康 柏 中 学
COMPASSVALE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
BIOLOGY 6093/01
PAPER 1 Multiple Choice
Secondary Four Express

Name	:	_____	Duration	:	1 hour
Index No	:	_____	Date	:	29 Aug 2022
Class	:	_____	Marks	:	_____/40

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, index number and class on the Answer Sheet in the spaces provided.

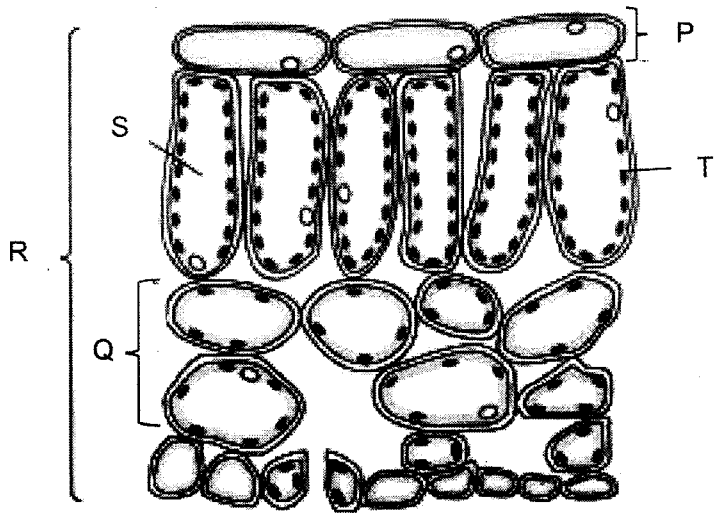
There are **forty** questions on this paper. Answer all questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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.

This paper consists of **18** printed pages including this cover page. Setter: Mdm Fazleen

Answer **all** questions in this section.

1 The diagram shows a section through a leaf.



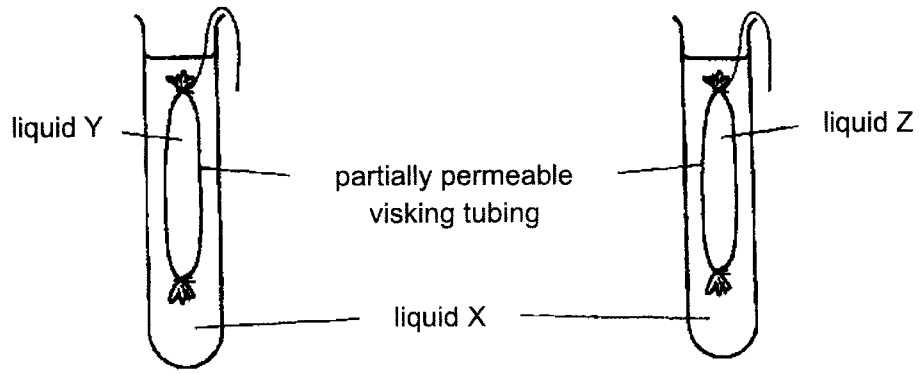
Which shows the correct level of organisation of different parts of the leaf?

	organ	tissue	cell	organelle
A	R	Q	T	P
B	Q	S	P	R
C	R	P	S	T
D	T	Q	S	R

2 Which structure(s) can be seen in a human sperm cell when viewed under a light microscope?

	nucleus	ribosome	mitochondria
A	√	√	√
B	X	X	√
C	√	√	X
D	√	X	X

3 The apparatus was set up as shown in the diagram.



After 30 minutes, the partially permeable tubing containing liquid Y had collapsed while the tubing containing liquid Z was firm.

Which would be a correct description of the liquids at the start of the experiment?

	liquid X	liquid Y	liquid Z
A	10% sucrose solution	water	25% sucrose solution
B	25% sucrose solution	10% sucrose solution	water
C	water	25% sucrose solution	10% sucrose solution
D	10% sucrose solution	25% sucrose solution	water

4 The table shows the rate at which two sugars are absorbed into the lining of the small intestine of a person. The rates are shown for a healthy person and for one who has been subjected to a respiratory poison.

type of sugar	rate of absorption / arbitrary units	
	healthy person	poisoned person
ribose	120	43
raffinose	39	39

Which statement is true?

A Ribose is absorbed by diffusion and active transport.

B Ribose is absorbed by active transport only.

C Raffinose is absorbed by active transport only.

D Both ribose and raffinose are absorbed by diffusion and active transport.

5 Which molecule is **not** made up of glucose?

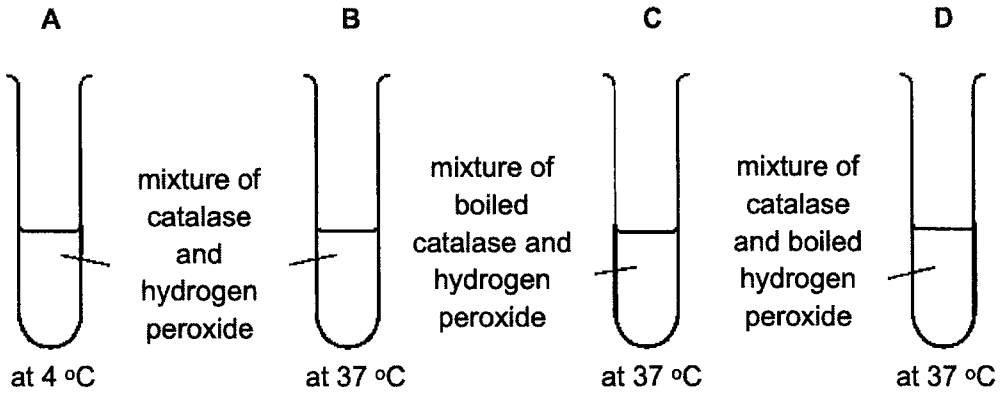
A cellulose

B glycerol

C glycogen

D starch

6 The diagram shows an experiment on enzyme activity. The test-tubes contain hydrogen peroxide and the enzyme catalase.



In which test-tube is the enzyme inactive?

7 Some statements about the active site of a lipase molecule are listed.

1 It accounts for the specificity of the lipase.

2 It can be used once only.

3 It is altered irreversibly at 10 °C.

4 It lowers the activation energy needed for chemical reactions.

5 It has the same shape in acidic and alkali conditions.

Which statements are correct?

A 1 and 3 only

B 1 and 4 only

C 2, 3 and 5 only

D 2, 4 and 5 only

8 Which of the following explains the importance of chemical digestion?

A to speed up the rate of enzyme action

B to build up large insoluble molecules from small and soluble molecules

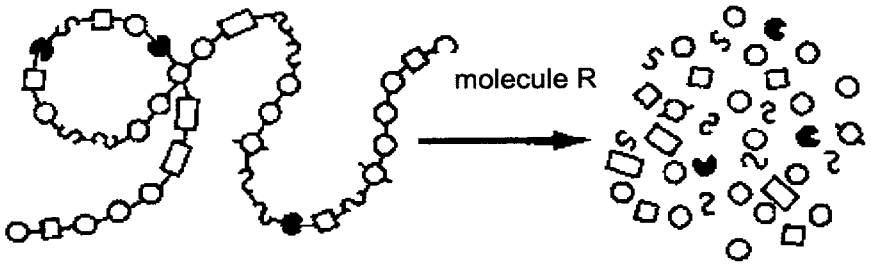
C to break down large food molecules into smaller and soluble molecules which can then be absorbed into the bloodstream

D to break up food into smaller pieces which provide a larger surface area to volume ratio for enzyme action

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

	function	chemical
A	deamination	glycogen
B	detoxification	alcohol
C	excretion	urea
D	storage	amino acids

