AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.7.5 FOOD PRODUCTION (PACK 1)

SCORE	PERCENTAGE
/254	%

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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

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[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

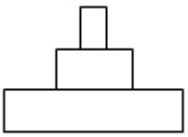
1

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) $0.03 = \frac{\text{output}}{5950 \div 50} \times 10$

*an answer of 1.8 scores **3** marks*

1

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

1

1.8

1

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(b) indoor % efficiency = $\frac{40}{10000 \div 6000} \times 100$

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.

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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 × 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

[8]

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Q6.

(a) (i) fewer cows

1

any **one** from:

- less methane

  *do **not** allow CH^4*

- less CO_2 in the atmosphere because of less deforestation **or** less plants consumed.

  *allow less CO_2 released into the atmosphere because less fuel used e.g. to heat cowsheds **or** to transport meat*

  *do **not** allow CO^2*

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 <u>glucose</u> (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

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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.

$\frac{60}{100} \times$ *(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 / O_2

accept air

accept O_2

*do **not** allow O^2 / O / O2*

1

(iii) glucose (syrup)

allow carbohydrate / sugar

ignore food / starch

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allow oxygen if oxygen / air not given in (a)(ii)

1

(b) any **two** from:

- quicker
- suitable for vegetarians
- cheaper
- more efficient **or** less land / methane

ignore high in protein
ignore sustainability unqualified
ignore less pollution unqualified
allow less animals harmed / killed
*allow food chain is shorter **or** has less trophic levels*
allow less energy lost (from the food chain)
*do **not** allow no energy lost*
allow low(er) in calories (than some meat)
allow low(er) in fat / healthier (than some meat)
allow source of fibre / prevent constipation

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

must use two comparative figures for 2nd marking point

1

(iii) so that breeding continues

alllow prevent extinction / limit impact of fishing on food chain / web

1

(iv) 95%

*correct answer gains **2** marks*
*2000-100=1900 award **1** mark*

2

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(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

$\frac{465}{611.5}$ *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

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if size of mesh is stated then it must be larger

1

(c) (fish) cannot move freely / as much

1

(therefore) less <u>energy</u> 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 <u>aerobic</u> conditions
or for <u>faster</u> 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 <u>material</u> for growth / to <u>make</u> mycoprotein

1

(c) <u>respiration</u>

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

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(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 <u>mainly</u> 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

<u>overall conclusion:</u>

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

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- 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

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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.*

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*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 <u>and</u> 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

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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

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(±) 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 <u>concentration</u> / named eg -NH_4^+
  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

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- 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 / $CO_{2\ released}$

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

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- 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 CO_2

- 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

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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 / CO_2 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

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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]

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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 <u>more</u> protein

it = beef
must be comparative

or

<u>better</u> 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*

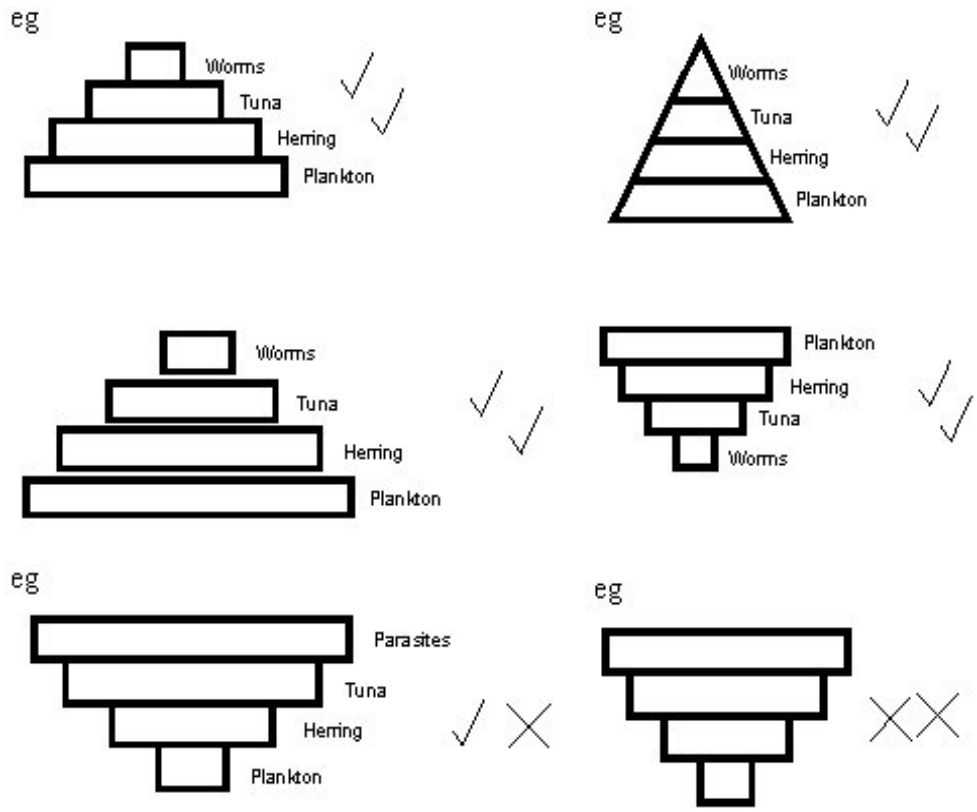
*unlabelled upside down pyramid = **0** marks*

accept separate boxes

*correct food chain with correct arrows if given gains **1** mark*

1

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(ii) any **two** from:

- waste / excreted / urine / faeces / CO_2 (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*

*allow 48.3 / 48 $\frac{1}{3}$ / 48 for **1** mark*

2

(ii) cost of food / protein

1

(c) any **one** from:

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- 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 <u>equivalent</u> 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

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(b) any **three** from:

- heat
  allow keeping warm
- respiration
  not *<u>for</u> 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 <u>oxygen</u>
*do **not** allow oxygen for anaerobic respiration*

or

for <u>aerobic</u> conditions

or

for <u>faster</u> respiration

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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

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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 fishermens' 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

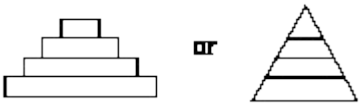
ignore working or lack of working

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$\frac{88 \times 100}{88\,000}$ *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

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(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

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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]

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