Mark schemes

Q1.

(a)

	1960 − 1977	1977 − 2003	2003 − 2015	
trend in carbon dioxide concentration		increasing	increasing	1
trend in air temperature	decreasing	increasing	constant / decreasing	1

allow synonyms e.g. level / goes up / goes down

(b) traps heat / energy or (long-wavelength / IR) radiation
> *do **not** accept light / UV*

or
less loss of heat
> *allow stops (some) heat escaping*
> *do **not** accept stops all heat escaping*

or
insulates
> *ignore greenhouse effect*
> *ignore reference to ozone layer*

1

(c) **Level 2:** Some logically linked reasons are given. There may also be a simple judgement.

3−4

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

1−2

No relevant content

0

Indicative content

for the theory:
- (overall increased CO_2 parallels) overall increased temperature (e.g. by 0.4 (°C))
- CO_2 traps (long-wave) radiation / IR / heat

against the theory:
- in some years (e.g. 1960–1977) temperature falls (while CO_2 is rising)
- many (large and small) erratic rises and falls in temperature
- overall correlation does not necessarily mean a causal link
- other (unknown) factors may be involved in temperature change

to access level 2 there must be evidence both for and against the theory **and** use of data from the graph

(d) burning of (fossil) fuels

> *allow e.g. coal / oil / gas*
> *allow driving cars*
> *allow any activity which leads to burning fuels −*
> *e.g. using central heating*
>
> *ignore power stations unqualified*
> *ignore burning / fires unqualified*
> *ignore deforestation*

1

(e) photosynthesis

> *allow full description or full equation*
> *allow a symbol equation which is not balanced*

1

(f) any **two** from:
  • (some) plants grow faster / higher yield
  • loss of habitat
  • migration **or** change in distribution*
  • extinction*

> **if neither is given allow alters biodiversity for **1**
> mark*
>
> *allow (in terms of extinction) death due to e.g.*
> *lack of water / food or increased disease*
>
> *ignore death unqualified*

2

> *allow points made using examples*

[11]

Q2.

(a) (i) insulin

> *accept glucagon (correct spelling only)*

1

(ii) pancreas

> *accept phonetic spelling*
> *allow pancrease*

1

(b) (i) 11(.0)

> *accept in range 10.5-11 (.0)*

1

(ii) any **two** from:

> *ignore numbers unless comparative*

  • high(er) concentration (of blood glucose) (anywhere / any time)

> *accept 115 not 88*
> *   139 not 99*

- large(r) increase (in concentration after the drink)

  accept increase by 24 not 11 / their b(i)

- fast(er) / steep(er) rise

  accept it takes 3 hours not 1 ¼ hours to get back to original level

  accept it takes a long time to get back to normal

- slow(er) fall

2

(iii) any **one** from:

- insulin present / produced

  accept glucagon not produced

- (used in) respiration

  allow exercise

- taken into cells

  allow converted to glycogen

  allow taken into liver (cells) / muscle (cells)

  allow produce / make energy

1

[6]

Q3.

(a) receptors detect / sense stimuli / change in surroundings **or** convert stimulus into an impulse

  ignore send impulses to brain / spinal cord

1

example of a receptor

  allow any appropriate organ or part of an organ, eg eye / retina or named type of receptor eg light receptor

1

effectors allow / make response **or** convert an impulse to an action

  ignore receive impulses from brain / spinal cord

1

(effector) muscle / gland

  allow an example

  ignore eg arm / leg

1

(b) (i) junction

  allow idea of a (small) gap / space

  *do **not** allow if implication is that the neurones move*

1

between neuron(e)s

allow named types of neurones

1

    (ii)   chemical

allow answers in terms of specific types of neurone

allow neurotransmitter / named neurotransmitter released

1

any **one** from:
- (chemical released) from one neurone
  ignore produced
- (chemical) passes (across synapse) to next neurone to stimulate / cause (electrical) impulse
  allow diffuses for passes (across)

1

(c)   (i)   skin

ignore hand / leg

1

    (ii)   1.6 (cm per millisecond)

allow 2 if evidence of rounding up of 1.6

1

    (iii)   any **two** from:
  ignore length of neurones
- synapses slow down transmission / impulse
  allow idea of movement of chemical being slower than electrical impulse
- fewer synapses (via brain)
  *allow one synapse compared to two **or** only one synapse*
- (therefore) fewer delays
  allow impulse travels more slowly in relay neurones

2

[12]

Q4.

