

Q1.

- (a) kills microorganisms / bacteria / fungi / viruses / microbes
allow to remove microorganisms / bacteria / fungi / viruses / microbes
ignore germs
allow so mycoprotein is not contaminated 1
- (which) compete for food / oxygen
or
 which make toxins
allow so mycoprotein is safe to eat
- or**
 which are pathogens
or
 which might kill the fungus / *Fusarium* 1
- (b) 30 °C 1
- (c) for (aerobic) respiration
*do **not** accept anaerobic* 1
- (which) releases energy (for growth)
*do **not** accept produces energy*
allow glucose is used to make other organic substances e.g. protein 1
- (d) any **two** from:
 so *Fusarium* can
- grow faster / better
 - get sufficient food / glucose / minerals
allow more / enough
 - get sufficient oxygen
allow more / enough
 - get rid of sufficient carbon dioxide
allow more / enough
allow waste
 - be kept at a (suitable) temperature
allow to avoid 'clumping' 2
- (e) 200 grams 1

[8]



Q2.

(a) correct figures from graph: 5.0 / 5 and 2.60 / 2.6

2.40 / 2.4

an answer of 2.40 / 2.4 scores 2 marks

1

allow correct answer from candidate's figures from graph for 1 mark

1

(b) $\frac{1}{3}$

1

(c) protein

1

(d) a genetically-modified variety of seed was sown in 2004

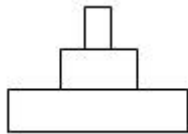
1

more rain fell in spring and early summer in 2004

1

the mean summer temperature was lower in 2003

1



(e)

1

(f) 80

1

(g) chickens use energy for movement and for keeping warm

1

much of the food eaten by chickens is wasted as faeces

1

[11]

Q3.

(a) $0.03 = \frac{\text{output}}{5950 + 50} \times 10$

an answer of 1.8 scores 3 marks

1

$$\text{output} = \frac{0.03 \times (590 + 50)}{100}$$

1

1.8

1



- (b) indoor % efficiency = $\frac{40}{10000 + 6000} \times 100$ 1
- or**
- $\frac{40}{16000} \times 100$
- 0.25(%)
- an answer of 8.33 scores 3 marks*
allow 8 / 8.3 / 8.333... 1
- $\left(\frac{0.25}{0.03} = \right) 8.33$ (times) 1
- (c) any **two** from:
- in faeces / egestion
 - or**
 - not all food is absorbed
 - not all food is ingested
 - in urine / excretion
 - in respiration
 - keeping warm
 - movement
- do not accept 'for respiration'*
allow as 'heat' 2
- (d) warmer indoors so less energy wasted in keeping warm
- allow less energy lost as 'heat'* 1
- less movement indoors so less energy wasted
- if no other mark awarded, allow it is warmer and there is less movement indoors for 1 mark* 1
- [10]**

Q4.

- (a) any **two** from:
- diseases spread more rapidly
 - antibiotics can build up in the food chain
 - or**
 - over use of antibiotics
 - increased use of fossil fuels (to heat the barn)
- 2
- (b) **Level 2 (3–4 marks):**
Clear statements made identifying the farming methods which are linked to relevant explanations of how this increases the efficiency of food production.
- Level 1 (1–2 marks):**
Simple statements made identifying the farming methods used, but no attempt to

link to explanations of how this increases the efficiency of food production.

0 marks:

No relevant content.

Indicative content

statements:

- kept inside or in a temperature controlled environment
- kept enclosed or in a restricted environment

explanations:

- less energy / heat is lost in controlling body temperature
- less energy required for movement
- so more energy is available for growth
- less energy / heat is transferred to the environment

4

(c) $(362 - 67 = 295) / 362 \times 100$

1

81 / 81.49 / 81.5

allow 81 / 81.49 / 81.5 with no working shown for 2 marks

1

(d) aboriginal people can eat other foods (so they may not be in food insecurity)

1

we do not know if other (traditional) food sources have declined

1

[10]

Q5.

- (a) (i) any **three** from:
- lights to help guide / attract fish (to the holes)
 - (rigid so) holes stay open
 - (holes) allow small / young fish to escape
 - (so that) they can breed

3

(ii) (fishing) quotas / legislation

1

(b) (i) movement is restricted

1

(in a building **or** close together so) heat is conserved

allow in heated buildings to reduce heat loss

1

(ii) any **two** from:

- it is cruel
allow descriptions of 'cruelty'
- disease spreads faster
- (meat) often has antibiotics in it

2

Q6.

