1. Question | 5090 May-June 2023 P2 V1 Q6

6 **(a)** The human heart pumps blood which circulates around the body in blood vessels.

(i) Name the chamber of the heart with the thickest wall.

..... [1]

(ii) State what causes the sound of the heartbeat.

..... [1]

(iii) Name the blood vessel that carries blood from the aorta to the liver.

..... [1]

(iv) State **one** function of blood plasma.

..... [1]

(b) Explain the difference between antibodies and antibiotics.

.....

.....

.....

.....

..... [3]

(c) Describe how the process of natural selection has led to the development of strains of antibiotic-resistant bacteria.

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 12]

6 Fig. 6.1 shows a biological molecule.



Fig. 6.1

(a) (i) Name this molecule.

..... [1]

(ii) Describe **three** features of the structure of this molecule.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(b) Animal and bacterial cells contain this molecule.
Describe how the location and shape of the molecule differ in animal and bacterial cells.

location .....

.....

shape .....

.....

[2]

(c) Explain how this molecule controls cell function.

.....

.....

.....

.....

..... [3]

[Total: 9]

3 DNA controls cell function by controlling the production of proteins.

These proteins determine the phenotype of an organism, including blood group in humans.

(a) Describe the structure of a DNA molecule.

.....

.....

.....

.....

.....

..... [4]

(b) One parent of a child has blood group B and the other parent has blood group A. The child has blood group O.

The parents decide to have another child.

(i) Complete the genetic diagram in Fig. 3.1 to show the possible blood groups for the second child of these parents.

genotypes of parents ..... x .....

gametes ....

possible genotypes of child ....

possible blood groups of child ....

[4]

Fig. 3.1

(ii) State the probability that the second child of these parents:

has the same sex as the first child .....

has the same blood group as the first child .....

[2]

[Total: 10]

4. Question part 1/2 | 5090 May-June 2024 P2 V2 Q3

3 **(a)** Complete Table 3.1, using terms from the list below to match each description to a term.

phenotype **dominant** **gene** **genotype**

heterozygous **homozygous** **allele** **recessive**

Table 3.1

description	term
a form of a gene that codes for one of a pair of contrasting features	.....
a form of a gene that always has an effect when it is present	.....
having two different forms of a gene for a particular feature	.....
having two of the same form of a gene for a particular feature	.....
the combination of alleles that an organism has in its chromosomes	.....

[5]

(b) Fig. 3.1 is a diagram of part of a molecule of DNA taken from a bacterial cell.

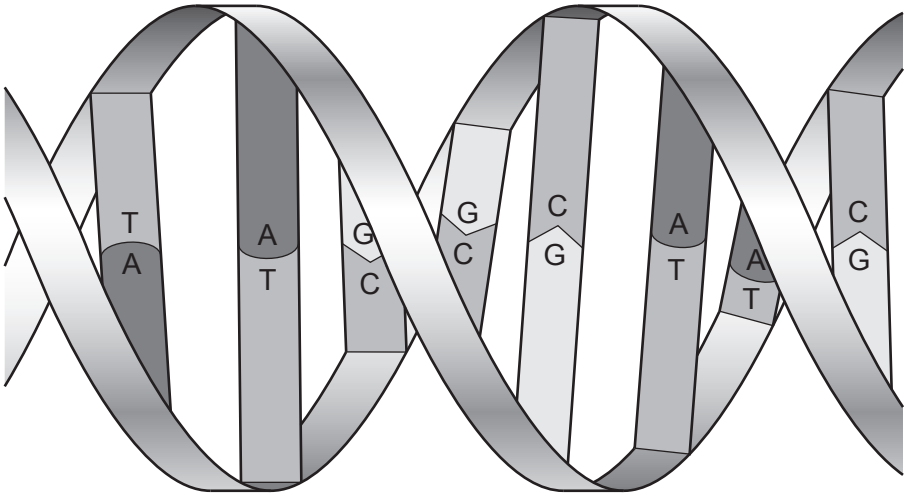

Fig. 3.1

(i) State the term which describes the shape of the DNA molecule.

