AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.6.2 VARIATION AND EVOLUTION (PACK 1)

SCORE	PERCENTAGE
/302	%

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Q1.

(a) (organism) soft-bodied

allow lack hard parts / skeleton / shell

allow (organism) eaten / decayed

or

(fossil) destroyed

allow buried (very) deep
allow they are (very) small

1

(b) any **two** from:

- the fish (dies) buried in sediment / sand / mud

  allow other examples of sediments
  *do **not** accept rock(s)*

- (only) the soft parts decayed / eaten **or** the hard parts / bones did not decay or were not eaten

- mineralisation occurred

  allow description of mineralisation e.g. bones turned to stone
  allow imprinted (in the sediment)

2

(c) any **two** from:

ignore pollution

- drought
- ice age / global warming
- volcanic activity

  allow earthquakes / tsunami

- asteroid / meteor collision
- (new) predators

  allow hunters / poachers
  allow eaten

- (new) disease / named pathogen
- competition for food

  allow lack of food

- competition for mates

  allow isolation or lack of mates

- lack of habitat or habitat change

  *if no other marks awarded allow natural disaster / climate change / weather change / catastrophic event / environmental change for **1** mark*

2

(d) a change in a gene

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1

(e) there is variation (between members of a species)

allow mutation

1

better adapted survive

allow 'survival of the fittest'

1

(reproduce and) pass on (favourable) allele(s) / gene(s) / mutation(s) / DNA / genetic material

ignore pass on characteristic(s)

1

allow in terms of an example

[9]

Q2.

(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)

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- 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]

Q3.

(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

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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

1

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

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

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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]

Q4.

(a)

Classification group	Name
Class	*Mammalia*
Order	*Primates*
Family	*Lemuroidea*
Species	*catta*

*all 4 correct = **2** marks*
*2 or 3 correct = **1** mark*
*0 or 1 correct = **0** marks*

2

(b) Lemur catta

ignore capitalisation / non-capitalisation of initial letters
ignore italics / non-italics
ignore underlining / non-underlining

1

(c) carried by (favourable) currents on masses of vegetation

allow description of currents from Figure 2
ignore swimming

1

(d) isolation of different populations

1

habitat variation between lemur populations

allow examples − biotic (e.g. food / predators) or abiotic (e.g. temperature)

1

genetic variation or mutation (in each population)

1

better adapted survive (reproduce) **and** pass on (favourable) allele(s) to offspring

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*allow natural selection **or** survival of the fittest*
***and** pass on (favourable) allele(s) to offspring*
allow gene(s) / mutation as an alternative to allele(s)

1

(eventually) cannot produce fertile offspring with other populations

allow cannot reproduce 'successfully' with other populations

ignore cannot reproduce unqualified

1

[9]

Q5.

(a) (molecules are) (too) large

1

cannot pass through (filtration) membrane / (holes in) filter
allow 'is not filtered out of the blood'

1

(b) glucose is reabsorbed

ignore 'is absorbed' unless qualified by 'into blood'

1

<u>all</u> of it

1

(c) (molecules / ions) small so pass through filter
or
not all is reabsorbed

allow the body needs to maintain the right balance of ions and urea in the blood

ignore 'are filtered' unqualified

1

more water reabsorbed on a hot day

1

due to more water lost in sweat

'more' needed at least once to gain both marks

1

(d) **Level 3 (5-6 marks):**
A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

Level 2 (3-4 marks):
A judgement, supported by some relevant reasons is given.

Level 1 (1-2 marks):
Relevant points are made. If there is a judgement, this is asserted, but not logically linked to the points made.

No relevant content (0 marks)

Indicative content

pro transplant:

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- (dialysis requires repeated treatments to prevent) build-up of toxins
  or
  to prevent raised blood pressure between sessions
- inconvenience of dialysis, e.g. long sessions of immobility **or** repeated hospital visits
- (dialysis requires restricted diet) to prevent build-up of urea / ions
- there is a greater risk of infection with dialysis e.g. repeated puncturing of skin **or** use of non-sterile equipment allows entry of microorganisms
- there is a risk of blood clots with dialysis
- dialysis more expensive in the long term / 2+ years
  or
  examples given e.g. 2 yrs dialysis = £60 000 compared with 2 yrs after transplant
  = (£51 000 + £5 000) = £56 000
- transplant is a long term treatment **or** may remain healthy for many years

con transplant:
- shortage of kidney donors leading to long waiting time
- requires death of another person **or** live donation leaving a person with just one kidney
- exploitation of poor people for donor kidneys (paying for organs)
- need to match tissue type
- rejection – role of wbcs / lymphocytes
- need immunosuppressant drugs – susceptibility to infection
- dangers of surgery – physical damage / infection / brain damage from anaesthetic
- high initial cost – limited funding (either personal or NHS / CCG)

[13]

Q6.

