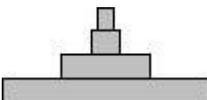## Mark schemes

Q1.

(a)   carbon dioxide

1

water

1

(b)   light

1

(c)

1

(d)   2.3 and 0.5

allow figures in millions allow in range 2.25 to 2.3 for 2.3 allow in range 0.5 to 0.55 for 0.5

1

$\dfrac{(2.3 - 0.5) \times 100}{2.3}$ **or** $\dfrac{1.8 \times 100}{2.3}$

allow correct substitution of student's incorrect graph readings

1

78.2(6087....)

allow correct answer from student's substitution of incorrect graph readings ignore incorrect rounding

1

78

allow correct rounding of calculated value

1

(e)   increase (in biomass of herring)

1

from 0.1 to 1.8 (million tonnes)
or
change of 1.7 (million tonnes)
or
change of 1700%

allow a tolerance of ± ½ small square for graph readings

1

(f)   smaller / 4-yr-old fish not caught

allow younger fish not caught
allow (only) older fish caught

1

(so) escaping fish can reproduce

allow so younger fish can survive to
reproduce

1

[12]

Q2.

(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

•   respiration or respiring (in mackerel)

do not accept respiration produces /
makes / creates energy

•   excretion (by mackerel)

allow loss of a named waste product
such as CO2 / 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

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

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
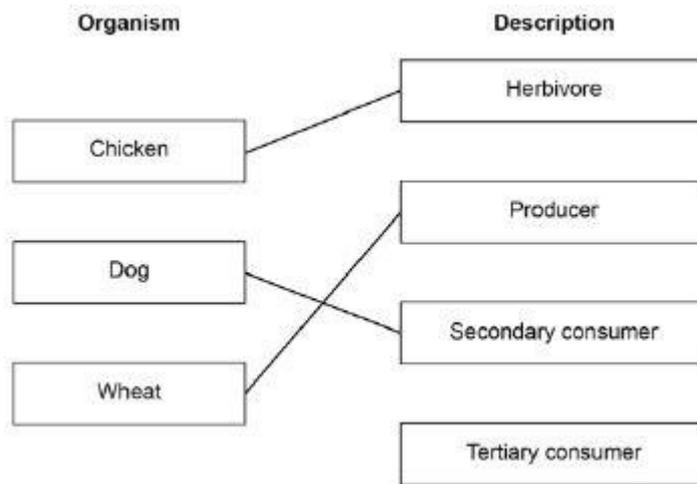
[17]

Q3.

(a)   3

1

(b)

Organism	Description
	Herbivore
Chicken	
	Producer
Dog	
	Secondary consumer
Wheat	
	Tertiary consumer

Chicken → Herbivore
Dog → Secondary consumer
Wheat → Producer

additional line from a box on the left negates the mark for that box
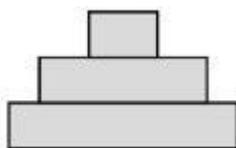
3

(c)   photosynthesis

1

(d)   the dog produces waste in faeces

1

(e)

1

(f)   farming cows needs more land than farming insects

1

fewer cows being farmed will slow down global warming

1

[9]

Q4.

(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]

Q5.

    (a)   primary consumer

1

    (b)   correct shape: 4 tiers with largest at bottom and smallest at top

1

    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

(c)   any one from:
    (Daphnia biomass smaller because)
- non-digestible parts (of algae) or lost in faeces

  > *ignore waste*
- not all absorbed
- lost in urine / urea
- used in respiration or lost as carbon dioxide / CO_2

  > *allow excretion*
  > *allow (to supply energy) for movement / warmth*
  > *allow used to supply energy*
- algae not all eaten or eaten by other organisms
- some algae decompose

1

(d)

> *an answer of 14 000 scores 2 marks*

14

1

14 000

> *allow evidence of an incorrectly calculated mean × 1000*
> *allow 1.4×10^4*

1

(e)

> *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 part (d)*

(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 part (d)*

1

26250

1

2.625 × 104

allow 2.63 × 104 or 2.6 × 104

1

(f) increased (growth / reproduction of) algae

1

(more algae so) more food for Daphnia

allow fertiliser toxic to Hydra (1) (so)
fewer Daphnia eaten (1)

1

(g) (Hydra have) less food

1

because (graph shows) fewer Daphnia (with more fertiliser)

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)
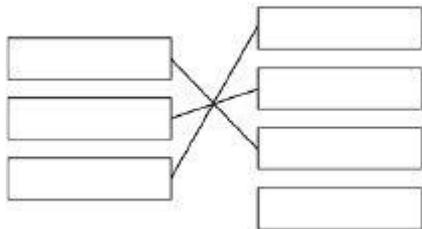*(decay / eutrophication) uses up oxygen*
(so lack of oxygen for Hydra) (1)

1

[14]

Q6.
(a)

extra line from a scientific term cancels
the mark

1
1
1

(b) $\dfrac{10}{200} \times 100$

1

5 / 5.0

1

an answer of 5 / 5.0 scores 2 marks

(c)   digestion

1

   respiration

1

   excretion

1

       in this order only

(d)   fewer are eaten (by small fish)

       allow there are fewer (small) fish eating them
       do not accept none are eaten

1

[9]

Q7.