.....

[1]

(ii) Most of the DNA in bacterial cells is found in one large loop in the cytoplasm.

Name another structure in bacterial cells which contains DNA.

.....

[1]

(iii) State the name of the **type** of molecule that is represented by the letters A, T, G and C in Fig. 3.1.

.....

[1]

(iv) Outline the importance of the sequence of A, T, G and C in DNA.

.....

.....

.....

..... [2]

[Total: 10]

5. Question | 5090 May-June 2025 P2 V1 Q1

1 **(a)** Large molecules in cells are made from smaller molecules.

Complete Table 1.1 to show which small molecules make up each large molecule.

Choose the small molecules from this list.

amino acids **fatty acids** **glucose** **glycerol** **nucleotides**

Table 1.1

large molecule	small molecules
protein	
cellulose	
lipid	

[3]

(b) DNA is found in the nucleus of each cell.

Put a tick (✓) next to any statements that correctly describe the structure of DNA.

A DNA molecule has four strands coiled together to form a helix.	
Each strand is made up of a chain of nucleotides.	
Each nucleotide contains a base, a sugar and an amino acid.	
The bases always pair up in the same way, A with T, and C with G.	
Bonds between sugar molecules hold the strands together.	

[2]

(c) Explain how the sequence of bases in a DNA molecule controls how a cell functions.

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

6. Question | 5090 May-June 2025 P2 V1 Q7

7 The inheritance of ABO blood groups in humans is an example of codominance.
The blood groups are controlled by three different alleles, I^A, I^B, and I^O.

(a) (i) State the blood group of a person who has the genotype $I^A I^O$.

..... [1]

(ii) State the genotype of a person who is blood group O.

..... [1]

(b) Fig. 7.1 is a family tree showing the ABO blood groups of eight different people, numbered (1) to (8).

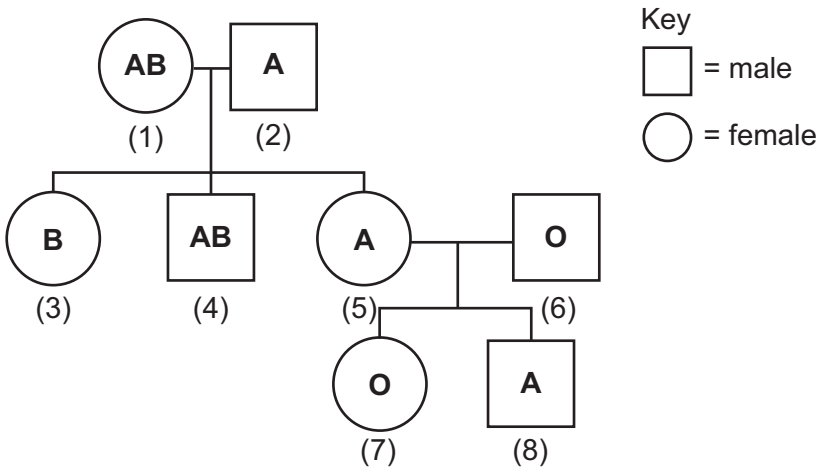

Fig. 7.1

(i) The parents (5) and (6) in Fig. 7.1 are expecting another child.

Complete this Punnett square to show the possible genotypes of the child.

parent 5 \ parent 6		
I^A		
I^O		

[2]

(ii) What is the probability that this child is male with blood group A?

probability = ... [1]

(iii) How many people in the family tree in Fig. 7.1 are homozygous for the ABO blood group alleles?

..... [1]

[Total: 6]

7. Question part 1/3 | 5090 May-June 2025 P2 V2 Q3

3 *Staphylococcus aureus* is a pathogen which infects humans. It can be destroyed by antibodies and antibiotics.

The cells of this bacterium are spherical and about 1 μm in diameter.

Fig. 3.1 shows a diagram of an *S. aureus* cell.

