AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.6.2 VARIATION AND EVOLUTION (PACK 3)

SCORE	PERCENTAGE
/234	%

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Q1.

(a) genes

1

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]

Q2.

(a) any **four** from:

- mutation / variation
- produces smaller wings / fatter body
  must be linked to mutation / variation
- wings no longer an advantage since no predators
  allow wings / flight not needed as no predators
- wings no longer an advantage since food on ground
  allow wings / flight not needed as food on ground
- fatter body can store more energy when fruit scarce
- successful birds breed / pass on genes

4

(b) any **one** from:

- evidence has all gone
- no scientists on island at time to record evidence
- no records (from sailors)

1

[5]

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Q3.

(a) (i) chromosomes

allow DNA

ignore nucleus

1

(ii) 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

(d) any **one** from:

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

  allow 'think that GM food is bad for health'

  *ignore not natural **or** against religion*

- crop plants may pass on gene to wild plants

- encourages use of herbicides

1

[6]

Q4.

(a) any **two** from:

accept other logical / reasonable ideas

- other scientists not aware of his work

- chromosomes / DNA / genes not seen / discovered / known

  *do **not** accept there was no interest in genetics*

- other theories accepted at the time

- not considered to be a scientist / not eminent / respected

  allow 'he was just / only a monk'

2

(b) (i) random selection

accept a method of achieving random selection
eg "take a handful"

if number given, minimum 20

1

(ii) any **one** from:

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- 1:1 / one to one
- 19:21
  accept any ratio to give correct answer, eg "50:50"
  *do **not** accept 21:19 unqualified*

1

(iii) A + a as gametes from 1st parent

1

a + a as gametes from 2nd parent
allow a alone

1

(offspring / 2nd generation) Aa aa
offspring must be derived from correct gametes

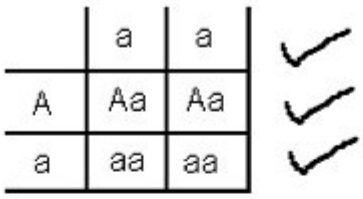
correct identification of yellow (Aa)
other symbols correctly used can gain full marks

1

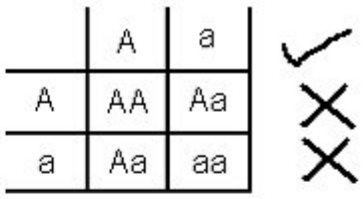
or

green (aa) (if both given, both must be correct)
ignore references to previous generations
*if no other marks awarded, both correct parental genotypes given gains **1** mark*

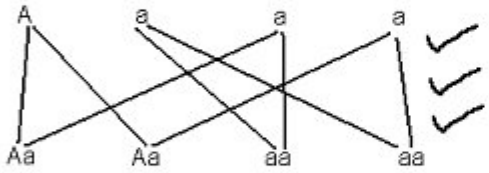
examples of award of first three marks

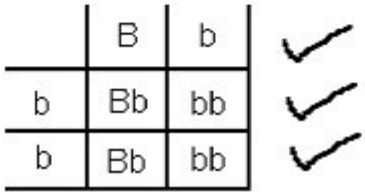


	a	a
A	Aa	Aa
a	aa	aa



	A	a
A	AA	Aa
a	Aa	aa





	B	b
b	Bb	bb
b	Bb	bb

1

[8]

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Q5.

(a) (i) 40 – 42

1

(ii) Palaeocene

1

(iii) bush babies

1

(b) any **two** from:

- religious objections
- insufficient evidence

  allow 'could not prove'
  ignore 'no evidence'
- mechanism of heredity not known

2

[5]

Q6.

any **four** from:

*max **two** marks for a Lamarck explanation*

- mutation produced a bird whose bill was crossed

  *do **not** allow birds decide to mutate*
- birds compete for <u>food</u> / <u>seeds</u>
- mutant crossbill able to obtain food faster / easier / more successfully
- selected for **or** more likely to survive
- reproduce / mate / breed / produce offspring

[4]

Q7.

(a) any **two** from:

- streamlined / shape reduces friction / long and thin / smooth surface OWTTE
- fins / flippers / tail / paddle

  *do **not** accept 'arms' or 'legs'*
- structures that push against water

2

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

fossil has hind limb / legs / feet

it = minke

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accept any valid comparison

fossil has more ribs / bones

fossil has teeth

fossil has curved spine

2

(ii) billion

1

give evidence for

1

[6]

Q8.

