	Class	Index No.
Candidate Name: ______________________		

FUHUA SECONDARY SCHOOL

Secondary Four Express

Preliminary Examination 2017

4E

BIOLOGY 5158/01

28 Aug 2017
0950 - 1050
1 hour

Additional Material: OMR

READ THESE INSTRUCTIONS FIRST

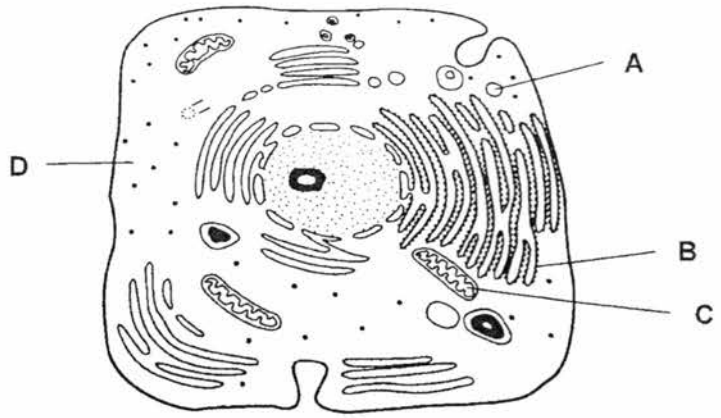
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the OMR and this question booklet.

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 OMR.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected where appropriate.

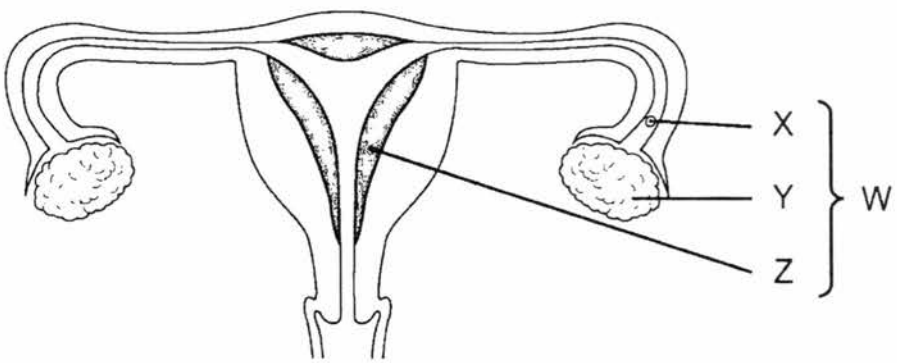
PARENT'S SIGNATURE	FOR EXAMINER'S USE
	/ **40**

1 The diagram shows a cell as it appears in an electron micrograph.



In which part of a living cell is the carbon dioxide concentration the highest?

2 The diagram shows the female reproductive system.



Which level of organisation are the structures W, X, Y and Z?

	cell	tissue	organ	organ system
A	X	Z	Y	W
B	W	Y	X	Z
C	Y	X	Z	W
D	Z	W	Y	X

3 Which of the following require(s) a living membrane in order to occur?

1 active transport
2 diffusion
3 osmosis

A 1 only

B 1 and 2 only

C 1 and 3 only

D 1, 2 and 3

4 Paramecium, a protozoan has two contractile vacuoles for the removal of excess water from its body. The table records the average time taken by a contractile vacuole to fill up and empty its contents when the protozoan is immersed in three different liquids W, X and Y.

bathing liquid	time taken by protozoan to fill up and empty its contents /s
W	68
X	29
Y	175

What could the bathing liquids W, X and Y be?

	W	X	Y
A	0.1 M salt solution	0.3 M salt solution	water
B	water	0.1 M salt solution	0.3 M salt solution
C	0.3 M salt solution	0.1 M salt solution	water
D	0.1 M salt solution	water	0.3 M salt solution

5 A student carried out four tests for biological molecules. The observations are shown in the table.

test	observations
Benedict's	blue
biuret	purple
emulsion	clear
iodine	yellowish-brown

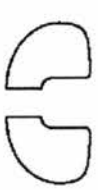
Which molecule is likely to be present in the solution?

A $(C_6H_{10}O_5)_n$
B $C_6H_{12}O_6$
C $C_{29}H_{41}N_9O_{10}$
D $CH_3(CH_2)_3COOH$

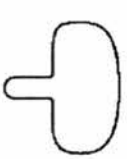
6 The diagram represents an enzyme molecule.

What could be substrate(s) for this enzyme?

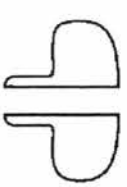
W



X



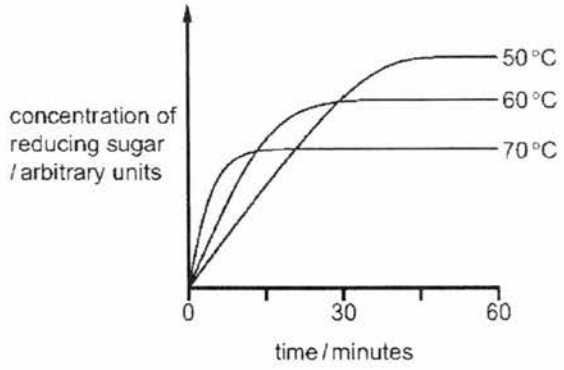
Y



Z

A W only **B** Y only **C** W and X **D** Y and Z

7 The graph shows the results of an investigation into the effect of amylase on starch at three different temperatures.



Which statements are correct conclusions using these results?

1 The optimum temperature is 50 °C.
2 The initial rate of reaction is highest at 70 °C.
3 The higher the temperature the more quickly the enzyme denatures.

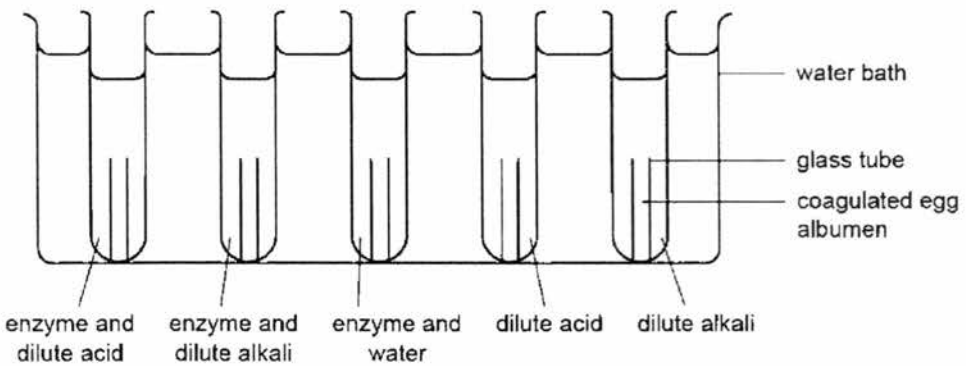
A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

8 What are the effects of drinking a large amount of alcohol?

	effect on brain	effect on reaction time
A	depressed	decreases
B	depressed	increases
C	stimulated	decreases
D	stimulated	increases

9 An experiment was set up to investigate the effect of an enzyme on coagulated egg albumen.

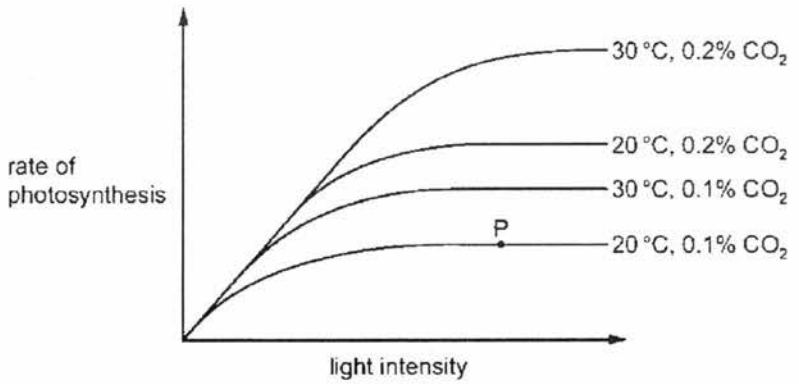
The results, after three hours, are shown in the diagram.



Where in the digestive system is the enzyme produced?

