

Full Higher Separate content. ★ = Higher Tier. ◆ = Separate Science only.

**Q1. Explain why food chains rarely contain more than five trophic levels.**

[3 marks]

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**Q2. Explain why eating a plant-based diet requires less land than eating a meat-based diet. Use your knowledge of energy transfer in food chains.**

[4 marks]

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★ HIGHER TIER

**Q3. ★ A grassland ecosystem: grass = 12,000 kg, rabbits = 1,200 kg, foxes = 60 kg. (a) Calculate biomass transfer efficiency from rabbit to fox. (b) Suggest why this value is lower than expected.**

[3 marks]

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Total: 10 marks

**Q1 (3 marks)**

*Explain why food chains rarely contain more than five trophic levels.*

- Energy is lost at each trophic level through respiration (heat), movement and waste [1]
- Only approximately 10% of energy transfers from one level to the next [1]
- After 5 levels, so little energy remains that a further level cannot be supported [1]

**Q2 (4 marks)**

*Explain why eating a plant-based diet requires less land than eating a meat-based diet. Us...*

- Plants are producers — first trophic level [1]
- Eating plants directly provides the most efficient energy transfer to humans [1]
- Eating meat adds an extra trophic level — ~90% energy lost at each step [1]
- Far more plant material required to produce 1 kg of meat than 1 kg of plant food → more land needed [1]

**Q3 (3 marks) [★ HT]**

★ *A grassland ecosystem: grass = 12,000 kg, rabbits = 1,200 kg, foxes = 60 kg. (a) Calcula...*

- (a)  $(60 \div 1200) \times 100 = 5\%$  [1]
- (b) Lower than typical 10% because: foxes are active predators — use a lot of energy in hunting (respiration/movement) [1]
- Or: foxes eat a lot of bone/indigestible material — large proportion lost as waste [1]