(a)   2400 **and** 2280
or
500 **and** 380

1

120

1

*an answer of 120 scores **2** marks*

(b)   respiration of glucose

1

(c)   (more) sweating

ignore reference to vasodilation /

vasoconstriction

1

(because) exercise releases heat
or
need to cool the body
or
need to lose heat
or
need to maintain body temperature

*do **not** accept energy being produced*

1

(d)   more energy needed

*do **not** accept energy production*
*do **not** accept energy needed for respiration*

1

(so) more (aerobic) respiration

1

(so) increased breathing (rate / depth) (to supply oxygen **or** remove carbon dioxide / water)

1

'more' does not need to be stated a second time
to gain marking point 1 and marking point 2

[8]

Q5.

(a)   methane is produced

ignore bad smell

1

which is a greenhouse gas / causes global warming

1

(b)   (9.80 / 0.20 = 49 therefore) 49:1

1

(c)   horse (manure)

*allow ecf from **11.2***

closest to 25:1 (ratio)

1

(d)   **Level 3 (5–6 marks):**
A detailed and coherent explanation is given, which logically links how carbon is released from dead leaves and how carbon is taken up by a plant then used in growth.

Level 2 (3–4 marks):
A description of how carbon is released from dead leaves and how carbon is taken up
by a plant, with attempts at relevant explanation, but linking is not clear.

Level 1 (1–2 marks):
Simple statements are made, but no attempt to link to explanations.

0 marks:
No relevant content.

Indicative content

statements:
- (carbon compounds in) dead leaves are broken down by microorganisms / decomposers / bacteria / fungi
- photosynthesis uses carbon dioxide

explanations:
- (microorganisms) respire
- (and) release the carbon from the leaves as carbon dioxide
- plants take in the carbon dioxide released to use in photosynthesis to produce glucose

use of carbon in growth:
- glucose produced in photosynthesis is used to make amino acids / proteins / cellulose
- (which are) required for the growth of new leaves

6

(e)   any **three** from:
(storage conditions)
- (at) higher temperature / hotter
- (had) more oxygen
- (had) more water / moisture
- (contained) more microorganisms (that cause decay)
    allow reference to bacteria / fungi / mould

3

[13]

Q6.
(a)   there is an uneven distribution of dandelions
or
(more) representative / valid
or
avoid bias
or
more accurate / precise mean
    ignore accurate / precise unqualified
    ignore repeatability / reproducibility / reliability / fair test

1

(b)   (correct mean per m² =) 6 or 6.0

1

(correct field area =) 55 000 (m²)

1

mean × area − e.g. 6(.0) × 55 000

allow incorrect calculated values for mean and / or field area

1

330 000

allow correct calculation from previous calculation

1

$3.3 × 10^5$

allow calculated value in standard form

an answer of $3.3 × 10^5$ scores 5 marks
an answer of 330 000 scores 4 marks

1

(c) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5−6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3−4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1−2

No relevant content

0

Indicative content

- placing of quadrat
- large number of quadrats used
- how randomness achieved − e.g. table of random numbers **or** random number button on calculator **or** along transect
- quadrats placed at coordinates **or** regular intervals along transect
- in each of two areas of different light intensities **or** transect running through areas of different light intensity
- for each quadrat count number of dandelions
- for each quadrat measure light intensity
- compare data from different light intensity

to access **level 3** the key ideas of using a large number of quadrats randomly, or along a transect, and counting the number of dandelions in areas of differing light intensity need to be given to produce a valid outcome

(d) any **two** from:
- temperature
  allow heat

- water

allow moisture / rain

- (soil) pH
    allow acidity

- minerals / ions
    *allow e.g. magnesium ions **or** nitrate*
    allow salts / nutrients

- winds
- herbivores
    allow trampling
    ignore carbon dioxide
    ignore space
    ignore competition unqualified
    *do **not** accept oxygen*

2

[14]

Q7.

