AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.6.2 VARIATION AND EVOLUTION (PACK 2)

SCORE	PERCENTAGE
/210	%

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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]

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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) (i) fusion / joining / combining of gametes / egg **and** sperm / sex cells

accept fertilisation

allow fusion / joining / combining DNA from two parents

ignore meeting / coming together / mixing of gametes etc

1

(ii) (mixture of) genes / DNA / genetic information / chromosomes

ignore nucleus / inherited information but allow second mark if given

1

from both parents / horse **and** zebra

dependent on sensible attempt at 1st mark

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should apply a 'best-fit' approach to the marking.

0 marks

No relevant content

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Level 1 (1-2 marks)
There is simple description of the early stages of adult cell cloning. However there is little other detail and the description may be confused or inaccurate.

Level 2 (3-4 marks)
There is an almost complete description of the early stages of the process and description of some aspects of the later stages. The description may show some confusion or inaccuracies.

Level 3 (5-6 marks)
There is a clear, detailed and accurate description of all the major points of how adult cell cloning is carried out.

Examples of Biology points made in the response could include:

- skin cell from zorse
- (unfertilised) egg cell from horse
- remove nucleus from egg cell
- take nucleus from skin cell
- put into (empty) egg cell
- (then give) electric shock
- (causes) egg cell divides / embryo formed
- (then) place (embryo) in womb / uterus

6

[9]

Q4.

(a) mutation

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 hatching (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]

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Q5.

(a) sexual

1

characteristic

1

mutation

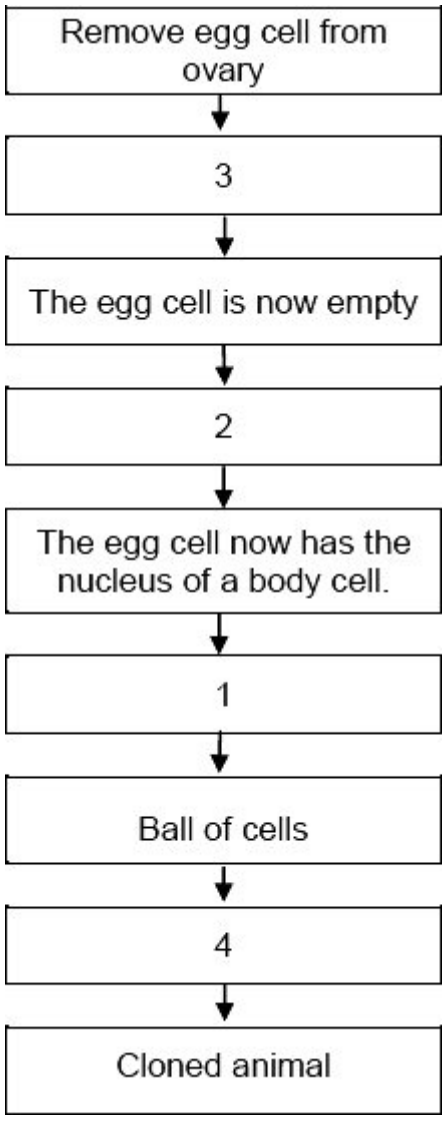
1

chromosome

this order only

1

(b)



*four correct gains **3** marks*
*two or three correct gains **2** marks*
*one correct gains **1** mark*
accept correct connection between statement and box

3

[7]

Q6.

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(a) fusion of gametes / named gametes

allow meet / join / fertilise

1

results in mixing of genetic information / DNA / chromosomes

accept genetic information / DNA / chromosomes from two parents

1

(b) (i) use enzyme

1

to cut gene from pout <u>chromosome / DNA</u>

1

insert <u>gene</u> into salmon chromosome / DNA / egg / embryo / nucleus

accept use of plasmid as carrier

ignore salmon / cell

1

(ii) eg fear of gene transfer to wild salmon / extinction of wild salmon / fear of harmful effect on consumers / unsure of long term effects

ignore cruel / ethics / morals / religion / unnatural / economics

1

[6]

Q7.