10 The diagram below shows a reaction that occurs in the alimentary canal.



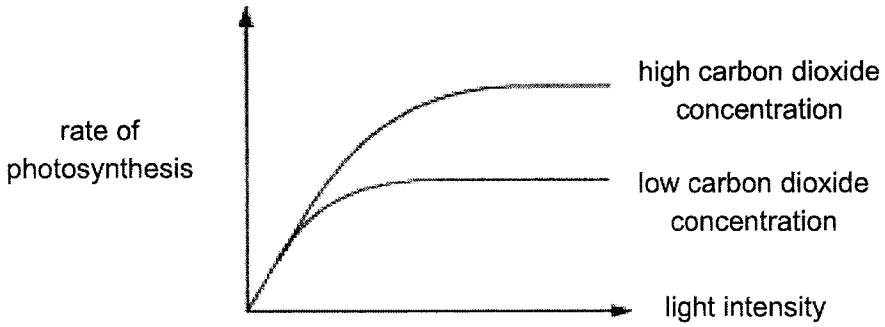
Which option states where the above reaction occurs and the identity of molecule R?

	where the reaction occurs	molecule R
A	mouth	amylase
B	stomach	pepsin
C	duodenum	maltase
D	duodenum	protease

11 What is a result of the action of stomata?

	action of stomata	result
A	closed	no water is lost from leaves
B	closed	photosynthesis stops immediately
C	open	carbon dioxide diffuses in during daylight
D	open	oxygen and water vapour diffuse out at night

12 The graph shows the effects of carbon dioxide concentration and light intensity on the rate of photosynthesis.



What can be deduced from the graph?

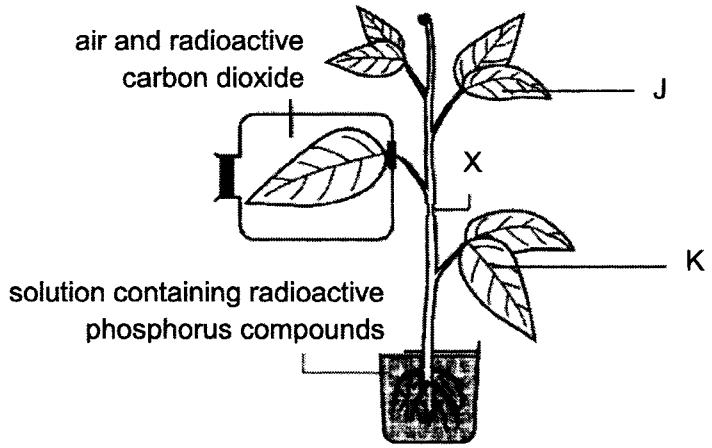
A Carbon dioxide concentration limits the rate of photosynthesis at low light intensity.

B Light intensity and carbon dioxide concentration limit the rate of photosynthesis.

C The rate of photosynthesis is proportional to light intensity.

D Temperature affects the rate of photosynthesis.

13 An experiment was set up as shown below, to study the movement of substances in a plant. A ring of tissues was removed at X, leaving only the woody inner part exposed. After several hours, the relative amounts of radioactive carbon and phosphorus compounds in different parts of the plant were measured.



Which statement is true?

A Radioactive carbon compounds were found in both leaves J and K.

B Radioactive carbon compounds can only be found in the roots and radioactive phosphorus compounds were found in both leaves J and K.

C Radioactive phosphorus compounds were found in both leaves J and K and radioactive carbon compounds were found in leaf J but not in leaf K.

D Radioactive phosphorus compounds were found in leaf K but not in leaf J.

14 Which of the following is **not** true of wilting?

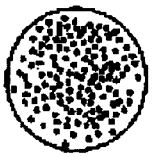
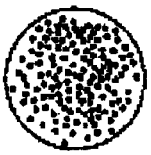
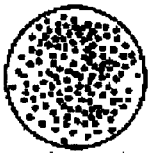
A Wilting occurs when rate of transpiration exceeds rate of water absorption.

B Increased temperature and humidity increase chances of wilting.

C Guard cells are flaccid and stomata close during wilting.

D Less starch is produced during wilting.

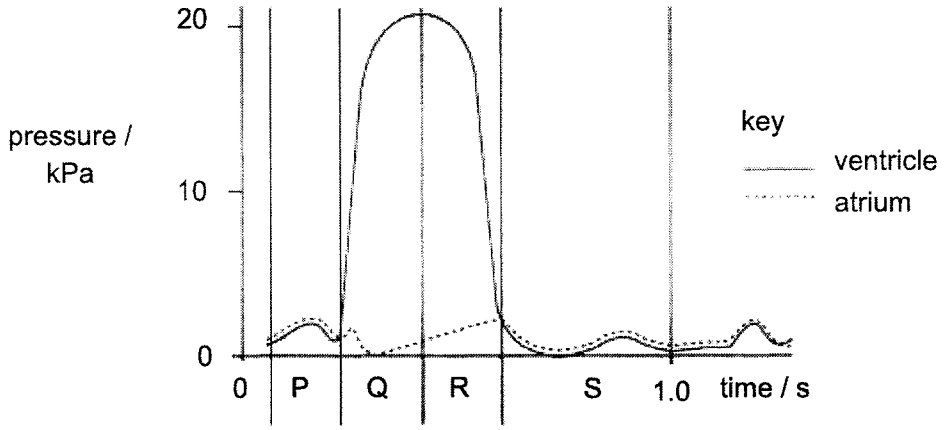
15 The blood of three people S, T and U were tested to determine their blood groups. The results are shown below.

blood of person	S	T	U
plasma from blood of group A	 clumping	 clumping	 no clumping
plasma from blood of group B	 no clumping	 clumping	 no clumping

Which of the following shows the correct blood types of people S, T and U?

	S	T	U
A	A	AB	O
B	B	AB	O
C	A	O	AB
D	B	O	AB

16 The graph shows pressure changes in the left ventricle and the left atrium in one cycle of contraction of the heart.



Which statement correctly describes the events that occur at different periods, P, Q, R and S of the cardiac cycle?

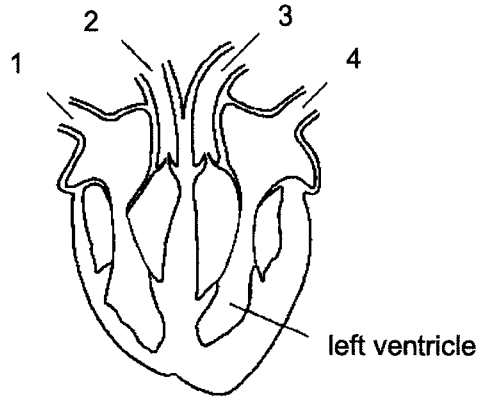
A Muscles of the atria wall relax and bicuspid vales open at period P.

B Muscles of the ventricle wall contract and bicuspid valves close at the start of Q.

C Muscles of the ventricle wall contract and bicuspid valves open at the start of R.

D Blood is filling up the heart and bicuspid valves close at period S.

