1.5 Homeostasis and Response: Test Pack

AQA 8461 · Calculator allowed · about 45 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Give one example of an internal condition that is controlled by homeostasis.

(Total for Question 1 is 1 mark)

2 Name the hormone that increases water reabsorption in the kidneys.

(Total for Question 2 is 1 mark)

3 Explain in one sentence how negative feedback works when blood glucose is too high.

(Total for Question 3 is 2 marks)

4 State one way blood flow to the skin changes to help cool the body, and explain how this helps cooling.

(Total for Question 4 is 2 marks)

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5 Homeostasis is essential for maintaining a stable internal environment in the body.

(a) Define the term 'homeostasis'. **(1)**

(b) State three internal conditions of the body that are controlled by homeostasis. **(3)**

(Total for Question 5 is 4 marks)

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6 Thyroxine, released by the thyroid gland, helps regulate metabolic rate and is itself controlled by negative feedback.

(a) Name the gland that releases thyroxine. **(1)**

(b) Explain, using the principle of negative feedback, what happens if the concentration of thyroxine in the blood becomes too high. **(3)**

(Total for Question 6 is 4 marks)

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7 Required practical: Aisha and her partner carried out an investigation into human reaction time using the ruler-drop method. Aisha held her thumb and forefinger apart, with her partner suspending a ruler vertically so that the 0 cm mark was level with the top of her thumb. Her partner released the ruler without warning, and Aisha caught it as quickly as she could.

(a) Describe how the distance the ruler falls before being caught is used to find a person's reaction time. **(2)**

(b) Explain why Aisha and her partner should repeat the test several times and calculate a mean falling distance. **(2)**

(c) On one attempt, the ruler fell a distance of 0.20 m before Aisha caught it. Using the equation $d = 0.5 \times g \times t^2$ (where $g = 9.8$ m/s^2), calculate Aisha's reaction time, t, in seconds. Give your answer to 2 significant figures. **(3)**

(Total for Question 7 is 7 marks)

8 Jamal weighs 88 kg and is 1.60 m tall. Body Mass Index (BMI) can be calculated using the equation: BMI = mass (kg) / [height (m)]^2. A BMI above 30 is classified as 'obese'.

(a) Calculate Jamal's BMI. Give your answer to 1 decimal place. **(2)**

(b) Using your answer to part (a), suggest why Jamal may have an increased risk of developing type 2 diabetes. **(2)**

(Total for Question 8 is 4 marks)

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9 ADH affects the permeability of the collecting duct in the kidney. Explain how a rise in blood osmolality leads to increased water reabsorption by the collecting duct. Your answer should include the roles of osmoreceptors, ADH and aquaporins.

(a) Explain the sequence from increased blood osmolality to increased water reabsorption. **(4)**

(Total for Question 9 is 4 marks)

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10 A person's blood glucose is measured during an oral glucose tolerance test (OGTT). The data points are: time 0 min: 4.5 mmol per L; 30 min: 9.2 mmol per L; 60 min: 7.0 mmol per L; 120 min: 5.0 mmol per L.
Calculate the area under the curve (AUC) using the trapezium rule between 0 and 120 minutes in mmol per L x min. Use intervals [0-30], [30-60], [60-120]. Show working.

(a) Calculate the AUC using trapezium rule for the three intervals and give the total to 3 significant figures. **(4)**

(Total for Question 10 is 4 marks)

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Mark scheme · 1.5 Homeostasis and Response: Test Pack

Question 1

one valid example such as body temperature, blood glucose concentration, water balance, or ion concentration **B1**

Answer: Any one of: body temperature; blood glucose concentration; water balance; ion concentration.

Question 2

antidiuretic hormone or ADH cao **B1**

Answer: Antidiuretic hormone (ADH)

Question 3

increase in blood glucose is detected by the pancreas or sensors, oe **B1**

pancreas releases insulin which causes cells to take up glucose and restores concentration back to normal, oe **B1**

Answer: Pancreas detects high blood glucose and releases insulin so cells take up glucose, returning blood glucose to normal.