A liver
B pancreas
C salivary glands
D stomach wall

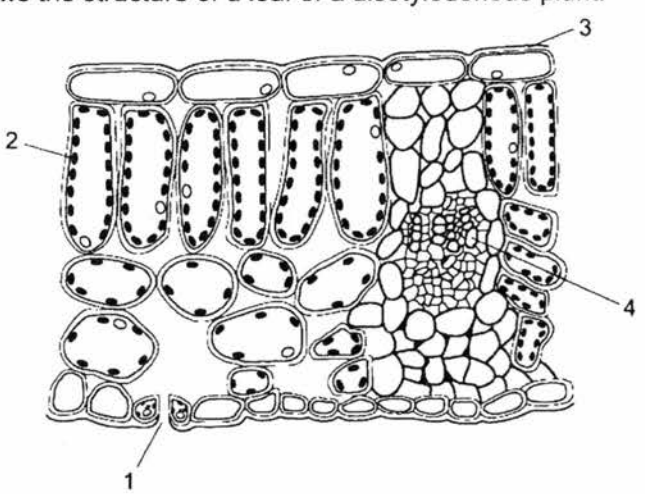
10 The diagram shows how the rate of photosynthesis varies with light intensity.
The four curves show different temperature and carbon dioxide concentration.



What limits the rate of photosynthesis at point **P**?

	light intensity	carbon dioxide concentration	temperature
A	✓	✓	×
B	✓	×	×
C	×	✓	✓
D	×	×	✓

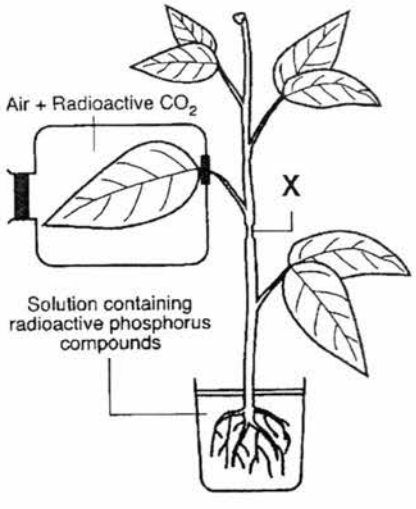
11 The diagram shows the structure of a leaf of a dicotyledonous plant.



What are the functions of the parts labelled on the diagram?

	1	2	3	4
A	gaseous exchange	photosynthesis	reducing evaporation	transport
B	photosynthesis	gaseous exchange	transport	reducing evaporation
C	photosynthesis	reducing evaporation	gaseous exchange	transport
D	transport	reducing evaporation	gaseous exchange	photosynthesis

12 An experiment was designed to study the movement of materials in a photosynthetic plant with the phloem removed at the level marked **X** and the xylem left intact. After several hours, the relative amounts of radioactive carbon and phosphorus compounds in different parts of the plant were determined.

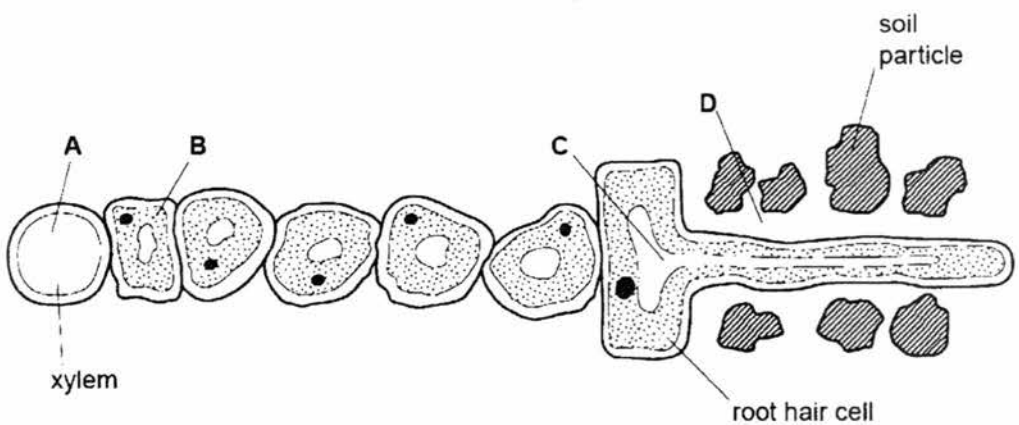


What would be observed at the end of the experiment?

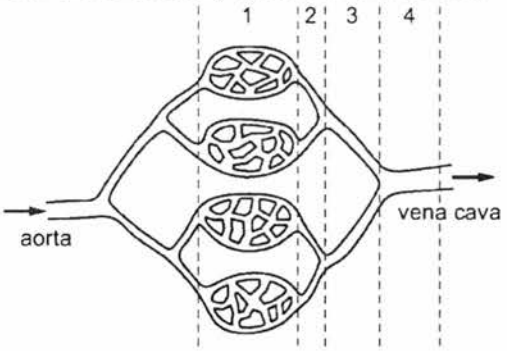
1 Radioactive carbon compounds were detected in the root tissues.
2 Transport of radioactive carbon compounds occurred in both directions of the stem.
3 Radioactive phosphorus compounds were transported up the stem in the xylem.
4 There was a small swelling containing radioactive carbon compounds located in the region above **X**.

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

13 The diagram shows part of a plant root in the soil. The root is absorbing water. At which labelled point is the water potential highest?



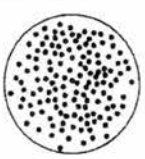
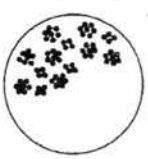
14 The diagram shows part of the circulatory system of a mammal.



At which regions, are the blood pressure and speed of flow the lowest?

	lowest blood pressure	lowest speed of flow
A	1	4
B	2	3
C	3	2
D	4	1

15 A sample of blood is taken from Edwin and his blood is tested with serum containing antibodies a and antibodies b respectively. The results of the test are shown below.

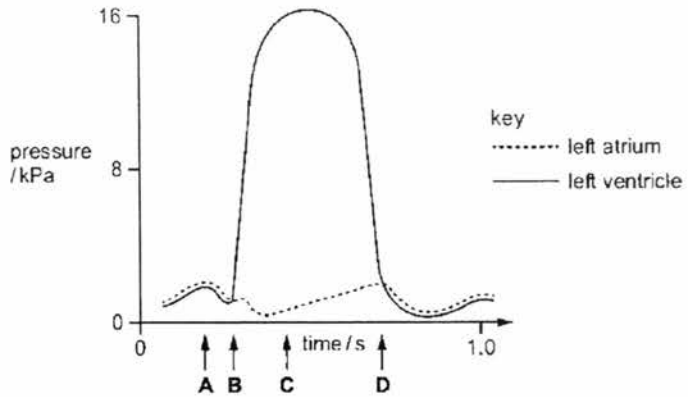
	serum with antibodies a	serum with antibodies b
blood samples		

What does this tell you about the characteristics of Edwin's blood type?

A His red blood cells contain antigen A.
B His red blood cells do not have any antigens.
C His blood type is AB.
D He can donate blood to another person of blood type B.

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

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



17 What maintains the steep concentration gradients needed for successful gas exchange in the lungs?

1 Air flow in the alveoli is in the opposite direction to blood flow in the capillaries.

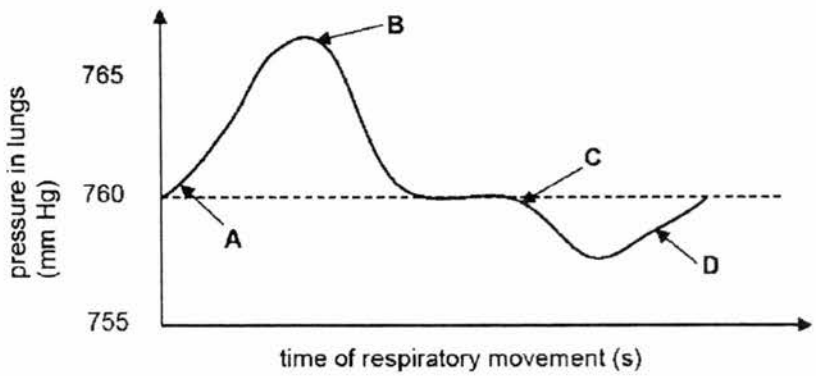
2 Blood arrives in the lungs with a lower oxygen concentration and a higher carbon dioxide concentration than the air in the alveoli.

