Section A:

1. Blood is a tissue that is made up of different components. Red blood cells and white blood cells are two of these components.

a. State the other two components of blood.

_____

_____

b. Match the blood components with their functions.

Red blood cells	Help blood to clot
White blood cells	Protect against infection
Plasma	Carry dissolved substances
Platelets	Carry oxygen around the body

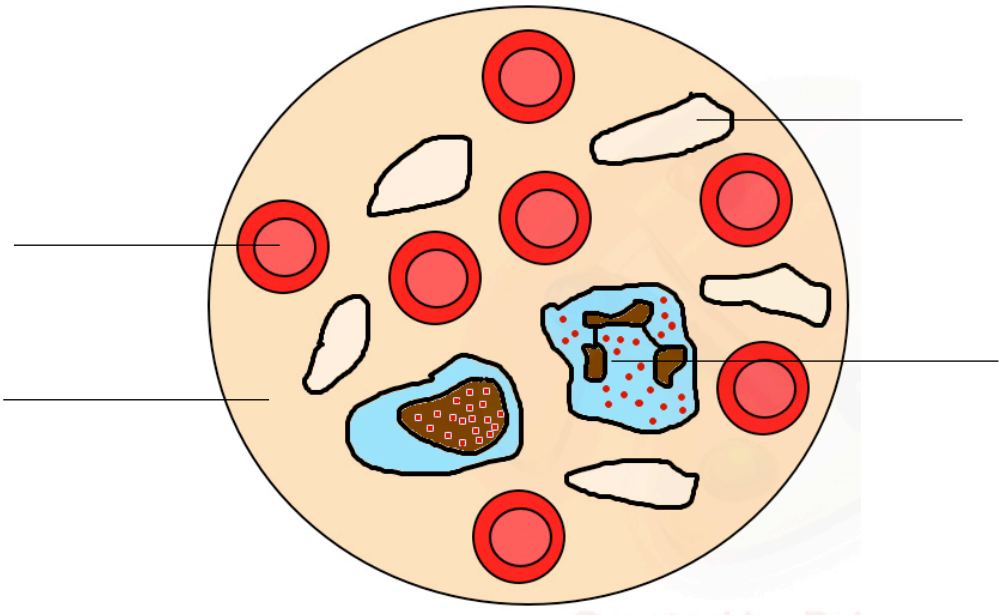
c. Name the protein that carries oxygen in red blood cells.

Hormone ☐

Haemoglobin ☐

Capillary ☐

d. Label the blood components in the diagram below.



Section B

1. The blood supply to parts of the body changes during exercise. The table below shows some of the changes.

	Number of red blood cells per cm^3 of blood (millions)	
Sample	**Person A**	**Person B**
1	4.1	5.6
2	4.1	5.1
3	4.1	5.7
4	4.0	5.5
5	3.9	5.6
Mean		

a. Identify the anomalous result.

b. Complete the table by calculating the mean number of red blood cells per cm3 of Person A's blood and Person B's blood.

c. Explain the advantage of taking a mean.

d. Suggest how these measurements could be made more representative.

e. The average human body contains approximately 5000 cm^3 of blood. Assuming that Person B is average, estimate how many red blood cells they have in their body.

f. Anaemia is a condition where a person's blood does not contain enough healthy red blood cells. Is Person A or Person B more likely to be anaemic? Explain your answer.

g. Explain why sufferers of anaemia may easily get tired.

h. EPO (erythropoietin) is a method of blood doping that is banned in competitive sports. It involves injections which stimulate the production of red blood cells in the bone marrow, as well as increasing the production of haemoglobin.

Explain why EPO may give athletes an unfair advantage.



Science Mastery

Section C:
Platelets are fragments of large cells that have the very important function of blood clotting. Without blood clotting, someone could lose a lot of blood from a small cut. When there is a cut to a blood vessel, blood clotting allows the cut site to be 'plugged' to prevent further bleeding. When there is an injury, a protein called von Willebrand's Factor (VWF) is released from cells that line the inside of blood vessels. Platelets are recruited to the site of injury because they stick to the specific shape of VWF molecules and therefore carry out clotting where it is needed.

There is a common genetic disease called von Willebrand's disease, that approximately 1% of the population suffer from. Type 1 von Willebrand's disease is caused by inheriting a dominant allele of the VWF gene. The sufferers that have this dominant allele have mutations in the gene that codes for VWF, which means that the protein structure is altered and faulty. Sufferers of this disease may have prolonged nose bleeds, frequently bleeding gums, and long-lasting bleeding after cuts or surgery.

1. Describe the role of platelets following a cut.
   _____
2. Explain why platelets do not contain nuclei.
   _____
   _____
3. Describe the function of von Willebrand's factor.
   _____
   _____
4. Explain why a sufferer of von Willebrand's disease would have long-lasting bleeding after cuts or surgery.
   _____
   _____
   _____
5. Explain how a mutation in the gene can cause altered protein structure of VWF.
   _____
   _____
   _____
6. Determine the genotypes and phenotypes of children who have a father who has von Willebrand's disease (genotype = Dd) and a mother who isn't a sufferer. Complete the Punnett square.

