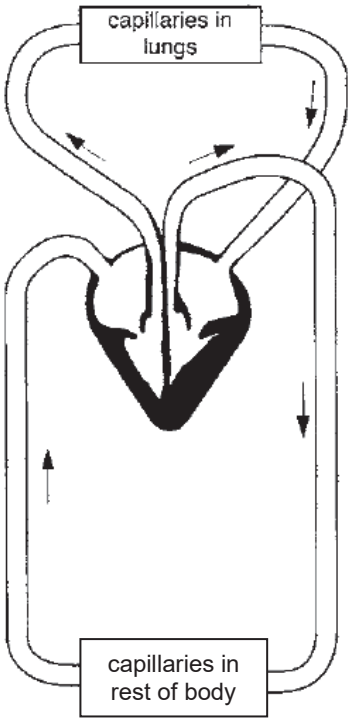


Fig. 9.1

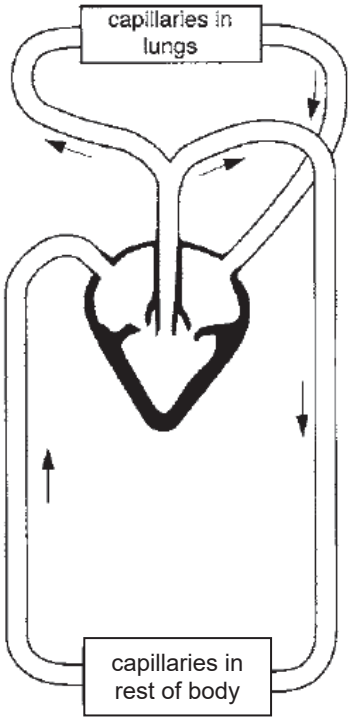


Fig. 9.2

(a) State and explain two differences that can be observed from the above circulatory systems of the mammal and the frog, why the circulatory system shown for the frog may be less effective in supplying the body tissues with oxygen.

[4]

(b) Describe the sequence of events involved in one cardiac cycle in humans.

[6]

[Total: 10]

10 (a) Describe how hormones are involved in the regulation of the menstrual cycle.

[4]

(b) The menstrual cycle is part of the reproductive process in mammals. Briefly describe the part reproduction plays in natural selection.

[2]

(c) Pollination is part of the reproductive process in flowering plants. Describe the events that occur in the flower from pollination to fertilisation.

[4]

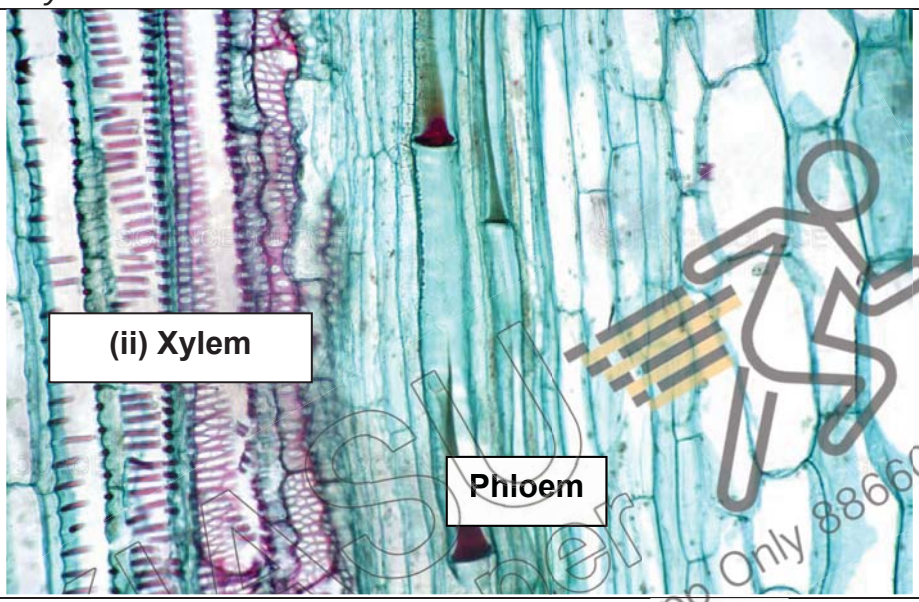
[Total: 10]

