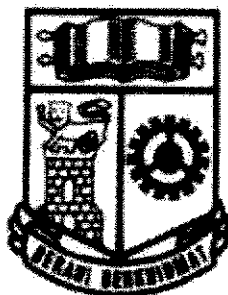


Name: ()

Class: Sec 4B

Queenstown Secondary School



**Preliminary Examination 2021
Secondary Four Express
Biology
6093/01**

**1 September 2021
Wednesday**

**Time: 1200 – 1300h
Duration: 1 hour**

Additional Materials: Multiple Choice Answer Sheet

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 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.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

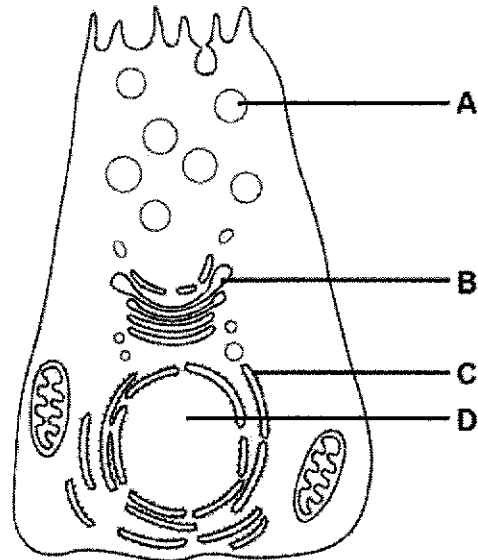
The use of an approved scientific calculator is expected, where appropriate.

This document consists of 22 printed pages.

2

- 1 Radioactively-labelled amino acids are introduced into a cell.

In which cell structure will the radioactivity first become concentrated?

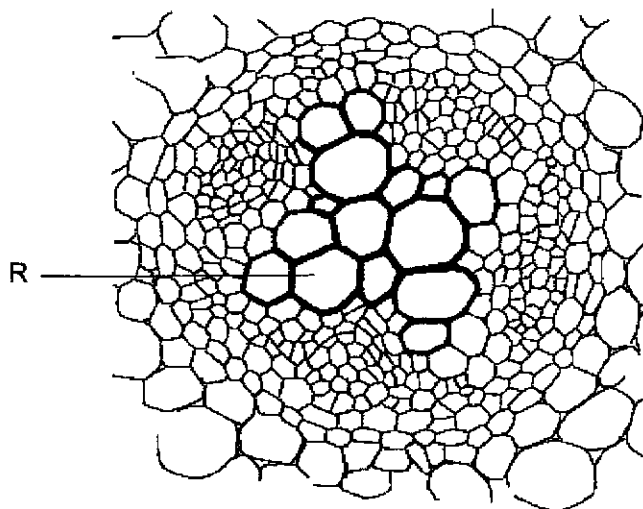


- 2 Which of the following options correctly classifies the body components?

	cell	tissue	organ	organ system
A	blood	stomach	neurone	heart, blood and blood vessels
B	neurone	heart, blood and blood vessels	blood	stomach
C	neurone	blood	stomach	heart, blood and blood vessels
D	blood	neurone	stomach	heart, blood and blood vessels

3

- 3 The diagram shows a photomicrograph of the cross section of a plant stem.



Which row applies to structure R?

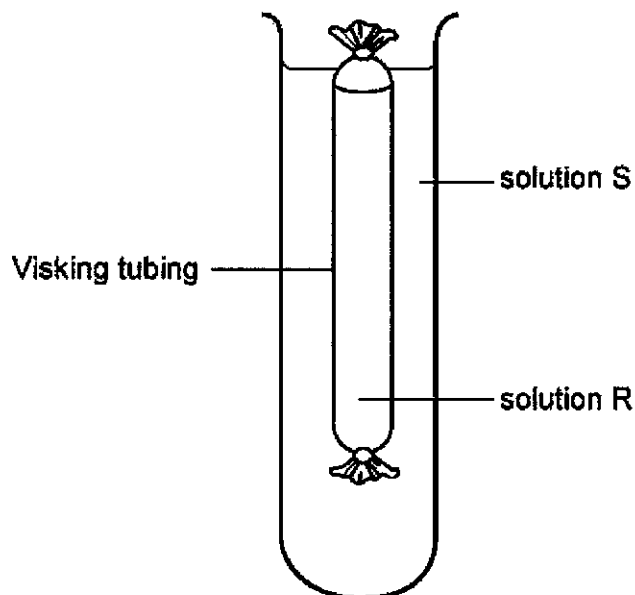
	adaptation present in structure R	function
A	absence of cross wall	keep the plant upright
B	lignified walls	provide mechanical support
C	presence of nucleus	active transport of carbon dioxide
D	presence of sieve plates	conduction of water

4

- 4 Visking tubing is selectively permeable. In the experiment shown below to demonstrate osmosis, the following results were obtained:

initial mass of Visking tubing + contents = 10.0 g

mass of Visking tubing + contents after experiment = 11.8 g

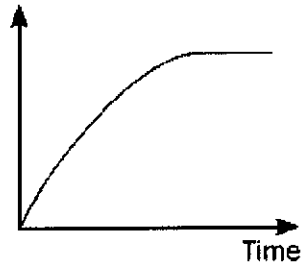


The results shown could be obtained when

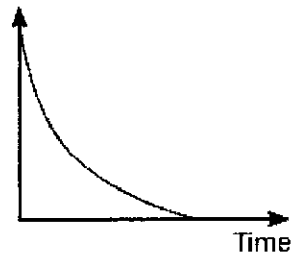
- A R is a 5% salt solution and S is a 10% salt solution.
 - B R is a 10% salt solution and S is a 5% salt solution.
 - C R is water and S is a 10% salt solution.
 - D R is water and S is a 5% salt solution.
- 5 Proteins have different functions.
- Which of the following statements correctly identifies a protein and its function?
- A Antibodies defend the body against disease.
 - B Cellulose provides strength and structure to a plant cell wall.
 - C Enzymes carry chemical messages around the body.
 - D Hormones carry oxygen around the body.

- 6 Which graph shows the changes in the concentration of a product in an enzyme-controlled reaction?

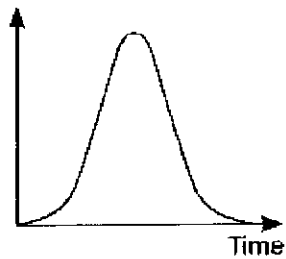
A Concentration of product



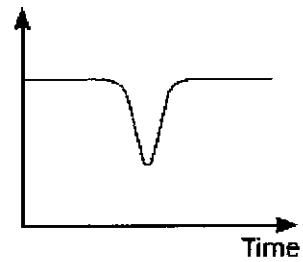
B Concentration of product



C Concentration of product



D Concentration of product

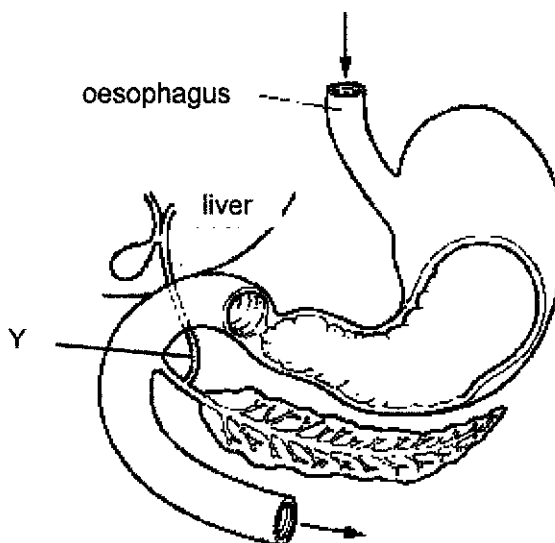


- 7 Which is **not** a function of the liver?

- A** deamination of excess amino acids
- B** detoxification of alcohol
- C** secretion of digestive enzymes
- D** synthesis of bile

6

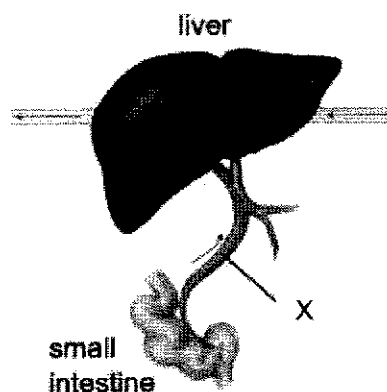
- 8 The diagram shows part of the alimentary canal and associated organs.



What will be the effect of a blockage in tube Y?

- A Amylase will not be produced.
- B Fat will not be emulsified.
- C Insulin injections will be needed.
- D Protein digestion will stop.

- 9 The following diagram shows part of the human alimentary canal.



What is the identity of X and what does it contain?