(a) less sweating so less water loss

1

(as) no / little water available in desert

1

(b) (fat store) can be metabolised / respired to water

1

(little urine…) conserve water

1

(hard mouth) not damaged by spines on plants / on food
or
not damaged by hard / dry food

1

(c) dromedary / *C.dromedarius*
and bactrian / *C. bactrianus*
no mark for the names, but must be identified
because
same genus
ignore 'both are Camelus'

1

(d) any **two** from:

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- the fossil record
- oldest fossils in N. America
  or
- newer fossils in S. America / in Asia / in Africa

  *allow numbers for ages (45 Mya **and** 3 Mya / 6 Mya)*

- chemical / DNA analysis of living species

  allow radioactive dating of fossils

2

(e) isolation of separate camel populations by sea
or
by mountains

1

habitat variation / described between populations

allow examples – biotic (e.g. food / predators) or abiotic

1

genetic variation / mutation in each population

1

45 million years is sufficient time to accumulate enough mutations

1

natural selection
or
better adapted survive to reproduce

1

pass on favourable allele(s)

allow gene(s)

1

[14]

Q7.

(a) white blood cells have the same DNA / genes / chromosomes
or
have the gene for GH

allow have all the genes

allow all body cells (except RBCs) have all of the genes

1

(b) enzyme has specifically-shaped <u>active site</u>

1

the 2 antibiotic resistance genes have different (sequence of) <u>bases</u>

1

only Tetracycline-resistance gene fits (active site of) enzyme
or
only Tetracycline-resistance gene is complementary to (active site of) enzyme

1

(c)

Ampicillin	Tetracycline

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✔	✖
✖	✖
✔	✔

1 *mark for each correct row*
if no other mark, allow ***1*** *mark for one correct column*

1
1
1

(d) clone produced by asexual reproduction
allow by 'mitosis'

1

all DNA / all genes are copied
allow GH gene copied
allow plasmid copied

1

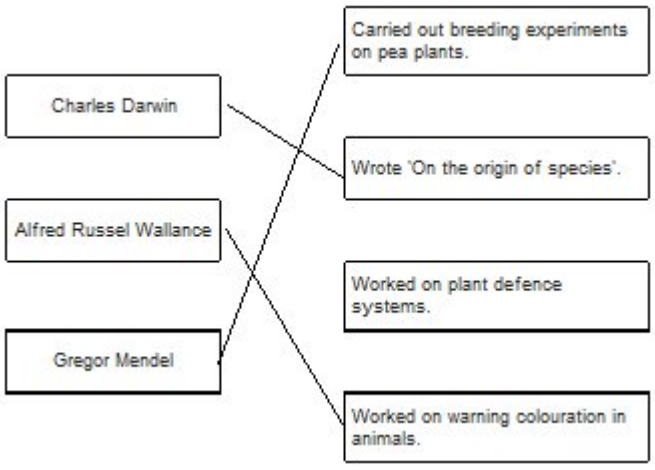
every cell receives a copy
or
receives every gene
or
receives GH gene
or
receives plasmid
or
genetically-identical cells

1

[10]

Q8.

(a)



3

(b) a gene
allow allele

1

(c) 4

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1

(d) correct derivation of children's genotypes

1

identification of children with cystic fibrosis (dd)

1

0.25

allow ecf

allow ¼ / 25% / 1 in 4 / 1:3

1

*do **not** accept 1:4*

(e) heterozygous

1

[9]

Q9.

(a) (Jean Baptiste) Lamarck

allow phonetic spelling

1

(b) (snake is) covered in sediment / mud
or
sinks into the mud

1

(then) the soft parts decay / are eaten
or
bones / hard parts do not decay

1

(so) minerals enter bones
or
bones are replaced by minerals

1

(c) **Level 3 (3–4 marks):**
A detailed and coherent explanation is provided. Logical links between clearly identified, relevant points explain how the rat snake evolved through the process of natural
selection.