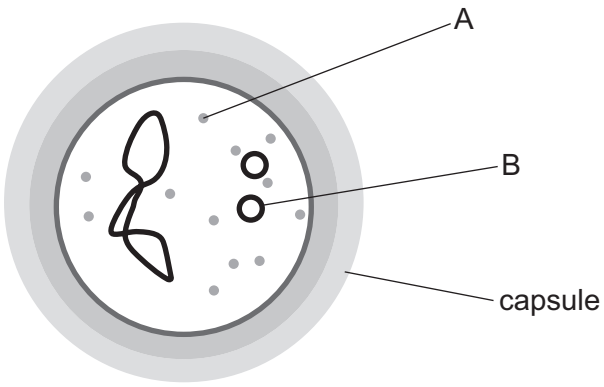

Fig. 3.1

(a) (i) Name parts A and B.

A .....

B .....

[2]

(ii) Part A can also be found in animal and plant cells.

State **two** other components of this bacterial cell that can also be found in animal **and** plant cells.

1 .....

2 .....

[2]

(iii) Antibodies can destroy bacterial cells without destroying human cells.

Explain how this is possible.

.....

.....

.....

.....

..... [3]

(b) There are different types or strains of *S. aureus* cells and some can resist antibiotics better than others.

A disc diffusion test is carried out to investigate the resistance of four strains of *S. aureus* (**K**, **L**, **M** and **N**) to different antibiotics. The four strains are first grown to cover the surface of separate agar plates. Then discs containing six different antibiotics (1–6) are placed on the agar plates.

Fig. 3.2 shows the results of the investigation after several days.

Any clear zones indicate where *S. aureus* has died.

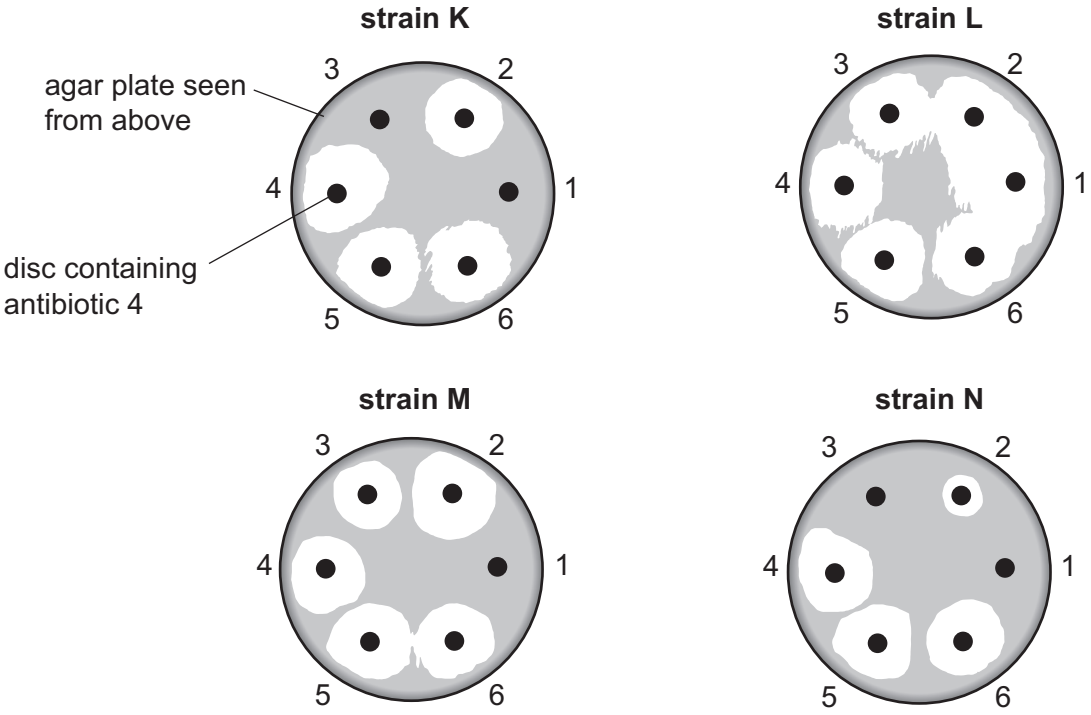

Fig. 3.2

(i) Suggest why this is called a disc diffusion test.

