Mark schemes

Q1.

(a) from light / sunlight

ignore sun unqualified

1

absorbed by chlorophyll / chloroplasts

*if no other mark awarded allow by photosynthesis for **1** mark*

1

(b) krill / herring / copepod

1

(c) algae

1

(d) 1 algae
2 krill **or** copepod
3 squid
4 mackerel
(5 Human)

*all correct for **1** mark*

1

(e) any **two** from: (losses due to)

- non-eaten parts (of squid / krill)

  allow bones / shells

  allow eaten by other animals

- <u>respiration</u> **or** <u>respiring</u> (in mackerel)

  *do **not** accept respiration produces / makes / creates energy*

- excretion (by mackerel)

  allow loss of a named waste product such as CO_2 / urea

  ignore loss of waste unqualified

  ignore faeces

2

(f) 2.3 **and** 0.1 (million)

allow in the range 2.25 to 2.3 for 2.3 (million)

1

$\frac{2.3 - 0.1}{2.3} \times 100$ **or** $\frac{220}{2.3}$

1

95.65217.....

*allow answer from correct substitution of incorrect values from **Figure 3***

1

96

allow student's calculated answer correctly rounded to the nearest whole number

1

(g) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5–6

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

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

[17]

Q2.

(a)

$\frac{6.0}{1.6}$

allow a range of 5.9 to 6.1 for 6.0

1

3.75

*do **not** accept if a unit is given*

*if no other marks awarded, allow a correct answer using a value of 5.8 or 6.2 for **1** mark*

1

(b)

$\frac{2.5 - 1.6}{50}$

allow $\frac{0.9}{50}$

1

0.018 (billion per year)

1

(c) suitable extrapolation line drawn on the graph.

allow straight extrapolation

1

reading taken at 2050 from student's line

allow a tolerance of ± ½ small square

*allow **1** mark for 10 billion if no extrapolation drawn*

1

(d) fewer fish caught **or** limit the number of fish caught

*allow a method of doing this, eg increase mesh size **or** do not catch young fish*

1

(remaining fish) can reproduce

allow more fish (survive to) reproduce

1

(e) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

human land use
- increasing population requires more food
- crops / livestock for food
- farming crops for biofuels
- peat use as compost
- peat use as fuel
- increased use of pesticide / insecticide / herbicide / fertilisers
- use of free-range / organic methods increases land use (for same yield)

link to biodiversity
- deforestation
- monocultures
- loss of hedgerows to make fields larger
- loss of habitat
- consequence of loss of habitat e.g. (change in) migration
- fertiliser run off polluting water
- use of pesticide / insecticide / herbicide reduces insects / plants which damages food chains
- more soil erosion

link to atmospheric pollution
- more carbon dioxide (from farm animals / machinery)
- more methane (from cows)
- climate change **or** global warming
- example of impact on biodiversity
- acid rain
- desertification

Answers referring to only land use or only biodiversity are level 1

(f) golden rice has improved nutritional value

1

(g) any **one** from:

- gene may contaminate / enter other breeds / species
- reduction / extinction of population of wild / traditional rice
- reduction / extinction of population of flowers / insects
- high cost of seeds

  allow decrease in biodiversity
- may have too much vitamin A (in diet)

  allow decrease in gene pool
  allow may harm (human) health
  allow may cause side effects (on humans)

  ignore references to religious beliefs

  ignore may harm humans unqualified

1

[16]

Q3.

(a) triangular pyramid with 3 levels

1

correct labels: (waste) vegetables / plants; insect(s); dog(s)

*do **not** accept additional incorrect labels*

1

(b) any **two** from:

- carbon dioxide from respiration (from dog)

  allow carbon dioxide breathed out (by dog)
- urea from excretion (from dog)

  allow urea in urine (from dog)
- not all parts (of insects) are absorbed / digested (by 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

(c) less land required

1

(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

[8]

Q4.

(a) **Level 2:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

3–4

Level 1: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.

1–2

No relevant content

0

Indicative content

- use of quadrat
- (quadrat) of given area / dimensions – e.g. 0.25 m^2 or 1 m × 1 m
- quadrats are placed randomly
- method of obtaining randomness – e.g. random coordinates from a calculator **or** throw over shoulder **or** throw with eyes closed
- suitable number of quadrats (10 or more **or** a large number)
- count number of plants (in each quadrat)
- calculation of mean per quadrat or per unit area
- determination of area of field (length × width)
- population = mean per m^2 × area of field

(b) more bacteria so more divisions / reproduction (per unit time)

1

(c) any **three** from:

- add (more) sugar
- add (more) amino acids / protein

  if neither point given, allow add (more) nutrients
- add (more) oxygen
- increase temperature

  allow in range 26 °C to 40 °C
  allow maintain optimum temperature
- remove toxins / waste **or** maintain pH
- stir the culture

  *if no other mark awarded allow **1** mark for add more food*

3

(d)

*an answer in the range of 2.9 to 3.4 scores **4** marks*

*an answer in the range of 2.08 to 3.77 scores **3** marks*

tangent drawn to the curve at 12 hours

*do **not** accept if there is an incorrect tangent at 7 hours*

1

calculation of rate at 7 hours $\frac{\Delta y}{\Delta x}$

allow an answer that correctly rounds to a value in range 10.0 to 11.7

1

calculation of rate at 12 hours $\frac{\Delta y}{\Delta x}$

allow an answer that correctly rounds to

a value in range 3.1 to 4.8

1

3.3

allow in range 2.9 to 3.4 if both rates are in the correct ranges

1

(e) can use the glyphosate / weed killer to kill weeds but not kill / affect crop

*allow **only** kills weeds*

1

(so) less competition for light / water / minerals / ions

allow less competition for nutrients

ignore food / carbon dioxide / space

1

(so) crops have high(er) yield

allow crops grow better / well

1

[15]

Q5.

(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]

Q6.

(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

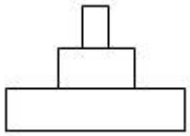
1

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]

Q7.

(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

(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

$\left(\frac{0.25}{0.03} =\right) 8.33 \text{ (times)}$

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]

Q8.

(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 × 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]

Q9.

(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]

Q10.

(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 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]