- (a) (i) fewer cows 1

any **one** from:

- less methane
do not allow CH⁴
- less CO₂ in the atmosphere because of less deforestation **or** less plants consumed.

*allow less CO₂ released into the atmosphere because less fuel used e.g. to heat cowsheds **or** to transport meat*

do not allow CO₂

1

- (ii) any **two** from:

- could be mass produced to feed an increasing population
- disease free meat
- no / low fat
- no harm to animals or less intensive farming

allow (may be) suitable for vegetarians

- antibiotic free meat
 - more land available for farming crops
- allow no energy loss along a food chain*

2

- (b) fungus / Fusarium 1

with glucose (syrup) 1

in aerobic conditions **or** in presence of oxygen
ignore air 1

mycoprotein is harvested / purified
allow ammonia added (as source of nitrogen)
ignore stirring / mixing and temperature 1

[8]

Q7.

- (a) limiting their movement
or
controlling the temperature of their surroundings 1

reason:

reduces energy transfer

if no other marks awarded, allow 1 mark for: 'fit more



- chickens in same space'* 1
- (b) (i) without oxygen
ignore 'without air' 1
- (ii) any **two** from:
• ethanol
allow alcohol
• carbon dioxide
• lactic acid.
do not accept energy / ATP (*apply list rule*) 2
- (c) enzymes are denatured / change shape
ignore microbes are killed 1
- (enzyme) shape is vital for function **or** won't work (as efficiently) 1
- (d) (i) 200 1
- (ii) 120
allow ecf from (d)(i)
e.g.
 $\frac{60 \times}{100}$ (i) 1
- (e) causes global warming 1
- one predicted consequence of global warming
eg rising sea levels, climate change, change in migration patterns, change in distribution of species
- or**
methane is flammable
so might cause fire / damage
if no other marks awarded, allow methane is a greenhouse gas for 1 mark 1

[11]

Q8.

- (a) (i) fungus 1
- (ii) oxygen / O₂
accept air
accept O₂
do not allow O² / O / O₂

		1	
	(iii) glucose (syrup)		
	<i>allow carbohydrate / sugar</i>		
	<i>ignore food / starch</i>		
	<i>allow oxygen if oxygen / air not given in (a)(ii)</i>	1	
	(b) any two from:		
	• <u>quicker</u>		
	• suitable for vegetarians		
	• <u>cheaper</u>		
	• more efficient or less land / methane		
	<i>ignore high in protein</i>		
	<i>ignore sustainability unqualified</i>		
	<i>ignore less pollution unqualified</i>		
	<i>allow less animals harmed / killed</i>		
	<i>allow food chain is shorter or has less trophic levels</i>		
	<i>allow less energy lost (from the food chain)</i>		
	<i>do not allow no energy lost</i>		
	<i>allow low(er) in calories (than some meat)</i>		
	<i>allow low(er) in fat / <u>healthier</u> (than some meat)</i>		
	<i>allow source of fibre / prevent constipation</i>	2	
			[5]
	Q9.		
	(a) it is impossible to weigh all the fish in the sea	1	
	(b) (i) increase / from 50 to 350 / by 300 thousand tonnes	1	
	(ii) due to fishing ban / not allowed	1	
	(c) (i) fishing quotas / limits	1	
	changes to net size	1	
	(ii) yes, biomass increases	1	
	use of figures from graph eg approx 4- times or (was effective at first) but numbers decline again after 2004		
	<i>must use two comparative figures for 2nd marking point</i>	1	
	(iii) so that breeding continues		
	<i>allow prevent extinction / limit impact of fishing on food chain / web</i>		

- 1
- (iv) 95%
correct answer gains 2 marks
2000-100=1900 award 1 mark
- 2
- (d) any **four** from:
- increase in sea / water temperature
accept ref to lower sea / water temp if shift in Gulf Stream is referred to
 - changes in migration patterns / distribution of species
 - more eggs may survive (up to 19 °C) and could lead to an increase in herring pop
 - reduction in herring pop (because eggs die if >19 °C)
accept change in other populations of fish which are alternative prey for cod
 - (appropriate) change in cod population as a result
- 4
- [14]**
- Q10.**
- (a) (i) 76.0 / 76
correct answer with or without working gains 2 marks
allow 76.04 for 2 marks
allow 76.04 with extra decimal places eg 76.042 for 1 mark
- $$\begin{array}{r} 465 \\ \hline 611.5 \end{array}$$
- 611.5 for 1 mark*
- 2
- (ii) mass of fish declines (until 2008)
ignore use of numbers
allow number of fish decline (until 2008)
- 1
- (due to an) increase in fishing / overfishing
- 1
- and then rises (until 2010)
- 1
- (which could be due to) quotas / net restrictions working
allow any reasonable suggestion, such as countries swapping quotas or restrictions on fishing during breeding seasons
ignore less fishing
*if no other marks awarded allow 1 mark for a decrease in mass **and** an increase in mass if answer relates to sustainable fishing*
- 1
- (iii) (this is due to) public awareness / demand