.....

..... [1]

(ii) Describe what these results show about the effectiveness of antibiotics 1 and 5.

antibiotic 1 .....

.....

antibiotic 5 .....

.....

[2]

7. Question part 3/3 | 5090 May-June 2025 P2 V2 Q3

(c) Over time the percentage of each strain in the *S. aureus* population will change.

(i) Suggest which strain, **K**, **L**, **M** or **N**, in Fig. 3.2 is likely to become the largest percentage of the population.

…… [1]

(ii) Explain why the strain named in **(c)(i)** is likely to become the largest percentage of the population over time.

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 16]

8. Question | 5090 May-June 2025 P2 V2 Q6

6 The nucleus of a cell contains DNA molecules that control cell function.

Fig. 6.1 is a diagram showing one of these DNA molecules.

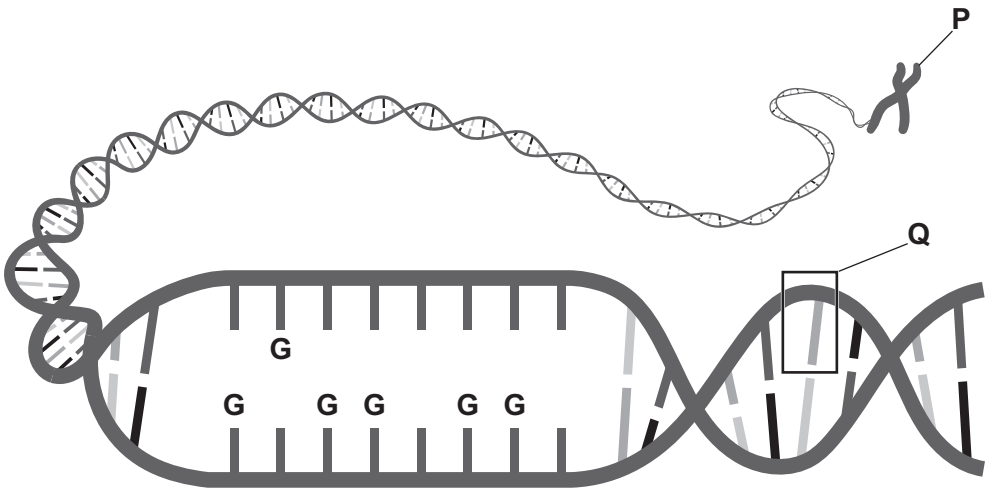

Fig. 6.1

(a) Using information from Fig. 6.1:

(i) state the name of the structure labelled **P**

..... [1]

(ii) state the name of the unit of DNA labelled **Q**

..... [1]

(iii) state the letter of the base that pairs with **G**.

..... [1]

(b) Explain how this DNA molecule controls cell function.

Include an example in your answer.

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

9. Question part 1/2 | 5090 Oct-Nov 2025 P2 V2 Q5

5 A sample of human blood is put in a small tube. The tube is placed in a centrifuge, which spins it around very fast, to separate the components of the blood. The denser components of the blood collect at the bottom of the tube.

Fig. 5.1 shows the composition of this blood sample.

