# 1.5 Ecosystems and Interdependence: Test Pack

Calculator allowed · about 55 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°C). **(1)**

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

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**2** 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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**3** 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)**

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

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**4** 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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**5** Give one example of a decomposer and describe its role in an ecosystem in one sentence.

**(2)**


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**6** In a small river, pollution reduces oxygen levels. Explain two likely effects this change will have on the river community and why.

(4)

**7** Describe how removing a top predator, such as foxes, from an area could change the numbers of plants and small animals in that ecosystem.

(4)

**8** A simple food web for a pond is given by these relationships:
Algae eaten by water fleas and snails.
Water fleas eaten by small fish.
Snails eaten by herons.
Small fish eaten by herons and otters.
Draw two different food chains from this web, each starting with algae and ending with a top predator.

(4)


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**9** Organisms in a food chain have different feeding roles.

**(a)** State what is meant by a 'producer', giving one example. **(1)**

**(b)** State what is meant by a 'consumer', giving one example. **(1)**

**(c)** State what is meant by a 'decomposer', giving one example. **(1)**

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**10** Practical investigation: Olamide used the capture-mark-recapture method to estimate the population of snails in a garden. On day 1 he caught and marked 60 snails with a small dot of non-toxic paint, then released them. On day 2 he caught 45 snails, of which 9 had a marked dot.

**(a)** State the formula used to estimate the total population using the capture-mark-recapture method. **(1)**

**(b)** Calculate an estimate of the total snail population in the garden. Show your working. **(2)**

.....

**(c)** State one assumption that must be true for this population estimate to be valid. **(1)**


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**11** Some pesticides do not break down easily and build up in the bodies of organisms, becoming more concentrated at each trophic level. This is called bioaccumulation. In a river ecosystem, algae contain a pesticide at a concentration of 0.2 ppm (parts per million). Small fish that eat the algae have a pesticide concentration of 1.0 ppm, a five-fold increase.

**(a)** Herons feed on the small fish. Assuming the same five-fold increase applies at this next trophic level, calculate the pesticide concentration in the herons. **(2)**

.....

**(b)** Calculate the overall factor by which the pesticide concentration has increased from the algae to the herons. **(1)**

.....

**(c)** Explain why top predators, such as herons, are usually at the greatest risk from bioaccumulation of pesticides. **(2)**


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**12** Grey squirrels were introduced to the UK from North America in the 19th century. They now compete with the native red squirrel for the same woodland food and nesting sites.

**(a)** Define 'intraspecific competition'. **(1)**

**(b)** Define 'interspecific competition'. **(1)**

**(c)** Using the idea of competition, explain why the introduction of grey squirrels has led to a decline in red squirrel populations in many parts of the UK. **(2)**

**13** Callum was estimating the population of dandelions in a school field using a 1 m x 1 m quadrat, but for convenience he only placed the quadrat at points close to the car park at the edge of the field. Explain why this sampling method could make his population estimate inaccurate, and suggest one change Callum could make to improve his method.

**(4)**


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# Mark scheme · 1.5 Ecosystems and Interdependence: Test Pack

## Question 1

(a) one abiotic factor named with an example/measure eg water temperature 15°C; light intensity bright/dim; pH 7; dissolved oxygen low/high, oe — **B1**

(a) Answer: **Any one abiotic factor with an example, for example: water temperature 15°C.**

(b) second abiotic factor named with an example/measure eg pH 6.5; light low; dissolved oxygen high, oe — **B1**

(b) Answer: **Any second abiotic factor with an example, for example: pH 6.5.**

## Question 2

(a) site 1 cao — **B1**

(a) Answer: **Site 1**

(b) idea that higher DO gives more oxygen available for respiration — **M1**

(b) 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 — **A1**

(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 3

(a) subtraction 35 - 22 — **M1**

(a) 13% cao — **A1**

(a) Answer: **13%**

(b) 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 — **B1**

(b) Answer: **Site Y may have less shading or grazing that reduces taller competitors, allowing clover to spread.**

## Question 4

(a) light intensity (distance of lamp) cao — **B1**

(a) Answer: **Light intensity (distance of lamp).**

(b) number of bubbles per minute (rate of oxygen production) cao — **B1**

(b) Answer: **Number of bubbles per minute (rate of photosynthesis).**

(c) two controls named eg temperature, type/length of pondweed, volume of water, concentration of dissolved salts, $CO_2$ availability, lamp brightness setting, oe — **B1**

(c) Answer: **Examples: keep water temperature constant and keep the same length of pondweed.**

## Question 5

example of a decomposer, e.g. fungi, bacteria, earthworm — **B1**

role described: breaks down dead material and returns nutrients to the soil — **B1**

Answer: **e.g. Earthworms: they break down dead plant material and help return nutrients to the soil.**

## Question 6

effect 1 identified: organisms requiring high oxygen, such as insect larvae and trout, will decrease — **M1**

reason for effect 1: low oxygen reduces respiration and survival — **M1**

effect 2 identified: decomposer bacteria may increase if organic pollution increases, causing further oxygen drop or change in species — **M1**

linking statement about changes in food web or community structure as a result, oe — **A1**

