

**WJEC**

**Extension Energy Flow Questions  
From AQA**

**MS**

**Question 4**

- (a) Organisms cannot interbreed/ breed or mate or reproduce with another group/ incompatible gametes/ wrong courtship behaviour/ other valid; 1
- (b) 1 Populations separated by physical barrier/ example;  
 2 No mixing of gene pools;  
 3 Different selection pressures;  
 4 Become adapted to local environment;  
 5 Survive and reproduce;  
 6 Mutation in one group (different from other group);  
 7 Change in allele frequencies; [*Reject: Gene*]  
 8 Isolated populations/ new species cannot interbreed; max 4

Total 5 marks

**Question 5**

- (a) (i) 0.24 : 1; 1
- (ii) Mammals more active / higher metabolic rate;  
 Respiration provides heat;  
 To maintain body temperature / for endotherms / warm-blooded; 2
- (b)  $R = C - (F + P)$  /  $R = C - F - P$ ; [*Accept: transposed F and P*] 1
- (c) Diet of primary consumer contains more cellulose / more indigestible material;  
 OR Diet of secondary consumers protein rich / more digestible material;  
 OR Primary consumers lose more (energy) in faeces; 1

Total 5 marks

**Question 6**

- (a) (i) Discrete groups / types / categories / explained e.g. large and small seed diameters / types exist; [*Reject: Bimodal*] 1
- (ii) Different survival advantages / explained e.g. size linked to location; selection against intermediate forms / in favour of extreme forms; 2
- (b) Interbreed / cross the two types of flax plants;  
 Offspring fertile (if same species)/ offspring can also interbreed/ or reasonable alternative; [*Reject: Viable*] 2

Total 5 marks

**Question 3**

- (a) On diagram, correctly labelled:
- Light-dependent: granum/thylakoid membranes – labelled ‘X’  
AND  
Light-independent: stroma – labelled ‘Y’; 1
- (b) Any two from:
- (Water) forms  $H^+$  /hydrogen ions and electrons/ $e^-$  ;  
  
 $O_2$ /oxygen formed; [*NOT* ‘O’, *NOT* ‘ $O^-$ ’]
- (Light) excites electrons / raises energy level of electrons / electrons to chlorophyll / to photosystem; max 2
- (c) (ATP) Provides energy for  $GP \rightarrow TP$  / provides P for  $RuP/TP \rightarrow RuBP$ ;  
  
(Reduced NADP) Provides H / electrons for  $GP \rightarrow TP$  / reduces GP to TP; 2

Total 5 marks

**Question 4**

- (a) (i)  $P = C - R - U - F$  /  $C - (R + U + F)$  / eq; 1
- (ii) 3.74; 1
- (b) Correct answer: 2.18 (*Accept* 2.19 or 2.2)  
/ correct for candidate’s (a)(ii) ;; = 2 marks
- Correct use of data but wrong answer:
- $$\frac{(a)(ii) \times 10^6 \times 100}{21135 \times 8100}$$
 = 1 mark 2
- (c) Less energy lost as heat / in maintaining body temperature / in movement; 1

Total 5 marks

3

**Question 3**

- (a) May/June/July; 1
- (b) Loss of energy/heat/use of energy/loss of materials/loss of mass;  
By respiration/movement/excretion/excreta/egestion/egesta  
*IGNORE 'waste' REJECT 'growth'*  
Less energy/mass/matter left to sustain higher level/to be passed on  
inedible parts/Non-digestible parts; 3
- (c) Phytoplankton reproduce at rate  $\geq$  rate of their consumption; 1

Total 5 marks

**Question 4**

- (a) (i) Volume decrease/change in A/reading in A/ 'A'; [ALLOW '20'] 1
- (ii) Volume decrease in B = (O<sub>2</sub> in – CO<sub>2</sub> out); (= 1 mark)  
Vol. change in A – Vol. change in B/A-B; (= 2 marks) [ALLOW '20-10'] 2
- (b) (i) EITHER Correct answer = 0.73;; (2 marks)  
OR  
Correct formula **or** Correct use of data but wrong answer:  
Vol CO<sub>2</sub>/ Vol O<sub>2</sub> **or** 114/157;  
0.7; max 2
- (ii) Using some carbohydrate (as well as tricinolein) /using protein/  
/ some anaerobic respiration/mixture of aerobic and anaerobic respiration; 1