- End of Paper -

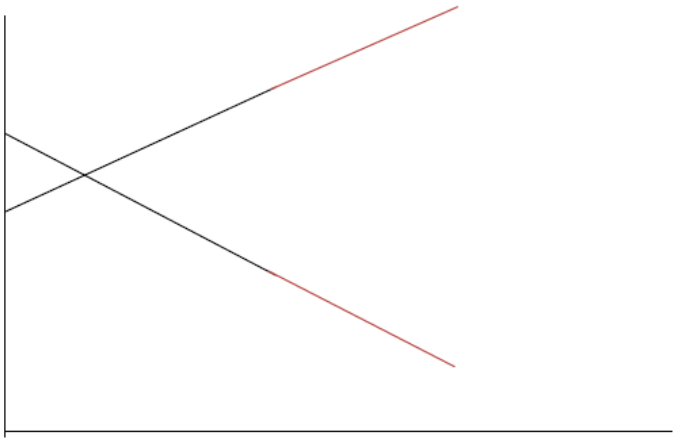
Mark Scheme
Sec 4 Express Prelims 6093/1 – 2020

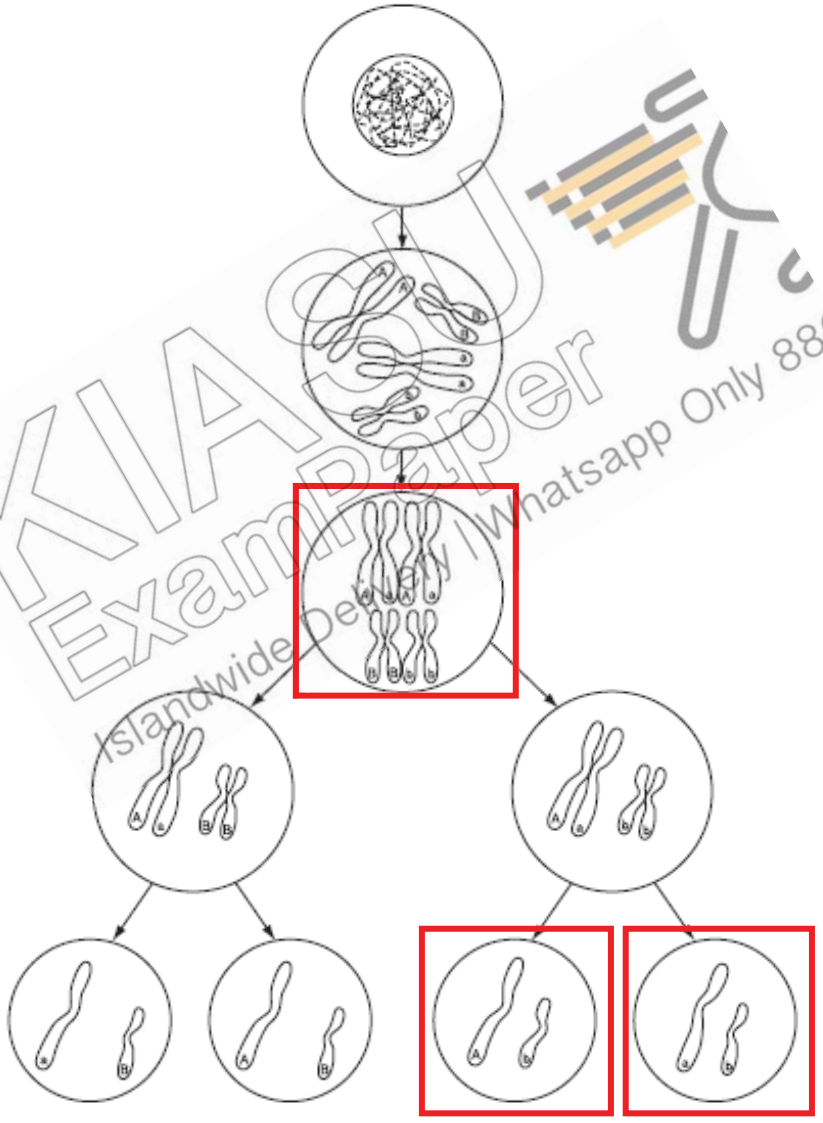
No.	Answer
1	D
2	C
3	C
4	D
5	B
6	A
7	A
8	B
9	B
10	D
11	B
12	D
13	D
14	C
15	C
16	C
17	B
18	A
19	D
20	D
21	D
22	B
23	D
24	C
25	A
26	A
27	D
28	C
29	C
30	A
31	B
32	B
33	C
34	B
35	C
36	A
37	D
38	D
39	C
40	B

Section A: (50 marks)

