



K2D Nutrition and Digestion: Exam Drill

AQA AQA KS3 Science - Biology · Calculator allowed · about 75 minutes

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** Give three different nutrients found in food and state one role for each nutrient in the human body.
 - (a) Nutrient 1 and its role. (1)
 - (b) Nutrient 2 and its role. (1)
 - (c) Nutrient 3 and its role. (1)

- 2** Name the organ where most digestion by enzymes occurs in the human body. (1)

- 3** Describe how digestive enzymes help to break down food. Give one example of an enzyme and the food it acts on.
 - (a) Describe how enzymes help digestion. (1)
 - (b) Name one enzyme and the food it acts on. (1)

4 Label the three types of human teeth from their descriptions. 1) Sharp front teeth used for biting. 2) Long teeth with a pointed shape used for tearing. 3) Flat back teeth for grinding food.

(a) 1) Sharp front teeth used for biting. (1)

(b) 2) Long teeth with a pointed shape used for tearing. (1)

(c) 3) Flat back teeth for grinding food. (1)

5 A 100 g slice of bread contains 50 g carbohydrate and 5 g fat. Calculate how many grams of the slice are neither carbohydrate nor fat. State your working.

(a) Calculate grams not carbohydrate or fat. (2)

6 A student plans to test how the concentration of starch affects the time taken for a sample of saliva to turn iodine-stained starch solution from brown to yellow, showing starch is broken down. Identify one variable they should change, one variable they should keep the same, and one control they should include. Explain each choice in one sentence.

(a) Variable to change and explanation. (1)

(b) Variable to keep the same and explanation. (1)

(c) Control to include and explanation. (1)

- 7** The table shows the time (seconds) taken for amylase in saliva to reduce visible starch in separate test tubes with different starch concentrations. Times were measured three times and the mean time calculated.

Starch concentration (g per 100 cm³): 0.5, 1, 2, 4

Mean time to lose visible starch (s): 150, 120, 90, 70

(a) Plotting concentration against mean time gives a trend where higher starch concentration gives shorter mean time. Explain two possible scientific reasons for this trend. (b) Suggest one limitation of the experiment and how to improve it.

- (a) Give two scientific reasons why higher starch concentration might give a shorter mean time for starch disappearance, up to a point. One reason per line. (3)

- (b) Suggest one limitation and an improvement. (2)

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- 8** Describe what is meant by a balanced diet and give two examples of foods that would help make a diet balanced. One example must supply protein and the other must supply fibre.

- (a) Describe a balanced diet. (1)

- (b) Give one food that supplies protein. (1)

- (c) Give one food that supplies fibre. (1)

9 The table shows how long three different foods take to be digested in a simple simulated stomach test (times in minutes).

Food A: 30, 28, 32

Food B: 45, 40, 50

Food C: 20, 22, 18

(a) Calculate the mean digestion time for each food to 1 decimal place. (b) Which food is digested fastest?

(a) Calculate mean time for Food A, B and C to 1 decimal place. (3)

(b) Which food is digested fastest? (1)

10 Design a simple practical to test whether lipase digests fat using a visible change. Describe the key steps, one safety or ethical point, and what you would measure to decide if digestion occurred.

(a) Describe the key steps of the practical. (2)

(b) Give one safety or ethical point. (1)

(c) State what you would measure to decide if digestion occurred. (1)

11 Explain briefly what is meant by peristalsis in the digestive system.

(a) Give definition and how it moves food. (2)

12 Describe two features of the small intestine that help absorption of nutrients, and explain how each feature helps absorption.

(a) Feature 1 and explanation. (1)

(b) Feature 2 and explanation. (1)

13 Match each food to the nutrient it contains most of. Write the letter and nutrient. Foods:

A) Lentils B) Olive oil C) Bananas

Nutrients: 1) Carbohydrate 2) Protein 3) Fat

(a) A) Lentils (1)

(b) B) Olive oil (1)

(c) C) Bananas (1)

14 A student adds a drop of iodine solution to a sample of food extract and the liquid turns blue-black. What does this result show? State the test and the conclusion.

(a) Name the test used. (1)

(b) Give the conclusion from the blue-black colour. (1)

15 A pupil has mass 54 kg and height 1.65 m. Calculate the pupil's body mass index (BMI) to one decimal place. BMI = mass / height squared. Is the BMI in the healthy range for adults (18.5 to 24.9)?

(a) Calculate BMI to one decimal place. (2)

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(b) State whether this BMI is in the healthy adult range and justify. (1)

16 Explain two reasons why chewing food properly helps digestion.

(a) Reason 1. (1)

(b) Reason 2. (1)

17 You are asked to plan an investigation to find how temperature affects the rate of amylase activity on starch. Describe a method, what variables you would control, how you would measure rate, and how you would present your results. Include any safety considerations.

