



PE.AP8 Blood: Composition and Its Role in Sporting Performance

AQA 8582 • Calculators not allowed • about 35 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 Which component of blood is primarily responsible for carrying oxygen to working muscles?

- ☐ A) Plasma
- ☐ B) Red blood cells
- ☐ C) White blood cells
- ☐ D) Platelets

(Total for Question 1 is 1 mark)

2 State the primary function of plasma in the blood, as relevant to sport and recovery.

(Total for Question 2 is 1 mark)

3 Name the blood component responsible for clotting to seal wounds after a sporting injury, for example after a rugby tackle.

(Total for Question 3 is 1 mark)

4 Identify one role of white blood cells that is important for an athlete's health during heavy training, giving a short example related to training.

(Total for Question 4 is 1 mark)

5 Describe two substances transported in blood plasma that help an athlete during recovery after training, and give one short function for each substance in recovery.

(Total for Question 5 is 2 marks)

- 6** Explain how an increased number of red blood cells, for example after altitude training, benefits a marathon runner during competition.

(Total for Question 6 is 3 marks)

- 7** A rugby player suffers a cut to the lower leg during a match. Explain two ways platelets help the player immediately after the injury to reduce blood loss and begin repair.

(Total for Question 7 is 3 marks)

- 8** State one way in which blood plasma helps to regulate an athlete's body temperature during a long match or training session, naming the mechanism.

(Total for Question 8 is 1 mark)

- 9** Describe two ways white blood cells respond to a bacterial infection picked up during heavy training, giving one brief example of each response.

(Total for Question 9 is 2 marks)

- 10** Explain how plasma transports carbon dioxide from the leg muscles to the lungs after high intensity exercise, describing the main transport forms.

(Total for Question 10 is 3 marks)

- 11** Table 1 lists four short prompts about blood components in a sporting context. Answer each row.

Table 1

Part	Prompt
(a)	Name the component that carries oxygen to muscles during exercise
(b)	Give one function of platelets after a sporting injury
(c)	Name a substance transported in plasma used for muscle repair
(d)	Give one role of white blood cells in preventing training illness

(a) Answer for row (a). (1)

(b) Answer for row (b). (1)

(c) Answer for row (c). (1)

(d) Answer for row (d). (1)

(Total for Question 11 is 4 marks)

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- 12** Analyse how the composition of blood affects endurance performance, using a long distance runner as your sporting example. Make a judgement about which blood component changes are most important for maintaining high performance during a marathon.

(Total for Question 12 is 6 marks)

Mark scheme · PE.AP8 Blood: Composition and Its Role in Sporting Performance

Question 1

- **B1** B (red blood cells)
- **Answer: B (red blood cells)**

Question 2

- **B1** transports nutrients, hormones, carbon dioxide and heat around the body, oe
- **Answer: Plasma transports nutrients, hormones, carbon dioxide and heat around the body.**

Question 3

- **B1** platelets
- **Answer: Platelets**

Question 4

- **B1** fight infection / destroy pathogens / produce antibodies, any one, oe
- **Answer: Fight infection, for example by producing antibodies to a virus contracted during heavy training.**

Question 5

- **B1** nutrients such as glucose or amino acids, moved to muscles for refuelling and repair, oe
- **B1** hormones such as insulin or growth factors, which regulate metabolism and aid tissue repair, oe
- **Answer: Plasma transports nutrients such as glucose and amino acids to muscles for refuelling and repair, and hormones such as insulin and growth factors that regulate metabolism and help tissue repair.**

Question 6

- **B1** more red blood cells means more haemoglobin available to bind oxygen, oe
- **B1** this increases the blood's oxygen carrying capacity, allowing more oxygen to be delivered to working muscles, oe
- **B1** improved oxygen delivery delays the onset of fatigue and can improve endurance performance in long races, oe
- **Answer: More red blood cells mean more haemoglobin to bind oxygen, increasing the blood's oxygen carrying capacity so more oxygen is delivered to working muscles; this delays fatigue and can improve endurance performance in a marathon.**