1	**(a)i**	Mitochondrion	[1]
	ii	• modification of, proteins / polypeptides **;** • packaging into vesicles / formation of Golgi vesicles / formation of secretory vesicles **;** **A** 'budding off' / 'breaking off' / transport proteins in Golgi vesicles • AVP e.g. modification of lipids; synthesis of, phospholipids / glycolipids *Any 2*	[2]
	(b)		[2]
	(c)	• Leaves contain stomata on their surface, that open to allow exchange of gases, in particular CO2 in & O2 out. • Many long thin leaves with numerous stomata to increase surface area for exchange. • Cavity inside leaf in close proximity to the cells/air spaces between the spongy mesophyll cells, which maintains a high concentration gradient and ensuring efficient internal gaseous exchange. • The internal surface of the leaf cavity is coated in a layer of moisture. This allows for the dissolving of the gases. ***Any 2. Must have both structure and function.***	[2]
2	**(a)**	• At 15 °C the mark should be higher than the 37 °C mark. • At 75 °C mark would be even higher than the one they drew for 15 °C *Students could indicate their value either as a bar/line/cross on the graph*	[1] [1]
	(b)	**15 °C:** The reaction occurs at a slower rate as it is lower than the optimum temperature or there are few effective collisions occurring between the enzyme and substrate molecules. **75 °C**: The enzyme is denatured.	[1] [1]
	(c)i	Large intestine [1];	[2]

		• virus cause the lining to be unable to reabsorb water [1] that is why there is diarrhea. **OR** Stomach [1]; • presence of virus cause the stomach to churn drastically [1] to cause vomiting, either as a reaction to remove toxins/virus (OWTTE)	
	(ii)	Stimulus – increase in blood temperature immune response to viral infection; [1] Receptor/control center – hypothalamus of the brain is stimulated and sends nerve impulses to the various effectors; [1] Corrective mechanism [x2] - arterioles in skin dilate and the shunt vessels constrict, more blood flows to the blood capillaries in the skin and more heat is loss by conduction and convection [1] - sweat glands become more active, more sweat is produced and more latent heat is loss. [1] Blood temperature will decrease to the norm and the fever will be reduced.	[4]
3	**(a)**	Green [1] Photosynthesis is occurring thus chlorophyll is present [1]	[2]
	(b)	Tube A  When the lights are turned off photosynthesis stops but aerobic cellular respiration continues. Therefore production of oxygen stops but continues to be used in respiration therefore the level of oxygen continues to decrease and carbon dioxide stops being used due to lack of photosynthesis. Because of ongoing respiration, the level of carbon dioxide continues to increase.	[1]
		Tube B	[1]

		 Organism B is only respiring and NOT photosynthesising therefore the rate of respiration remains the same regardless of whether the light is on or off. Therefore, both lines will continue in the same direction.	
	(c)	To prevent the carbon dioxide and oxygen from diffusing in/out of the tube, so that an accurate measurement can be taken. Or Any change is amount of gas is due to the reaction (by organism)	[1]
	(d)	Glucose [1] is the substrate for respiration; Enters by diffusion [1] as there is a higher concentration of glucose outside of the cells/oragnisms [1]	[3]
4	**(a)**	liver	[1]
	(bi)	Any two of: urea, glucose, amino acids, salts	[1]
	ii	It is **all reabsorbed** back into blood/capillaries from **proximal convoluted** tubule.	[1]
	iv	• Large quantities of water are reabsorbed back into the blood stream [1]. • Urea is not reabsorbed (actively) back into the blood stream [1] or urea can be secreted (actively) into the tubule from the blood (rare but can happen) (1). • Other substances in the glomerular filtrate such as glucose were also reabsorbed further reducing the volume of liquid increasing the concentration.	Max [2]
	(c)	• Large numbers of mitochondria - provide energy for active reabsorption • Microvilli (folds in inner wall) - increase the surface area of the tubule to increase the rate of reabsorption. • Capillary and tubule wall in close proximity - to facilitate reabsorption. • Wall of tubule/capillary only one cell thick - reducing the diffusing distance. Must have feature with related explanation – 1mark Other relevant reasons were also considered if they related to an increased rate of diffusion/active transport.	Max [3]

<table>
<tr><td>5</td><td>(a)</td><td>
<table>
<tr><td></td><td>Glucagon</td><td>Adrenaline</td></tr>
<tr><td>Stimulus that trigger its release</td><td>Drop in <u>blood</u> glucose level/Fasting</td><td>Stress/Fear/ Anxiety</td></tr>
<tr><td>Organ/ gland released from</td><td>Pancreas</td><td>Adrenal gland</td></tr>
</table>
Correct stimulus and organ to get 1mark
</td><td>[2]</td></tr>
<tr><td></td><td>(b)</td><td>- light sensitive/receptor (cells) or named/retina receive the stimulus/increase in light intensity [1]
- neurones/nerve cells or fibres [1] A: optic nerve transfer the
- nerve impulses [1]
- contraction + circular muscles and relaxation + radial muscles [1]</td><td>[4]</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>6</td><td>(a)</td><td>  </td><td>[3]

