

Section A
[50 marks]

Answer all the questions in the spaces provided.

- 1 Fig. 1.1 shows some of the ways in which proteins in our diet may be utilised in the body.

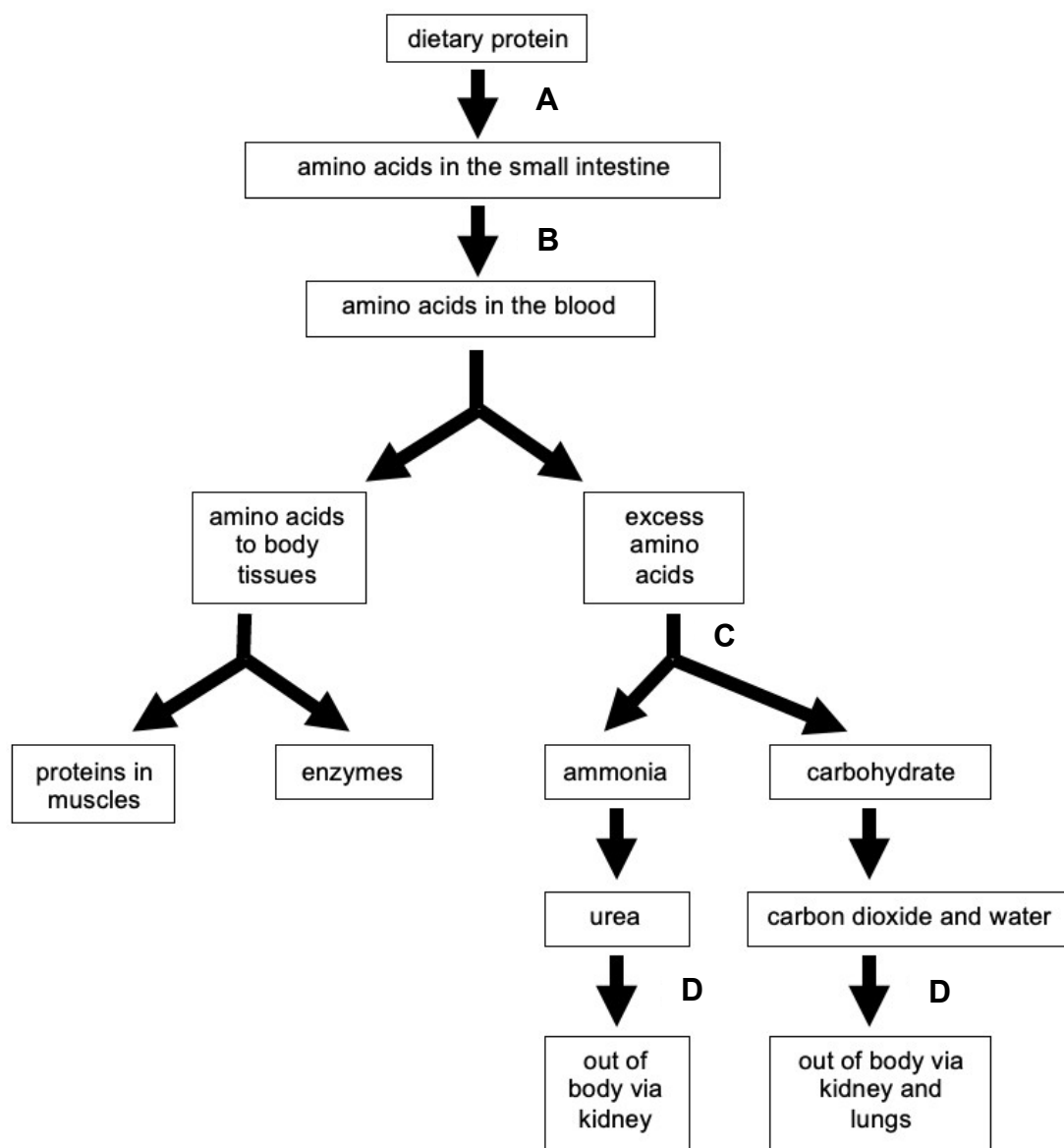


Fig. 1.1

- (a) Name the processes labelled **A** to **D** in Fig. 1.1.
- A**..... **C**.....
- B**..... **D**..... [2]
- (b) Name two enzymes found in the small intestine that aid in process **A**.
- [2]
- (c) Describe how process **B** takes place in the small intestine with reference to movement of substances.
-
-
- [2]
- (d) One of the arrows in Fig. 1.1 represents a process carried out by living organisms to release energy.
- (i) On Fig. 1.1, label the arrow with the name of the process. [1]
- (ii) State the word equation for the process.
- [1]
- (e) Suggest what would happen to the cells of the body if excess water was not removed during process **D**.
-
-
- [2]

[Total: 10]

- 2** Spirometry is a common breathing test that measures the volume and speed at which air is inspired and expired by the lungs.