17 The diagram shows a vertical section through the heart.



What are the functions of the numbered blood vessels?

	carries blood to body	carries blood to lungs	carries blood from lungs	carries blood from body
A	1	4	3	2
B	2	1	3	4
C	2	3	4	1
D	3	2	4	1

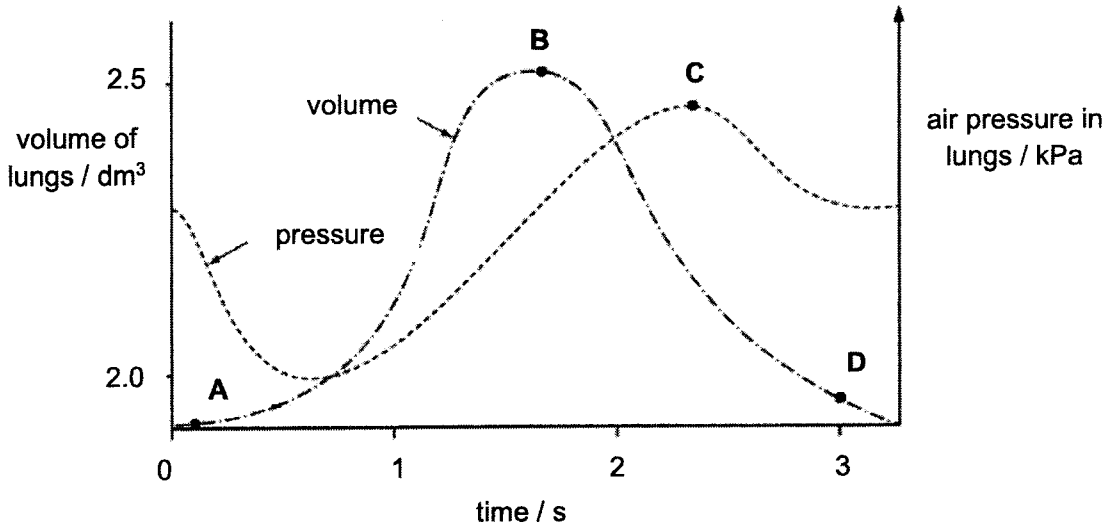
18 Some changes in the concentrations of chemicals in contracting muscles are listed.

1 decrease in glucose
2 decrease in oxygen
3 increase in amino acid
4 increase in carbon dioxide

Which changes lead to lactic acid production?

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

19 The graph shows how the pressure and volume inside the lungs change during one complete breath.



At which point are the muscles of the diaphragm starting to relax?

20 Which of the following is a harmful effect of carbon monoxide in cigarette smoke?

A increased risk of blood clots
B increased risk of lung cancer
C breakdown of alveolar walls
D increased deposition of fats in blood vessels

21 Two organs secrete substances which affect the body.

organ 1 ⟶ product 1
organ 2 ⟶ product 2

Negative feedback control of product 2 would be achieved if

A Product 1 counteracts product 2.

B Product 1 reinforces the effect of product 2.

C Product 2 inhibits organ 1 and product 1 stimulates organ 2.

D Product 2 stimulates organ 1 and product 1 stimulates organ 2.

22 Organisms that live in the hot and dry deserts need to conserve water.

Which features will help them adapt to the environment and reduce water loss?

	sweat glands	collecting duct	secretion of anti-diuretic hormone
A	more	shorter	less
B	more	longer	more
C	less	shorter	less
D	less	longer	more

23 Which is **not** an example of excretion?

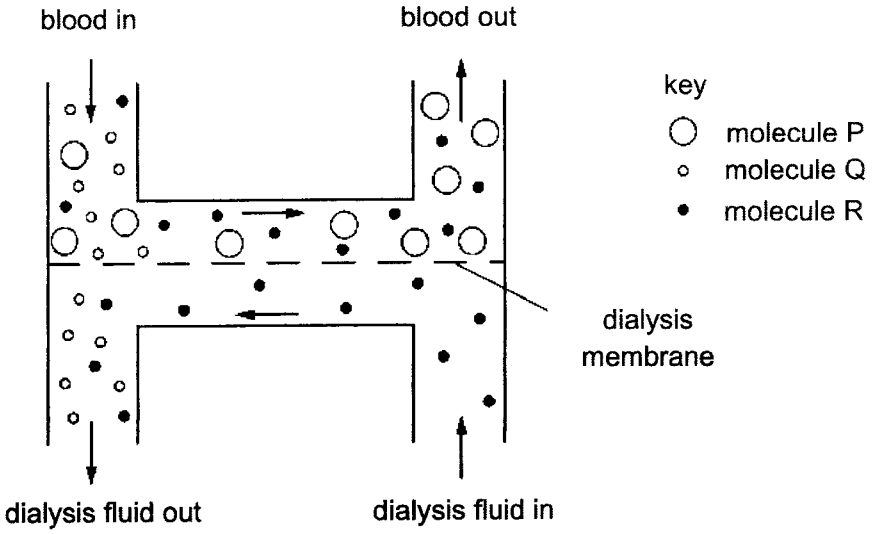
A Carbon dioxide is breathed out from the lungs.

B Undigested food leaves the body through the anus.

C Urea leaves the body in urine.

D Water is removed from the kidneys and leaves the body through the urethra.

24 The diagram shows what happens to molecules of glucose, protein and urea as blood passes through a kidney dialysis machine.



What are molecules P, Q and R?

	molecule P	molecule Q	molecule R
A	glucose	protein	urea
B	glucose	urea	protein
C	protein	glucose	urea
D	protein	urea	glucose

25 In a reflex action, the arm pulls away after touching a hot object.

What is the role of the brain in this nervous response?

	receives information	co-ordinator of arm movement
A	√	√
B	√	X
C	X	√
D	X	X

26 When a person looks up from reading a book to look out of the window, a reflex response occurs in the eye.

Which shows the pathway taken by nerve impulses in this reflex response?

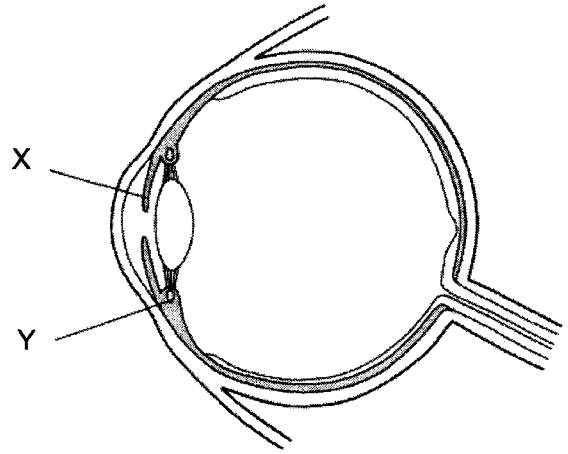
A pupil → optic nerve → brain and spinal cord → ciliary muscle

B pupil → lens → retina → optic nerve → brain → iris muscle

C retina → optic nerve → brain and spinal cord → iris muscle

D retina → optic nerve → brain → ciliary muscle

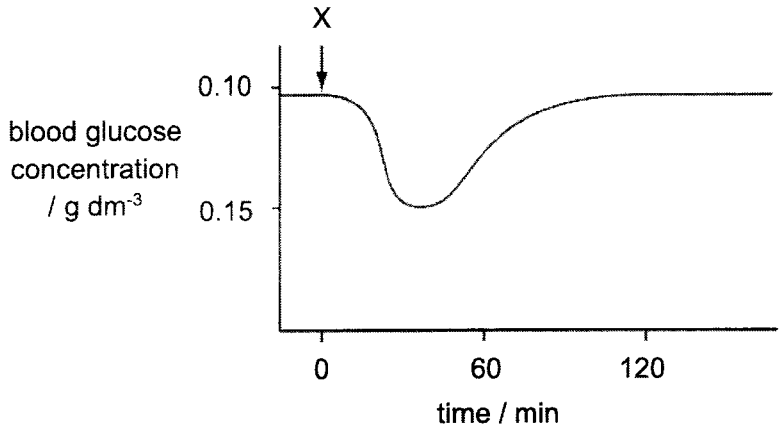
27 The diagram shows the human eye in section.



What happens to the muscles at X and muscles at Y when the eye focuses on a near object in bright light?

	X	Y
A	contract	contract
B	contract	relax
C	relax	contract
D	relax	relax

28 The graph shows the changes in blood glucose concentration following the injection of a small amount of a substance into the blood of a person at time X.



Which substance was injected at time X?