1m ea</td></tr>
<tr><td></td><td>(b)</td><td>In meiosis, there is a reduction division. Chromosome pairs line up together and one of each pair goes into the daughter cells. For each pair, this process is independent – hence a large number of combinations are possible.</td><td>[2]</td></tr>
<tr><td></td><td>(c)i</td><td>Amniotic fluid</td><td>[1]</td></tr>
</table>

	ii	44	[1]
7	**(a)**	The gene for spider silk is isolated and cut out from the spider genome using a restriction enzyme.	[1]
	(b)	Stage 5	[1]
	(c)	The spider silk gene is expressed in the mammary cells of the goat. [1] The milk produced contains the spider silk protein, [1] which is purified/filtered and spun into thread.	[2]

Section B: (30 marks)

8	**(a)**	Correct axis with labels; Appropriate scale & accurate plotting; Best fit line/curve.	[3]
	(b)	• glycogen content decreases with exercise / all workloads cause glycogen content to decrease; • the heavier the workload, the quicker the glycogen content decreases; / the heavier the workload the greater the decrease in glycogen content; • athlete becomes exhausted quicker with the heavier workload; • workload C so intense that glycogen runs out before 60 minutes/athlete exhausted before 60 minutes/AW; correct use of figs.; use of calculated gradients;	[4]
	(c)	High protein – Increase formation of muscles/ repair wear and tear on muscles that occur during training; [1] High carbohydrates - increase source of energy for greater speed/endurance/store as glycogen store in muscles;[1] Low fat - gets stored as fat, less easy to access / enough present in normal foods Hydration/Drink lots of water - to replenish water loss ***Must have diet + rationale for 1mark*** 1m – 3 options of diet without rationale.	[3]
9	**(a)**	**Difference 1:** Frog- ventricles not separated/only one ventricle/partial or no septum/three chambers/left and right side not separated/single circulation; human- four distinct chambers/median septum/double circulation **Reason**: Result in the mixing of oxygenated and deoxygenated blood , less oxygen transported to other parts of the body	[4]

		Difference 2: Frog- single vessel from heart; Human – 2 vessels: aorta to pump blood to other parts of body and pulmonary artery to pump blood to lungs **Reason**: Lesser volume of blood leaves to the rest of the body since blood can go to either lungs or body. OR deoxygenated blood may be transported to the body instead of the lungs, thus less oxygen is transported to other parts of body. **Difference 3:** Frog- ventricle wall of uniform thickness. Humans - ventricles are thicker than frog's; left ventricle wall is thicker than right ventricle **Reason**: Lower pressure **generated** to push blood **over a long distance in frog,** hence less efficient in transporting blood. *Each difference 1m each. (max 2). Explanation (max 2)* *Must be point-to-point comparison*	
	(b)	**Atrial systole**: The atria contract, forcing blood into the ventricles. [1] **Ventricular systole; atrial diastole** After atrial systole, the atria relax. The ventricles begin to contract and pressure within the ventricles become **higher** than that in the atria, [1] hence the AV valves close to prevent backflow of blood into the atria. [1] The pressure within the ventricles become **higher** than that of the aorta/pulmonary artery [1], hence the semi-lunar valves present in the vessels open [1] and blood leaves the heart. **Ventricular diastole; atrial diastole** After the ventricles are fully contracted, they start to relax. The pressure in ventricles drops **lower than** in the blood vessels [1] and the semi-lunar valves close, preventing backflow of blood into the ventricles [1]. Blood **passively** enters the atria and the ventricles. [1] and pressure within the atria and ventricles slowly increase.	Max [6]
10	**(a)**	• Oestrogen secreted by the follicular cells and causes the repair and growth of the uterine lining.[1] The uterine lining becomes thick and spongy with blood vessels. • High levels of oestrogen will trigger ovulation [1], as it inhibits FSH production and stimulate LH production; • Progesterone (secreted by the corpus luteum) maintains the uterine lining by causing it to thicken further and be supplied with blood capillaries, [1] preparing it for the fertilised egg • High level of progesterone will inhibit ovulation [1] as it inhibits FSH production which will prevent the development/growth of primary follicle. • In the absence of a fertilised egg, the corpus luteum will breakdown and the levels of progesterone will drop. The uterine lining will breakdown and be removed as menses (OTTWE). [1]	Max [4]

	(b)	In natural selection, reproduction ensures that there is variation amongst the offspring / population; [1] Once the fittest survive, reproduction will allow the passing on of the beneficial gene/traits to the offspring/next generation. [1]	[2]
	(c)	1. Stigma secretes sugary fluid to stimulate the growth of the pollen tube, [1] 2. Growth of pollen tube is controlled by the pollen tube nucleus. [1] 3. Generative nucleus divides into two male gametes. [1] 4. Pollen tube grows down the style and enters the ovule through the micropyle. [1] 5. One male gamete fuses with the ovum to form the zygote, while the other fuses with the definitive nucleus to form the endosperm. [1] Max 4	[4]

--End of Answer Sheet--