Level 2 (1–2 marks):
Simple statements made, but not precisely. The logic is unclear.

0 marks:
No relevant content.

Indicative content

statements:

- there are lots of different colours of snakes
- some shades of green are closer to the colour of the environment (in Japan) than others
- survivors (in each generation) will breed and produce offspring

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explanations:
- different colours are controlled by different genes / alleles / are caused by mutations
- being green means they are best suited to grassy / green environments
- being green means they are camouflaged
- those that are camouflaged best will be able to catch more food
- those that are camouflaged best will be able to avoid being eaten
- survivors' offspring will inherit the genes / alleles / mutation for the shade of green colouration

additional examiner guidance:
- allow converse points relating to the Texas rat snake if they clearly identify the reasons why this snake was at an evolutionary disadvantage, ie more likely to be caught and eaten by a predator
- a good level 2 answer will clearly link survival and breeding to the passing on of the advantageous genes / alleles / mutations and link the idea of colour (AO2) to a correct explanation of its significance for survival

4

(d) any **one** from:
- changes to the environment
- new predators
- new diseases
- new (more successful) competitors
- catastrophic event / described event

1

[9]

Q10.

(a) any **two** from:
- so that they do not have specific genetic defects
- to produce docile cats or so they are not aggressive

  allow descriptions of aggression such as biting and scratching
- for aesthetic reasons

  allow descriptions of suitable aesthetic reasons

2

(b) (cats) are more likely to pass on (recessive) disorders
or
more likely to be susceptible to diseases

1

(c) **Level 2 (3–4 marks):**
A detailed and coherent explanation is given, which logically links the process of selective breeding with explanations of how this produces cats that do not cause allergic reactions.

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

0 marks:
No relevant content.

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Indicative content

process:
- parents with the desired characteristic are selected
- the parents are bred together to produce offspring
- offspring with the desired characteristics are selected and bred
- this is repeated over many generations.

explanations:
- parents who produce the least Fel D1 are initially selected
- in their offspring there will be individuals with differing amounts of Fel D1 produced
- care is taken to ensure cats are healthy and avoid possible problems associated with selective breeding
- over time the population of (selectively bred) cats will produce less Fel D1

4

[7]

Q11.

(a) three billion

1

(b) mutation(s)

1

breed / reproduce

in this order only

allow pass on their genes

1

[3]

Q12.

(a) any **two** from:
- larger / longer / thicker
  *allow examples eg fewer toes **or** bones fused*
- fewer (bones in total)
  allow smaller surface area touching the ground
- fewer bones touching the ground

2

(b) (i) large(r) surface / area in contact with the ground

or

low / less pressure on ground

1

(so) less likely to sink into mud / ground

or

(so) could run fast(er)

allow easy / easier to escape predators

1

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(ii) variation (in size / number / arrangement of bones)

allow mutation(s) (in size / number / arrangement of bones)

1

(and) those with large(r) / few(er) bones more suited to running **or** run faster (on harder / drier ground)

1

these survive **and** breed

allow ref to offspring for breed

1

(so) genes / DNA (for larger / fewer bones) passed on

allow alleles passed on

1

[8]

Q13.

(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

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- 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]

Q14.

(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

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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]

Q15.

(a) reference to interbreeding

1

successfully between Island types

allow ref. to production of fertile offspring

allow ref. to DNA analysis / comparison for 1 mark

ignore ref. to grey fox

1

(b) (i) (two ancestral populations) separated / isolated (by geographical barrier / sea)

1

and genetic variation (in each population) **or** different / new alleles **or** mutations occur

1

under different environment / conditions

allow abiotic or biotic example

allow different selection pressures

1

natural selection occurs **or** better adapted survived to reproduce

1

so (favourable) alleles / genes / mutations passed on (in each population)

ignore they adapt to their environment

1

(ii) any **one** from:

- continued to mate with one another
- few beneficial mutations (between island varieties)
- similar conditions on each island so similar adaptations/features fit

1

[8]

Q16.