Fig 2.1 is a graph known as a spirogram, which shows the changes in air flow through a healthy person's lungs over a period of time.

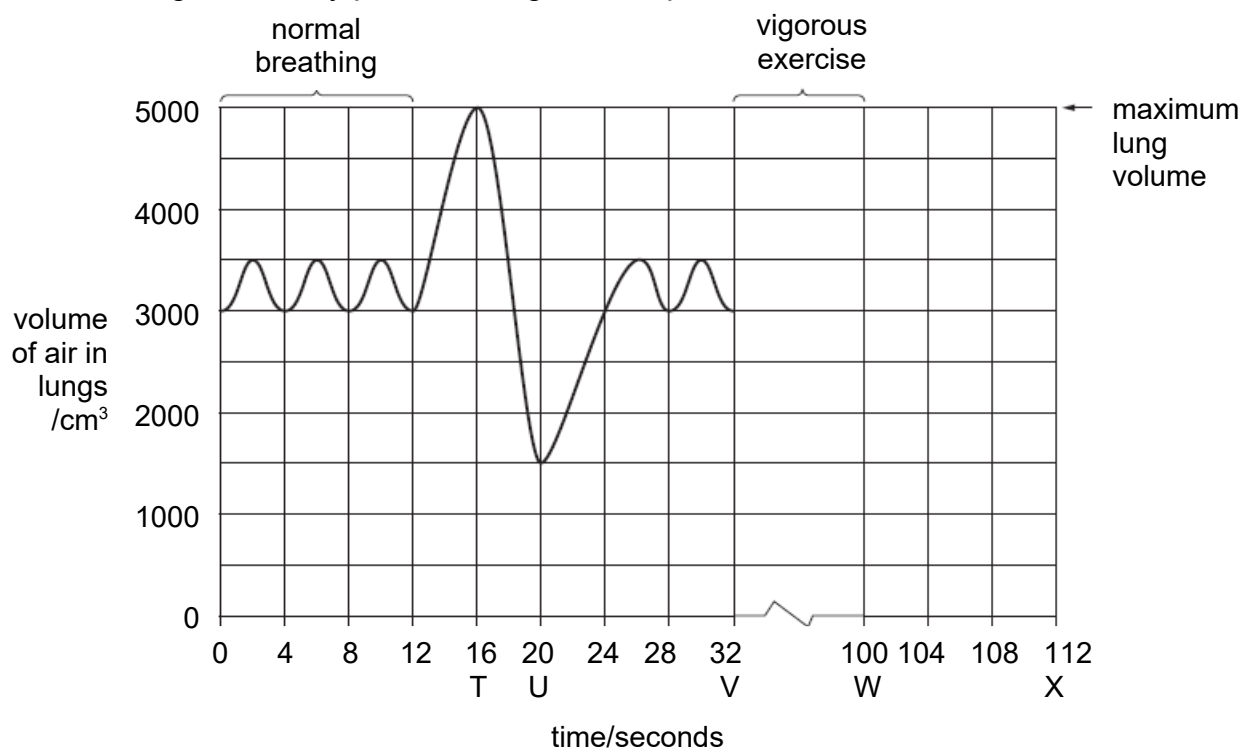


Fig. 2.1

- (a)** Using Fig. 2.1, calculate the maximum volume of air the person can expire after he takes a deep breath. Show your working clearly.

..... [1]

- (b)** Describe the mechanism that brings about expiration of air.

.....

.....

.....

.....

..... [3]

- (c) The person engaged in vigorous exercise from time **V** to **W**. Complete the graph in Fig 2.1 to show the volume and speed at which air is inspired and expired by the lungs from **W** to **X**. [1]

- (d) Suggest how the spirogram might differ for an individual that suffers from chronic bronchitis.

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

[Total: 6]

- 3** Non-disjunction refers to the failure of homologous chromosomes or sister chromatids to separate properly during cell division. When non-disjunction occurs, it results in a change in chromosome number in cells.

- (a) Suggest a human disease that might result from non-disjunction. Explain your answer.