Answer: **Low oxygen causes sensitive species like insect larvae and trout to decline because they cannot respire effectively, and increased decomposer activity on extra organic matter can lower oxygen further, changing the community structure.**

## Question 7

identifies that removal of foxes reduces predation on their prey (small predators or herbivores) — **M1**

states that the prey population will increase as a result — **M1**

links increased prey numbers to greater grazing or predation on plants or smaller animals — **M1**

gives the likely consequence: decrease in some plant species or reduced numbers of the smaller animals that get eaten by the now more abundant prey, with causal link — **A1**

Answer: **Without foxes small predator or herbivore numbers rise, leading to more plant eating and a decrease in plant numbers or declines in some small animal populations.**

## Question 8

first correct chain algae -> water flea -> small fish -> heron or otter — **M1**

second correct chain algae -> snail -> heron or other top predator different from first chain — **M1**

both chains start with algae and end with a top predator — **M1**

chains correctly written with arrows and valid organisms, oe — **A1**

Answer: **Examples: 1) Algae -> water flea -> small fish -> heron. 2) Algae -> snail -> heron.**


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## Question 9

(a) an organism that makes its own food by photosynthesis, e.g. a green plant or algae oe **B1**

(a) Answer: **A producer makes its own food by photosynthesis, for example grass or a green plant.**

(b) an organism that gets its energy by eating other organisms, e.g. any named animal oe **B1**

(b) Answer: **A consumer gets its energy by eating other organisms, for example a rabbit or a fox.**

(c) an organism that breaks down dead organisms and waste material, releasing nutrients back into the environment, e.g. bacteria or fungi oe **B1**

(c) Answer: **A decomposer breaks down dead organisms and waste, releasing nutrients back into the environment, for example bacteria or fungi.**

## Question 10

(a) population estimate = (number caught and marked in sample 1 x total number caught in sample 2) / number of marked individuals recaptured in sample 2 oe **B1**

(a) Answer: **Population estimate = (number marked in sample 1 x number caught in sample 2) / number of marked individuals recaptured.**

(b) 60 x 45 (= 2700) seen **M1**

(b) 300 (snails) cao, from 2700 / 9 **A1**

(b) Answer: **300 snails**

(c) any valid assumption, e.g. no snails are born, die, enter or leave the garden between the two samples, or the marked snails mix randomly back into the population and the mark does not affect survival **B1**

(c) Answer: **The population must not change (through births, deaths, migration in or out) between the two samples, and the marked snails must mix randomly with the rest of the population.**

## Question 11

(a) 1.0 x 5 seen **M1**

(a) 5.0 ppm cao **A1**

(a) Answer: **5.0 ppm**

(b) 25 (times) cao, from 5.0 / 0.2, ft from part a **B1**

(b) Answer: **25 times**

(c) the pesticide is not easily broken down or excreted, so it builds up in the body (often in fatty tissue) of each organism that eats contaminated prey oe **B1**

(c) because the concentration increases at each trophic level, and top predators eat many organisms from lower levels over their lifetime, they accumulate the highest concentrations, which can reach harmful/toxic levels oe **B1**

(c) Answer: **Because the pesticide is not broken down or excreted easily, it builds up in body tissue at every trophic level; top predators eat many contaminated organisms over their lifetime, so they end up with the highest, potentially toxic, concentrations.**

## Question 12

(a) competition between organisms of the same species for the same resources, e.g. food, mates or territory oe **B1**

(a) Answer: **Competition between organisms of the same species for the same resources, such as food, mates or territory.**

(b) competition between organisms of different species for the same resources oe **B1**

(b) Answer: **Competition between organisms of different species for the same resources.**

(c) grey squirrels compete with red squirrels for the same food and nesting sites (interspecific competition) oe **B1**

(c) grey squirrels are generally more successful in this competition, leaving fewer resources for red squirrels, so fewer red squirrels survive and reproduce and their population falls oe **B1**

(c) Answer: **Grey and red squirrels compete for the same food and nesting sites; grey squirrels tend to out-compete red squirrels for these resources, so fewer red squirrels survive and reproduce, causing their population to decline.**

## Question 13

only sampling near the car park is not random, so the field is not sampled fairly/representatively oe **B1**

conditions near the car park (e.g. more trampling, compacted soil, more light or disturbance at the field edge) may differ from the rest of the field, so dandelion numbers there may not represent the whole field oe **B1**

this introduces bias into the results, so the population estimate calculated from this sample is likely to be inaccurate for the field as a whole oe **B1**

improvement: use randomly generated coordinates (e.g. from a random number generator) to place the quadrat across the whole field, not just near the car park oe **B1**

Answer: **Sampling only near the car park is not random and conditions there (e.g. trampling, compacted soil) may differ from the rest of the field, so the sample is biased and the resulting estimate is unlikely to be accurate for the whole field; Callum should use randomly generated coordinates to place his quadrat across the entire field instead.**


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