1.6 Short-Term Effects of Exercise on the Body Systems: 30-minute Pack

Total Marks

AQA 8582 · Calculators not allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Explain why blood flow to the digestive system is reduced during exercise, even though this could make someone feel less like digesting a large meal at that time.

(Total for Question 1 is 2 marks)

2 A runner's breathing rate stays higher than resting levels for several minutes after they finish a hard interval session. Explain why breathing rate remains elevated during this recovery period.

(Total for Question 2 is 2 marks)

3 Suggest one reason why the short-term rise in cardiac output during exercise is important for delivering energy to the working muscles.

(Total for Question 3 is 2 marks)

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4 A basketball player notices their leg muscles feel noticeably warmer partway through a game. Explain how increased blood flow to the muscles (vasodilation) contributes to this rise in temperature.

(Total for Question 4 is 2 marks)

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5 Table 2 shows typical values for a hockey player at rest and during a match.

Table 2

Variable	At rest	During the match
Heart rate (bpm)	68	165
Breathing rate (breaths/min)	14	42
Tidal volume (ml)	500	2200
Muscle temperature (degrees Celsius)	37.0	38.5

(a) State the direction of change (increase or decrease) shown for heart rate during the match. **(1)**

(b) State the direction of change shown for breathing rate during the match. **(1)**

(c) State the direction of change shown for tidal volume during the match. **(1)**

(d) State the direction of change shown for muscle temperature during the match, and suggest one reason for this change. **(2)**

(Total for Question 5 is 5 marks)

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6 Exercise produces a number of immediate, short-term effects on the body's muscular-skeletal, cardiovascular and respiratory systems.

(a) State one short-term effect of exercise on the cardiovascular system. **(1)**

(b) State one short-term effect of exercise on the respiratory system. **(1)**

(c) State one short-term effect of exercise on the muscular system. **(1)**

(d) State one short-term effect of exercise on the skeletal system, specifically the joints. **(1)**

(Total for Question 6 is 4 marks)

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7 A 10,000 m runner finishes a hard race, but their heart rate takes over ten minutes to fall back down to its resting level. Explain why heart rate takes this long to return to resting levels after exercise stops.

(Total for Question 7 is 3 marks)

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8 A coach insists that players complete a thorough warm-up before every match, arguing that it triggers many of the short-term effects of exercise before the match itself becomes intense.

Explain one benefit of triggering short-term effects such as increased muscle temperature and increased blood flow to the muscles during a warm-up, before the match reaches its most demanding moments.

(Total for Question 8 is 2 marks)

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9 Which one of the following is a short-term effect of exercise, rather than a long-term training adaptation?

- ☐ A) A lower resting heart rate
- ☐ B) Cardiac hypertrophy (a larger, stronger heart muscle)
- ☐ C) Increased capillarisation around the muscles
- ☐ D) An increase in breathing rate during a hard session

(Total for Question 9 is 1 mark)

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10 What is meant by the term 'stroke volume'?

- ☐ A) The volume of blood pumped out of the heart's ventricle with each beat
- ☐ B) The number of times the heart beats in one minute
- ☐ C) The volume of blood pumped out of the heart in one minute
- ☐ D) The total volume of blood in the body

(Total for Question 10 is 1 mark)

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11 Chloe is a club cyclist. Table 3 shows her heart rate and stroke volume at rest and during a hard hill climb.

Table 3

Measurement	At rest	Hill climb
Heart rate (beats per minute)	70	160
Stroke volume (ml per beat)	80	120

(a) Calculate Chloe's cardiac output at rest. Give your answer in ml per minute. **(2)**

.....

(b) Calculate Chloe's cardiac output during the hill climb. Give your answer in ml per minute. **(2)**

.....

(Total for Question 11 is 4 marks)

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12 During exercise, heart rate typically rises very rapidly in the first few seconds, then continues to rise more gradually if the exercise continues at a steady, sub-maximal intensity. Explain why heart rate rises so quickly at the very start of exercise.

(Total for Question 12 is 2 marks)

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13 During exercise, blood flow is redistributed around the body, a process sometimes called the vascular shunt.

(a) State what happens to the blood vessels supplying the working muscles during exercise. **(1)**

(b) State what happens to the blood vessels supplying organs not essential during exercise, such as the digestive system. **(1)**

(c) Explain why this redistribution of blood flow is beneficial during exercise. **(1)**

(Total for Question 13 is 3 marks)

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Mark scheme · 1.6 Short-Term Effects of Exercise on the Body Systems: 30-minute Pack

Question 1

digestion is not essential for the exercise being performed, so the body prioritises sending its available blood elsewhere, oe **B1**

the arterioles supplying the digestive system vasoconstrict, freeing up blood to be redirected (via vasodilation) to the working muscles, which need the extra oxygen more urgently, oe **B1**

Answer: Digestion is not essential for the exercise being performed, so the body prioritises sending its available blood elsewhere; the arterioles supplying the digestive system vasoconstrict, freeing up blood to be redirected to the working muscles, which need the extra oxygen more urgently.

