Mark schemes

1

(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]

2

(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

offspring must be derived from correct gametes

correct identification of yellow (Aa)

other symbols correctly used can gain full marks

1

or

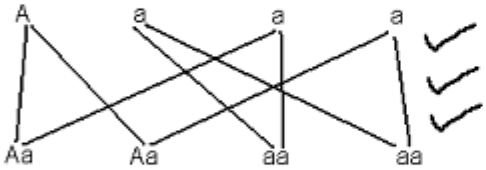
green (aa) (if both given, both must be correct)

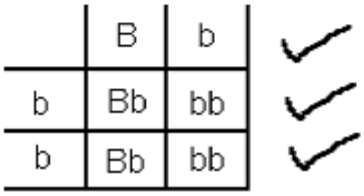
ignore references to previous generations
*if no other marks awarded, both correct parental genotypes given gains **1** mark*

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]

3 (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]

4 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]

5 (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]

6 (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]

7 (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]

8 (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]

9 joining

1

sexual

1

identical

1

asexual

1

clones

1

[5]

10 (a) (i) 56

accept 54 – 58

1

(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]

11 (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
- 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]

12 (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]

13 (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

(c) (i) DNA

1

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

1

[7]

14 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]

15 (a)

Ampicillin	Tetracycline
✓	–
–	–
✓	✓

*accept blank **or** cross **or** –*

*1st: mark by rows to maximum **3** marks*

*2nd: 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 <u>one</u> cell i.e. bacterium

1

by asexual reproduction / no fusion / not sexual

allow reference to 'mitosis'

1

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

1

[6]

16 (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) survival in polluted areas:

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

or non survival

(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]

17 (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:

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]

18 (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

*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]

19 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]

20 (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;
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]

21 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]

22 (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

each for 1 mark

6

[12]

23 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]

24 (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]

25 (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

[7]

26 (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]

27 (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]

28 (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]

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

30 (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 parent
(*reject* all the same)
disadvantage
all the same / all get same disease

for 1 mark each

2

[3]

31 (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

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]

32

(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]

33

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

any three for 1 mark each

3

[6]

34 dominant

1

recessive

1

genes

1

gametes

1

environmental

1

[5]

35 (a) asexual

mitosis is neutral

1

(b) (body cell)
nucleus *is* from body cell

no mark for just body cell – mark the explanation
allow converse nucleus from egg cell is removed

1

nucleus contains (genetic) information / instructions / chromosomes / genes / DNA / allele

*do **not** credit 'contains characteristics'*

1

(c) splitting apart (cells from clonal) embryo

*do **not** credit 'repeat process'*

1

[4]

36 chromosomes

1

enzymes

1

[2]

37 (a) genetically identical / same genetic information / same DNA

accept identical / same chromosomes / alleles / genes

allow 1 mark for identical same characteristics

2

(b) Quality of written communication:
Correct sequence
split → transfer

1

any **two** from

- split apart cells (from embryo)
- before specialised

allow early stage

- implant / transplant
- into host / mother / uterus / womb

2

[5]

38 (a) agilisaurus / camarasaurus / ornitholestes

1

(b) eorapter

allow lagosuchus

1

(c) lagusuchus (it) walks on hind limbs / two limbs / alamosaurus has longer neck / lagusuchus has back legs longer than front but alamosaurus has the reverse

1

(d) (i) alamosaurus

1

(ii) increased

1

(e) from hard parts / bones / imprints
e.g. footprints / parts replaced by other materials / conditions for decay absent or example

buried is neutral

1

(f) simple

1

billion

1

[8]

39 (a) genes

1

asexual

1

clones

1

(b) keeps cuttings damp / prevents wilting

allow keeps warm / acts like a greenhouse
allow keeps pests off

1

[4]

40 (a) (i) meiosis

1

(ii) mitosis

1

(c) (i) **X** pituitary

1

Y FSH

1

(ii) stimulates LH production

1

inhibits FSH production / production of **Y**

1

[6]