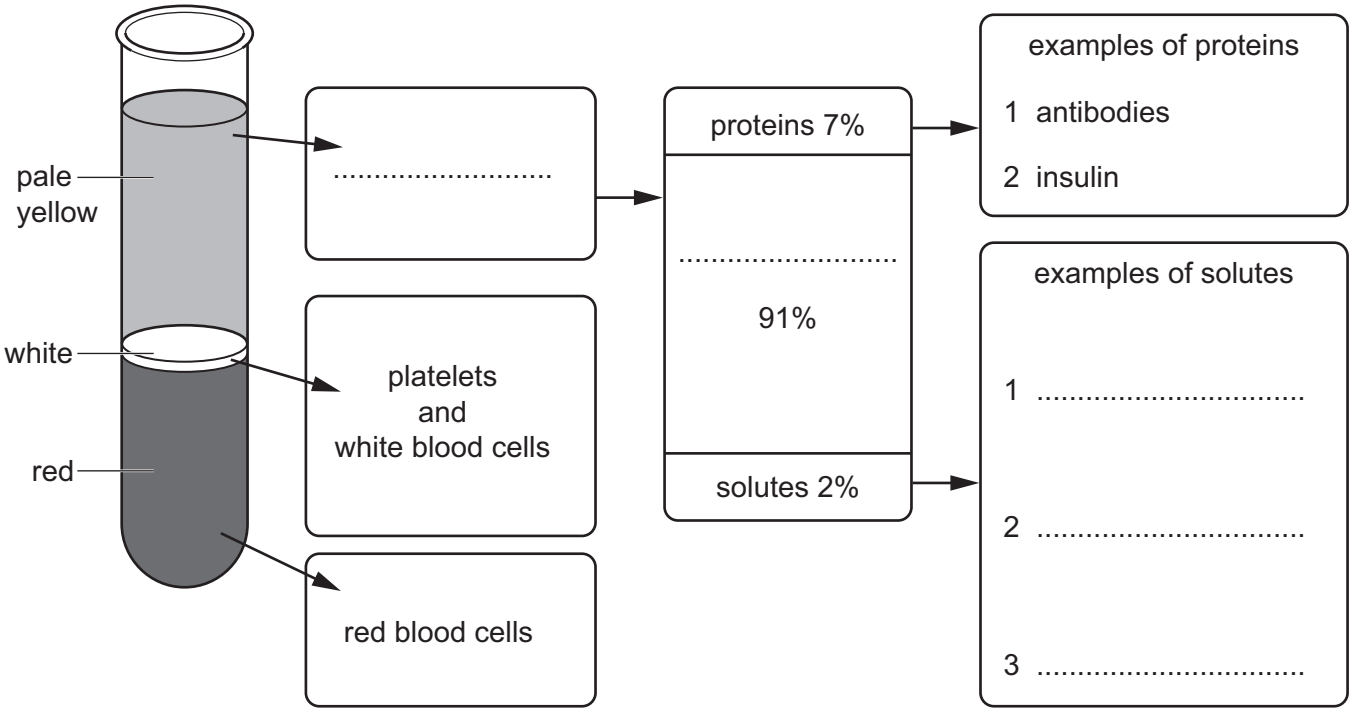

Fig. 5.1

(a) (i) Complete Fig. 5.1 by filling in the names of **five** components shown by the blank spaces. [5]

(ii) Suggest why red blood cells are **more** dense than white blood cells.

.....

.....

.....

.....

..... [2]

(b) The ABO blood groups in humans are determined by three alleles, I^A, I^B and I^O.
There are four blood groups (phenotypes) but six different genotypes for the ABO blood groups.

Complete Table 5.1 to match the blood groups to their possible genotypes.

Table 5.1

blood group (phenotype)	possible genotype(s)
A	
B	
AB	
O	

[4]

(c) A pregnant woman has blood group O.

The fetus in the woman's uterus developed from one of her fertilised eggs and has blood group B.

(i) State the **genotype** of the fetus.

..... [1]

(ii) The woman and the fetus have different blood groups so they have different antigens on their red blood cell membranes.

The woman has antibodies to the antigens on the red blood cell membranes of the fetus.

Explain why the woman's antibodies are **not** usually able to come into contact with the antigens of the fetus.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 15]

10. Question part 1/2 | 5090 May-June 2026 P2 V1 Q4

4 **(a)** Figure 4.1 shows a food web from the Antarctic Ocean.