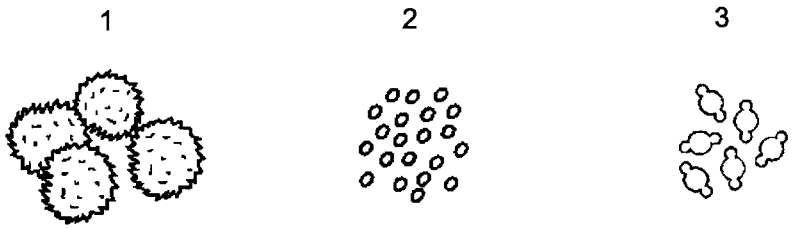
A adrenaline

B bile

C glucagon

D insulin

29 The diagrams show pollen grains from three different species of plant as they appear under the microscope. The diagrams are all to the same scale.



Which pollen grain(s) is/are involved in insect pollination?

A 1 only

B 1 and 2

C 2 and 3

D 3 only

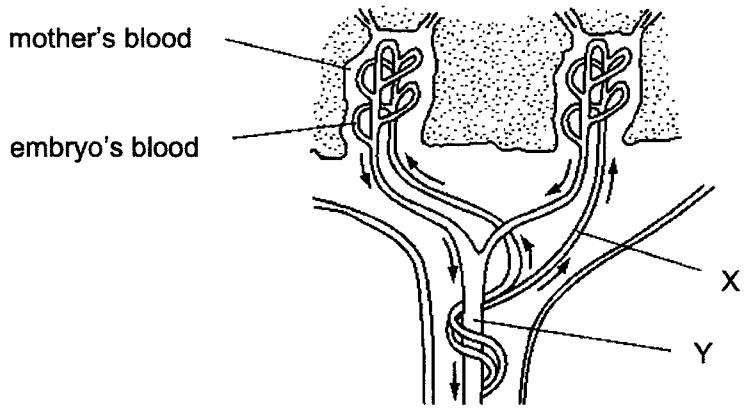
30 Which row correctly describes the type of plant reproduction that involves self-pollination?

	type of reproduction	offspring compared with parents
A	asexual	genetically different
B	asexual	genetically identical
C	sexual	genetically different
D	sexual	genetically identical

31 Which row shows the effects of estrogen and progesterone?

	high levels for ovulation	high levels needed to stop development of more ova	maintains the uterus lining	repairs the uterus lining
A	estrogen	progesterone	progesterone	estrogen
B	estrogen	progesterone	estrogen	progesterone
C	progesterone	estrogen	estrogen	progesterone
D	progesterone	estrogen	progesterone	estrogen

32 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?

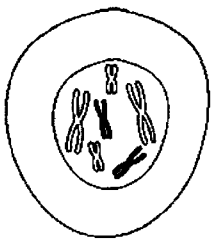
A carbon dioxide and glucose

B carbon dioxide and urea

C glucose and oxygen

D glucose and urea

33 The diagram shows chromosomes during mitosis.



How many pairs of homologous chromosomes are shown and which stage of mitosis is shown?

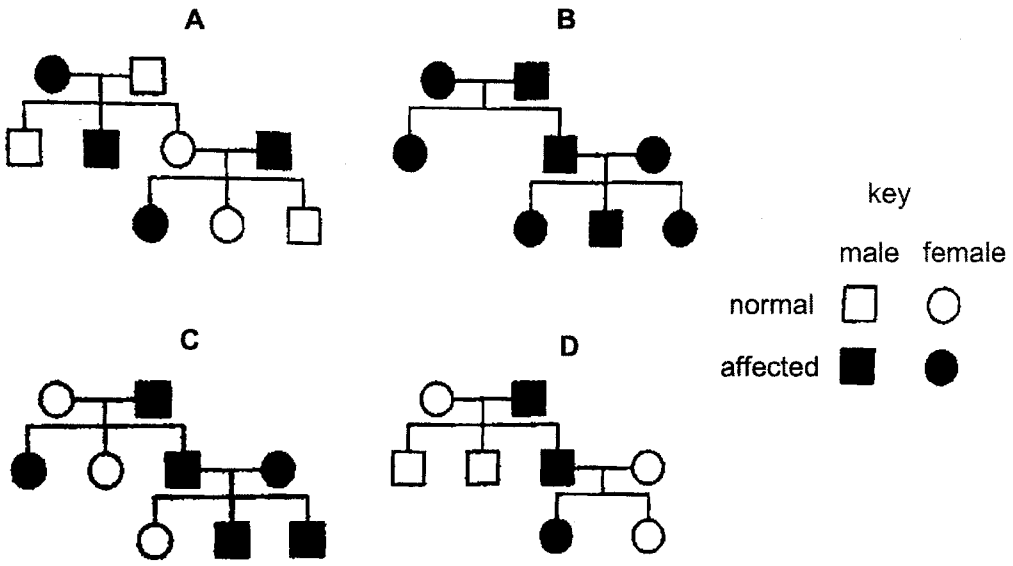
	number of pairs of homologous chromosomes	stage of mitosis
A	3	prophase
B	3	telophase
C	6	prophase
D	6	telophase

34 Which pair of gametes will result in a female with Down's Syndrome?

	number of chromosomes in ovum	number of chromosomes in sperm
A	22 + 1X	22 + 1Y
B	22 + 1Y	23 + 1X
C	23 + 1X	22 + 1X
D	23 + 1X	22 + 1Y

35 The inheritance pattern of an abnormal condition in four families is shown.

Which family proves that the condition must be caused by a dominant allele?



36 Which statement about chromosomes is correct?

A Chromosomes are long DNA molecules called genes which are divided into sections.

B Chromosomes include a long molecule of DNA divided into sections called genes.

C Chromosomes include genes which are divided into sections called DNA molecules.

D Genes include long DNA molecules called chromosomes.

37 The table shows the results of mapping 100 nucleotides on a single strand of DNA.

nucleotide	quantity
adenine	22
cytosine	20
guanine	47
thymine	11

How many thymine nucleotides will there be on the strand of DNA that is complementary to this strand?

A 11

B 20

C 22

D 28

38 Which process would result in a transgenic organism?

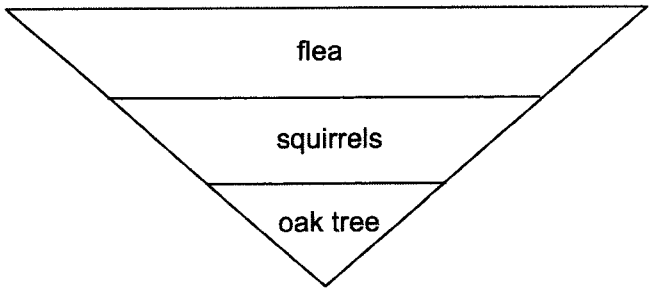
A adding a chemical to embryo plants that causes the diploid chromosome number to double which makes the plant produce larger fruit

B crossing two different varieties of the same species of plant to obtain high yield crops resistant to insect pests

C fusing an egg cell without a nucleus from one animal with a diploid cell from a related species

D inserting gene from one species into the egg cell of a different species to make the animal produced grow faster

39 A pyramid of numbers is shown.



Which statement best explains why the pyramid is inverted?

