1.6 Variation, Classification and Adaptation: 30-minute Pack

Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A UK farm removes several hedgerows to make its fields larger for machinery. Ecologists notice that the local population of yellowhammers, a hedge-nesting bird, falls sharply over the following five years. Explain why the yellowhammer population may have fallen.

(4)

2 Peppered moths exist in a pale form and a dark ('melanic') form, caused by different gene variants. Before industrial pollution, tree trunks in a wood were pale and covered in lichen. After nearby factories blackened the tree trunks with soot, the proportion of dark moths in the wood increased greatly over the next few decades. Explain why the proportion of dark moths increased after the tree trunks were blackened by soot.

(3)

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3 Vertebrates (animals with a backbone) are sorted into five groups: fish, amphibians, reptiles, birds and mammals. Use the clues to identify the group of each animal described.

(a) Animal A has moist, permeable skin, lives in water as a young animal (breathing through gills) and on land as an adult (breathing with lungs). **(1)**

(b) Animal B has dry, scaly, waterproof skin and lays soft-shelled eggs on land. **(1)**

(c) Animal C has feathers, a beak, and lays hard-shelled eggs. **(1)**

(d) Animal D has fur, feeds its young on milk, and controls its own body temperature. **(1)**

(e) Animal E has wet scales, breathes using gills for its whole life, and lays soft eggs in water. **(1)**

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4 The Arctic fox lives in the very cold Arctic tundra. It has thick white-grey fur that turns brown in summer, small rounded ears, a short muzzle, and fur-covered paws. Explain how these adaptations help the Arctic fox survive in its environment, and predict what might happen to Arctic fox populations if the Arctic climate continues to warm.

(6)

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5 State two causes of variation between individuals of the same species.

(2)

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6 Classify each characteristic below as an example of continuous or discontinuous variation.

(a) Height of a student. **(1)**

(b) Blood group (A, B, AB or O). **(1)**

(c) Hand span (distance from thumb tip to little finger tip when the hand is stretched out). **(1)**

(d) Ability to roll your tongue into a U-shape (can or cannot). **(1)**

(e) Foot length. **(1)**

(f) Whether an earlobe is attached to the side of the head or hangs free. **(1)**

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Mark scheme · 1.6 Variation, Classification and Adaptation: 30-minute Pack

Question 1

hedgerows provide nesting sites, so fewer hedgerows means fewer safe places to breed — **B1**

hedgerows also provide seeds, berries and insects to eat, so removing them reduces the food supply — **B1**

with less shelter, more chicks/eggs may be lost to predators or bad weather — **B1**

overall, fewer birds survive and breed successfully, so the population decreases, oe — **B1**

Answer: **Removing hedgerows destroys nesting sites and reduces the supply of seeds, berries and insects, and removes shelter from predators. With less food, fewer safe nest sites and more predation, fewer yellowhammers survive and breed, so the population falls.**

Question 2

both pale and dark moths already existed in the population because of natural genetic variation — **B1**

on blackened trunks, dark moths are better camouflaged from birds, so pale moths are more often seen and eaten — **B1**

more dark moths survive to reproduce and pass on the gene for the dark colour, so the proportion of dark moths increases over generations, oe — **B1**

Answer: **Genetic variation meant both forms already existed. Once trunks were blackened, dark moths were better camouflaged and survived predation better than pale moths, so more dark moths reproduced and passed on their genes, increasing the proportion of dark moths over time.**

Question 3

(a) amphibian cao — **B1**

(a) Answer: **Amphibian**

(b) reptile cao — **B1**

(b) Answer: **Reptile**

(c) bird cao — **B1**

(c) Answer: **Bird**

(d) mammal cao — **B1**

(d) Answer: **Mammal**

(e) fish cao — **B1**

(e) Answer: **Fish**

Question 4

Level 1 Simple, isolated statements identifying one or two adaptations, e.g. thick fur keeps it warm, with little or no explanation and no prediction about climate change. — **1-2**

Level 2 Several adaptations are correctly explained (structural and/or behavioural, e.g. fur, ear size, camouflage), with some reference to survival, and a simple prediction about the effect of warming that lacks detail or reasoning. — **3-4**

Level 3 A clear, well-linked explanation of multiple adaptations (insulation, reduced heat loss from small ears/short muzzle, seasonal camouflage) showing how each aids survival, together with a well-reasoned prediction of population decline or range shift linked to loss of camouflage and/or increased competition as the climate warms. — **5-6**

Indicative content:

- Thick fur (and fur-covered paws) traps a layer of insulating air, reducing heat loss from the body in extreme cold - a structural adaptation.
- Small, rounded ears and a short muzzle reduce the surface area from which body heat can be lost, helping the fox conserve heat (structural adaptation, linked to lower surface area to volume ratio).
- Fur that turns from white-grey in winter to brown in summer gives camouflage against snow or bare tundra, making the fox harder for prey to detect and less visible to predators (structural/seasonal adaptation).
- Foxes may also den underground or reduce activity in the harshest weather, a behavioural adaptation that further reduces heat loss and energy use.
- Prediction: if the Arctic warms, snow cover lasts for a shorter part of the year, so the fox's white winter coat may be mismatched with a snow-free background for longer periods, making it more visible to predators and less successful at hunting.
- A warmer climate may also let the larger, more dominant red fox move further north, increasing competition for food and space with Arctic foxes.
- Both effects (poorer camouflage and competition) would be expected to reduce Arctic fox survival, breeding success and population size over time, or force populations further north.

Question 5

genetic variation (differences in genes inherited from parents) — **B1**

environmental variation (differences caused by surroundings, diet, lifestyle etc.), oe — **B1**

Answer: **Genetic variation (inherited differences) and environmental variation (differences caused by surroundings or lifestyle).**

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Question 6

(a) continuous cao **B1**

(a) Answer: **Continuous**

(b) discontinuous cao **B1**

(b) Answer: **Discontinuous**

(c) continuous cao **B1**

(c) Answer: **Continuous**

(d) discontinuous cao **B1**

(d) Answer: **Discontinuous**

(e) continuous cao **B1**

(e) Answer: **Continuous**

(f) discontinuous cao **B1**

(f) Answer: **Discontinuous**

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