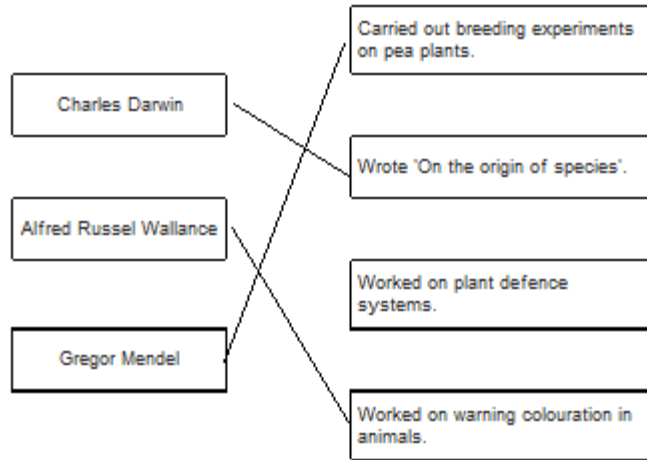


Mark schemes

1

(a)



3

(b) a gene

allow allele

1

(c) 4

1

(d) correct derivation of children's genotypes

1

identification of children with cystic fibrosis (dd)

1

0.25

allow ecf

allow 1/4 / 25% / 1 in 4 / 1:3

1

do not accept 1:4

(e) heterozygous

1

[9]

2

(a) (Jean Baptiste) Lamarck

allow phonetic spelling

1

(b) (snake is) covered in sediment / mud

or

sinks into the mud

1

(then) the soft parts decay / are eaten

or

bones / hard parts do not decay

1

(so) minerals enter bones

or

bones are replaced by minerals

1

(c) **Level 3 (3–4 marks):**

A detailed and coherent explanation is provided. Logical links between clearly identified, relevant points explain how the rat snake evolved through the process of natural selection.

Level 2 (1–2 marks):

Simple statements made, but not precisely. The logic is unclear.

0 marks:

No relevant content.

Indicative content

statements:

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

explanations:

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

additional examiner guidance:

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

4

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

1

[9]

3

- (a) any **two** from:
- so that they do not have specific genetic defects
 - to produce docile cats or so they are not aggressive
allow descriptions of aggression such as biting and scratching
 - for aesthetic reasons
allow descriptions of suitable aesthetic reasons

2

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

1

- (c) **Level 2 (3–4 marks):**

A detailed and coherent explanation is given, which logically links the process of selective breeding with explanations of how this produces cats that do not cause allergic reactions.

Level 1 (1–2 marks):

Simple statements are made relating to process of selective breeding, but no attempt to link to explanations.

0 marks:

No relevant content.

Indicative content

process:

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

explanations:

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

4

[7]

- 4** (a) organisms that reproduce together to form fertile offspring 1
- (b) (i) fossils of **P** and **Q** in same stratum / layer / level / height 1
- (ii) earlier – fossil in deeper layer / further down 1
- (iii) the fossils of animals **S** and **T** have many features in common, but **T** is more complex than **S** 1
- the fossil of animal **S** was found in a deeper layer of rock than the fossil of animal **T** 1
- (c) (i) **X** has white tail / shorter tail 1
allow other points eg X has furrer tail / smaller feet / is furrer
or
W has sharper claws / W has larger claws
- (ii) two (ancestral) populations separated / isolated (by geographical barrier / by canyon / river) 1
- genetic variation (in each population) / different alleles / different genotypes / (different) mutation(s) 1
- different environmental conditions / example described
allow abiotic or biotic example 1
- the better adapted survive / natural selection occurs
allow survival of the fittest
ignore they adapt to the environment 1
- so (different / favourable) alleles / genes passed on (in each population) 1
- eventually two types cannot interbreed successfully
allow to produce fertile offspring 1

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

2

[14]**5**

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

1

(kills weeds) so less competition for named factor eg light / water / ions
ignore space

1

crops grow better / higher yield

1

- (b) (i) plasmid

1

(ii) use an enzyme
allow correct example

1

(iii) only some cells become GM / take up the plasmid / take up resistance gene
allow idea of transfer of gene / plasmid to some plant cells from bacteria

1

GM cells survive / non-GM cells are killed

1

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

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

1

+ any **three** from:

Con:

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

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

3

[11]

- 6** (a) Taking cuttings from plants

1

- (b) (i) Adult cell cloning

1

- (ii) an egg cell

1

- (iii) nucleus

1

- (iv) an electric shock

1

- (v) uterus / womb

accept phonetic spelling

1

- (c) any **two** from:
- unethical / immoral
allow 'rights' of the cloned child
allow against religious teachings
 - cloned child would have to give up a kidney
 - possible operation complications.
allow illegal
allow parents may not want another child
allow a long time to wait (for the kidney)