3 Blood is constantly flowing through and out of the lungs, bringing a fresh supply of red blood cells.

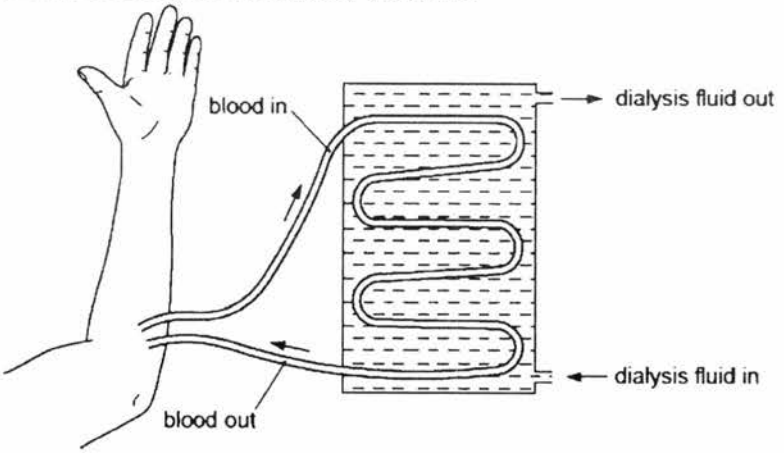
A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

18 The diagram below illustrates changes in air pressure taking place inside the lungs during a complete cycle of breathing. Atmospheric pressure is 760mm of mercury.

Which one of the positions **A**, **B**, **C** or **D** on the graph corresponds to the stage when the ribs are going to be raised?



19 The diagram represents part of a kidney machine.



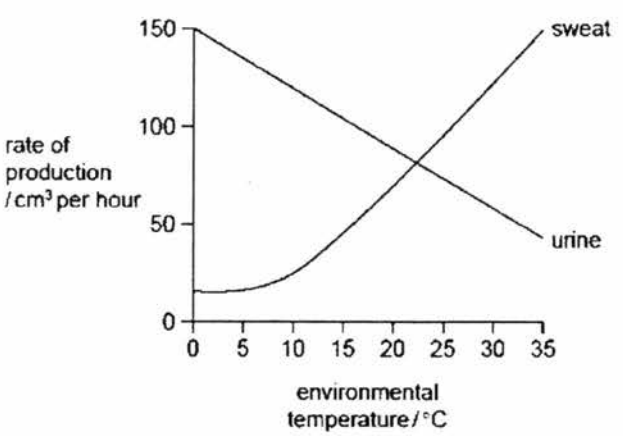
Which substance must be at the same concentration in the dialysis fluid and in the blood?

A glucose **B** salt **C** urea **D** water

20 Which part of the skin plays a major role in insulating the human body?

A blood vessels
B fatty tissue
C hair follicles
D sweat glands

21 The graph shows the rates of production of sweat and urine at different environmental temperatures.



Which statement is correct?

A As the temperature increases, the rate of sweat production decreases.
B At 22 °C, the rates of sweat and urine production are the same.
C Urine and sweat production are directly proportional to environmental temperature.
D When the urine production decreases, the sweat production decreases.

22 A man injures his arm in an accident. Thereafter, he can feel objects touching his hand, but he cannot move his hand away from them.

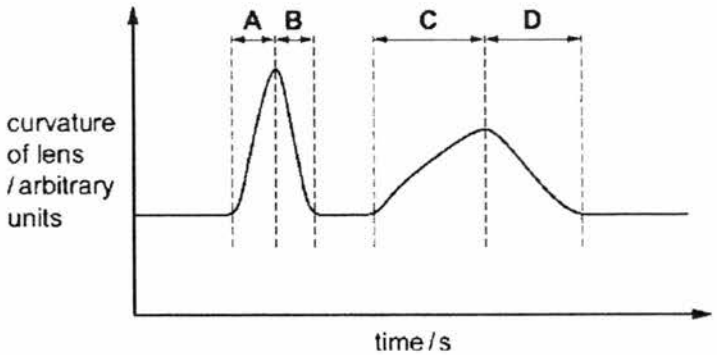
What could cause this?

A Receptors in his hands are damaged.
B The nerve connection is cut only between the receptors in his hand and his central nervous system.
C The nerve connection is cut only between his central nervous system and the effectors in his arm.
D Both of these nerve connections are cut.

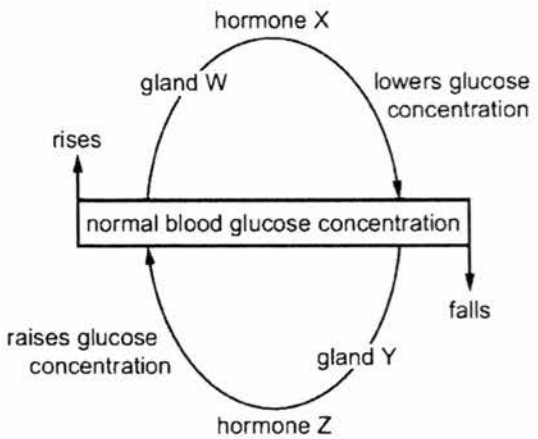
23 The diagram shows the curvature of the lens in a person's eye.

The shape of the lens changes as the person watches two motorbikes go past at different speeds.

During which period was a motorbike moving towards the person at the higher speed?



24 The diagram shows the mechanisms that control the concentration of glucose in the blood.



Which row identifies the glands and hormones labelled W, X, Y and Z?

	gland W	hormone X	gland Y	hormone Z
A	adrenal gland	adrenaline	adrenal gland	glucagon
B	adrenal gland	adrenaline	pancreas	insulin
C	pancreas	glucagon	adrenal gland	insulin
D	pancreas	insulin	pancreas	glucagon

25 A double stranded DNA molecule was analysed and 29% of its nucleotide bases were found to be adenine.

What percentage of its nucleotide bases will be cytosine?

A 21% **B** 29% **C** 42% **D** 58%

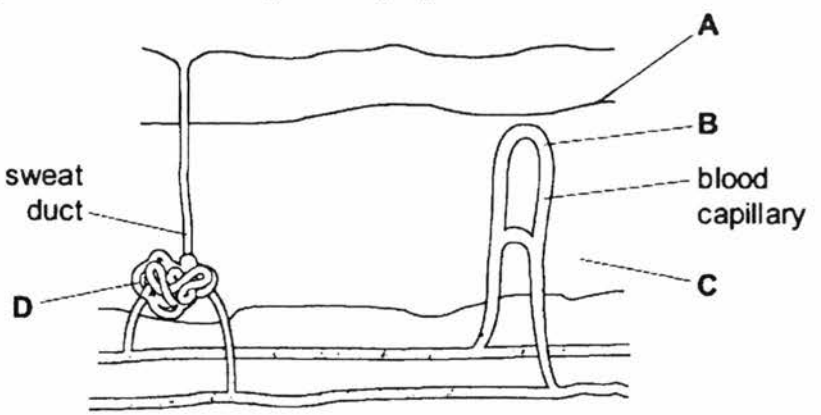
26 When a gene mutation occurs, which of the following may be altered, resulting in the production of a non-functional protein?

1 amino acid sequence
2 DNA nucleotide sequence
3 mRNA nucleotide sequence

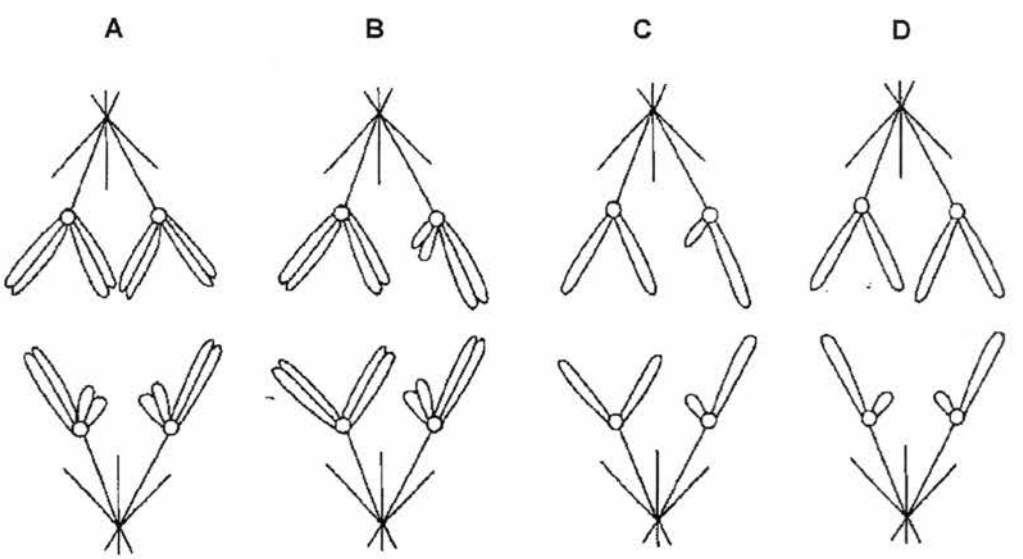
A 2 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

27 The diagram represents a section through the human skin.

In which part is mitosis occurring most rapidly?