Assess the quality of a proposed method, control of variables, measurement and presentation for an investigation into the effect of temperature on amylase activity. Use your knowledge of practical techniques to give a detailed plan and justify choices.

(6)

18 The graph below shows enzyme activity against temperature for a digestive enzyme. Activity rises with temperature up to 37 degrees C, then falls rapidly above 50 degrees C. (a) Explain why activity increases with temperature up to 37 degrees C. (b) Explain why activity falls rapidly above 50 degrees C.

(a) Explain the increase in activity up to 37 degrees C. (2)

(b) Explain the rapid fall in activity above 50 degrees C. (2)

Mark scheme · K2D Nutrition and Digestion: Exam Drill

Question 1

- (a) **B1** one nutrient named with one correct role (e.g. carbohydrate - provide energy) oe
- (a) Answer: **Carbohydrate - provide energy**
- (b) **B1** one nutrient named with one correct role (e.g. protein - growth and repair) oe
- (b) Answer: **Protein - growth and repair**
- (c) **B1** one nutrient named with one correct role (e.g. fat - energy store and insulation) oe
- (c) Answer: **Fat - energy store and insulation**

Question 2

- **B1** small intestine (cao)
- Answer: **Small intestine**

Question 3

- (a) **B1** they speed up chemical reactions that break large food molecules into smaller ones without being used up (oe)
- (a) Answer: **Enzymes speed up reactions that break large food molecules into smaller molecules without being used up.**
- (b) **B1** one correct enzyme and substrate (e.g. amylase acts on starch) oe
- (b) Answer: **Amylase acts on starch**

Question 4

- (a) **B1** incisors (cao)
- (a) Answer: **Incisors**
- (b) **B1** canines (eye teeth) (cao)
- (b) Answer: **Canines**
- (c) **B1** molars (or premolars if accepted) (cao)
- (c) Answer: **Molars**

Question 5

- (a) **M1** calculate $100 - (50 + 5)$ or equivalent
- (a) **A1** 45 g (cao)
- (a) Answer: **45 g**

Question 6

- (a) **M1** starch concentration changed with explanation that this is the factor being tested
- (a) Answer: **Change starch concentration - this tests how different starch (substrate) levels affect the rate of starch breakdown.**
- (b) **M1** keep temperature constant with explanation that temperature affects enzyme activity
- (b) Answer: **Keep temperature the same - temperature affects enzyme activity so it must be constant to make the test fair.**
- (c) **M1** include a control with no starch or no saliva and explain it shows change is due to the variable
- (c) Answer: **Include a control with no added starch (or no saliva) - this shows whether colour change is due to the starch concentration rather than other factors.**

Question 7

- (a) **M1** more substrate (starch) molecules increase the chance of collision with amylase active sites, increasing reaction rate
- (a) **M1** more enzyme-substrate complexes form per second at higher substrate concentration, so starch is broken down faster (until enzyme becomes the limiting factor)
- (a) **A1** both reasons linked to observed shorter times, oe
- (a) Answer: **1) More starch molecules give more chances of collision with amylase active sites, increasing the rate of reaction. 2) At higher substrate concentration more enzyme-substrate complexes form each second, so the starch is broken down faster, up to the point where the enzyme becomes the limiting factor.**
- (b) **M1** state a limitation such as temperature not controlled or timing method imprecise
- (b) **A1** propose an improvement that addresses the limitation (e.g. use a water bath to keep constant temperature or use a colorimeter) oe
- (b) Answer: **Limitation: temperature was not kept constant. Improvement: use a water bath to hold samples at a fixed temperature to make the test fair.**

Question 8

- (a) **B1** contains the right types and amounts of nutrients for health (e.g. carbohydrates, proteins, fats, vitamins, minerals, fibre, water) oe
- (a) Answer: **A diet with the right types and amounts of different nutrients needed for health, including carbohydrates, proteins, fats, vitamins, minerals, fibre and water.**
- (b) **B1** one correct example supplying protein (e.g. chicken, beans, eggs) oe
- (b) Answer: **Chicken**
- (c) **B1** one correct example supplying fibre (e.g. wholemeal bread, oats, vegetables) oe
- (c) Answer: **Wholemeal bread**

Question 9

- (a) **M1** correct method for at least one mean (sum values / 3)
- (a) **A1** Food A = 30.0 min cao
- (a) **A1** Food B = 45.0 min and Food C = 20.0 min cao (either order) ft
- (a) Answer: **Food A = 30.0 min; Food B = 45.0 min; Food C = 20.0 min**
- (b) **B1** Food C cao
- (b) Answer: **Food C**