2

[8]

7 (a) selection

1

(b) (i) 4

1

(ii) ground finch / lives on the ground

1

(only) eats seeds

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

1

(c) Lamarck

1

[5]

8 (a) part of a chromosome

allow piece of DNA

allow parts of chromosomes

1

controls a characteristic

allow controls characteristics

allow codes for (or controls production of) protein / enzyme

ignore examples of characteristics

1

(b) (iPS method)

max 3 similarities or differences

allow converse if clearly referring to adult cell cloning

similarities

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

differences

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

4

(c) any **one** from:

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

1

[7]

9

(a) (i) nucleus

correct spelling only

accept mitochondrion

ignore genes / genetic material / chromosomes

1

(ii) base(s)

Accept all four correct names of bases

ignore nucleotides and refs to organic / N-containing

1

(iii) 4

1

(iv) codes for sequence / order of amino acids

ignore references to characteristics

1

codes for a (specific) protein / enzyme

or

the sequence / order of three bases / compounds / letters

codes for a specific amino acid

or

the sequence / order of 3 bases / compounds / letters

codes for the order / sequence of amino acids

1

(b) (i) DNA

1

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

1

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

1

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

1

(iii) cells divide by mitosis

ignore ref to asexual reproduction

correct spelling only

1

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

1

(iv) any **two** from:

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

2

[13]

10(a) any **two** from:

- most people still believed that God made all the animals / plants on Earth
allow against their 'religion'
- insufficient evidence
do not allow no proof / evidence
ignore 'fossil'
- the mechanism of inheritance / genes unknown (at the time)

2

(b) any **four** from:

- finches separated / isolated
- genetic variation / mutation (in finch population(s))
- finches with alleles / genes best suited to their environment survive
Do not allow 'characteristics'
- advantageous alleles / genes passed on (to offspring)
- after many generations / a long time, the populations can no longer successfully interbreed
Ignore 'speciation'

4

(c) (i) vegetarian finch

1

(ii) **R**

1

(iii) mangrove **and** woodpecker finches

1

[9]**11**

(a) (i) gamete(s)

ignore reproductive cells

1

(ii) womb / uterus

allow phonetic spellings

1

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

1

(ii) embryo transplantation

1

(iii) any **one** from:

- (calves will have some) genes / DNA from bull / sperm
allow not all genes from the cow
- idea that sexual reproduction produces variation
allow may be male
allow idea that gene for low fat milk may not be passed on

1

[5]**12**

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

1

(ii) there is more evidence / specimens / results (for Homo sapiens)
allow examples of this, eg more / better fossils
allow converse if clearly referring to Australopithecus
ignore reference to being 'more recent'

1

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

1

(c) (i) Darwin

1

(ii) any **one** from:

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

1

[5]**13**

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

1

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

1

(these) survivors breed (more)

1

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

1

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

1

passed on (stretched nose) to offspring

allow offspring inherit (stretched nose)

*do **not** allow ref to genes*

1

(b) (i) insufficient evidence / no proof

ignore other theories, eg religion

*do **not** allow no evidence*

1

mechanism of inheritance not known

allow genes / DNA not discovered

1

(ii) God made all living things / them

allow creationism

ignore religion

1

[9]

14

(a) lack of fossils / fossils destroyed

allow lack of evidence

1

(due to soft parts) decaying / geological activity

allow an example – eg vulcanism or earth movements or erosion

allow converse points re skeletons, shells, hard parts

1

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

'A and B did not mate' insufficient

allow did not produce fertile offspring

1

(ii) any **two** from:

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

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

2

- (c) 1. (two ancestral populations) separated (by geographical barrier / by land) / were isolated 1
2. genetic variation (in each population) **or** different / new alleles **or** mutations occur 1
3. different environment / conditions
allow abiotic or biotic example 1
4. natural selection occurs **or** some phenotypes survived **or** some genotypes survived 1
5. (favourable) alleles / genes / mutations passed on (in each population) 1
6. eventually two types cannot interbreed successfully
allow eventually cannot produce fertile offspring 1
- [11]**
- 15** (a) (i) natural 1
- (ii) simple 1
- (iii) three billion 1
- (b) any **two** from:
- reference to religion
 - insufficient evidence / couldn't prove it / no proof
ignore no evidence
 - mechanism of inheritance / variation not known
allow genes / DNA not known about
 - reference to other theories
 - reference to Darwin's status 2
- (c) (i) tree 1
- (ii) hippopotamus **and** pig
both required, either order
allow hippo 1

(iii) new evidence from fossils

1

[8]

16

(a) any correct named physical environmental condition, e.g. light / water / rain / temperature / minerals / nutrients / space (between plants)

ignore carbon dioxide / climate / weather / sun / pollution

1

genes / inheritance

ignore 'variety'

