

Mark schemes

- 1** (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) $(11\ 000 \times 0.1 =)$
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]**
- 2** (a) 3-layered triangular pyramid
as blocks or layered triangle, ignore (small) gaps between layers 1
- (pyramid) labelled in food chain order
all three labels are required
for 2 marks the pyramid must be fully correct 1
- (b) (i) **C** 1

- (ii) shortest
- or**
- fewest stages / transfers / (trophic) levels

allow only if (b)(i) is C or blank

1

less losses in waste / faeces / urine / CO₂ / excretion*allow smaller amount uneaten*

1

less loss in respiration / heat / movement

*allow less lost keeping warm**do **not** allow energy for respiration**do **not** allow respiration makes energy**allow less loss (of biomass / energy) **or** less transfer (of biomass / energy) to surroundings if neither 2nd nor 3rd point given, for **1** mark*

1

[6]**3**

- (a) (i) 1800(g)

1

- (ii) triangular pyramid with four layers

*accept ecf from (a)(i)**allow inverted pyramid*

1

correctly labelled in order of food chain

1

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

- (lost as) crab faeces / not all digested
*allow waste / excretion for **one** mark if neither faeces nor urine are given*
- (lost as) crab urine / urea
- loss of carbon dioxide by crab
accept (lost via) respiration
- not all the limpet is eaten eg don't eat the shell
- not **all** limpets are eaten (by crabs)
*allow not enough crabs to eat **all** the limpets / the limpet population*
ignore energy losses, such as movement

2

[5]**4**

- (a) (i) 6000

*award **2** marks for correct answer irrespective of working**allow **1** mark for 60 × 100 with incorrect or no answer**allow answer in table if answer line blank*

2

(ii) bar width 6000 **or** to match answer to (a)(i)
anywhere on scale ignore depth / height of bar

1

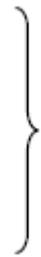
drawn below slugs
label not required

1

(b) any **three** from:

ignore references to number / size / mass of organisms
assume reference is to / of hedgehog unless stated otherwise

- respiration (by hedgehog)
*do **not** accept idea that respiration uses / produces energy*
- faeces (of hedgehog) **or** (slug) not absorbed (by hedgehog) **or** (slug) not digested (by hedgehog)
- excreted / urine / urea (by hedgehog)



accept waste for 1 mark if neither faeces nor excretion point made

- not all slug (s) eaten (by hedgehogs) **or** some slugs eaten by other things **or** not all parts (of slug) eaten
ignore (some) slugs die
- movement (by hedgehog)
- heat (from hedgehog)
allow appropriate references to biomass lost by these methods, rather than energy losses

3

[7]

5

(a) Sun / sunlight / light
accept radiation from the Sun / solar energy

1

(b) (i) 2 (.0)

1

8 (.0)

1

(ii) 3 layers of decreasing size as they go up

1

labelled wheat grains, field mice, red kites in correct order of food chain

1

sizes correct (showing half on each side)

allow ecf from (b)(i)

error \pm half square

1

(c) any **two** from:

- not all the field mice are eaten
- not all parts of eaten mice are absorbed / some passed as faeces (of red kite)
- due to respiration (of red kites) / production of CO₂

allow reference to uric acid / urea / urine (of red kite)

reference to waste / excretion alone gains 1 mark

2

(d) any **two** from:

- cannot find all wheat grains / too many to count
- field mice hiding / in hedgerows

allow ref to hibernation / nests / burrows

- red kites / mice come and go all the time

allow count an organism more than once

2

[10]**6**

(a) sulfur dioxide

1

(b) (i) mutation

1

(ii) pale form now (more) easily seen (by predators) **or** dark form now less easily seen (by predators)

accept ref to camouflage

1

so pale form (more) likely to be eaten **or** dark form less likely to be eaten

1

so dark form (more likely to) breed / pass on genes

or

pale form less likely to breed / pass on genes

1

(c) (i) pyramid of three layers of diminishing size

either way up

1

three labels in food chain order

award 2 marks only if the pyramid is correctly labelled

accept trees / birch

accept (peppered) moth(s) / larvae

1

(ii) some material is lost in waste from the birds

1

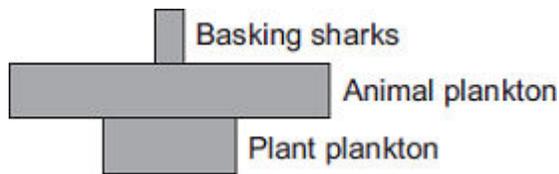
peppered moth larvae do not eat all the leaves from the trees