Question 2

the body has an oxygen debt to repay following the intense exercise, oe **B1**

the extra oxygen taken in through continued faster breathing is used to help break down/remove the lactic acid that built up and to replenish the muscle's stores of ATP and phosphocreatine, oe **B1**

Answer: The body has an oxygen debt to repay following the intense exercise, so it continues breathing faster than resting levels to take in the extra oxygen needed to help break down the lactic acid that built up and to replenish the muscle's stores of ATP and phosphocreatine.

Question 3

a higher cardiac output means more blood, and so more oxygen and glucose/fuel, is delivered to the working muscles every minute, oe **B1**

this supports the aerobic system in producing energy at the faster rate needed during exercise, helping delay fatigue, oe **B1**

Answer: A higher cardiac output means more blood, and so more oxygen and fuel, is delivered to the working muscles every minute; this supports the aerobic system in producing energy at the faster rate needed during exercise, helping delay fatigue.

Question 4

vasodilation increases the volume of warm blood flowing through the working muscles, oe **B1**

combined with heat produced by the muscles' own increased metabolic activity, this raises the overall temperature of the muscle tissue, oe **B1**

Answer: Vasodilation increases the volume of warm blood flowing through the working muscles; combined with the heat produced by the muscles' own increased metabolic activity, this raises the overall temperature of the muscle tissue.

Question 5

(a) increase **B1**

(a) Answer: Increase

(b) increase **B1**

(b) Answer: Increase

(c) increase **B1**

(c) Answer: Increase

(d) increase **B1**

(d) increased metabolic activity/energy production in the working muscles produces heat, and increased blood flow to the muscles also carries warm blood into them, oe **B1**

(d) Answer: Increase; this is because increased metabolic activity in the working muscles produces heat, and increased blood flow to the muscles also carries warm blood into them.

Question 6

(a) any one of: increased heart rate / increased stroke volume / increased cardiac output / redistribution of blood flow to the working muscles **B1**

(a) Answer: For example, an increase in heart rate.

(b) any one of: increased breathing rate / increased tidal volume/depth of breathing **B1**

(b) Answer: For example, an increase in breathing rate.

(c) any one of: increased muscle temperature / build-up of lactic acid / muscle fatigue **B1**

(c) Answer: For example, an increase in muscle temperature.

(d) increased production of synovial fluid, which lubricates the joints more during exercise, oe **B1**

(d) Answer: An increase in the production of synovial fluid, which lubricates the joints more during exercise.

Question 7

the body has built up an oxygen debt during the hard, sustained effort of the race, oe **B1**

an elevated heart rate is needed during recovery to keep delivering the extra oxygen required to help remove lactic acid and replenish the muscle's ATP and phosphocreatine stores, oe **B1**

only once this recovery process is largely complete does heart rate gradually fall back down towards its normal resting level, oe **B1**

Answer: The body has built up an oxygen debt during the hard, sustained effort of the race, and an elevated heart rate is needed during recovery to keep delivering the extra oxygen required to help remove lactic acid and replenish the muscle's ATP and phosphocreatine stores; only once this recovery process is largely complete does heart rate gradually fall back towards its normal resting level.

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Question 8

raising muscle temperature and blood flow gradually during a warm-up means the muscles are already warmer, more elastic and better supplied with oxygen before the match's most intense moments begin, oe **B1**

this can reduce the risk of injury (e.g. muscle strains) and mean the player is not starting the most demanding actions of the match 'cold', helping performance from the very first sprint or tackle, oe **B1**

Answer: Raising muscle temperature and blood flow gradually during a warm-up means the muscles are already warmer, more elastic and better supplied with oxygen before the match's most intense moments begin; this can reduce the risk of injury and means the player is not starting demanding actions 'cold', helping performance from the very first sprint or tackle.

Question 9

D (An increase in breathing rate during a hard session) **B1**

Answer: D (An increase in breathing rate during a hard session)

Question 10

A (The volume of blood pumped out of the heart's ventricle with each beat) **B1**

Answer: A (The volume of blood pumped out of the heart's ventricle with each beat)

Question 11

(a) stroke volume x heart rate, e.g. 80 x 70 **M1**

(a) 5600 (ml per minute) cao; accept 5.6 litres per minute **A1**

(a) Answer: 5600 ml per minute

(b) stroke volume x heart rate, e.g. 120 x 160 **M1**

(b) 19200 (ml per minute) cao; accept 19.2 litres per minute **A1**

(b) Answer: 19200 ml per minute

Question 12

the working muscles' demand for oxygen increases very suddenly as soon as exercise begins, oe **B1**

the nervous system responds quickly to this by increasing heart rate rapidly, to try to increase the delivery of oxygenated blood to the muscles as fast as possible, oe **B1**

Answer: The working muscles' demand for oxygen increases very suddenly as soon as exercise begins, so the nervous system responds quickly by increasing heart rate rapidly, to try to increase the delivery of oxygenated blood to the muscles as fast as possible.

Question 13

(a) they vasodilate (widen), oe **B1**

(a) Answer: They vasodilate (widen).

(b) they vasoconstrict (narrow), oe **B1**

(b) Answer: They vasoconstrict (narrow).

(c) it directs more oxygenated blood towards the working muscles, which need it most, and away from organs (such as the gut) that need less blood during exercise, oe **B1**

(c) Answer: It directs more oxygenated blood towards the working muscles, which need it most during exercise, and away from organs such as the gut, which need less blood while exercising.

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