

- M1.** (a) circulating / mixing / described **or** temperature maintenance 1
- supply oxygen  
**or** for aerobic conditions  
**or** for faster respiration  
*do not allow oxygen for anaerobic respiration* 1
- (b) energy supply / fuel / use in respiration  
*do not allow just food / growth*  
*ignore reference to aerobic / anaerobic*  
**or** material for growth / to make mycoprotein 1
- (c) respiration  
*allow exothermic reaction*  
*allow catabolism*  
*ignore metabolism*  
*ignore aerobic / anaerobic* 1
- (d) (i) any **one** from:
- compete (with *Fusarium*) for food / oxygen **or** reduce yield of *Fusarium*
  - make toxic waste products or they might cause disease / pathogenic **or** harmful to people / to *Fusarium*  
*do not allow harmful unqualified* 1
- (ii) steam / heat treat / sterilise fermenter (before use)  
*not just clean*  
**or**

steam / heat treat / sterilise glucose / minerals / nutrients / water (before use)

**or**

filter / sterilise air intake

**or**

check there are no leaks

*allow sterilisation unqualified **not** just use pure glucose*

1

(e) any **three** from:

- beef is best or beef is better than mycoprotein
- mycoprotein mainly better than wheat
- more phenylalanine in wheat than in mycoprotein  
*allow equivalent numerical statements*
- but no information given on other amino acids / costs / foods

3

overall conclusion:

statement is incorrect because

**either**

it would be the best source for vegetarians

**or**

for given amino acids, beef is the best source

**or**

three foods provide insufficient data to draw a valid conclusion

1

[10]

**M2.** (a) circulation / mixing / described

1

**or**

temperature maintenance

supply oxygen

*do not allow oxygen for anaerobic respiration*

**or**

for aerobic conditions

**or**

for faster respiration

1

(b) any **one** from:

- energy supply / fuel  
**or** use in respiration  
*do not allow just food / growth*  
*ignore reference to aerobic / anaerobic*
- material for growth  
**or** to make mycoprotein

1

(c) (heat / energy) from respiration

*allow exothermic reactions*

*allow description eg breakdown of glucose / catabolism*

*ignore metabolism*

*ignore aerobic / anaerobic*

1

(d) (i) any **one** from:

- compete (with Fusarium) for food / oxygen  
**or** reduce yield of Fusarium
- make toxic waste products  
**or** they might cause disease / pathogenic  
**or** harmful to people / Fusarium  
*do not allow harmful unqualified*

1

(ii) any **two** from:

- steam / heat treat / sterilise fermenter (before use)  
*not just clean*  
*allow sterilisation unqualified for 1 mark*
- steam / heat treat / sterilise glucose / minerals / nutrients / water (before use)  
*not just use pure glucose*
- filter / sterilise air intake
- check there are no leaks

2

(e) any **three** from:

- beef is best **or** beef is better than mycoprotein(\*)
- mycoprotein mainly better than wheat(\*)
- more phenylalanine in wheat than in mycoprotein(\*)  
*allow equivalent numerical statements(\*)*
- but no information given on other amino acids / costs / foods

3

overall conclusion:

statement is incorrect

**or**

it would be the best source for vegetarians

**or**

for given amino acids, beef is the best source

**or**

three foods provide insufficient data to draw a valid conclusion

1

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**M3.** (a) No

*no mark  
if yes max 1 for correct statement*

diffusion is down the concentration gradient  
*accept by diffusion ions would leave the root*

1

to enter must go up / against the concentration gradient  
**or** concentration higher in the root  
**or** concentration lower in the soil

1

(b) (i) 0.9 **or** 3.25

*for correct answer with or without working  
if answer incorrect 1.3 **or** their rate – 0.4 gains 1 mark  
**or** 130 – 40 **or** 90 gains 1 mark*

2

(ii) (uptake) by active transport

1

requires energy

more energy from aerobic respiration

1

**or**

more energy when oxygen is present

1

[7]

**M4.** (a) (i) 120

1

(ii) 11 760 **or**

correct answer from candidate's answer to (a)(i)

*correct answer with or without working*

*if answer incorrect*

**120 × 98 or**

*candidate's answer to (a)(i) × corresponding SV gains 1 mark*

*if candidate uses dotted line / might have used dotted line(bod) in (a)(i) **and** (a)(ii) no marks for (a)(i) but allow full ecf in (a)(ii) eg 140 × 88 = 12320 gains 2 marks*

2

(b) trained athlete has higher stroke volume / more blood per beat

1

same volume blood expelled with fewer beats

**or** for same heart rate more blood is expelled

1

(c) increased aerobic respiration

**or**

decreased anaerobic respiration

*allow correct equation for aerobic respiration*

*accept don't have to respire anaerobically*

1

increased energy supply / need

1

less lactic acid formed

**or** to breakdown lactic acid **or** less O<sub>2</sub>-debt

1

can do more work **or** can work harder / faster / longer  
*accept muscle contraction for work*

**or** less fatigue / cramp / pain

1

[9]

**M5.** insufficient / no oxygen available 1

for (just) aerobic respiration

**or**

respires anaerobically

1

[2]

**M6.** (a) 7.15 to 7.45 am and 7.15 to 7.45 pm  
*both required, either order*  
*accept in 24 hr clock mode* 1

(b) (i) 11 1

(ii) 32.5 to 33  
*allow answer to (b)(i) + 21.5 to 22* 1

(c) any **two** from:  
• more photosynthesis than respiration  
• more biomass / carbohydrate made than used  
*allow more food made than used*  
• so plant able to grow / flower  
*accept plant able to store food* 2

[5]



**M7.** (a) LHS: carbon dioxide **AND** water

*in either order*

*accept  $\text{CO}_2$  **and**  $\text{H}_2\text{O}$*

*allow  $\text{CO}_2$  and  $\text{H}_2\text{O}$*

*if names given ignore symbols*

*do **not** accept  $\text{CO}^2$  /  $\text{H}^2\text{O}$  /  $\text{Co}$  /  $\text{CO}$*

*ignore balancing*

1

RHS: sugar(s) / glucose / starch / carbohydrate(s)

*accept  $\text{C}_6\text{H}_{12}\text{O}_6$*

*allow  $\text{C}_6\text{H}_{12}\text{O}_6$*

*do **not** accept  $\text{C}^6\text{H}^{12}\text{O}^6$*

1

(b) (i) light is needed for photosynthesis

**or**

no photosynthesis occurred (so no oxygen produced)

1

(ii) oxygen is needed / used for (aerobic) respiration

*full statement*

*respiration occurs **or** oxygen is needed for anaerobic*

*respiration gains **1** mark*

2

(c) (i) (with increasing temperature) rise then fall in rate

1

use of figures, ie

max. production at  $40^\circ\text{C}$

**or** maximum rate of 37.5 to 38

1

(ii)  $25 - 35^\circ\text{C}$

**either** faster movement of particles / molecules / more collisions **or** particles

have more energy / enzymes have more energy

1

**or** temperature is a limiting factor over this range

40 – 50 °C

denaturation of proteins / enzymes

*ignore denaturation of cells*

*ignore stomata*

1

- (d) above 35 °C (to 40 °C) – little increase in rate  
**or** > 40 °C – causes decrease in rate

1

so waste of money **or** less profit / expensive

1

because respiration rate is higher at > 35 °C

**or**

respiration reduces the effect of photosynthesis

1

[12]