AQA GCSE Biology | 8461

SPECIFICATION POINT 4.7.4.1

Trophic levels

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**17**
Available paper years	**2009–2024**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.7.4.1 Trophic levels

Answer 01 · Mark scheme

January 2009 | BLY1H | Original Q6 | Legacy

question	answers	extra information	mark
6(a)	any **four** from:		4
	• nucleus / DNA / chromosomes / genetic material removed (from egg)	linked to second point allow 'empty egg cell' for first **two** marks	
	• from (unfertilised) egg / ovum	do **not** allow fertilised egg allow egg from champion cow	
	• nucleus from body cell of champion (cow)		
	• inserted into egg / ovum		
	• electric shock		
	• to make cell divide **or** develop into embryo		
	• (embryo) inserted into womb / host / another cow	allow this point if wrong method eg embryo splitting	

Question 6 continued on next page…

4.7.4.1 Trophic levels

Answer 01 · Mark scheme

COMPONENT NUMBER: BLY1H

COMPONENT NAME: Science B / Biology

STATUS: Final

DATE: January 2009

Question 6 continued…

question	answers	extra information	mark
6(b)	any **four** from:		4
	Pros:	max **3** marks	
	• economic benefit eg increased yield / more profit		
	• clone calf not genetically engineered		
	• genetic material not altered		
	• milk safe to drink / same as ordinary milk		
	Cons:	max **3** marks	
	• consumer resistance		
	• caused by misunderstanding process		
	• not proved that milk is safe	ignore 'God would not like it' **or** 'it's not natural'	
	• ethical / religious argument		
	• reduce gene pool / eg		
	Conclusion:		
	sensible conclusion for or against, substantiated by information from the passage and / or own knowledge	conclusion at end	1
Total			**9**

4.7.4.1 Trophic levels

Answer 02 · Mark scheme January 2009 | BLY3H | Original Q8 | Legacy

question	answers	extra information	mark
8	any **four** from: Points for Ethanol: • renewable fuel **or** carbon neutral **or** uses plant <u>waste</u> • less CO / hydrocarbons / SO_2 / NOx emissions • details of what emissions do eg CO is toxic / hydrocarbons cause smog / SO_2 / NO_x causes acid rain Points against Ethanol: • releases less energy • so need to burn more • more fuel loss due to evaporation • need to burn fuel to grow and process crop plants • reduces (land use for) food crops / causes deforestation Debatable points: • claimed to increase NO_x emissions – but this not <u>observed</u> by air quality monitoring • takes more energy to produce than it releases – but sugar cane yields 8:1 / maize yields 1.34:1 Conclusion: sensible conclusion for **or** against ethanol substantiated by information from passage	 max **3** marks allow petrol is non renewable less <u>named</u> emission max **3** marks **must** reach conclusion using information from the passage	4 1
Total			**5**

4.7.4.1 Trophic levels

Answer 03 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)	three layer triangular pyramid soya / beans / food – trout / fish – people / human (in sequence)	either way up (as blocks or triangle) ignore reference to producers / herbivores / consumers award **1** mark only for a correct food chain with 2 correct arrows showing energy flow	1 1
1(b)	The trout release energy when they respire Some energy will be lost in waste from the trout		1 1
1(c)	any **one** from eg • easy / easier to catch / more caught • easy / easier to feed • no / less predation • less energy loss • less movement	 allow easy / easier to monitor allow control food allow less fishing / poaching allow grow faster ignore less space to move do **not** allow easier to farm	1
1(d)	any **two** from: • microorganisms / bacteria / decomposers / microbes / fungi / detritus feeders • decay / rot / decompose / digest / break down • (microorganisms) respire • turned into fossil fuels / named fossil fuels • carbon dioxide / CO_2 released	 ignore biodegrade do **not** award this mark if response implies the trout respire	2
Total			**7**

4.7.4.1 Trophic levels

Answer 03 · Mark scheme

January 2010 | BLY2H | Original Q1 | Legacy

BLY2H

4.7.4.1 Trophic levels

Answer 04 · Mark scheme

January 2011 | BLY2H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	6000	award **2** marks for correct answer irrespective of working allow **1** mark for 20 x 300 with incorrect or no answer allow answer in table if answer line blank	2
2(a)(ii)	bar width 6000 **or** to match answer to (a)(i) drawn below slugs	anywhere on scale ignore depth / height of bar label **not** required	1 1
2(b)	any **three** from: • respiration (by hedgehog) • (results in) loss of CO_2 • faeces (of hedgehog) **or** not digested • excreted / urine / urea (by hedgehog) • not all slug(s) are eaten (by hedgehogs) **or** some slugs eaten by other things	ignore reference to size / mass / number of organisms assume reference is to / of hedgehog unless stated otherwise do **not** accept idea that respiration uses / produces energy accept waste for **1** mark if neither faeces nor excretion point made ignore sweat alone ignore some slugs die ignore reference to movement / heat / growth allow references to energy losses by these methods, rather than biomass losses	3
Total			**7**