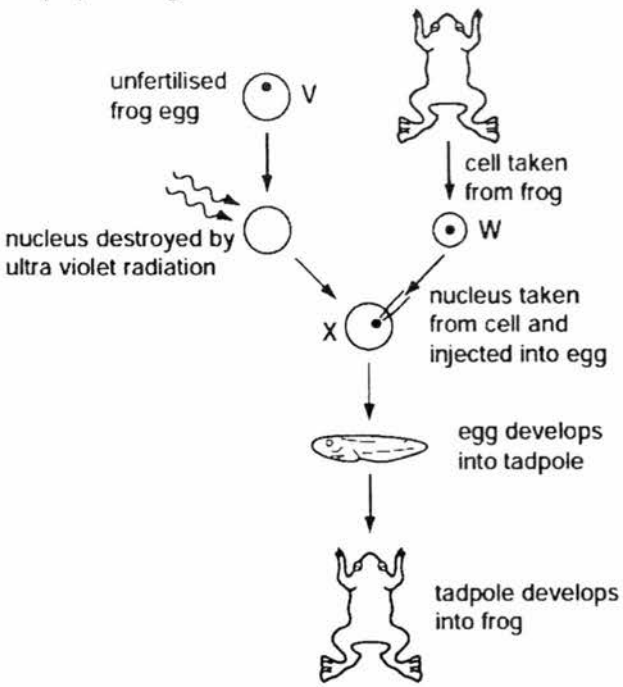


28 Which diagram shows early anaphase of the first division of meiosis (anaphase I) of a nucleus containing two pairs of homologous chromosomes?



29 The diagram shows how genetically identical frogs can be developed from unfertilised frog eggs.

The diploid number (2n) for frogs is 26.



Which combination of numbers correctly identifies the number of chromosomes in each cell in the diagram?

	V	W	X
A	13	13	26
B	13	26	13
C	13	26	26
D	26	26	13

30 Small pieces of root tissue are taken from an oil palm tree and placed in a nutrient medium. Each small piece produces a new oil palm tree.

Which type of reproduction is this and how do the genotypes of the new trees compare with that of the parent tree?

	type of reproduction	genotype
A	asexual	different
B	asexual	identical
C	sexual	different
D	sexual	identical

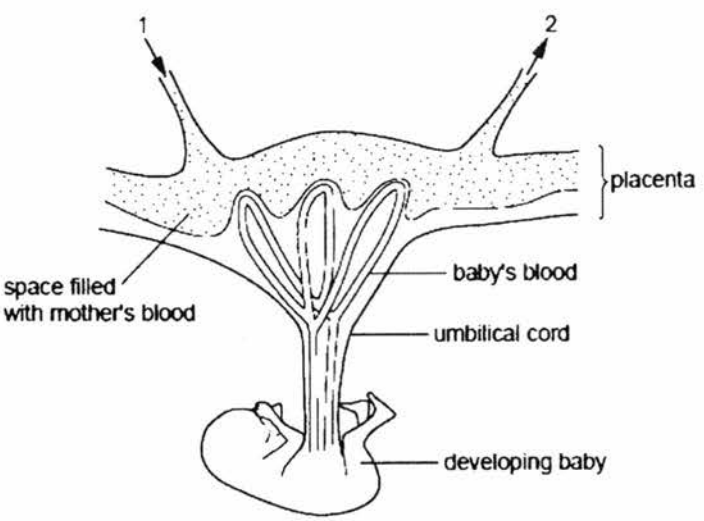
31 During sexual reproduction in plants, which of the following will result in the greatest variation in the offspring?

A All of the flowers on the same plant have male and female reproductive organs.
B The anthers and stigmas on the same plant mature at the same time of year.
C There are separate male and female flowers on the same plant.
D There are separate male and female plants.

32 Flowers show adaptations for wind or insect pollination.
Which of these adaptations are found in a wind-pollinated flower?

	anther	nectar	petals	stigma
A	firmly attached	present	brightly coloured	within the flower
B	firmly attached	present	dull	outside the flower
C	loosely attached	absent	brightly coloured	within the flower
D	loosely attached	absent	dull	outside the flower

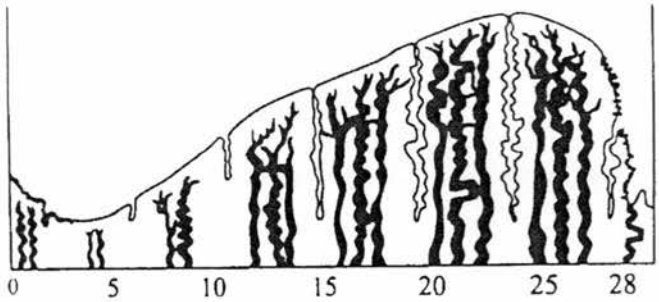
33 The diagram shows the arrangement of blood vessels in the uterus wall and placenta of pregnant woman.



Which will increase in concentration in the blood as it flows from 1 to 2?

A amino acids
B carbon dioxide
C glucose
D oxygen

34 The diagram shows the variation in thickness of the endometrium throughout a menstrual cycle of a healthy female.



During which stage of the menstrual cycle would the levels of oestrogen and progesterone surge?

	surge in oestrogen	surge in progesterone
A	days 1 to 5	days 15 to 20
B	days 5 to 10	days 1 to 5
C	days 5 to 15	days 15 to 25
D	days 15 to 25	days 5 to 15

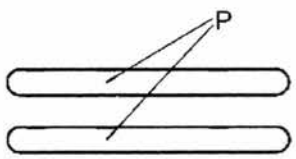
35 In humans, the allele for achondroplasia dwarfism is dominant over the normal allele.

A homozygous recessive individual is normal; a heterozygous individual is dwarfed, while a homozygous dominant individual is always fatal before or shortly after birth due to severe developmental defects.

If a dwarf man marries a dwarf woman, what is the probability of them having a normal child that will grow into adulthood?

A 0% **B** 25% **C** 33% **D** 50%

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



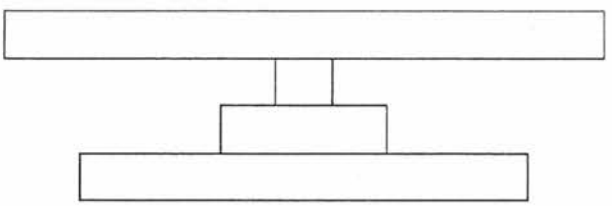
What do the lines labelled P point to?

A the site of alleles made up of two or more genes which are always the same
B the site of alleles made up of two or more genes which might be different
C the site of genes made up of two or more alleles which are always the same
D the site of genes made up of two or more alleles which might be different

37 How does artificial selection differ from natural selection?

A Selection changes the characteristics of living things.
B Selection is based on genetic variation.
C Selection is not based on adaptation to their environment.
D Selection occurs over many generations.

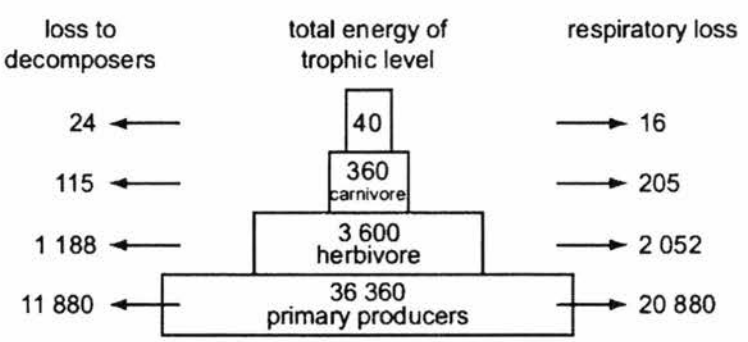
38 The diagram shows a pyramid of numbers.



