AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.6.3 THE DEVELOPMENT OF UNDERSTANDING OF GENETICS AND EVOLUTION (PACK 2)

SCORE	PERCENTAGE
/233	%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

(a) (i) DNA replication / copies of genetic material were made

'it' = a chromosome

allow chromosomes replicate / duplicate / are copied

ignore chromosomes divide / split / double

1

(ii) one copy of each (chromosome / chromatid / strand) to each offspring cell

ignore ref. to gametes and fertilisation

1

each offspring cell receives a complete set of / the same genetic material

allow 'so offspring (cells) are identical'

1

(b) (i) meiosis

allow mieosis as the only alternative spelling

1

(ii) Species A = 4 **and** Species B = 8

1

(iii) sum of A + B from (b)(ii) e.g. 12

1

(c) (i) similarities between chromosomes
or
similarities between flowers described

e.g. shape of petals / pattern on petals / colour / stamens

1

can breed / can sexually reproduce

allow can reproduce with each other / they can produce offspring

1

(ii) any **two** from:

- offspring contain 3 copies of each gene / of each chromosome / odd number of each of the chromosomes
- some chromosomes unable to pair (in meiosis)
- (viable) gametes not formed / some gametes with extra / too many genes / chromosomes

or
some gametes with missing genes / chromosomes

2

[10]

STEMUP.CO.UK

Q2.

(a) lemur(s)

1

(b) gorilla(s)

in either order

1

chimpanzee(s)

accept chimps

1

(c) (i) (Charles) Darwin

accept (Alfred) Wallace
if first name given it must be correct

1

(ii) variation

in this order

1

environment

allow phonetic spellings

1

survive

1

generation

1

[8]

Q3.

(a) <u>mutation</u>

correct spelling only
ignore other adjectives eg random / spontaneous

1

(b) *ignore references to X / Y chromosomes*

idea of mutant gene / new form / this allows <u>hatching</u> (of males)

1

(individual with advantage) (more) survive / (more) live / (more) don't die

allow immunity rather than resistance throughout

1

(so survivors) breed / reproduce

1

mutation / gene passed (from survivors) to offspring / next generation

allow resistance / characteristic for gene
'gene passed on' is insufficient

1

[5]

STEMUP.CO.UK

Q4.

(a) (soft) body parts / other parts / named parts

accept flesh

1

decayed / decomposed / rotted / eaten

or

bones do not decay / decompose / rot / get eaten

ignore disintegrated / dissolved

ignore microorganisms

1

(b) any **one** aquatic feature from: eg

- streamlined body shape
- long tail
- eyes on top of head
- scales
- fins / paddles / flippers / webbed feet

ignore gills

1

any **one** terrestrial feature from:

- (front) legs / limbs / hands
- could lift front end upwards

ignore feet

*accept for **2** marks eg fin / flipper can be used for walking **or** fins like legs*

1

[4]

Q5.

(a) too cold / very cold **or** oxygen / microbes cannot reach it

allow not enough energy / heat / warmth

ignore frozen

1

for microorganisms / microbes / bacteria / fungi / enzyme / reaction (to work)

ignore other consumers

1

(b) no longer exist
or no more left
or died out / all died

ignore died unqualified

1

STEMUP.CO.UK

(c) (i) egg cell

1

(ii) nucleus

1

(iii) given an electric shock

1

(iv) womb

1

(d) has mammoth genes / chromosomes

accept genetic information / DNA / alleles / nucleus
accept converse

1

[8]

Q6.

(a) (i) dead / inactive / weakened

allow antigen / protein
ignore ref to other components
ignore small amount

1

pathogen / bacterium / virus / microorganism

ignore germs / disease

1

(ii) *antigen / antibiotic instead of antibody = max 2*

white blood cells produce / release antibodies

accept lymphocytes / leucocytes / memory cells produce antibodies
*do **not** accept phagocytes*

1

antibodies produced quickly

1

(these) antibodies destroy the pathogen

allow kill
*do **not** accept antibodies engulf pathogens*

1

(b) (i) (live) bacteria still in body

ignore numbers

1

would reproduce

ignore mutation / growth

1

(ii) antibiotics / treatment ineffective **or** resistant pathogens survive

accept resistant out compete non-resistant

1

STEMUP.CO.UK

these reproduce

1

population of resistant pathogens increases

allow (resistant pathogens reproduce) rapidly

1

[10]

Q7.

