

M1.(a) R.

1

- (b) 1. Protein / amino acids broken down (to ammonium ions / ammonia);  
*Accept: nucleic acids / RNA / DNA / urea / any named nitrogen containing compound as an alternative to protein / amino acids*  
*Accept: saprophytes / saprotrophs*

2. By saprobionts / saprobiotic (microorganisms).  
*Neutral: decomposers*  
*Reject: answers where incorrect type of bacteria given as saprobionts e.g. Nitrogen fixing bacteria*

2

- (c) 1. (Fertility increased as) more nitrate formed / less nitrate removed / broken down;  
*Accept: Nitrate remains*

2. Less / no denitrification / process P is decreased / fewer denitrifying bacteria.  
*Accept: more nitrification / more nitrifying bacteria / process R is increased*

2

- (d) 1. Grow crops / plants with nitrogen-fixing (bacteria);  
*Accept: grow legumes / named example e.g. peas, beans, clover*  
*Accept: fallow year*  
*Accept: use different amounts of ions / nutrients*
2. (Different crops use) different minerals / salts / nutrients / ions (from the soil);
3. (Different crops have) different pests / pathogens / diseases.

2 max

[7]

- M2.(a)**
1. To kill any fungus / bacteria on surface of seeds or in soil;
  2. So only the added fungus has any effect.
- 2
- (b) So that only nitrate or ammonia / type of fertiliser affects growth.
- 1
- (c)
1. So that effects of nitrate or ammonium alone could be seen;
  2. So that effects of fungus can be seen.
- 2
- (d)
1. Weigh samples at intervals during drying;
  2. To see if weighings became constant (by 3 days).
- 2
- (e) With live fungus – showing effects of the fungus:
1. Fungus increases growth of roots and shoots in both;
  2. Produces greater growth with nitrate.
- With heat-treated fungus – showing effects of fertiliser:
3. Similar dry masses for roots and shoots;
  4. (Probably) no significant difference because SDs overlap.
- 4
- (f)
1. Dry mass measures / determines increase in biological / organic material;
  2. Water content varies.
- 2
- (g)
1. Fungus with nitrate-containing fertiliser gave largest shoot: root ratio;
  2. And largest dry mass of shoot;
  3. 6.09:1 compared with ammonium-containing fertiliser 4.18:1

2 max

[15]

- M3.(a)** (i) 1. Amino acid / protein / enzyme / urea / nucleic acid / chlorophyll / DNA / RNA / / ATP / ADP / AMP / NAD / NADP;  
 2. DNA / RNA / nucleic acid / ATP / ADP / AMP / NADP / TP / GP / RuBP / phospholipids;  
*1. and 2. Accept any named equivalent examples e.g. nucleotides.*  
*Neutral: ammonia / nitrite / nitrate / phosphate.*

2

- (ii) 1. Saprobiotic (microorganisms / bacteria) break down remains / dead material / protein / DNA into ammonia / ammonium;  
*Accept: saprobionts / saprophytes / saprotrophs*  
*Neutral: decomposer*  
 2. Ammonia / ammonium ions into nitrite and then into nitrate;  
*Allow correct chemical symbols.*  
*Accept: correct answers which use incorrect bacteria e.g. nitrogen-fixing but then reject m.p. 3.*  
 3. (By) Nitrifying bacteria / nitrification;

3

- (b) 1. Nitrate / phosphate / named ion / nutrients for growth of / absorbed / used by plants / algae / producers;  
 2. More producers / consumers / food **so** more fish / fish reproduce more / fish grow more / fish move to area;  
*Must have idea of more plants related to some increase in fish.*

2

[7]

- M4.1.** Carbon dioxide combines with ribulose biphosphate / RuBP;  
 2. Produces two glycerate (3-)phosphate / GP;  
*Accept: any answer which indicates that 2 x as much GP produced from one RuBP.*  
 3. GP reduced to triose phosphate / TP;  
*Must have idea of reduction. This may be conveyed by stating m.p. 4.*

4. Using reduced NADP;  
*Reject: Any reference to reduced NAD for m.p.4 but allow reference to reduction for m.p. 3.*
5. Using energy from ATP;  
*Must be in context of GP to TP.*
6. Triose phosphate converted to glucose / hexose / RuBP / ribulose biphosphate / named organic substance;

[6]

**M5.1.** Growth of algae / surface plants / algal bloom blocks light;

2. Reduced / no photosynthesis so (submerged) plants die;
3. Saprobiotic (microorganisms / bacteria);  
*3. Accept: Saprobiont / saprophyte / saprotroph*  
*3. Neutral: decomposer*
4. Aerobically respire / use oxygen in respiration;
5. Less oxygen for fish to respire / aerobic organisms die;

[5]

**M6.(a)** (i) Nitrification / oxidation;  
*Accept 'nitrifying'*

1

(ii) Denitrification;  
*Accept 'denitrifying'*

1

- (b) 1. (Nitrogen) to ammonia /  $\text{NH}_3$  / ammonium;  
*1. Do not disqualify mark for any references to ammonia being converted to nitrite, nitrate etc*
2. Produce protein / amino acids / named protein / DNA / RNA;  
*2. Do not disqualify mark for any references to protein being formed from nitrogen, nitrite or nitrate*

- (c) 1. Soil has low(er) water potential / plant / roots have higher water potential;
1. *Reference to water potential gradient is sufficient if correct direction of gradient or water movement is outlined*
  1. *Accept WP or  $\Psi$  for water potential*
2. Osmosis from plant / diffusion of water from plant;
2. *Accept plant takes up less / not enough water by osmosis*
  2. *Reference to movement of minerals by osmosis negates mark*