Which food chain is represented by this pyramid of numbers?

A grass → antelope → lion → flea
B mahogany tree → caterpillar → finch → hawk
C microscopic plants → microscopic animals → small fish → shark
D pond plant → snail → large beetle → fish

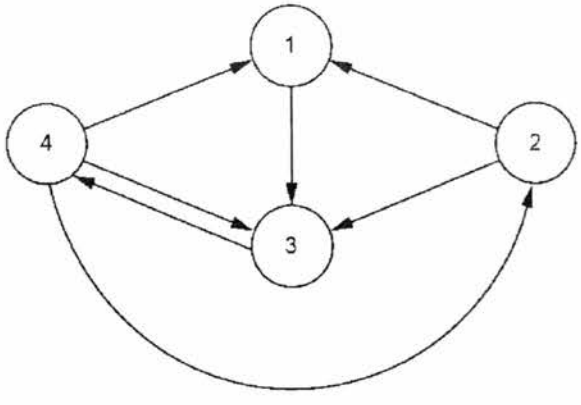
39 The diagram represents loss of energy from a food chain to decomposers, transfer of energy to the next trophic level and energy loss through respiration. All figures are in kJ m^{-2} y^{-1}.



What is illustrated by this diagram?

A Carnivores lose more energy than herbivores.
B Energy loss to decomposers is higher than respiratory loss.
C Energy transfer between trophic levels is about 10%.
D The energy of the final trophic level is not used.

40 In the diagram, arrows represent the movements of carbon compounds in the carbon cycle. The circles represent carbon compounds in animals, decomposers, plants and the atmosphere.



What is represented by each circle?

	1	2	3	4
A	animals	atmosphere	plants	decomposers
B	atmosphere	plants	decomposers	animals
C	decomposers	animals	atmosphere	plants
D	plants	decomposers	animals	atmosphere

Candidate Name:	Class	Index No.

FUHUA SECONDARY

FUHUA SECONDARY SCHOOL

Secondary Four Express

Preliminary Examination 2017

4E

BIOLOGY

5158/02

23 Aug 2017
1125 - 1310
1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

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

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

Section B
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.
The last question is in the form of Either/ Or.

You are advised to spend no longer than 1 hour on Section A and no longer than 45 minutes on Section B.

Electronic calculator may be used.

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

PARENT'S SIGNATURE	FOR EXAMINER'S USE		
	50	30	80

This question paper consists of 16 printed pages including this page.

Section A: Structured Questions [50 marks]

Answer **all** the questions in this section in the spaces provided.

1 A student investigated the effect of pH on the activity of the enzyme amylase. She set up the apparatus shown in Fig. 1.1.

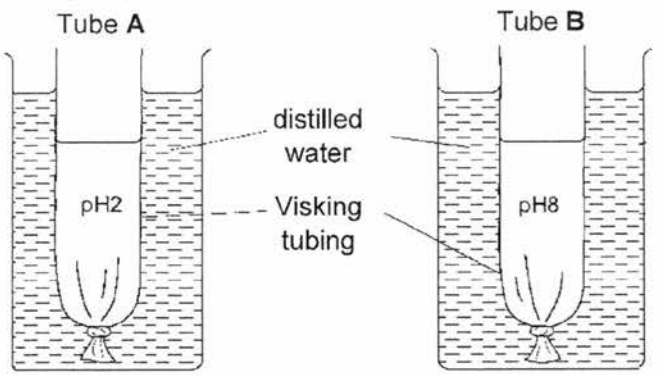


Fig. 1.1

- She added an equal volume of amylase solution and starch to each tube.
- She added a buffer solution at pH 2 to tube **A**.
- She added an equal volume of buffer solution at pH 8 to tube **B**.

After 30 minutes, she measured the height of the solutions in both tubes. She then tested the solutions outside of tubes A and B using Benedict's test. The results of the measurements are shown in Table 1.1.

Table 1.1

	tube **A**	tube **B**
initial height/ cm	5.0	5.0
final height/ cm	5.0	6.0

(a) State the results of the Benedict's test obtained using the samples from tubes **A** and **B** in the table below.

	results of Benedict's test
tube **A**	
tube **B**	

[1]

(b) Explain the result observed for tube **B** in Table 1.1.

[3]

(c) The student concluded from her investigation that the optimum pH of amylase was pH 8. Suggest whether this conclusion is valid.

_____

_____ [1]

[Total: 5]

2 Fig. 2.1 shows the blood supply to the liver of a mammal.

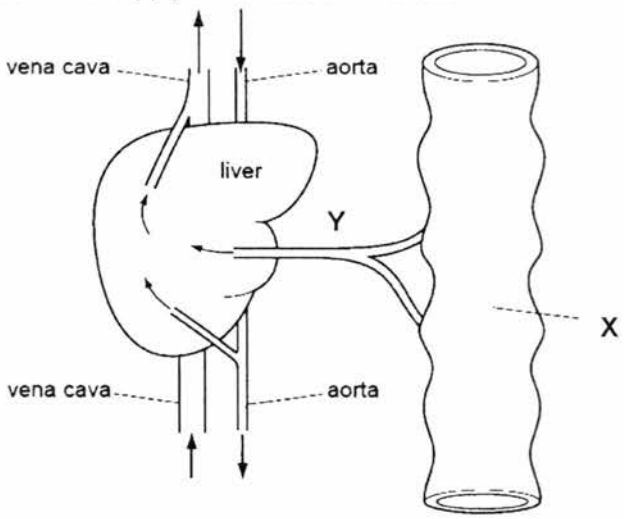


Fig. 2.1

(a) Name organ **X** and blood vessel **Y**.

organ **X** _____

blood vessel **Y** _____ [1]

(b) The products of protein digestion are carried to the liver.
State **two** ways in which the liver may deal with these products of protein digestion.

1. _____

_____

2. _____

_____ [2]

(c) Explain how on arriving at the liver, the carbohydrate in blood vessel **Y** is converted into a storage form.

_____

_____

_____ [2]

(d) Coeliac disease is a disease of the digestive system. It damages the lining of the small intestine when foods that contain gluten are eaten. Gluten is a protein found in wheat.

Fig. 2.2 shows the lining of the small intestine of a child unaffected by gluten and a child with coeliac disease.

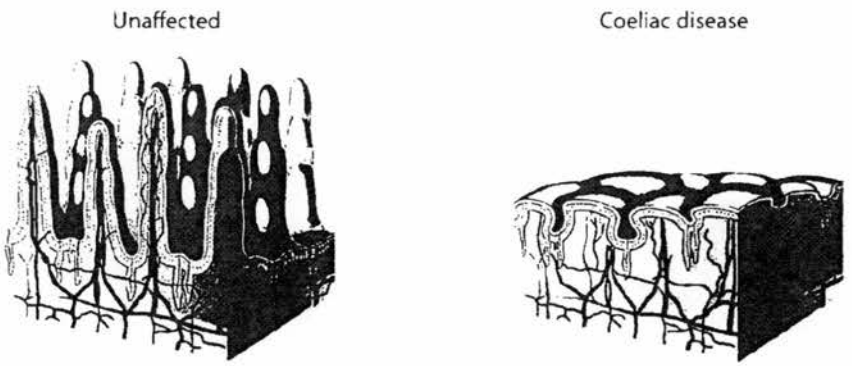


Fig. 2.2

Symptoms of coeliac disease include poor growth.
Suggest why a person with coeliac disease might have this symptom.

_____

_____

_____

_____

_____ [3]

[Total: 8]

3 Fig. 3.1 shows a vertical section through a human heart and the major blood vessels.

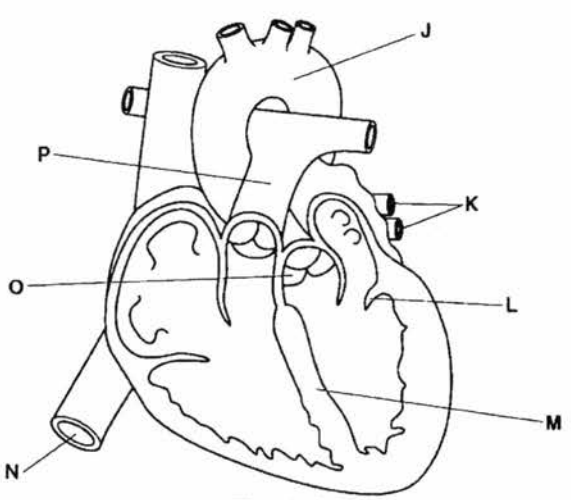


Fig. 3.1

(a) Identify the structures labelled **K** and **O** as shown in Fig. 3.1.