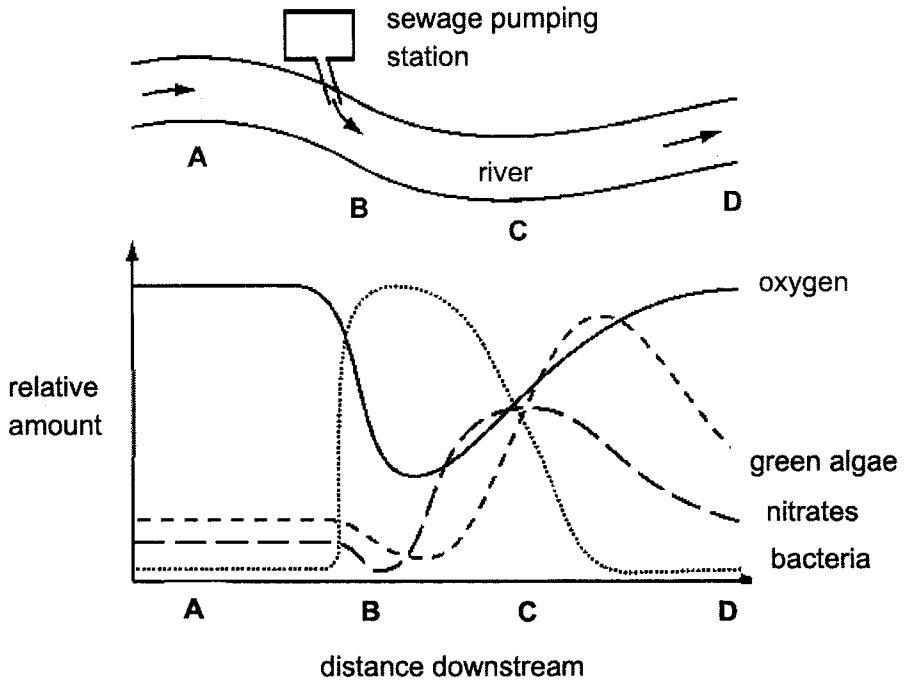
A Each trophic level has organisms of a smaller size than the one below.

B The oak tree is of the lowest biomass compared to the squirrels and fleas.

C The fleas and squirrels die out at a much faster rate than the oak tree.

D There is an overpopulation of higher consumers, resulting in drastic decline in the lower trophic levels.

40 The diagram shows part of a river into which sewage is being pumped. Some of the effects of adding sewage to the river are shown in the graph.



At which point in the river are decomposers **most** active?

End of Paper -

康 柏 中 学
COMPASSVALE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
BIOLOGY 6093/02
PAPER 2 Theory
Secondary Four Express

Name : _____ Duration : 1 h 45 min

Index No: _____ Date : 25 Aug 2022

Class : _____ Marks : _____/80

READ THESE INSTRUCTIONS FIRST

Write your full name, index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs or rough working.
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 including questions 7, 8 and 9 **Either** or 9 **Or**.
Write your answers in the spaces provided.

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.

This paper consists of **17** printed pages including this cover page. Setter: Mdm Fazleen

Section A

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

The total marks for this section is 50.

1 Biological molecules are essential for the survival of living cells.

(a) Five statements about water are listed below:

i. It cools a surface from which it evaporates.

ii. It is used as a solvent.

iii. It is involved in many metabolic reactions.

iv. It has high specific heat capacity.

v. There is cohesion between its molecules.

State which statement(s) above make water suitable for the following functions:

(i) to use in a blood transport system .....

(ii) to move up the xylem via transpiration pull .....

[2]

(b) Complete the table below on the various food tests for different biological molecules.

biological molecule	test reagent(s)	observation if present
glucose		
protein		
fat		

[3]

[Total: 5]

2 Cystic fibrosis is a genetic condition in humans that results from a failure to inherit a particular dominant allele of a gene.

(a) Explain the terms *gene* and *allele*.

gene .....

.....

.....

allele .....

.....

.....

[2]

(b) Use a fully labelled genetic diagram to determine the chance of a child inheriting cystic fibrosis from two heterozygous parents.

Use the letter **D** to represent the dominant allele and **d** to represent the recessive allele.

chance of child inheriting cystic fibrosis: ..... [3]

(c) Fig. 2.1 shows some of the main regions of the alimentary canal in a person.

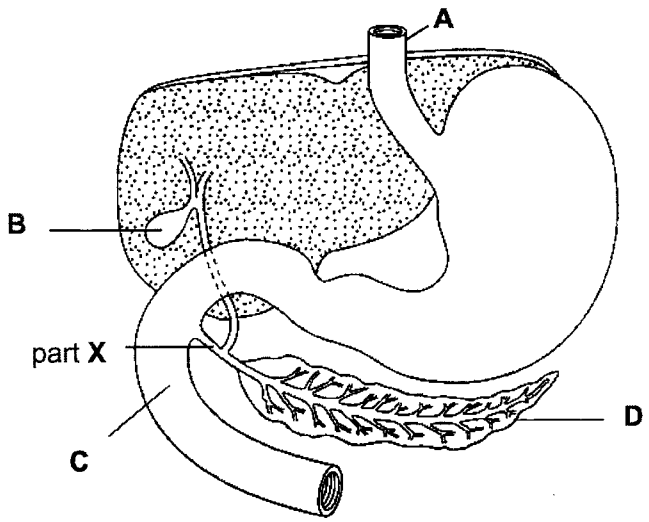


Fig. 2.1

(i) Name the parts labeled **A** to **D**.

A ..... **B** .....

C ..... **D** .....

[2]

(ii) One effect of cystic fibrosis is that part **X** becomes blocked with mucus.

Suggest and explain how this condition affects the nutrition of a person.

.....

.....

.....

.....

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.....

.....

..... [4]

[Total: 11]

3 There are many different drugs available to treat high blood pressure. Fig. 3.1 shows the mean heart rates of two groups of people, **J** and **K**, over a five-year period.

From the start, and throughout the period, people in group **K** were treated with a drug called a beta-blocker.

Group **J** did not take any form of medication.

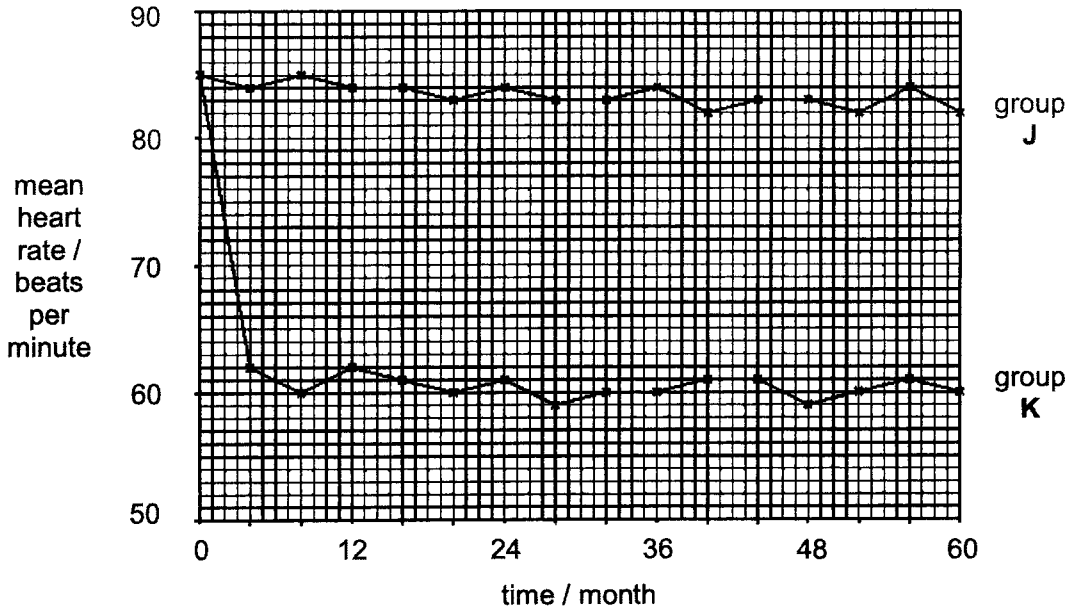

Fig. 3.1

(a) Using information from Fig. 3.1, describe the effect on the mean heart rate of taking beta-blockers.

.....

.....

.....

..... [2]

(b) On Fig. 3.1, draw a curve to show the expected effect on the mean heart rate of Group **J** if, after three years, half of them started to take beta-blockers.

[2]

(c) Suggest how the change in mean heart rate for group **K** may treat high blood pressure.