4.7.4.1 Trophic levels

Answer 04 · Mark scheme

January 2011 | BLY2H | Original Q2 | Legacy

BLY2H

4.7.4.1 Trophic levels

Answer 05 · Mark scheme

January 2012 | BL1HP | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	triangular pyramid with 3 layers	may be as blocks or as triangle ignore food chains and arrows	1
	layers appropriately labelled: bean / plant aphid, ladybird	labelled in food chain order must **not** contradict correct pyramid allow correctly labelled inverted pyramid for **2** marks	1
3(a)(ii)	any **two** from: (for aphid / ladybird) • not all digested / faeces • loss in urine • loss of CO_2 • not all eaten	ignore energy ignore loss of CO_2 from bean plant if none of first 3 points given then allow waste (materials) / excretion for **1** mark	2
3(b)	microorganisms / microbes / bacteria / fungi / decomposers / detritivores / named	do **not** accept germs allow mould ignore aphids	1
	decay / breakdown / digest / decompose / rot (bean plant)	ignore eat	1
	respiration (of microorganisms etc / aphids)	allow burning / combustion	1
	carbon dioxide released (from respiration of microorganisms etc / aphids)	allow carbon dioxide released / produced (from burning / combustion) ignore other parts of the carbon cycle ignore formation of fossil fuels	1
Total			**8**

4.7.4.1 Trophic levels

Answer 05 · Mark scheme

January 2012 | BL1HP | Original Q3 | Legacy

COMPONENT NUMBER: BL1HP

4.7.4.1 Trophic levels

Answer 06 · Mark scheme

Question 3

question	Answers	extra information	mark
3(a)(i)	wheat → humans chain transfers 10 times more energy than wheat → pigs → humans chain or wheat → pigs → humans chain transfers 810 000 (kJ per hectare) less	allow 10% if given as a comparison e.g. one is 10% of the other ignore less unqualified	1
3(a)(ii)	any **one** reason for energy loss from pigs e.g.: • movement • (maintaining) body temperature • waste materials • not all parts of pig eaten by human • because there is an extra stage (pigs) in the food chain and energy is lost at each stage	ignore respiration, growth ignore heat unqualified allow named examples allow longer food chain so more energy lost	1

Question 3 continues on the next page . . .

Question 3 continued

3(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content.	There is a basic description of at least one factory farming method **or** identification of an advantage or disadvantage of factory farming.	There is a description of at least one factory farming method **and** an advantage or disadvantage is explained.	There is a description of factory farming methods **and** advantage(s) and disadvantage(s) are explained.

examples of biology points made in the response:

factory farming methods e.g.:

- Kept in cramped conditions / battery hens / calf crates / pig barns / fish tanks
- Controlled temperature / heating
- Controlled feeding / modified food given / growth hormones
- Controlled lighting
- Treated with prophylactic antibiotics

Advantages e.g.:

- Increased efficiency / profit / greater food production / cheaper food / faster growth
- Farmer can have more livestock
- Less energy is lost through movement
- Less energy is used keeping warm
- (Food is high in calories / protein) so animals will grow faster / lay more eggs
- Easier to vaccinate all the animals
- Easier to protect animals from predators
- Antibiotic treatment stops infections in animals

Disadvantages e.g.:

- Stress / cruelty / inhumane / unethical
- Restricted movement / overcrowding
- Faster spread of diseases
- Antibiotics in the food chain / residual chemicals in the food chain
- Wasting fossil fuels / increasing global warming
- Increased pollution from animal waste and from additional transport

Total			**8**

4.7.4.1 Trophic levels

Answer 07 · Mark scheme

Question	Answers	Extra information	Mark	AO / spec ref.
1(a)	3-layered triangular pyramid	as blocks or layered triangle, ignore (small) gaps between layers	1	AO2 1.5.1b
	(pyramid) labelled in food chain order	all three labels are required for **2** marks the pyramid must be fully correct	1	
1(b)(i)	C		1	AO3 1.5.1c
1(b)(ii)	shortest **or** fewest stages / transfers / (trophic) levels	allow only if (b)(i) is C or blank	1	AO1 / AO2 1.5.1c
	less losses in waste / faeces / urine / CO_2 / excretion	allow smaller amount uneaten	1	
	less loss in respiration / heat / movement	allow less lost keeping warm do **not** allow energy for respiration do **not** allow respiration makes energy	1	
		allow less loss (of biomass / energy) **or** less transfer (of biomass / energy) to surroundings if neither 2nd nor 3rd point given, for **1** mark		
Total			**6**	

Answer 07 · Mark scheme

Question	Answers	Extra information	Mark	AO / spec ref.
2	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.		6	AO1 1.4.1d,f

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	At least **one** way in which animals **and / or** plants are adapted to survive.	A description of ways in which animals **and / or** plants are adapted **and** an attempt to link at least **one** adaptation to how it increases the chance of survival.	A description of ways in which animals **and** plants are adapted **and** a description of how at least **one** adaptation increases the chance of survival.

examples of biology points made in the response:

(animals)

- (A) change / decrease in surface area / example
  - (decrease in surface area which) reduces area from which sweat / water may be lost
- (A) hump with fat / fat stores
  - (fat in hump) to convert to water (via respiration)
- (A) long eyelashes
  - (long eyelashes) to keep (wind-blown) dust out of eyes
- (A) nocturnal / 'keep out of the sun'
  - reduce sweat loss (in heat of the day)

(plants)

- (A) decrease in surface area
- (A) leaves are spikes
  - (reduced area / leaves are spikes) reduces water loss / transpiration / evaporation
- (A) long / wide spread / extensive roots
  - (long / wide spread /extensive roots) to absorb (more) water
- (A) fleshy / thick stem
  - (fleshy / thick stem) to store water

extra information

allow adaptations of specific animals to living in specified dry conditions, eg a desert