K _____ **O** _____ [1]

(b) Using the letters in Fig. 3.1, identify a blood vessel that has:

(i) blood with the highest concentration of carbon dioxide _____

(ii) the highest pressure _____ [1]

(c) Describe how blood is moved by the heart from structure **K** to structure **J**.

_____

_____

_____

_____

_____

_____

_____

_____ [4]

(d) Fig. 3.2 shows the volume of blood pumped out of the left ventricle per minute.

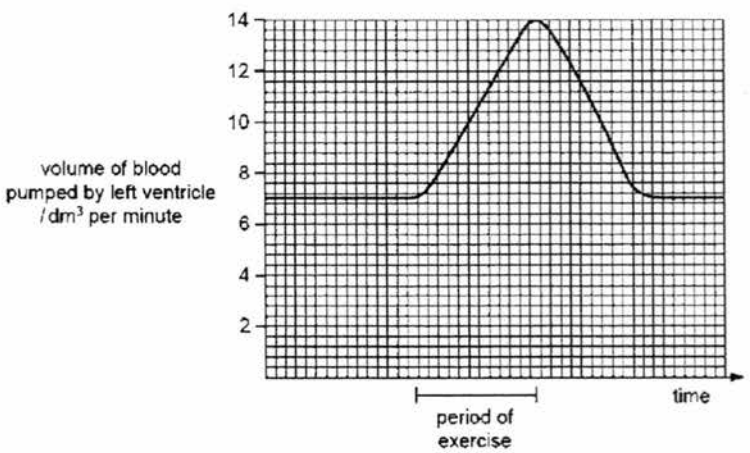


Fig. 3.2

(i) What is the maximum increase in the volume of blood pumped out of the left ventricle during exercise?

_____ [1]

(ii) Explain the advantages of this increased flow of blood during exercise.

_____

_____

_____

_____

_____

_____ [3]

[Total: 10]

4 Fig. 4.1 shows the flow of energy through an aquatic ecosystem that is **not** used by humans at any of the trophic levels.

The unit of energy flow is kJ per m^2 per year.

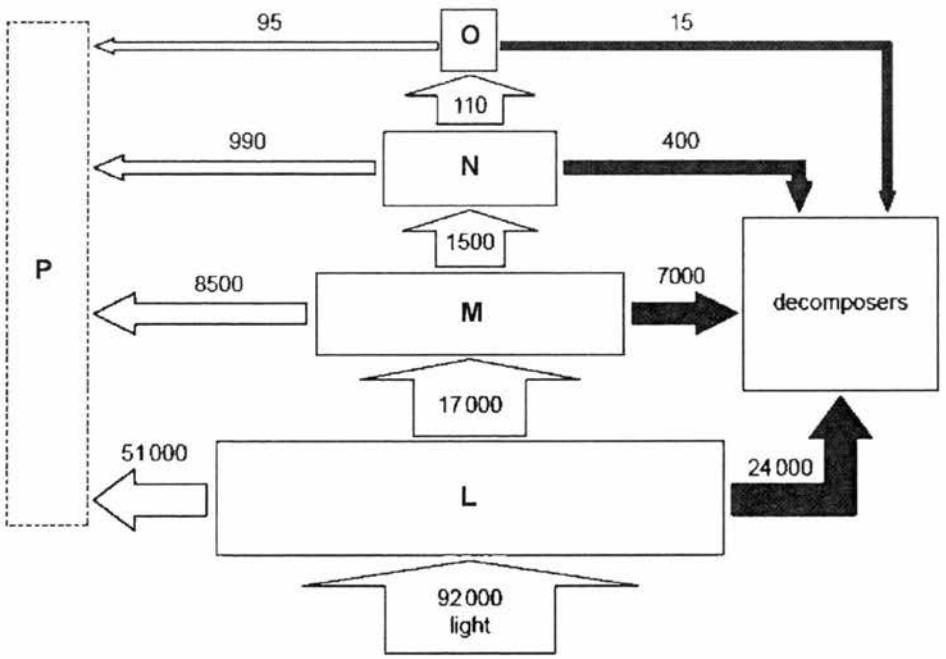


Fig. 4.1

(a) The letters **L** to **O** represent the different trophic levels in the ecosystem.

(i) Name the first and third trophic levels, **L** and **N**.

L _____

N _____ [1]

(ii) With reference to Fig. 4.1, suggest why there are no predators in the ecosystem feeding on the animals in trophic level **O**.

_____

_____

_____

_____ [2]

(iii) **P** in Fig. 4.1 does **not** represent any organism.
Explain what **P** represents in the energy flow diagram.

_____

_____ [1]

(b) Fig. 4.2 show the changes in nitrate levels and the biological oxygen demand (BOD) of the same rivers over a number of years. A high BOD means that there is a large population of microorganisms in a water sample.

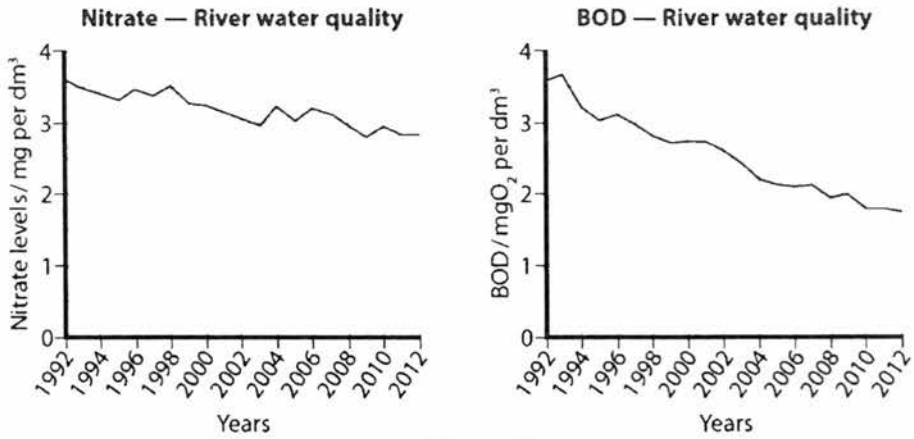


Fig. 4.2

Explain the relationship between nitrate levels and BOD in these rivers.

_____

_____

_____

_____

_____ [3]

[Total: 7]

5 Pepper plants can be grown in glasshouses with electric lamps installed.

The amount of carbon dioxide in the air inside a glasshouse was measured on two different days, **M** and **N**. The lamps could not be used on one of these days because there was no electricity.

Fig. 5.1 shows the amount of carbon dioxide in the air around the pepper plants on day **M** and day **N**.

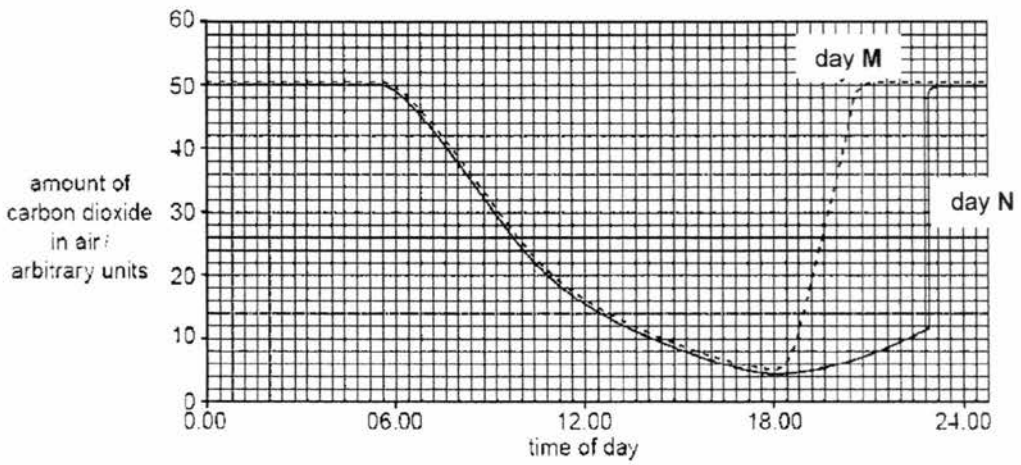


Fig. 5.1

(a) **(i)** State the time of day by which the pepper plants had removed most of the carbon dioxide.

