

1 (a)	carbon ; hydrogen ; oxygen ; nitrogen ; sulfur ; [4 max]	R CHONS
(b)	1 N / nitrogen, fixation ; 2 bacteria / <i>Rhizobium</i> ; R 'nodules are bacteria' 3 convert, nitrogen / N ₂ / AW, into, ammonia / NH ₃ / ammonium / NH ₄ ⁺ / amino acid(s) ; 4 plants use (fixed) nitrogen to make, amino acids / proteins / AW ; [3 max]	N-fixing bacteria = 2 mar R to nitrite / nitrate A plants use NH ₃ / NH ₄ ⁺
(c)	1 (dead plants) eaten by, animals / detritivores / scavengers ; 2 e.g. earthworms / termites / AW ; 3 ref. their faeces / increase in surface area ; 4 decay / decomposition ; A decomposers 5 by, bacteria / fungi / saprophytes / saprotrophs ; 6 break down proteins to amino acids ; 7 deamination ; 8 ammonia / NH ₃ / NH ₄ ; } 9 ammonia to <u>nitrite</u> ; } 10 <u>nitrite</u> to nitrate ; A one mark for ammonia to nitrate 11 nitrification / nitrifying bacteria ; 12 <i>Nitrosomonas</i> / <i>Nitrobacter</i> in correct context of nitrification ; [6 max]	MP3 must be related to MP1 or 2 A even if linked to incorrect organism R if wrong type of bacteria (e.g. N-fixing) A if in context of MP1 or 2 but do not award twice protein → ammonia / AW = 1 mark if 6, 7, 8 not given R 'nitride' unless qualified by NO ₂ R nitrate unqualified by nitrite or ammonia

<p>1 (d)</p>	<p>1 light intensity ; A limited sunlight / lack + of sunlight / sunshine 2 light duration ; A day length 3 water / moisture availability ; A drought / flood / humidity / soil water 4 carbon dioxide, availability / concentration / tension / level ; 5 temperature ; 6 competition / overcrowding / space / weeds ; 7 grazing / herbivores / predation / primary consumers ; 8 pests ; 9 parasites / disease ; 10 use of (inappropriate) herbicides / nearby use of herbicides ; A drift of herbicides / weed killers 11 pollution / sulphur dioxide / acid rain ; 12 soil pH / depth of soil / type of soil / poor soil / oxygen in the soil ; 13 wind speed ; 14 salt concentration of soil ;</p> <p style="text-align: right;">[3 max]</p>	<p>R heat / warmth</p> <p>R oxygen unqualified</p>
<p>(e)</p>	<p><i>accept ora with population starting to increase about day 40</i></p> <p>1 small population to start with ; 2 takes time for eggs to hatch ; 3 not enough food / soya bean plants not grown enough / AW ; 4 aphids, not sexually mature / cannot breed / finding mates ; 5 too cold / too wet / AW (another appropriate weather condition) ; 6 ref. to, predators / ladybirds ; 7 ref. to, parasites / disease ; 8 ref. to, pesticides / insecticides ; 9 no immigration ; 10 competition (between aphids, with another pest) ; 11 AVP ;</p> <p style="text-align: right;">[3 max]</p>	<p><i>do not expect knowledge of aphid biology</i> <i>I names of phases (lag, log)</i> <i>I 'adjusting to surroundings'</i> refs. to soya must refer to food for aphids A few soya plants / competition for food / soya grows slowly</p> <p>R unfavourable conditions unqualified</p> <p>(e.g. correct ref. biotic and abiotic factors)</p>
<p>[Total: 19]</p>		

- 2 (a) (reserves last longer for walking / ora ;
(approx) 4 times longer / other use of figures ; [2]
- (ii) glucose **and** muscle glycogen ; [1]
- (iii) fat **and** carbohydrate ; [1]
- (iv) *award two marks if correct answer (16.6 / 17) is given
if no answer or incorrect answer award one mark for correct working*
- 1660 / 100 **OR** 5800 / 350 **OR** average of the two
16.57 / 16.58 / 16.59 / 16.6 / 17 (kJ per gram) ;; **R** rounding down to 16.5 [2]
- (b) (muscle, growth / development / repair ; **A** 'make / build up, muscle' [1]
- (ii) to build up, energy / glycogen, reserves / stores ;
muscle / liver, glycogen ;
converted to fat / stored as fat ; [2]
- (c) ($C_6H_{12}O_6 \longrightarrow 2C_3H_6O_3$ (+ energy released)
- 1 mark for glucose + lactic acid formulae correct ;
1 mark for balanced equation ; **R** if anything else given ($CO_2 + H_2O$) [2]
- (ii) 1 short, time / distance, for sprint *or* long, time / distance, for marathon ;
2 sprint needs (lots of) energy quickly / marathon needs energy over long
period ;
3 sprint oxygen supply not sufficient / oxygen supplied during marathon ;
4 anaerobic does not need oxygen / aerobic needs oxygen ;
5 lactic acid, removed after sprint / would build up in marathon ;
6 ref to muscle, fatigue / cramp / pain ;
7 ref to oxygen debt ;
8 AVP ; e.g. fat has higher energy content useful for marathon [max 4]
- (iii) glycogen in liver broken down to glucose ;
correct ref to glucagon ; **R** if 'glucagon breaks down glycogen...'
glucose from liver enters the blood ; **R** 'excreted into blood'
idea that balances use of glucose ; **A** 'replaces glucose used up' [max 2]

[Total: 17]