Total 6 marks

**Question 3**

- (a) Group of physically/physiologically similar individuals / genetically similar;  
Can (inter)breed;  
To produce fertile offspring; max 2
- (b) Allopatric speciation involves isolation of populations by a geographical/physical feature;  
Sympatric speciation - inhabit same area;  
Isolated by differing reproductive patterns / suitable example (seasonal, temporal, behavioural);  
Second suitable example; max 3  
*Note must be either differing reproductive patterns for 1 mark or two examples gains 2 marks*  
*If wrong way round then max 2*
- Total 5

**4 Question 4**

- (a) (i)  $\frac{\text{Increase in biomass}}{\text{time}}$  ; 1
- (ii) Approximately 10% of energy passed (from phytoplankton to zooplankton) ;  
Energy lost as heat/in respiration/in excretory products/ to decomposers; 2  
*not urine/movement*
- (b) Membership of Protocista is often by exclusion from other kingdoms; 1
- Total 4

**Question 1**

- (a) *two of:* temperature, water (content of soil)/rainfall (*allow humidity*)/  
compacted soil (*reject pH, light or oxygen*); 2
- (b) (i) burrow deeper into soil;
- (ii) idea of avoiding drying out (*reject predators*); 2
- (d) aerates the soil / increases availability of oxygen for (aerobic) respiration;  
breaks up organic material;  
increases surface area for action by microorganisms;  
OR  
idea of increasing organic content of soil;  
more food for microbes; 2  
(*points must be linked*)

Total 5

**Question 2**

- (a) (i) herbivore =  $\frac{11 - 12}{24 - 26} \times 100 = 42.3 - 50\%$   
carnivore =  $\frac{6}{24 - 26} \times 100 = 23 - 25\%$   
(*correct method measurement = 1 mark*)  
*total*  
(*correct answer = 2 marks*) 2
- (ii) cellulose present in faeces;  
cellulose/much of food indigestible;  
indigestible material contains energy; 2 max
- (b) (smaller mammals) have a larger SA:V ratio;  
so lose more heat (*linked to size*);  
maintains body temperature (*linked to higher rate of respiration*); 2 max

Total 6

**Question 3**

- (a) pesticide not biodegradable/broken down;  
stored in tissues/fat;  
persists in food chain/bioaccumulation/biomagnification;  
animals higher up the food chain eating larger numbers of organisms  
lower down; 3 max

- (b) sharp decrease, levelling off/gradual decrease, decrease;  
 increased decomposition due to increased temperature/warmer months;  
 enzyme action increases due to increased temperature;  
 rapid decrease due to removal of sugars/starch;  
 cellulose takes longer to be digested; 3 max
- (c) secrete enzymes/cellulase/carbohydrase;  
extracellular digestion;  
 absorption of soluble/digested products/sugars; 3
- Total 9
- 

6 **Question 3**

- (i) 2860-2970; 1
- (ii)  $\frac{\text{answer to (i)} \times 100}{1\ 417\ 500} = 0.2\% - 0.21\%;$   
 (correct answer = 2 mark)
- principle of mean energy in heather; = 1 mark  
 energy absorbed 2
- (iii) energy lost as heat/by respiration/metabolic processes;  
 qualified comment on the inefficiency of photosynthesis  
 e.g. 25% efficient/energy lost as electrons passed on;  
 carbon dioxide/temperature limiting; 2 max
- (b) only a proportion of heather eaten/not all plants eaten/energy lost in  
 decay;  
 not all food eaten is digested/energy lost in faeces;  
 heat/energy lost due to respiration; 3
- Total 8
-

**BYB5/W**

7

**Question 1**

- (a) secondary consumer / trophic level 3;  
second species to peak / in which phosphorus appears; 2
- (b) energy is lost at each level (so not enough left); 1
- (c) ATP;  
DNA;  
RNA / tRNA / mRNA;  
nucleotides (*accept only if DNA/RNA not mentioned*);  
phospholipids;  
NADP;  
RuBP; 2 max
- Total 5

