1.5 Homeostasis and Response: 1-hour Pack

AQA 8461 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 In vitro fertilisation (IVF) can be used to help couples who are struggling to conceive naturally.

(a) Give one reason why a couple might choose to have IVF treatment. **(1)**

(b) Describe the main stages of the IVF process. **(3)**

(c) Suggest one social or ethical issue associated with IVF treatment. **(1)**

(Total for Question 1 is 5 marks)

2 Sofia measured the height of a seedling shoot growing towards a lamp over a 4-day period. At the start (day 0), the shoot was 20 mm tall; by day 4, it had grown to 32 mm tall.

(a) Calculate the mean rate of growth of the shoot, in mm per day, over the 4-day period. **(2)**

(b) Sofia's teacher suggests she should repeat the investigation using several seedlings, rather than just one. Explain why this would improve her investigation. **(2)**

(Total for Question 2 is 4 marks)

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3 Scientists use different methods to study the brain and map its functions, including studying patients with brain damage, electrically stimulating regions of the brain during surgery, and using MRI scanning. Evaluate the strengths and limitations of these different methods.

(Total for Question 3 is 6 marks)

4 Neurones communicate with each other across small gaps.

(a) Name the gap between two neurones. **(1)**

(b) Describe how a nerve impulse crosses a synapse to reach the next neurone. **(3)**

(Total for Question 4 is 4 marks)

5 The eye is a sense organ containing receptors sensitive to light intensity and colour.

(a) Name the part of the eye that: (i) refracts light entering the eye (ii) contains the light receptor cells (iii) controls the amount of light entering the eye. **(3)**

(b) Describe what happens to the pupil in dim light, and explain why this response is useful. **(2)**

(Total for Question 5 is 5 marks)

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6 The eye can focus on objects at different distances by changing the shape of the lens, a process called accommodation.

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

(b) Describe how the shape of the lens changes when the eye focuses on a distant object. **(2)**

(c) Ffion is short-sighted (myopic), so distant objects appear blurred. State the type of lens used in glasses to correct short-sightedness, and explain how it corrects her vision. **(2)**

(Total for Question 6 is 5 marks)

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7 Different regions of the brain control different functions, and doctors use various techniques to study the brain.

(a) State which part of the brain is mainly responsible for each of the following: (i) consciousness, intelligence, memory and language (ii) muscular coordination and balance (iii) controlling unconscious activities such as breathing rate and heart rate. **(3)**

(b) Give one reason why it can be difficult for doctors to investigate and treat damage or disease in the brain. **(1)**

(c) Name one non-invasive scanning technique that can be used to study the structure or activity of the brain. **(1)**

(Total for Question 7 is 5 marks)

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8 During a cross country run on a cold day, Callum's core body temperature is monitored. Explain how Callum's body responds to keep his core temperature close to 37°C, both while he is exercising and generating heat, and if he were to become too cold.

(Total for Question 8 is 6 marks)

9 Hormones are chemical messengers released directly into the blood by glands, and carried to target organs.

(a) Name the gland, often called the 'master gland', that releases hormones which act on other glands to control the release of their hormones. **(1)**

(b) State the main hormone released by each of the following glands: (i) the ovaries (ii) the testes (iii) the adrenal glands. **(3)**

(Total for Question 9 is 4 marks)

10 Insulin and glucagon are hormones that control blood glucose concentration. A person has a fasting blood glucose concentration of 4.8 mmol per litre. After eating, their blood glucose rises to 8.6 mmol per litre. Calculate the percentage increase in blood glucose concentration. Show your working.

(a) Calculate the percentage increase from 4.8 mmol per litre to 8.6 mmol per litre. Show working and give the answer to 2 significant figures. **(4)**

(Total for Question 10 is 4 marks)

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Mark scheme · 1.5 Homeostasis and Response: 1-hour Pack

Question 1

(a) to help a couple have a baby when one or both partners are infertile/struggling to conceive naturally, oe **B1**

(a) Answer: To help a couple conceive when one or both partners are infertile.

(b) FSH and LH are given to stimulate the maturation of several eggs in the ovaries, oe **B1**

(b) the eggs are collected from the ovary/ovaries and fertilised with sperm in a laboratory dish, oe **B1**

(b) the fertilised eggs develop into embryos, and one or two embryos are inserted into the mother's uterus (womb), oe **B1**

(b) Answer: Hormones (FSH and LH) stimulate several eggs to mature; eggs are collected and fertilised with sperm in a laboratory dish; the resulting embryos develop, and one or two are inserted into the uterus.

(c) any valid social/ethical issue, e.g. multiple births carry increased health risks to mother and babies; unused embryos are destroyed, which some people object to; treatment is expensive, emotionally stressful, and not always successful, oe **B1**

(c) Answer: For example, multiple embryos may lead to multiple births, which carries increased health risks for the mother and babies.

Question 2

(a) (32 - 20) / 4 calculated, oe **M1**

(a) 3 mm/day, cao (units required) **A1**

(a) Answer: 3 mm per day

(b) using only one seedling means an anomalous or unrepresentative result could not be identified/would not be detected, oe **B1**

(b) using several seedlings and calculating a mean growth rate reduces the effect of natural variation between individual seedlings, making the result more reliable, oe **B1**

(b) Answer: Using several seedlings and calculating a mean reduces the effect of natural variation between individual seedlings, making the result more reliable and reducing the impact of any anomalies.