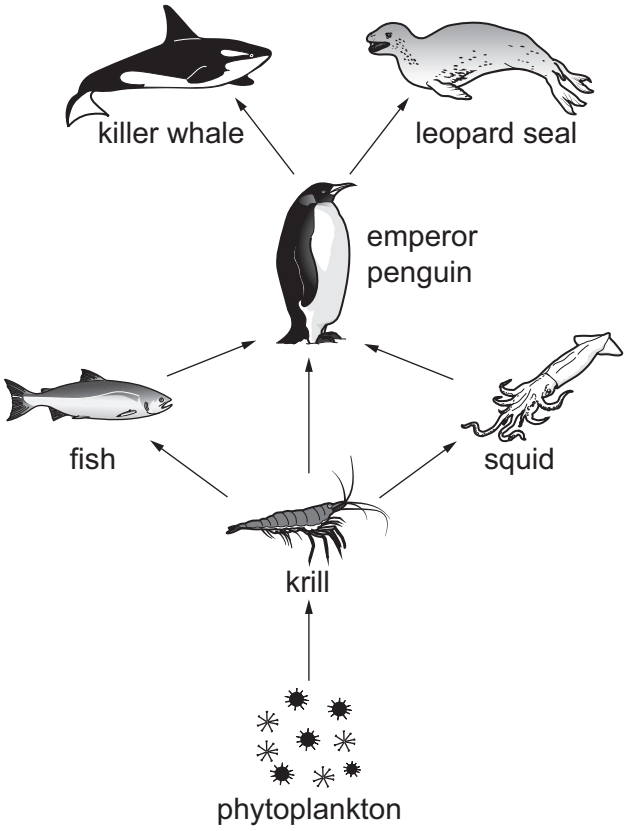

Figure 4.1

(i) Give the name of the herbivore in this food web.

..... [1]

(ii) How many food chains containing five organisms can be drawn from this food web?

..... [1]

(iii) Large numbers of squids are caught by fishing boats.

Explain the possible effects of this overfishing on the krill population.

.....

.....

.....

..... [2]

10. Question part 2/2 | 5090 May-June 2026 P2 V1 Q4

(b) Most penguins have dark feathers on their backs and white feathers on their fronts.

Penguins can be born with white feathers all over. This is caused by a recessive allele **a**.

The dominant allele for having both black and white feathers is **A**.

(i) A heterozygous penguin with both black and white feathers mates with an all-white penguin to produce one chick.

Complete the genetic diagram to calculate the probability that the chick will have both black and white feathers.

all-white penguin

		a	**a**
black and white penguin			

probability = ... [3]

(ii) Seals hunt penguins when both are swimming in the sea.

When seals are swimming above the penguins and looking down at them, the background of the sea looks dark.

When seals are swimming below the penguins and looking up at them, the sky in the background looks light.

Populations of penguins are made up almost entirely of individuals with both black and white feathers. All-white penguins are extremely rare.

Explain why populations of penguins are made up almost entirely of black and white individuals.

Use ideas about natural selection in your answer.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 11]

11. Question part 1/2 | 5090 May-June 2026 P2 V2 Q7

7 The Devon Rex is a breed of cat. Most breeds of cat have straight hair. Due to a gene mutation the Devon Rex has wavy hair.

(a) Explain what a gene mutation is, and how it has produced a change in the hair of the Devon Rex cat.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The wavy hair characteristic is caused by a recessive allele.

Define the term allele.

.....

..... [1]

(c) **(i)** A male Devon Rex cat has the genotype **bb**. A female straight-haired cat has the genotype **Bb**. They are bred together.

Complete the genetic diagram to calculate the probability that a kitten will have wavy hair.

		male Devon Rex cat	
female straight-haired cat			

probability = ...

[3]

11. Question part 2/2 | 5090 May-June 2026 P2 V2 Q7

(ii) The male Devon Rex cat and the female straight-haired cat have seven kittens. Only one of the kittens has wavy hair; the others have straight hair.

Explain why the observed ratio of hair type in the kittens is different to the expected ratio.

.....

.....

.....

.....

..... [2]

[Total: 10]