1

[9]

7

(a)



if more than one box is ticked award no mark

1

(b) increasing / higher light / temperature

ignore references to months other than February – April

*do **not** accept mineral / ions increase*

1

more / increased photosynthesis

*for both marks there must be a reference to 'more' at least once
(e.g. 'more light for photosynthesis' gains 2 marks)*

*allow 1 mark for reference to light **and** photosynthesis without an
idea of 'more'*

1

(c) increase due to increase in plant plankton / food

ignore references to months other than April – July

1

decrease due to fall in plant plankton / food **or** decrease as eaten by (basking) sharks

allow decrease as eaten by predators / animals / fish

1

(d) fall due to use / intake by plant (plankton)

ignore ref to no change section of graph

for fall allow March / April

ignore May / February

1

increase due to decay / decomposition / breakdown

for increase allow any month in range August to November

ignore December

1

of dead (plant / animal) plankton

allow of dead organisms / waste

1

[8]

8

- (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
- 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]

9

- (a) (i) triangular pyramid with 3 layers
may be as blocks or as triangle
ignore food chains and arrows

1

layers appropriately labelled:

bean / plant

aphid,

ladybird

*labelled in food chain order must **not** contradict correct pyramid*

*allow correctly labelled inverted pyramid for **2** marks*

1

(ii) any **two** from:
(for aphid / ladybird)

ignore energy

- not all digested / faeces

- loss in urine

- loss of CO₂

ignore loss of CO₂ from bean plant

- not all eaten

*if none of first 3 points given then allow waste (materials) / excretion for **1** mark*

2

(b) microorganisms / microbes / bacteria / fungi / decomposers / detritivores / named

*do **not** accept germs*

allow mould

ignore aphids

1

decay / breakdown / digest / decompose / rot (bean plant)

ignore eat

1

respiration (of microorganisms etc / aphids)

allow burning / combustion

1

carbon dioxide released (from respiration of microorganisms etc / aphids)

allow carbon dioxide released / produced (from burning / combustion)

ignore other parts of the carbon cycle

ignore formation of fossil fuels

1

[8]

10

(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]

11

(a) 0.18

*award both marks for correct answer irrespective of working**if no answer or incorrect answer**allow 1 mark for $45 \times 100 / 25000$*

2

(b) heat / thermal

allow heat from respiration

1

(c) energy / mass / biomass lost / not passed on **or** energy / mass / biomass is used **or** not enough energy / mass / biomass left*ignore reference to losses via eg respiration / excretion / movement / heat*

1

a sensible / appropriate use of figures including heron

eg only 2 from frog / to heron

ignore units

1

(d) any **three** from:

accept marking points if candidate uses other terms for microorganisms

- (microorganisms) decay / decompose / digest / breakdown / rot
ignore eat
- (breakdown) releases minerals / nutrients / ions / salts / named
ignore food
- (microorganisms) respiration
ignore other organisms respiring
- (microorganisms / respiration) release of carbon dioxide

3

[8]

12

(a) (i) sun

ignore light

apply list principle

1

(ii) photosynthesis

apply list principle

allow approximate spelling

*do **not** accept phototropism*

1

(b) (i) chemical

1

(ii) carbon dioxide

1

(iii) carbohydrates

1

(c) As carbon dioxide from the caterpillar

if more than 2 boxes ticked deduct one mark for each additional incorrect box

1

As faeces (droppings) from the blue-tit

1

[7]

13

(a) (i) 0.6 **or** 6×10^{-1} *for correct answer**if no / incorrect answer* $\frac{2.4 \times 10^4}{4 \times 10^8} \times 100$ **or***0.006 or 6×10^{-3} gains 1 mark*

2

(ii) any **two** from:

- reflected
ignore some of light is green
- not absorbed **or** misses chloroplasts / chlorophyll
allow transmitted or passes through leaves
allow hits other plant parts
- wrong wavelength
- photosynthesis inefficient
accept other limiting factors / named
- allow some lost through respiration / as heat (from respiration)

2

(b) energy lost via faeces / not digested / waste / excreted (of insect-eating birds)

1

energy loss via respiration / movement / muscle contraction / heat
(by insect-eating bird)*accept examples of muscle contraction*
*do **not** accept energy used for respiration*

1

some of (insect eating) bird not eaten but all / most / more of insect is eaten

1

[7]

14(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]**15**

(a) (i) 6000

*award 2 marks for correct answer irrespective of working
allow 1 mark for 20 x 300 with incorrect or no answer
allow answer in table if answer line blank*

2

(ii) bar width 6000 **or** to match answer to (a)(i)