- (A) change / increase in surface area / example
  - (increase in surface area which) increases area heat may be lost from (by radiation)
- (A) changes to thickness of insulating coat
  - (thicker coat on upper surface) increases insulation from sun's heat
- (A) thin (layer) / reduced amount of body fat
  - (reduced amount of body fat which) reduces insulating layer
- (A) wide feet
  - (wide feet) to reduce pressure / spread weight / prevent sinking

allow adaptations of specific plants to living in specified dry conditions, eg a desert

- (A) thick wax
  - (thick wax) to reduce evaporation / water loss / transpiration
- (A) few(er) stomata
  - (few stomata) to reduce evaporation / water loss / transpiration

Total			6	

4.7.4.1 Trophic levels

Answer 07 · Mark scheme

June 2014 | BL1HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.7.4.1 Trophic levels

Answer 08 · Mark scheme June 2016 | BL1HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	0.67(%)	allow $0.\dot{6}$ or 0.7 allow **1** mark for evidence of $(2 \times 10^6) \div (3 \times 10^8)$ **or** allow **1** mark for 0.0067 or 0.6	2	AO2 1.1.2
6(b)(i)	idea that food chains start with plants / producers idea that these make food (for other organisms in the chain)	allow food chains do not start with animals **or** larvae are consumers allow idea that plants / producers photosynthesise **or** plants / producers get energy from the sun allow mosquito larvae do not make food / photosynthesise **or** mosquito larvae do not get energy from the sun	1 1	AO1 1.5.1a

4.7.4.1 Trophic levels

Answer 08 · Mark scheme

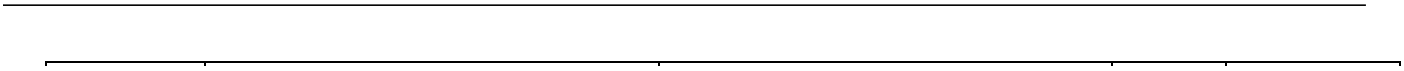
June 2016 | BL1HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(b)(ii)	any **four** from: • reasoned argument for **or** against release *advantages:* • fewer mosquitos biting **or** spreading malaria • fewer people get / die from malaria • lower medical costs (for those infected **or** for treatment) **or** less healthcare needed • better economically for developing / tropical countries. *disadvantages:* • fewer crops reproduce • poorer crop yield • possible starvation (of people) • high cost of GM production / mosquito release • less food for bats / birds **or** bats / birds die • gene could 'escape' into other wildlife / species	must refer to at least one advantage and one disadvantage. max **3** marks for either only advantages **or** only disadvantages allow people won't get / die from malaria allow fewer crops pollinated allow disruption to food chain / ecosystem **or** reduction of biodiversity ignore into plants	4	AO3 1.7.2f
6(b)(iii)	any **three** from: • gene from bacteria cut out • ref to enzymes (anywhere in process) • (gene) transferred to chromosome of mosquito • at an early stage of development	allow allele for gene allow at any point in process, ie in cutting or in splicing allow DNA for chromosome allow egg / embryo	3	AO1 1.7.2d/e
Total			**11**	

4.7.4.1 Trophic levels

Answer 08 · Mark scheme

June 2016 | BL1HP | Original Q6 | Legacy



4.7.4.1 Trophic levels

Answer 09 · Mark scheme June 2016 | BL1HP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)(i)	any **two** from: • not all eaten • used for respiration • lost as CO_2 / water / urea • lost as faeces **or** not all digested	allow eaten by other animals ignore used / lost in heat / movement if neither mark awarded allow 1 mark for lost as waste ignore references to energy losses do **not** allow for growth / repair / reproduction	2	AO1 1.5.1b/c
7(a)(ii)	any **one** from: • thrushes eat other things • thrush numbers likely to vary (considerably) • thrushes were not present all the time • thrushes feed on a much bigger area	allow it is only an estimate (of population size) **or** only counted thrushes for 5 hours	1	AO3 1.5.1
7(b)(i)	any **one** from: • there are two dependent variables • there is no independent variable • to show the association / correlation / pattern (between the two variables)		1	AO2 1.5.1

4.7.4.1 Trophic levels

Answer 09 · Mark scheme

June 2016 | BL1HP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(b)(ii)	(snails in woodlands) more have dark(er) colour (ed shells) **or** fewer have light-coloured shells (shells have) no / fewer stripes or have no stripes	allow converse for grassland, if clear allow converse for grassland, if clear	1 1	AO2 1.4.1d/f/g
7(b)(iii)	less likely to be seen (by predators / birds / thrushes)	allow camouflaged (from predators / birds / thrushes) allow light coloured shells with stripes would be more visible (to predators / birds / thrushes in woodland (than grassland)).	1	AO3 1.4.1d/f/g
7(c)(i)	*Indicator species* invertebrate (animals) **or** correctly named invertebrate *Environmental factor* (concentration of dissolved) oxygen	both required for **1** mark allow water pollution allow other correct examples	1	AO1 1.4.2c
7(c)(ii)	oxygen meter	must match factor given in **(c)(i)** allow oxygen probe / sensor (and data logger) ignore pollution meter	1	AO1 1.4.2d
Total			**9**	