(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

(c) (i) egg cell

1

(ii) nucleus

1

(iii) given an electric shock

1

(iv) womb

1

(d) has mammoth genes / chromosomes

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accept genetic information / DNA / alleles / nucleus
accept converse

1

[8]

Q8.

(a) insects don't eat / damage crop
allow idea of insects carrying plant disease

1

(b) (i) 60

1

(ii) lower (yield)
accept 'higher' if answer clearly refers to wheat with transferred gene
*allow yield is only 52 **or** goes down to 52*

1

by 8 (arbitrary units)
*accept ecf from (b)(i) for **2** marks*

1

(iii) grow / use wheat without insect poison (gene)

1

higher yield (in fields)
accept bigger crop / more wheat
ignore grows better

1

(c) *ignore unnatural / unethical / against religion unqualified*

(concerned about)
accept specific examples given

effect on populations of (wild) flowers / insects
ignore harms the environment

1

effect of <u>eating</u> GM crops on human health
allow harmful to humans if eaten

1

[8]

Q9.

(a) (jellyfish) gene(s) <u>cut</u> out

1

ref to enzymes (at any stage)

1

(gene) transferred to zebra fish at early stage of development / embryo / egg
ignore removal of zebra fish genes

1

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(b) any **two** from:

ignore unethical / religious / unnatural

- could transfer gene to other (fish) species
- effects on food chains

  accept effects on other species / humans who eat them
- effects on zebra fish themselves, eg may out compete non GM zebra fish

2

[5]

Q10.

(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) <u>variation</u> or <u>range</u> or <u>mutation</u> of beak sizes

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

1

birds with larg(er) beaks are better adapted for <u>feeding</u>

accept idea of competition <u>for food</u> / <u>seeds</u> 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]

Q11.

(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

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fossils have similar features to present-day species

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

1

(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]

Q12.

(a) characteristics

1

genes

1

clones

1

asexual

1

(b) (i) tissue culture

accept other asexual methods eg runners / plantlets / dividing

accept use of (named) organ e.g. root / leaf

ignore cloning / asexual / stem cuttings / reproduction / genetic engineering

*do **not** accept seeds / sexual reproduction*

1

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(ii) embryo transplant / splitting

ignore asexual

or

(adult cell / fusion) cloning

*do **not** accept clones*

*do **not** accept sexual reproduction*

ignore genetic engineering

1

[6]

Q13.

(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

  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*

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- 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]

Q14.

(a) seeds produced by sexual reproduction / fusion of gametes / fertilisation

allow produced by pollination / crossing

1

mixture of genes / genetic information / chromosomes / DNA
or from two parents / apple trees

*if no other mark obtained allow **1** mark for apples had different genes / genetic information / chromosomes / DNA*

or

mutation occurred

ignore environmental effects / cloned

1

(b) (i) cuttings / tissue culture

accept grafting
allow adult cell cloning
ignore cloning unqualified
ignore genetic engineering
ignore asexual reproduction

1

(ii) asexual reproduction

allow produced by cloning / mitosis

1

have identical genes / genetic information / chromosomes / DNA

or no mixing of genes / genetic information /chromosomes /DNA

1

[5]

Q15.

(a) (i) 3

1

(ii) Q

1

(iii) 1

1

(b) from fossils / bones

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allow artefacts / named artefacts / drawings / evidence of fires

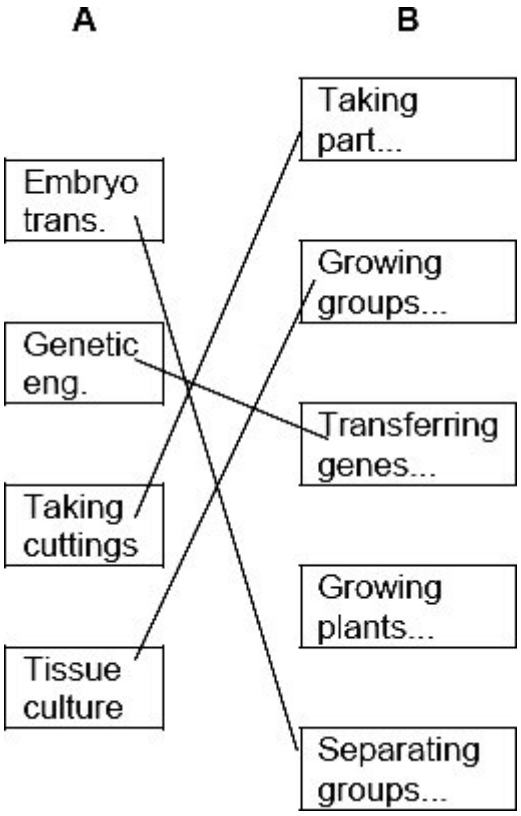
1

(c) Darwin

1

[5]