(a) antibodies

1

antitoxins

1

antibiotics

1

(b) any **two** from:

- measles
- mumps
- rubella / German measles

2

(c) less / low / no chance of getting named / all condition(s) if vaccinated

1

quantitative figure(s) e.g. 5 times less likely to get convulsions
must be comparative

1

(d) enzymes

1

genes

1

[9]

Q9.

(a) wing pattern similar to *Amauris*

1

birds assume it will have foul taste

1

(b) mutation / variation produced wing pattern similar to *Amauris*

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*do **not** accept breeds with Amauris*
*do **not** accept idea of intentional adaptation*

1

these butterflies survived

1

breed / genes passed to next generation

1

[5]

Q10.

(a) have identical genes / chromosomes / genetic material

1

since asexual reproduction
accept mitosis

1

(b) mixture of genes / chromosomes / genetic material from two parents
accept meiosis

1

sexual reproduction / fusion of gametes

1

(c) public misunderstand technique as cloning **or** worried about large numbers of clones **or** moral / ethical / religious issues **or** unnatural process **or** scientists must not play god **or** technique may lead to embryo death
*do **not** allow mark for embryos lost*

1

[5]

Q11.

joining

1

sexual

1

identical

1

asexual

1

clones

1

[5]

Q12.

(a) (i) 56
accept 54 – 58

1

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(ii) increased

1

reasonable qualification eg slowly then more quickly
or
to 174 / 176
or
by 138 / 140

1

(b) any **two** from:

- no immunity **or** antibodies ineffective
  accept no resistance
- no vaccines **or** humans not immunised
- idea of large scale contact **or** large scale travel
  *do **not** accept passed on*
  ignore no cure

2

[5]

Q13.

(a) asexual reproduction / mitosis
ignore cloning

or

no fusion of gametes

or

division after fusion

or

from fertilised egg

or

from same embryo

or

from same egg **and** sperm

1

each embryo has identical genetic information / genes / DNA / chromosomes

1

(b) any **two** from:

- experimental subject and control are identical
  or
  fair test since monkeys identical

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- monkeys similar to humans, so effect of drugs likely to be similar

  allow closely related so…
  ignore evolved from

- all identical so will have same reaction to drugs / disease

- it's better than catching wild ones

2

[4]

Q14.

(a) present day organisms have evolved from simpler organisms

ignore answers in terms of natural selection

1

over long periods of time
or
millions / billions of years

1

(b) (natural selection operates on successful)
characteristics produced by chance / (random) mutation

1

in this experiment caused by hormones / environment

*allow this example indicates inheritance of acquired characteristics for **2** marks*
*allow this is Lamarckism only for **1** mark*

1

[4]

Q15.

(a) **X** (no mark)

X is more visible **or Y** is more camouflaged

1

(b) (i) so camouflage not changed **or** so not easier to see

1

(ii) 25

1

7

1

(iii) any **one** from:

- eaten (by birds) / died
- mixed in with large number of unmarked moths
- moved away

1

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(c) (i) DNA

1

(ii) the gene / allele for being dark / dominant

1

[7]

Q16.

any **five** from:

- genetic variation exists in a population **or**
  variation caused by mutation / change in gene / in DNA
- larger voles have smaller $\frac{\text{S.A.}}{\text{Vol.}}$
  or have more fat
  'they' accept as larger voles
- larger voles lose less heat / are better insulated **or** more energy stored
- larger voles survive
- larger voles breed
- larger voles pass on (beneficial) gene / allele / mutation / DNA
  ignore characteristic

[5]

Q17.

(a)

Ampicillin	Tetracycline
✓	–
–	–
✓	✓

*accept blank **or** cross **or** –*
*1 st: mark by rows to maximum **3** marks*
*2 nd: if no marks by rows, mark by columns to maximum **1** mark*
*table completely blank = **0** marks*

3

(b) 1st: Yes (no mark)
*if 'no' - read on for logical argument e.g. loss of plasmid **or** gene mutation*

2nd: all formed from same original cell
must be one cell i.e. bacterium

1

by asexual reproduction / no fusion / not sexual
allow reference to 'mitosis'

1

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offspring cells are genetically identical **or**
all have a copy of the insulin gene / of the plasmid

1

[6]

Q18.