4.7.4.1 Trophic levels

Answer 10 · Mark scheme

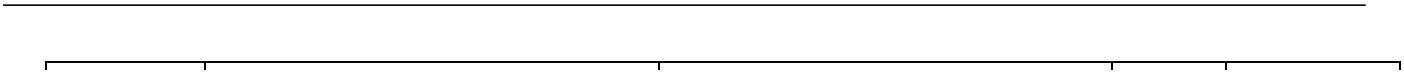
June 2017 | BL1HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	5000	allow **1** mark for 2500 **or** allow **1** mark for (3500 – 1000) x 2 **or** equivalent	2	AO2 1.5.1b/c
1(a)(ii)	Hawks produce faeces		1	AO2 1.5.1c
1(b)	photosynthesis sugar / glucose	 allow starch allow $C_6H_{12}O_6$	1 1	AO1 1.5.1a
Total			**5**	

4.7.4.1 Trophic levels

Answer 10 · Mark scheme

June 2017 | BL1HP | Original Q1 | Legacy



4.7.4.1 Trophic levels

Answer 11 · Mark scheme June 2018 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	*x*-axis: scale + labelled, including units	scale ≥ ½ width of graph paper label: biomass in g/m^2	1	AO2 4.7.4.1 4.7.4.2
	bar widths correct	± ½-square each side allow 1 mark if 3 correct	2	
	all 4 bars correctly labelled	large fish + small fish + invertebrate (animals) + algae **or** (trophic level) 4 + 3 + 2 + 1 **or** tertiary consumer + secondary consumer + primary consumer + producer ignore bar heights	1	
07.2		an answer of 99 scores **3** marks		AO2 4.7.4.3
	$\frac{840 - 10}{840} \times 100$	allow equivalent calculation	1	
	98.809523... / 98.810 / 98.81 / 98.8		1	
	99	allow answer given to two significant figures from an incorrect calculation in step 2	1	
07.3	inedible parts / example **or** egested / faeces **or** respiration / as CO_2	allow eaten by other animals **or** not all organisms eaten allow not digested allow excretion / urine ignore waste ignore energy losses ignore movement	1	AO1 4.7.4.3

4.7.4.1 Trophic levels

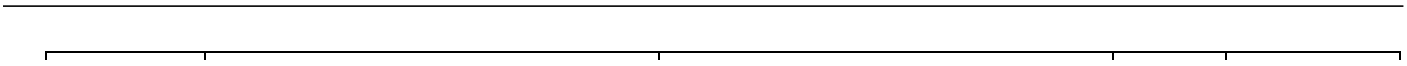
Answer 11 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4		ignore causes of death for algae and plants		
	bacteria decay organic matter / sewage / algae / dead plants		1	AO1 4.7.2.3
	(by) digestion	allow example such as starch broken down to sugar **or** protein broken down to amino acids	1	AO1 4.2.2.1 4.7.4.1
	(and) bacteria respire aerobically **or** respire using oxygen		1	AO1 4.4.2.1
	(which) lowers oxygen concentration (in water) **or** fish have less oxygen	allow reduced respiration of fish	1	AO2 4.4.2.1
	(so) reduced energy supply causes death of fish	allow toxins in the sewage kill fish ignore pathogens or (pathogenic) bacteria cause disease in fish and kills them	1	AO2 4.4.2.1
Total			**13**	

4.7.4.1 Trophic levels

Answer 11 · Mark scheme

June 2018 | 8461/2H | Original Q7



4.7.4.1 Trophic levels

Answer 12 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	primary consumer		1	AO2 4.7.2.1 4.7.4.1
01.2	correct shape: 4 tiers with largest at bottom and smallest at top correctly labelled: dragonfly / nymph + hydra + daphnia + algae	 in this order **or** allow: 3rd-order **or** tertiary consumer **or** apex / top predator **or** (trophic level) 4 2nd-order **or** secondary consumer **or** (trophic level) 3 1st-order **or** primary consumer **or** herbivore **or** (trophic level) 2 producer **or** (trophic level) 1 allow for **2** marks inverted pyramid if correctly labelled	1 1	AO2 4.7.4.2
01.3	any **one** from: (Daphnia biomass smaller because) • non-digestible parts (of algae) or lost in faeces • not all absorbed • lost in urine / urea • used in respiration **or** lost as carbon dioxide / CO_2 • algae not all eaten **or** eaten by other organisms • some algae decompose	 ignore waste allow excretion allow (to supply energy) for movement / warmth allow used to supply energy	1	AO1 4.7.4.3
01.4	 14 14 000	an answer of 14 000 scores **2** marks allow evidence of an incorrectly calculated mean × 1000 allow 1.4×10^4	 1 1	AO2 4.7.2.1

4.7.4.1 Trophic levels

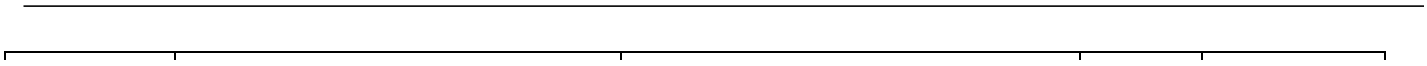
Answer 12 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5		an answer of 2.625×10^4 **or** 2.63×10^4 **or** 2.6×10^4 scores **4** marks an answer of 26250 scores **3** marks allow ecf from Question **01.4**		AO2 4.7.2.1
	(volume of pond =) 1.875 **or** 2.5 × 1.5 × 0.5	an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps	1	
	14 000 × 1.875	allow ecf from Question **01.4**	1	
	26250		1	
	2.625×10^4	allow 2.63×10^4 **or** 2.6×10^4	1	
01.6	increased (growth / reproduction of) algae		1	AO2 4.7.2.1 4.7.3.2
	(more algae so) more food for Daphnia		1	4.7.4.1
		allow fertiliser toxic to Hydra (1) (so) fewer Daphnia eaten (1)		
01.7	(Hydra have) less food		1	AO3 4.7.2.1
	because (graph shows) fewer Daphnia (with more fertiliser)		1	4.7.3.2
		allow other valid suggestions, eg fertiliser toxic to Hydra (1) **or** fertiliser causes growth of algae (on surface) which block light and so die and decay **or** eutrophication (1) (decay / eutrophication) uses up oxygen (so lack of oxygen for Hydra) (1)		
Total			**14**	

