

WJEC

Energy Flow

Mark Scheme

3

3. (a) A Light/solar energy/(sun)light (not: sun, allow: photosynthesis) (1)
- B (Energy loss) Respiration (1)
- C (Energy loss) Excretion/Egestion/production of faeces/urine/waste (not: faeces/urine/wastage) (1)
- (b) Third (1)
- (c) (i) Spider (1)
- (ii) Higher/maintaining body temp / Higher metabolic rate (not: ref. to size) (1)
- (iii) Less cellulose/fibre in diet/undigestible matter. (1)
- (d) (i) (Could be) greater productivity in oceans / higher energy conversion
less support required in oceans, less cellulose etc./less egestion/
oceans mainly ectothermic animals, respiratory loss greater/
less muscular activity, support etc. in oceans, respiratory rate lower.
Any one (1)
- (ii) Any one of above but different. (1)
- (iii) Less cellulose/lignin/undigestible material in grasses; (or converse)
Productivity could be lower in forest? (1)
- (iv) Energy lost at each transfer, not enough energy in last trophic level to support another layer. (allow: energy runs out) (1)

Total 11 marks

4. (a) (i) 95% saturation (1)
- (ii) 44/45% saturation in muscle (1)
- (iii) $571/560 \times 10^6$ (1)
- (b) (i) To left of normal (1)
- (ii) Does not become saturated at the pp of oxygen in environment/
At low pp oxygen does not release as much oxygen
(allow: does not have a strong enough affinity) (1)
- (iii) In tissues with high pp. O₂ no release of O₂;
Small drop in pp O₂ at lower pp O₂ too much released/all or nothing;
Less oxygen released at lower pp of oxygen (max 1) (1)

Question	Answer/Explanatory Notes	Marks Available		
5	(a) (i) potometer	1		
	(ii) 1600	1		
	(iii) decreased	1		
	(iv) increased	1		
	(v) water is absorbed faster than transpired (not: stomata closed)	1		
	(b) light (intensity)	1		
	(c) guard cells (Not: stomata)	1		
	(d)	(i) (actively) pumped into cells (to lower cell water potential)/draw water in by osmosis (not: move in/diffuse)	1	
		(ii) Lowered water potential draws water in (from adjacent cells)	1	
		(iii) (extra water increases volume of cell), uneven wall thickness/inner wall thicker/cause cells to bend/curve (Not: open)	1	
	(e)	(i) xylem	1	
		(ii) cohesion/adhesion or capillary action/root pressure/hydrogen bonding/ dipolar bonds Any two for 1 mark	1	
			[12]	
	4 6	(a)	(i) 15576 (1) written on dotted line alongside R2 (1)	2
			(ii) $C2 = C3+R3+E3/C3 = C2-(R3+E3)$	1
(b)		(i) total energy expelled per $m^2 = 972+3732+110+20=4834$ (1) total energy expelled = 4834×25000 (1) = $120,850,000/1.2085 \times 10^{-8}$	2	
		(ii) passes to decomposers/detritivores; respired/used/released by decomposers; lost as heat (Any 2) (not: eaten)	2	
			[7]	

Question	Answer/Explanatory Notes	Marks Available
5 6.	(a) (i) Death/defaecation.	2
	(ii) W W contains $900 - 10 - 290 = 600\text{KJ}$: X must contain $<10\text{kJ}$ (not: description)	1 1
	(b) (i) Reflected/passes through leaves/wrong wavelength/raises temperature.	1
	(ii) Inedible material (bark/tannin)/out of reach (roots/heartwood)/heat loss	1
	(c) (i) Y = carnivorous animals/predators/secondary consumer.	1
	(ii) Z = Respiration.	1
	(iii) Z.	1
	(d) $((10/900) \times 100 = 100/90) = 1.1\%$	1
	(e) Heat	1
		[11]

Question	Answers/Explanatory Notes	Marks Available
6 3.	(a) (i) $\frac{21060}{1,700,000} \times 100;$ 1.24(%)	2
	(ii) reflected; passes straight through the leaf/transmission through leaf (not: transmission unqualified) misses photosynthetic parts/leaves; wrong wavelength; absorbed by water; not present because of season;	3 max
	(b) (i) 4;	1
	(ii) energy at last/4 th trophic level only <u>21 units</u> ; insufficient to pass on/support another level;	2
	(c) death/decay; excretion/urine; faeces/egestion;	2 max
	(d) bacteria; fungi/saprophytes;	2
	(e) producer floats out/removed from, ecosystem/fishing/ migration qualified;	1
		[13]