Q16.



***1** mark for each correct line*

mark each line from left hand box

two lines from left hand box cancels mark for that box

[4]

Q17.

a mutation occurs **or** variation in size / shape of pelvis

allow idea that walking upright needs larger pelvis to bear weight

1

large / wide birth canal / pelvis allowed passage of wide skull / brain

*do **not** allow pelvis became larger to enable birth of larger-skulled babies*

1

link between brain size and intelligence

1

those with larger pelvis / brain more likely to survive / reproduce

1

[4]

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Q18.

(a) two species / types involved

1

(b) *full marks only if at least **one** pro, **one** con and an attempt at a conclusion*

any **three** from:

pros (max **two** pros)

- useful if species difficult to breed
- prevents extinction / continues genetic line

cons (max **two** cons)

ignore reference to ethical issues / cruelty

- low success rate **or** figures given
- development problems
- diverts attention from habitat conservation / poaching / pollution / climate change
- cloning reduces gene pool

3

conclusion

argued conclusion

*must include references to **both** pros and cons and must be at end of answer*

1

[5]

Q19.

(a) **1** egg

1

2 embryo

1

3 nucleus

1

4 skin cell

1

(b) the child created by cloning would not have been able to give permission

extra boxes ticked cancels the mark

1

[5]

Q20.

(a) warmer / dryer

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allow greenhouse effect / global warming
ignore wind

1

(b) (i) genes / alleles / chromosomes / DNA / genetic material / genetics
allow inheritance
allow nutrition / food / metabolism / growth rate
ignore environment

1

(ii) natural selection / evolution
allow survival of the fittest

1

[3]

Q21.

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*
ignore competition / predation / human influence

1

[4]

Q22.

(a) any **two** from:
assume it refers to asexual

- no fusion in asexual **or** sexual involves fusion
*accept no fertilisation in asexual **or** fertilisation in sexual*

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or no mixing of genetic information in asexual **or** mixing of genetic information in sexual

accept genes / alleles / chromosomes / genetics for genetic information

or asexual involves splitting (of one individual)

- no gametes in asexual **or**
  sexual involves gametes

  accept named gametes

- only one parent in asexual **or**
  sexual involves two parents

- no variation in asexual
  or asexual produces clones
  or sexual leads to variations

  allow offspring of sexual have characteristics of both parents for this point

  ignore sexual intercourse

  ignore external / internal

  ignore plants / animals

  ignore mitosis / meiosis

2

(b) nucleus of egg removed **or**
involves empty egg cell

1

so only one nucleus **or** one set of genetic information / genes / chromosomes
or
so genetic information / genes / chromosomes from one parent only

1

[4]

Q23.

(a) sexual

1

(b) chromosome

1

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

ignore answers that do not relate to list

- genetic-engineering can produce fast-growing food animals
- genetic engineering can be used to clone animals in danger of extinction
- using GM animals can reduce the number of animals used in medical research

2

(ii) GM animals might escape and breed with wild animals

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ignore answers that do not relate to list

1

animals have the right to be free from genetic modification

1

[6]

Q24.

(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:
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

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(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]

Q25.

(a) (i) characteristic

1

(ii) gene

1

(iii) gamete

1

(b) sexual

1

asexual

1

clones

1

[6]

Q26.

(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

1

[5]

Q27.

