K5D Ecosystems and Interdependence: Exam Drill

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

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Name two abiotic factors in a pond ecosystem. Give one example for each.

(a) Name one abiotic factor in a pond and give an example value or description (for example: water temperature 15 degrees C). **(1)**

(b) Name a second abiotic factor with an example value or description. **(1)**

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2 A simple food chain in a meadow is: grass -> caterpillar -> song thrush.
State the producer, two consumers and name a possible predator of the song thrush.

(a) State the producer in this food chain. **(1)**

(b) State two consumers in the chain, naming them separately. **(1)**

(c) Name a possible predator of the song thrush in this meadow. **(1)**

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3 Explain why removing a top predator from an ecosystem can cause numbers of some species to increase and others to decrease. Use the terms: predation, population, trophic level, and competition in your answer.

(a) Write your explanation. **(4)**

4 Biologists measure the number of dandelions in two grassy fields using quadrats. Field A: counts in five quadrats = 12, 9, 15, 13, 11. Field B: counts in five quadrats = 8, 7, 6, 9, 10. Calculate the mean number of dandelions per quadrat for each field. Which field is likely to have the greater dandelion density overall?

(a) Calculate the mean for Field A. **(2)**

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(b) Calculate the mean for Field B. **(1)**

.....

(c) State which field likely has the greater dandelion density and give a brief reason. **(1)**

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5 A student tests how light intensity affects the number of pondweed bubbles produced per minute (a measure of photosynthesis). Light intensity is changed by moving a lamp to different distances. Which variable is the independent variable, which is the dependent variable, and name two control variables that should be kept constant?

(a) State the independent variable. **(1)**

(b) State the dependent variable. **(1)**

(c) Give two control variables to keep constant during the test. **(1)**

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6 Define biodiversity in one sentence.

(a) Write a definition of biodiversity. **(2)**

7 A food web in a pond includes: algae, water fleas, small fish, big fish, and herons. Draw or describe a food web that includes all five organisms and explain how energy flows through it.

(a) Describe a food web including arrows that show who eats whom. **(2)**

(b) Explain how energy flows through the food web. **(2)**

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8 An ecologist samples beetles along a transect in a woodland and records the following numbers in five equal-area squares placed along the transect: 3, 5, 2, 7, 4. Calculate the median number of beetles per square and suggest one reason why the numbers might vary along the transect.

(a) Calculate the median of the counts 3, 5, 2, 7, 4. **(2)**

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(b) Suggest one reason for variation in beetle numbers along the transect. **(1)**

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9 Name one way plants are adapted to reduce competition with other plants for light.

(a) Give one plant adaptation to reduce competition for light and briefly say how it helps. **(2)**

10 A student investigates how different fertiliser types affect plant growth. She grows identical bean plants in pots and applies either no fertiliser, fertiliser X or fertiliser Y. After 4 weeks the mean heights are: no fertiliser 12.0 cm, X 18.4 cm, Y 20.1 cm.
State what conclusion can be drawn about the effect of fertiliser X and Y compared to no fertiliser, and suggest one improvement to the method to make the test fairer.

(a) State the conclusion about the effect of fertiliser X and Y compared to no fertiliser. **(2)**

(b) Suggest one improvement to make the method fairer. **(1)**

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11 A pyramid of numbers for a pond community shows: 400 algae at bottom, 40 water fleas that eat algae, 4 small fish that eat water fleas, 1 heron that eats small fish.
Calculate the approximate percentage of energy transferred from algae to water fleas if we assume number is proportional to energy. Then explain one limitation of using a pyramid of numbers to represent energy transfer.

(a) Calculate the percentage of energy transferred from algae to water fleas assuming numbers are proportional to energy (use: energy transferred = (number at next level / number at previous level) x 100%). **(2)**

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(b) Explain one limitation of using a pyramid of numbers to represent energy transfer. **(2)**

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12 Give one example of mutualism between two species and briefly describe the benefit to each species.

