

A Level AQA Biology

17 Energy transfers and nutrient cycles – answers

Question	Answers	Extra information	Mark	AO Spec reference
01.1	mountain lion;		1	AO1 3.5.3
01.2	Any two from: they are at the start of the food web; they can photosynthesise; they can produce organic substances;	Allow “food chain”	2 max	AO1/AO2 3.5.3
01.3	the pesticide is present on the wheatgrass, which is eaten by the mule deer; if the mule deer consumes a lot of the wheatgrass, they will accumulate the pesticide in their bloodstream; this could build to toxic concentrations in the mountain lions if they consume many mule deer;	Allow “bioaccumulation”	3	AO2 3.5.4
01.4	$\frac{(300 - 28)}{300} \times 100 = 90.6666\dots$; $100 - 90.6666 = 9.3\%$;	Alternative working: $\left(\frac{28}{300}\right) \times 100$ Allow 9.33%	2	AO2 3.5.3 MS1.4
01.5	respiration / movement; heat loss / urine or excretion;		2	AO2 3.5.3
01.6	saprobionts (decomposers) feed on dead organisms; release minerals/elements into the soil;		2	AO1 3.5.4
02.1	total quantity of chemical energy store / the rate at which plants assimilate chemical energy; in plant biomass in a given area;		2	AO1 3.5.3
02.2	$(100 - 42 = 58)$ $8200 \times \left(\frac{58}{100}\right)$; $4756 \text{ kJ m}^{-2} \text{ year}^{-1}$;	Alternative working: 8220×0.42 $= 3444$ $8200 - 3444 = 4756$	2	AO2 3.5.3 MS 2.2

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02.3	8200 – 4756; 3444 kJ m ⁻² year ⁻¹	Allow error carried forward from 02.2 Accept alternative working	2	AO2 3.5.3 MS 2.3
02.4	some chemical energy used in respiration; the efficiency of the crop doing photosynthesis (more efficient would mean less losses) so if cold, less photosynthesis; the area of land covered by leaves of the crop;		3	AO2 3.5.3
03.1	Any two from: water molecules are split; by breaking the bonds in water; using light energy; yields protons, electrons and oxygen;		2 max	AO1 3.5.1
03.2	primary (consumer);	Allow “second trophic level” OWTE	1	AO2 3.5.3
03.3	$\left(\frac{1700 - 164}{1700}\right) \times 100$; 90%;	Allow 90.4 (3 s.f.)	2	AO2 3.5.3 MS 3.3
03.4	to ETC / oxidative phosphorylation; H released and split into H ⁺ and e ⁻ ; Proton gradient used to make ATP;		3	AO2 3.5.2

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04.1	Any four from: the dissolved oxygen increases until 10 days due to increased algal density; the dissolved oxygen increases until 10 days due to increased photosynthesis; increased algal density blocks light, reducing photosynthesis; plants below the algae die and oxygen is used by decomposers; dissolved oxygen decreases so freshwater shrimps are unable to aerobically respire; fewer freshwater shrimps as they die out;		4 max	AO3 3.5.1 3.5.2 3.5.4
04.2	$\left(\frac{40 - 3}{40}\right) \times 100$; 93%;		2	AO2 3.5.4 MS 4.2
04.3	Any one <u>pair</u> from: area of the lake measured / area used; AND as different areas may have difference concentrations of oxygen; measure the same species of shrimp; AND as there may be different species of shrimp that may affect the data; same fertiliser concentration; AND as different concentrations of fertiliser will cause different concentrations of oxygen; same temperature; AND as temperature is a limiting factor of photosynthesis;		2 max	AO2 3.5.4
04.4	Freshwater shrimp being killed;		1	AO2 3.5.4
04.5	Any one from: the Mississippi is much bigger than the lake; the Mississippi is a flowing river, so the fertiliser is washed down stream / does not accumulate; the lake and the Mississippi has different biotic and abiotic factors affecting them;		1 max	AO2 3.5.4