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(a) organisms that reproduce together to form fertile offspring

1

(b) (i) fossils of **P** and **Q** in same stratum / layer / level / height

1

(ii) earlier − fossil in deeper layer / further down

1

(iii) the fossils of animals **S** and **T** have many features in common, but **T** is more complex that **S**

1

the fossil of animal **S** was found in a deeper layer of rock than the fossil of animal **T**

1

(c) (i) **X** has white tail / shorter tail

*allow other points eg **X** has furrier tail / smaller feet / is furrier*

or

***W** has sharper claws / **W** has larger claws*

1

(ii) two (ancestral) populations separated / isolated (by geographical barrier / by canyon / river)

1

genetic variation (in each population) / different alleles / different genotypes / (different) mutation(s)

1

different environmental conditions / example described

allow abiotic or biotic example

1

the better adapted survive / natural selection occurs

allow survival of the fittest
ignore they adapt to the environment

1

so (different / favourable) alleles / genes passed on (in each population)

1

eventually two types cannot interbreed successfully

allow to produce fertile offspring

1

(iii) any **two** from:

- environments similar / described
  allow example, e.g. similar predator(s) / food / climate
- therefore similar adaptations / features / phenotypes suit
  accept suitable named feature
- original ancestor already well adapted
  ignore reference to not enough time for evolution.

2

[14]

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Q17.

(a) kills weeds among crops / does not kill crops

1

(kills weeds) so less competition for <u>named</u> factor eg light / water / ions

ignore space

1

crops grow better / higher yield

1

(b) (i) plasmid

1

(ii) use an enzyme

allow correct example

1

(iii) only some cells become GM / take up the plasmid / take up resistance gene

allow idea of transfer of gene / plasmid to some plant cells from bacteria

1

GM cells survive / non-GM cells are killed

1

(c) Pro:
(positive) correlation between use of glyphosate and number of cases of kidney disease

*allow **1** mark for justified conclusion that the claim is not justified*

1

+ any **three** from:
Con:

- lack of controls / control group
- correlation does not prove a causal link
- some other factor could be the cause

  accept obesity / infection
- no evidence that kidney patients actually consumed GM crops / crops treated with glyphosate / no evidence about amount consumed
  or graph shows amount of herbicide not amount of GM crops grown
  or graph shows data only for maize and soya / not for other (GM) crops
- data have been manipulated by carefully chosen scales to make it look like they coincide
- data from some years is missing
- no data for the dosage of herbicide used

  allow kidney disease has been around for much longer than GM crops / better diagnosis of kidney disease.

3

[11]

Q18.

(a) Taking cuttings from plants

1

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(b) (i) Adult cell cloning

1

(ii) an egg cell

1

(iii) nucleus

1

(iv) an electric shock

1

(v) uterus / womb

accept phonetic spelling

1

(c) any **two** from:

- unethical / immoral

  allow 'rights' of the cloned child

  allow against religious teachings
- cloned child would have to give up a kidney
- possible operation complications.

  allow illegal

  allow parents may not want another child

  allow a long time to wait (for the kidney)

2

[8]

Q19.

(a) selection

1

(b) (i) 4

1

(ii) ground finch / lives on the ground

1

(only) eats seeds

*allow eg eats seeds on / from the ground for **2** marks*

1

(c) Lamarck

1

[5]

Q20.

(a) part of a chromosome

allow piece of DNA

allow parts of chromosomes

1

controls a characteristic

allow controls characteristics

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*allow codes for (**or** controls production of) protein / enzyme*
ignore examples of characteristics

1

(b) (iPS method)

*max **3** similarities or differences*
allow converse if clearly referring to adult cell cloning

similarities

- (both) use of skin / body cell
- (both) ref to (formation of) embryo
- (both) transfer (embryo) into womb / uterus
- (both) use surrogate mothers

differences

- (iPS) uses sexual reproduction
  *allow ref to egg **and** sperm **or** gametes **or** fertilisation*
- (iPS) surrogate mother is different species
- (iPS) no nucleus transfer / removal
- (iPS) offspring genetically different from parent
  allow not a clone
- (iPS) no electric shock

4

(c) any **one** from:

- idea of retaining biodiversity
- may be (economically) useful (in the future)
- idea of maintaining food chain / ecosystem

1

[7]

Q21.