.....

..... [1]

(d) Some other drugs reduce blood pressure by having an effect on blood vessels. Suggest and explain how these drugs may cause a decrease in blood pressure.

.....

.....

.....

..... [2]

[Total: 7]

4 Fig. 4.1 shows stages in the development of human twins.

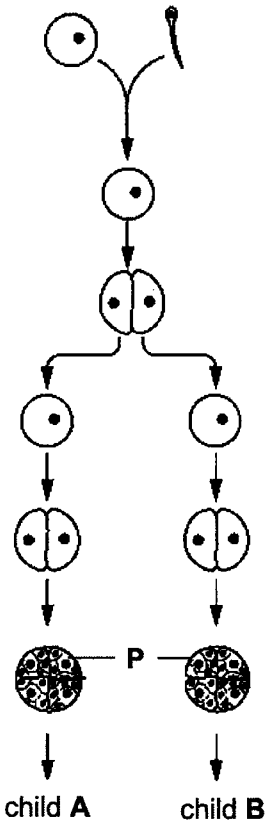

Fig. 4.1

(a) On Fig. 4.1, draw lines to label each of the following:

- a gamete
- a zygote

[2]

(b) Explain how the first division of meiosis is involved in the formation of gametes.

.....

.....

.....

..... [2]

(c) Describe the sequence of events that occur after structure **P** is formed which enable it to develop and survive in the uterus.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) Explain why child **A** and **B** have the same blood type but different weight when born.

.....

.....

.....

..... [2]

[Total: 10]

5 Fig. 5.1 shows the flow of energy within a biological system.

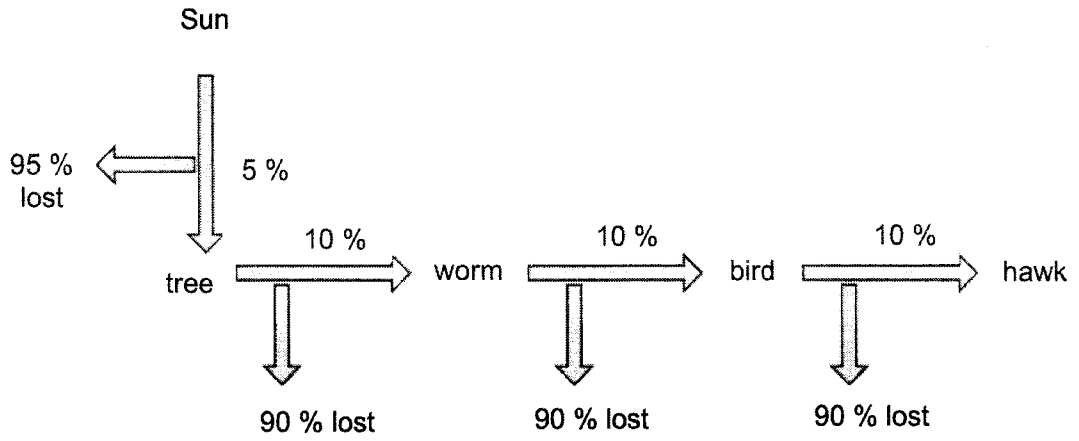

Fig. 5.1

(a) The energy flow in Fig. 5.1 is non-cyclical.

Use Fig. 5.1 to explain the term *non-cyclical*.

Include information about the source of energy for the food chain in your answer.

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..... [3]

(b) Suggest two reasons why only 5% of the energy from the Sun passes to the tree.

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..... [2]

(c) Fig. 5.2 shows two possible uses of the same area of land to produce food.

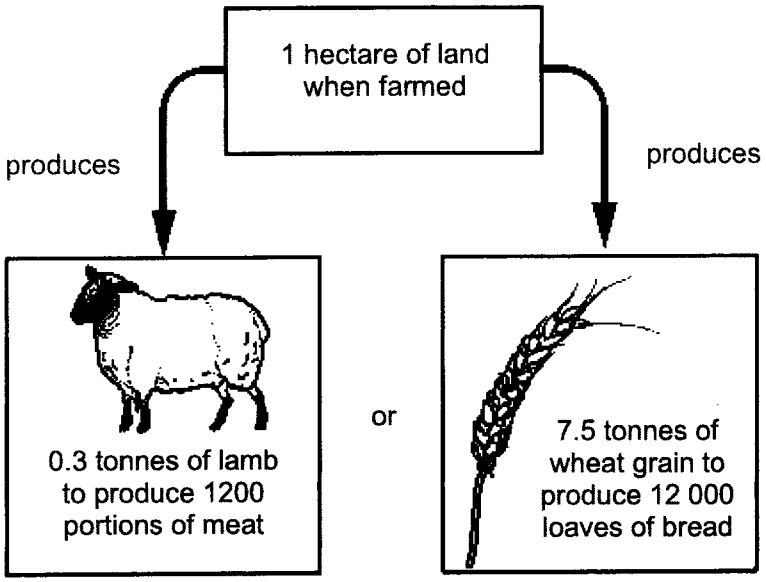

Fig. 5.2

Use the information in Fig. 5.1 and 5.2, and your own knowledge, to explain why it is possible to feed a greater number of people if the area of land is used to farm crops rather than to farm animals.

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..... [3]

[Total: 8]

6 **(a)** Fig. 6.1 shows the percentage of energy provided by anaerobic respiration when athletes run in races of different distances.

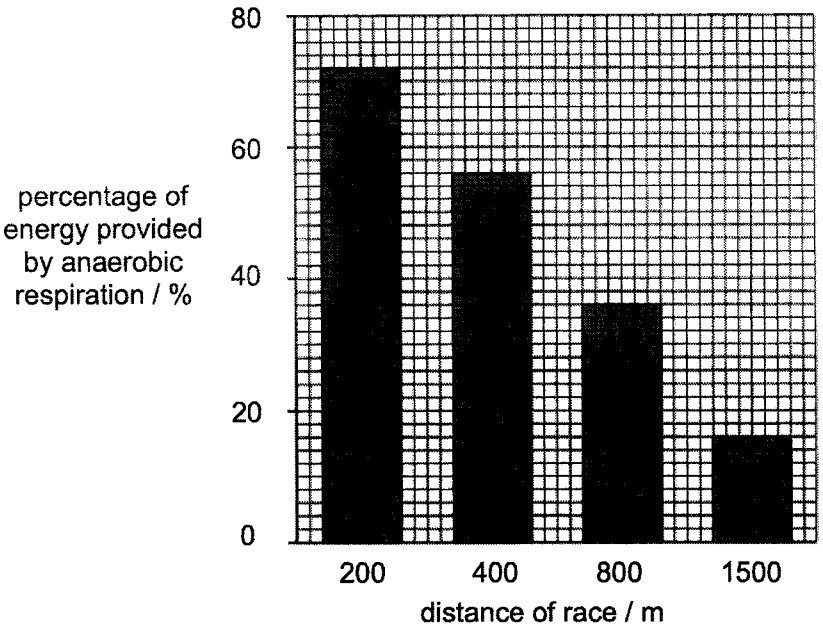

Fig. 6.1

(i) State the word equation for anaerobic respiration.

..... [1]

(ii) Describe and explain the results shown in Fig. 6.1.

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..... [4]

(b) In an investigation the volume of sweat produced by a student was measured when running while carrying different masses in a bag.

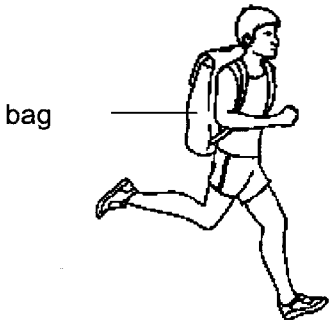

Table 6.2

mass of content of bag / kg	volume of sweat produced / arbitrary units
0	6
3	7
6	9
9	13

(i) Calculate the percentage increase in sweat production when running with a 9 kg bag.
Give your answer to the nearest whole number. Show your working.

answer: ..... [1]

(ii) Explain the percentage increase in sweat production as the mass of content of bag increases.