- allow legislation / rules* 1
- (b) fishing quotas / bans 1
- (small) net / mesh size
if size of net is stated then it must be smaller
if size of mesh is stated then it must be larger 1
- (c) (fish) cannot move freely / as much 1
- (therefore) less energy loss from the fish
*do **not** allow 'no energy is lost'*
ignore references to less heat loss through controlling body temperature
ignore references to respiration 1
- (there is) more food available / better quality food / fed more often
accept 'high-protein food (for making cells)' 1
- (so) there is more energy for growth **or** (more food) is converted to biomass 1
- [13]
- Q11.**
- (a) circulating / mixing / described **or** temperature maintenance 1
- supply oxygen
or for aerobic conditions
or for faster respiration
*do **not** allow oxygen for anaerobic respiration* 1
- (b) energy supply / fuel / use in respiration
*do **not** allow just food / growth*
ignore reference to aerobic / anaerobic
- or** material for growth / to make mycoprotein 1
- (c) respiration
allow exothermic reaction
allow catabolism
ignore metabolism
ignore aerobic / anaerobic 1
- (d) (i) any **one** from:



- compete (with *Fusarium*) for food / oxygen **or** reduce yield of *Fusarium*
 - make toxic waste products or they might cause disease / pathogenic **or** harmful to people / to *Fusarium*
do not allow harmful unqualified
- 1
- (ii) steam / heat treat / sterilise fermenter (before use)
not just clean
- or**
steam / heat treat / sterilise
glucose / minerals / nutrients / water (before use)
or
filter / sterilise air intake
or
check there are no leaks
allow sterilisation unqualified not just use pure glucose
- 1
- (e) any **three** from:
- beef is best or beef is better than mycoprotein
 - mycoprotein mainly better than wheat
 - more phenylalanine in wheat than in mycoprotein
allow equivalent numerical statements
 - but no information given on other amino acids / costs / foods
- 3

overall conclusion:

statement is incorrect because

either

it would be the best source for vegetarians

or

for given amino acids, beef is the best source

or

three foods provide insufficient data to draw a valid conclusion

1

[10]

Q12.

- (a) C
- 1
- (b) otherwise species may disappear altogether
allow to avoid extinction
- 1
- (c) any **two** from:



- regulate net size
if mesh size specified, must be larger
- impose fishing quotas
- limit fishing during breeding seasons
- bans on discarding of fish
- bans on fishing in certain areas

2

[4]

Q13.

- (a) (i) wheat → humans chain transfers 10 times more energy than wheat → pigs → humans chain
allow 10% if given as a comparison e.g. one is 10% of the other

or

wheat → pigs → humans chain transfers 810 000 (kJ per hectare) less
ignore less unqualified

1

- (ii) any **one** reason for energy loss from pigs e.g :
ignore respiration, growth
ignore heat unqualified

- movement
- (maintaining) body temperature
- waste materials
allow named examples
- 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
allow longer food chain so more energy lost

1

- (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 in the [Marking guidance](#), and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a basic description of at least one factory farming method

or

identification of an advantage or disadvantage of factory farming.

Level 2 (3-4 marks)

There is a description of at least one factory farming method
and
an advantage or disadvantage is explained.

Level 3 (5-6 marks)

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

6

[8]

Q14.

(a) 3 (.0)

*correct answer, irrespective of working gains 2 marks.
if the answer is incorrect or there is no answer, award 1 mark
for use of correct figures (0.5 and 3.5) [and no other figures]*

2

(b) as faeces

*if more than two boxes ticked deduct 1 mark for each
additional tick*

1

as carbon dioxide from respiration

1

(c) (i) pigs kept inside are kept in small pens

*if more than two boxes ticked deduct 1 mark for each
additional tick*

1

pigs kept inside are kept warm in the winter

1

(ii) any **one** from:

- faster growth
ignore bigger / less flavour / fatty
- need less food
ignore references to movement / energy
- ready for market sooner
ignore ethical arguments

1

[7]

Q15.