(a) in 1978
fewer finches **or** population smaller

1

any **two** from:

- no beaks less than 8mm
- no beaks greater than 11.5 / 12mm

*if these points not given allow smaller range of beak sizes for **1** mark*

- mean / average beak size higher

2

(b) variation or range or mutation of beak sizes

*do **not** accept idea that drought / seed size caused mutation*

1

birds with larg(er) beaks are better adapted for feeding

accept idea of competition for food / seeds amongst finches

1

birds with larg(er) beaks survive

accept (only / more) birds with large beaks were better competitors

1

birds with larg(er) beaks breed **or** gene / allele for large beak passed on

*do **not** accept large beak passed on*

1

[7]

Q9.

(a) fossil is (remains / impression of) organism that lived a long time ago

if numbers, ≥ 1000s years

1

fossils show changes over time **or** older fossils simpler **or** fossils simpler than present-day species

1

fossils have similar features to present-day species

allow fossils allow us to compare old species with present-day species

1

STEMUP.CO.UK

(b) isolation / separation / splitting

1

by geographical barrier / sea

ignore other examples

1

there was variation (in these isolated populations) / different alleles

accept mutation

1

different environmental conditions **or** example eg climate / predators / food

1

natural selection acted on the isolated populations

accept became adapted <u>in each area</u>

1

OR

only certain allele(s) passed on to offspring / different alleles passed on in different environments

allow genes

so <u>differences</u> lead to inability to interbreed

allow differences described – eg mismatch of genitalia / different courtship displays / different breeding seasons

1

[9]

Q10.

(a) 3.75

accept answers in range 3.6 – 3.9

1

(b) (Paranthropus) aethiopicus

1

(c) (Homo) ergaster

1

(d) any **two** from:

ignore references to H. floresiensis or not enough data

- Homo erectus fossils found in other parts of the world

  *allow **only** 50 fossils found in China*

  ignore the two species were alive at the same time

- (too many) gaps in fossil record

  Homo erectus on different branch of 'tree'

  or no evidence of other 'humans' developing from Homo erectus

  or no link shown between Homo erectus to Homo sapiens / modern humans

STEMUP.CO.UK

allow diagram shows they are not closely related

or (fossils show that) H. sapiens evolved from H. heidelbergensis / H. mauritanicus / H. ergaster

2

(e) any **two** from:

- 'religious' reasons
  allow people did not wish to believe they had evolved from apes

- insufficient evidence at that time
  allow took a long time to get evidence
  ***or** communications not as good at that time*
  *ignore **no** evidence / could not prove it*

- Darwin was not a respected / well known scientist
  ignore references to Lamarck

- mechanism of inheritance / variation not known at that time
  allow (people) did not know about genes / genetics / DNA / chromosomes / mutations

2

[7]

Q11.

(a) 18.06 / 18 / 18.1

*correct answer gains **2** marks*
if answer incorrect evidence of
(4131 - 3499) ÷ 3499 × 100
***or** 632 ÷ 3499 × 100*
***or** ((4131 ÷ 3499) × 100) - 100*
***or** 0.18*
*gains **1** mark*

2

(b) antibiotics kill non-resistant strain
or resistant strain bacteria survive

accept resistant strain the successful competitor
*do **not** accept intentional adaptation*
ignore strongest / fittest survive
ignore mutation
ignore people do not finish antibiotic course

1

resistant strain bacteria reproduce
or resistant strain bacteria pass on genes

1

population of resistant strain increases **or** proportion of resistant bacteria increases
allow high numbers of resistant bacteria

STEMUP.CO.UK

or
people more likely to be infected by resistant strain (than non-resistant strain)
1

[5]

Q12.

(a) kills / destroys bacteria / MRSA
*do **not** allow germs*
1

prevents / reduces transfer
allow stops MRSA entering ward
1

(b) mutation
*do **not** accept antibiotics causes mutation*
1

(causes) resistance
allow not effective
ignore immunity
1

to antibiotics
1

[5]

Q13.

mutation **or** variation **or** range of sizes
*do **not** accept deliberate mutation **or** factor caused mutation*
1

warm(er) / dry(er) now
allow global warming
1

if warmer more smaller lambs / sheep survive winter
award 'survival' point only if linked to warmer / dryer conditions
1

or if warmer sheep do not need fat / wool / fur to keep warm
or if warmer smaller sheep can lose heat more readily / do not overheat / keep cool (so survive)
*do **not** accept smaller sheep retain more heat*

or if warmer smaller sheep have larger SA / V ratio (so survive)
*do **not** accept smaller sheep have smaller SA / V ratio*

or if dryer smaller lambs / sheep need less grass (to survive)
ignore small sheep feed easier on grass

small sheep breed / pass genes / mutations / characteristics to next generation
*do **not** accept if Lamarckian*

STEMUP.CO.UK

ignore competition / predation / human influence

1

[4]

Q14.