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..... [3]

[Total: 9]

Section B

Answer **all** the questions in this section. The last question is in the form of either/or and only one of the alternatives should be attempted.

The total marks for this section is 30.

7 **(a)** Describe the role of chloroplasts in photosynthesis.

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..... [2]

(b) The rate of photosynthesis in six tropical crop plants was measured when the plants were growing outside under normal conditions (rate **X**).

The measurements were repeated when the plants were grown under controlled optimum conditions in a glasshouse (rate **Y**).

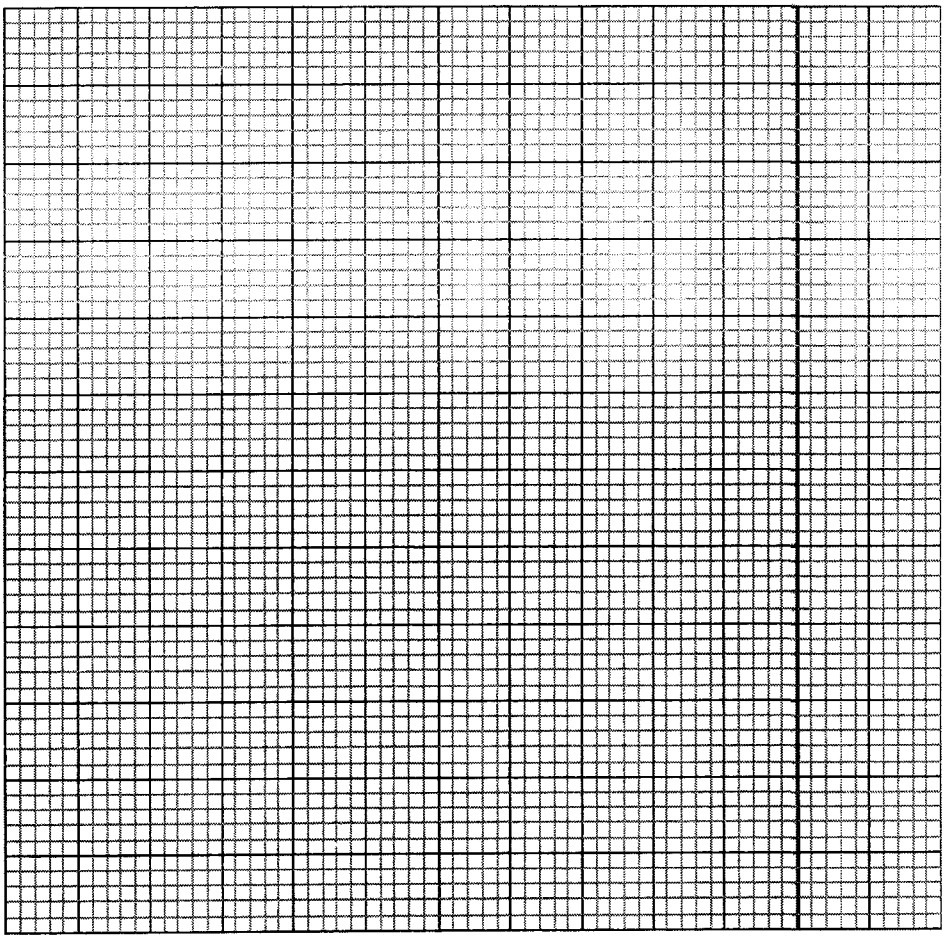
The results are shown in the Table.

Table

crop plant	rate of photosynthesis (**X**) / µmol per m^2 per second	rate of photosynthesis (**Y**) / µmol per m^2 per second	difference in rate of photosynthesis (**Y-X**) / µmol per m^2 per second
cassava	13.7	23.1	9.4
eucalyptus	18.4	26.0	7.6
maize		26.0	2.6
soya bean	18.3		6.8
sugar cane	24.0	26.8	2.8
sunflower	24.3	31.7	7.4

(i) Calculate the missing values in the table and complete the table. [1]

(ii) Draw a bar chart of the difference (**Y-X**) in the rate of photosynthesis of each plant.



[3]

(iii) The measurements of the rate of photosynthesis (**X**) of the plants when grown outside are means of 10 readings.
Suggest a reason why mean measurements were used.

.....

..... [1]

(iv) Suggest two factors that were changed when the plants were grown in controlled optimum conditions.

.....

..... [2]

(c) The rate of photosynthesis can be measured by:

- calculating the rate per unit area of leaf

  or

- calculating the rate per unit mass of the leaf

Suggest why these measurements may give different results.

.....

..... [1]

[Total: 10]

8 Both artificial selection and genetic engineering leads to genetic variation.

(a) Describe the difference between artificial selection and genetic engineering.

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..... [2]

(b) Medical biotechnology can be used to produce chicken eggs that contain human proteins. These proteins can be used in medicines.

Discuss **two** social and **two** ethical implications of using chickens to produce human proteins.

social implications .....

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ethical implications .....

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..... [4]

(c) Describe one example of artificial selection in the production of an economically important plant and animal.

(i) plant

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(ii) animal

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[4]

[Total: 10]

9 Either

(a) Explain the basic principles of homeostasis.

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..... [2]

(b) Describe the role of the skin in homeostasis when a person is in freezing conditions.

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..... [4]

(c) With reference to the basic principles of homeostasis, compare regulation of blood glucose concentration and regulation of water potential of blood.

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..... [4]

[Total: 10]

9 Or

(a) Some cells secrete enzymes.

Describe how different parts of such a cell work together to synthesize and secrete the enzymes.

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..... [4]

(b) Compare the effect of temperature and pH on enzymes.

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..... [4]

(c) Explain why the lock and key hypothesis does not accurately represent how enzymes work.

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..... [2]

[Total: 10]

The End

Sec 4 Biology Prelims 2022

Answers

Paper 1

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
C	D	A	A	B	A	B	C	B	D

Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
C	B	C	B	B	B	D	C	B	D

Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
C	D	B	D	B	D	A	D	A	C

Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
A	B	A	C	C	B	C	D	A	B

Sec 4 Biology Prelims 2022

Answers

Paper 2

Section A

1ai ii (1)

aii v (1)

b

biological molecule	test reagent(s)	observation if present
glucose	Benedict's solution (0.5)	Red precipitate (0.5)
Protein	Biuret solution (0.5) or sodium hydroxide and copper (II) sulfate solution (0.5)	purple solution (0.5)
Fat	ethanol and water (0.5)	white emulsion (0.5)

2a gene : unit of inheritance (0.5) that determines a particular characteristic / trait of an organism (0.5) OR a segment of DNA that is made up of a specific sequence of nucleotides (0.5) which codes for a specific polypeptide (0.5) that determines a specific characteristic .

allele: alternative forms of a gene (0.5) that occupies the same relative positions on a pair of homologous chromosomes (0.5)

b

Parents	Male	X	Female
Phenotype	Normal		Normal (0.5)
Genotype	Dd		Dd (0.5) *
Gametes	D d		D d
F1 genotype	DD Dd		Dd dd (0.5) *

F1 phenotype Normal normal normal cystic fibrosis (0.5)

Phenotypic ratio: 3 normal : 1 cystic fibrosis (0.5)

Chance of child inheriting cystic fibrosis: 25% or ¼ (0.5)

*can be awarded for Punnett Square too

Penalise 0.5m if no headings at all

ci A: oesophagus B: gall bladder

C: duodenum D: pancreas

cii Less bile (0.5) and pancreatic juice / enzymes (0.5) are secreted into the duodenum (0.5). with less bile, there is less emulsification/break up of fats (0.5) resulting in a smaller surface area to volume ratio for digestion (0.5). With less enzymes, there is less digestion of food (any named nutrient) (0.5) into smaller molecules resulting in less nutrients absorbed (0.5) and assimilated /used for growth / energy (0.5). Hence the person will have poor nutrition.