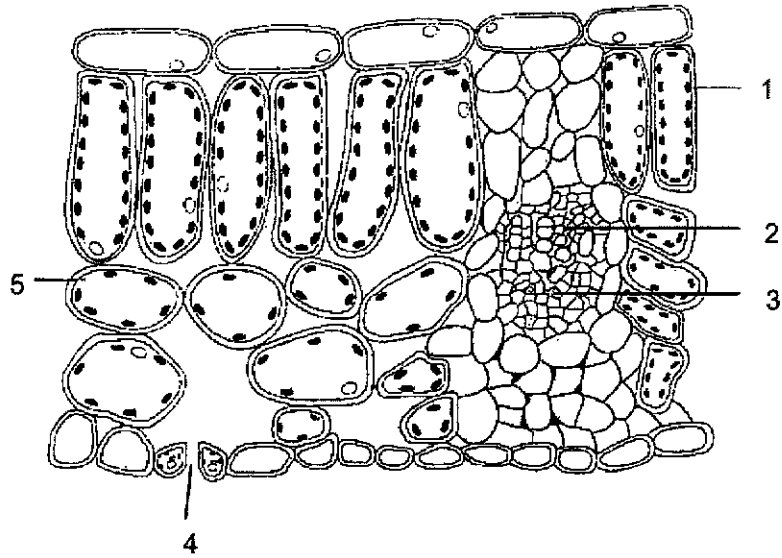
	identity	contents of X
A	hepatic portal vein	rich in digested nutrients
B	hepatic portal artery	contains more urea than glucose
C	hepatic artery	contains more urea than glucose
D	hepatic vein	rich in digested nutrients

- 10 Which of the following are effects of excess consumption of alcohol?

- 1 depression
- 2 disorderliness in public
- 3 improved reaction time
- 4 increased self-control
- 5 liver damage

- A** 1, 2 and 5
B 1, 3 and 4
C 2, 4 and 5
D 3, 4 and 5

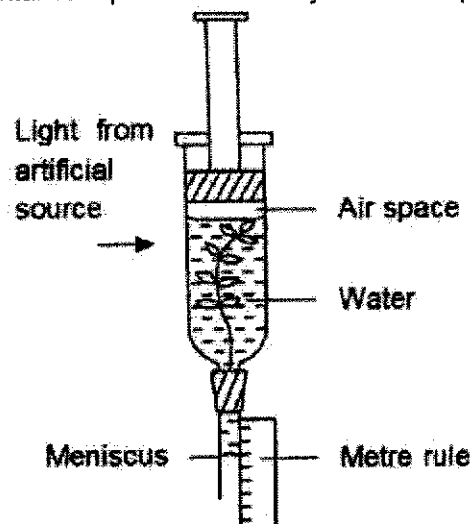
11 The diagram shows a section through a leaf.



Which row correctly describes the function of the numbered parts?

	where most photosynthesis occurs	where most water is lost from the leaf	where water enters the leaf
A	1	4	2
B	3	5	1
C	4	3	5
D	5	2	4

- 12 The following experimental set up is used to study the rate of photosynthesis.



The student decided to replace the water with equal volume of dilute sodium bicarbonate solution. Which of the following would likely be observed?

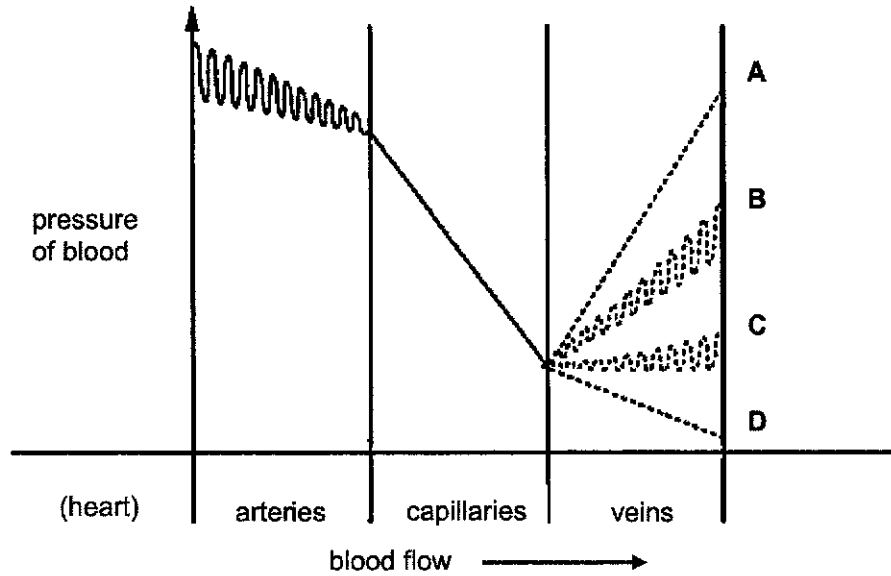
- A The dilute sodium bicarbonate solution will turn green.
 B The meniscus will move downward at a faster rate.
 C The meniscus will move upward at a faster rate.
 D The meniscus will move upward at a slower rate.
- 13 A person has just lost a lot of blood in an accident and a blood transfusion is needed. This patient has blood group B.

Which correctly indicates the patient's blood antigen, antibody and the possible blood groups that the patient can receive?

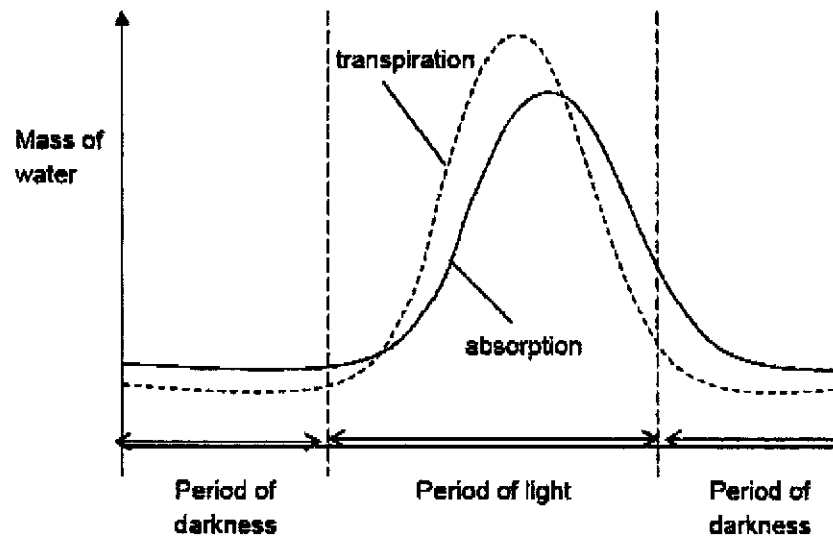
	antigen in patient's blood	antibody in patient's blood	possible donor blood groups
A	A	a	A, B
B	B	b	B, O
C	A	b	A, AB
D	B	a	B, O

- 14 The diagram shows the pressure of blood after it leaves the heart and passes through arteries and then capillaries.

Which dotted line shows the pressure of blood as it flows through veins before returning to the heart?



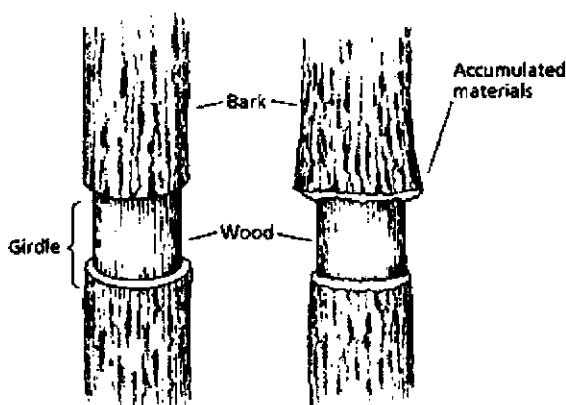
- 15 The graph shows the rate of water absorption and transpiration that occurred in a sunflower plant during a 24-hour period.



Which of the following is a valid conclusion?

- A In darkness, absorption rate always exceeds transpiration rate.
- B In darkness, transpiration rate exceeds absorption rate.
- C In light, absorption rate always exceeds transpiration rate.
- D In light, transpiration rate exceeds absorption rate.

16 A ringing experiment was carried out.



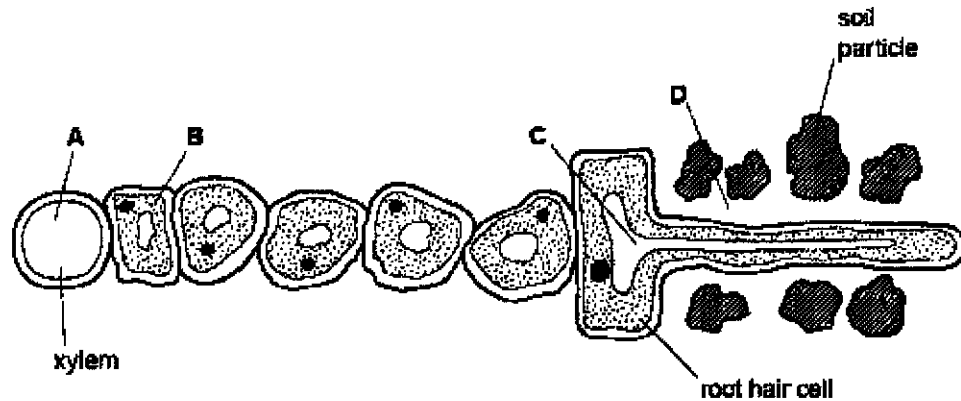
After a few weeks, a swelling formed above the ring. Which of the following is/are the explanation(s) for the appearance of such a swelling?