4.7.4.1 Trophic levels

Answer 12 · Mark scheme

June 2019 | 8461/2H | Original Q1



4.7.4.1 Trophic levels

Answer 13 · Mark scheme

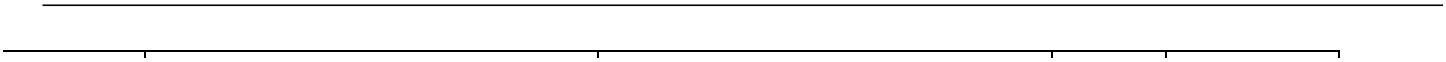
November 2020 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	triangular pyramid with 3 levels		1	AO1 4.7.4.1 4.7.4.2
	correct labels: (waste) vegetables / plants; insect(s); dog(s)	do **not** accept additional incorrect labels	1	AO2 4.7.4.2
07.2	any **two** from: • carbon dioxide from respiration (from dog) • urea from excretion (from dog) • not all parts (of insects) are absorbed / digested (by dog)	allow carbon dioxide breathed out (by dog) allow urea in urine (from dog) allow faeces from egestion (from dog) ignore references to loss of energy if no other mark awarded allow **two** factors without descriptions for **1** mark	2	AO1 4.7.4.3
07.3	less land required		1	AO2 4.7.5.1 4.7.3.5
	(so) more space for crops (for humans)	allow more meat (from cows etc) for humans	1	
	less methane (from animals) therefore less global warming	allow less methane from rotting vegetables in landfill	1	
	(therefore) less harmful effects of global warming on (human) food production	allow example such as less flooding of farmland allow may lead to the development of more foods for humans made from insects	1	
Total			**8**	

4.7.4.1 Trophic levels

Answer 13 · Mark scheme

November 2020 | 8461/2H | Original Q7



4.7.4.1 Trophic levels

Answer 14 · Mark scheme

November 2021 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	from light / sunlight absorbed by chlorophyll / chloroplasts	ignore sun unqualified if no other mark awarded allow by photosynthesis for **1** mark	1 1	AO1 4.7.2.1 4.7.4.3 4.4.1.1
07.2	krill / herring / copepod		1	AO2 4.7.2.1 4.7.4.1
07.3	algae		1	AO2 4.7.2.1 4.7.4.1
07.4	1 algae 2 krill **or** copepod 3 squid 4 mackerel (5 Human)	all correct for **1** mark	1	AO2 4.7.2.1
07.5	any **two** from: (losses due to) • non-eaten parts (of squid / krill) • <u>respiration</u> **or** <u>respiring</u> (in mackerel) • excretion (by mackerel)	 allow bones / shells allow eaten by other animals do **not** accept respiration produces / makes / creates energy allow loss of a named waste product such as CO_2 / urea ignore loss of waste unqualified ignore faeces	2	AO1 4.7.4.3

4.7.4.1 Trophic levels

Answer 14 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	2.3 **and** 0.1 (million)	allow in the range 2.25 to 2.3 for 2.3 (million)	1	AO2 4.7.5.3
	$\frac{2.3 - 0.1}{2.3} \times 100$ **or** $\frac{220}{2.3}$		1	
	95.65217.....	allow answer from correct substitution of incorrect values from **Figure 11**	1	
	96	allow student's calculated answer correctly rounded to the nearest whole number	1	

4.7.4.1 Trophic levels

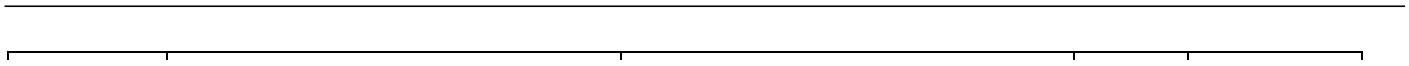
Answer 14 · Mark scheme

Question	Answers	Mark	AO / Spec Ref.
07.7	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.7.5.3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content figures may be given without units (million tonnes) throughout **points for:** • small fish are not caught so can live long enough to reproduce • biomass / stocks have generally increased after these laws introduced • '77-'81 law (total ban) resulted in increase in biomass, eg 0.1 to 0.48 **or** to 0.9 by '84 • '84 law (mesh size) resulted in increase in biomass, eg 0.9 to 1.8 (by '90) • '97 law (quotas) resulted in increase, eg 1.15 to 1.25 • '98 law (ban in breeding season) resulted in increase, eg 1.25 to 2.5 **points against:** • could be a cause other than the law **or** correlation does not necessarily indicate causal relationship **or** other factors • laws superimposed so can't necessarily tell the effect of each • each law results in an increase followed by a decrease • quotas lead to dead fish being thrown back into sea For **Level 3** points both for and against must be considered together with appropriate use of data		
Total		**17**	

