



PE.HW3 Health, Fitness and Wellbeing: Macronutrients - Carbohydrate, Fat and Protein

AQA 8582 · Calculator allowed · about 50 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** Which macronutrient is the body's preferred energy source during exercise, particularly at higher intensities?

- ☐ A) Carbohydrate
- ☐ B) Protein
- ☐ C) Fat
- ☐ D) Fibre

(Total for Question 1 is 1 mark)

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- 2** State the main role in the body of each of the following macronutrients.

(a) Carbohydrate. (1)

(b) Fat. (1)

(c) Protein. (1)

(Total for Question 2 is 3 marks)

3 Carbohydrates can be classified as simple or complex.

(a) Distinguish between simple and complex carbohydrates, giving an example of each. (2)

(b) Explain why complex carbohydrates are often used to provide a sustained energy release during exercise, compared with simple carbohydrates. (2)

(Total for Question 3 is 4 marks)

4 State two examples of foods that are good sources of protein.

(Total for Question 4 is 2 marks)

5 Which nutrient is mainly responsible for the growth and repair of muscle tissue?

- ☐ A) Carbohydrate
- ☐ B) Protein
- ☐ C) Fat
- ☐ D) Water

(Total for Question 5 is 1 mark)

6 Explain why protein is not usually the body's main energy source during exercise.

(Total for Question 6 is 2 marks)

7 Explain why an endurance athlete, such as a marathon runner, relies more heavily on fat as an energy source during long, lower-intensity training sessions, compared with a 100 metre sprinter.

(Total for Question 7 is 3 marks)

- 8** A rugby prop and a marathon runner have different training demands. Explain why the rugby prop's diet is likely to need a relatively higher protein intake than a distance runner focused primarily on aerobic endurance training.

(Total for Question 8 is 3 marks)

- 9** State two functions of fat in the body, other than as an energy source.

(Total for Question 9 is 2 marks)

- 10** The approximate energy value of carbohydrate is 4 kcal per gram, and the approximate energy value of fat is 9 kcal per gram. A snack contains 30 g of carbohydrate and 10 g of fat. Using the formula $\text{energy (kcal)} = \text{mass (g)} \times \text{energy value (kcal per g)}$, calculate the total energy provided by the carbohydrate and fat in this snack.

(Total for Question 10 is 2 marks)

- 11** Which macronutrient provides the most energy per gram?

- ☐ A) Carbohydrate (approximately 4 kcal per gram)
- ☐ B) Protein (approximately 4 kcal per gram)
- ☐ C) Fat (approximately 9 kcal per gram)
- ☐ D) Fibre (approximately 2 kcal per gram)

(Total for Question 11 is 1 mark)

- 12** Discuss the roles that carbohydrate, fat and protein each play in supporting Ben, a club-level cyclist preparing for a long-distance sportive lasting several hours, during his training and on the day of the event, and evaluate why an appropriate balance of all three macronutrients, rather than a focus on just one, best supports his training and performance.

(Total for Question 12 is 9 marks)

- 13** Which of the following is an example of a complex carbohydrate food?

- ☐ A) Table sugar
- ☐ B) Wholegrain pasta
- ☐ C) Fruit juice
- ☐ D) A glucose sports gel

(Total for Question 13 is 1 mark)

- 14** Explain why a performer's carbohydrate needs generally increase as their weekly training volume (hours of training per week) increases.

(Total for Question 14 is 2 marks)

- 15** Explain the process by which dietary energy that is not used by the body can be stored as body fat, and explain why this is a normal physiological process rather than, by itself, evidence of an unhealthy diet.

(Total for Question 15 is 3 marks)

16 State two food sources that are good sources of complex carbohydrate.

(Total for Question 16 is 2 marks)

17 Which of the following best describes the role of glycogen in the body?

- ☐ A) A stored form of carbohydrate, kept in the muscles and liver for use as fuel
- ☐ B) A type of protein used for muscle repair
- ☐ C) A vitamin needed for bone health
- ☐ D) A fat-soluble energy reserve stored under the skin

(Total for Question 17 is 1 mark)

18 Compare the timescale over which the body can access energy from carbohydrate stores versus fat stores during exercise, and explain why this matters for a performer choosing a pre-event fuelling strategy.

(Total for Question 18 is 3 marks)

19 Erin is preparing for a 30-minute, high-intensity indoor cycling race.

State which macronutrient is likely to be her main energy source during the race, and justify your answer.