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

- (b) Cohesin is a group of proteins that is synthesised immediately when chromosomes are newly formed. It ensures proper segregation of the chromosomes or sister chromatids during cell division. Once the chromosomes or sister chromatids are properly separated, Cohesin is disintegrated.

- (i) From the information provided, identify which stages of meiosis I does cohesion exist in.

From to [1]

- (ii) Explain your answer to (i).

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

[Total: 5]

- 4 Fig. 4.1 shows the concentration of blood glucose and two hormones, **P** and **Q**, over a period of time. Both hormones are known to have influence over blood glucose concentration.

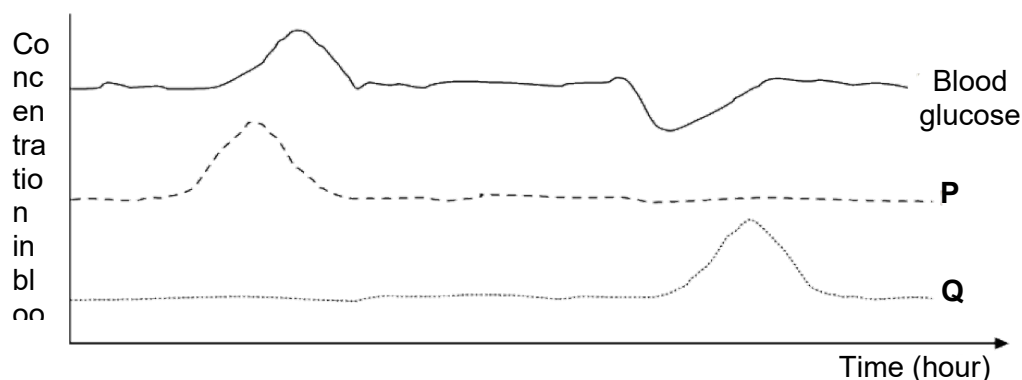


Fig. 4.1

- (a) Suggest and explain the stimulus that caused the following:

- (i) Sudden increase in blood glucose concentration.

.....

 [2]

- (ii) Sudden increase in concentration of hormone **Q**.

.....

 [2]

- (b) Identify hormones **P** and **Q**.

Hormone **P**.....

Hormone **Q**..... [2]

- (c) Describe how hormone **P** was returned to its normal level in blood.

.....

 [2]

[Total: 8]

[Turn over

- 5** Warfarin is a poison used to kill rats. However, a dominant mutation in the VKORC1 gene in rats has resulted in some rats gaining resistance to warfarin, and as such, they are no longer susceptible to the poison.

(a) State the type of mutation that has occurred.

.....[1]

(b) State and explain the type of variation shown by warfarin resistance.

.....

 [2]

(c) Using the symbol **R** to represent the dominant allele and **r** to represent the recessive allele, draw a genetic diagram to show how two parental rats can result in half the offspring being resistant to the rat poison warfarin.

	Parent 1		Parent 2	
phenotype of parents				
genotype of parents				
gametes				
genotype of offspring				
phenotype of offspring				

[4]

(d) A scientist claims that in time to come, Warfarin will no longer work in poisoning rats due to the VKORC1 mutation. Explain why this may be true.

.....

 [3]

[Total: 10]