OR

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

1

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

ignore number of plants

1

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

1

decompose / rot / break down / decay / digest

ignore feed / eat

1

(these organisms) respire

do not allow respiration by pea (plants)

1

(decay / respiration / microorganisms etc) releases carbon dioxide

do not allow combustion / fossilisation

1

[7]

17

(a) organisms that can breed together

accept converse points re. 2 different species

1

successfully

accept produces fertile offspring

1

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

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

2

AND

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

1

natural selection acts differently on the two populations

or different characteristics in the two populations survive

or different alleles passed on in the two groups

1

eventually resulting in interbreeding no longer possible

1

[7]**18**

(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]**19**

(a) wing pattern similar to *Amauris*

allow looks similar to Amauris

1

birds assume it will have an unpleasant taste

1

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

do not accept breeds with Amauris

do not accept idea of intentional adaptation

1

these butterflies not eaten (by birds)

1

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

1
[5]

20

(a) (use of) enzymes

1

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

ignore clones

1

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

1

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

crop survives herbicide insufficient

1

(d) any **one** from:

allow 'think that GM food is bad for health'

- fears / lack of knowledge about effects of GM food on health
ignore not natural or against religion
- crop plants may pass on gene to wild plants
- encourages use of herbicides

1

[5]

21

(a) sulfur dioxide

1

(b) (i) mutation

1

(ii) pale form now (more) easily seen (by predators) **or** dark form now less easily seen (by predators)

accept ref to camouflage

1

so pale form (more) likely to be eaten **or** dark form less likely to be eaten

1

so dark form (more likely to) breed / pass on genes

or

pale form less likely to breed / pass on genes

1

(c) (i) pyramid of three layers of diminishing size

either way up

1

three labels in food chain order

award 2 marks only if the pyramid is correctly labelled

accept trees / birch

accept (peppered) moth(s) / larvae

1

(ii) some material is lost in waste from the birds

1

peppered moth larvae do not eat all the leaves from the trees

1

[9]

22

(a) sexual reproduction

1

(b) (i) genes

1

(ii) gametes

1

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

answers must be comparative

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

2

(ii) (milk contains) more protein

answers must be comparative

1

less time before having a calf when no milk produced

1

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

1

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

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

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

ignore ethical / religious arguments

1

[9]

- 23** (a) Lamarck
ignore any first name(s) 1
- (b) (i) variation / range of sword lengths (in ancestors)
accept mutation produced longer sword 1
- those with long swords get more food
accept those with short swords get less food 1
- swordfish (with long swords) survive **and** breed
allow have offspring for breed 1
- (survivors) pass on gene(s) / allele(s) (for long sword)
allow mutation for gene(s) / allele(s) 1
- (ii) any **one** from:
- more evidence (now)
accept examples of evidence, e.g. more fossils
 - DNA / genes / mechanism of inheritance discovered
allow Lamarck's theory has been disproved
ignore religious arguments
ignore proof 1
- [6]
- 24** (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]

25

(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]**26**

- (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

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]

27

(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]

28

(a) sexual

1

characteristic

1

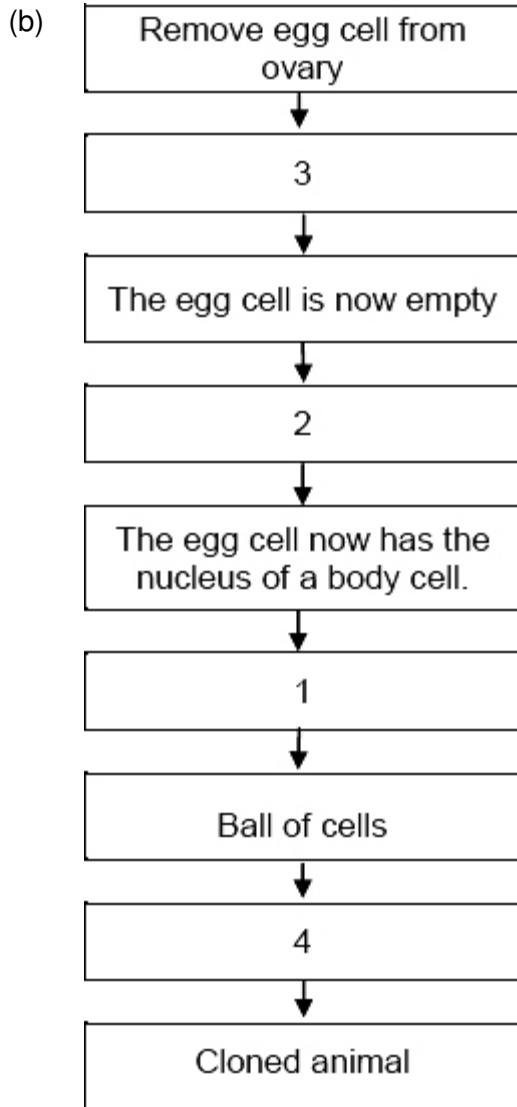
mutation

1

chromosome

this order only

1



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]

