

# Ecosystems and material cycles practice questions

28 questions • 80 marks • mark scheme at the back

For Edexcel GCSE Biology 1BI0 and Combined Science 1SC0. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Name .....

Total ..... / 80

## Communities and interdependence Spec 9.1–9.4

**1** All the individuals of one species living in the same area are called a [1 mark]

- A. ☐ community
- B. ☐ population
- C. ☐ ecosystem
- D. ☐ habitat

**2** State two abiotic factors that can affect a community. [2 marks]

---

---

---

---

**3** Two species of plant in a meadow need the same resources. Explain how competition between them could affect the number of each species. [3 marks]

---

---

---

---

---

---

**4** Explain why the organisms in a community are said to be interdependent. [2 marks]

---

---

---

---



## Energy transfer in ecosystems Spec 9.7B–9.8B Triple only

**9** Triple only [1 mark]

Food chains rarely have more than five trophic levels because

- A. ☐ there is too little light for plants
- B. ☐ too little energy is left to support more trophic levels
- C. ☐ predators eat too many organisms
- D. ☐ plants cannot grow near large animals

**10** Triple only [3 marks]

In a field, the biomass of the grass is much greater than the biomass of the cows that eat it. Explain why.

---

---

---

---

---

**11** Triple only [2 marks]

A field of grass contains 12 500 kJ of energy in its biomass. Rabbits eating the grass gain 1 500 kJ. Calculate the percentage efficiency of the energy transfer from grass to rabbits.

Answer = .....

---

---

---

---

---

**12** Triple only [2 marks]

A caterpillar eats 50 g of leaf (dry mass). Its own dry mass increases by 8 g. Calculate the percentage of the dry mass of leaf eaten that becomes caterpillar biomass.

Answer = .....

---

---

---

---

---

## Human impacts, biodiversity and food security Spec 9.9–9.11B

**13** [1 mark]

Which is a negative effect of introducing a non-indigenous species to an area?

- A. ☐ It increases the number of native species
- B. ☐ It competes with native species so their numbers fall
- C. ☐ It always provides food for native species
- D. ☐ It increases biodiversity

**14** Fertiliser from a farm runs into a lake and the fish die. Explain how the fertiliser causes the fish to die. **[4 marks]**

---

---

---

---

---

---

---

---

---

---

**15** Explain how reforestation can benefit the environment. **[3 marks]**

---

---

---

---

---

---

---

---

---

---

**16** **Triple only** **[3 marks]**  
Describe three biological factors that can reduce food security.

---

---

---

---

---

---

---

---

---

---

**17** Evaluate the positive and negative impacts of fish farming on biodiversity. **[6 marks]**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

## Material cycles Spec 9.12-9.15

- 18** Explain why materials such as carbon and nitrogen need to be cycled in an ecosystem. **[2 marks]**

---

---

---

---

- 19** Explain the role of decomposers in the carbon cycle. **[3 marks]**

---

---

---

---

---

- 20** (a) Name the process by which plants lose water vapour from their leaves. (1) (b) Name the process that turns water vapour into liquid water droplets in clouds. (1) **[2 marks]**

---

---

---

---

- 21** In areas of drought, desalination of sea water can be used to produce potable water. Explain what is meant by 'potable water' and 'desalination', and give one disadvantage of desalination. **[3 marks]**

---

---

---

---

---

---

---

- 22** Which type of bacteria converts ammonium ions in the soil into nitrates? **[1 mark]**

- A. ☐ Nitrifying bacteria  
B. ☐ Denitrifying bacteria  
C. ☐ Decomposers  
D. ☐ Nitrogen-fixing bacteria in root nodules

**23** Explain how nitrates are made available for plants to take up from the soil, including the use of fertilisers and crop rotation. **[6 marks]**

[illegible]

## Indicator species and decomposition

24 Triple only Higher tier [2 marks]

A river contains many bloodworms and sludgeworms but no stonefly nymphs or freshwater shrimps. What does this suggest about the water?

.....

.....

.....

**25** Triple only Higher tier [4 marks]

Evaluate the use of lichens as indicator species to assess air quality, compared with measuring the concentration of sulfur dioxide with a meter.

[illegible]

26

Triple only

[4 marks]

Explain how (a) vacuum packing and (b) adding salt each preserve food.

