



Ecosystems (Continuity and change) practice questions

17 questions · 55 marks · mark scheme at the back

For IB Diploma Biology SL undefined. **HL only** is additional higher level content, for HL students only.

Name

Total / 55

Natural selection **Spec D4.1**

1 PAPER 1A STYLE [1 mark]

Which process generates new alleles?

- A. ☐ Mutation
- B. ☐ Crossing over
- C. ☐ Random orientation of bivalents
- D. ☐ Random fertilisation

2 PAPER 1A STYLE [1 mark]

Which is a density-independent selection pressure?

- A. ☐ Competition for nesting sites
- B. ☐ A very cold winter
- C. ☐ Predation by owls
- D. ☐ Spread of disease in a crowded population

3 PAPER 2A STYLE [2 marks]

A gardener grows a plant in rich, fertile soil and it grows very tall. Explain why its offspring will not inherit this extra height.

4

[6 marks]

In an experiment modelled on Endler's work, guppies were kept in replicate ponds with no predator, with the weak predator *Rivulus*, or with the strong predator *Crenicichla*. The table shows the mean number of coloured spots per male (practice data). (a) Calculate the percentage change in mean spots per male in the no-predator ponds from 0 to 14 months. [2] (b) Compare the results for *Rivulus* and *Crenicichla* ponds. [2] (c) Explain the trend in the *Crenicichla* ponds. [2]

Mean number of spots per male guppy			
Treatment	0 months	5 months	14 months
No predator	10.0	11.2	12.5
Rivulus	10.0	11.0	12.2
Crenicichla	10.0	9.1	8.4

[illegible]

5

[6 marks]

Explain how natural selection can lead to evolutionary change in a population.

[illegible]

Stability and change Spec D4.2

6 PAPER 1A STYLE [1 mark]

- When is harvesting of a wild fish population sustainable?
- A. ☐ When only adult fish are caught
 - B. ☐ When the population is above its carrying capacity
 - C. ☐ When the rate of harvesting is lower than the rate of replacement
 - D. ☐ When the catch is the same every year

7 PAPER 1A STYLE [1 mark]

- Why is a sealed glass vessel preferred to an open tank for a mesocosm?
- A. ☐ It stops light energy entering
 - B. ☐ It prevents entry and exit of matter but allows energy transfer
 - C. ☐ It keeps the temperature constant
 - D. ☐ It prevents decomposers from growing

8 PAPER 2A STYLE [5 marks]

(a) The forest area of a part of the Amazon basin fell from 520 000 km² to 442 000 km² (practice figures). Calculate the percentage change in forest area. [2] (b) Explain how deforestation on this scale could reduce rainfall over the remaining forest. [3]

Answer =

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The table shows DDT concentrations in an estuary food chain (practice data). (a) Calculate how many times greater the concentration is in the fish-eating birds than in the zooplankton. [1] (b) Explain the pattern shown in the data. [3]

DDT concentration	
Sample	DDT concentration / parts per million
Water	0.00005
Zooplankton	0.04
Small fish	0.5
Large fish	2.0
Fish-eating birds	25

Answer =

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Explain how the use of fertilizers on farmland can lead to the death of fish in a nearby lake.

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11 PAPER 2A STYLE

[3 marks]

Outline the effects of plastic pollution on marine life.

Climate change Spec D4.3

12 PAPER 1A STYLE

[1 mark]

Which is an example of a positive feedback cycle in global warming?

- A. ☐ Increased photosynthesis by trees absorbs more CO₂
- B. ☐ Melting ice exposes darker surfaces that absorb more solar radiation
- C. ☐ Warmer oceans increase upwelling of nutrients
- D. ☐ More cloud reflects sunlight back into space

13 PAPER 1A STYLE

[1 mark]

What is the cause of coral bleaching?

- A. ☐ Ocean acidification dissolving coral skeletons
- B. ☐ Microplastics blocking coral polyps
- C. ☐ Increased water temperature causing corals to expel their symbiotic algae
- D. ☐ Reduced upwelling of nutrients

14

[5 marks]

the increase. [2]

Annual mean atmospheric CO₂ concentration at Mauna Loa (NOAA data)

Answer =

[illegible]

15

[3 marks]

Explain how early breakout of landfast ice threatens emperor penguins.

[illegible]

PAPER 2B STYLE

Explain how climate change could cause boreal forests to change from net carbon accumulation to net carbon loss.

[illegible]

PAPER 2A STYLE

Explain how warmer surface water can reduce energy flow through marine food chains.