- I. The cut area absorbed moisture directly from the damp atmosphere that cause it to swell.
- II. The ringing action stimulated the active cell division around the cut area to repair the wounded tissues.
- III. The removal of the phloem caused the downward translocated nutrients to be accumulated above the ringed region thus enhanced active growing of cells.

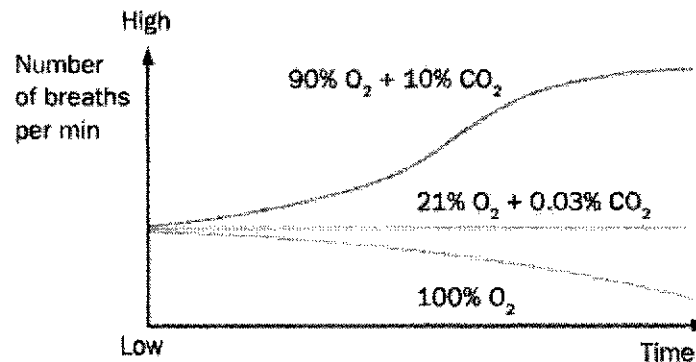
- A I only
- B II only
- C II and III only
- D III only

12

- 17 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?

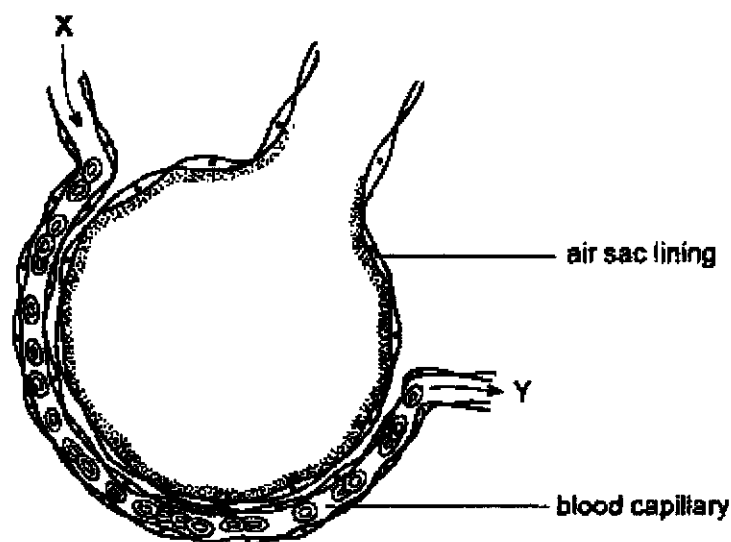


- 18 The diagram shows the effect of concentration of different gases on breathing rate. What can be concluded from the diagram?



- A 0.03% CO₂ concentration is the optimum carbon dioxide concentration for breathing.
 B More aerobic respiration takes place when there is more oxygen.
 C The higher the carbon dioxide concentration, the higher the rate of breathing.
 D The higher the oxygen concentration, the lower the breathing rate.

- 19 The diagram below shows the blood supply to cells lining an air sac in the lungs.



Which row in the table shows correctly the change in concentration of glucose and oxygen as blood flows from X to Y?

	glucose	oxygen
A	increase	increase
B	increase	decrease
C	decrease	increase
D	decrease	decrease

- 20 What causes a smoker to cough?

- A** carbon monoxide reducing the carriage of oxygen by haemoglobin
- B** cilia stop beating and the bronchi becoming blocked with mucus
- C** nicotine damaging the lining of bronchi
- D** tar reducing the surface area for gas exchange in the alveoli

- 21 Fitness training increases the concentration of lactic acid that runners can build up in their muscles before pain stops them from running.

What is a consequence of this increase?

- A Aerobic respiration in muscles can be more rapid.
 - B Blood flow to the muscle is increased.
 - C More anaerobic respiration can take place in muscles.
 - D More energy is needed by the muscles.
- 22 Which row in the table below identifies correctly the effect of increased secretion of anti-diuretic hormone (ADH) on the composition and volume of urine?

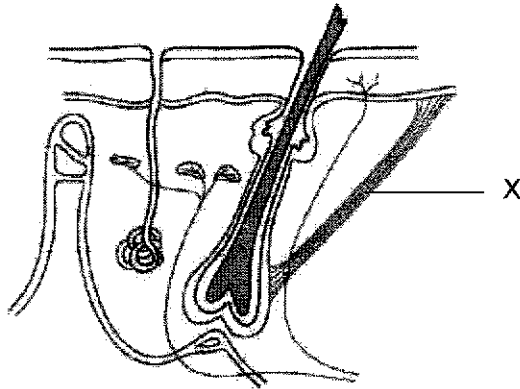
	concentration of urea	concentration of glucose	volume of urine
A	no change	no change	increase
B	increase	increase	decrease
C	increase	no change	decrease
D	decrease	no change	increase

- 23 What are the percentages of urea, water and glucose in the urine of a healthy human?

	percentage in the urine		
	urea	water	glucose
A	85	15	0
B	30	65	2
C	2	95	0
D	10	80	5

15

24 The diagram shows a section through the human skin.

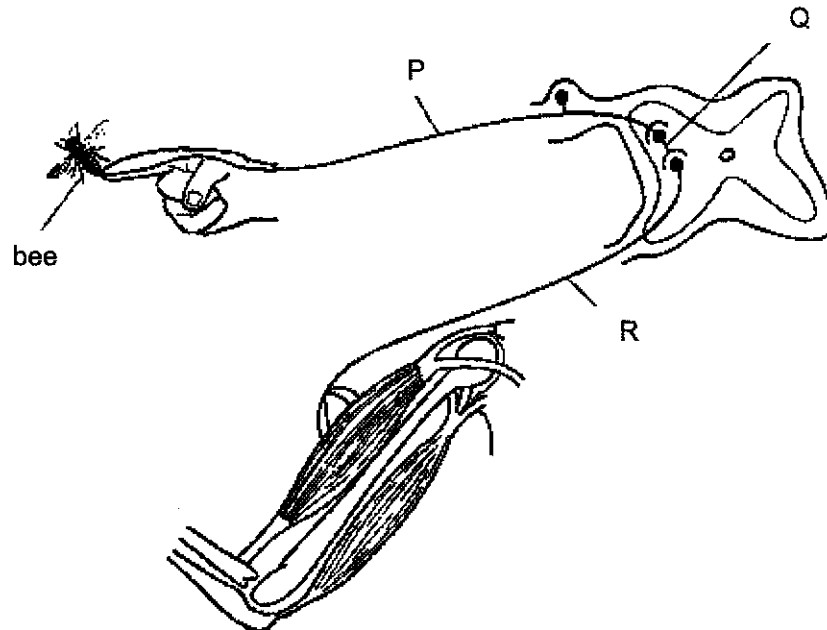


What happens when structure X fails?

- A less blood will flow towards the skin
- B more sweat will be produced to cool the body even faster
- C the skeletal muscles will contract to cause shivering
- D the skin will not be protected against cold

16

- 25 The diagram shows a reflex arc in which a bee sting causes the arm to be moved quickly.



If the neurone at R is damaged, how will the transmission of nerve impulses in the reflex arc be affected?

	pain felt?	arm moved?
A	no	no
B	no	yes
C	yes	no
D	yes	yes

- 26 In myopia, or short-sightedness, distant objects appear blurred while near objects are clear. Which of the following are possible reasons for myopia?

- 1 ciliary muscles cannot contract sufficiently
- 2 circular muscles cannot relax sufficiently
- 3 lenses are unable to become thinner
- 4 suspensory ligaments cannot become taut

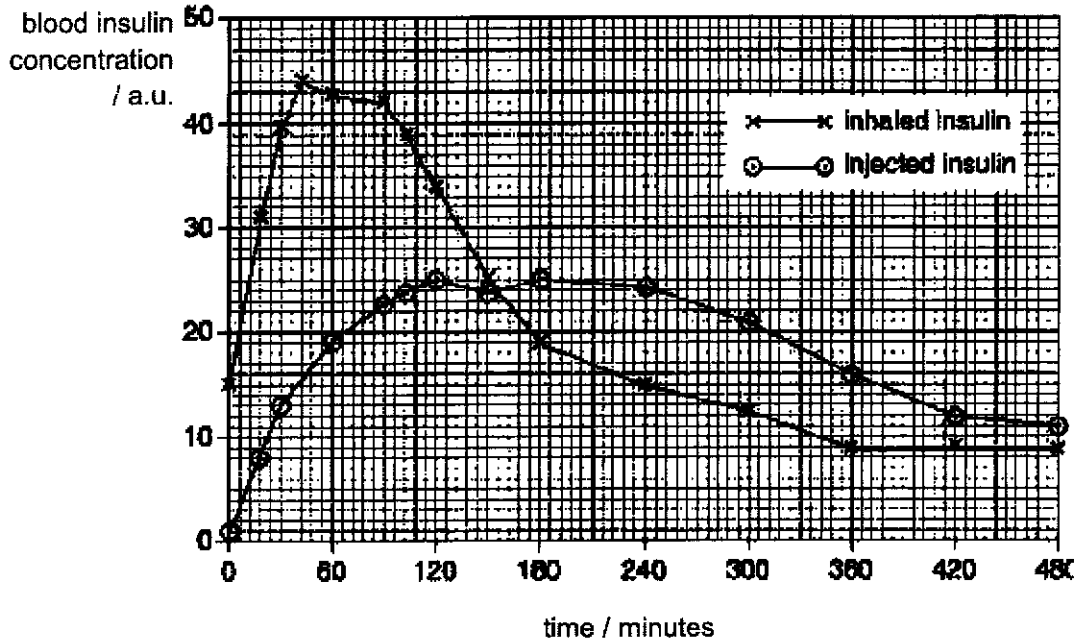
A 3 only

B 2 and 4

C 3 and 4

D 1, 3 and 4

- 27 A study was done to compare the uptake of insulin in the blood plasma by injection and by inhalation. The graph below shows the results of the study.

