1.2 Nutrition and Digestion: 30-minute Pack

Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 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)**

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

2 Explain two reasons why chewing food properly helps digestion.

(a) Reason 1. **(1)**

(b) Reason 2. **(1)**

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3 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)

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4 Name the organ where most digestion by enzymes occurs in the human body.

(1)

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5 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)**

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6 Label the three types of human teeth from their descriptions.

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

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

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

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7 A student plans to test how the concentration of starch affects the time taken for saliva to break down starch. They test drops of the mixture with iodine solution, which turns blue-black while starch is present and stays orange-brown once the starch has been 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)**

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8 The table shows the mean rate at which amylase in saliva broke down starch in separate test tubes with different starch concentrations. The same volume of amylase was used in every test tube. Each rate was measured three times and the mean calculated.

Starch concentration (g per 100 cm^3)	Mean rate of starch breakdown (arbitrary units)
0.5	50
1	67
2	80
4	89

(a) Give two scientific reasons why higher starch concentration might give a faster mean rate of starch breakdown, up to a point. One reason per line. **(3)**

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

9 The test for fats uses ethanol and then water. State the observation that shows fat is present.

(1)

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Mark scheme · 1.2 Nutrition and Digestion: 30-minute Pack

Question 1

(a) substitute 54 / (1.65 x 1.65) or equivalent **M1**

(a) 19.8 (kg/m^2) cao **A1**

(a) Answer: **19.8 kg/m^2**

(b) state it is in the healthy range because 19.8 is between 18.5 and 24.9 **B1**

(b) Answer: **Yes; 19.8 is between 18.5 and 24.9 so it is within the healthy adult range.**

Question 2

(a) mechanical breakdown increases surface area allowing enzymes to act more quickly **M1**

(a) Answer: **Chewing breaks food into smaller pieces, increasing surface area so enzymes can digest it faster.**

(b) mixes food with saliva containing amylase, starting chemical digestion of starch **M1**

(b) Answer: **Chewing mixes food with saliva so amylase can start breaking down starch chemically in the mouth.**

Question 3

Level 3 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. **5-6**

Level 2 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. **3-4**

Level 1 Simple or incomplete method with few controls, vague measurement or presentation ideas and little or no justification. **0-2**

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°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 the mean.
- 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 4

small intestine (cao) **B1**

Answer: **Small intestine**

Question 5

(a) they speed up chemical reactions that break large food molecules into smaller ones without being used up (oe) **B1**

(a) Answer: **Enzymes speed up reactions that break large food molecules into smaller molecules without being used up.**

(b) one correct enzyme and substrate (e.g. amylase acts on starch) oe **B1**

(b) Answer: **Amylase acts on starch**

Question 6

(a) incisors cao **B1**

(a) Answer: **Incisors**

(b) canines (eye teeth) cao **B1**

(b) Answer: **Canines**

(c) molars (or premolars if accepted) cao **B1**

(c) Answer: **Molars**

Question 7

(a) starch concentration changed with explanation that this is the factor being tested **M1**

(a) Answer: **Change starch concentration - this tests how different starch (substrate) levels affect the rate of starch breakdown.**

(b) keep temperature constant with explanation that temperature affects enzyme activity **M1**

(b) Answer: **Keep temperature the same - temperature affects enzyme activity so it must be constant to make the test fair.**

(c) include a control with boiled saliva or no saliva (water instead of saliva) and explain it shows the starch is broken down by the enzyme (amylase) in saliva and not by something else **M1**

(c) Answer: **Include a control with boiled saliva (or water instead of saliva) - this shows that the starch is broken down by the amylase in saliva and not by something else.**

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Question 8

(a) more substrate (starch) molecules increase the chance of collision with amylase active sites, increasing reaction rate **M1**

(a) more enzyme-substrate complexes form per second at higher substrate concentration, so starch is broken down faster (until enzyme becomes the limiting factor) **M1**

(a) both reasons linked to the observed faster rates, oe **A1**

(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) state a limitation such as temperature not controlled or timing method imprecise **M1**

(b) propose an improvement that addresses the limitation (e.g. use a water bath to keep constant temperature or use a colorimeter) oe **A1**

(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 9

cloudy or milky emulsion appears (white cloudy layer) cao **B1**

Answer: **A cloudy or milky emulsion appears**

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