4.7.4.1 Trophic levels

Answer 14 · Mark scheme

November 2021 | 8461/2H | Original Q7



Answer 15 · Mark scheme

June 2022 | 8461/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	evaporation	allow vaporisation	1	AO1 4.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	osmosis	allow diffusion ignore absorption	1	AO1 4.7.2.2 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	any **two** from: • photosynthesis • support • (solvent for) transport **or** translocation **or** for the transpiration <u>stream</u>	 allow turgor allow to fill vacuole allow opening of stomata allow to prevent wilting allow (as a) solvent allow (as a) medium for chemical reactions allow hydrolysis / digestion / breakdown of stored food allow cooling allow making cytoplasm	2	AO1 4.7 4.7.2.2 4.1.1.2 4.2.3.2 4.4.1.1 4.4.2.3

4.7.4.1 Trophic levels

Answer 15 · Mark scheme

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	*substitution* $\frac{21\ 800}{1\ 700\ 000} \times 100$ 1.282(3529) *comparative efficiency* $\frac{4.098}{1.282}$ 3.196..... *significant figures* 3.20	 allow 1.28 **or** 1.3 allow an incorrectly calculated value for efficiency correctly substituted do **not** accept 3.2 do **not** accept if a unit is given	 1 1 1 1 1	AO2 4.7.2.1 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	less energy lost as heat less energy lost in movement	allow less heat lost allow less energy lost keeping warm **or** less energy for maintaining body temperature ignore less movement ignore less energy lost unqualified ignore controlling diet do **not** accept energy used for respiration do **not** accept energy produced / made / created	1 1	AO1 4.7.4.3 4.7.5.2

4.7.4.1 Trophic levels

Answer 15 · Mark scheme

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	any **two** from: • increased spread of disease **or** increased use of drugs / antibiotics (to reduce disease) • more antibiotics in meat / milk • (extra) cost of heating / lighting / food / drugs • aggressive behaviour (causing harm) **or** 'emotional' stress reduces productivity	allow diseases spread (more) easily allow (extra) energy used for heating / lighting ignore (extra) cost unqualified ignore cruelty / unethical ignore need to clean out barns / sheds ignore need to maintain / build barns	2	AO3 4.7.5.1 4.7.5.2

Total Question 6		13

Answer 16 · Mark scheme

June 2024 | 8461/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	lack of oxygen for (aerobic) respiration	do **not** accept ref to respiration in dead plants	1	AO3
	(so) less / no energy (released)	do **not** accept energy produced / made / created	1	AO2
	(for) microorganisms / bacteria / fungi / microbes / decomposers **OR** low pH denatures enzymes (1)	allow low pH / acidity reduces enzyme activity	1	AO2 4.2.2.1 4.4.2.1 4.7.1.2 4.7.2.3
	(so) less / no (chemical) reactions / metabolism / respiration **or** less **/** no energy released (1) in microorganisms / bacteria / fungi / microbes / decomposers (1)	do **not** accept energy produced / made / created		

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	34 g/m^2/year		1	AO2 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	DNA		1	AO1 4.6.1.5 4.7.1.2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	protein		1	AO1 4.4.1.1 4.4.2.1 4.4.2.3 4.7.1.2 4.7.1.4

4.7.4.1 Trophic levels

Answer 16 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	increase in temperature	allow global warming allow heat (energy) is trapped ignore reference to greenhouse gases	1	AO3
	(because) carbon dioxide is released (from the peat bog)		1	AO2
	(because) carbon dioxide is produced by burning / decay of peat	ignore methane is released from burning / decay of peat allow fewer plants to take in carbon dioxide (for photosynthesis)	1	AO2
	(because) methane is released (from the peat bog)		1	AO2
				4.4.2.1 4.7.2.3 4.7.3.3 4.7.3.5

Total Question 2	10

4.7.4.1 Trophic levels

Answer 17 · Mark scheme

June 2024 | 8461/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.1	46 000 **or** 16 400 **or** 12.8 **or** 0.8		1	AO2 4.7.2.1 4.7.4.3 4.7.5.2
	46 000 **and** 16 400 **or** 262 400		1	
	46 000 **and** 209 920 **or** 3593.75		1	
	2191.3 **or** $\frac{46\,000 \times 10\,000}{209\,920}$ **or** $\frac{3593.75 \times 10\,000}{16\,400}$		1	
	2190		1	

4.7.4.1 Trophic levels

Answer 17 · Mark scheme

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Question	Answers	Extra information	Mark	AO / Spec Ref.
07.2	suitable scale, symmetrical around 0 labels for *x*-axis **and** for bars correct values plotted: chickens 2200 maize 4200	 (biomass in) kg (bars) maize and chickens allow a tolerance of ±½ small square ignore height of bars	1 1 1	AO2 4.7.4.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.3	2200 4200 = 0.5238… : 1 **or** 11 : 21 **or** 1 : 1.9	 allow rounded value	1 1	AO2 4.7.4.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.4	lost via egestion / faeces	ignore urine / excretion / waste ignore not digested do **not** accept respiration do **not** accept not eaten do **not** accept movement **or** as heat **or** for keeping warm	1	AO1 4.7.4.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.5	lysine and tryptophan		1	AO3 4.4.2.3 4.7.5.2

4.7.4.1 Trophic levels

Answer 17 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.6	any **one** from: • chickens need low amounts of leucine (for growth) • (chicken) proteins contain low amount / proportion of leucine	do **not** accept leucine is not needed (for growth)	1	AO3 4.4.2.3 4.7.5.2