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05.1	Any two from: nitrogen-fixing bacteria convert gaseous nitrogen to ammonium ions; mutualistic nitrogen-fixing bacteria obtain carbohydrates from the plant; ammonium ions can be readily absorbed by plants, converted to nitrate ions and then amino acids;	Allow N ₂ and NH ₃	2 max	AO1/2 3.5.4
05.2	aeration (by ploughing) increases oxygen in the soil; increases the numbers of nitrifying bacteria;		2	AO3 3.5.4
05.3	smooth curve drawn through all of the plots;		1	AO2 3.5.4
05.4	from 0–30 kg hectare ⁻¹ there is an increased yield due to replenishment of nitrates; from 30–50 kg hectare ⁻¹ there is a decreased yield due to another factor limiting the yield / nitrate; concentration now too high to increase yield;		3	AO3 3.5.4
06.1	digestion;	Allow feeding	1	AO2 3.5.4
06.2	no gaseous phase in the phosphorus cycle, but there is in the nitrogen cycle; main reservoir in the phosphorus cycle is in mineral form, whereas it is in atmospheric form in the nitrogen cycle;		2	AO1 3.5.4
06.3	Any two from: provides immediate energy source; for cell processes; ATP cannot be stored / needs to be continuously made;		2 max	AO2 3.1.6
06.4	Any two from: ATP breaks the myosin-actin cross bridge; ATP is hydrolysed to ADP and Pi; the myosin head is returned to its original position;		2	AO1 3.1.6 3.6.3

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06.5	$\frac{700}{44}$; 16;	Allow 15.9	2	3.6.3 AO2 MS 6.5																				
07	<p>The following are suitable topic areas from the specification that could be used to explain the role of phosphates in biology.</p> <p>In order to fully address the question and reach the highest mark bands students must also include at least five topics in their answer, to demonstrate a synoptic approach to the essay.</p> <table border="1"> <thead> <tr> <th>Specification reference</th> <th>Topic area</th> </tr> </thead> <tbody> <tr> <td>3.1.3</td> <td>Lipids</td> </tr> <tr> <td>3.1.5.1</td> <td>Structure of DNA and RNA</td> </tr> <tr> <td>3.1.6</td> <td>ATP</td> </tr> <tr> <td>3.1.8</td> <td>Inorganic ions</td> </tr> <tr> <td>3.2.3</td> <td>Transport across cell membranes</td> </tr> <tr> <td>3.5.1</td> <td>Photosynthesis</td> </tr> <tr> <td>3.5.2</td> <td>Respiration</td> </tr> <tr> <td>3.5.4</td> <td>Nutrient cycles</td> </tr> <tr> <td>3.6.3</td> <td>Skeletal muscles are stimulated to contract by nerves and act as effectors</td> </tr> </tbody> </table> <p>Note: other topics from beyond the specification can be used, providing they relate to the title and contain factually correct material of at least an A-level standard. Credit should not be given for topics beyond the specification which are below A-level standard</p>	Specification reference	Topic area	3.1.3	Lipids	3.1.5.1	Structure of DNA and RNA	3.1.6	ATP	3.1.8	Inorganic ions	3.2.3	Transport across cell membranes	3.5.1	Photosynthesis	3.5.2	Respiration	3.5.4	Nutrient cycles	3.6.3	Skeletal muscles are stimulated to contract by nerves and act as effectors		25	3.1.3 3.1.5.1 3.1.6 3.1.8 3.2.3 3.5.1 3.5.2 3.5.4 3.6.3 AO1
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Skills box answers

Question	Answer
1	$\text{kJ m}^{-2}\text{year}^{-1}$ or $\text{kJ ha}^{-1}\text{year}^{-1}$
2a	5.50%
2b	60.3%
2c	16.7%
3	percentage efficiency increases from 10% to 48%
4	the efficiency of energy transferred would increase, which is a positive; however, fish provide a good source of protein which may be missing in algae;