(a) (i) any **two** from:

- more milk
*(about) 50 litres milk compared to (up to) 20 litres / 30 litres
more
ignore costs / profit*
- electricity produced
- farmers can keep more cows in the space



answers must refer to number of cows and space

2

(ii) any **two** from:

- less stress for cow **or** not cruel to cow **or** cows have freedom to move around
ignore references to ethical / unnatural without qualification
- crops fertilised
- less disease **or** disease not as easily spread

2

(b) more

1

less

in this order

1

[6]**Q16.**

any **three** from:

*maximum 2 marks if only advantages **or** only disadvantages given*

ignore references to cost unqualified

advantages: (max 2)

ignore reference to fresher

- less transport / example of transport **or** less fuel used
accept implication eg less food miles
allow no transport / fuel costs
- less pollution / example
accept eg less carbon dioxide / smaller carbon footprint
allow no pollution / example
- support of local / UK economy / farmers

disadvantages: (max 2)

- not available all year
- may require use of heat / light
- (production of) heat / light causes pollution

[3]**Q17.**

(a) (i) cholesterol

1



- fat
in this order
- 1
- (ii) mycoprotein has (approx) half amount of protein / has 11.8 (g) protein while chicken has 22.0 (g)
accept has less protein
ignore less fat
- 1
- (b) (i) increased
- 1
- (±) constant rate **or** (from 0) to 9.2 / by 9.2(cm) **or** about 1 cm a day **or** increase slower at the beginning and / or at the end
- 1
- (ii) species **A** grows faster / more than species **B**
or
species **A** has larger diameter **or** is bigger
or
the growth of species **B** slows down after 6 weeks
accept use of approximate figures
- 1
- (c) any **two** from:
- pH / acidity / alkalinity
ignore references to carbon dioxide / waste products
 - (speed of) stirring
ignore time in the fermenter
 - oxygen (concentration) / aeration
ignore initial amount of Fusarium
 - ion concentration / named eg -NH₄⁺
allow ammonia
 - pressure
- 2

[8]

Q18.

- (a) three layer triangular pyramid
either way up (as blocks or triangle)
- 1
- (soya / beans / food – trout / fish – people / human (in sequence)
ignore reference to producers / herbivores / consumers
award 1 mark only for a correct food chain with 2 correct arrows showing energy flow
- 1



- (b) the trout release energy when they respire 1
- some energy will be lost in waste from the trout 1
- (c) any **one** from eg
- easy / easier to catch / more caught
allow easy / easier to monitor
 - easy / easier to feed
allow control food
 - no / less predation
allow less fishing / poaching
 - less energy loss
allow grow faster
 - less movement
ignore less space to move
*do **not** allow easier to farm*
- 1
- (d) any **two** from:
- microorganisms / bacteria / decomposers / microbes / fungi / detritus feeders
 - decay / rot / decompose / digest / break down
ignore biodegrade
 - (microorganisms) respire
*do **not** award this mark if response implies the trout respire*
 - turned into fossil fuels / named fossil fuels
 - carbon dioxide / CO₂^{released}
- 2

[7]

Q19.

- (a) (i) 20 1

(ii) one tenth / 0.1 / 10% / 1:9 / 1 in 10 / 1 out of 10 / $\frac{1}{10}$

for correct answer irrespective of working 2 marks

ignore any units

accept equivalent fractions eg $\frac{4}{40}$ / $\frac{2}{20}$

*do **not** allow eg 1:10 / 1 to 10*

if answer is incorrect

*clear selection of 2 **and** 20, **or** equivalent **or** 1:4:5 / 1:5:4 gains 1 mark*

2

(b) any **two** from:

*do **not** accept sweating / cooling / excretion*

- (body) heat / maintaining body temperature
allow keep warm
- movement (max 2)
*allow 2 **different** examples of movement, internally and / or externally eg breathing / exercise / eating / circulation*
allow muscle contraction if no other muscle action is credited
movement + breathing = 1 mark
- growth / cell division / repair / reproduction / building molecules
allow examples eg making proteins (from amino acids)
ignore 'chemical reactions' / digestion
- accept active transport

2

(c) more movement / have to hunt / catch food

allow converse if stated for herbivore eg herbivores food is all around

*ignore reference to size **or** predator unqualified*

1

(d) any **two** from

ignore reference to food

- less movement
allow no movement
allow less space to move
ignore less space unqualified
- less heat loss
*allow no heat loss **or** they are kept warm*
- less respiration

2

[8]

Q20.(a) any **one** from:

- increase / give light
- increase temperature / make warmer

award marks if the method by which these could be done is given
eg leave lights on all night **or** use a heater