41 (a) (reject)

if support then zero marks

any **two** from:

giraffe spend almost all of the dry season feeding from low bushes

only in the wet season do they feed from tall trees, when new leaves are plentiful

females spend over 50 % of their time feeding with their necks horizontal

both sexes feed faster and most often with their necks bent

2

(b) any **two** from:

mutations produce male giraffes with longer necks

either

male giraffes with longer neck more likely to win fight / more likely to mate with female

or

females prefer long necks / more likely to mate with long necked male

their genes more likely to pass to next generation

accept long necks inherited or offspring have long necks

2

[4]

42 (a) (i) to go under teeth **or** mower

accept not damaged by grazing animals

accept do not get cut or bitten

accept reduces competition by other plants

do not credit maximum surface of leaves facing Sun

1

(ii) any **one** from

it can force its way through grass roots

accept in competition with grass roots

it is a store of food (to help the plant recover)

do not credit a good store of water

to reach down to water

to give good anchorage

accept it is hard to pull up

1

(iii) any **one** from

to reach more light

*accept to get out of the shadow of the hedge **or** tall grass*

to let seeds be caught on animals' coats (more easily)

*accept improves access **or** visibility **or** ease for pollination*

do not credit to help it grow up the hedge

1

(iv) any one from

(they reach out from hedge) to find water

accept increase surface area

*accept to find nutrients **or** minerals*

do not award mark if food mentioned

to give good anchorage

1

(b) (i) gene **or** allele

do not credit chromosome

1

(ii) any **one** from

they do not crossbreed **or** interbreed

*accept different species do not breed together **or** do not fertilise each other*

do not produce fertile offspring

have different numbers or types of chromosomes

accept genes are incompatible

*do not credit have different genes **or** are genetically different*

do not credit do not pollinate each other

1

(c) one mark is for the adaptation and one is for an appropriate reason

have white fur

for camouflage

are huge

for large volume to surfae area

thick layer of fat

*for insulation or to reduce heat loss **or** retain heat*

*do not credit to stop it losing heat **or** withstand the cold **or** keep it warm*

have thick fur

*for insulation **or** to reduce heat loss **or** retain heat*

hibernate

to avoid the coldest part of year

is a carnivore

because animals provide high energy food

has big paws **or** claws

to be able to walk on snow

have small ears

to reduce heat loss

have furry feet

for insulation from the snow

2

[8]

43 any **four** from

dark were better adapted to survive **or**
dark ones can hide in dirty environment

*dark is the survival of the fittest **or** they are better camouflaged*

those which survive breed

they are able to pass on their genes

light ones more easy to see on smoky
surfaces (so get eaten)

birds can see light ones more easily

as environment becomes cleaner or less
smoky light ones hide easier

those which survive breed **or** increase
the population

accept the converse argument

[4]

44 (a) gene or allele

1

chromosome

*do not credit cell **or** pancreatic cell **or** genome*

1

DNA

accept plasmid

1

(b) any **two** from

bacteria grow **or** reproduce

a growth related point

DNA ring **or** plasmid **or** insulin gene produced each time

***a** genetic related point*

insulin gene (in ring instructs bacteria to) make insulin

2

(c) any **two** from

same match to human insulin

*accept animal insulin may be rejected **or** may not suit humans*

no crossing species risk

accept no risk of BSE type species crossing

more easy to obtain **or** can be made in large quantities

*accept it is cheaper to make in the long term **or** it's quicker*

do not credit it's cheap

an ethical answer such as no religious **or** cultural concerns

accept it is cheaper so can be made available to many more people

2

[7]

45 (a) (i) any **one** from

mutations

discontinuous variation

1

(ii) gene

accept any clear indication such as a tick

1

(b) any **one** from
gamma radiation

accept radiation

X-rays

ultra violet rays

chemicals

accept mutagens

chance

1

(c) zebras breed (to produce)

1

fertile offspring

do not accept mating

1

[5]

46

(i) vegetative/asexual/cloning

for 1 mark

(ii) clones/identical copies/all same

for 1 mark

not clones if cloning in b(i)

[2]

47 idea brown colour/plain shell inconspicuous

for 1 mark

less likely to be eaten

gains 1 mark

but

less likely to be eaten <u>before breeding</u>

gains 2 marks

so alleles (genes) passed on

for 1 mark

(N.B accept inverse of any of the above)

