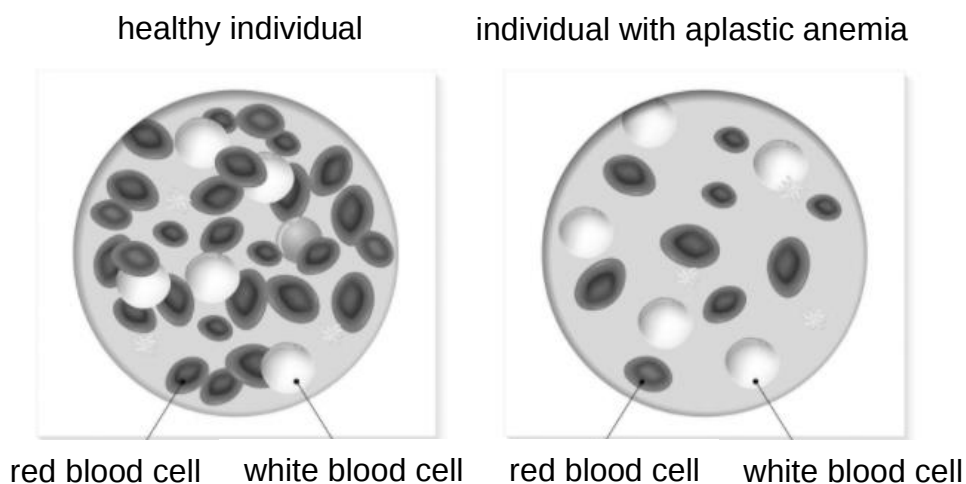


Section A [50 marks]Answer **all** questions.

Write your answers in the spaces provided.

- 1** Aplastic anaemia is a rare blood disorder where stem cells in the bone marrow are damaged. Fig. 1.1 depicts the blood samples taken from a healthy individual and an individual with aplastic anemia.

**Fig. 1.1**

- (a) State one difference that can be observed in the two blood samples in Fig. 1.1.

.....
[1]

- (b) Individuals with **aplastic anemia** may often experience **light-headedness**, especially when **active** or **standing up**. Explain why.

.....

[3]

- (c) Suggest an effect that aplastic anemia can have on the heart. Explain your answer.

.....

[2]

[Total: 6]

[Turn over]

- ↓ O₂
 - Hb

- 2 *Camellia sinensis* is a widely grown plant as its leaves are used to make tea. A photomicrograph of a section through the midrib of the tea leaf is shown in Fig. 2.1.

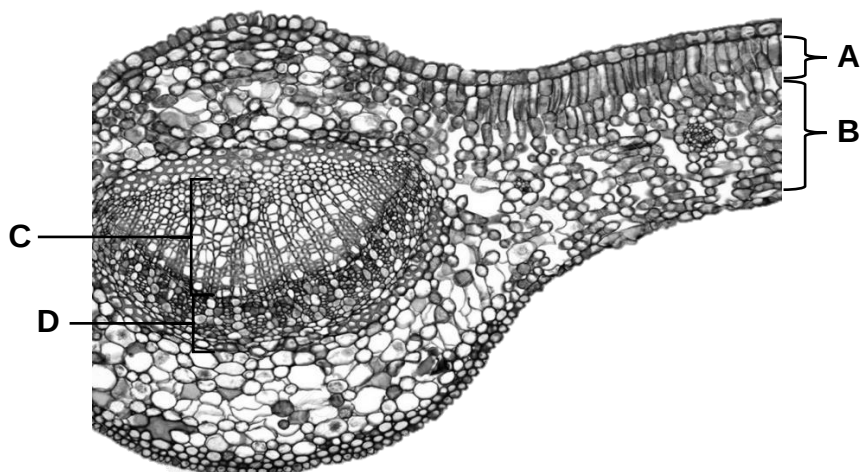


Fig. 2.1

(a) State the structural differences between

(i) tissues **A** and **B**

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

(ii) tissues **C** and **D**

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

- (b)** The lower epidermis of the leaf contains many minute openings called stomata. The opening and closing of each stoma is regulated by the guard cells surrounding it.

