Mark schemes

Q1.

Level 3: Relevant adaptations are identified, given in detail and logically linked to form a clear account.	5-6
Level 2: Relevant adaptations are identified, and there are attempts at logical linking. The resulting account is not fully clear	3-4
Level 1: Adaptations are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2
No relevant content	0
Indicative content •a small SA:V ratio •means less thermal energy transferred to surroundings •thick fur **or** hollow hair shafts •traps a layer of air which acts as an insulating layer stopping transfer of thermal energy •a layer of fat or blubber under the skin •acts as an insulating layer **or** as a food store for respiration when food is in short supply •small ears •reduces surface area for thermal energy transfer •white colour •camouflage in the snow so prey do not see them coming and they get more to eat **or** so predators do not see them and they can escape •large feet •to spread weight over snow so they can run faster •hibernate in winter •to conserve energy stores allow 'heat loss' for transfer of thermal energy	

6

[6]

Q2.

(a) any **two** from:

- increased use of electronic devices (for reading / working)

    allow less paper used

- increased recycling of paper

    ignore less paper produced

- paper production processes are more efficient / modern (and produce less carbon dioxide)

    ignore references to re-planting trees

ignore carbon offset

2

(b) any **two** from:
  • decreased use of fossil fuels
    allow named example

  • increased use of renewable sources for electricity production
    allow named example

  • increased electricity production from nuclear power stations

  • increased use of carbon capture / carbon storage

  • less electricity produced / used (in the UK)
    allow idea of greater use of energy efficient appliances / devices

  • to comply with government regulations

2

(c)
*an answer of 20 scores **2** marks*

$$\frac{126\ 300\ 000}{631\ 400\ 000} \times 100$$

$$\text{allow} \quad \frac{1263}{6314} \times 100$$

1

20 (%)

1

(d) **Level 3**: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5-6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3-4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1-2

No relevant content

0

Indicative content

mechanism:
  • rise in greenhouse gases
  • carbon dioxide / greenhouse gases absorb (long-wavelength) radiation
  • (causing) an increase in temperature
  • (causing) global warming
  • (causes) climate change

consequences of global warming:
- melting of ice caps
- (causing) sea levels to rise
- (causes) flooding (of low-lying land masses)

- (causes) habitat destruction
- leading to extinction
- (causing) reduction in biodiversity

- increase in extreme weather
- changes in rainfall
- (causes) drought / water shortage
- (causes) changes to yield of crops in some areas
- (may lead to) food shortages

- changes to migratory patterns of animals
- changes in species distributions
- (causes) changes in food webs

- increased (geographical) range of tropical diseases
- increased absorption of carbon dioxide into the seas and oceans
- (causes) acidification of oceans
- (which) could lead to changes in species abundance

For Level 3 mechanism and linked consequences needed

[12]

Q3.

(a)

Factor	Biotic	Abiotic
Diseases	✓	
Herbivores	✓	
Temp		✓
Water		✓

*allow **1** mark for 2 or 3 correct*

2

(b) (leaves block light near tree so) more light (as you move outwards)

allow low light intensity under tree
ignore Sun

1

for photosynthesis

allow less photosynthesis under the tree

1

(which) produces (more) glucose / proteins (for growth)

ignore growth
ignore food

allow molecules, cell components or other correct substances instead of proteins

if no other mark awarded allow less water / ions / minerals / nutrients under the tree

1

(c)   quadrat

correct spelling only

1

light meter

allow lux meter
allow light intensity meter
allow light data logger

1

in this order

(d)   1.5(0) (m^2)

allow 15 000 cm^2

1

(e)   to keep light (intensity) as similar as possible

allow the light (intensity) might change
ignore references to temperature
ignore weather
ignore Sun

1

(f)   any **one** from:
   •   repeat (investigation) around the tree

allow repeat in different directions

   •   repeat (investigation) for other trees / areas
   •   sample every one metre
   •   count the number of each species present (rather than percentage cover)

ignore repeats unqualified
ignore repeat at different times / days / seasons
ignore different size quadrat
ignore random sampling

1

(g)   daisy

1

(h)   as light (intensity) increased so did the percentage / cover of plants

ignore directly proportional
ignore positive correlation unqualified

1

up to 100% / maximum at 175 (arbitrary units)

ignore distance

1

(i)   any pair from:
* (lack of) water / rain (1)

    because the leaves are stopping the rain
    or
    because the roots of the tree are absorbing it (1)
    allow soil moisture

* (lack of) minerals / ions (1)
    allow magnesium / nitrate / nutrients

    because the tree (roots) have absorbed them (1)

* temperature (1)
    allow too cold / cooler

    because less thermal energy from the sun is reaching under the tree canopy (1)
    allow 'heat' for thermal energy
    allow pH / acidity (1)
    because (some) fallen leaves are acidic (1)

    2

    ignore carbon dioxide
    *do **not** accept oxygen*

    [15]

Q4.

(a)   (the scientists)

chose / used (traditional varieties of) rice plants with short stems and rice plants with large grains
or
chose rice plants with short stems and large grains.