B12

Question	Answer/Explanatory Notes	Marks Available
7 1.	(a) (i) Weeds/Periphyton	1 mark
	(ii) Pond snail/Mayfly larvae/Gammarus	1 mark
	(iii) Trout/Minnows/Sticklebacks/Notonecta/water boatman	1 mark
	(b) starting with weeds/periphyton and food chains from diagram Pyramid shape correct way up	1 mark 1 mark
2.	(a) A = Trachea B = Bronchiole C = Pleural membrane D = Diaphragm	4 marks
	(b) (i) 15 Acc 14 - 16	1 mark
	(ii) 450 cm^3 Acc. 440-460	1 mark
	(iii) 1075 cm^3 Acc 1050 - 1150	1 mark
	(c) <u>high</u> /increased levels of carbon dioxide in inhaled air; Lower <u>concentration gradient</u> between blood and alveolar air; Slower <u>diffusion</u> ;	2 Max
(d) (i) Residual (volume)	1 mark	
(ii) Prevent surfaces sticking together/reduce surface tension (not: keep alveoli open)	1 mark	
3.	(a) (i) Drawing, cell with extension. (ii) Large SA; (Welsh medium – surface qualified) Large number of mitochondria (energy for active transport); Thin cell wall, (does not interfere with flow); Low water potential/vacuole extends into hair/ protein pumps in the membrane (not: large vacuole)	3 Max
	(b) Cell walls; (not: cellulose) Plasmodesmata/cytoplasm	2 marks
	(c) Casparian strip/suberin; prevents apoplastic movement; forces water into cytoplasm/cell; Actively transport mineral ions into xylem vessels.	2 marks
	(d) Water moves upwards in Xylem.	1 mark

Question	Answers/Explanatory Notes	Marks Available
8 5.	(a) (i) Be reflected off leaves / pass between leaves / evaporate water / strike dust particles / water molecules in air (Any 2) (not: wrong wavelength unqualified / ref. to heat)	2
	(ii) Gross production = $1,970,000 - 1,946,820 = 23,180$ Net production = $23180 - 3668 = 19512$	1 1
	(b) (i) $1603 - (192+88) = 1323$	1
	(ii) Faeces / urine / dead bodies (Any 1 from 3) (not: waste / dead plants)	1
	(c) (i) rabbits (allow: the same)	1
	(ii) Take only 30 days to produce the same weight of meat as compared with 120 days for cow / convert same amount from one tonne of hay.	1
	(iii) rabbits have a larger surface area / they move about more than the cow / higher metabolic rate (not: more energetic / more respiration)	1
	(iv) Keep them in heated sheds / keep them in small cages so they cannot move Speed up meat production	1 1
		[11]

Question	Answers/Explanatory Notes	Marks Available
9 4.	(a) (i) Symmetrical and correct way up	1
	Labels correct using names in table	1
	Correct proportions	1
	(ii) not all of organism eaten; dead organisms not eaten; loss of undigested material; loss of CO ₂ /respiration/loss of heat; Loss as urine/urea/excretion	Max. 2
	(b) Dead organisms may not be collected/only living organisms collected; Roots/part of organisms not collected; Not representative areas samples; Time of collection/seasonal variation; Variable water content unless dried/dry biomass; Animals may be at more than one trophic level.	Max. 2
	(c) Reflected; Light passes through leaf/does not get absorbed by a chloroplast; Converted to heat energy; Some <u>wavelengths</u> not absorbed by plant pigments/eq. (not: ref. to short wavelengths; not all hits the plant)	Max. 2
		Total 9

Question	Answers/Explanatory Notes	Marks Available
10 6. (a)	respiration; movement; heat loss; death; excretion/waste products; egestion/defaecation; non consumed/inedible material;	[3 max]
(b) (i)	28.6/28.57 (kg day ⁻¹) (not: 29); 0.8 (kg day ⁻¹) 8.8/8.79	[3]
(ii)	cow has greater efficiency of conversion/ results in greatest total mass / sheep give wool as well / rabbits because of greater daily mass increase; [1] (not: rabbits consume food more quickly)	Total 7

Question	Answers/Explanatory Notes	Marks Available
3.	(a) (i) Actively transported into the guard cell (allow : pumped in) to increase turgor or decrease water potential	[1] [1]
	(ii) Outer walls thinner than inner walls (not : difference in thickness) turgor pushes outer wall outwards to open stomata (not : guard cells change shape) (mention of turgor required in either i or ii)	[1] [1]
	(b) Light / water deficiency (humidity) / temperature / carbon dioxide. (not : ref. to windspeed/daytime/night time)	[2]

[Total mark 6]

4.	(a) Large energy loss between one trophic level and the next means that very little would normally remain at level 5. (allow : comparison between 2000 and 0.6)	[1]
	(b) Leaves → caterpillars → birds → hawks. (allow : Plants/ worms/ insects, not : mice) (Arrows indicating direction of energy flow must be given)	[1]
	(c) (i) 80-50 = 30	[1]
	(4.5 / 30) × 100	[1]
	= 15%	[1]
	(ii) Lost as excreta/urine/faeces/dead bodies	[1]
	and passes to decomposers	[1]
	(not: respiration)	
	(d) Primary producers	[1]
	They take up quantities of carbon dioxide (in photosynthesis).	[1]
Decomposers.	[1]	
They generate carbon dioxide (from all the other trophic levels). (linked marks; allow : ref. to trophic levels)	[1]	
(e) Loss of habitat / nesting sites / shelter	[1]	
Loss of biodiversity / extinction/endangered	[1]	

[Total mark 13]