- increase / give CO₂
- add fertiliser / nutrients / minerals / named
allow nitrogen
ignore 'food'

1

(b) (i) any **two** from:

- cheaper
allow grow faster / more grown
- better quality / flavour
ignore size
- available all year
accept converse if clear that answer refers to use of British tomatoes
allow 'Fair Trade'

2

(ii) any **two** from:

- greater distance **or** more food miles **or** more transport
idea of more needed only once
- transport needs (more) energy / fuel
- reference to eg greenhouse effect / global warming / pollution / CO₂ release / carbon footprint
ignore ozone

2

[5]**Q21.**

(a) (i) tick in box of FIRST pyramid

1

(ii) any **one** from:

- less energy / biomass lost / wasted



- greatest biomass / energy for humans
ignore human box is bigger
ignore .food. for humans
- shortest food chain **or** less stages **or** least number of different organisms **or** only one predator **or** only 2 boxes tall **or** least boxes
allow only one stage

1

(b) (i) any **two** from:

- quicker / more growth **or** grow fatter
- less* urine **or** less faeces
- less* heat (lost)
- less* movement
assume for pigs indoors
allow converse if clear for pigs outdoors
(* **do not** allow no for less
ignore less space

2

(ii) any **one** from:

- less cruelty **or** more ethical **or** better animal welfare
ignore more natural
ignore ideas referring to against God's will
- better flavour / quality (of meat)
*ignore pig health **or** free range / organic*
- less pollution / etc / less fossil fuel used for heating
ignore quality of life
assume for pigs outdoors
allow converse if clear for pigs indoors

1

[5]**Q22.**

(a) 4

*award **both** marks for correct answer, irrespective of working.*

*allow 125/3125 (× 100) **or** 0.04 for 1 mark*

2

(b) any **three** from:

- excreted / urine / urea(*)
- not digested / faeces(*)



(*) if neither of these marks is awarded then waste gains 1 mark

- methane
- respiration
do not allow for respiration
- movement / named internal / external movement
allow sound
- heat / temperature control / sweating
allow milk production
allow active transport

3

(c) any **two** from:

- no / less biomass / energy lost (by intermediate) **or** examples of losses
herbivores contain more energy is insufficient
- shorter food chain
- cheap(er) to feed herbivores
ignore reference to carnivores being dangerous

2

[7]

Q23.

(a) (i) bacteria

1

(ii) 8

1

(iii) 4 tonnes

1

(b) (i) mycoprotein contains less fat

1

or

less circulatory problems

mycoprotein contains (more) fibre

or

reduces colon cancer

it = mycoprotein

fat must be comparative

1

(ii) beef contains more protein

it = beef
must be comparative

or

better for growth / making cells /
enzymes / antibodies

1

[6]

Q24.

- (a) (i) a triangular-shaped pyramid, with 4 layers – widest at the bottom
either in blocks or as a triangle

1

labels in food chain order (from widest part)
ie plankton – herring – tuna – parasitic / worms

upside down labelled pyramid with producer at top gains 2 marks

upside down labelled pyramid with producer at bottom gains 1 mark for labels

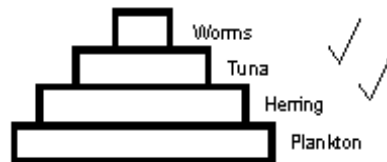
unlabelled upside down pyramid = 0 marks

accept separate boxes

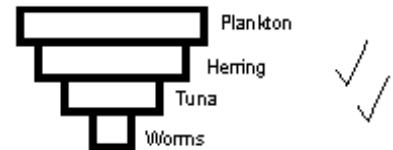
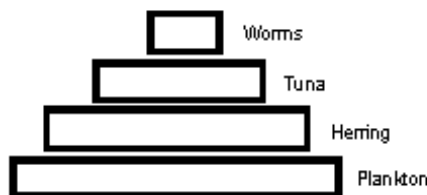
correct food chain with correct arrows if given gains 1 mark

1

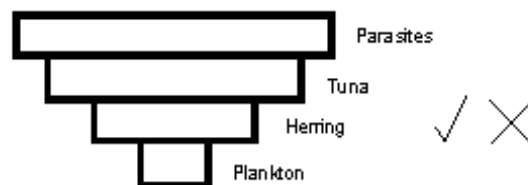
eg



eg



eg



eg



- (ii) any **two** from:



- waste / excreted / urine / faeces / CO₂ (from tuna)
from / of tuna not required but do not accept if of / from other organisms
 - respiration (of tuna)
ignore used in reproduction
 - movement (of tuna) / hunting
if a mark is not awarded for respiration / movement / heat allow 1 mark for energy (unqualified)
 - used for heat (production) (of tuna)
 - not digested / absorbed
- 2
- (b) (i) 40
- award both marks for correct answer, irrespective of working
allow (290 – 50) / 6 or 240/6 for 1 mark*
- $\frac{1}{3}$
- allow 48.3 / 48 $\frac{1}{3}$ / 48 for 1 mark*
- 2
- (ii) cost of food / protein
- 1
- (c) any **one** from:
- concern about animal welfare **or** examples **or** cruel to tuna
or unethical **or** lack of space
*allow immoral
ignore not natural*
 - poorer flavour / quality
- 1
- [8]**

Q25.

- (i) customers concerned with the environment / green issues (will be attracted) owtte
allow idea of helping the world
- 1
- (ii) reduces transport of food
- 1
- less carbon dioxide / greenhouse gas / emissions / harmful gases / lower carbon footprint (from transport)
*allow less fuel used
ignore pollution unqualified*
- 1
- [3]**

**Q26.**

- (a) 30
award both marks for correct answer, irrespective of working
100 – (33 + 27 + 10) or equivalent for 1 mark 2
- (b) 2 or 1.98
award both marks for correct answer, irrespective of working
(33 / 100) × 6 or equivalent for 1 mark 2
- (c) respiration 1
- (d) (i) less / no heat loss / movement
do not accept 'energy' / warmth unqualified 1
- (ii) any reference to cruelty eg stress to calf / cramped conditions
ignore references to disease / hygiene 1

[7]

Q27.

- (a) 8.3 or 8.3 recurring or 8
award both marks for correct answer, irrespective of working
7 / 84 × 100 or equivalent for 1 mark 2
- (b) any **three** from:
- heat
allow keeping warm
 - respiration
not for respiration
 - movement or example of movement eg exercise / kinetic
 - faeces / waste / urine / excretion / urea
ignore eggs / sound
- 3
- (c) any **one** from:
- less / no movement
allow examples of movement
 - less / no heat loss
 - reference to selective breeding
 - reference to controlled / better / more feeding



1

(d) any **two** from:

- less steps in food chain
- less losses of biomass / energy / examples of losses
- cheaper to feed herbivores
allow dangerous to keep carnivores
herbivores contain more energy is insufficient

2

[8]**Q28.**

(a) circulation / mixing / described

1

or

temperature maintenance

supply oxygen

*do **not** allow oxygen for anaerobic respiration*

or

for aerobic conditions

or

for faster respiration

1

(b) any **one** from:

- energy supply / fuel
or use in respiration
*do **not** allow just food / growth*
ignore reference to aerobic / anaerobic
- material for growth
or to make mycoprotein

1

(c) (heat / energy) from respiration

allow exothermic reactions

allow description eg breakdown of glucose / catabolism

ignore metabolism

ignore aerobic / anaerobic

1

(d) (i) any **one** from:



- compete (with Fusarium) for food / oxygen
or reduce yield of Fusarium
- make toxic waste products
or they might cause disease / pathogenic
or harmful to people / Fusarium
*do **not** allow harmful unqualified*

1

(ii) any **two** from:

- steam / heat treat / sterilise fermenter (before use)
***not** just clean*
allow sterilisation unqualified for 1 mark
- steam / heat treat / sterilise glucose / minerals / nutrients / water (before use)
***not** just use pure glucose*
- filter / sterilise air intake
- check there are no leaks

2

(e) any **three** from:

- beef is best **or** beef is better than mycoprotein(*)
- mycoprotein mainly better than wheat(*)
- more phenylalanine in wheat than in mycoprotein(*)
allow equivalent numerical statements()*
- but no information given on other amino acids / costs / foods

3

overall conclusion:

statement is incorrect

or

it would be the best source for vegetarians

or

for given amino acids, beef is the best source

or

three foods provide insufficient data to draw a valid conclusion

1

[11]

Q29.



(a) scientists figures based on research / calculations / data

or

scientists sample whole area

ignore reasons based on bias

1

fishermen based on impression / hearsay / experience

or

fishermen fish in well-stocked / limited areas

scientists sample a wider area = 2 marks

fishermen only fish in well-stocked areas = 2 marks

*if no marks gained fishermen's opinion **and** scientists' opinion gains 1 mark*

1

(b) any **two** from:

- economic considerations

eg fear for jobs, profits, big demand for cod

- political impact

eg allow EU / government decide or laws will be passed

- pressure groups **or** fears of extinction

2

[4]

Q30.