29

(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 chromosome / DNA 1
- insert gene 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]

30

- (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
accept genetic information / DNA / alleles / nucleus
accept converse 1

[8]

- 31** (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 eating GM crops on human health
allow harmful to humans if eaten 1

[8]

- 32** (a) (jellyfish) gene(s) cut 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

(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]

33

(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]

34

- (a) fossil is (remains / impression of) organism that lived a long time ago
if numbers, ≥ 1000 s 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

- (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 in each area

1

OR

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

allow genes

so differences lead to inability to interbreed

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

1

[9]

35

- (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

(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]**36**

(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*

- 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]

37

(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]

38

(a) (i) 3

1

(ii) Q

1

(iii) 1

1

(b) from fossils / bones

allow artefacts / named artefacts / drawings / evidence of fires

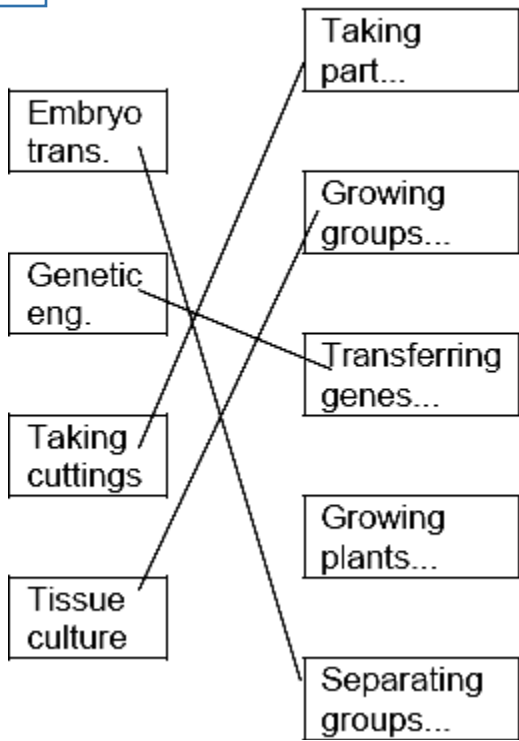
1

(c) Darwin

1

[5]

39 A



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]

40

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]

41

(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]

42

(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]

- 43** (a) warmer / dryer
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]

- 44** 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]

45

(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*
- 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]

46

(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
ignore answers that do not relate to list
- 1
- animals have the right to be free from genetic modification
- 1
- [6]**

47

- (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

(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]

48

(a) (i) characteristic

1

(ii) gene

1

(iii) gamete

1

- (b) sexual 1
- asexual 1
- clones 1

[6]

49

- (a) predation / eaten 1
ignore competition
- (b) could run fasterer / jump higherer /climb betterer 1
to escape / or escape describe 1
- (c) (i) natural selection 1
(ii) Darwin 1

[5]

50

- (a) genetically identical / same DNA / same chromosomes 2
gains 2 marks
accept identical without reference to genetic material for 1 mark
- (b) remove nucleus from egg 1
allow use empty egg cell
- insert genetic material / nucleus /DNA / chromosomes from frozen mouse 1
do not allow if reference to sperm
- 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]

51

(a) variation / range of leg sizes / mutation

*do **not** allow intention 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 / breed / 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]

52

(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

(iii) simple life forms

1

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

1

[8]**53**

(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]

54

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

2

[5]

55

(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

4

Conclusion:

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

conclusion at end

1

[9]

56

(a) killed by poachers / killed for tusks

1

less trees / leaves to eat

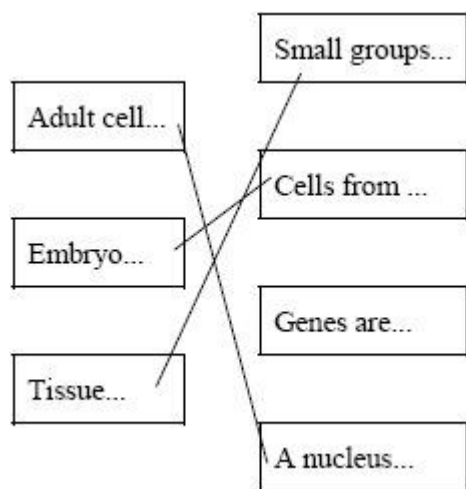
ignore feed on lots of leaves

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]

57

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'*

- longer snake less susceptible to toxin **or** longer snake survives

- survivors reproduce

- gene passed to next generation

allow characteristic passed to next generation

[4]

58

(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]

59

(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]**

60

- (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]**