In the space below, draw a labelled diagram of a pair of guard cells surrounding a single stoma.

[3]

- (c) *Camellia sinensis* is mainly cultivated in tropical climates as it prefers a moist growing location. Explain how this affects the rate of transpiration of the plant.

Chap 9.

↑ humidity → move ... →

humidity.

[2]

[Total: 9]

3 Fig. 3.1 shows the respiratory system of a human.

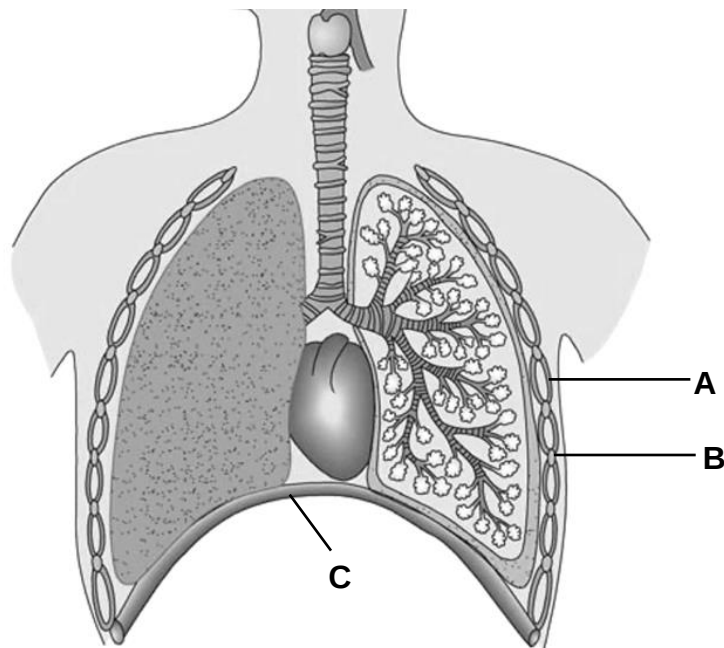


Fig. 3.1

[Turn over

- (a)** Describe the process of inhalation and how it involves structures **A**, **B** and **C**.

.....

.....

.....

.....

.....

.....

..... [4]

- (b)** Suggest and explain the effect of having low levels of carbonic anhydrase on gaseous exchange in an individual.

.....

.....

.....

.....

.....

..... [3]

- (c)** Cystic fibrosis is a genetic disorder which results in the build-up of thick, sticky mucus that affects various organ systems in the body. Explain the effects this condition will have on an individual's respiratory system.

.....

.....

.....

.....

..... [2]

[Total: 9]

- 4 Fig. 4.1 depicts the changes in a follicle during the menstrual cycle.

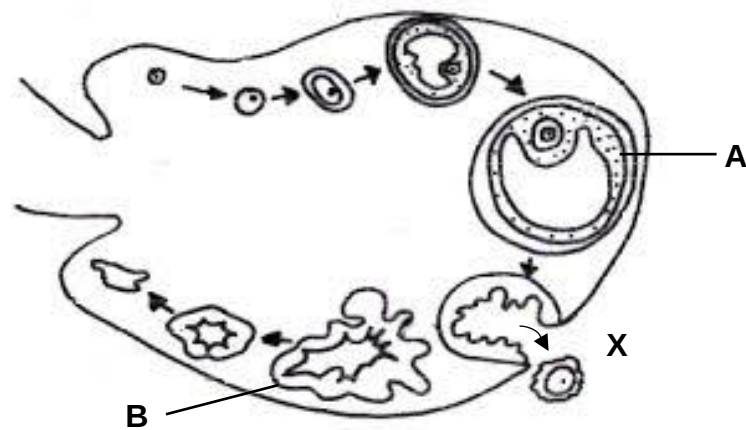


Fig. 4.1

- (a) Identify the structures labelled **A** and **B**.