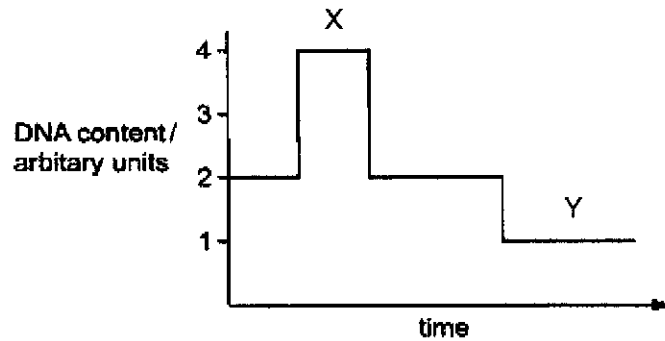


What is a valid conclusion from the results?

- A Blood glucose concentration at 480 minutes is the same, whether insulin is injected or inhaled.
- B Inhaled insulin enters the blood faster than injected insulin.
- C Injected insulin gets broken down faster than inhaled insulin.
- D Injected insulin is dispersed among adipose tissue before reaching blood vessels.
- 28 Each skin cell in a mouse has 40 chromosomes. How many chromosomes were present in each cell after a skin cell divided four times during cell culture?

- A 10 B 20 C 40 D 160

- 29 The graph shows the amount of DNA in the nuclei of cells dividing by meiosis.



What stages do X and Y represent respectively?

- A metaphase I and telophase I
 - B prophase I and telophase II
 - C telophase I and metaphase II
 - D telophase I and telophase II
- 30 Flowering plants have evolved to use different methods to ensure successful pollination.

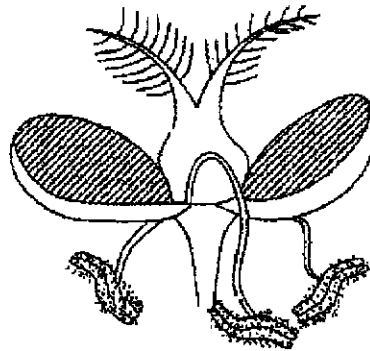
Some of these methods are listed.

- 1 Plant 1 has flowers in which the female parts ripen before the male parts.
- 2 Plant 2 has separate male and female flowers.
- 3 Plant 3 has separate male and female parts.
- 4 Plant 4 has flowers in which the male parts ripen before the female parts.
- 5 Plant 5 has flowers in which the male and female parts ripen at the same time.

Which method(s) make it more likely that cross-pollination will take place?

- A 1, 2, 3 and 4 only
- B 1 and 4 only
- C 2 and 3 only
- D 5 only

- 31 The diagram shows the structure of a particular flower.



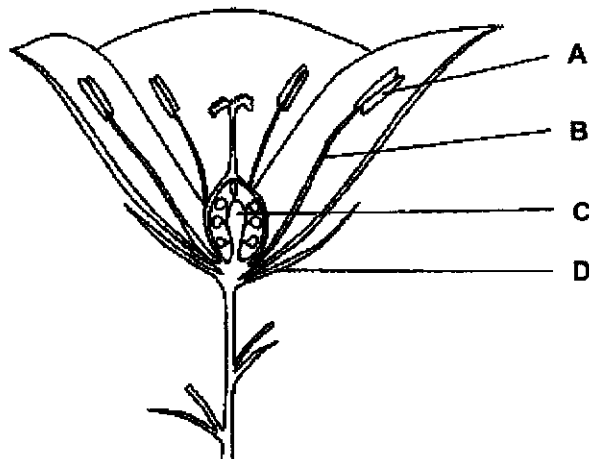
Which of the following features show(s) that the flower is wind-pollinated?

- 1 the flowers bear both male and female reproductive organs
- 2 the stamen has anthers that hang outside the flower
- 3 the stigma is feathery

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

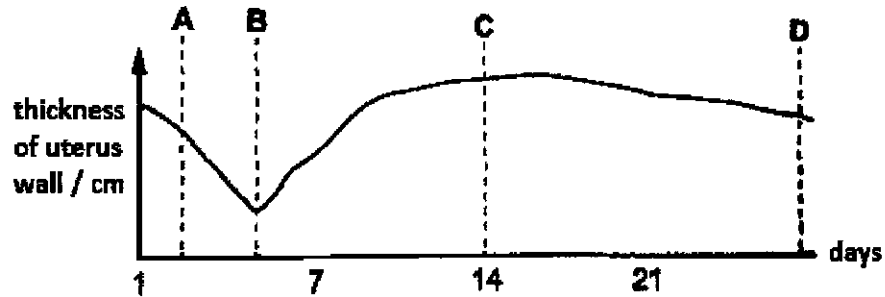
- 32 The diagram shows a section through a flower.

Which labelled part contains cells with haploid nuclei?

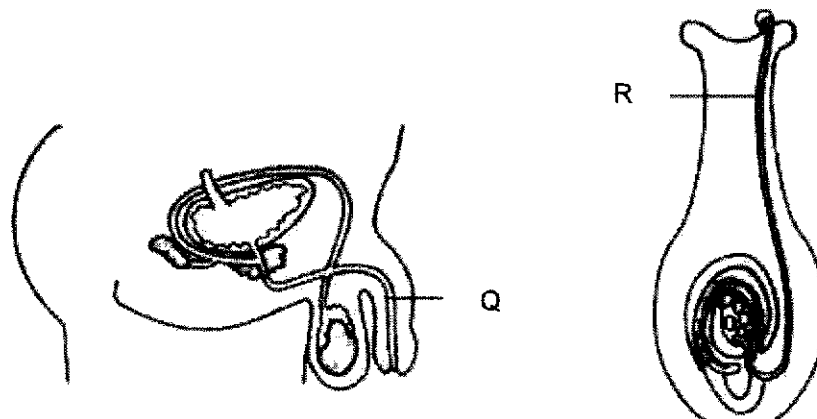


- 33 The graph below shows how the thickness of the uterus wall varies over the period of one menstrual cycle.

At which point will the levels of both oestrogen and progesterone be the lowest?



- 34 The following diagram shows the reproductive systems of a human and a flowering plant.



How are the functions of the two structures marked Q and R related?

	Q	R
A	passage for urine	removal of unfertilised pollen
B	secretes seminal fluid	nourishes the developing embryo
C	transfers semen	carries pollen grain to the ovary
D	transfers gametes	carries male gamete to female gamete

- 35 A particular section of the DNA double helix coding for a gene consists of 3600 nucleotides.

How many amino acid molecules are in the polypeptide that this gene codes for?

- A 600 B 900 C 1200 D 1800

- 36 Which of the following list arranges the sizes of the structures in ascending order?

	smallest	→	largest
A	gene		nucleotide
B	chromosome		nucleotide
C	nucleotide		gene
D	nucleotide		chromosome

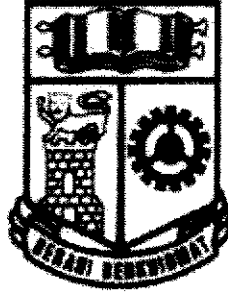
- 37 Which of the following explains why sickle cell anaemia is **not** eradicated?
- A Sickle cell anaemia gives the individual some resistance against malaria.
 B Identification of carriers is impossible as they show no symptoms.
 C Sickle cell anaemia is an inherited disease, so we cannot go against nature.
 D The gene responsible for sickle cell anaemia has a high rate of mutation.
- 38 Farmers crossed two breeds of cattle, the Jersey from Europe and the Sahiwal from Africa. For many generations, the farmers picked out the offspring with the highest milk yields to breed the next generation. Which phrase best describes this process?
- A artificial selection
 B discontinuous variation
 C evolution
 D natural selection

- 39 Which statement about genotypes is correct?
- A Dominant alleles are only found in homozygotes.
 - B One recessive allele always causes a recessive phenotype.
 - C Recessive phenotypes must be homozygous.
 - D The dominant phenotype must be heterozygous.
- 40 Which of the following consists of human traits that display discontinuous variation only?
- A height, widow's peak hairline, eye colour
 - B intelligence, ABO blood group, eye colour
 - C tongue rolling, ABO blood group, detached earlobe
 - D weight, intelligence, detached earlobe

Name: ()

Class: Sec 4B

Queenstown Secondary School



**Preliminary Examination 2021
Secondary Four Express
Biology
6093/02**

**31 August 2021
Tuesday**

**Time: 1045 – 1230h
Duration: 1 hour 45 minutes**

Additional Materials: Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all 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.