Total Question 7	**13**

4.7.4.1 Trophic levels

Answer 13 · Examiner comments November 2020 | 8461/2H | Original Q7

Question 7 (standard, standard/high & high demand)

This question presented students with a novel situation: the development of a new type of food for dogs from insects. This was set in the context of a food chain, the transfer of biomass and, ultimately, in the provision of food security for humans. **07.1** was a relatively straightforward question for students. Problems mainly arose in the labelling with the use of terms such as 'secondary' and 'tertiary' consumers (the latter being entirely inappropriate), or by adding multiple labels that included the names of the organisms, the types of producer and consumer and the numbered trophic levels, but with an error in one of these, and thus this mark could not be awarded. In 07.2 reasons given by students for the incomplete transfer of biomass from the insects to the dogs were largely incorrect, with 1% of students being able to describe two. Some students made inappropriate references to some of these processes occurring in the insects rather than in the dogs.

07.3 related the scenario of insect-based dog food to human food security. Students found this difficult and, although nearly three-quarters scored one mark (usually for stating that more meat would be available for human consumption if dogs were fed on insects), 7% gained further credit. Few realised that if less meat were consumed by dogs, then less land would be required for animal grazing and hence it could be utilised for growing crops. Hardly any suggested that a reduction in farm animals would perhaps reduce methane output and the negative effects of methane on the climate and hence on the growth of crops.

Answer 14 · Examiner comments November 2021 | 8461/2H | Original Q7

Question 7 (standard, standard/high & high demand)

This question was about a marine food web and legislation to ensure sustainable fishing of herring in the North Sea. In **07.1**, almost two-thirds of students scored 1 mark for stating either that light was the source of energy for the algae or that the algae used photosynthesis. Many stated that the energy came 'from the Sun' which did not distinguish between light and other forms of solar energy. Incorrect answers included carbon dioxide, water, mineral ions and even from eating other organisms. 1% of answers mentioned that chlorophyll or chloroplasts absorbed the light energy.

Most students were able to identify a primary consumer and the producer in the food web in **07.2** and **07.3**, respectively. A common incorrect answer for the primary consumer was the 'human', presumably confusing primary with top. Similarly, around three-quarters of students were able to assign 5 organisms from the food web to a food chain ending in the human.

In **07.5**, although one reason for the lower biomass of the mackerel than that of the combined biomass of the krill and squid was given as non-digestibility of parts of these animals, many students suggested 'lost in faeces' as an additional reason. Around one-third of students gained some credit for their answers by suggesting losses due to respiration or excretion or, alternatively, that some parts of the krill and squid were not even eaten or they were eaten by other animals.

4.7.4.1 Trophic levels

Answer 14 · Examiner comments

November 2021 | 8461/2H | Original Q7

07.6 was a 4-mark calculation of percentage decrease using figures read from a graph. Fewer than half of students were completely successful. Errors included the use of an incorrect starting point – the first and highest value on the graph for the year 1950 was quite a common error, or reading the value for 1977 as '0.2' or '0.05' instead of 0.1. Many students did not get credit for not rounding their answer to the nearest whole number as instructed in the question. Some calculated a percentage reduction in excess of 100%, the highest such value being '2300%'. Around one-sixth of students scored no marks.

07.7 was a 6-mark extended response question requiring the evaluation of the data from the graph in relation to various acts of legislation introduced at different times. Many students found this very difficult with more than two-thirds attaining no higher than Level 1. The question instructed students to use data from the graph and information from the diagram showing the relationship between mesh size of fishing nets and the sizes of herring of different ages. Many students did not cite any data, or did not consider all four pieces of legislation and their subsequent effects on herring biomass. It was rare to read any negative points – the most common being the decrease in biomass at certain times despite the legislation that had been introduced – and hardly any students thinking that causes in addition to the given legislation might have been responsible for the changes in biomass or that, since the acts of legislation overlapped in their application, it was hard to ascertain the effect of each. Very few students attempted to make a judgement on the basis of the points they had made and no-one scored all 6 marks.

Answer 15 · Examiner comments

June 2022 | 8461/2H | Original Q6

Question 6

This question was about the water cycle and the efficiency of energy transfer in a simple food chain.

06.1 Process **X** in **Figure 6** was successfully identified as *evaporation* by the vast majority.

06.2 Only around half knew that plant roots absorb water by *osmosis*, or by *diffusion*.

06.3 Although most could give at least one use of water to a plant, such as photosynthesis, support or for transport, only around a quarter could give two uses.

06.4 In this question, students were given an equation for energy conversion efficiency and had to select data from the food chain in **Figure 7** to calculate how many more times efficient the cow was at converting energy (given as 4.098%) than the grass it ate. Around 60 percent of students were completely successful and scored all 5 marks. The most common errors were to calculate the reciprocal of the comparative efficiency and not to

4.7.4.1 Trophic levels

Answer 15 · Examiner comments

June 2022 | 8461/2H | Original Q6

round the answer to 3 significant figures correctly – i.e. 3.196... to 3 significant figures is 3.20, not 3.2, nor 3.19.

06.5 Reasons for the greater energy efficiency of raising cows indoors were often expressed inadequately. Many failed to explain that less energy would be *lost* as heat and *lost* in movement indoors compared with outdoors. Thus fewer than half scored any marks.