(a) (i) nucleus

correct spelling only
accept mitochondrion
ignore genes / genetic material / chromosomes

1

(ii) base(s)

Accept all four correct names of bases
ignore nucleotides and refs to organic / N-containing

1

(iii) 4

1

(iv) codes for sequence / order of amino acids

ignore references to characteristics

1

codes for a (specific) protein / enzyme

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or

the sequence / order of <u>three</u> bases / compounds / letters

codes for a specific amino acid

or

the sequence / order of 3 bases / compounds / letters

codes for the order / sequence of amino acids

1

(b) (i) DNA

1

circular / a ring **or** a vector / described

1

(ii) kills any cells not having **kan**^{r} gene / so only cells with **kan**^{r} gene survive

1

hence surviving cells will also contain **Bt** gene / plasmid

1

(iii) cells divide by <u>mitosis</u>

ignore ref to asexual reproduction

correct spelling only

1

genetic information is copied / each cell receives a copy of (all) the gene(s) / all cells produced are genetically identical / form a clone

1

(iv) any **two** from:

- gene may be passed to pathogenic bacteria
- cannot then kill these pathogens with kanamycin
  or
  cannot treat disease with kanamycin
- may need to develop new antibiotics
- gene may get into other organisms
- outcome unpredictable

2

[13]

Q22.

(a) any **two** from:

- most people still believed that God made all the animals / plants on Earth

  allow against their 'religion'
- insufficient evidence

  do not allow no proof / evidence

  ignore 'fossil'
- the mechanism of inheritance / genes unknown (at the time)

2

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(b) any **four** from:

- finches separated / isolated
- genetic variation / mutation (in finch population(s))
- finches with alleles / genes best suited to their environment survive

  Do not allow 'characteristics'
- advantageous alleles / genes passed on (to offspring)
- after many generations / a long time, the populations can no longer successfully interbreed

  Ignore 'speciation'

4

(c) (i) vegetarian finch

1

(ii) **R**

1

(iii) mangrove **and** woodpecker finches

1

[9]

Q23.

(a) (i) gamete(s)

ignore reproductive cells

1

(ii) womb / uterus

allow phonetic spellings

1

(b) (i) are formed from the same original embryo

1

(ii) embryo transplantation

1

(iii) any **one** from:

- (calves will have some) genes / DNA from bull / sperm

  allow not all genes from the cow
- idea that sexual reproduction produces variation

  allow may be male

  allow idea that gene for low fat milk may not be passed on

1

[5]

Q24.

(a) (i) (volume) increases (with time)

ignore numbers

1

(ii) there is more evidence / specimens / results (for Homo sapiens)

allow examples of this, eg more / better fossils

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allow converse if clearly referring to Australopithecus
ignore reference to being 'more recent'

1

(b) 2.5 – 3.15 (million years ago)
accept any number in range

1

(c) (i) Darwin

1

(ii) any **one** from:

- they believed in other theories
  allow they believed that God made all life
- insufficient evidence
  ignore 'no evidence'
- no proof
  allow not enough proof
- genes / mechanism of inheritance not known / discovered

1

[5]

Q25.

(a) (i) variation (in population) / mutation

1

longer nosed individuals get more food / leaves
allow longer nosed individuals more likely to survive

1

(these) survivors breed (more)

1

pass on genes / alleles / DNA (for long nose)
allow pass on mutation

1

(ii) Phiomia / ancestor stretched its nose (during its lifetime) to reach food / leaves

1

passed on (stretched nose) to offspring
allow offspring inherit (stretched nose)
*do **not** allow ref to genes*

1

(b) (i) insufficient evidence / no proof
ignore other theories, eg religion
*do **not** allow no evidence*

1

mechanism of inheritance not known
allow genes / DNA not discovered

1

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(ii) God made all living things / them

allow creationism

ignore religion

1

[9]

Q26.

(a) lack of fossils / fossils destroyed

allow lack of evidence

1

(due to soft parts) decaying / geological activity

allow an example – eg vulcanism or earth movements or erosion

allow converse points re skeletons, shells, hard parts

1

(b) (i) **A** and **B** did not mate successfully

*'**A** and **B** did not mate' insufficient*

allow did not produce fertile offspring

1

(ii) any **two** from:

- may not be mating season
- **A** and **B** may not find each other attractive
- this is just a one-off attempt / an anomaly / need repeats
- may be juvenile / immature
- may be the same sex

allow other sensible suggestion eg were put in unfavourable environment or one / both could be infertile

2

(c) 1. (two ancestral populations) separated (by geographical barrier / by land) / were isolated

1

2. genetic variation (in each population) **or** different / new alleles **or** mutations occur

1

3. different environment / conditions

allow abiotic or biotic example

1

4. natural selection occurs **or** some phenotypes survived **or** some genotypes survived

1

5. (favourable) alleles / genes / mutations passed on (in each population)

1

6. eventually two types cannot interbreed successfully

allow eventually cannot produce fertile offspring

1

[11]

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Q27.