*anywhere on scale
ignore depth / height of bar*

1

drawn below slugs

*label **not** required*

1

(b) any **three** from:

ignore reference to size / mass / number of organisms

assume reference is to / of hedgehog unless stated otherwise

- respiration (by hedgehog)
*do **not** accept idea that respiration uses / produces energy*
- (results in) loss of CO₂
- faeces (of hedgehog) **or** not digested
- excreted / urine / urea (by hedgehog)
*accept waste for **1** mark if neither faeces nor excretion point made*
ignore sweat alone
- not all slug(s) are eaten (by hedgehogs) **or** some slugs eaten by other things
ignore some slugs die
ignore reference to movement / heat / growth
allow references to energy losses by these methods, rather than biomass losses

3

[7]

16

(a) bottom / third pyramid ticked

extra box ticked cancels the mark

1

(b) the sun

extra ring drawn cancels the mark

1

(c) any **two** from:

- heat
ignore keeping warm
- movement / named example internal or external
ignore digestion
- respiration
*do **not** allow for respiration*
- faeces / not all digested
*allow waste for **1** mark if neither faeces nor excretion given (ie waste + movement = **2** marks waste + faeces = **1** mark*
- excretion/ urine
- not all of animal / all parts eaten
*do **not** accept growth / reproduction*

2

[4]

17

(a) 16

*accept correct answer for **2** marks, irrespective of working
if no answer **or** answer incorrect accept $0.64 \times 100 / 4 (.0)$ **or** 0.16
for **1** mark*

2

- (b) insect cold-blooded / not warm blooded **or** does not control body temperature
*accept mammal warm-blooded / constant (high) body temperature /
controls body temperature*

1

reference to insect 0.96 (kJ) **and** mammal 12.25 (kJ) transferred by respiration
or relevant calculation of this transfer

ignore references to other data

1

(less respiration) so more energy / biomass / food available (for growth of insect)
*(more respiration) so less energy / biomass / food available (for
growth of mammal)*

1

[5]

18

- (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]

19

(a) (i) 20

1

(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]

20

- (a) the sun / light / sunshine / solar

allow radiation from the sun

ignore photosynthesis / respiration

apply list principle

*do **not** allow water / minerals / heat*

1

- (b) 2.5 (:1)

correct answer with or without working

ignore rounding with correct working

*do **not** allow other equivalent ratios for both marks*

*evidence of selection of 10(insects) **and** 4(frogs) **or** 50 **and***

*20 **or** 1 **and** 0.4 for 1 mark*

if no other working allow 1 mark for 0.4:(1) on answer line

2

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

*allow for insects **or** frogs*

allow energy for biomass

- some parts indigestible / faeces
- waste / examples of waste eg urea / nitrogenous compounds / urine / excretion
- movement / eg of movement
allow keeping warm
- heat
- not all eaten / eg of not all eaten
- respiration
do not accept energy for respiration

2

(d) any **four** from:

- (bodies) consumed by animals / named / scavengers / detritus feeders
- microorganisms / bacteria / fungi / decomposers
- reference to enzymes
- decay / breakdown / decompose / rot
ignore digest(ion)
- respiration
- carbon dioxide produced
- photosynthesis
- sugar / glucose produced
accept other organic molecules
- fossilisation / fossil fuels / named
- combustion / burning
must be linked with fossilisation / fossil fuels
- (burning) produces carbon dioxide
allow carbon dioxide produced once only

4

[9]

21

(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]

22

(a) 4

award **both** marks for correct answer, irrespective of working.
 allow $125/3125 (\times 100)$ **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]**23**