(a) genetically identical / same DNA / same chromosomes

gains 2 marks

*accept identical without reference to genetic material for **1** mark*

2

(b) remove nucleus from egg

allow use empty egg cell

1

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insert genetic material / nucleus /DNA / chromosomes from frozen mouse

*do **not** allow if reference to sperm*

1

electric shock **or** allow to divide **or** insert into womb / uterus

1

(c) ethical / religious / emotional reasons

or

not known if it is safe / long term effects not known

ignore playing God / unnatural / immoral

1

[6]

Q28.

(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]

Q29.

(a) protection / defence

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

ignore camouflage

1

from predators / from being attacked / from being eaten

1

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(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

(iii) simple life forms

1

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

1

[8]

Q30.

(a) sexual reproduction

1

(b) any **three** from:

- coat colour inherited / controlled by genes
- it has horse and zebra features
- gets gametes from both parents
- genes / DNA / chromosomes / genetic information in gametes
- zorse receives genes / DNA / chromosomes / genetic information from parents

3

[4]

Q31.

(a) variation / mutation

1

individuals with characteristics most suited to environment survive

allow survival of the fittest

1

genes passed to next generation **or** these individuals reproduce

1

(b) any **two** from:

- similar in size to Emperor penguin **or** bigger than all penguins

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- large size is adaptation to cold climate
- since less heat loss per unit of body volume **or** smaller surface area / volume ratio

2

[5]

Q32.

(a) any **four** from:

- nucleus / DNA / chromosomes / genetic material removed (from egg)
- from (unfertilised) egg / ovum

  linked to second point

  *allow 'empty egg cell' for first **two** marks*

  *do **not** allow fertilised egg*

  allow egg from champion cow
- nucleus from body cell of champion (cow)
- inserted into egg / ovum
- electric shock
- to make cell divide **or** develop into embryo
- (embryo) inserted into womb / host / another cow

  allow this point if wrong method eg embryo splitting

4

(b) any **four** from:

Pros: Max 3 marks

- economic benefit eg increased yield / more profit
- clone calf not genetically engineered
- genetic material not altered
- milk safe to drink / same as ordinary milk

Cons: Max 3 marks

- consumer resistance
- caused by misunderstanding process
- not proved that milk is safe

  *ignore 'God would not like it' **or** 'it's not natural'*
- ethical / religious argument
- reduce gene pool / eg

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4

Conclusion:

sensible conclusion for or against, substantiated by information from the passage and / or own knowledge

conclusion at end

1

[9]

Q33.

(a) killed by poachers / killed for tusks

1

less trees / leaves to eat

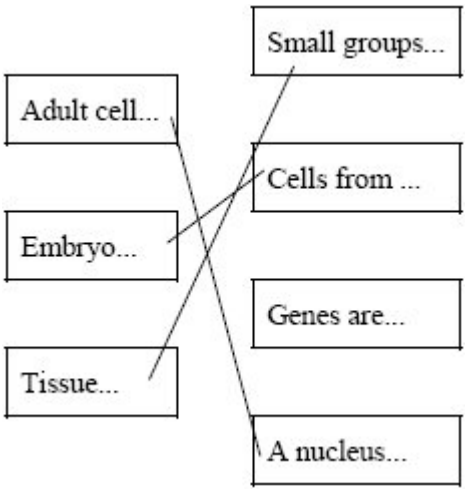
ignore feed on lots of leaves

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]

Q34.

any **four** from

- mutation

  *do **not** accept 'had to mutate / decided to mutate'*

- produces longer snake **or** there is variation in snake length

  *do **not** accept 'had to adapt and became longer'*

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- longer snake less susceptible to toxin **or** longer snake survives
- survivors reproduce
- gene passed to next generation

  allow characteristic passed to next generation

[4]

Q35.

(i) any **three** from:

ignore references to other methods eg tissue culture and embryo transplantation

- remove gene
- use of enzymes
- from plant with high sugar production

allow from bacteria

- insert gene into rye grass

3

(ii) any **two** from eg

- concern about effect on (health) of cow
- concern about effects on human (health)
- concern about food chain effects **or** effects on ecosystem
- effect on gene pool

  *ignore not natural **or** cost*

  ignore ethical / religious arguments

  if no other marks awarded

  'we don't know the long term effects' = 1 mark

2

[5]

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