[4]

48 (a) *ideas:*

frog 2

nucleus comes from this frog

DNA/genes/information in nucleus

this controls development

for 1 mark each

4

(b) *advantages:*

large number of identical offspring

guaranteed desired features

quick

economic

disadvantages:

may all succumb to unexpected disease/change in conditions

cut adaptation/reduce gene pool/limits variation

any 5 for 1 mark each

5

[9]

49 (a) idea

- unbanded dominant/plain **or** banded recessive
- because banded appears in young/
- parents heterozygous/Bb
- offspring BB }
 Bb } credit response consistent with parents
 Bb } even if not both heterozygous
 bb }

  Accept any clear and consistently used notation
- identify BB, Bb as plain
- identify bb as banded
- ratio 3:1 unbanded/banded (stated or clearly implied
- matches 35:12 results e.g. all the outcomes clearly identified as banded/unbanded)

for 1 mark each

7

(b) *idea*

- many genes control [accept "continuous variation"]
- many alleles for a gene/large genepool
- snails can inherit lots of different combinations
- mutation (gives rise to many alleles)
  allow selection allows alleles to be passed on unless [very]disadvantageous or if advantageous

any 4 for 1 mark each

[Also credit, for 1 mark each, up to 2 causes of mutation, e.g. mistakes in cell division, radiation]

4

[11]

50 *idea*

- banded snails camouflaged/less easily seen
- fewer banded eaten [by birds]
- more banded survive to breed
- more genes for banded passed on
  or more banded snails in population

for 1 mark each

N.B.
Accept reverse of all above for plain snails
*All 4 marks may be gained by a relatively short response

[4]

51 (a) *idea*
advantages

- large scale
- cheaper
- easy to grow/produce or quick to produce
- non-seasonal

disadvantages

- loss of farmers' income
- loss of foreign exchange
- less work in Kenya/developing country
- mass use of a of particular pyrethin
- can allow insect populations to become resistant

any 6 for1 mark each
maximum of 4 in
advantages/disadvantages

6

(b) *idea*
chromosomes /DNA carry genes
cut off gene/part of chromosome/DNA
insert into yeast chromosome/DNA/plasmid/nuclear
Accept DNA answers

for 1 mark each

3

[9]

52 (a) *ideas that*

- birds reached islands by flying
- some variation between these birds
- flight not needed to escape predators
- flight uses energy
- flight could result in death by drowning
- so non-flying birds favoured by natural selection
  or better chance to survive and breed
- so larger birds at an advantage
- any six for 1 mark each

6

(b) *idea*

- large number of genes per characteristic
- large range of alleles/large gene pool

(credit for these points not to be given if they are made in (a))

- mutation(s)

(credit idea of inheritance and environment as the two factors with 1 mark)

any two for 1 mark each

2

[8]

53 *idea*

- gene cut out/taken
- put in bacterial (cell) do not allow “nucleus”)
- cells cultured / grown in bulk

1 mark each

(allow 1 mark for “genetic engineering” if no other marks gained)

[3]

54 (a) *idea about*

- environment change / habitat drier / climate change
- couldn’t escape from predators / ref to predators / killed / eaten

[Do not allow "died"]

- because feet not adapted to run on dry ground
- couldn’t compete (with Merychippus) / more difficult to get food

[Use v + x = x principle]

any two for 1 mark each

2

(b) (i) fossil remains / from the bones

for 1 mark

1

(ii) (known) age of rock **or** any reason for knowing the age of the rock
eg by the rock layers by RA dating (not C-dating)

for 1 mark

1

(c) *idea that*
(present day) horses / species evolved / adapted / developed <u>from earlier species</u>/ <u>horses</u>

- over a long period of time / millions of years
- via many / gradual changes
- which gave a survival advantage /passed on genes / characteristics

