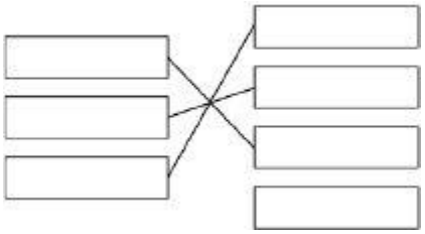
Q1.

(a)



extra line from a scientific term cancels the mark

1
1
1

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

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]

Q2.

(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) $\frac{840-10}{840} \times 100$

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 CO_2

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]

Q3.

(a) any **two** from:
- sprinkled through air
- air spaces between stones
- thin layer over stones (for efficient diffusion)
- slow flow (for efficient diffusion)

2

(b) green algae
1

(c) (large / small) protist
1

(d) **Level 2 (3-4 marks):**
Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

Level 1 (1-2 marks):
Facts, events or processes are identified and simply stated but their relevance is not clear.

No relevant content (0 marks)

Indicative content

digestion:
- (external) enzymes released
- role of enzymes – e.g. amylase / protease / lipase
- substrates & products – e.g. starch ⟶ sugar / protein ⟶ amino acids / fat ⟶ fatty acids

absorption:
- by diffusion / active transport

deamination:
- amino acids ⟶ ammonia / ammonium ions

release of other ions:
- e.g. phosphate / nitrate / magnesium

respiration:
- produces carbon dioxide (+ water)

or

equation is given

- release of energy allows other processes to take place e.g. active transport

[8]

Q4.

(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

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

Q5.

(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

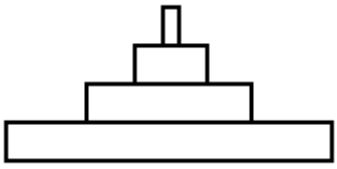
[8]

Q6.

(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(%)

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
- large wings **or** flies quickly
  allow streamlined / aerodynamic
  ignore powerful wings
- good eyesight

2

[9]

Q7.

(a) 0.67(%)

allow $0.\dot{6}$ or 0.7

allow **1** *mark for evidence of* $(2 \times 10^6) \div (3 \times 10^8)$

or

allow **1** *mark for 0.0067 or 0.6*

2

(b) (i) idea that food chains start with plants / producers

allow food chains do not start with animals ***or*** *larvae are consumers*

1

idea that these make food (for other organisms in the chain)

allow idea that plants / producers photosynthesise ***or*** *plants / producers get energy from the sun*

allow mosquito larvae do not make food / photosynthesise ***or***

mosquito larvae do not get energy from the sun

1

(ii) any **four** from:

- reasoned argument for **or** against release
  must refer to at least one advantage and one disadvantage.
  *max **3** marks for either only advantages **or** only disadvantages*

advantages:

- fewer mosquitos biting **or** spreading malaria
- fewer people get / die from malaria
  allow people won't get / die from malaria
- lower medical costs (for those infected **or** for treatment) **or** less healthcare needed
- better economically for developing / tropical countries.

disadvantages:

- fewer crops reproduce
  allow fewer crops pollinated
- poorer crop yield
- possible starvation (of people)
- high cost of GM production / mosquito release
- less food for bats / birds **or** bats / birds die
  *allow disruption to food chain / ecosystem **or** reduction of biodiversity*
- gene could 'escape' into other wildlife / species
  ignore into plants

4

(iii) any **three** from:

- gene from bacteria cut out
  allow allele for gene
- ref to enzymes (anywhere in process)
  allow at any point in process, ie in cutting or in splicing
- (gene) transferred to chromosome of mosquito
  allow DNA for chromosome
- at an early stage of development
  allow egg / embryo

3

[11]

Q8.

(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]

Q9.

(a) (i) reduced photosynthesis
ignore growth
*do **not** allow need light for respiration*

1

(ii) less food (for animals) **or** less oxygen (for animals)
allow loss of habitat

1

(iii) any **two** from:
accept 2 physical factors or 2 biological factors or one of each for full marks

examples of physical factors, eg
- flooding
- drought
- ice age / temperature change

ignore *pollution*

- volcanic activity

examples of biological factors, eg

- (new) predators (allow hunters / poachers)
- (new) disease / named pathogen
- competition for food
- competition for mates
- cyclical nature of speciation
- isolation
- lack of habitat or habitat change

*If no other answers given allow natural disaster / climate change / weather change / catastrophic event / environmental change for **1** mark*

2

(b) (i) 3

1

(ii) fossils

ignore bones, remains, fossil fuels

1

(c) (i) 65 million years ago

1

(ii) 17

allow ecf

1

(iii) fossil record incomplete
or
some fossils destroyed

accept not enough evidence

or

cannot perform experiment to test

1

[9]

Q10.

(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 / CO_2 / 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]

Q11.

(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]

Q12.

(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]

Q13.

(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 <u>in correct order of food chain</u>

1

sizes correct (showing half on each side)

*allow ecf from **(b)(i)***
error ± 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 CO_2

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]

Q14.