Question 4

blood vessels near the skin widen (vasodilation) so more blood flows to the skin, oe **B1**

explanation: increased blood at the skin allows more heat to be lost to the environment by radiation and evaporation, oe **B1**

Answer: Blood vessels widen (vasodilation), increasing blood flow to the skin so more heat is lost by radiation and evaporation.

Question 5

(a) the regulation/maintenance of a constant internal environment in response to internal and external changes, oe **B1**

(a) Answer: Homeostasis is the regulation of a constant internal environment in the body, in response to internal and external changes.

(b) body temperature **B1**

(b) blood glucose concentration **B1**

(b) water content/levels (or ion content); allow blood pressure **B1**

(b) Answer: Body temperature; blood glucose concentration; water (or ion) content.

Question 6

(a) thyroid gland **B1**

(a) Answer: Thyroid gland.

(b) the high thyroxine concentration is detected (by the pituitary gland), oe **M1**

(b) this reduces the release of TSH (thyroid stimulating hormone) from the pituitary gland, oe **M1**

(b) less TSH means the thyroid gland is stimulated less, so it releases less thyroxine, bringing the concentration back towards normal, oe **A1**

(b) Answer: High thyroxine is detected by the pituitary gland, which releases less TSH; this reduces stimulation of the thyroid gland, so less thyroxine is released, returning the concentration to normal.

Question 7

(a) the distance the ruler falls (the reading level with the top of the thumb/finger when caught) is recorded, oe **B1**

(a) this distance is used (e.g. with a conversion table or calculation) to work out the time taken to react, since a longer falling distance means a longer/slower reaction time, oe **B1**

(a) Answer: The distance the ruler falls before it is caught is measured; a greater distance means the ruler fell for longer, so the person's reaction time was longer.

(b) a single reading could be an anomaly, or could be affected by chance factors (e.g. Aisha anticipating the drop, or being distracted), oe **B1**

(b) repeating and taking a mean reduces the effect of random variation/anomalous results, giving a more reliable value for reaction time, oe **B1**

(b) Answer: A single reading could be affected by chance or anticipation; repeating the test and calculating a mean reduces the effect of random variation, giving a more reliable result.

(c) equation rearranged: $t = \sqrt{2d / g}$, oe **M1**

(c) values substituted: $t = \sqrt{(2 \times 0.20) / 9.8}$, oe **M1**

(c) 0.20 s, awrt, cao **A1**

(c) Answer: 0.20 s

Question 8

(a) $88 / (1.60)^2$ substituted, oe **M1**

(a) 34.4, awrt, cao **A1**

(a) Answer: 34.4

(b) Jamal's BMI (34.4) is above 30, so he is classed as obese, oe **B1**

(b) obesity is linked to the body's cells becoming less responsive to insulin (insulin resistance), which increases the risk of developing type 2 diabetes, oe **B1**

(b) Answer: Jamal's BMI of 34.4 classes him as obese; obesity is linked with reduced cell response to insulin (insulin resistance), which increases the risk of type 2 diabetes.

Question 9

(a) states osmoreceptors in the hypothalamus detect increased blood osmolality **M1**

(a) states pituitary releases more ADH into the blood **M1**

(a) states ADH binds to receptors on collecting duct cells causing insertion of aquaporins into the membrane **M1**

(a) concludes that water permeability of the collecting duct increases so more water is reabsorbed back into the blood, reducing osmolality cao **A1**

(a) Answer: Osmoreceptors detect higher osmolality, the pituitary releases more ADH, ADH binds collecting duct cells causing aquaporins to be inserted, increasing water reabsorption.

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Question 10

(a) applies trapezium for 0-30: (4.5 + 9.2) / 2 x 30 = 6.85 x 30 = 205.5 (evidence of calculation shown) **M1**

(a) applies trapezium for 30-60: (9.2 + 7.0) / 2 x 30 **M1**

(a) applies trapezium for 60-120: (7.0 + 5.0) / 2 x 60 **M1**

(a) adds intervals correctly (205.5 + 243 + 360 = 808.5) and gives AUC = 809 mmol per L x min to 3 s.f. cao (accept 808.5) **A1**

(a) Answer: 809 mmol per L x min

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