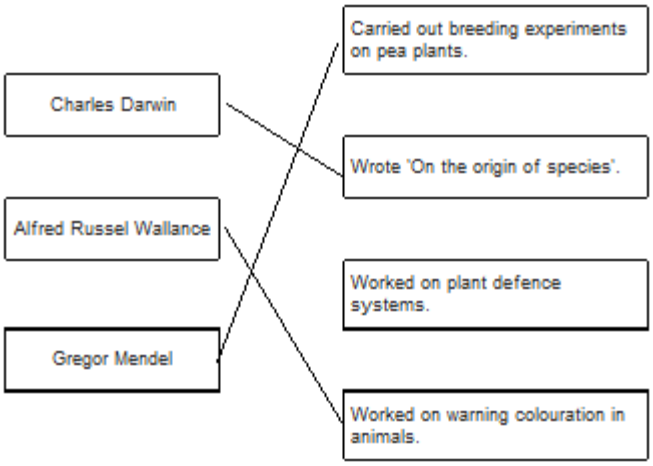
Mark schemes

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 ¼ / 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) 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 that **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

*allow other points eg **X** has furrier tail / smaller feet / is furrier*

or

***W** has sharper claws / **W** has larger claws*

1

(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]

4

(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]

5

(a) microorganism / bacteria / virus / fungus that causes (infectious) disease

1

(b) reduce / stop use of (current) antibiotics

1

(reduce / stop use) for non-serious / mild / viral infections
allow ensure course is completed
allow use of variety of antibiotics

1

(c) (i) 40 °C

1

(ii) any **one** from:

- microorganisms grow / reproduce / work / act faster
- results / product acquired sooner

1

[5]

6

(a) (i) any **two** from:
- trapped / held (since sticky)
- engulfed / covered by resin
  allow engulfed / covered by amber
- prevented decay.

2

(ii) any **two** from:

- animal / plant (dies and) body covered in sediment / mud

  ignore ref to rock

  allow covered in tar / ice
- bones / shells / hard parts do not decay
- minerals enter bones / parts are replaced by other materials / mineralisation
- preserved traces / footprints / burrows / rootlet traces / impressions / casts.

2

(b) (i) New technology provides more valid evidence.

1

(ii) any **three** from:

examples of physical factors, e.g.

accept 3 physical factors or 3 biological factors or some of each for full marks

- flooding
- drought
- ice age / temperature change.

ignore pollution

examples of biological factors, e.g.

- (new) predators (allow hunters)
- (new) disease / named pathogen
- competition for food
- competition for mates

competition must be qualified
- cyclical nature of speciation
- isolation
- lack of habitat or habitat change.

***if no other answers given allow** natural disaster / weather change / catastrophic event / environmental change / climate change for **1** mark*

3

[8]

7 (a) (i) any **two** from:

- (dead) animal buried in sediment

  allow imprint in mud
- hard parts / bones do not decay **or** soft parts do decay

  allow (one of) the conditions for decay is missing − accept example, eg oxygen / water / correct temperature / bacteria
- mineralisation (of hard parts / bones)

  allow replacement by other materials

2

(ii) any **two** from:

- conditions not right for fossilisation
  ignore references to soft-bodied
- geological activity has destroyed fossils / has destroyed evidence
  allow a named / described example − eg vulcanism / earth movements / erosion
- fossils not yet found
  allow description of why not yet found

2

(b) any **four** from:

- separation / isolation (of different populations)
- different environmental conditions (between locations)
- mutation(s) occur **or** genetic variation (within each population)
- better adapted survive **or** natural selection occurs
  allow 'survival of the fittest'
  ignore animals adapt to their environment
  ignore reference to stronger survive
- favourable alleles passed on (in each population)
  allow genes for alleles
- eventually different populations unable to breed successfully with each other
  allow unable to produce fertile offspring

4

[8]

8 (a) (i) 3.15 : 1

accept 3.147:1 ***or*** *3.1 : 1* ***or*** *3 : 1*

do ***not*** *accept 3.14 : 1*

Ignore 705:224

1

(ii) any **two** from:

- fertilisation is random **or** ref. to chance combinations (of alleles / genes / chromosomes)
- more likely to get theoretical ratios **or** see (correct) pattern **or** get valid results if large number
  allow ref. to more representative / reliable
  do ***not*** *allow more accurate* ***or*** *precise*
  ignore fair / repeatable
- anomalies have limited effect / anomalies can be identified
  accept example of an anomaly

2

(b) (i) in sequence:

Homozygous
Homozygous
Heterozygous

All 3 correct = 2 marks

2 correct = 1 mark

1 or 0 correct = 0 marks

2

(ii) genetic diagram including:

Parental genotypes: **Nn** and **Nn**

allow other characters / symbols only if clearly defined

1

or

Gametes: **N** and **n + N** and **n** derivation of offspring genotypes: **NN Nn Nn nn**

allow genotypes correctly derived from candidate's P gametes

1

identification: **NN** and **Nn** as purple **and nn** as white

allow correct identification of candidate's offspring genotypes but only if some F_2 are purple and some are white

1

(c) any **two** from:

- did not know about chromosomes / genes / DNA
  or did not know chromosomes occurred in pairs

  ignore genetics
- had pre-conceived theories

  eg blending of inherited characters

  ignore religious ideas unless qualified
- Mendel's (mathematical) approach was novel concept

  allow his work was not understood or no other scientist had similar ideas
- Mendel was not part of academic establishment

  allow he was not considered to be a scientist / not well known / he was only a monk
- work published in obscure journal / work lost for many years
- peas gave unusual results cf other species

  allow he only worked on pea plants
- Mendel's results were not corroborated until later / 1900

2

[10]

9 (a) any **three** from:

- parts of organisms have not decayed
  accept in amber / resin
  allow bones are preserved
- conditions needed for decay are absent
  accept appropriate examples, eg acidic in bogs / lack of oxygen
- parts of the organism are replaced by other materials as they decay
  accept mineralised
- or other preserved traces of organisms, eg footprints, burrows and rootlet traces
  allow imprint or marking of organism

3

(b) (i) teeth for biting (prey)
must give structure + explanation

1

claws to grip (prey)
accept sensible uses

1

wing / tail for flight to find (prey)

1

(ii) any **two** from:

- new predators
- new diseases
- better competitors
- catastrophe eg volcanic eruption, meteor
- changes to environment over geological time
  accept climate change
  allow change in weather
- prey dies out **or** lack of food
  allow hunted to extinction

2

[8]

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) (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]

12 (a) mumps

in either order rubella / German measles

both needed for the mark

ignore measles unqualified

1

(b) (i) 80(.0)

*allow **1** mark for* $\frac{504}{630}$ ***or** 0.8*

2

(ii) less chance of epidemic / pandemic

or

less chance of spread of disease / measles / mumps / rubella

allow idea of herd immunity (increased protection for those who are not vaccinated)

*ignore less chance of getting the disease **or** to eradicate the disease*

1

(c) (i) dead / inactive pathogens / viruses / bacteria

allow antigens / proteins from pathogens / viruses / bacteria

ignore microorganisms

1

(ii) white blood cells produce antibodies

1

antibodies produced rapidly (on re-infection) **or** response rapid (on re-infection)

allow ecf if antibodies incorrectly identified in first marking point

1

these antibodies kill pathogens / viruses / bacteria

*do **not** accept idea that original antibodies remain in blood and kill pathogens*

1

(d) (i) antibiotics don't kill viruses

allow antibiotics only kill bacteria

1

(because measles) virus / pathogen lives inside cells

*allow antibiotics do not work inside cells **or** killing virus / pathogen would kill / damage cell*

1

(ii) (bacteria / pathogens) develop resistance (to antibiotic)
ignore reference to immunity
ignore viruses develop resistance
1

[11]

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) fossils show change over time.
1

(b) covered in sediment / mud or sinks into the mud
1

soft parts decay / are eaten
or
bones / hard parts / shell do not decay
1

minerals enter bones / parts are replaced by minerals / mineralisation

accept turns to rock

allow 'is an impression' / 'imprint' / 'cast'

1

(c) skin is soft / skin not preserved / not fossilised / skin decays

accept not enough / no evidence / no-one has seen one

allow 'this fossil is only bones'

1

(d) any **two** examples of:

accept 2 physical factors or 2 biological factors or one of each for full marks

physical factors such as volcanic activity (allow volcanoes) / earthquakes / asteroid (collision) / ice age / temperature change

ignore pollution

and / **or**

biological factors such as predators / disease / named pathogen / competition/ lack of food / mates / cyclical nature of speciation / isolation / lack of habitat or habitat change

if no other answers given allow natural disaster / climate change / weather change / catastrophic event / environmental change for 1 mark

2

[7]

15 (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]

16 (a) pathogens

1

(b) (i) A disease affecting people in many countries

1

(ii) birds fly / migrate

accept converse

OR

human contact with birds more likely

birds not contained / difficult to control movement

OR

there are more birds (than pigs)