(Total for Question 19 is 2 marks)

20 State two functions of protein in the body.

(Total for Question 20 is 2 marks)

21 Which macronutrient provides approximately 9 kcal of energy per gram, more than double the value of the other two main macronutrients?

- ☐ A) Carbohydrate
- ☐ B) Protein
- ☐ C) Fat
- ☐ D) Water

(Total for Question 21 is 1 mark)

Mark scheme · PE.HW3 Health, Fitness and Wellbeing: Macronutrients - Carbohydrate, Fat and Protein

Question 1

- **B1 A**
- **Answer: A**

Question 2

- (a) **B1** the body's preferred energy source for exercise, oe
- (a) **Answer: The body's preferred energy source for exercise.**
- (b) **B1** a secondary/reserve energy source, particularly important for prolonged, lower-intensity exercise, oe
- (b) **Answer: A secondary energy source, particularly important for prolonged, lower-intensity exercise.**
- (c) **B1** growth and repair of muscle and other body tissue, oe
- (c) **Answer: Growth and repair of muscle and other body tissue.**

Question 3

- (a) **B1** simple carbohydrates (sugars, e.g. found in fruit or table sugar) are broken down quickly, oe
- (a) **B1** complex carbohydrates (starches, e.g. found in pasta, rice or potatoes) are broken down more slowly, oe
- (a) **Answer: Simple carbohydrates (sugars, e.g. found in fruit or table sugar) are broken down quickly; complex carbohydrates (starches, e.g. found in pasta, rice or potatoes) are broken down more slowly.**
- (b) **B1** complex carbohydrates release glucose into the bloodstream more gradually, oe
- (b) **B1** this provides a steadier, more sustained energy supply rather than a rapid rise and fall, oe
- (b) **Answer: Complex carbohydrates release glucose into the bloodstream more gradually than simple carbohydrates, providing a steadier, more sustained energy supply rather than a rapid rise and fall.**

Question 4

- **B1** any valid protein source, e.g. chicken, fish, eggs, oe
- **B1** a second, distinct valid protein source, e.g. beans, lentils, dairy, oe
- **Answer: For example, chicken and eggs.**

Question 5

- **B1 B**
- **Answer: B**

Question 6

- **B1** the body preferentially uses carbohydrate and fat stores for energy during exercise, oe
- **B1** protein is only broken down for energy in any significant amount when carbohydrate and fat stores are very depleted, oe
- **Answer: The body preferentially uses carbohydrate and fat stores for energy during exercise, and protein is only broken down for energy in significant amounts when carbohydrate and fat stores are very depleted.**

Question 7

- **B1** fat is used more during prolonged, lower-intensity aerobic exercise, since it can be broken down using oxygen over a longer timescale, oe
- **B1** the marathon runner's event lasts a much longer duration at lower relative intensity, matching the conditions where fat metabolism is most effective, oe
- **B1** a 100m sprint lasts only a few seconds and is extremely high-intensity, relying mainly on stored carbohydrate/anaerobic energy systems rather than fat, oe
- **Answer: Fat is used more during prolonged, lower-intensity aerobic exercise, since it can be broken down using oxygen over a longer timescale, and a marathon's duration and intensity match those conditions closely. A 100m sprint lasts only a few seconds at extremely high intensity, relying mainly on stored carbohydrate rather than fat.**

Question 8

- **B1** the prop's training is likely to involve more resistance/strength-based work aimed at increasing muscle size and strength, oe
- **B1** protein is needed for the growth and repair of muscle tissue, oe
- **B1** so a higher relative demand for muscle-building and repair is generally matched with a higher relative protein need, oe
- **Answer: The prop's training is likely to involve more resistance-based work aimed at increasing muscle size and strength, and protein is needed for the growth and repair of muscle tissue, so this higher muscle-building demand is generally matched with a higher relative protein need.**

Question 9

- **B1** insulation, helping to maintain body temperature, oe
- **B1** protection/cushioning of internal organs, oe
- **Answer: Fat helps to insulate the body, maintaining body temperature, and it cushions and protects internal organs.**

Question 10

- **M1** $30 \times 4 (= 120)$ or $10 \times 9 (= 90)$ seen, oe
- **A1** 210 kcal cao
- **Answer: 210 kcal.**