3a Beta-blockers caused the mean heart rate to decrease (0.5) from 85 to 62 beats per minute / by 23 beats per minute (0.5) in 4 months (0.5). The mean heart rate then remains relatively constant (0.5) between 59 to 62 beats per minute (0.5). Max 2 m

b decrease trend starts at 36 months (0.5)

decreases from 85 to 72 beats per minute (0.5) within 4 months (0.5) + remains relatively constant till 60 months (0.5)

c As the mean heart rate has decreased, less blood will be pumped into the blood vessels (0.5), causing the blood pressure to decrease (0.5).

d The drugs relax the muscles (0.5) found in the wall (0.5) of blood vessels causing the blood vessels to dilate (0.5) which results in pressure of blood flowing through the vessels to decrease (0.5)

4a label sperm/egg as 'gamete' (1) R:label as 'sperm' or 'egg'

Label immediate structure formed after fertilisation (1)

b During prophase 1, homologous chromosomes pair up (0.5). They then arrange themselves in two lines in the centre of the cell during metaphase 1 (0.5). During anaphase I, homologous chromosomes separate to opposite poles (0.5), causing the daughter cells to be haploid gametes (0.5)

c structure P gets implanted in the uterine lining (0.5). A placenta (0.5) then develops which allows for oxygen/nutrients (0.5) and antibodies (0.5) to diffuse from the mother's blood to the fetus blood (0.5). It also allows for carbon dioxide/waste products (0.5) to diffuse from fetus blood to mother's blood (0.5). The fetus also develops an amniotic membrane/sac (sac) to protect the fetus (0.5). These help the fetus to be able to develop and survive.

d Since child A and B are identical twins / came from the same sperm and egg (0.5), they inherited the same genetic information from their parents (0.5) Thus, they have the same blood type. However, weight is of continuous variation (0.5) which can be affected by environmental factors / combined effects of several genes (0.5). Thus, their weight is different when born.

5a Non-cyclical means that the energy is not returned to its source (1) which is the sun (0.5). As energy is transferred from one trophic level to another, 90% is lost (0.5) as heat during respiration (0.5) and chemical energy in waste products / uneaten body parts (0.5).

b Any of the following two (1m each):

- light from the sun gets reflected off the leaves

- rate of photosynthesis was not high enough due to low/high temp

- rate of photosynthesis was not high enough due to low carbon dioxide concentration

- some light energy does not fall on the leaves to be absorbed

c Since 90% of the energy is lost as it gets transferred from one trophic level to another (0.5), the crops/wheat grain has more energy than the lamb (0.5) as the crops are at a lower trophic level/ crops is a producer while lamb is a consumer (0.5). 1 hectare of land can produce 12000 loaves bread which is 10 times more than 1200 portions of meat (1). Thus, more bread can feed more more people and provide them with more/sufficient energy (0.5).

6ai glucose -> lactic acid + small amount of energy

aii As the distance of race increases from 200 m to 1500 m, the percentage of energy provided by anaerobic respiration decreases (0.5) from 72% to 14% / by 58% (0.5). This is because, as the distance increases, the increase in energy demand is more gradual (0.5) and the athlete can breathe more to take in more oxygen (0.5). Thus, more aerobic respiration (0.5) can occur in the muscle cells (0.5) to release more energy (0.5). Hence, less anaerobic respiration is needed to meet the energy demand (0.5).

bi (13-6)/6 X 100% = 117 % (nearest whole number) (1)

*0.5m for working, 0.5m for final answer to the nearest whole no/

bii More respiration (0.5) occurs to release more energy needed to run with a heavier bag (0.5). More heat energy released causes the blood temperature to increase (0.5) above normal (0.5). Thus, more sweat is produced to lose more heat/decrease blood temperature (0.5) as water evaporates (0.5) during sweating.

7a Chloroplasts contain chlorophyll (0.5) which traps/absorbs light energy (0.5) and converts it to chemical energy (0.5) which is stored in the glucose produced (0.5) during photosynthesis.

bi maize – 23.4 (0.5)

soya bean – 25.1 (0.5)

bii labelled axis with units (1)

6 bars of equal width (1)

Correct height for all bars (1) (0.5 m for 1 bar wrong bar, 0m for more than 1 wrong bar)

biii Mean measurements were used to increase the reliability of the results (1)

iv light intensity / carbon dioxide concentration / temperature (any 2 factors, 1 mark each)

c The leaves may be of different thickness. Hence, leaves of the same area can have different mass due to different thickness. / There is a lack of proportionality between mass and area. (1)

8a Artificial selection is the deliberate/selective breeding of organisms with desirable characteristics/traits (1) but genetic engineering is a technique/method used to transfer genes from one organism to another (1).

8b Social implications

- May lead to class distinctions. Only individuals with sufficient financial means can afford the medicine/gene technologies
- Long term impact of the proteins used as medicines may be unknown

Ethical implications

- Vegetarians / vegans who need the medicine may find it unacceptable to consume it as its production involved the use of chickens.
- Some people feel that it is morally wrong to exploit animals for medical research especially when the animals are designed to suffer.

8ci Variety of sugarcane plant with high sugar content (1) is crossed/bred with another variety that is resistant to diseases (1) to produce offsprings that have both of these traits.

8cii Jersey cows which produce a lot of milk (1) were mated with Brahman bull which thrive well in warm climates (1) to produce offsprings that have both of these traits.

*accept other possible answers

9 either

9a The basic principles of homeostasis includes a stimulus resulting from a change in the internal environment (0.5) which triggers/stimulates a corrective mechanism (0.5) to restore normal conditions (0.5) by negative feedback (0.5).

b In freezing conditions, the skin has thermoreceptors (0.5) to detect the decrease in skin temperature (0.5) and produce nerve impulses (0.5). The skin also has arterioles (0.5) which constrict (0.5) to reduce blood flow to the capillaries at the skin surface (0.5) so that less heat is lost (0.5) through the skin by conduction, convection and radiation (0.5).

c similarities:

- both involve negative feedback (1)

- both involve hormones to carry out the corrective mechanisms (1)

Differences (1m for each difference):

Regulation of blood glucose concentration	Regulation of water potential of blood
stimulus is detected by the pancreas	stimulus is detected by the hypothalamus
organ involved in the corrective mechanism is the liver / muscles	organ involved in the corrective mechanism is the kidney

9 Or

a The nucleus contains the genetic material/gene/DNA (0.5) that codes for the enzymes (0.5). The ribosomes attached to the rough endoplasmic reticulum (RER) (0.5) synthesizes the proteins / enzymes (0.5) coded by the gene. The RER then transports the enzymes to the Golgi body (0.5) via vesicles. The Golgi body stores/modifies the enzymes (0.5) and packages them into vesicles (0.5) which fuses with the cell membrane (0.5) to be secreted out of the cell.

b similarities:

- enzymes work best at the optimum temp and pH (1)

- above optimum pH and temperature, enzymes are denatured (0.5) whereby their active site is altered (0.5)

differences: (1m for each difference)

effect of temperature	effect of pH
temperature affects the kinetic energy of the enzymes	pH does not affect the kinetic energy of the enzymes
Below the optimum temperature, enzymes are inactive / have little kinetic energy	Below the optimum pH, enzymes are denatured

c The lock is the enzyme and the key is the substrate (0.5). The enzyme remains unchanged at the end of the reaction (0.5) while the substrates are broken down/synthesized (0.5). However, the lock changes shape after being unlocked / the key is the one that remains the same after being used (0.5).