A

B

[2]

- (b) A woman is trying to conceive a baby.

- (i) If the process labelled **X** takes place on the 14th day of a 28-day month, suggest a time period where she would have a good chance of getting pregnant. Explain your answer.

.....

 [3]

- (ii) Explain the limitations to this method of family planning.

.....

 [2]

[Total: 7]

- 5** Canavan disease is an inherited disease caused by a mutation in the gene for the enzyme aspartoacylase, which acts to break down the brain chemical known as N-acetyl-aspartate (NAA). Studies have suggested that if NAA is not broken down properly, the resulting chemical imbalance interferes with the formation of the myelin sheath as the nervous system develops.

(a) Describe how a mutation in the gene results in a deficiency of the enzyme.

.....

.....

.....

..... [3]

(b) Suggest a symptom that would be observed in an individual with the disease. Explain your answer.

.....

.....

.....

..... [2]

(c) Canavan disease is inherited as an autosomal recessive trait.

(i) Explain what is meant by the term 'recessive trait'.

.....

..... [1]

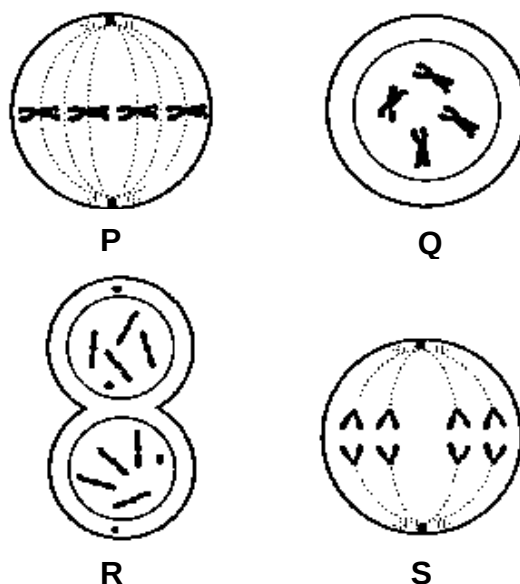
(ii) Using the symbol **N** to represent the dominant allele and **n** to represent the recessive allele, draw a genetic diagram to show how a mother and father who do not have the disease, can have a child with the Canavan disease.

	Mother		Father	
phenotype of parents				
genotype of parents				
gametes				
genotype of offspring				
phenotype of offspring				

[4]

[Total: 10]

6 Fig. 6.1 shows the four stages of mitosis in an animal cell.



(a) Using the letters **P**, **Q**, **R** and **S**, list the correct order of the stages.

..... [1]

(b) State the diploid number of chromosomes in this cell.

..... [1]

(c) Non-disjunction refers to the failure of sister chromatids to separate properly during mitosis. Using the letters **P**, **Q**, **R** and **S**, identify the stage at which non-disjunction occurs. Explain your answer.

.....

.....

..... [2]

(d) Compare and contrast between mitosis and meiosis.

.....

.....

.....

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..... [5]

[Total: 9]

[Turn over

Section B [30 marks]

Answer **three** questions.

Question **9** is in the form of an **Either/Or** question. Only one part should be answered.

- 7** In recent years, two popular diets – the Atkin's diet and the ketogenic diet, have been increasingly adopted by individuals planning to lose weight.