1

(cross) bred the rice plants
    allow cross pollinated the rice plants

1

(from the offspring) chose the plants with best / desired characteristics
or
chose plants with short(est) stems and big(gest) grains

1

bred repeatedly until all plants had desired characteristics
or
bred repeatedly until they bred true
or
bred repeatedly until they produced IR8

1

(b)   agree (**max 3** marks)

- resistance to disease / pests / pathogens
  so higher yield

- resistant to herbicides
  so less competition for (sun)light / water / minerals / ions (from weeds)

- larger / more grains per plant or higher yield
  so more food for people or more income for farmers

- better nutritional content (vitamins / protein / low GI index)
  so will improve health

  *allow improved survival in harsh conditions so
  can be grown in wider area*

disagree (**max 3** marks)
- may affect wild plants (if genes transfer)
  so making them herbicide resistant
- use of herbicides may reduce biodiversity
  because other plants are killed
- traditional varieties no longer grown
  so reduction in biodiversity
- may affect health of people who eat the rice
  because not enough research done yet

  *allow (GM) seeds are expensive for farmers
  because they have to buy new seeds every year
  or because farmers have to buy specific
  herbicide*

  *if no explanations allow **1** mark for one agree
  reason **and** one disagree reason*

4

  each reason must be explained to gain credit

[8]

Q5.

(a) $\dfrac{33}{72}$
or
0.45833…

  allow $\dfrac{34}{72}$

  or
  0.47222…

1

0.46 (arbitrary units per hour)

  allow 0.47 (arbitrary units per hour)

  *allow an answer given to 2 significant figures
  from an incorrect calculation in step 1 for **1** mark*

1

(b) any **five** from:

- (during the first days of the cycle) FSH from the pituitary stimulates an egg / follicle to mature

- FSH stimulates oestrogen from the ovaries

- oestrogen causes thickening of the uterus lining (in the first half of the cycle)

- oestrogen inhibits FSH but stimulates LH from the pituitary

- the high levels of LH stimulate release of the egg / ovulation (on day 14))

- progesterone is secreted by the (empty) follicle / corpus luteum (after day 14 / ovulation)

- progesterone maintains the lining of the uterus (during the second half of the cycle)
  or
  progesterone inhibits both FSH and LH

- progesterone falls (if no pregnancy happens) and uterus lining comes away as the menstrual blood flow

  *if no other marks awarded allow **1** mark for oestrogen and progesterone are produced by the ovaries and FSH and LH are produced by the pituitary*

  points must be in correct order to gain full credit

5

(c) any **one** from:
- (lower dose so) fewer side effects

- (patch lasts longer so) don't have to remember to take pill every day

- hormone (from patch) goes directly into bloodstream so (contraception) unaffected by vomiting

1

[8]

Q6.

(a) one X and one Y chromosome and 9 pairs of other chromosomes

1

(b) any **three** from:
- (called) meiosis
  correct spelling only

- DNA / chromosomes replicate
  or
  DNA makes a copy
- two divisions to form 4 cells
- so only 1 set of chromosomes per cell
  allow cells are haploid

ignore half the DNA

- (daughter cells / gametes) are all genetically different

    *if no other mark awarded allow **1** mark for forms
    gametes / cells which are all different
    or only happens in testes and (embryonic)
    ovaries*

    3

(c) (meiosis will not work because) number of chromosomes cannot halve

    *allow chromosomes cannot form pairs
    allow chromosomes cannot split up evenly*

    1

(d) do not use energy in reproduction

    1

    so more (energy) available to synthesise proteins

    allow other correct molecules or cell components

    1

    *allow converse if clearly describing diploid
    oysters*

(e) any **two** from:
- global warming may be raising temperature of water and killing oysters
- pollutants in the water may be toxic and kill the oysters
    or
    increased acidity of the oceans is killing oysters

    allow correctly named pollutant with reason

- new competitors / triploid oysters are using up the normal food source
- new pathogens may be causing diseases
- new predators eating oysters

    ignore over harvesting

    2

(f) **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 also may be a simple
    judgement.

    3−4

    Level 1: Relevant points are made. They are not logically linked.

    1−2

    No relevant content

    Indicative content

    for:
- oysters are available to eat all year **so** eating oysters has become very
    popular
- cheaper to produce **so** more food for expanding population

- oysters grow faster **so** more oysters for supermarkets / restaurants or more profit for farmers
- stocks are replenished each year **so** more sustainable fishing
- they can harvest / sell all year **so** more stable and profitable for oyster farmers

against:
- carcinogen put into environment / oysters **so** may enter the food chain or cause cancer in humans
- bigger triploid oysters may outcompete the smaller native diploid oysters **so** upset balance of the ecosystem / cause extinction
- people may not buy / eat them because they have used a carcinogenic chemical **so** reduced profit for farmers / suppliers / supermarkets / restaurants
- farmers have to buy new seed oysters every time **so** more expensive

other content:
- shouldn't be eating the oysters until they are thoroughly tested
- should be looking for alternative ways to get triploid oysters
- should stop using triploid oysters until the effect on the (marine) environment is known
- would replace lost oyster beds **but** could change the ecosystem
- oysters available to eat all year **but** probably do not taste the same or have the same flavour

[15]

Q7.

(a) 160 000

if incorrect answer / no answer:

allow max. 2 for method:

1 mark for mean = total number ÷ area of ten quadrats

$$eg \ \frac{20}{0.625} \ or \ \frac{20 \times 8}{5} \ or \ \frac{160}{5} \ or \ 32$$

1 mark for final answer = mean × field area

eg mean × 5000

3

(b) Improvement: place quadrats randomly
and
Reason: avoid bias / (more) representative / (more) reliable

allow 1 mark if 2 correct improvements but no reasons / only incorrect reasons

1

Improvement: more quadrats
and
Reason: overcome random variation / (more) typical / (more) representative / (more) reliable / repeatable

1

Improvement: larger quadrats **or** repeat when plants are bigger
and
Reason: less likely to miss plants

ignore accurate, valid, precise and fair
ignore anomalies

1

[6]