(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

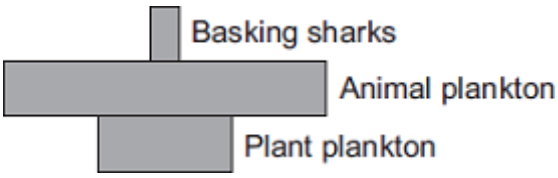
peppered moth larvae do not eat all the leaves from the trees

1

[9]

Q15.

(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]

Q16.

(a) (i) wheat → humans chain transfers 10 times more energy than wheat → pigs → humans chain

allow 10% if given as a comparison e.g. one is 10% of the other

or

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

ignore less unqualified

1

(ii) any **one** reason for energy loss from pigs e.g :

ignore respiration, growth

ignore heat unqualified

- movement
- (maintaining) body temperature
- waste materials

  allow named examples
- not all parts of pig eaten by human
- because there is an extra stage (pigs) in the food chain and energy is lost at each stage

  allow longer food chain so more energy lost

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance, and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1-2 marks)
There is a basic description of at least one factory farming method
or
identification of an advantage or disadvantage of factory farming.

Level 2 (3-4 marks)
There is a description of at least one factory farming method
and
an advantage or disadvantage is explained.

Level 3 (5-6 marks)
There is a description of factory farming methods
and
advantage(s) and disadvantage(s) are explained.

Examples of Biology points made in the response:

factory farming methods e.g.:

- Kept in cramped conditions / battery hens / calf crates / pig barns / fish tanks
- Controlled temperature / heating
- Controlled feeding / modified food given / growth hormones
- Controlled lighting
- Treated with prophylactic antibiotics

Advantages e.g.:

- Increased efficiency / profit / greater food production / cheaper food / faster growth
- Farmer can have more livestock
- Less energy is lost through movement
- Less energy is used keeping warm
- (Food is high in calories / protein) so animals will grow faster / lay more eggs
- Easier to vaccinate all the animals
- Easier to protect animals from predators
- Antibiotic treatment stops infections in animals

Disadvantages e.g.:

- Stress / cruelty / inhumane / unethical
- Restricted movement / overcrowding
- Faster spread of diseases
- Antibiotics in the food chain / residual chemicals in the food chain
- Wasting fossil fuels / increasing global warming
- Increased pollution from animal waste and from additional transport

6

[8]

Q17.

(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 CO_2

  ignore loss of CO_2 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]

Q18.

(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]

Q19.

(a) 0.18

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

2

(b) heat / thermal

allow heat <u>from</u> 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 <u>only</u> **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]

Q20.

(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]

Q21.

(a) (i) 0.6 **or** 6 x 10^{-1}

for correct answer

$\frac{2.4 \times 10^4}{4 \times 10^6} \times 100$

if no / incorrect answer

or

0.006 ***or*** *6 x 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 <u>but</u> all / most / more of insect is eaten

1

[7]

Q22.

(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

2

(b) more

1

less

in this order

1

[6]

Q23.

(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 CO_2
- 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]

Q24.

(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 <u>for</u> 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]

Q25.

(a) 16

*accept correct answer for **2** marks, irrespective of working*

*if no answer **or** answer incorrect accept 0.64 x 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]

Q26.

(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 / CO_2 released

2

[7]

Q27.

(a) (i) 20

1

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

*for correct answer irrespective of working **2** marks*
ignore any units
accept equivalent fractions eg $\frac{4}{40}$ / $\frac{2}{20}$

*do **not** allow eg 1:10 / 1 to 10*
if answer is incorrect
*clear selection of 2 **and** 20, **or** equivalent **or** 1:4:5 / 1:5:4 gains **1** mark*

2

(b) any **two** from:
*do **not** accept sweating / cooling /excretion*

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

2

(c) more movement / have to hunt / catch food
allow converse if stated for herbivore eg herbivores food is all around
*ignore reference to size **or** predator unqualified*

1

(d) any **two** from
ignore reference to food

- less movement
  allow no movement
  allow less space to move
  ignore less space unqualified

- less heat loss
  *allow no heat loss **or** they are kept warm*

- less respiration

2

[8]

Q28.

(a) the sun / light / sunshine / solar
allow radiation <u>from the sun</u>
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]

Q29.

(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]

Q30.

(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]