Question 7

- **B1** platelets stick together at the site of the wound to form a temporary platelet plug, reducing blood loss, oe
- **B1** platelets release clotting factors which trigger a series of reactions leading to fibrin formation that stabilises the clot and seals the wound, oe
- **B1** this clotting process helps begin tissue repair and reduces the risk of continued bleeding and infection during the match, oe
- **Answer: Platelets aggregate at the wound to form a temporary plug that reduces blood loss, and they release clotting factors that trigger fibrin formation to stabilise the clot and seal the wound, which helps start repair and reduces the risk of further bleeding and infection.**

Question 8

- **B1** transports heat away from working muscles around the body, redistributing heat, oe
- **Answer: Plasma transports heat away from working muscles around the body, redistributing heat to help regulate temperature.**

Question 9

- **B1** engulf and digest pathogens by phagocytosis, example: neutrophils ingest bacteria, oe
- **B1** produce antibodies to target specific pathogens, example: lymphocytes make antibodies to neutralise a bacterium, oe
- **Answer: White blood cells can engulf and digest bacteria by phagocytosis, for example neutrophils ingesting bacteria, and they can produce specific antibodies, for example lymphocytes making antibodies to neutralise a particular bacterium.**

Question 10

- **B1** some carbon dioxide is dissolved directly in plasma and carried in solution, oe
- **B1** some carbon dioxide combines with water in the blood to form bicarbonate ions which are transported in plasma, oe
- **B1** a small amount is carried bound to haemoglobin but the majority in plasma is as dissolved CO₂ or bicarbonate, which is carried to the lungs to be exhaled, oe
- **Answer: Carbon dioxide is carried in plasma partly dissolved directly in the plasma and largely as bicarbonate ions formed when CO₂ reacts with water; a small amount is carried bound to haemoglobin, but most CO₂ produced by working muscles is transported in plasma to the lungs to be exhaled.**

Question 11

- (a) **B1** red blood cells
- (a) **Answer: Red blood cells**
- (b) **B1** form a platelet plug / initiate clotting to stop bleeding, oe
- (b) **Answer: Form a platelet plug to initiate clotting and stop bleeding.**
- (c) **B1** amino acids (or glucose), oe
- (c) **Answer: Amino acids**
- (d) **B1** recognise and destroy pathogens / produce antibodies, any one, oe
- (d) **Answer: Recognise and destroy pathogens, for example by producing antibodies.**

Question 12

- **Level 2** (4-6): A clear and well developed analysis that links changes in blood composition to endurance performance, uses the long distance runner context, and reaches a supported judgement about which component changes are most important.
- **Level 1** (1-3): Basic analysis that describes relevant effects of one or two blood components on endurance, with limited application to the runner and little or no judgement.
- **Indicative content:**
 - Increased red blood cell number and haemoglobin concentration raise the oxygen carrying capacity of the blood, which directly improves oxygen delivery to muscles and delays fatigue in prolonged events like a marathon.
 - Plasma volume can increase with endurance training and hydration, helping maintain blood pressure and enabling steady transport of nutrients, hormones and waste products during long efforts.
 - Efficient removal of carbon dioxide in plasma and via haemoglobin helps maintain acid base balance in muscles, delaying fatigue from metabolic acidosis during sustained high intensity periods within the race.
 - White blood cell competence affects illness risk; reduced immune function during heavy training or illness can lower training quality and impair performance on race day, so maintaining immune health is important.
 - Platelets and clotting are less directly linked to day to day endurance performance but are important for recovery from injuries sustained during training; excessive bleeding would obviously harm overall performance ability.
 - A judgement might conclude that increases in red blood cells and plasma volume are the most important acute adaptations for maintaining high endurance performance because they directly increase oxygen delivery and support circulation, while white blood cells and platelets play supporting roles in health and recovery.