(a) Aa

*allow dominant **and** recessive*

allow heterozygous

1

(b) (i) gametes A, a **and** A, a

*max **1** if gametes are incorrect (eg in punnet square)*

1

correctly derived offspring from cross

allow ecf from their gametes

1

identification of round **and** wrinkled offspring

for this mark the phenotype of each different offspring genotype must be indicated

1

(ii) (due to) chance **or** expected ratio is only a probability

accept the idea of small numbers not representative

ignore anomaly / random / coincidence

*do **not** accept error*

1

(c) any **one** idea from:

- genes / chromosomes / alleles / DNA not discovered / known about

  *do **not** accept religious theme (ie confusion with Darwin's difficulties with the church)*

- published in obscure journal / few scientists read his work

1

[6]

Q15.

(a) any **two** from:

- survival of fittest

  allow examples

- amplification of fittest ie has adaptations to survive

  allow examples

- go on to breed **or** genes / characteristics passed on to next generation

  *NB best adapted organisms survive gains **2** marks*

2

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

STEMUP.CO.UK

ignore unqualified change eg 'the skull changes shape'

- increased height
- increased erectness

  allow description of modern human characteristic eg 'modern humans stand up straight'
- shorter arms
- legs straighter
- larger skull

  allow description of ape-like characteristics eg ape-like ancestor walked on four legs
- larger pelvis **or** changing shape described
- humans walk on two legs / feet

2

(c) any **two** from:

- religious objections
- insufficient evidence

  *ignore **no** evidence*

  accept could not prove
- mechanism of heredity not known
  did not know about genes /chromosomes / DNA / mutations
- did not like the thought of being descended from apes

2

(d) Darwin's theory depends on differences in genes at birth / inborn variation / mutation

allow Darwin's theory depends on genetics

ignore reference to time

1

[7]

Q16.

(a) predation / eaten

ignore competition

1

(b) could run faster / jump higher /climb better

1

to escape / or escape describe

1

(c) (i) natural selection

1

(ii) Darwin

STEMUP.CO.UK

1

[5]

Q17.

(a) variation / range of leg sizes /mutation

*do **not** allow <u>intention</u> to mutate*

1

ones with longer legs could feed in deeper water / get more food
or
long legged ones less likely to get feathers wet
or
long-legged ones could escape from leopards

allow reverse argument

1

survive / <u>breed</u> / pass on genes

allow characteristics passed onto next generation

1

(b) flamingos stretched their legs (to be able to feed in deeper water/ keep feathers dry / escape from leopards)

It must be clear that the characteristic develops during the organism's lifetime ie it is not inherited from parents

accept long legs are an acquired characteristic

1

longer legs / acquired characteristic inherited by offspring

accept (acquired) genes for long legs passed on

1

[5]

Q18.

(a) protection / defence

*ignore insulation **or** rolls into a ball*

ignore camouflage

1

from predators / from being attacked / from being eaten

1

(b) looks like snake / looks scary

1

deters predators **or** has large eyes to spot predator **or** camouflage **or** warning colouration from predator or prey

*allow **two** separate adaptations for **2** marks*

1

(c) (i) natural selection

1

(ii) Darwin

1

STEMUP.CO.UK

(iii) simple life forms

1

(d) believe that God created all organisms **or** humans there from the beginning

1

[8]

Q19.

(a) killed by poachers / killed for tusks

1

less trees / leaves to eat

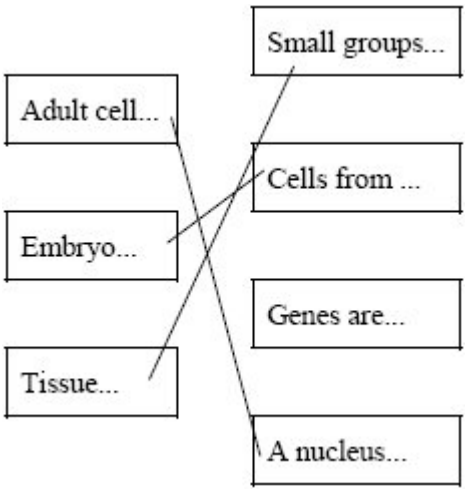
ignore feed on lots of leaves

1

land available disappearing

1

(b)



*all three correct = **3** marks*
*two correct = **2** marks*
*one correct = **1** mark*
extra line from a statement cancels the mark

max 3

[6]

Q20.

(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

STEMUP.CO.UK

- 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]

Q21.

(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:

- 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

STEMUP.CO.UK

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)

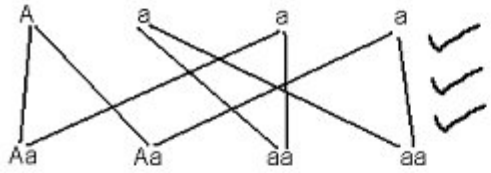
ignore references to previous generations

*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]

Q22.