(a)   *x*-axis: scale + labelled, including units

       scale ≥ ½ width of graph paper label:
       biomass in g/m2

1

   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

(b) $\dfrac{840-10}{840} \times 100$

       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

an answer of 99 scores 3 marks

(c)　inedible parts / example

> *allow eaten by other animals or not all organisms eaten*

or

egested / faeces

> *allow not digested*
> *allow excretion / urine*
> *ignore waste*

or

respiration / as CO2

> *ignore energy losses*
> *ignore movement*

1

(d)　bacteria decay organic matter / sewage / algae / dead plants

1

(by) digestion

> *allow example such as starch broken down to sugar*
> *or*
> *protein broken down to amino acids*

1

(and) bacteria respire aerobically
or
respire using oxygen

1

(which) lowers oxygen concentration (in water)
or
fish have less oxygen

> *allow reduced respiration of fish*

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

[13]

Q8.

(a)　$0.03 = \dfrac{\text{output}}{5950 \div 50} \times 10$

> *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 = $\dfrac{40}{10000 \div 6000} \times 100$

or

1

$\dfrac{40}{16000} \times 100$

0.25(%)

an answer of 8.33 scores 3 marks
allow 8 / 8.3 / 8.333...

1

$\left(\dfrac{0.25}{0.03} = \right)$ 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]

Q9.
(a)   snail
or
shrew

additional incorrect answer negates correct answer

1

    (b)   shrew

                additional incorrect answer negates correct answer

1

    (c)   fewer shrews to eat them

1

    (d)   population

1

    (e)   C

1

    (f)   (11 000 × 0.1 =)
          1 100 (kJ)

1

    (g)   the snails do not eat the roots of the lettuces

1

    (h)   any one from:
- light (intensity)
- temperature
- moisture (levels)
- soil pH
- mineral / ion content (of soil)
- wind intensity / speed

             ignore wind direction
- carbon dioxide (levels)
- oxygen (levels)

1

                                             [8]

Q10.

    (a)   any two from:
- *idea of* absorption of light / energy
- transfer to chemical energy

             allow produce sugars / glucose / starch /
             carbohydrate / food / biomass
- provides food / energy for animals / caterpillar
- releases oxygen

2
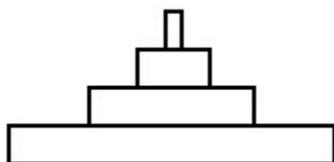
    (b)

1

    (c)   15(%)

$$\frac{3 \times 100}{20}$$

allow 1 mark for $\frac{3 \times 100}{20}$ *with no answer or incorrect answer*

or

allow 1 mark for 0.15

2

(d) (i) any two from:
- markings look like eyes / face / mouth of much larger animal
- looks fierce / scary / dangerous
- *allow it looks like a snake*
  to frighten blue tit / bird

max 1 if reference to camouflage

2

(ii) any two from:
- sharp / long / big claws

- *ignore strong*

- sharp / hooked beak

- *ignore strong / big*

- good eyesight
  large wings or flies quickly

  allow streamlined / aerodynamic
  ignore powerful wings

2

[9]

Q11.
(a) (i) any two from:
- not all eaten

- *allow eaten by other animals*

  used for respiration

-
  ignore used / lost in heat / movement

  lost as CO_2 / water / urea
  lost as faeces or not all digested
  if neither mark awarded allow 1 mark for lost as waste

  ignore references to energy losses

  do not allow for growth / repair / reproduction

2

(ii) any one from:
- thrushes eat other things
- thrush numbers likely to vary (considerably)
  allow it is only an estimate (of population size) or only counted thrushes for 5 hours
- thrushes were not present all the time
- thrushes feed on a much bigger area

1

(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

(ii) (snails in woodlands)
more have dark(er) colour(ed shells) or fewer have light-coloured shells

allow converse for grassland, if clear

1

(shells have) no / fewer stripes or have no stripes

allow converse for grassland, if clear

1

(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

[7]