(a) Give an example and a one-line description of benefits. **(1)**

13 A river survey records the following dissolved oxygen (DO) readings in mg/L at three sites: site 1 = 9.2 mg/L, site 2 = 6.8 mg/L, site 3 = 4.1 mg/L.
State which site is most likely to support the greatest variety of aerobic aquatic animals and explain why.

(a) Which site likely supports the greatest variety of aerobic aquatic animals? **(1)**

(b) Explain the reason using the DO values. **(2)**

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14 Explain how invasive species can reduce biodiversity in a habitat. Give one specific example and describe the effect.

(a) Explain the general mechanism by which invasive species reduce biodiversity. **(2)**

(b) Give one specific example and describe the effect. **(2)**

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15 State two reasons why sampling with quadrats might give an inaccurate estimate of plant population size across a whole field.

(a) Give two reasons (one per line). **(2)**

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16 Describe how you would use a belt transect to investigate how plant species change from the edge to the centre of a hedgerow. Include the main steps and one piece of equipment you would use.

(a) Describe the method in clear steps and name one piece of equipment. **(3)**

17 Extended response (6 marks). A local nature group plans to restore a small pond that has become overgrown with duckweed and has low oxygen levels in summer. They consider removing some duckweed, planting native aquatic plants, and reducing nutrient runoff from a nearby garden. Discuss the advantages and disadvantages of these actions and recommend which single action or combination you would choose. In your answer evaluate likely effects on biodiversity and water quality, and consider practical issues such as effort and time. You will be assessed on the quality of your written communication and the balance of science in your evaluation.

(6)

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18 A survey of two grassland sites recorded the following percentage cover of clover: Site X = 22%, Site Y = 35%.
Calculate the difference in percentage cover and suggest one ecological reason why Site Y might have more clover cover than Site X.

(a) Calculate the difference in percentage cover between Site Y and Site X. **(2)**

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(b) Suggest one ecological reason why Site Y might have higher clover cover. **(1)**

Mark scheme · K5D Ecosystems and Interdependence: Exam Drill

Question 1

- (a) **B1** one abiotic factor named with an example/measure eg water temperature 15 degrees C; light intensity bright/dim; pH 7; dissolved oxygen low/high, oe
- (a) Answer: **Any one abiotic factor with an example, for example: water temperature 15 degrees C.**
- (b) **B1** second abiotic factor named with an example/measure eg pH 6.5; light low; dissolved oxygen high, oe
- (b) Answer: **Any second abiotic factor with an example, for example: pH 6.5.**

Question 2

- (a) **B1** grass cao
- (a) Answer: **Grass**
- (b) **B1** two consumers named (one mark if two given together is acceptable) eg caterpillar and song thrush cao
- (b) Answer: **Caterpillar; song thrush.**
- (c) **B1** predator named eg fox, sparrowhawk, cat, kestrel, owls, oe
- (c) Answer: **Fox (or sparrowhawk, cat, kestrel, owl).**

Question 3

- (a) **M1** idea that top predator normally eats prey species so predation reduces prey numbers
- (a) **M1** removal of predator leads to increase in those prey populations (direct effect)
- (a) **M1** increased prey leads to more competition for resources among those species or for species at other trophic levels
- (a) **A1** linked conclusion that some other species may decrease because of increased competition or because their food source is reduced, oe
- (a) Answer: **Removing a top predator stops predation on its prey so those prey populations increase. This can cause greater competition for food and space among those species and reduce food for species at other trophic levels, so some other populations fall.**

Question 4

- (a) **M1** correct addition and division shown for Field A: (12+9+15+13+11) / 5
- (a) **A1** 12 (dandelions per quadrat) cao
- (a) Answer: **12 dandelions per quadrat**
- (b) **A1** 8.0 (dandelions per quadrat) cao
- (b) Answer: **8.0 dandelions per quadrat**
- (c) **B1** Field A, because its mean number per quadrat (12) is higher than Field B (8), oe
- (c) Answer: **Field A, because the mean per quadrat is higher (12 > 8).**