Question 10

- (a) **M1** mix known volume of fat emulsion with lipase solution in test tube or use series at different times
- (a) **A1** state a final step such as observe formation of clear layer or measure pH change due to fatty acid production, cao
- (a) Answer: **Mix a measured volume of fat emulsion with lipase solution, incubate at a set temperature, and observe samples over time for the emulsion becoming clearer or a pH drop indicating fatty acid formation.**
- (b) **B1** one safety/ethical point such as wear goggles, heat carefully, dispose of waste down drain with plenty of water, or do not taste samples
- (b) Answer: **Wear safety goggles and avoid tasting any samples; dispose of enzyme solutions according to school rules.**
- (c) **B1** measure time taken for emulsion to clear or record pH change magnitude or record amount of clear layer, oe
- (c) Answer: **Measure time for the fat emulsion to become clearer or measure the change in pH indicating fatty acid production.**

Question 11

- (a) **M1** muscular contractions in the gut wall move food along
- (a) **A1** these waves push food in one direction toward the stomach or intestines, oe
- (a) Answer: **Peristalsis is waves of muscular contraction in the gut wall that push food along in one direction through the digestive system.**

Question 12

- (a) **M1** villi increase surface area with explanation that larger surface area increases absorption rate
- (a) Answer: **Villi increase surface area so more nutrients can be absorbed quickly.**
- (b) **M1** each villus has many blood capillaries so absorbed nutrients are carried away, maintaining concentration gradients
- (b) Answer: **Each villus has many capillaries to carry away absorbed nutrients, keeping the concentration gradient high and aiding diffusion.**

Question 13

- (a) **B1** B1: protein (cao)
- (a) Answer: **A) Protein**
- (b) **B1** C1: fat (cao)
- (b) Answer: **B) Fat**
- (c) **B1** A1: carbohydrate (cao)
- (c) Answer: **C) Carbohydrate**

Question 14

- (a) **B1** iodine test for starch (or iodine solution) cao
- (a) Answer: **Iodine test for starch**
- (b) **B1** starch is present in the sample (cao)
- (b) Answer: **Starch is present in the sample.**

Question 15

- (a) **M1** substitute 54 / (1.65 x 1.65) or equivalent
- (a) **A1** 19.8 (kg/m²) cao
- (a) Answer: **19.8 kg/m²**
- (b) **B1** state it is in the healthy range because 19.8 is between 18.5 and 24.9
- (b) Answer: **Yes; 19.8 is between 18.5 and 24.9 so it is within the healthy adult range.**

Question 16

- (a) **M1** mechanical breakdown increases surface area allowing enzymes to act more quickly
- (a) Answer: **Chewing breaks food into smaller pieces, increasing surface area so enzymes can digest it faster.**
- (b) **M1** mixes food with saliva containing amylase, starting chemical digestion of starch
- (b) Answer: **Chewing mixes food with saliva so amylase can start breaking down starch chemically in the mouth.**

Question 17

- **Level 3** (5-6): Detailed method with appropriate control of variables, clear and accurate measurement of rate, realistic presentation plan and safety considerations. Justifications show understanding of how variables affect enzyme activity and how to obtain reliable data.
- **Level 2** (3-4): Method with some suitable controls and a way to measure rate. Partial plan for presentation and basic safety points. Some justification of choices but lacking detail or precision.
- **Level 1** (0-2): Simple or incomplete method with few controls, vague measurement or presentation ideas and little or no justification.
- **Indicative content:**
 - Method: prepare starch solution and amylase solution at known concentrations; use water baths set to different temperatures (e.g. 10, 20, 30, 40, 50 degrees C); mix equal volumes and start timing; take samples every 30 s and test with iodine or use a colorimeter to record change in absorbance.
 - Control variables: keep enzyme concentration, starch concentration, volume, and timing method constant; run repeats for each temperature.
 - Measure rate: record time until iodine no longer gives blue-black (time to endpoint) or measure initial rate from change in absorbance per second; use repeats to calculate mean and standard deviation.
 - Presentation: plot temperature on x axis and rate (1/time to endpoint or absorbance change per s) on y axis; include error bars and a best-fit line; look for optimum temperature and denaturation at high temperatures.
 - Safety: wear goggles, handle water baths carefully to avoid burns, tie back long hair, and label samples. Ethical: do not use bodily fluids unless following school guidance; if using saliva, get consent and use gloves.

Question 18

- (a) **M1** higher temperature increases kinetic energy so more collisions between enzyme and substrate
- (a) **A1** this increases reaction rate up to the enzyme's optimum (oe)
- (a) Answer: **Rising temperature increases kinetic energy so enzyme and substrate collide more often and reactions occur faster up to the enzyme's optimum at about 37 degrees C.**
- (b) **M1** high temperature causes enzyme to denature, changing its shape
- (b) **A1** so the active site no longer fits the substrate and activity drops rapidly (oe)
- (b) Answer: **Temperatures above 50 degrees C cause the enzyme to denature, altering its active site so the substrate cannot bind and activity falls rapidly.**