---

---

---

---

---

---

---

---

27

Triple only

[3 marks]

A gardener turns the compost heap regularly and keeps it moist but not waterlogged. Explain why this speeds up decomposition.

---

---

---

---

---

---

---

---

28

Triple only

[2 marks]

A sample of leaves had a mass of 20.0 g. After 5 days its mass was 14.0 g. Calculate the mean rate of decay in g per day.

Answer = .....

---

---

---

---

---

---

---

---

## Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

**1. [1]**

**B** population (1)

**2. [2]**

- temperature (1)
- light (1) allow light intensity
- water (1) allow water availability
- pollutants (1)
- Max 2

**3. [3]**

- both need the same limited resources, such as light, water or mineral ions (1)
- the better adapted species gets more of the resources, so grows and reproduces more (1)
- so the number of the other species decreases (1)

**4. [2]**

- organisms depend on other species for food / shelter / pollination / seed dispersal (1)
- so a change in the number of one species affects other species in the community (1)

**5. [4]**

- in parasitism the parasite benefits and the host is harmed (1)
- in mutualism both organisms benefit (1)
- parasitism example: tapeworm in human gut / flea on dog / any correct parasite (1)
- mutualism example: nitrogen-fixing bacteria in root nodules of legumes / cleaner fish / any correct example (1)

**6. [2]**

- lay two tape measures at right angles / mark out a grid (1)
- use a random number generator to choose coordinates and place a quadrat at each (1)

**7. [3]**

- mean =  $(4 + 6 + 5 + 7 + 3) \div 5 = 5$  (1)
- $200 \div 0.25 = 800$  (1)
- $5 \times 800 = 4000$  buttercups (1) allow ecf for an incorrect mean; award 3 marks for a correct answer with no working

## 8. [6]

|                        |                                                                                                                                                                                                                                                      |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Level 3<br/>5-6</b> | A detailed, logical method that includes the transect, regular quadrat placement, counting the species and measuring light intensity at each point, plus at least two ways of improving reliability or control. Scientific terms are used correctly. |
| <b>Level 2<br/>3-4</b> | A method is given with most of the main steps in a sensible order but some detail is missing, for example the light measurement or the control of variables.                                                                                         |
| <b>Level 1<br/>1-2</b> | Some relevant steps are stated but the method is incomplete or not in a logical order.                                                                                                                                                               |

### Indicative content

- lay a tape measure in a straight line from the edge of the wood out into the open
- place a quadrat at regular intervals along the tape, for example every 2 m
- count the number of the plant species (or estimate the percentage cover) in each quadrat
- measure light intensity at each quadrat using a light meter
- use the same size quadrat and the same person counting each time
- repeat the transect or take more than one transect and calculate mean values
- plot the number of plants against light intensity to look for a pattern or correlation
- safety: wear suitable footwear, wash hands after, avoid touching unknown plants

## 9. [1] Triple only

**B** too little energy is left to support more trophic levels (1)

## 10. [3] Triple only

- some of the grass is not eaten / some is not digested and is lost in faeces (1)
- energy is released by respiration and transferred to the surroundings as heat (1)
- energy is used for movement / keeping warm / lost in urine (1)
- so less energy / biomass is available at the next trophic level to support cows (1)
- Max 3

## 11. [2] Triple only

- $1\,500 \div 12\,500 \times 100$  (1)
- = 12 % (1) award 2 marks for a correct answer with no working

## 12. [2] Triple only

- $8 \div 50 \times 100$  (1)
- = 16 % (1) award 2 marks for a correct answer with no working

## 13. [1]

**B** it competes with native species so their numbers fall (1)

## 14. [4]

- fertiliser increases the nitrates in the water so algae grow rapidly / algal bloom (1)
- the algae block light so plants / algae below cannot photosynthesise and die (1)
- bacteria / decomposers feed on the dead material and increase in number, using up oxygen (1)
- fish die because there is not enough oxygen (1)

## 15. [3]

- restores habitats so biodiversity increases (1)
- trees absorb carbon dioxide by photosynthesis, reducing carbon dioxide in the atmosphere (1)
- tree roots hold soil so there is less soil erosion / flooding (1)