Question 11

- **B1** C
- **Answer: C**

Question 12

- **Level 3** (7-9): A detailed and coherent response that accurately explains the roles of carbohydrate, fat and protein, applies them specifically to Ben's several-hour sportive, and reaches a well-justified evaluative judgement about why a balance of all three, rather than any single macronutrient, best supports his training. Sustained, accurate use of nutrition terminology throughout.
- **Level 2** (4-6): Some accurate coverage of the roles of at least two macronutrients, with some application to Ben's situation, though coverage of all three or the evaluative judgement may be underdeveloped. Generally correct use of terminology.
- **Level 1** (1-3): Basic or generic statements about carbohydrate, fat and/or protein with little or no specific application to Ben's situation and little evaluation of the need for balance.
- **Level 0** (0): No relevant content.
- **Indicative content:**
 - Carbohydrate: the preferred fuel, particularly during the higher-intensity climbs or surges within the sportive, and stored as glycogen that is used up progressively over several hours.
 - Fat: a much larger energy reserve than carbohydrate, particularly important for fuelling the many hours of lower-intensity, steady riding within the event.
 - Protein: does not fuel the ride directly in significant amounts, but supports repair of muscle tissue damaged during the long ride, aiding recovery and adaptation between training sessions.
 - Evaluative point: relying only on carbohydrate risks running out of readily available fuel later in a several-hour event, since glycogen stores are comparatively limited.
 - Evaluative point: relying only on fat would not provide fuel quickly enough for higher-intensity efforts within the ride, such as climbs.
 - Evaluative point: neglecting protein would slow muscle repair between long training rides, potentially limiting how well Ben adapts to and recovers from his training programme.
 - Balanced conclusion: because the sportive combines a long duration with variable intensity, and training needs ongoing recovery, a balance matched to these specific demands supports both performance on the day and progress in training, better than emphasising a single macronutrient.

Question 13

- **B1** B
- **Answer: B**

Question 14

- **B1** carbohydrate is stored in the muscles and liver as glycogen and used as the main fuel during exercise, oe
- **B1** more training means more glycogen is used up overall, so more carbohydrate is generally needed to restore and fuel that training, oe
- **Answer: Carbohydrate is stored in the muscles and liver as glycogen and used as the main fuel during exercise. More training means more glycogen is used up overall, so more carbohydrate is generally needed to restore and fuel that training.**

Question 15

- **B1** when energy intake from food and drink is greater than energy expenditure over a period of time, the surplus energy can be stored by the body, partly as fat, oe
- **B1** this is a normal, useful physiological mechanism that allows the body to store energy for later use, oe
- **B1** whether this represents a health concern depends on many other factors (e.g. the amount, how long it continues, the individual), so it cannot be judged from this process alone, oe
- **Answer: When energy intake is greater than energy expenditure over time, the surplus energy can be stored by the body, partly as fat. This is a normal, useful physiological process that allows the body to store energy for later use, and whether it represents a health concern depends on many other factors, so it cannot be judged from this process alone.**

Question 16

- **B1** wholegrain bread or pasta, oe
- **B1** rice, potatoes or oats, oe
- **Answer: Wholegrain bread or pasta, and rice, potatoes or oats, are all good sources of complex carbohydrate.**

Question 17

- **B1** A
- **Answer: A**

Question 18

- **B1** carbohydrate (glycogen) stores are comparatively limited but can be broken down quickly, providing readily available energy, especially for high-intensity efforts, oe
- **B1** fat stores are much larger but are broken down more slowly, providing a steadier supply over longer, lower-intensity efforts, oe
- **B1** so a performer preparing for a short, intense event may prioritise topping up carbohydrate stores, while a performer preparing for a longer, steadier event can also rely more on fat stores, oe
- **Answer: Carbohydrate stores are comparatively limited but broken down quickly, providing readily available energy, especially for high-intensity efforts. Fat stores are much larger but broken down more slowly, providing a steadier supply over longer, lower-intensity efforts. A performer preparing for a short, intense event may therefore prioritise topping up carbohydrate stores, while one preparing for a longer, steadier event can also rely more on fat stores.**

Question 19

- **B1** carbohydrate, oe
- **B1** because the event is short and high-intensity, and carbohydrate can be broken down quickly enough to match this energy demand, oe
- **Answer: Carbohydrate, because the event is short and high-intensity, and carbohydrate can be broken down quickly enough to match this energy demand.**

Question 20

- **B1** growth of new muscle tissue, oe
- **B1** repair of tissue damaged during exercise, oe
- **Answer: Protein supports the growth of new muscle tissue, and the repair of tissue damaged during exercise.**

Question 21

- **B1** C
- **Answer: C**