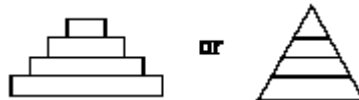
(a) 0.1

ignore working or lack of working

$$\frac{88 \times 100}{88000} \text{ for 1 mark}$$

2

(b) shape: pyramid with 4 tiers



1

labels:

Plants + Herbivores + Carnivores + Top carnivores

(in sequence – largest to smallest)

allow suitable named examples

inverted pyramid correctly labelled = 1 mark

1

(c) more energy / biomass / materials / matter available or less energy lost or energy used up (by herbivores)



not just plants

1

[5]

Q31.

- (a) 4 of:
 intensification due to need to improve efficiency of energy transfer;
 has led to developing fast growing crop varieties;
 native plants cannot compete with these;
 for e.g. light/water/minerals;
 effect of herbicides;
 pesticides killing pollinating insects

each for 1 mark

4

- (b) recommend a variety of measures; (can be implied)
 because rotational will allow these species to continue;
 permanent will allow others;
 leading to conservation of a wide range of species

each for 1 mark

4

[8]

Q32.

- (a) (i) 200 kJ

for 1 mark

1

- (ii) 2

gains 2 marks

(if answer incorrect, 20 / 1000 × 100 gains 1 mark)

2

- (b) *ideas that*
 energy lost by animal (pig / cattle) / extra stage / extra trophic level
 in waste materials e.g.
 in muscular activity / movement
 in keeping body temperature higher than surroundings / lost as heat

any three for 1 mark each

references to respiration regarded as neutral

3

- (c) *ideas that*
 controlling (high) temperature of surroundings / keeping indoors / insulating
 reduces energy transferred from animal as heat / animal uses body heat to maintain
 temperature restricting movement (e.g. caging or keeping in darkness)
 reduces muscular contraction / muscular activity

each for 1 mark

*accept respiration as explanation once only if neither
 explanation point has received credit*

reject give more food / different food

4

[10]

Q33.

to reduce energy 'lost' (by movement)

accept need less energy

so more energy is available for growth

accept prevents loss of body mass to provide energy

accept so need less food

accept get fatter

accept so weight gain

accept so more growth

[2]

Q34.

indication that carbon dioxide emissions contribute to global warming

accept 'greenhouse effect' for global warming

1

argument for:

in terms of decreases carbon dioxide emissions because less (fuel / energy used for) transport / imports

1

argument against:

in terms of increases carbon dioxide emissions because of (fuel / energy used for) heating and lighting greenhouses

1

[3]

Q35.

use less nitrate / fertiliser

accept use none

use a different fertiliser is neutral

prevent nitrate fertiliser run off is neutral

1

any **two** from:

explanation that with less or none the crops still grow

make more land available to grow more crops

monitoring of water

legislation

organic farming / manure

genetically modified crops

give babies bottled water

2

[3]

Q1.

- (a) 115 1
- (b) any **four** from
- less energy lost / used
- as heat lost to the atmosphere
- since warm indoors
accept temperature controlled
- (less energy lost) in movement
- since movement restricted
- more growth / eggs
accept prevents loss of body mass or gets fatter / weight gain

4

[5]**Q2.**

- (a) 12 500
incorrect numerical answer but clear evidence of correct working e.g. 365 million ÷ 365 ÷ 80 or 3285 million ÷ 365 ÷ 720 credit with (1) 2
- (b) (i) vegetation
→ (farm) animals → humans
*accept any correct variation on this theme
e.g. grass → lambs → humans* 1
- (ii) any **three** linked points from
- * less links in the food chain
or only one link in the food chain
 - * energy 'wasted' **or** 'lost' **or** 'used' at each link
 - * energy 'wasted' **or** 'lost' in (the process of) respiration
 - * energy 'used' to maintain body temperature
 - * energy 'used' by the animals in movement
- 3
- (c) people will eat more/greater proportion of food from plants



accept people will eat less/smaller proportion of food from animals
do not credit 'everyone will stop eating meat'

1

any **three** linked points from

these marks are independent of the 'prediction' mark

do not credit 'food from plants will become less expensive'

- * meat will become more expensive
- * only a limited area of land available on the planet (for food production **or** otherwise)
- * more people means less land available for food production because some used for housing etc.
- * land will become more expensive
- * land will have to be used more efficiently

or more people will go hungry

or people will (each) eat less

- * livestock farmers will try to improve efficiency
- * (leading to) growth of 'factory farming'
- * demand for food will rise (total)

3

[10]

Q3.