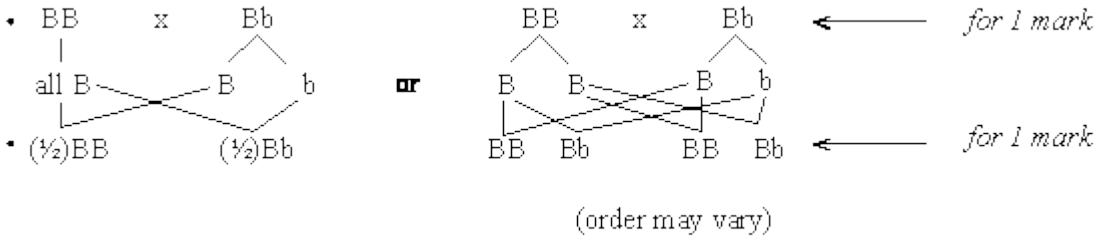
any three for 1 mark each

[First bullet point answer is required before marks can be awarded for others]

3

[7]

55 (a) <u>First Generation</u>



<u>or</u> as matrix

	B	B
B	BB	BB
b	Bb	Bb

1 mark for correct column and row headings
1 mark for correct outcomes

allow one mark for being able to produce a correct genetic cross
(even if from an incorrect starting point)

Second generation

( ) = picking out this idea gets both marks

or as a matrix

	B	b
B	BB	Bb
b	Bb	bb

1 mark for correct column and row headings
1 mark for correct outcomes

4

(b)

- green colour gives an advantage/camouflage
- more green flies dm black flies survive to breed*
- pass on their genes to the next generation
- (* but implied by 3rd bullet point)
  for 1 mark each

3

[7]

56 (a) *ideas that*

- (toxin) gene cut out (from bacterium)
- of bacterial chromosome/DNA / plasmid (not nucleus)
- transferred to tomato chromosomes / cells/DNA/nucleus
- makes the toxin in the tomato plant
  each for 1 mark

4

(b) **For:**

- good if we are sure that it only kills tomato pests, not bees etc
- humans will not be eating toxic insecticide
- don't have to buy insecticides
- less use of 'chemical' insecticides/less pollution
- reduce labour costs
- no hit or miss spraying
- spray washed off / needs respraying

(not to ensure better crop/better quality tomatoes \ Q asks.... in this way)

any two for 1 mark each

2

Against:

- not sure how the gene will affect other tomato genes/characteristics/named
- characteristic
- toxin might affect other organisms that feed on plant eg useful insects
- genetic engineering unethical/unnatural
- can't predict the effect of mutations
- could mutate to form a human toxin

(not 'insects may develop resistance ∴ also applies to chemical insecticides)

NB Credit other sensible responses for/against

any two for 1 mark each

2

[8]

57 (a) (i) moist (warm and cold are neutral)
for 1 mark
1

(ii) *idea that* roots / plants (only) grow with moisture (second condition negates answer)
idea that same (amount of growth) whether warm or cool
for 1 mark each
2

(b) *idea that* quicker / cheaper / more successful / same as the parent plant
for 1 mark
1

[4]

58 (a) sexual / sex
for 1 mark
1

(b) *idea that*
sexual reproduction brings about a mixture of genes
or similar / different genes / parents / gametes / DNA / characteristics / chromosomes (*not* features)
for 1 mark
1

(c) (i) asexual / cloning (*allow* vegetative)
for 1 mark
1

(ii) (A) *idea that* (they are exactly the same). *Do not allow* similar or just one named feature.
for 1 mark
2

(b) different (*allow* similar but *do not allow* same).
Allow any one named difference
for 1 mark

(d) (i) greater the X-ray dose, greater the % of mutations
or % of mutations increases steadily / in proportion to X-ray dose
for 1 mark

1

(ii) ionising radiations / ultra-violet light / alpha particles / beta particles / gamma rays / radio activity / chemicals / drugs / smoking / natural in meiosis / spontaneous / cell replication / toxic waste / pollution

1

Accept radioactivity but not radiations alone.
for 1 mark

[7]

59 *idea that*

- variations / mutations / differences in genes / alleles (in wild salmon population)
- adapted to own river
- any appropriate difference between rivers

  e.g. flow rate, waterfalls, pH, temperature, food supply, disease predators, competitors
- homing instinct

for 1 mark each

survive to breed
gains 1 mark

but
pass on genes to offspring
gains 2 marks

[4]