Section A

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

Section B

Answer all **three** questions, the last question is in the form either/or.
Answer **all** questions 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.

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

Examiner's Use	
Section A	/50
Section B	/30
B8	
B9	
B10	
TOTAL	/80

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

Section A

Answer all questions in this section in the spaces provided.

The total marks for this section is 50.

- A1** Fig. 1.1 shows the results of experiments investigating the effect of different light intensities on the rate of photosynthesis of cucumber plants measured as $\text{mm}^3 \text{CO}_2$ uptake per cm^2 leaf area per hour. The experiments were carried out at two different temperatures and two different carbon dioxide concentrations.

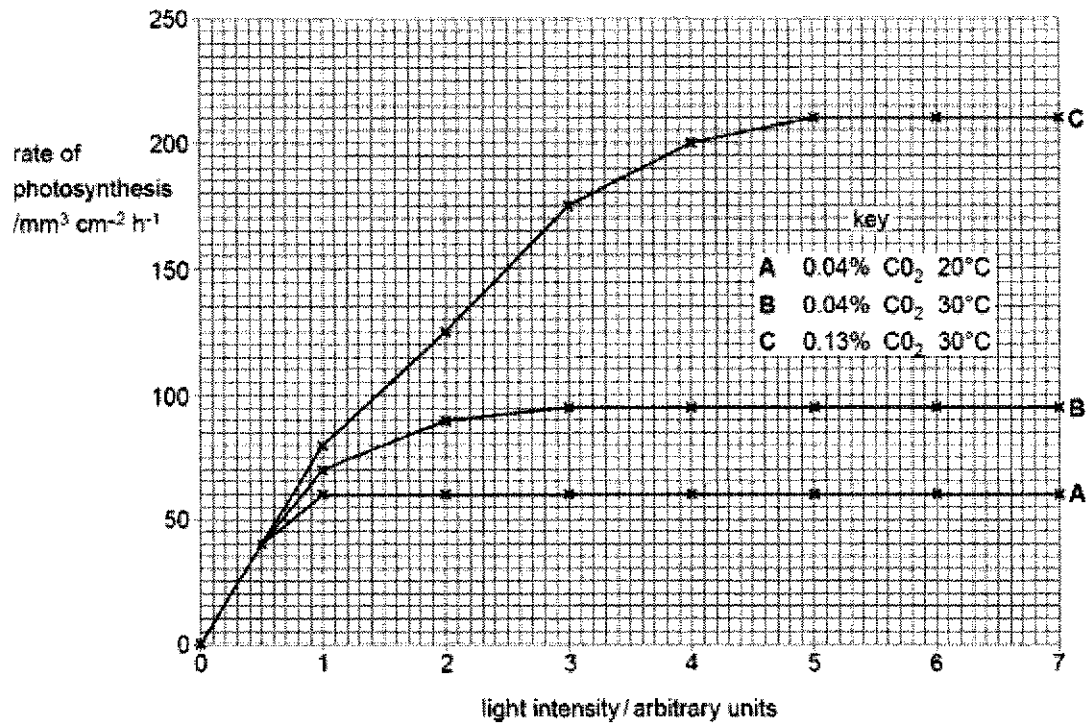


Fig. 1.1

- (a) Calculate the percentage change in the rate of photosynthesis at light intensity of 6 arbitrary units when carbon dioxide concentration was increased from 0.04% to 0.13% at 30 °C.

Leave your answers in three significant figures.

percentage change:%

[2]

(b) With reference to Fig. 1.1,

(i) describe the shape of curve **A**,

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.....
.....
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.....

[2]

(ii) Explain the difference between curves **B** and **C** at light intensities of 5 to 7 arbitrary units.

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.....
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[2]

[Total: 6]

A2 Fig. 2.1 shows the mean blood pressure as blood passes from the aorta to the vena cava.

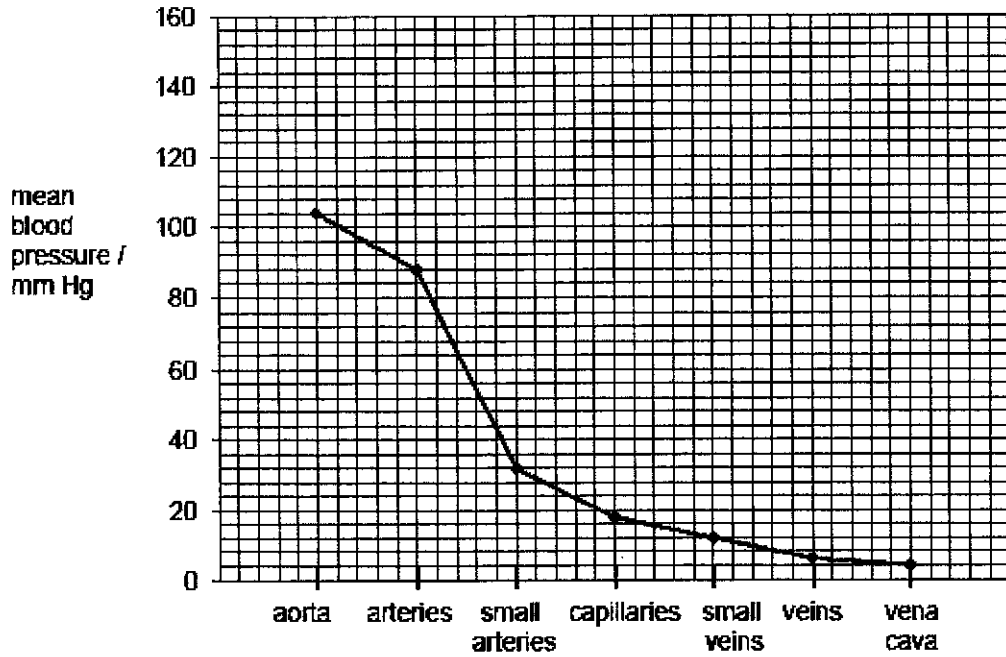


Fig. 2.1

(a) Describe the process that generates the pressure in the aorta.

.....

.....

[1]

(b) Suggest what causes the change in blood pressure as blood passes from the aorta to the vena cava.

.....

.....

.....

.....

[2]

(c) Sketch a line on Fig. 2.1 to show the mean blood pressure of an adult human who smokes and is overweight.

[1]

- (d) During an experiment, a drug was injected into the vein of a mammal which blocks nerve impulses to the heart muscle.
Explain how the drug given to the mammal was transported to the heart muscle.

.....

.....

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.....

.....

[4]

[Total: 8]

A3 Fig. 3.1 shows a cell at different stages of meiosis I.

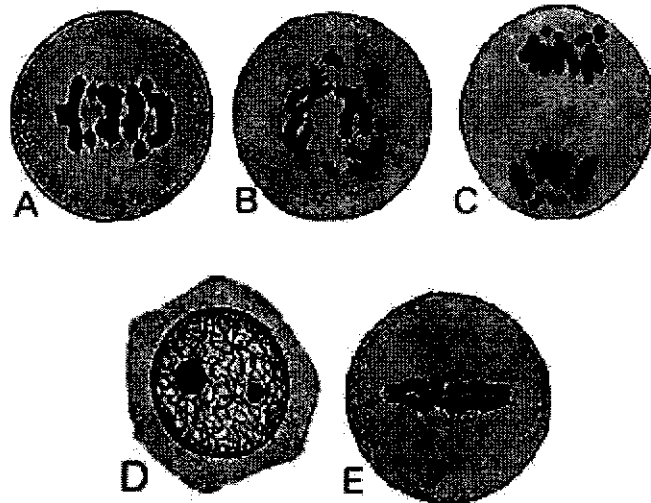


Fig. 3.1

- (a) Arrange the stages in Fig. 3.1 in chronological order.

..... → → → →

[1]

(b) Describe how meiosis II is similar to mitosis.

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[2]

(c) Discuss the importance of meiosis.

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[4]

[Total: 7]

A4 Fig. 4.1 shows a human fetus developing inside a uterus.