(a) both axes labelled
 both axes appropriate scale
 plotting 7 correct
 good attempt at line graph
each for 1 mark

4

(b) more fertiliser added more yield increased
gains 1 mark

but

yield increases with fertiliser up to maximum
gains 2 marks

yield **increase** slows down above 125/150 kg/ha
either for 1 further mark

(do **not** allow yield falls)
 maximum yield with 175 kg/ha

3

[7]

**Q4.**

- (a) (i) carbohydrate*/fat/protein in cell
(or example e.g. glucose/starch)
for 1 mark 1
- (ii) $\frac{21500}{1050000} \times 100$ or 2.(05)%
for 1 mark 1
- (b) *ideas that:*
little energy used for growth/most wasted/lost
gains 1 mark
- but**
only 4% used for new growth
gains 2 marks
- evidence/idea that this is repeated at each stage
idea of diminishing return/less energy at each stage
for 1 mark each
(maximum of 3) 3
- (c) *idea:*
plants at the start of all food chains
shorter food chain
more efficient/less energy lost/more food
cheaper/more economic
(must bear consequence of at least one of earlier marks)
any three for 1 mark each 3

[8]**Q5.***ideas that:***large mesh**

allows small fish to escape so they live long enough/grow big enough to breed
maintains stocks

close season

maintains stocks
unless catch more in rest of time
especially important in breeding season

closed areas

maintains stocks
especially important for breeding grounds
but can't make fish stay inside area

quotas

maintains stocks
plus difficulty of enforcement of any/all of above



any 7 for 1 mark each

fisherman (effect of controls on)
 reduced catches/less income ∴ controls
 harder to catch fish
 but will ensure their future

any 3 for 1 mark each
 to max. of 9
 (credit other good but unanticipated reasons)

[9]

Q6.

(a) Decrease: seals will eat more squid and penguins
 for 1 mark

1

Stay the same:

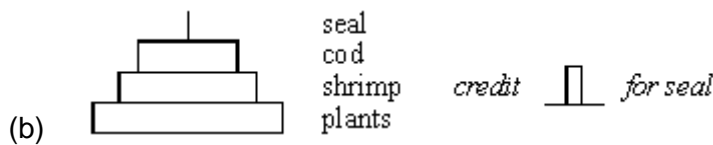
- more shrimp/food for squid and penguins

ideas that

- increase in squid and penguins balances the extra eaten by seals
- seals find other prey (allow start to eat shrimps)

any two for one mark each

2



allow



- correct shape (doesn't need to be to scale)
- correctly with organisms

(if wholly correct but inverted then credit 1 mark)

each for 1 mark

2

- (c)
- seals are mammals
 - *idea that* seals have (to maintain) a constant body temperature
 [allow warm blooded]
 - heat losses to cold seas



- more of food eaten used to replace heat loss

(credit use of figures i.e. 95% loss compared to 90%
or 5% efficient compared to 10%
or 20 : 1 conversion ratio compared to 10 : 1
with 1 mark)

any three for 1 mark each

3

(d) (i) *ideas that*

- reduce number of fishing boats allowed
- breed in captivity and then release
- agree quotas [not an unqualified 'ban']
- avoid breeding areas
- avoid breeding seasons
- increase size of net mesh/don't catch small fish
- limit catches of shrimps
- cull seals

any two for 1 mark each
[allow any other reasonable answer]

2

- (ii)
- breeding areas closer to some countries than others
 - difficult to police/easy to cheat/'poach'
 - difficult to agree quotas
 - some countries eat more fish than others
 - best weather for fishing maybe in breeding seasons
 - fisherman/trawlers need employment
 - big demand for cod

any one for 1 mark
[allow any other sensible response]

1

[11]

Q7.

(a) *idea that*

- so they don't get too hot / cold
for high temperatures
- don't lose condition / weight **or** don't become ill



- don't lose too much water / become dehydrated
(*allow* don't sweat too much)
for low temperatures
 - reduce heat loss from pigs
 - less energy wasted in maintaining body temperature
for 1 mark each
- 2
- (b)
- reduce energy loss by movement
 - so more is available for growth*
(**credit this point if given in (a) but only credit once*)
 - don't use body mass to provide energy
 - easier to handle / monitor
for 1 mark each
- 2
- (c) *idea that*
- less humane / not natural / cruel / no room to exercise / stressful
 - more intensive labour
 - increased risk of disease / (often) in contact with faeces
 - antibiotic residues in meat
any two for 1 mark each
- 2

[6]