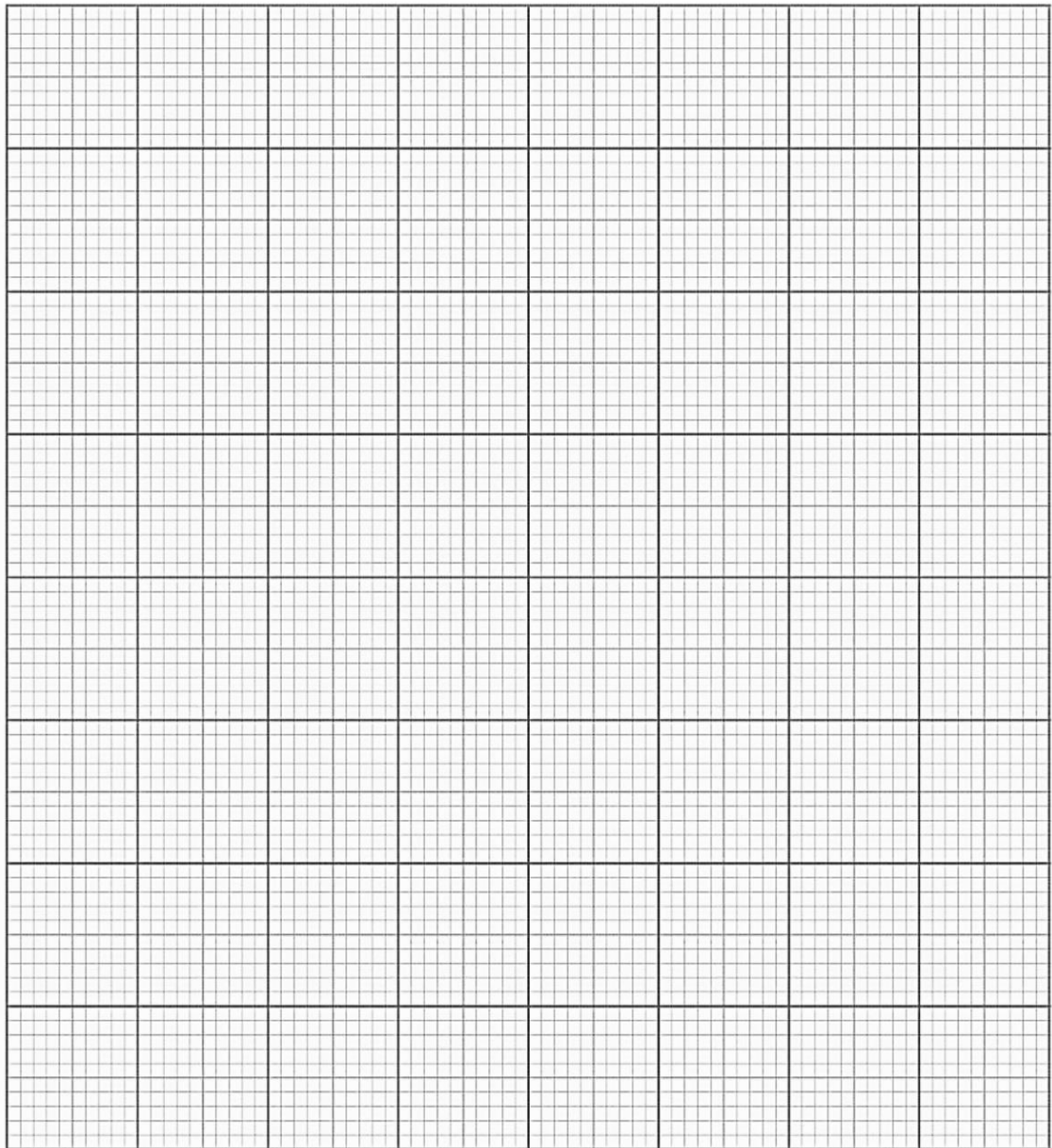
The principle behind the Atkin's diet is to increase protein intake while reducing carbohydrate intake, while the principle behind the ketogenic diet, is to increase fat intake to replace carbohydrates, promoting the use of fats as the primary energy source.

An investigation was conducted to compare the effectiveness of both diets in weight loss amongst 200 participants. Table 7.1 shows the results of the investigation.

Table 7.1

number of weeks	average reduction in body mass index (%)	
	Atkin's diet	ketogenic diet
2	0.6	0.6
4	0.9	0.9
6	1.2	1.3
8	1.3	1.7
10	1.5	2.6
12	1.7	3.4
14	1.9	4.6
16	2.2	5.4

- (a) Plot graphs of average reduction in body mass index against number of weeks for both the Atkin's diet and the ketogenic diet. Label the graphs.