(a) (i) dark form lives in the industrialised/ densely populated areas
or
dark form lives to the East/downwind/North East of industrialised are

1

(ii) more pollution/discolouration in those areas
or
pollution blown by prevailing winds

1

(b) a **change** to the genetic material/DNA/chromosomes/genes in an organism

*do **not** accept fault. error*

1

(c) <u>survival in polluted areas:</u>

one mark for each mark point to a maximum of 4

(pollution) lichen/trees/buildings become(s) blackened

credit an answer given in terms of survival in polluted areas or non-survival in other areas

(camouflage) black formed camouflaged / more difficult to see

(predation) not preyed upon eaten by thrushes

(survival) survive to breed

<u>or non survival</u>

(no pollution) lichen/trees/buildings remain(s)pale/non-blackened

(no camouflage) black formed not camouflaged / easier to see

(predation) preyed upon/eaten by thrushes

(survival) do not survive to breed

4

[7]

Q19.

(a) long neck or legs

1

(b) change in environment **or** reaching
for food **or** stretching led to **more use**
of neck (and legs) [1]

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use led to **increased** size **or**
characteristic acquired during lifetime
[1]

this characteristic was passed to
offspring [1]

3

(c) phenotypic changes do not affect genotype **or** genes [1]

acquired characteristics are not passed to offspring **or** the offspring were bom with tails **or** inheritance has to be genetic [1]

2

(d) **one** mark awarded for each of the following general points:

variation exists in all populations **or**
mutation occurred [1]

or if written specific to giraffes:

*all giraffes are different **or** reference to short necked giraffes[1]*

4

some individuals will have an advantage in certain areas **or** will be better adapted **or** there is survival of fittest [1]

*taller giraffes **or** those with longer necks will have an advantage in being able to reach high vegetation **or** there is survival of fittest [1]*

advantaged individuals breed more **or**
are more successful [1]

*these giraffes will breed more **or** will be more successful [1]*

the genes **or** units of heredity **or** DNA
of these individuals are passed on [1] (look for idea of genetic information being passed on)

*the genes **or** units of heredity **or** DNA of these giraffes are passed on [1]*

[10]

Q20.

(a) breed (together)

accept have same number of chromosomes

*do **not** accept have the same number of genes*

1

to produce fertile offspring

1

(b) male **or** testes

accept dog

1

testes **or** male

accept testis

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*do **not** accept testicles*

1

ovary **or** ovaries

1

gametes

1

fertilisation

*do **not** accept conception*

1

fetus **or** zygote **or** embryo

*do **not** accept baby **or** puppy*

1

(c) genetic information **or** genes **or** chromosomes **or** DNA

*do **not** accept characteristics by itself*

1

(comes) **from** two parents

*accept **from** both parents*

1

[10]

Q21.

mutation or description of mutation (gives resistance to penicillin)

1

some survive (penicillin)

1

(survivors) reproduce **or** multiply

1

asexual reproduction **or** binary fission **or** cloning

accept mitosis

1

gene for resistance **or** the mutation is passed on (to offspring)

allow reference to bacteria being immune

ignore reference to survival of fittest

1

[5]

Q22.

(a) select for breeding;
the plants with the sweetest taste

each for 1 mark

2

(b) natural population has a wide range of variations;
because it has a large number of alleles;

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selective breeding reduces the number of alleles;
cloning perpetuates this reduced number of alleles

each for 1 mark

4

(c) 3 of:
reference to cuttings;
reference to tissue culture;
reference to hormones;
cloning

each for 1 mark

3

(d) 4 of:
cut genes for disease resistance;
from chromosomes of 'cooking banana';
introduce into chromosomes of 'ordinary banana';
tissue culture to produce disease resistant plants/clone;
enzymes cut chromosomes

each for 1 mark

4

[13]

Q23.

natural variation in amount of body hair;
in cold environment, (having genes) which produce long hair is an advantage;
because hair insulates; OWTTE
such animals more likely to survive;
and pass these genes onto succeeding generations

each for 1 mark

[5]

Q24.

(a) genes
cut from plant chromosomes
transferred to cells of other plants
at early stage of development

each for 1 mark

4

(b) use of cuttings
use of tissue culture

each for 1 mark

2

(c) 6 of: pros e.g.:
faster growing tomatoes with longer shelf life
disease-resistant crops
cons e.g.:
lack of proper field trials may have disastrous environmental consequences
example
possible effects of the altered genes on humans

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each for 1 mark

6

[12]

Q25.

advantages 2 of:
kills weeds but not cotton
higher yields of cotton
increased profits

any 2 for 1 mark each

2

disadvantages 2 of:
reduced genetic variability in ecosystem
other species of plants may become resistant to herbicide
possible devastating effect on future crop growth
effects on ecosystem on spread of herbicide resistant plants

2

any 2 for 1 mark each

evaluation anywhere = 1

for 1 mark

1

[5]

Q26.