_____ [1]

(ii) With reference to Fig. 5.1, explain how you know that there was no electricity on day **M**.

_____

_____

_____ [2]

(b) A student carried out an investigation on transpiration from the leaves.
She chose leaves of similar sizes from the same plant, weighed them and then placed them in different conditions.

Table 5.1 shows the results.

Table 5.1

leaf	initial mass/g	final mass/g	percentage change in mass/%
H	6.3	2.1	
K	6.2	3.7	
L	5.1	4.7	

(i) Complete the table by calculating the percentage change in mass for all the leaves. Leave your answer to the nearest whole number. [1]

(ii) The leaves were exposed to three different conditions as shown in Table 5.2.

State the leaf that was exposed to the conditions listed.

Table 5.2

condition	leaf
cool and humid	
hot and humid	
hot and dry	

[1]

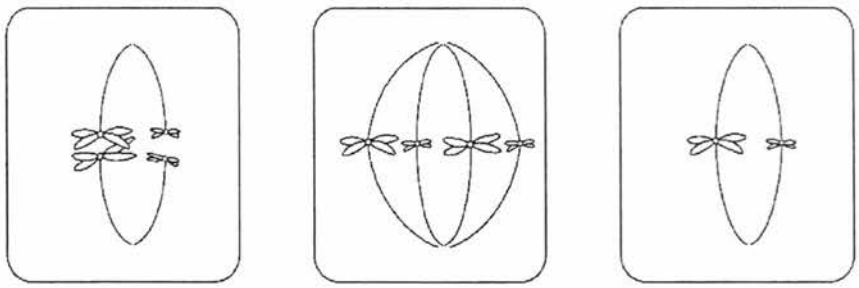
[Total: 5]

6 **(a)** State two reasons why mitosis is important in the life of an organism.

1. _____

2. _____ [2]

(b) Fig 6.1 shows three cells, **A**, **B** and **C**, from tissues in the same organism. Each cell is in a particular stage of either mitosis or meiosis.



cell **A** cell **B** cell **C**

Fig. 6.1

(i) Complete the table below with a tick if the cell matches the feature described.

feature	cell **A**	cell **B**	cell **C**
homologous chromosomes are present			
a stage of mitosis			

[2]

(ii) Fig. 6.2 shows the mass of DNA present in cells of a population of healthy cells where mitosis is occurring.

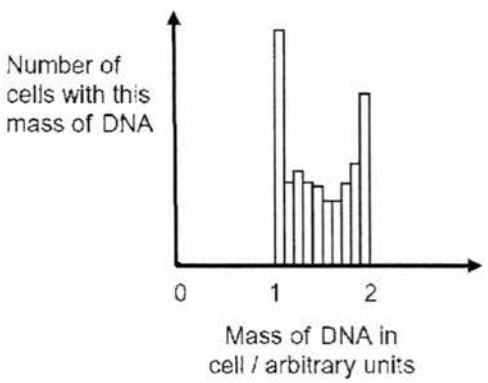


Fig. 6.2

Explain why some cells contain a mass of DNA between 1 and 2 arbitrary units.

_____

_____ [1]

[Total: 5]

7 **(a)** Table 7.1 shows the concentration of substances in different liquids extracted from different locations in the kidney.

Table 7.1

substance	concentration of each substance/g per 100 cm^3	
	plasma	urine
protein	8.0	0.0
glucose	0.10	0.0

With reference to Table 7.1, explain the difference in the concentration of protein and glucose between plasma and urine.

_____

_____

_____

_____

_____

_____

_____ [4]

(b) In an investigation, the volume of urine produced by a student in each day is measured and shown in Table 8.1.

Table 8.1

day	volume of urine/cm^3 per day
1	1440
2	1410
3	910
4	1445
5	1500

Suggest **two** possible reasons for the lower volume of urine produced by the student on day 3.

1. _____

_____

_____

2. _____

_____

_____ [2]

[Total: 6]

8 Fig. 8.1 shows the structure of the placenta and parts of the fetal and maternal circulatory systems.

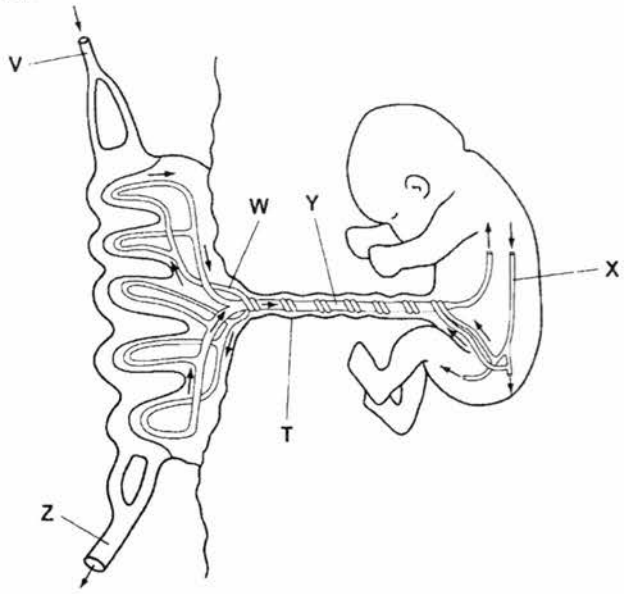


Fig. 8.1

(a) Complete the table below by listing the blood vessels that carry oxygenated blood. Use the letters in Fig. 8.1 to identify the blood vessels.

circulatory system	blood vessels that carry oxygenated blood
maternal	
fetal	

[1]

(b) With reference to named substances in cigarette smoke, explain why a pregnant woman is advised against smoking.

_____

_____

_____

_____

_____ [3]

[Total: 4]

Section B: Free-Response Questions [30 marks]

Answer **all** the questions in this section in the spaces provided.
The last question is in the form of Either/ Or.

9 The distribution of blood groups in the population of some countries is shown in Table 9.1.

Table 9.1

country	percentage of each blood group/ %			
	A	B	AB	O
S	40	20	5	35
T	45	15	8	32
U	24	25	6	45
V	10	0	0	90

(a) Plot a bar chart to show the distribution of the percentage of blood groups for country **S** using the data shown in Table 9.1.

[4]

(b) Based on the data above, state and explain the type of variation shown.

_____

_____

_____ [2]

(c) Suggest why

(i) the percentage of the population with each blood group differs among the countries listed.

_____

_____

_____

_____ [2]

(ii) there is no individual with blood group AB in country V.

_____

_____ [1]

(d) Thalassaemia is an inherited condition in which the haemoglobin in blood does not work properly.

People who have thalassaemia have inherited an allele that causes the condition from both parents. This can happen even if neither parent has the condition.

(i) State and explain whether the allele that causes thalassaemia is dominant or recessive.

_____

_____ [1]

(ii) Using the symbols T (dominant) and t (recessive) to represent the two alleles, state the possible genotypes for a person who does not show symptoms of this condition.

_____ [1]

(e) Before carrying out kidney transplants, blood group of the donor must be checked if it is compatible with the blood group of the recipient. This is called blood typing. However, it is possible to carry out transplants of the cornea without blood typing.

Suggest why it is possible to transplant corneas successfully without carrying out blood typing.

_____

_____ [1]

[Total: 12]

10 **(a)** Describe fertilisation in each of the following:

(i) a human

(ii) a flowering plant.

[5]

(b) Some plant species are self-pollinated.
Discuss the long-term effects of self-pollination on the evolution of these plant species.

[3]

[Total: 8]

EITHER

11 (a) The quality and quantity of food available worldwide has been improved by genetic engineering and artificial selection.

(i) Define *genetic engineering*.

[1]

(ii) Use a **named** example to outline how artificial selection is used to improve quantity or quality of food.

[5]

(b) Explain how chromosomes are involved in the process of inheritance.

[4]

[Total: 10]

OR

11 **(a)** A runner participates in a 400 m race.
Explain how the runner is able to inhale clean atmospheric air during the race.

[5]

(b) Describe how the nervous system is involved in allowing the runner to see ahead clearly.