Question 3

Level 1 A simple strength or limitation of one method is identified, with little or no reasoning or comparison between methods. **1-2**

Level 2 Strengths and/or limitations of two of the three methods are described, with some reasoning linking them to how reliable or useful the conclusions from that method are. **3-4**

Level 3 A well-linked evaluation of all three methods is given, with clear reasoning about the reliability, safety and practicality of each, and a reasoned overall conclusion (e.g. that combining methods gives more reliable conclusions than any one method alone). **5-6**

Indicative content:

- Studying patients with brain damage can show which functions are lost or affected, linking a damaged region to a function
- This method relies on naturally occurring damage, so the location and extent of damage cannot be controlled, and damage often affects more than one region, making it hard to isolate a single function
- Electrically stimulating regions of the brain during surgery allows doctors to observe a patient's immediate response (e.g. movement or sensation) linked to the stimulated region
- This method is invasive and carries a risk of damaging brain tissue, so it is normally only used when a patient is already undergoing brain surgery for another medical reason
- MRI scanning is non-invasive and safe, and can produce detailed images of brain structure, or show which regions are active in real time (functional MRI)
- MRI scanning is expensive, requires the patient to remain still, and may not give as direct a causal link between a region and a function as damage or stimulation studies do
- Using a combination of these methods gives more reliable conclusions than relying on any single method alone, since the limitations of one method can be offset by the strengths of another

Question 4

(a) synapse **B1**

(a) Answer: Synapse.

(b) the electrical impulse arriving at the synapse triggers the release of a chemical (neurotransmitter), oe **B1**

(b) the neurotransmitter diffuses across the synapse (gap), oe **B1**

(b) the neurotransmitter binds to receptor molecules on the membrane of the next neurone, triggering a new electrical impulse in that neurone, oe **B1**

(b) Answer: The impulse triggers release of a neurotransmitter, which diffuses across the synapse and binds to receptors on the next neurone, triggering a new electrical impulse.

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Question 5

(a) (i) cornea **B1**

(a) (ii) retina **B1**

(a) (iii) iris **B1**

(a) Answer: (i) cornea (ii) retina (iii) iris.

(b) the pupil widens/dilates in dim light, oe **B1**

(b) this allows more light to enter the eye, so the retina can still detect enough light to form a clear image, oe **B1**

(b) Answer: The pupil widens (dilates) in dim light, allowing more light to enter the eye so the retina can still detect enough light to form an image.

Question 6

(a) the ability of the eye to change focus (by changing the shape of the lens) to focus on objects at different distances, oe **B1**

(a) Answer: Accommodation is the ability of the eye to change focus, by changing the shape of the lens, to view objects at different distances.

(b) the ciliary muscles relax, oe **B1**

(b) the suspensory ligaments are pulled tight, so the lens is pulled into a thinner/less curved shape, oe **B1**

(b) Answer: The ciliary muscles relax, pulling the suspensory ligaments tight, which pulls the lens into a thin, less curved shape.

(c) a concave (diverging) lens **B1**

(c) the lens causes light rays to diverge slightly before entering the eye, so they focus further back, on the retina, rather than in front of it, oe **B1**

(c) Answer: A concave (diverging) lens is used; it makes light rays diverge slightly before they enter the eye, moving the point of focus back onto the retina instead of in front of it.

Question 7

(a) (i) cerebral cortex (cerebrum) **B1**

(a) (ii) cerebellum **B1**

(a) (iii) medulla oblongata (medulla) **B1**

(a) Answer: (i) cerebral cortex (ii) cerebellum (iii) medulla oblongata.

(b) the brain is complex/delicate and difficult to access safely (protected by the skull), so investigating or operating on it carries a high risk of causing further damage, oe **B1**

(b) Answer: The brain is complex and delicate, and protected by the skull, so it is difficult to access without risking further damage to it.

(c) MRI scanning (accept CT scanning or PET scanning) **B1**

(c) Answer: MRI scanning (accept CT scanning or PET scanning).

Question 8

Level 1 Simple, isolated statements are made, e.g. sweating or shivering is named, with little or no reasoning or reference to negative feedback. **1-2**

Level 2 Describes some responses to being too hot and/or too cold (e.g. sweating, vasodilation, shivering, vasoconstriction), with some reasoning about how they change heat loss or heat production. **3-4**

Level 3 Gives a clear, well-linked explanation covering responses to both overheating and overcooling, correctly using vasodilation, vasoconstriction, sweating and shivering, and explains that the thermoregulatory centre (in the hypothalamus) monitors and corrects temperature by negative feedback. **5-6**

Indicative content:

- The thermoregulatory centre, in the hypothalamus of the brain, monitors the temperature of the blood and receives information from thermoreceptors in the skin
- While exercising, heat produced by respiring muscles raises core temperature above 37°C
- Blood vessels supplying the skin capillaries dilate (vasodilation), increasing blood flow near the skin surface so more heat is lost by radiation
- Sweat glands release more sweat, which evaporates from the skin and transfers heat energy away from the body, cooling it
- If Callum becomes too cold, blood vessels supplying the skin capillaries constrict (vasoconstriction), reducing blood flow near the surface and reducing heat loss
- Shivering occurs: muscles contract involuntarily and rapidly, and the extra respiration needed for this releases heat
- These are examples of negative feedback: once the core temperature returns to around 37°C, the responses are reduced/switched off

Question 9

(a) pituitary gland **B1**

(a) Answer: Pituitary gland.

(b) (i) oestrogen **B1**

(b) (ii) testosterone **B1**

(b) (iii) adrenaline **B1**

(b) Answer: (i) oestrogen (ii) testosterone (iii) adrenaline.

Question 10

(a) calculates change: 8.6 - 4.8 = 3.8 mmol per litre **M1**

(a) divides by initial value: 3.8 / 4.8 **M1**

(a) 0.79 (or 79) cao to 2 s.f. **A1**

(a) gives percentage: 79% cao **A1**

(a) Answer: 79%

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