1

(c) (i) antibiotics (only) kill bacteria

ignore flu is caused by a virus unqualified

OR

antibiotics don't kill viruses

ignore virus resistant / immune

1

(ii) painkillers

accept any correct named painkiller, eg aspirin or paracetamol

allow antivirals / Tamiflu

ignore medicine / tablets

1

(iii) resistant

1

bacteria

1

in this order

[7]

17 (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]

18 (a) variation (between organisms within species)

allow described example

*allow mutation – but **not** if caused by change in conditions*

1

those most suited / fittest survive

1

genes / alleles passed on (to offspring / next generation)

allow mutation passed on

1

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

allow converse

- increase in latitude reduces number of (living) species

  ignore references to severity of conditions
- increase in latitude reduces time for evolution (of new species)
- the less the time to evolve the fewer the number of (living) species

2

(ii) any **two** from:

*do **not** accept intention or need to evolve*

- (increase in latitude reduces number of (living) species because) less food / habitats / more competition <u>at high latitude</u>

  allow only extremophiles / well-adapted species can survive
- (increase in latitude reduces time for evolution (of new species) because) severe conditions act more quickly / to a greater extent on the weakest
- (the less the time to evolve the fewer the number of (living) species because) species that evolve slowly don't survive

2

[7]

19 (a) (i) animal walking on soft material **or** suitably named material

or

further detail – eg dries out / buried / hardens / turns to rock

*do **not** allow general descriptions of how fossils are formed **or** reference to bones not decaying*

1

(ii) any **one** from:

- (from) bones / shells / hard parts **or** from parts that do not decay / rot or are preserved
  ignore imprint / impression
- animal trapped in resin / amber / ice / peat
  allow frozen
- infiltration with minerals / named

1

(b) any **two** from:

examples of physical factors such as flooding, volcanic activity (allow volcanoes) asteroid collision, drought, ice age / temperature change

accept 2 physical factors or 2 biological factors or one of each for full marks

ignore pollution

examples of biological factors such as predators (allow hunters), disease / named pathogen, competition lack of food / mates, cyclical nature of speciation / isolation / lack of habitat or habitat change

*If no other answers given allow natural disaster / climate change / weather change / catastrophic event / environmental change for **1** mark*

2

(c) older fossils simpler

to gain the mark there must be implication of change

or

change (with time)

ignore evolve
ignore extinction

1

(d) insufficient / no evidence / no remains **or** fossils survive

ignore no people were there

allow no proof

1

[6]

20 (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]

21 any **two** from:

- religious objections
- insufficient evidence
  allow 'could not prove'
  *ignore '**no** evidence'*
- mechanism of heredity not known

[2]

22 (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]

23 (a) (i) decrease

1

rate of decrease slows

1

(ii) any **one** from:

- more use of disinfectant

  allow any reasonable increase in hygiene or sterilisation precautions
- more use of hand washing
- more careful / more often cleaning of patient facilities
- raised awareness / education about hygiene

1

Explanation:
stops / reduces the bacteria being transferred / spreading

1

(iii) 800 – 500 / 800 × 100 =

1

37.5 (%)

*correct answer with or without working gains **2** marks*

1

(iv) any **one** from:

- numbers quite low now so hard to reduce further
- was a big campaign / much publicity (in 2009) so more people already doing it
- hygiene / cleaning now good so hard to improve
- hospitals short of money so less staff to clean

1

(b) mutation occurred giving resistance (to methicillin)

*do **not** accept overuse caused mutation*

1

resistant bacteria not able to be treated / not killed

1

these bacteria multiplied / reproduced / spread quickly

1

[10]

24 (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]

25 (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]

26 (a) (i) (remains of) an organism / a bone / a shell / hard part of an organism / part of organism that does not decay / impression of an organism / footprint / burrow / rootlet trace

1

further detail – eg in rock / ice / amber / mineralisation

or

from a long time ago / many years ago
if number, > 1000 years
ignore hundreds

1

(ii) older fossils are simple(r)
must make ref to change and time
allow deeper fossils are simple(r)

or

fossils show change / adaptation with time

1

(b) (i) 18 to 30
allow 30 to 18
allow 12
ignore units

1

(ii) small sample
allow <u>only</u> 49 shells / not representative / not enough evidence
allow not all fossils found

1

(c) example of a physical factor such as flooding, volcanic activity (allow volcanoes) asteroid collisions, drought, ice age / temperature change

allow natural disaster / climate change / weather change / catastrophic event / environmental change

or

example of a biological factor such as predators / disease / competition / lack of food or mates / cyclical nature of speciation / isolation / lack of habitat or habitat change

ignore human factors eg hunting / pollution

1

[6]