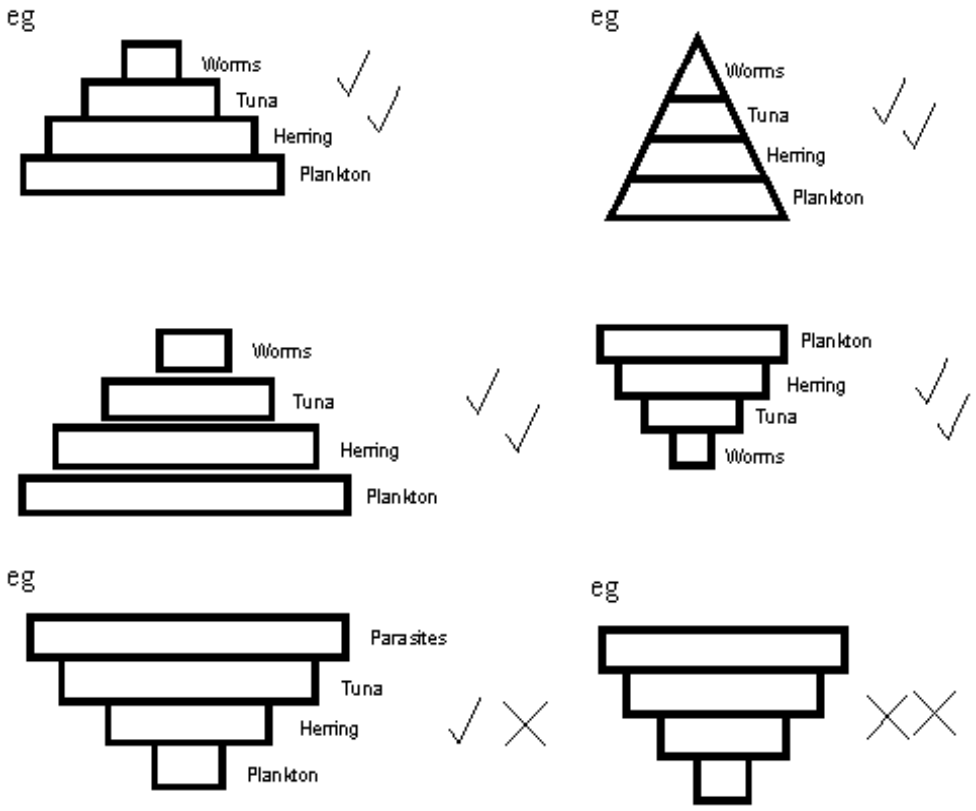
Q31.

(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 / 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:

- 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]

Q32.

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

*award **both** marks for correct answer, irrespective of working*
*7 / 84 × 100 or equivalent for **1** mark*

2

(b) any **three** from:

- heat
  allow keeping warm
- respiration
  ***not** <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]

Q33.

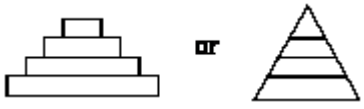
(a) 0.1

ignore working or lack of working

$\frac{88 \times 100}{88\,000}$ *for 1 mark*

2

(b) <u>shape</u>: pyramid with 4 tiers



1

<u>labels:</u>

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]

Q34.

(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

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

2

[5]

Q35.

(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 indications1

1

(iii) carbon dioxide

1

mineral salts

1

[10]

Q1.

(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]

Q2.

(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]

Q3.

(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 detritivors
reference to microbes

each for 1 mark

8

[10]

Q4.

(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]

Q5.

(a) pyramid correct shape labelled

2

(b) warm
moist
oxygen

3

[5]

Q6.

(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]

Q7.

(a) (i) 200 kJ
for 1 mark

1

(ii) 2
gains 2 marks
(if answer incorrect, 20 / 1000 × 100 gains 1 mark)

2

(b) *ideas that*

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

any three for 1 mark each
references to respiration regarded as neutral

3

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

each for 1 mark
accept respiration as explanation once only if neither explanation point has received credit
reject give more food / different food

4

[10]

Q8.

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]

Q9.

(a) all bars correct for greenfly, ladybird (± 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]

Q10.

(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]

Q11.

(a) 12 500

*incorrect numerical answer but clear evidence of correct working e.g. 365 million ÷ 365 ÷ 80 **or** 3285 million ÷ 365 ÷720 credit with (1)*

2

(b) (i) vegetation → (farm) animals → humans

accept any correct variation on this theme e.g. grass → lambs → humans

1

(ii) any **three** linked points from

* less links in the food chain

or *only one link in the food chain*

* energy 'wasted' **or** 'lost' **or** 'used' at each link
* energy 'wasted' **or** 'lost' in (the process of) respiration
* energy 'used' to maintain body temperature
* energy 'used' by the animals in movement

3

(c) people will eat more/greater proportion of food from plants

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

1

any **three** linked points from

these marks are independent of the 'prediction' mark
do not credit 'food from plants will become less expensive'

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

or *more people will go hungry*
or *people will (each) eat less*

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

3

[10]

Q12.

(food chain) A gives 7200kJ (of useful energy)

or *7.2MJ*
or *7200000J*
unit essential in each case

1

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

or *0.96MJ*
or *960000J*
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]

Q13.

(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]

Q14.

(a) (i) (tiny green) plants / phytoplankton

for 1 mark

1

(ii)
- penguin
- shrimp
- cod
- squid

any two for 1 mark

1

(b) <u>Decrease:</u> seals will eat more squid and penguins

for 1 mark

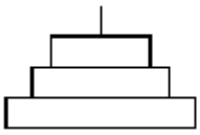
1

<u>Stay the same:</u>

- 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

(c) 

credit  *for seal*

allow 

- 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]

Q15.

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

for 1 mark

1

Stay the same:

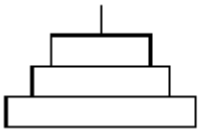
- more shrimp/food for squid and penguins

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) 

credit  *for seal*

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]