(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

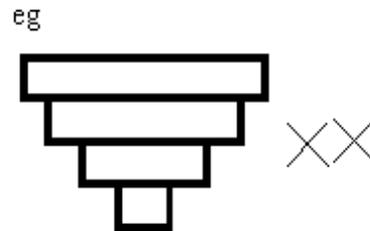
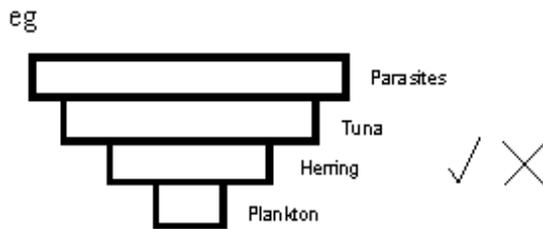
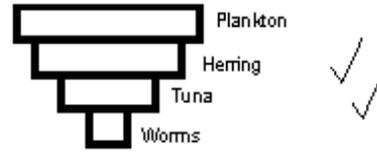
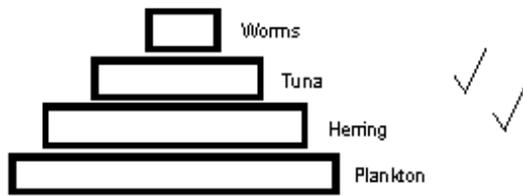
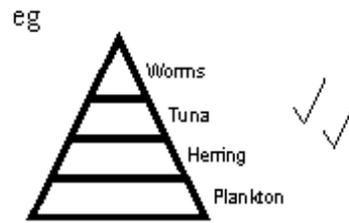
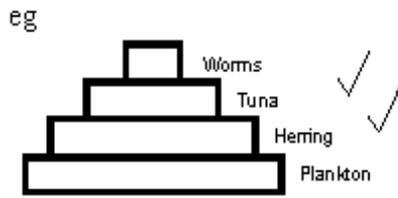
upside down labelled pyramid with producer at bottom gains 1 mark for labels

unlabelled upside down pyramid = 0 marks

accept separate boxes

correct food chain with correct arrows if given gains 1 mark

1



(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

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]**24**

(a) 8.3 **or** 8.3 recurring **or** 8

*award **both** marks for correct answer, irrespective of working*
 $7 / 84 \times 100$ 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]

25

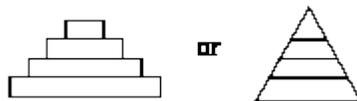
(a) 0.1

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]

26

(a) In sequence:

- heron
- frog
- slug
- lettuce

1

- (b) (i) light / sun
ignore photosynthesis / respiration
cancel mark if water / ions etc given
*do **not** accept heat* 1
- (ii) traps / absorbs light
accept energy for light
*do **not** accept collects / attracts*
*do **not** accept 'traps sun'* 1
- (iii) 162
if correct answer, ignore working / lack of working

$$\frac{10 \times 1620}{100} \text{ for 1 mark}$$
 2

[5]**27**

- (a) (i) (predator) lion 1
- (prey) antelope 1
- (ii) light
accept other positive indications 1
- (iii) in sequence (top to bottom):
 lion
 antelope
 grass 1
- (b) (i) bacteria / fungi / saprotrophs
accept moulds / decomposers / microorganisms / microbes /
saprophytes / saprobionts 1

- (ii) aerobic 1
- moist 1
- warm
accept other positive indications 1
- (iii) carbon dioxide 1
- mineral salts 1
- [10]**

28

- (a) $1.67 / 1\frac{2}{3}$
accept 1.6 to 1.7
- ignore working or lack of working $\frac{400 \times 100}{24000}$ for 1 mark* 2
- (b) any **three** from:
- deduct only 1 mark for any mention of in carnivore*
- lost as heat **or** keeping body warm
lost in metabolic functions is not enough
- lost in respiration
*do **not** accept 'used for respiration*
- movement
- not eaten parts or individuals / non-edible parts / dead leaves / wood / bones / faeces / urine
ignore 'waste'
ignore references to growth / reproduction 3

[5]

- 29** (a) (i) vole/small bird/beetle
gains 1 mark 1
- (ii) oak trees are large organisms;
therefore their biomass is large; but their numbers are small
each for 1 mark 3
- (b) 8 of:
energy stored in chemicals in cells/tissues/growth;
passed up food chain;
less energy stored at each stage in food chain/pyramid level;
because only part of energy taken in used for growth;
some lost in waste;
some used for repair;
used to main body systems;
some lost in respiration;
some converted into other forms of energy;
e.g. movement;
much lost as heat;
by time detritus feeders have used remains;
all returned to environment
each for 1 mark 8
- c1 → animals
c2 → decomposers
2 marks for sequencing and organising the information 2
- [14]**

- 30** (a) water
gains 1 mark
- oxygen
gains 1 mark 2

- (b) e.g.:
- some materials/energy lost in animals' waste materials
 - respiration releases energy
 - some materials/energy used in maintenance/repair
 - some energy used for movement
 - much lost as heat to surroundings
 - some organisms die (rather than eaten)
 - reference to detritivores
 - reference to microbes

each for 1 mark

8

[10]

31

- (a) (i) e.g. mussels/caddis loach
for 1 mark

1

- (ii) 3 of:
- carbon dioxide
 - water
 - chlorophyll/chloroplasts
 - light

any 3 for 1 mark each

3

- (b) 6 of e.g.
- some plant/animal material not digested by consumers passes out with faeces
 - respiration releases energy used in movement lost as heat
 - some 'lower' organisms die energy transferred to decomposers/detritivores
 - thence to environment

any 6 for 1 mark each

6

[10]