Question 5

- (a) **B1** light intensity (distance of lamp) cao
- (a) Answer: **Light intensity (distance of lamp).**
- (b) **B1** number of bubbles per minute (rate of oxygen production) cao
- (b) Answer: **Number of bubbles per minute (rate of photosynthesis).**
- (c) **B1** two controls named eg temperature, type/length of pondweed, volume of water, concentration of dissolved salts, CO2 availability, lamp brightness setting, oe
- (c) Answer: **Examples: keep water temperature constant and keep the same length of pondweed.**

Question 6

- (a) **M1** definition that biodiversity is the variety of different species in an area or the variety of living things in a habitat
- (a) **A1** mention of species and variety or genetic or habitat diversity, oe
- (a) Answer: **Biodiversity is the variety of different species of plants and animals living in an area or habitat.**

Question 7

- (a) **M1** correct links showing algae -> water fleas -> small fish -> big fish -> heron and also algae -> small fish directly or water fleas -> big fish, showing a web
- (a) **A1** use of arrows or text indicating direction of energy flow (eg algae eaten by water fleas), oe
- (a) Answer: **Example: algae -> water fleas -> small fish -> big fish -> heron, and algae -> small fish and water fleas -> big fish, showing several feeding links.**
- (b) **M1** energy enters via producers (algae) using sunlight
- (b) **A1** energy passes to consumers when they eat other organisms and is lost at each step as heat, so less energy at higher trophic levels, oe
- (b) Answer: **Energy enters the web when algae use sunlight; consumers gain energy by eating other organisms and energy is lost from the system at each step, so less energy reaches the heron than the small fish.**

Question 8

- (a) **M1** order the numbers and pick the middle value (2,3,4,5,7)
- (a) **A1** 4 cao
- (a) Answer: **4 beetles per square**
- (b) **B1** one plausible reason eg changes in vegetation, shade, moisture, presence of predators, human disturbance, microhabitat differences, oe
- (b) Answer: **Variation may be due to changes in vegetation or moisture along the transect.**

Question 9

- (a) **M1** adaptation named and brief correct explanation eg tall growth/long stems to reach light or large leaves to capture more light or climbing habit to reach above neighbours
- (a) **A1** linked effect eg more light captured so better photosynthesis, oe
- (a) Answer: **Example: growing tall stems so the plant reaches above neighbours and gets more light for photosynthesis.**

Question 10

- (a) **M1** both fertilisers increase mean plant height compared to no fertiliser shown by 18.4 and 20.1 > 12.0
- (a) **A1** conclusion that Y appears slightly more effective than X (20.1 > 18.4), oe
- (a) Answer: **Both fertilisers increase growth compared with no fertiliser; fertiliser Y appears slightly more effective than X.**
- (b) **B1** one improvement eg use more replicates per treatment, keep light and temperature constant, use same soil and pot size, randomise pot positions, same watering regime, oe
- (b) Answer: **Use more replicate plants for each treatment and randomise pot positions to reduce variation.**

Question 11

- (a) **M1** substitution 40 / 400 x 100
- (a) **A1** 10% cao
- (a) Answer: **10%**
- (b) **M1** limitation named eg pyramid of numbers does not account for organism size or actual energy content
- (b) **A1** explanation eg a single large organism may contain more energy than many small ones so numbers are misleading, oe
- (b) Answer: **Pyramids of numbers ignore organism size and energy content; many small algae may give the same energy as a few larger organisms so the numbers can be misleading.**

Question 12

- (a) **B1** example and benefit eg bees and flowering plants: bees get nectar, plants get pollinated; clownfish and sea anemone; oxpeckers and rhinos, oe
- (a) Answer: **Bees and flowering plants: bees get nectar and pollen for food, plants get pollinated.**