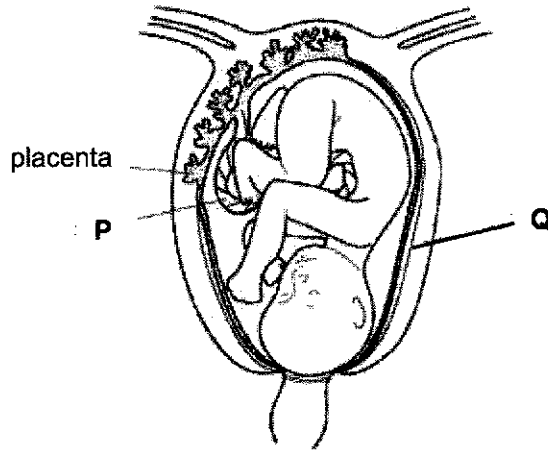


Fig. 4.1

(a) Name structures P and Q.

structure P:

structure Q:

[2]

(b) In the placenta, the blood capillaries of the fetus are separated from the mother's blood system by a thin layer of tissue. Explain the importance of this separation.

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[2]

(c) Fig. 4.2 shows a transverse section of structure P.

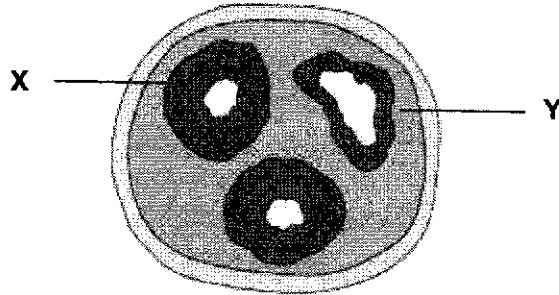


Fig. 4.2

(i) Name structures X and Y. Give a reason for your identification.

structure X:

structure Y:

reason:

..... [2]

(ii) State **one** difference between the function of structures X and Y.

.....

..... [1]

[Total: 7]

A5 In genetic engineering, transgenic bacteria are often manipulated to have a gene of interest. A company wants to produce *E. coli* bacteria with the ability to produce amylase. The procedure is outlined below.

Step 1: Chromosomes containing amylase gene is cut with a restriction enzyme.

Step 2: Plasmids from a bacterium are cut with the same restriction enzyme.

Step 3: The cut gene from step 1 and plasmids from step 2 are mixed and DNA ligase is used to join the gene to the plasmid.

Step 4: The resulting plasmid from step 3 is mixed with *E.coli* bacteria. Temporary heat shock is applied.

(a) Restriction enzymes are used in steps 1 and 2.

(i) State the function of the restriction enzyme.

.....
.....

[1]

(ii) Briefly explain why the same restriction enzyme must be used in step 2.

.....
.....

[1]

(b) The bacteria obtained after step 4 has to be further selected to ensure that they contain the amylase gene before they are produced in large quantities. Outline an experiment that can be conducted to confirm that the bacteria obtained contains the amylase gene.

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[3]

- (c) Table 5.1 shows information about the percentage of four different bases in the DNA of two organisms. Fill in the percentages of bases for organisms P and Q in the relevant blank boxes.

Table 5.1

organism	adenine (A) %	guanine (G) %	cytosine (C) %	thymine (T) %
P		15		
Q				42

[1]

- (d) Describe **one difference** and **one similarity** you will expect to find between the bases of organism P's mRNA and DNA molecules.

difference:

.....

similarity:

.....

[2]

[Total: 8]

- A6 Fig. 6.1 shows leaves taken from three plants, D, E and F of the same species.

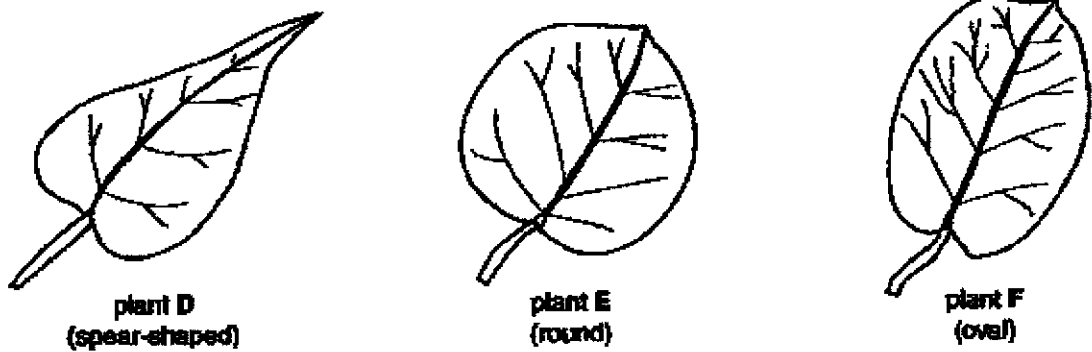


Fig. 6.1

In this species of plant, leaf shape is controlled by two alleles, S^1 and S^2 .

Plants D and E are both homozygous for leaf shape and plant F is heterozygous.

(a) Using the example in Fig. 6.1, state what is meant by *allele*.

.....
.....
.....
.....

[2]

(b) In the space below, construct a genetic diagram to show how a particular cross will always result in all offspring having a different phenotype from both parents.

[4]

(c) Suggest why the offspring in your answer to (b) always have leaves of a different shape from either of the parent plants.

.....
.....

[1]

[Total: 7]

A7 Fig. 7.1 shows the size of ovule in two flowers P and Q on the same plant over a period of 30 days.

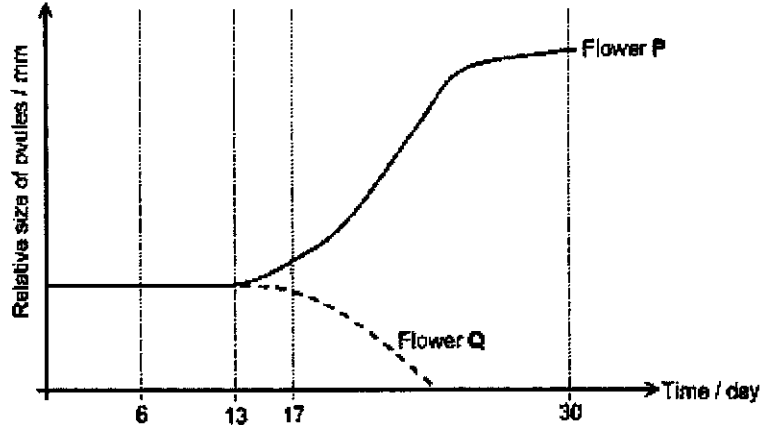


Fig. 7.1

(a) Name the process which is likely to take place on Day 6 in flower P.

..... [1]

(b) How many days, approximately, does it take for the pollen tube to reach the ovule of flower P after Day 6? Explain your answer.

.....
.....
.....
..... [2]

(c) Suggest what the ovule and the ovary in flower P have developed into on Day 30.

.....
.....
..... [2]

(d) Suggest **two** reasons to explain why the size of the ovule in flower Q decreases from Day 17 onwards until no measurement can be made.

.....
.....
.....
.....

[2]

[Total: 7]

Section B

Answer all **three** questions in this section.

The last question is in the form of an either/or and only one of the alternatives should be attempted.

- B8** An experiment was carried out to investigate the activity of a protease on gelatine (a protein). Exposed photographic film carries black silver salts which are bonded to it by gelatine as shown in Fig. 8.1. The protease acts upon the gelatine, which releases the salts when the gelatine is hydrolysed. The photographic film is therefore cleared.

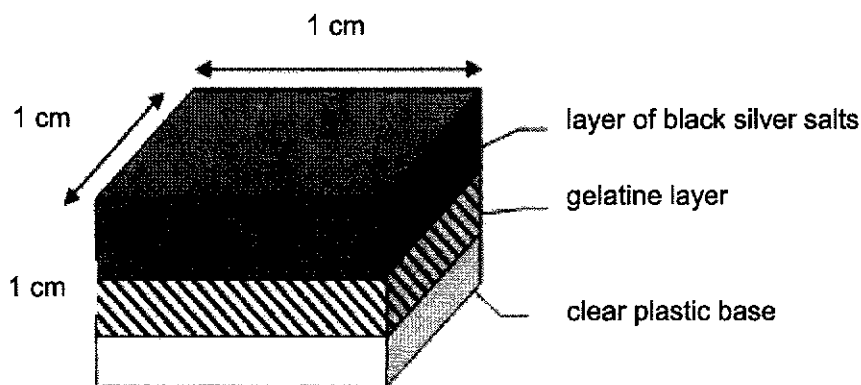


Fig. 8.1 - Square of exposed film used in the experiment

Six test-tubes were set up, containing 1 cm³ of 1% protease solution, each at a different pH. They were placed in a water bath at 30°C for 5 minutes. A small square of exposed film was then placed into each test-tube at the same time, and the time taken for the film to clear was recorded.

The experiment was repeated at 60°C. The results are shown in Table 8.1.