06.6 Disadvantages of raising cattle indoors were not well known with only a little over a third having any correct ideas, such as the increased spread of disease, extra costs of heating / lighting / supplying food and potentially aggressive behaviour of the animals in confined conditions resulting in harm to each other. Inadequate answers referred to 'cruelty' or to unqualified extra costs, and the unexpected idea that the grass would not grow so well indoors.

Answer 16 · Examiner comments

Question 2 (standard demand)

02.1 Some students appeared to be confused as to how decay happens, believing that the dead plant matter would decay itself. However, the majority of students did indicate that some sort of microorganism is involved in the decay process, gaining the third mark in the mark scheme. 40% of students gained at least 2 or more marks overall.

Some students spent time unnecessarily describing the factors needed for decay and often needed to extend their answers onto the additional pages.

There were two routes students could use to gain marks. Many students' answers included elements of both routes, so examiners awarded a mark for the described route which gave the higher mark. In most cases this was the first route given in the mark scheme.

The information in the question told students that layer B contains 'very little oxygen' and 'has a low pH'; thus, simply repeating either of these was insufficient to gain credit. To gain the first mark, students needed to link one of these pieces of information to their own knowledge, either in terms of respiration or in terms of enzymes being denatured or reducing in activity. Many students also gained this first marking point, although some who took the second route demonstrated confusion about what a 'low pH' constitutes, describing it as 'low acidity' or 'being 'alkaline'.

Achieving marking point 2 proved to be more problematic for many students, most simply by omitting any reference to energy or metabolism. Students should be advised that when referring to respiration in their answers (as many did), they should then go on to describe the role of respiration: 'releasing energy'. For those who did refer to energy, it was noted that very few described energy being 'produced', which is never acceptable as this would contradict the principle of conservation of energy.

02.2 Just under 70% of students identified the correct answer regarding the approximate biomass of moss that becomes biomass in primary consumers.

02.3 Half of students identified DNA as a substance that can be made using phosphates.

02.4 Around 65% of students could identify protein as the substance that can be made using nitrogen.

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4.7.4.1 Trophic levels

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02.5 This was a well answered question, with almost all students gaining at least one mark, and 65% of those gaining three or more marks. A number of students described a rise in temperature of the Earth's atmosphere, gaining marking point 1.

It should be noted that the 'greenhouse effect' and 'climate change' are not equivalent to 'global warming'. A significant number of students attempted to describe the mechanism of global warming. This was often confused, including references to the 'ozone layer' and incorrect descriptions of long and short-wave radiation. However, such descriptions are beyond the requirements of the specification, so were ignored.

Students who merely repeated the information that the peat bog 'contains' carbon dioxide and methane could not be awarded marking points 2 or 4. Instead further added value was required, in that these gases would be 'released' from the peat when the bog was destroyed. A significant number of students omitted any reference to methane, so were unable to gain marking point 4.

Again, students should be advised that repeating the information in the question will not gain credit, such as those that described 'the use of peat as a fuel' releasing carbon dioxide. To gain credit here, students needed to indicate that the peat would have to be 'burned' to produce carbon dioxide. In this case, examiners ignored the idea that burning would also release (trapped) methane, as this would inevitably also be burned, releasing more carbon dioxide.

4.7.4.1 Trophic levels

Answer 17 · Examiner comments

Question 7 (standard/high and high demand)

07.1 Students were provided with data regarding chickens and farmland, and were asked to calculate the area of land needed to provide enough energy from maize seeds for 1000 chickens to grow to full size. The mark scheme is designed to benefit the logical mathematical use of the numbers that were provided in the stem of the question.

Almost 35% of students were able to attain the maximum five marks by calculating the correct answer of 2190 m^2. Students with a final answer showing an error to the power of 10 (such as 2.19, 21.9, 21900 etc.) gained four marks in line with the marking procedure for calculations (section 3.3 of the mark scheme).

A small number of students did not convert their answer to 3 significant figures so could only be awarded four marks. Despite the high level of challenge provided by this calculation, 40% of students were able to gain 1 or 2 marks.

Students are encouraged to show their working out for all calculations.

07.2 Students were asked to complete a pyramid of biomass for maize seeds and chickens, and it was clear that many students had a weak understanding of this. 20% of students gained all three marks, with 40% of students not gaining any mark at all or not attempting the question.

Students used a vast range of different scales, but only those that were symmetrical and used over half the available grid were able to gain marking point 1. A number of students did not notice that they needed to calculate the value for chickens and not simply plot 2.2 kg. This went on to provide problems devising a suitable scale.

07.3 Over 50% of students correctly calculated the ratio of chicken biomass to maize seed biomass. Common errors were using the mean mass of 1 chicken, and not calculating the value for 1000 chickens, inverting the correct values and giving an answer of 21:11 or 1.9:1. Students are reminded to check their ratio reflects the order given in the question.

07.4 Just under a quarter of students correctly articulated what happened to the remaining 20% of the biomass in the maize seeds. It was clear a far greater number of students knew the correct answer but gave vague responses such as ‘waste’ or used colloquial terms which were insufficient for credit at this level.

07.5 85% of students correctly identified lysine and tryptophan as the amino acids found in significantly higher proportions in the QPM seeds.

07.6 Only 15% of students were able to correctly suggest why a diet containing less leucine does not slow down the growth of chickens. Many students did not appear to read all the information provided and incorrectly suggested that leucine was not an essential amino acid, or not essential to growth.

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