[5]

[Total: 10]

END-OF-PAPER

FHSS BIOLOGY 5158 SECONDARY 4 PRELIMINARY EXAMINATION 2017 MAR

PAPER 1: MULTIPLE CHOICE QUESTIONS (40 MARKS)

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

PAPER 2 (80 MARKS)

SECTION A: STRUCTURED QUESTIONS (50 MARKS)

- 1 mark O ½ mark ora or reverse argument AW: Alternate wording

1(a)	o Tube A – Solution remains blue o Tube B – Green/Yellow/Orange/Brick-red precipitate formed.
(b)	o Starch hydrolysed or broken down by amylase o Maltose produced o Lower water potential in the tube. o Water enters tube o By osmosis o Down water potential gradient o Through partially permeable membrane

(c) • Only 2 pHs studied/ more pHs need to be tested;

2(a) o X: Small intestine/Ileum
o Y: Hepatic portal vein

(b) Any 2 points
• synthesis of proteins / enzymes / other chemicals ,
• breakdown / deamination (of excess amino acids) ,
• (resulting in) urea formation ;
• (residue of amino acid molecule) used for energy / respired ;

(c) o Reference to insulin ;
o Secreted from pancreas ;
o into blood ;
o stimulate conversion of excess glucose to glycogen

(d) o Damaged villi/lack of villi
o less surface area
o Less absorption of named food molecule (amino acids or glucose)
o Fewer capillaries and/or lacteals
o Lesser glucose results in energy released from respiration is reduced.
o Lesser amino acids to make new proteins.

3(a) o Pulmonary vein
o Semilunar valve

(b) (i) Carbon dioxide: N/P
(ii) Pressure: J

(c) o blood from pulmonary vein / K, enters left atrium
o muscles in atria contract/systole
o Bicuspid valve / L, forced opens due to pressure from blood
o blood forced into left ventricle
o muscles in ventricle contract
o Bicuspid valve / L, forced shut to prevent blood entering atrium
o semi-lunar valves / O, forced open
o blood forced into, aorta / J

(d)(i) • 7 dm^3

(ii) o Exercise needs extra energy
o Increases respiration in muscle (cells)
o Increased delivery of oxygen
o Increased delivery of glucose

- Increased removal of carbon dioxide
- Increased removal of heat
- Reduces risk of depending on anaerobic respiration
- Removes any lactic acid that is produced
- For enhanced performance

4(a)(i)
- L = (primary) producer(s) [Ignore; Plant]
- N = secondary consumer(s) [Ignore: carnivore]

(ii) *Idea that*
- no, energy left
- use figures from Fig. 4.1 to show that all energy to O is already
- little / not enough, energy available from eating, tertiary consumers / O
- loss of (90%) energy, at / between, each trophic level
- would be very small population of predators of O
- (population of) predators of O unlikely to survive
- AVP ; e.g. idea that difficult to be a predator of O because O is likely to be 'large and fierce'

(iii)
- loss of energy (from, each / all, trophic level(s)) by respiration
- (to the) environment / atmosphere / surroundings
- as, heat / thermal energy

(b)
- lower nitrate levels means less plant/algae growth
- less eutrophication
- less plant death
- less decomposition/fewer decomposers/fewer bacteria/equivalent
- reduced aerobic respiration by bacteria
- less oxygen used

5(a)(i)
- 18.00h / 6.00 pm

(ii)
- photosynthesis needs light [Accept: – photosynthesis stopped at 18.00 when it got dark]
- the removal of carbon dioxide stops / amount of photosynthesis falls / amount of carbon dioxide rise

(b)(i) H: - 68%
K : - 40%
L : - 8%

- Negative sign
- Correct values for all 3 leaves

(ii) Cool and humid K:
Hot and humid: L

Hot and dry: H

Award 1m when all correct.

6(a) Any two reasons below:

- Growth / increase in cell number (Ignore growth of cells)
- Replace cells / repair tissue / organs /body (Ignore repair cells)
- Genetically identical cells
- Asexual reproduction / cloning/Allow example or description

(b)(i)

	cell A	cell B	cell C
homologous chromosomes are present	✓	✓	
a stage of mitosis		✓	

1m for each row

(ii)

- (DNA) replication taking place/not finished

7(a)

- Protein molecules are too large to pass out of glomerulus/into Bowman's capsule
- Protein stays in plasma and thus not found in glomerular filtrate and thus urine.
- Glucose molecule is small enough to pass out of glomerulus/into Bowman's capsule
- Glucose in plasma but not in urine
- **All** glucose reabsorbed at the proximal convoluted tubule by active transport

(b) Any two below:

- student drank less water/ ate fewer foods, containing water
- student sweated more
- it was a hotter day
- student exercised/ student had a fever
- student ate a lot of salty food
- lower humidity so water (vapour) lost in exhalation
- student had diarrhea
- student lost a lot of blood

8(a)

- Maternal –V
- Fetal – Y and X

(b)

- carbon monoxide
- combining with haemoglobin in mother's blood
- nicotine narrows blood vessels

- decreasing O_2 carriage / less O_2 absorption by red blood cells
- reduced oxygen available to foetus
- Impaired cell division in fetus
- toxins can pass from mother's blood to fetus' blood / across placenta ;
- impaired development / born underweight / stunted growth / damage to brain / stillbirth / premature b

SECTION B: STRUCTURED QUESTIONS (30 MARKS)

• 1 mark O ½ mark ora or reverse argument AW: Alternate wording

9(a)	• Plot (data correctly plotted) • Axes labelled • Scale along axes appropriate • Correct graph type (bar chart) (reject: histogram)
(b)	• Discontinuous variation • no intermediate values / distinct/ separate categories ;
(c)(i)	o reference to alleles o each person has two alleles (for blood group) o different (allele/ gene) frequency in different populations o ref. inbreeding (of separate groups)
(ii)	o Blood Group AB requires both alleles I^A and I^B to be present. o No Blood group B in country V o No allele I^B present
(d)(i)	o (thalassaemia allele is) recessive; o present in both parents but not affecting them
(ii)	• TT and Tt
(e)	• no, blood / capillaries / antigens / antibodies / white cells / lymphocytes, in the cornea
10(a)(i)	o *fusion / union o *male and female nuclei o (in) sperms / male gametes + ova / eggs / female gametes o oviduct / Fallopian tube

- formation of zygote

(ii)

- *fusion / union
- *male and female nuclei
- in pollen grain
- delivered by / from pollen tube
- to ovule
- an indication that the ovule is in the ovary (or shown on labelled diagram)
- and that female gamete is in the ovule/ovary/embryo sac (or shown on labelled diagram)
- accurate ref. to double fertilization

*only credit once in either (i) or (ii) fusion / union; male and female nuclei;

(b) Any three from:

- limited variation (in phenotype)/limited variety.
- offspring become homozygous (over time) / owtte; allow: reference to inbreeding / limited gene poo
- variation is due to mutation
- low chance that mutations will be expressed
- offspring will be well adapted to conditions near parent
- if environment does not change
- limited opportunity for evolution if environment changes / will not be able to adapt to change in the e
- allow: reference to disease in context (as a change)
- AVP e.g. some variation due to reassortment of chromosomes and crossing over during meiosis / r competition locally

Either

11(a)(i)

- change the genetic material (of an organism)
- by removing / changing / inserting (individual) genes
- from one organism / species to another

(ii)

- suitable named crop plant or domesticated animal
- suitable feature to improve
- select individuals for breeding
- select offspring that show improvement
- use these for future breeding / AW ; A 'repeat the process'

(b) Any 4 below:

- made of DNA
- carries genes

- responsible for characteristics AW (A traits / enzymes)
  (A named character or condition – e.g. eye colour / Down's syndrome)
- passed from one generation to the next AW
- during reproduction / ref. fertilisation
- correct ref. to chromosomes during cell (nuclear) division
- sexual + variation / asexual + no variation

OR

11(a) Any 5 below:

- Diaphragm contracts and flattens.
- Internal intercostal muscles relax while external intercostal muscles contract.
- Volume of thoracic cavity increases.
- Air pressure inside lungs decreases below atmospheric pressure.
- Atmospheric air forces into the lungs from the atmosphere.
- hairs in nose filter/trap + air/dirt
- mucus + adhesion trapping/catching
- cilia + beating/sweeping action (R filtering/trapping)
- carrying dirt/mucus + to throat/upwards

(b)

- Reference to Photoreceptors (in retina)
- Generate nerve impulses
- Transmitted along Optic nerve/sensory neurone
- Relay neurone in brain
- Across synapse
- From brain to effector (ciliary muscles)