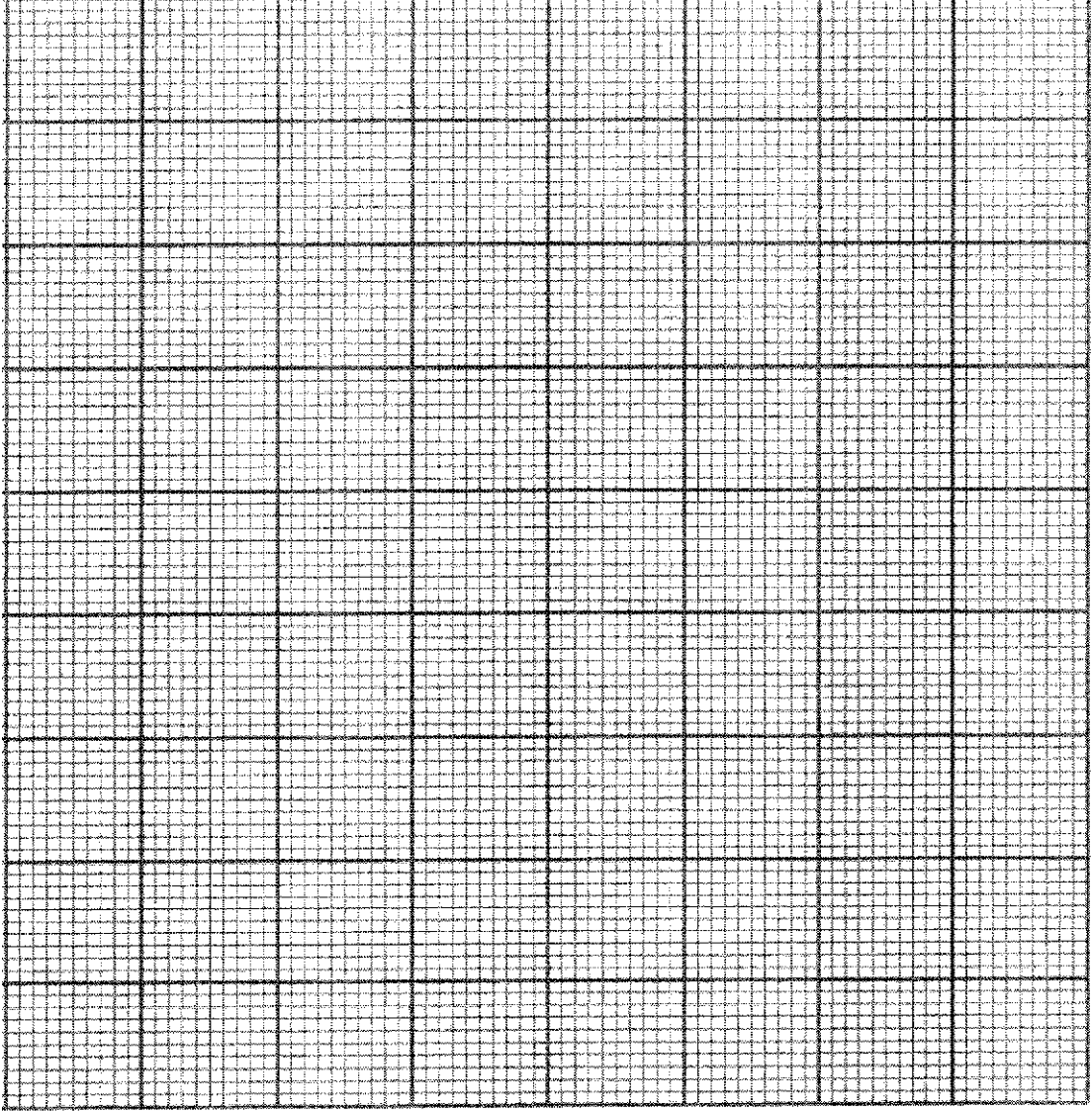
Table 8.1

pH	time taken to clear film / min	
	30°C	60°C
6	40	42
7	16	40
8	9	41
9	10	40
10	36	42

(a) Using the data from Table 8.1, plot and label the two graphs on the same axes.

Draw **two** lines of best fit.

[4]



(b) (i) Explain the term 'optimum pH'.

..... [1]
.....

(ii) From the graph for 30°C, estimate the optimum pH for this enzyme.

..... [1]

(c) Describe the trend shown by the two graphs and suggest explanations for the differences between them.

.....
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.....
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.....
.....
.....
.....
..... [4]

[Total: 10]

- B9** Fig. 9.1 shows the water balance of a person in an environment where the air temperature was 20°C.

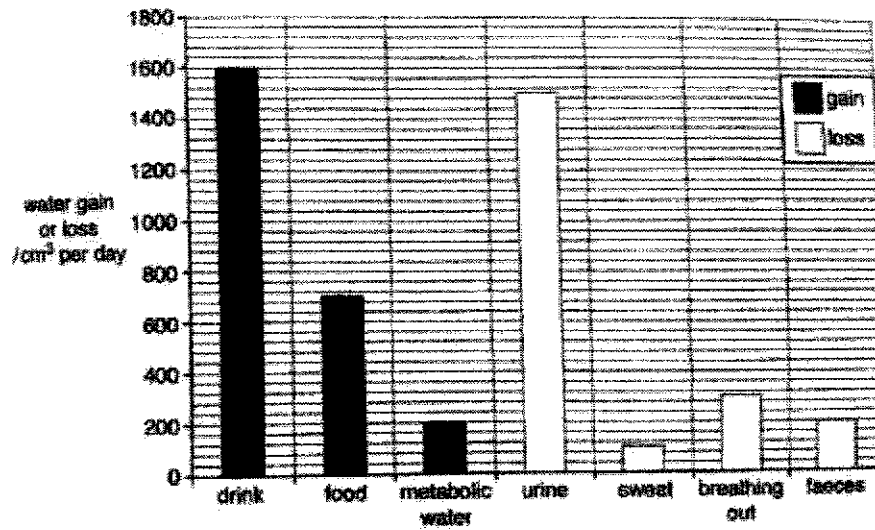


Fig. 9.1

- (a) (i) Calculate the total water gain per day.

[1]

- (ii) Calculate the total water loss per day.

[1]

- (iii) Hence, calculate the net gain or loss of water.

[1]

(b) Suggest what is meant by the term metabolic water.

.....
.....
.....
.....

[2]

(c) Name the chemical process which produces heat in the body.

.....

[1]

(d) Suggest how the water losses would change if the person is in an environment where the air temperature was 5°C.

.....
.....
.....
.....
.....
.....
.....
.....

[4]

[Total: 10]

MARK SCHEME

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

QTSS Prelims 2021

Biology 6093

Paper 2 MARK SCHEME

Section A

A1 (a)	<p>Percentage change = $[(210 - 95)/95] \times 100\% = +121\%$ $= +121\% (3 \text{ s.f.})$</p> <p>Note:</p> <ul style="list-style-type: none"> complete working and answer = 1 mark 0.5 mark is deducted if there is no '+' sign. 	
(b)(i)	<ol style="list-style-type: none"> Rate of photosynthesis increases from $0 \text{ mm}^3 \text{ cm}^{-2} \text{ h}^{-1}$ at light intensity 0 arbitrary unit to $60 \text{ mm}^3 \text{ cm}^{-2} \text{ h}^{-1}$ at light intensity 1 arbitrary units ; Rate of photosynthesis remains constant at $60 \text{ mm}^3 \text{ cm}^{-2} \text{ h}^{-1}$ as light intensity increases beyond 1 arbitrary units. <p>Note:</p> <ul style="list-style-type: none"> No marks awarded if no data is quoted 0.5 mark is deducted if units for photosynthesis not stated 	
(b)(ii)	<ol style="list-style-type: none"> Carbon dioxide concentration is the limiting factor; Carbon dioxide is required during photosynthesis; when carbon dioxide concentration increases [0.5], rate of photosynthesis also increases. 	
A2 (a)	ventricular systole/ ventricular contraction /contraction of the muscles of the left ventricle + pushes blood out at high pressure into aorta;	1
(b)	<ol style="list-style-type: none"> decreasing pressure as the diameter of the veins is larger than the diameter of the aorta; hence, speed of blood flow decreases, reducing blood pressure blood moving further away from heart (the pump); <p>any 2 points</p>	1 1 1

<p>(c)</p>	<p>mean blood pressure / mm Hg</p> <p>aorta arteries small arteries capillaries small veins veins vena cava</p>	<p>1</p>
<p>(d)</p>	<p>line is above the existing graph for aorta to small arteries;</p> <ol style="list-style-type: none"> 1. drug enters the vein and is transported in the blood plasma; 2. to the right atrium via the vena cava; 3. when the muscles of right atrium contract, blood containing the drug is pushed into the right ventricle; 4. from right ventricle, drug leaves the heart during ventricular systole to the lungs; 5. via the pulmonary artery; 6. after blood containing the drug gets oxygenated in the lungs; 7. they return to the left atrium via pulmonary vein; 8. enters the left ventricle during atrial systole and is pushed out of the aorta during ventricular systole; <p>(any 3 above) +</p> <ol style="list-style-type: none"> 9. coronary arteries branch from aorta + blood containing the drug is transported in the <u>coronary arteries</u> to the heart muscles; 	<p>1</p>
<p>A3 (a)</p>	<p>D → B → E → A → C</p>	<p>1</p>
<p>(b)</p>	<p>Any two of the following:</p> <ol style="list-style-type: none"> 1. Two daughter cells produced 2. No crossing over of homologous chromosomes during prophase of mitosis and prophase II of meiosis 3. Alignment of chromosomes at spindle equator during metaphase of mitosis and metaphase II of meiosis 4. Separation of chromatids during anaphase of mitosis and anaphase II of meiosis 	<p>1</p>