**Question 2**

- (a) (i) respiration; 1
- (ii) decomposers;  
(*accept bacteria/fungi*) 1
- (b)  $\frac{87402}{1.7 \times 10^6} \times 100 = 5.14/ 5.1\%$ ;  
(*correct answer = 2 marks*)  
(*principle: energy in producers  $\div$  energy of light absorbed = 1 mark*) 2
- (c) excites chlorophyll/electrons;  
release electron(s); 2 max
- (d) reduced NADP;  
reduces GP / to change GP to TP;  
ATP;  
provides the energy to reduce GP / convert GP to TP / TP to RuBP/  
provides phosphate to convert TP to RuBP; 4
- Total 10



**BYB5/W**

b

**Question 1**

- (a) decomposers/detritus feeders/saprotrophs/saprotrophic bacteria or fungi; 1
- (b)  $\text{kJm}^{-2} \text{ year}^{-1}$ ; 2  
 (allow  $\text{m}^{-3}$ )  
 (two correct units gains 1 mark)  
 (all three correct gains 2 marks)
- (c) light reflected;  
 light misses chlorophyll/chloroplast/transmission through leaf;  
 wrong wavelength;  
 respiration (by primary producer);  
 inefficiency of photosynthesis; 3 max

**Total 6****Question 2**

- (a) accumulation of insecticide within individual/tissue;  
 peregrines eat large numbers of birds;  
 biomagnification/high concentration of insecticide kills peregrine;
- OR*
- seed-eating birds eat large numbers of seeds;  
 biomagnification/high concentration of insecticide in seed-eating birds  
 kills them;  
 no/less food for peregrine; 3 max
- (b) kills only those insects which eat seed/specific in action/named  
 environmental effect e.g. reduced leaching/spray drift/more efficient delivery; 1
- (c) acetylcholine not broken down;  
 specified effect e.g. continuous impulses/tetanus/muscle spasms;  
 how effect would cause death e.g. lack of breathing/specific effects on  
 nervous system (in correct context); 3

**Total 7**

**Question 3**

- (a) Prevents doubling of chromosome no. (at fertilisation) / restores diploid no. (at fertilisation);  
*accept numerical example if clearly  $n+n \rightarrow 2n$  /  $\frac{1}{2} + \frac{1}{2} \rightarrow$  whole number* 1
- (b) (i) Prophase I; 1
- (ii) 9; 1
- (c) (i) Crossing over / chromosomes exchanging parts / chromatids exchanging parts / chiasma formation;  
Produces new combinations of alleles; 2
- (ii) Independent/random AND assortment / segregation/described; 1
- Total 6

**9 Question 4**

- (a) Correct answer: 23 273;; Allow 23 275 = 2 marks
- OR  $\frac{125}{4.1}$  and  $\frac{125}{13.1}$  but confusion re.  $10^n$ ; = 1 mark 2 max
- (b) Saprotrophs / bacteria / fungi / decomposers / microorganisms / detritivores;  
Breakdown by enzymes / by digestion / by hydrolysis;  
Respiration  $\rightarrow$  CO<sub>2</sub>; 3
- Total 5

10 **Question 1**

- (a) Energy lost (between trophic levels);  
Due to movement/ excretion/ respiration/ heat/ faeces/ indigestible/ inedible/  
10% is passed on/90% is lost; [*Reject growth*]<sup>2</sup>
- (b)  $\frac{45\,000 \times 0.54}{0.35 \times 0.02}$  or  $\frac{45\,000 \times 50 \times 0.54}{0.35}$  ;
- = 3 471 428 tonnes (accept 3 471 xxx); 2  
(x = any digit)  
(correct answer scores two marks, however derived)  
128571.x = 1 mark    6942x = 1 mark    6428xxx = 1 mark

**Total 4**

**Question 2**

- (a) Photolysis; 1
- (b) Excited electrons lose energy;  
Along electron transfer chain;  
Energy from electrons used to combine ADP and Pi; 3
- (c) Used to reduce GP (to TP)/ donate H/H<sup>+</sup> to GP; 1

**Total 5**

**Question 3**

- (a) Oxidation;  
Of ammonium/ ammonia to nitrate;  
Via nitrite;  
By nitrifying bacteria / correctly named example; 3 max
- (b) Reduction;  
Of nitrates to nitrogen gas;  
By denitrifying bacteria; 2 max