(a) (i) 40 – 42

1

(ii) Palaeocene

1

(iii) bush babies

1

(b) any **two** from:

- religious objections

STEMUP.CO.UK

- insufficient evidence

  allow 'could not prove'
  ignore 'no evidence'

- mechanism of heredity not known

2

[5]

Q23.

(a) (bacteria) produce toxins / poisons

1

(viruses) damage / kills cells **or** toxins released from cell

1

(b) any **two** from:

- viruses live inside cells
- viruses inaccessible to drug
- drug would damage body cells / tissue

2

(c) any **four** from:

- overuse of antibiotics
- bacteria mutate

  *do **not** allow antibiotic causes mutation*

- antibiotics kill non-resistant strains **or** idea of selection
- reduced competition
- resistant bacteria reproduce

4

[8]

Q24.

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]

STEMUP.CO.UK

Q25.

(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
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]

Q26.

(a) wing pattern similar to *Amauris*

1

birds assume it will have foul 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 survived

1

breed / genes passed to next generation

1

[5]

Q27.

(a) fossils / teeth / bones / skeleton / foot prints
allow cave drawings
*do **not** accept scientists have seen*

STEMUP.CO.UK

them

1

(b) only (some) bones remain / soft parts have decayed

accept 'no-one has ever seen one'

allow no photos, no pictures, no drawings

1

(c) any **two** from:

- hunted by human
- (new) predator

  allow more predators
- (new) competitor
- (new) disease
- environment changed / named environmental change

  allow natural disaster
- prey extinct / loss of food supply

  ignore not enough food

2

[4]

Q28.

(a) (i) viruses live inside cells

1

viruses inaccessible to antibiotic

allow drug / antibiotic (if used) would (have to) kill cell

1

(ii) mutation

ignore mutation caused by antibiotic

1

natural selection **or** no longer recognised by antibiotics

accept description of natural selection

1

(b) (stimulate) antibody production

ignore antitoxin

1

(by) white cells

1

<u>rapidly</u> produce antibody on re-infection

ignore antibodies remain in blood

1

[7]

STEMUP.CO.UK

Q29.

(a) antibiotics diffuse / pass (into agar)

*do **not** allow into dish*

1

kill / prevent growth of bacteria or destroy cell wall / bacteria

accept bacteria are dead

1

(b) it / higher concentration kills more bacteria **or** causes less growth

*do **not** accept anything referring to size of circle*

1

levels off (at 6 units)

accept above 4 units

1

(c) **Quality of written communication**:
for correct sequencing or linking of ideas or points

this mark can only be awarded for a plausible attempt (not necessarily biologically correct) to link a precaution to a purpose
Q ✓ or Q ✗

1

Loop flamed

to sterilise it / kill unwanted microorganisms

*accept so no bacteria present do **not** accept to clean it*

1

Lid taped

prevent bacteria getting in / out **or** prevent someone touching bacteria

accept microorganisms/fungi for bacteria
*do **not** accept viruses or germs*

1

25°C

prevents / reduces growth of / reproduction

1

harmful bacteria / microorganisms or pathogens

1

(d) any **two** from:

- to avoid over-use of antibiotics **or** use no / less / low concentration antibiotics
- select antibiotic that is most effective
- finish the course
- don't give or use for animals
- develop new antibiotics **or** alternatives

STEMUP.CO.UK

2

[11]

Q30.

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]

Q31.

Quality of written communication

*for correct use of at least **two** scientific terms eg mutation, resistant (**not** just 'antibiotic-resistant', **not** 'immune') / selection / natural selection / survival / reproduction / gene / allele / DNA*

1

any **two** from:

mutation occurs in bacteria or change in DNA / gene occurs

cancel if mutation 'caused by' antibiotic

(when antibiotic used) only resistant bacteria survive **or** non-resistant bacteria are killed **or** reference to 'natural selection'

resistant bacteria pass on the gene / allele

allow pass on the mutation
*do **not** accept just 'pass on resistance'*

2

[3]

Q32.

(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

STEMUP.CO.UK

(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]

Q33.

(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]

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:

STEMUP.CO.UK

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]

Q34.

(i) (sweet) peas

1

(ii) homozygous parents crossed [1]

heterozygous (F1) offspring crossed [1]

recognition of yellow dominant over green [1]

recognition that results support 3:1 **or**
0.75 to 0.25 ratio

*up to **4** marks awarded for an understanding of the monohybrid cross and the expected outcome*

4

[5]

Q35.

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]

STEMUP.CO.UK