6 Fig. 6.1 shows the structure of DNA.

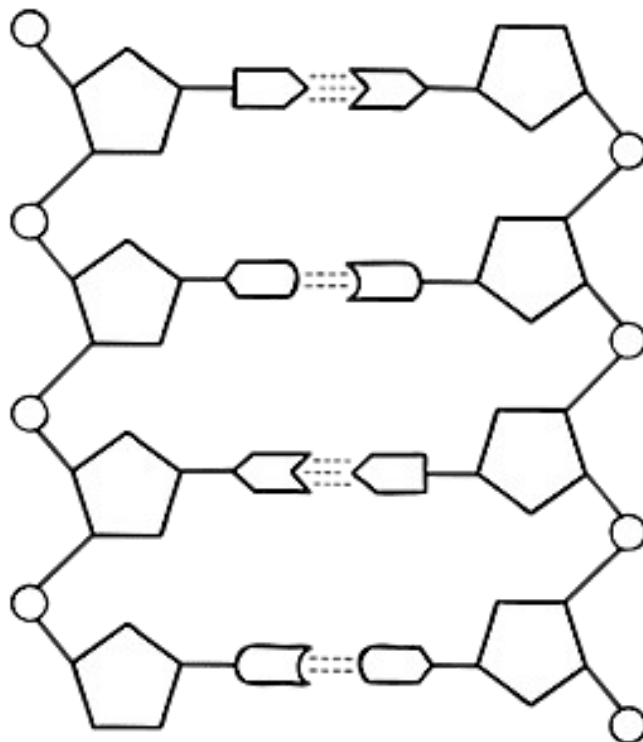


Fig. 6.1

- (a) Draw a circle around a single nucleotide.
Label all the parts of the nucleotide you have circled. [3]
- (b) State what the dotted lines in the diagram represent. Explain the importance of them.
-
-
- [3]
- (c) Chemical analysis of a sample of DNA showed that 38% of the bases were guanine. Calculate the percentage of thymine in the DNA sample. Show your workings clearly.

percentage of thymine = [2]

(d) Part of the DNA sequence in a human cell is shown below.

AATCTATCATCAGCATTTC

- (i) Write out the sequence of bases on a mRNA that is transcribed from the DNA template above.

..... [1]

- (ii) Explain the significance of the order of bases in a DNA molecule.

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.....

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..... [2]

[Total: 11]

Section B
[30 marks]

Answer **three** questions.

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

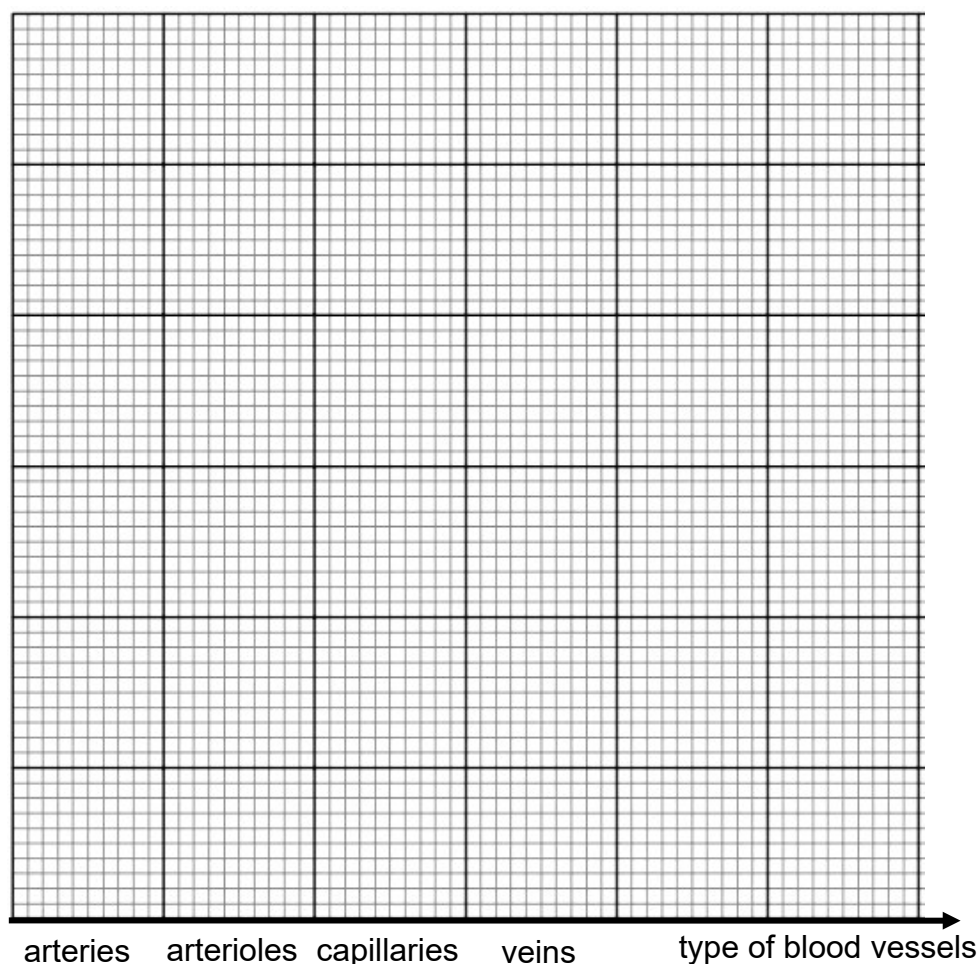
- 7 Blood pressure is the force that blood exerts on the walls of blood vessels. It varies in different parts of the body. Table 7.1 below shows the blood pressure of four types of blood vessels.