**16. [3]** Triple only

- increasing human population needs more food (1)
- increasing animal farming / meat and fish consumption needs more land and resources because energy is lost between trophic levels (1)
- new pests and pathogens destroy crops / animals (1)
- environmental change caused by human activity reduces yields (1)
- sustainability issues such as land used for biofuels, or the cost of fertilisers, pesticides and feed (1)
- Max 3

**17. [6]**

|                        |                                                                                                                                                                           |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Level 3<br/>5-6</b> | A balanced evaluation that gives several correct positive and negative impacts with explanations, and reaches a justified judgement. Scientific terms are used correctly. |
| <b>Level 2<br/>3-4</b> | Some positive and some negative impacts are given with some explanation, but the answer may be unbalanced or have no clear judgement.                                     |
| <b>Level 1<br/>1-2</b> | One or two simple points are made, without explanation or balance.                                                                                                        |

**Indicative content**

- positive: provides a food supply for a growing population
- positive: reduces overfishing so wild fish stocks and the species that feed on them are protected
- negative: waste and uneaten food pollute water and can cause eutrophication, so oxygen falls and organisms die
- negative: disease and parasites can spread from farmed fish to wild fish
- negative: escaped fish can compete or interbreed with wild fish, reducing genetic variety
- negative: fish may be fed on wild fish, and chemicals used can harm other organisms
- judgement: benefits depend on how well the farm is managed, for example controlling waste and preventing escapes

**18. [2]**

- the supply of each material is limited (1)
- so they must be returned to the abiotic environment to be used again by new organisms (1)

**19. [3]**

- they break down dead plants, dead animals and waste (1)
- they respire, releasing carbon dioxide into the air (1)
- so carbon dioxide is available again for photosynthesis (1)

**20. [2]**

- transpiration (1)
- condensation (1)

**21. [3]**

- potable water is water that is safe to drink (1)
- desalination removes the dissolved salt from sea water (1)
- needs large amounts of energy / expensive (1)

**22. [1]**

**A** nitrifying bacteria (1)

### 23. [6]

|                              |                                                                                                                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Level 3</b><br><b>5-6</b> | A clear, well-structured explanation covering the roles of several types of bacteria in the nitrogen cycle as well as fertilisers and crop rotation, with correct scientific terms. |
| <b>Level 2</b><br><b>3-4</b> | An explanation that covers some of the processes or methods, with some correct scientific terms but with gaps in the detail.                                                        |
| <b>Level 1</b><br><b>1-2</b> | Some relevant statements are made but with little explanation.                                                                                                                      |

#### Indicative content

- decomposers break down proteins and urea in dead material and waste into ammonia / ammonium ions
- nitrifying bacteria convert ammonium ions into nitrates
- nitrogen-fixing bacteria in the soil or root nodules convert nitrogen gas into nitrogen compounds, which become nitrates
- plants absorb nitrates through their roots and use them to make protein
- denitrifying bacteria remove nitrates from the soil by converting them into nitrogen gas
- fertilisers add nitrates to the soil to replace those removed in crops
- crop rotation: growing a legume (such as clover) increases nitrates in the soil because of nitrogen-fixing bacteria in its root nodules, then a crop needing nitrates is grown

### 24. [2] Triple only Higher tier

- it is polluted (1)
- with low oxygen levels / for example sewage (1)

### 25. [4] Triple only Higher tier

- lichens are cheap / easy / need no special equipment (1)
- they show the effect of pollution over a long period of time (1)
- but other factors, such as habitat or temperature, may affect lichens (1)
- they do not give an accurate or quantitative measure of pollution, whereas a meter gives a precise value for sulfur dioxide (1)

### 26. [4] Triple only

- vacuum packing removes oxygen (1)
- microorganisms need oxygen for aerobic respiration, so decomposition is slower (1)
- salt removes water from the microorganisms by osmosis / reduces available water (1)
- microorganisms need water to grow and reproduce (1)

### 27. [3] Triple only

- turning adds oxygen to the heap (1)
- decomposers need oxygen for aerobic respiration (1)
- decomposers need water, but waterlogging fills the air spaces so there is less oxygen (1)

### 28. [2] Triple only

- change in mass =  $20.0 - 14.0 = 6.0$  g (1)
- $6.0 \div 5 = 1.2$  g per day (1) award 2 marks for a correct answer with no working