[illegible]

Mark scheme

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

1. [1]

A A [1]

2. [1]

B B [1]

3. [2]

- height was acquired due to an environmental factor / soil, not genes [1]
- acquired characteristics are not encoded in the base sequence of genes / DNA of gametes [1]
- so they cannot be passed on / only heritable traits can evolve [1]
- max 2

4. [6]

- (a) $(12.5 - 10.0) \div 10.0 \times 100$ [1]
- (a) +25% / increase of 25% [1]
- (b) Rivulus: spots increased (10.0 to 12.2) whereas Crenicichla: spots decreased (10.0 to 8.4) [1]
- (b) both start at the same value / both change in the same time / difference grows with time [1]
- (c) brightly coloured males are more conspicuous / more likely to be eaten by Crenicichla [1]
- (c) males with fewer spots survive and reproduce more, passing on alleles for fewer spots [1]
- (c) predation outweighs sexual selection / female preference for colourful males OWTTE [1]
- max 6

5. [6]

- variation exists between individuals in a population [1]
- mutation generates new alleles [1]
- sexual reproduction / meiosis and fertilisation generate new combinations of alleles [1]
- more offspring are produced than the environment can support / overproduction [1]
- population exceeds carrying capacity so there is competition for limited resources, e.g. food [1]
- selection pressures, e.g. predation / extreme temperature, affect individuals differently [1]
- better-adapted individuals / those with higher fitness survive and reproduce more [1]
- they pass on alleles for the favourable traits to offspring [1]
- only heritable traits / not acquired characteristics are passed on [1]
- over many generations the frequency of the favourable trait / allele increases [1]
- max 6

6. [1]

C C [1]

7. [1]

B B [1]

8. [5]

- (a) $(442\,000 - 520\,000) \div 520\,000 \times 100$ [1]
- (a) -15% / decrease of 15% [1]
- (b) fewer trees so less transpiration / less water vapour released into the atmosphere [1]
- (b) less evaporative cooling / less driving of air flows that bring in moist air [1]
- (b) water vapour from transpiration normally condenses and falls as rain further inland / water is recycled [1]
- (b) longer dry season / drought stress / more fires reduce forest further (positive feedback) [1]
- max 5

9. [4]

- (a) $25 \div 0.04 = 625$ times [1]
- (b) concentration increases at each higher trophic level / biomagnification [1]
- (b) DDT is persistent / not broken down [1]
- (b) DDT is fat-soluble / stored in fatty tissue / not excreted [1]
- (b) each consumer eats many organisms from the level below, taking in all their DDT [1]
- max 4

10. [6]

- nitrate / phosphate fertilizers leach from soil (into the lake) [1]
- nutrient enrichment of the water is eutrophication [1]
- rapid growth of algae / algal bloom [1]
- algae block light so plants below cannot photosynthesise and die [1]
- algae / plants die and are decomposed by bacteria [1]
- decomposers respire aerobically / use oxygen [1]
- biochemical oxygen demand / BOD increases [1]
- dissolved oxygen concentration falls / water becomes hypoxic [1]
- fish cannot respire aerobically and die [1]
- Do not accept 'algae use up oxygen by photosynthesis'
- max 6

11. [3]

- plastics are non-biodegradable / persist for a long time [1]
- macroplastic / nets / bags cause entanglement, e.g. of seals / turtles / seabirds [1]
- macroplastic swallowed, e.g. bags mistaken for jellyfish by turtles, blocking the gut / starvation [1]
- microplastics eaten by zooplankton / filter feeders / fish [1]
- microplastics pass along food chains / carry toxic chemicals [1]
- max 3

12. [1]

B B [1]

13. [1]

C C [1]

14. [5]

- (a) $(414 - 317) \div 317 \times 100$ [1]
- (a) 30.6% / 31% [1]
- (b) rate doubled / 22 ppm per 20 years in 1960–1980 compared with 44 ppm per 20 years in 2000–2020 [1]
- (c) combustion of fossil fuels, e.g. coal / oil / natural gas [1]
- (c) deforestation / burning of forests, reducing CO₂ uptake and releasing CO₂ [1]
- (c) cement production [1]
- max 5

15. [3]

- emperor penguins breed on landfast ice / ice attached to the coast [1]
- chicks need stable ice until they have grown waterproof feathers [1]
- early breakout causes chicks to drown / die of cold [1]
- breeding grounds lost / breeding fails / population falls [1]
- max 3

16. [6]

- boreal forests / taiga currently store more carbon than they release / carbon sink [1]
- warmer temperatures [1]
- decreased winter snowfall / less spring meltwater [1]
- increased incidence of drought [1]
- reduced primary production / less photosynthesis so less CO₂ absorbed [1]
- forest browning / trees die [1]
- more frequent and intense forest fires [1]
- combustion of legacy carbon / old soil organic matter releases CO₂ [1]
- positive feedback: released CO₂ causes further warming [1]
- this is a tipping point / change becomes self-sustaining OWTTE [1]
- max 6

17. [3]

- warm surface water forms a stable layer that does not mix with deeper water [1]
- prevents upwelling of nutrients / nitrate / phosphate to the surface [1]
- phytoplankton growth / ocean primary production decreases [1]
- less energy available to consumers such as fish / seabirds [1]
- max 3