Table 7.1

Blood vessels	Blood pressure/ mmHg
Arteries	115 – 120
Arterioles	40 – 115
Capillaries	15 – 40
Veins	10 – 15

(a)

- (i) Plot a line graph of range of blood pressure against type of blood vessels, using the data provided in Table 7.1. One axis has been provided for you. [4]



[Turn over]

- (ii) Describe the graph you have drawn.

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

- (iii) Explain why there is a difference in the thickness of the walls between arteries and veins, with reference to the data provided.

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

- (b) Blood pressure can be affected by defects in the heart.
Read the following passage about Ventricular Septal Defect (VSD).

Ventricular Septal Defect, also referred to as 'hole in the heart', is a defect that results in a hole in the **median septum**. This causes blood to escape from the left ventricle of the heart through the hole into the right ventricle. This blood is then pumped to the lungs, resulting in **high pressure in the blood vessels leading from the heart to the lungs**. The higher pressure can result in **lower oxygen levels in the body** and over time, may even cause permanent damage to the blood vessels.

Source of excerpt: Children's Hospital of The King's Daughters

- (i) State the function of the median septum.

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

- (ii) Name the blood vessel mentioned that would face an increased blood pressure due to VSD.

..... [1]

- (iii) Explain why VSD results in lower oxygen levels in the body.

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

[Total: 12]

8 Fig. 8.1 below shows a developing foetus.

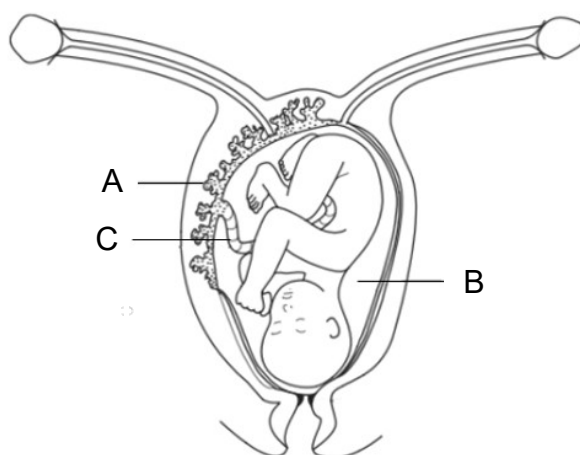


Fig. 8.1

- (a) Identify structure **A** and explain how its malformation may affect the development of the foetus.

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.....

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..... [4]

- (b) With reference to Fig. 8.1, explain how the foetus is protected from mechanical damage.

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..... [2]

- (c) Explain why foetal blood needs to be separated from maternal blood.

.....

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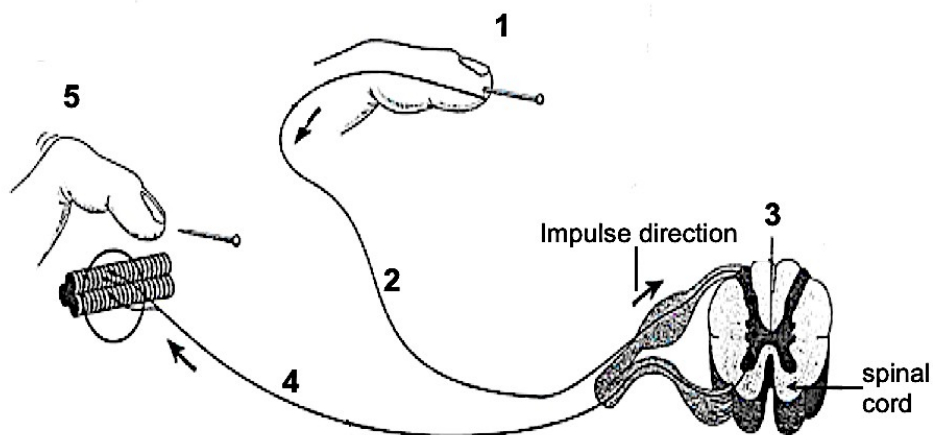
..... [2]

[Total: 8]

[Turn over

9 Either

- (a) With reference to steps shown in the figure below, describe the nervous pathway that is involved when a person accidentally pricks himself with a needle.



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..... [6]

- (b) Compare and contrast between a sensory and motor neuron.

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..... [4]

[Total: 10]

Or

Explain how the leaf structure is adapted for the process of photosynthesis.

..... [6

..... [4

[Turn over