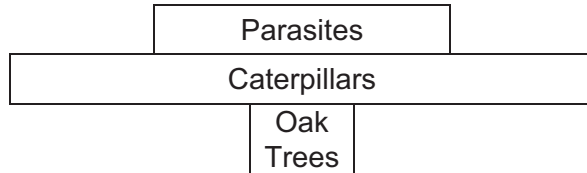
**Total 5**

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**Question 7**

- (a) Wrong wavelength;  
Does not hit chlorophyll/chloroplast;  
Reflected;  
Used for evaporation of water; 3 max

(b)



- (c) (i) 26.9% or 27%; 1  
1  
 (ii) 42.4%;; 2

**OR**

Energy content of new biomass = 33.5  
Energy content of digested products = 79; 1

- (d) (i) No enzymes to digest;  
Cellulose/lignin/cell wall; 2
- (ii) Release of enzymes;  
(Extracellular) digestion;  
Uptake of products (of digestion); 3

**Total 12**

**Question 8**

- (a) As pest numbers increase more food or predators, so they increase;  
Increased predation of pests reduces numbers;  
Low number of pests results in less food for predators, so their numbers decrease;  
Low predator numbers allow pest population to rise as fewer are eaten; 3 max

- (b) (i) Some individuals in population naturally resistant/not killed by pesticide;  
Due to mutation;  
These survive when pesticide applied/non-resistant ones are killed;  
To reproduce and pass on allele/gene (for resistance);  
Increase in frequency of allele for resistance; 5 max

- (ii) Not cost-effective to apply when not required;  
Pesticide kills predators of pest;  
other non-target/other species killed;  
Directly or by loss of food source;  
Pesticide stored in tissues/fat;  
pesticides increase in concentration up the food chains/bioaccumulation;  
Killing top carnivores; 5 max

**Total 13**

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Question	Marking guidance	Mark	Comments
4 (a)	$F - E - R / F - (E + R)$ ;	1	Accept: $F - (R + E) / F - R - E$
4 (b) (i)	Increase because fed concentrates/food with high nutritive value/food with high digestibility/food with little waste/because less egested;	1	
4 (b) (ii)	Decrease because movement restricted/heat loss reduced;	1	Accept: less movement/less muscle contraction Ignore references to keeping warm
4 (c) (i)	0.98 : 1 / 98 : 100;	1	Answer must be this way round and expressed in its simplest terms Reject: 0.98
4 (c) (ii)	Mammals maintain (body) temperature/have high (body) temperature;	1	Accept: mammals are endotherms /warm-blooded Accept: converse for insects
4 (d)	(Results show) positive correlation/positive correlation described;  Most/higher values close to line / curve shows good agreement;  Lower values less close to line/less correlation;  (Generally) predicted values are higher / actual values lower;	3 max	Reject: reference to line/curve of best fit  Ignore reference to anomalies  Reference to 'predicted' or 'actual' required

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Question	Marking guidelines	Mark	Comments
2(a)(i)	Stickleback + caddis fly (larva) + stonefly (larva);	1	All three required for mark. In any order.
2(a)(ii)	<ol style="list-style-type: none"> <li>(With fewer fish) reduced predation / not being eaten results in more freshwater shrimps;</li> <li>Increased competition for food/resources / more producers eaten by shrimps / more shrimps eating producers;</li> <li>Less food/resources for mayfly;</li> </ol>	2 max	Principles <ol style="list-style-type: none"> <li><u>Effect of</u> fish on shrimps</li> <li><u>Effect of</u> shrimps on producer</li> <li><u>Effect of</u> food on mayfly</li> </ol>
2(b)(i)	<ol style="list-style-type: none"> <li>Two marks for correct answer in range 16.8 to 18.9;;</li> <li>One mark for incorrect answer in which candidate divides 19 to 21 by 111 to 113;</li> </ol>	2	Ignore additional decimal places. Working shown in mm. Accept working in cm/2mm squares (10/56) for 1 mark.
2(b)(ii)	<ol style="list-style-type: none"> <li>Single-celled producers are more digestible / contain less cellulose (than plants) / less energy lost in faeces;</li> <li>All of producer eaten/parts of plant not eaten;</li> <li>Less heat/energy lost / less respiration;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>May refer to either trophic level</li> </ol>
2(c)	<ol style="list-style-type: none"> <li>Photosynthesis/light dependent reaction/light independent reaction;</li> <li>Carbon-containing substances;</li> </ol>	2	Allow organic substance or named organic substance