(a) (i) natural

1

(ii) simple

1

(iii) three billion

1

(b) any **two** from:

- reference to religion
- insufficient evidence / couldn't prove it / no proof
  ignore no evidence
- mechanism of inheritance / variation not known
  allow genes / DNA not known about
- reference to other theories
- reference to Darwin's status

2

(c) (i) tree

1

(ii) hippopotamus **and** pig
both required, either order
allow hippo

1

(iii) new evidence from fossils

1

[8]

Q28.

(a) any correct named physical environmental condition, e.g. light / water / rain / temperature / minerals / nutrients / space (between plants)
ignore carbon dioxide / climate / weather / sun / pollution

1

genes / inheritance
ignore 'variety'

OR

any correct named biotic factor e.g. predation / disease

1

(b) mass of crop also depends on number of pods (per plant) / size / mass of each pea
ignore number of plants

1

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(c) microorganisms / bacteria / fungi / decomposers / detritus feeders / named

1

decompose / rot / break down / decay / digest

ignore feed / eat

1

(these organisms) respire

*do **not** allow respiration by pea (plants)*

1

(decay / respiration / microorganisms etc) releases carbon dioxide

*do **not** allow combustion / fossilisation*

1

[7]

Q29.

(a) organisms that can breed together

accept converse points re. 2 different species

1

successfully

accept produces fertile offspring

1

(b) any **two** from:
(live at)

- different pH of soil
- different height above sea level
- different flowering times

2

AND

genetic variation / mutation / different alleles (produced in isolated populations)

1

natural selection acts differently on the two populations

or different characteristics in the two populations survive

or different alleles passed on in the two groups

1

eventually resulting in interbreeding no longer possible

1

[7]

Q30.

(a) genes

1

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chromosomes

1

(b) (i) higher yield

1

less use of pesticides

1

(ii) any **two** from:

- uncertain about effects on health
- fewer bees
- might breed with wild plant
- seeds only from one manufacturer

2

[6]

Q31.

(a) wing pattern similar to *Amauris*
allow looks similar to Amauris

1

birds assume it will have an unpleasant taste

1

(b) mutation / variation produced wing pattern similar to *Amauris*
*do **not** accept breeds with Amauris*
*do **not** accept idea of intentional adaptation*

1

these butterflies not eaten (by birds)

1

these butterflies breed **or** their genes are passed to the next generation

1

[5]

Q32.

(a) (use of) enzymes

1

(b) asexual reproduction / no gametes / no fusion / only one parent
ignore clones

1

cells all contain same genetic information / same genes (as parent) / same DNA

1

(c) can spray crop with herbicide – only weeds killed
crop survives herbicide insufficient

1

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(d) any **one** from:

allow 'think that GM food is bad for health'

- fears / lack of knowledge about effects of GM food on health

  ignore not natural or against religion

- crop plants may pass on gene to wild plants
- encourages use of herbicides

1

[5]

Q33.

(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]

Q34.

(a) sexual reproduction

1

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(b) (i) genes

1

(ii) gametes

1

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

answers must be comparative

- more meat (per cow)
  ignore bigger unqualified
- more milk each day
- can be milked for more time after giving birth / greater proportion of time
  *accept '(produce) more milk', for **1** mark, if neither more milk each day nor can be milked for more time after giving birth are given*

2

(ii) (milk contains) more protein

answers must be comparative

1

less time before having a calf when no milk produced

1

(d) (i) genes from one organism are transferred to a different organism

1

(ii) (possible) harm to babies' long term health

allow don't know long-term / side effects (on baby)

accept idea that there may be other things in (genetically engineered) cow's milk that might harm babies' health e.g. bacteria

ignore ethical / religious arguments

1

[9]

Q35.

(a) Lamarck

ignore any first name(s)

1

(b) (i) variation / range of sword lengths (in ancestors)

accept mutation produced longer sword

1

those with long swords get more food

accept those with short swords get less food

1

swordfish (with long swords) survive **and** breed

allow have offspring for breed

1

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(survivors) pass on gene(s) / allele(s) (for long sword)
allow mutation for gene(s) / allele(s)

1

(ii) any **one** from:

- more evidence (now)
  accept examples of evidence, e.g. more fossils
- DNA / genes / mechanism of inheritance discovered
  allow Lamarck's theory has been disproved
  ignore religious arguments
  ignore proof

1

[6]

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