32

- (a) pyramid correct shape labelled

2

- (b) warm
moist
oxygen

3

[5]

- 33** (a) levels in correct order
sizes correct
for 1 mark each 2
- (b) (i) working
0.96% (correct answer = 2)
for 1 mark each 2
- (ii) 2 of e.g.
heat up leaves
absorbed by non-photosynthetic parts
transmitted through leaves
any 2 for 1 mark each 2
- (iii) 3 of e.g.
respiration of primary consumers
movement of p.c.
waste from p.c.
repair/growth of p.c.; heat losses to surroundings
any 3 for 1 mark each 3
- [9]**

- 34** (a) (i) 200 kJ
for 1 mark 1
- (ii) 2
gains 2 marks
(if answer incorrect, $20 / 1000 \times 100$ 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]

35

any **five** from:

- the amount of energy (in the biomass of organisms) is reduced at each successive stage in a food chain
- all of prey organism is not consumed
- energy is 'lost' as the organisms' waste materials
- energy is transferred / lost during respiration
- energy is transferred / lost as movement (kinetic energy)
- energy is transferred / lost as heat (thermal energy)
- energy is transferred / lost to the surroundings
- the only energy transferred to a higher level is that which the organisms have used in growing

statements about energy flow the wrong way are neutral

[5]

36

- (a) all bars correct for greenfly, ladybird (\pm one square) and blackbird
 (less than one square)

1

bars are centred

*do not accept pyramid shape if **all** to left or right of centre*

1

bars are labelled (in correct sequence)

1

- (b) $\frac{1}{12}$ **or** 8.3% **or** 1:12
if answer is incorrect accept correct

working out (eg $\frac{50}{600}$) for 1 mark
accept 12 or 12:1 for 1 mark
accept 8.3 for 1 mark (without %)

2

[5]**37**

- (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]**38**

- (a) 12 500

incorrect numerical answer but clear evidence of correct working
*e.g. 365 million \div 365 \div 80 **or** 3285 million \div 365 \div 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]

39

(food chain) A gives 7 200 kJ
(of useful energy)

or 7.2 MJ
or 7 200 000 J
unit essential in each case

1

(food chain) B gives 960 kJ (of useful energy)

or 0.96 MJ
or 960 000 J
unit essential in each case
*credit 1 mark if **both** are numerically*
correct but unit omitted

1

same comparison made in **each** case
e.g. for each kilogram of grain

or refers to more stages in food chain
results in less efficiency

1

(so) (food chain) A is 7.5 times more efficient than (food chain) B

or for every unit of useful energy given
to a person by B, A gives $7\frac{1}{2}$ units
or food chain B is only 13(.3) % as
efficient as food chain A
or makes a correct comparison
in percentage terms

1

[4]**40**

(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]**41**

- (a) (i) (tiny green) plants / phytoplankton
for 1 mark

1

(ii)

- penguin
- shrimp
- cod
- squid

any two for 1 mark

1

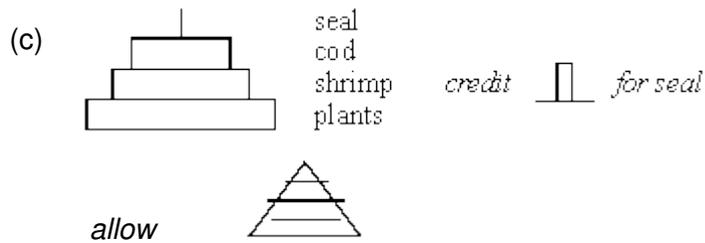
- (b) Decrease: seals will eat more squid and penguins
for 1 mark

1

Stay the same:

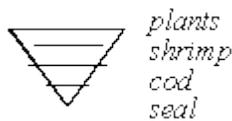
- more shrimp for squid and penguins
- squid and penguins increase balances the extra eaten by seals
- seals find other prey [allow shrimps]
any two for 1 mark each

2



- correct / shape (designs need to be to scale)
- correctly labelled with organisms

(if wholly correct but inverted then credit 1 mark)
each for 1 mark



2

[7]

42

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

1

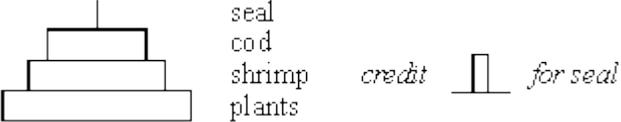
Stay the same:

- 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

- (b) 

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]