Biology

Standard level

Paper 1B

Markscheme

Question	Answers	Notes	Marks
1. a	- Growth rates decrease in both species when grown together (Species A: 2.5 → 1.2 cm/week; Species B: 3.0 → 1.8 cm/week). ✔ - Seed production decreases (Species A: 200 → 80; Species B: 250 → 120). ✔	Award 1 mark per correct comparison. Numerical data must be included for full marks.	2
1. b	- Demonstrates **interspecific competition** ✔ - Both species compete for resources, reducing growth/reproduction. ✔ **OR** - **Competitive exclusion principle** ✔ - One species may dominate over time. ✔	Accept either explanation. Award marks for linking data to the principle.	2
1. c (i)	- Abiotic factor (e.g., low pH) favors one species ✔	Award 1 for general influence, 1 for specific example.	1
1. c (ii)	- **Fundamental niche**: Full range of conditions a species can occupy without competition. ✔ - **Realized niche**: Restricted due to competition (e.g., Species A avoids areas with B). ✔	Award 1 for definition, 1 for effect, 1 for example.	2

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2. a (i)	- Inverse relationship: As water temperature increases, oxygen solubility decreases. ✔ **OR** - Negative correlation shown on the graph. ✔	Award 1 mark for a clear description of the trend. Do not accept "they are related" without specifying the trend.	1
2. a (ii)	- Rising temperatures reduce oxygen solubility, limiting availability for aquatic organisms. ✔ - This can lead to hypoxia, stressing respiration/metabolism (e.g., fish gills less efficient). ✔		2
2. b	- Polar water molecules form weak interactions (dipole-induced dipole) with O_2. ✔ - Hydrogen bonding creates "cages" that trap nonpolar O_2, enhancing solubility. ✔		2
2. c	- CO_2 is more soluble than O_2 because it reacts with water to form carbonic acid (H_2CO_3). ✔ - Biological significance: CO_2 solubility affects pH (ocean acidification), impacting coral calcification/shellfish survival. ✔		2

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3. a	- Energy flows linearly and is lost as heat (second law of thermodynamics). ✔ - Sun is the constant energy source; heat cannot be recycled. ✔ - Matter (e.g., carbon) is recycled via biogeochemical cycles (e.g., decomposition). ✔	Accept any two. Do not accept "energy is reused" without qualification.	2
3. b (i)	- **10%** (10,000 → 1,000 kJ/m²/yr). ✔		1
3. b (ii)	- **10%** (100 → 10 kJ/m²/yr). ✔		1
3. c	- **CO_2 release**: Decomposers respire, returning carbon to the atmosphere. ✔ - **Nutrient recycling**: Break organic matter into inorganic forms (e.g., CO_2, minerals) for producers. ✔	Accept "humus formation" or "detritivore actions" if linked to carbon.	2
3. d	- **Increased photosynthesis**: Higher CO_2 boosts primary production. ✔ - **Trophic cascade**: More energy flows to consumers (↑ biomass). ✔ - **Climate impact**: Excess CO_2 may disrupt ecosystems (e.g., coral bleaching). ✔	Accept any two.	2

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4. a	- **Complementary base pairing**: A-T and C-G pairing ensures accurate template copying; mismatches are rare due to hydrogen bonding specificity. ✔		1
4. b	- DnaB helicase unwinds the double helix, separating parental strands to serve as templates. ✔ - This exposes bases for complementary pairing, enabling synthesis of new strands (semi-conservative mechanism). ✔	Accept "creates replication fork" or "allows polymerase access."	2