	5. Both mitosis and meiosis consists of these stages: prophase, metaphase, anaphase and telophase.																
(c)	<ol style="list-style-type: none"> 1. Meiosis produces haploid gametes; 2. When the nucleus of the male and female gamete fuses, the diploid number of chromosomes is restored in the zygote; 3. Meiosis produces variations due to crossing over and independent assortment of chromosomes; 4. Variations increases the chances of survival during changes in the environment. 	1 1 1 1															
A4	P: umbilical cord Q: amniotic sac	2															
(b)	<ol style="list-style-type: none"> 1. If the blood system is continuous, the blood pressure of the mother would kill the fetus as it is much higher than the fetus; 2. The blood group of the fetus may not be the same as the mother; 3. The incompatibility of blood groups may cause agglutination to take place, endangering both the mother and fetus; Any 2 points.	1 1 1															
(c)(i)	X is the umbilical artery, Y is the umbilical vein; Deduct 0.5 marks if the word 'umbilical' is not written The umbilical artery has a thicker wall than the vein;	1 1															
(c)(ii)	X transports deoxygenated blood and metabolic waste from the fetus to the placenta; Y transports oxygenated blood and nutrients from the placenta to the fetus; (error carried forward accepted)	1 1															
A5	to cut the two ends of a gene to produce sticky ends	1															
(a)(i)	to produce complementary sticky ends / to allow the bases to pair with complementary bases to form a double strand	1															
(b)	<ol style="list-style-type: none"> 1. place bacteria into starch solution 2. incubate at suitable / optimum temperature for a suitable period of time 3. carry out iodine test on solution 4. negative result / iodine remains yellowish brown → starch has been digested by the amylase + bacteria has the amylase gene [underlined key words must be included]	1 1 1 1															
(c)	<table border="1"> <thead> <tr> <th>Organism</th> <th>(A) %</th> <th>(G) %</th> <th>(C) %</th> <th>(T) %</th> </tr> </thead> <tbody> <tr> <td>P</td> <td>35</td> <td>15</td> <td>15</td> <td></td> </tr> <tr> <td>Q</td> <td>42</td> <td></td> <td>8</td> <td>42</td> </tr> </tbody> </table>	Organism	(A) %	(G) %	(C) %	(T) %	P	35	15	15		Q	42		8	42	1
Organism	(A) %	(G) %	(C) %	(T) %													
P	35	15	15														
Q	42		8	42													
(d)	Difference : The Thymine bases will be replaced by the Uracil bases in mRNA	1 1															

	Similarity: The number of Uracil bases will be the same as Thymine bases or the number of Cytosine bases will be the same as Guanine bases																									
A6	An allele is an alternative form of the same gene;	1																								
(a)	For example, the alleles S^1 and S^2 codes for different leaf shape;	1																								
(b)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 25%; text-align: center;">spear-shaped</td> <td style="width: 25%; text-align: center;">round</td> <td style="width: 35%;"></td> </tr> <tr> <td>Parental phenotype</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Parental genotype</td> <td style="text-align: center;">$S^1 S^1$</td> <td style="text-align: center;">$S^2 S^2$</td> <td></td> </tr> <tr> <td>Gametes</td> <td style="text-align: center;">S^1</td> <td style="text-align: center;">S^1</td> <td style="text-align: center;">S^2 S^2</td> </tr> <tr> <td>Offspring genotype</td> <td style="text-align: center;">$S^1 S^2$</td> <td style="text-align: center;">$S^1 S^2$</td> <td style="text-align: center;">$S^1 S^2$ $S^2 S^2$</td> </tr> <tr> <td>Offspring phenotype</td> <td style="text-align: center;">oval</td> <td style="text-align: center;">oval</td> <td style="text-align: center;">oval</td> </tr> </table>		spear-shaped	round		Parental phenotype				Parental genotype	$S^1 S^1$	$S^2 S^2$		Gametes	S^1	S^1	S^2 S^2	Offspring genotype	$S^1 S^2$	$S^1 S^2$	$S^1 S^2$ $S^2 S^2$	Offspring phenotype	oval	oval	oval	1 1 1 1
	spear-shaped	round																								
Parental phenotype																										
Parental genotype	$S^1 S^1$	$S^2 S^2$																								
Gametes	S^1	S^1	S^2 S^2																							
Offspring genotype	$S^1 S^2$	$S^1 S^2$	$S^1 S^2$ $S^2 S^2$																							
Offspring phenotype	oval	oval	oval																							
(c)	Both alleles are incompletely dominant over one another / This species of plant, when heterozygous for leaf shape, expresses a co-dominant phenotype.	1																								
A7	pollination																									
(a)																										
(b)	<ol style="list-style-type: none"> 1. 7 days 2. Size of <u>ovule starts to increase</u> on day 13 (Indicates that male sex gametes just reached ovule to <u>fertilize ovum</u> hence causing ovule to enlarge.)	1 1																								
(c)	<ol style="list-style-type: none"> 1. Ovule develops into a seed [1] 2. Ovary develops into a fruit [1] 	1 1																								
(d)	<ol style="list-style-type: none"> 1. Flower Q not pollinated and fertilised [1] 2. Flower has withered /disintegrated[1] 3. Pollen grain is damaged 	1 1																								

Section B

B8 (a)	Size and scale – 1m Best fit line for 30°C – 1m Best fit line for 60°C – 1m Points plotted correctly – 1m	
(b)(i)	pH at which the enzyme activity is highest	1
(b)(ii)	Any pH value between 8 and 9	1
(c)	<ol style="list-style-type: none"> 1. for 30°C, decrease in time taken with increase in pH up to between pH 8 and 9 / optimum pH before an increase in time taken is observed 2. when pH increases beyond pH9, rate of enzyme activity also increases as enzyme has been denatured by high pH. 3. for 60°C, time taken does not change very much 4. protease denatures at 60°C /high temperatures /disrupted active site 	 1 1 1

B9(a)i	2500cm ³	1
(a)ii	2100cm ³	1
(a)ii	2500 – 2100 = +400cm ³ (+ sign must be present)	1
b	1. water that is produced in cells 2. As a by-product of chemical reactions	1 1
c	Aerobic respiration	1
d	1. Less water lost by evaporation of sweat / less sweat produced 2. less ADH is released by the pituitary gland, hence more water is reabsorbed at the nephron (kidney). 3. Volume of metabolic water will increase as metabolic rate will increase to generate heat 4. Urine production will increase to maintain osmoregulation due to increased water retention	1 1 1 1
B10		
Either	1. endocrine gland is a ductless gland 2. that secretes hormones directly into the bloodstream	1 1
(a)		
(b)	1. adrenaline secretion is via the endocrine system 2. and the knee jerk is a response triggered by the nervous system . 3. adrenaline is a hormone released into the blood to its target organs 4. whereas tapping the knee sends nerve impulses via neurons . 5. adrenaline affects multiple organs such as the skin, eyes and heart whereas the knee jerk only requires knee muscles as an effector 6. The knee jerk response is generated faster than the effects of adrenaline 7. both the release of adrenaline and the knee jerk are involuntary responses . 8. the effects of adrenaline as well as that for the knee jerk are short lived/ temporary [1].	1 1 1 1 1 1 1 1
B10		
Or	Excretion is the process by which metabolic waste products and toxic materials are removed from body of an organism	1
(a)		
(b)	role of ADH: 1. When water potential in blood increases, [due to drinking more water] 2. pituitary gland's stimulated; 3. releases less ADH into bloodstream; 4. so kidney tubules reabsorb less water and there'll be more urine which is more dilute [Vice-versa when water potential in blood drops.]	1 1 1 1
(c)	1. Blood drawn from an artery in the patient's arm, pumped through the dialysis tubing in dialysis machine; filtered blood returned to a vein;	1 1

	<p>2. Tubing membrane is partially / selectively permeable – urea and other metabolic waste products to diffuse out; blood cells, platelets and big molecules remain in tubing;</p> <p>3. Tubing is narrow, long, coiled – to increase surface area to volume ratio; to speed up rate of exchange of substances bet blood and dialysis fluid;</p> <p>4. Dialysis fluid contains same conc of essential subst (e.g mineral salts) – such substances will not diffuse out of blood but diffuse in if conc in blood is lower;</p> <p>5. Dialysis fluid does not contain metabolic waste products – conc gradient to allows waste products like urea, uric acid and creatinine, excess water, mineral salts to diffuse out of tubing;</p> <p>6. Direction of blood flow is opposite to the flow of dialysis fluid – to maintains the conc gradient for removal of waste products;</p> <p>any 5 max 5</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
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