Question 13

- (a) **B1** site 1 cao
- (a) Answer: **Site 1**
- (b) **M1** idea that higher DO gives more oxygen available for respiration
- (b) **A1** linked conclusion that more species and larger populations can be supported at higher DO eg 9.2 mg/L allows more aerobic life than 4.1 mg/L, oe
- (b) Answer: **Site 1 has the highest DO (9.2 mg/L) so more oxygen is available for respiration, allowing a greater variety and abundance of aerobic aquatic animals than sites with lower DO.**

Question 14

- (a) **M1** invasive species outcompete native species for resources or prey upon them or bring disease
- (a) **A1** leading to reduction or local extinction of native species and lower biodiversity, oe
- (a) Answer: **Invasive species compete with native species for food, space or light, or they may prey on or infect native species, causing declines or local extinctions and so reducing biodiversity.**
- (b) **M1** specific invasive example named eg grey squirrel in UK outcompeting red squirrel, Japanese knotweed outcompeting native plants, signal crayfish reducing native crayfish
- (b) **A1** effect described eg red squirrel numbers fall and local extinction risk increases, or native plants shaded out and soil changes reducing other plants, oe
- (b) Answer: **Example: grey squirrel introduced to the UK outcompetes native red squirrels for food and habitat, causing red squirrel populations to decline.**

Question 15

- (a) **B1** reason 1 eg quadrats not placed randomly so biased sampling
- (a) **B1** reason 2 eg too few quadrats or quadrat size not representative, or seasonal variation, oe
- (a) Answer: **Possible reasons: quadrats not placed randomly so results are biased; too few quadrats sampled so estimate is unreliable.**

Question 16

- (a) **M1** lay a tape measure from edge to centre and place quadrats at regular intervals along it
- (a) **M1** record species and abundance in each quadrat moving along the belt transect
- (a) **A1** equipment stated eg tape measure, quadrat, clipboard and identification key, oe
- (a) Answer: **Lay a tape measure from the hedgerow edge to the centre, place quadrats at regular intervals along the tape, record which plant species and their abundance in each quadrat, and repeat to get replicates. Equipment example: tape measure and quadrat.**

Question 17

- **Level 3** (5-6): A balanced, well-explained evaluation that considers advantages and disadvantages of the actions, makes a justified recommendation, and links effects to biodiversity and water quality. Good structure and clear use of biological terms.
- **Level 2** (3-4): Some evaluation with advantages and disadvantages described and a recommendation, but reasoning may be incomplete or partially linked to biodiversity and water quality. Communication is clear but not fully developed.
- **Level 1** (0-2): Simple statements or descriptions of actions with little or no evaluation or justification. Limited use of biological ideas and poor organisation.
- **Indicative content:**
  - Removing duckweed: advantage - increases light penetration and oxygen levels, immediate effect; disadvantage - must be repeated, may remove habitat for some invertebrates, labour intensive.
  - Planting native aquatic plants: advantage - increases oxygen through photosynthesis, provides habitat and increases biodiversity; disadvantage - takes time to establish and may need protection from grazing.
  - Reducing nutrient runoff: advantage - addresses root cause by lowering eutrophication, long-term improvement in water quality and biodiversity; disadvantage - may require cooperation from neighbours and changes in garden practices, time lag before benefits.
  - Evaluation points: combined approach likely best as removing duckweed gives immediate relief while planting and reducing runoff give medium to long-term improvement; consider effort and resources, prioritise actions that address cause and maintain habitat diversity.

Question 18

- (a) **M1** subtraction 35 - 22
- (a) **A1** 13% cao
- (a) Answer: **13%**
- (b) **B1** one reason eg soil nitrogen levels suitable, less shading from tall grasses, grazing reducing competitors, recent sowing, management practices such as less fertiliser favouring legumes, oe
- (b) Answer: **Site Y may have less shading or grazing that reduces taller competitors, allowing clover to spread.**