[4]

- (b)** Using the results from the graph in part (a), compare the effectiveness of the two diets in promoting weight loss.

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

- (c)** The Atkin's diet advises the increase in protein consumption. Suggest and explain possible side effects of the diet.

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

- (d)** Explain how adopting the ketogenic diet may be beneficial for individuals with type II diabetes.

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

[Total: 10]

8 Fig. 8.1 below shows a food web of a community of organisms.

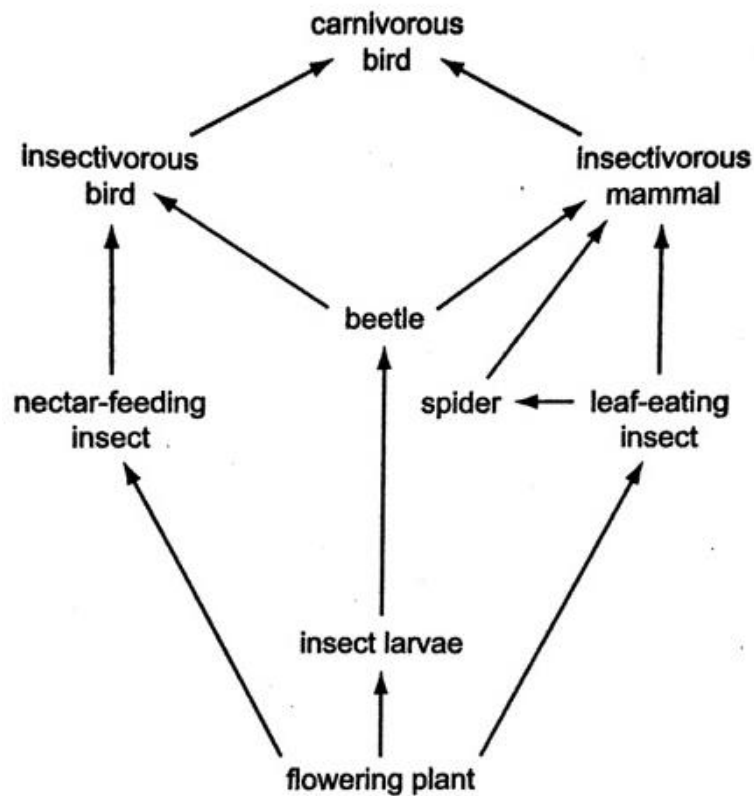


Fig. 8.1

- (a) Draw a labelled diagram of a pyramid of energy for one of the food chain that consists of at least four trophic levels in Fig. 8.1.

[2]

- (b) Explain the reason for the shape of the pyramid.

.....

.....

..... [2]

[Turn over

- (c) Insecticides such as DDT are often used by farmer to reduce insect pests feeding on their crops. These insecticides may be carried by rainwater into water bodies. Explain why high levels of DDT was found accumulating in the bodies of the dolphins and sharks.

.....

.....

.....

.....

..... [3]

- (d) Read the following passage about the construction of the Cross Island Line.

Initial plans to build the future Maju Cross Island Line (CRL) station within the boundaries of Clementi Forest were scrapped in favour of its current planned location underneath Clementi Road. The tunnels leading to Maju station from King Albert Park station were also realigned.

These decisions were made to limit the impact on what is an ecologically important area teeming with wildlife, an environmental impact study

Source of excerpt: The Straits Times

Discuss the need for conservation of the forest.

.....

.....

.....

.....

.....

..... [3]

[Total: 10]

(a) Describe the two processes in the kidney involved in the formation of urine.

[5]

(b) Describe how the water potential in blood returns to normal after a person has undergone profuse sweating and how this affects the composition of urine.

..... [5]

[Total: 10]

9 OR

(a) Describe the properties of enzymes.

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..... [5]

(b) Describe the sequence of events that allows for the production and secretion of enzymes out of a cell, stating clearly the organelles involved.

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..... [5]

[Total: 10]