(a)

	statement is true for		
	mitosis only	meiosis only	both mitosis and meiosis
all cells produced are genetically identical	✓		
in humans, at the end of cell division each cell contains 23 chromosomes		✓	
involves DNA replication			✓

*3 correct = **2** marks*
*2 correct = **1** mark*
*0 or 1 correct = **0** marks*

2

(b) any **two** from:

ignore references to one parent only

- many offspring produced
- takes less time
    allow asexual is faster

- (more) energy efficient
- genetically identical offspring

> *allow offspring are clones*

- successful traits propagated / maintained / passed on (due to offspring being genetically identical)
- no transfer of gametes or seed dispersal

  > *allow no vulnerable embryo stage*
  > *allow no need for animals*

- not wasteful of flowers / pollen / seeds
- colonisation of local area

  > *must imply local area*

2

(c) genetic variation (in offspring)

1

(so) better adapted survive

> *allow reference to natural selection or survival of the fittest*

1

(and) colonise new areas by seed dispersal
or
can escape adverse event in original area (by living in new area)

> *must imply new area*

1

many offspring **so** higher probability some will survive

1

> *allow bluebell example described (**max 3** if not bluebell)*

[8]

Q8.

(a) to prevent water affecting the direction of root growth

1

(b) gravity acts evenly on all sides

> *allow cancel out the effect of gravity*
> *do **not** accept there is no gravity*

1

(c) (mean) includes the (anomalous) result for seedling 4

> *allow (mean) includes the (anomalous) result which only grew 1 mm*

1

(d) calculate (mean) from just seedlings 1, 2, 3 and 5
or
repeat the investigation **and** recalculate (a new mean)

> *allow omit seedling 4 from (mean) calculation*

1

(e)   uneven distribution of hormone in (root / seedling of) A

allow reference to auxin

allow more hormone at bottom

*do **not** accept more hormone at the top*

1

even distribution of hormone in B

allow B does not have an uneven distribution of hormone

1

(so) top grows fast(er) (than bottom) in (root / seedling of) A (and equal growth in B)

allow (more) cell elongation or cell division on top of A

allow converse for lower surface

1

(f)
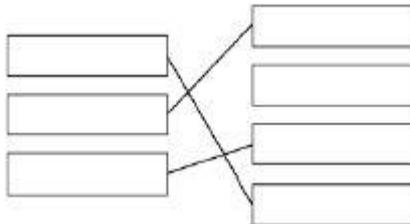
extra line for a hormone cancels mark for that hormone

1
1
1

[10]

Q9.

(a)   3.7

1

(b)   2

1

(c)   (different combinations of alleles cause) many / 22 values

allow continuous variation

or
in-between values
or
large range of values
or
there are not only two values

*allow there are not only 3 values if 3 is given in part **(b)***

1

(d)   different protein made

> *allow change in shape (of enzyme) or change in 3-D structure*
> *ignore denature*

1

active site changed

1

so substrate does not fit / bind

> *allow description of substrate*
> *allow cannot form E-S complex*
> *ignore lock and key description*

1

(e)   produces (some) offspring with high-fat milk
or
not all offspring have low-fat milk

> *ignore reference to alleles*

1

(f)   takes less time (to obtain results)
or
more offspring at the same time

> *allow other sensible suggestion − e.g. allows screening **or** allow cow 7 to continue to produce eggs **o**r avoid injury to cow 7 during mating or giving birth*

1

(g)   male gametes correct: d (and d)

1

female gametes correct: D and d

> *allow **1** mark if gametes are correct but gender not identified*

1

correct derivation of offspring genotypes from given gametes

> *allow 2 × 2 **or** 2 × 1 derivation*

1

Dd identified as low-fat **and** dd identified as high-fat in offspring

> *if DD offspring are produced, must also identify as low-fat*

1

(h)   find female with low(est) fat in milk **and** high(est) milk yield

> *allow choose from 7, 9, 12, 13 which has the highest yield*

1

find male whose female offspring have high(est) milk yield **and** low(est) fat in milk

allow choose from 16 or 18 whose female
offspring has the highest yield

1

or

find female with lowest fat in milk
or cow 13 (1)*

*or
allow female with high(est) milk yield

find male whose female offspring have high(est) milk yield (1)*

*or
allow male whose female offspring have lowest
fat in milk / male 16

cross the best (for both features) female with the best male

1

select best offspring (for both features) from each generation and repeat for
several generations

1

[16]