(a) grow from parents,
by vegetative reproduction/asexual reproduction/
no sexual reproduction

for 1 mark each

2

(b) e.g. different environmental conditions/named condition

for 1 mark

1

[3]

Q27.

(a) mutation

for 1 mark

1

(b) fall,
idea that resistant beetles more likely to survive to breed,
∴ their offspring more likely to appear in the next generation

for 1 mark each

3

(c) inbreeding between resistant brothers and sister,
will produce some individuals with 2 copies of the resistance allele,
if 2 of these individuals breed all their offspring will be resistant

for 1 mark each

3

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[7]

Q28.

(a) contain the same genes, because they are formed by division of identical nucleus

for 1 mark each

2

(b) genes located in nucleus, nucleus comes from donor cells

for 1 mark each

2

(c) number of alleles in population reduced, therefore less chance of successfully breeding, to cope with changed conditions

for 1 mark each

3

[7]

Q29.

(a) quick
cheap / many can be produced from one plant
cuttings produce plants identical (to parents) / outcome known

any two for 1 mark each

2

(b) *idea that* provides damp atmosphere / less likely to wilt
reduces or stops transpiration or water loss / keeps it warmer
(*reject prevents animals eating it*)

for 1 mark

1

[3]

Q30.

(a) greater proportion of dark moths survive in polluted woods
Greater proportion of pale moths survive in unpolluted woods
% survival on underside of branch is greater in both situations

each for 1 mark

3

(b) *ideas that (please indicate in body of answer by √1, √2, √3)*
1. different sorts of moths / pale and dark moths
2. ideal of differential survival in different habitats
3. this is evidence for natural selection / survival of the fittest
or idea that feature likely to be passed on

each for 1 mark

3

[6]

Q31.

(a) *ideas that*
embryos develop from cells with sheep nuclei / chromosomes / DNA

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which contains genetic information / information for development
OR placental cells (from goat) provide only e.g. nutrition

any two for mark each

2

(b) *Max. 3 pros e.g. ideas that* avoids extinction of rare breeds
rapid method for plants large numbers with same features can be produced
preserves features produced by genetic engineering *e.g. Tracey*
maintains particular genetic strains *e.g. produced by extensive selective breeding*
reject simple idea of identical offspring unless qualified as above

any three each for one mark

3

Max. 3 cons e.g. ideas that moral / ethical objections animal 'rights'
identical individuals less adaptable to change or changing needs
reduced gene pool

any three each for one mark

3

[8]

Q32.

(a) water / damp / wet
or
suitable temperature / warm / heat / hot
or
light / sun
(*accept* rooting powder / soil qualified e.g. fine / nutrients / fertiliser / minerals)
(*do NOT allow* oxygen / carbon dioxide / food)

for 1 mark

1

(b) *advantage*
quick / cheap / several from one plant / known outcome / same as <u>parent</u>
(*reject* all the same)
disadvantage
<u>all</u> the same / all get same disease

for 1 mark each

2

[3]

Q33.

(a) chromosomes
genes (*reject* alleles)
alleles

for 1 mark each

3

(b) (i) sexual / sex

for one mark

1

(ii) egg / gamete / sex cell / ovum (*reject* ovule)

for one mark

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1

(c) (i) information / genes / DNA passed from parents (*reject* chromosomes)
for one mark

1

(ii) genes / genetic information / chromosomes from <u>two</u> parents
alleles may be different
environmental effect / named may have been mutation
any two for 1 mark each

2

[8]

Q34.

(a) (i) sexual / sex

(ii) egg / gamete / sex cell / ovum (*reject* ovule)
for 1 mark each

2

(b) (i) meiosis / reduction

(ii) mitosis / somatic
for 1 mark each

2

(c) twice as many (*reject* answers based on 23 / 46 chromosomes)
for one mark

1

(d) (i) information / genes / DNA passed from parents
(chromosomes neutral)
for one mark

1

(ii) genes / genetic information / chromosomes from two parents
<u>alleles</u> may be different
environmental effect / named may have been mutation
any two for 1 mark each

2

[8]

Q35.

(a) 550 – 650
for one mark

1

(b) skulls
preserved as fossils / measure skull volume
for 1 mark each

2

(c) range of brain size / bigger brains arose by mutation
more with large brains more likely to survive

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because more intelligent / survival advantage described
their genes passed to next generation / offspring inherited large brains

any three for 1 mark each

3

[6]

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