27 (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]

28

(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]

29

(a) <u>mutation</u>

correct spelling only

ignore other adjectives eg random / spontaneous

1

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

idea of mutant gene / new form / this allows 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]

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

accept flesh

1

decayed / decomposed / rotted / eaten

or

bones do not decay / decompose / rot / get eaten

ignore disintegrated / dissolved
ignore microorganisms

1

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

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

ignore gills

1

any **one** terrestrial feature from:

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

ignore feet

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

1

[4]

31 (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]

32

(a) (i) dead / inactive / weakened

allow antigen / protein

ignore ref to other components

ignore small amount

1

pathogen / bacterium / virus / microorganism

ignore germs / disease

1

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

white blood cells produce / release antibodies

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

1

antibodies produced quickly

1

(these) antibodies destroy the pathogen

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

1

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

ignore numbers

1

would reproduce

ignore mutation / growth

1

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

accept resistant out compete non-resistant

1

these reproduce

1

population of resistant pathogens increases

allow (resistant pathogens reproduce) rapidly

1

[10]

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) remains of an organism **or** bone / shell / hard part of an organism / impression

1

further detail – eg in rock / from a long time ago

if numbers, greater or equal to hundreds of years
allow made of minerals
ignore over time
ignore fossil are rocks

1

(b) (i) D

1

(ii) B

1

(iii) predation / disease / lack of food / competition / loss of habitat / climate change / catastrophic event – or volcanic eruption / flood / drought / temperature change / weather change / ice age / change in atmosphere

ignore human effects
ignore pollution effects / acid rain
allow natural disaster

1

(c) C = 'widest' thickest / wider
thicker column **or** more fossils
(of type C found)

allow biggest / er

1

(d) members of the groups have similar physical structures

extra box ticked – cancel

1

[7]

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

if numbers, ≥ 1000s years

1

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

1

fossils have similar features to present-day species

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

1

(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 differences lead to inability to interbreed

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

1

[9]

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) 18.06 / 18 / 18.1

correct answer gains ***2*** *marks*

if answer incorrect evidence of

(4131 - 3499) ÷ 3499 × 100

or *632 ÷ 3499 × 100*

or *((4131 ÷ 3499) × 100) - 100*

or *0.18*

gains ***1*** *mark*

2

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

accept resistant strain the successful competitor

do ***not*** *accept intentional adaptation*

ignore strongest / fittest survive

ignore mutation

ignore people do not finish antibiotic course

1

resistant strain bacteria reproduce
or resistant strain bacteria pass on genes

1

population of resistant strain increases **or** proportion of resistant bacteria increases

allow high numbers of resistant bacteria

or

people more <u>likely</u> to be infected by resistant strain (than non-resistant strain)

1

[5]

38 (a) <u>kills</u> / destroys bacteria / MRSA

*do **not** allow germs*

1

prevents / reduces transfer

allow stops MRSA entering ward

1

(b) mutation

*do **not** accept antibiotics causes mutation*

1

(causes) resistance

allow not effective

ignore immunity

1

to <u>antibiotics</u>

1

[5]

39 mutation **or** <u>variation</u> **or** <u>range</u> 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]

40 (a) Aa

*allow dominant **and** recessive*
allow heterozygous

1

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

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

1

correctly derived offspring from cross

allow ecf from their gametes

1

identification of round **and** wrinkled offspring

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

1

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

accept the idea of small numbers not representative
ignore anomaly / random / coincidence
*do **not** accept error*

1

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

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

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

- published in obscure journal / few scientists read his work

1

[6]

41 (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]

42 (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]

43 (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 / <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]

44 (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]

45 (a) killed by poachers / killed for tusks

1

less trees / leaves to eat

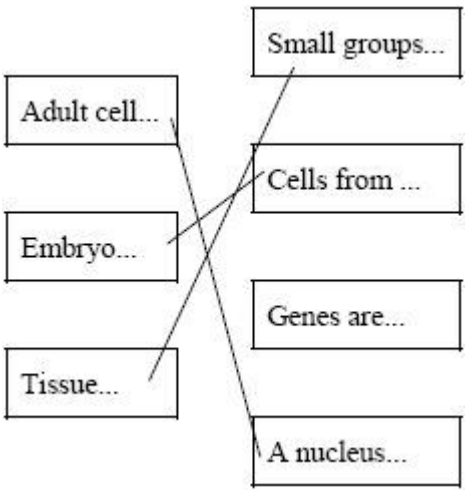
ignore feed on lots of leaves

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]

46 (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]