Mark schemes

(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*

(b) (i) teeth for biting (prey)

  *must give structure + explanation*

  claws to grip (prey)

  *accept sensible uses*

  wing / tail for flight to find (prey)

(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*

(a) (Jean Baptiste) Lamarck

  *allow phonetic spelling*

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

  or

  sinks into the mud
(then) the soft parts decay / are eaten
or
bones / hard parts do not decay

(so) minerals enter bones
or
bones are replaced by minerals

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

(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)

(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’

(c) (i) vegetarian finch
(ii) R
(iii) mangrove and woodpecker finches

(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
(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

(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

(a) selection

(b) (i) 4

(ii) ground finch / lives on the ground

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

(c) Lamarck

(a) (i) any two from:

- trapped / held (since sticky)
- engulfed / covered by resin
  allow engulfed / covered by amber
- prevented decay.
(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.

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

(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

(a) reference to interbreeding

successfully between Island types

*allow ref. to production of fertile offspring
*allow ref. to DNA analysis / comparison for 1 mark
*ignore ref. to grey fox

(b) (i) (two ancestral populations) separated / isolated (by geographical barrier / sea)

and genetic variation (in each population) or different / new alleles or mutations occur
under different environment / conditions
   allow abiotic or biotic example
   allow different selection pressures

natural selection occurs or better adapted survived to reproduce
so (favourable) alleles / genes / mutations passed on (in each population)

   ignore they adapt to their environment

   (ii) any one from:
   • continued to mate with one another
   • few beneficial mutations (between island varieties)
   • similar conditions on each island so similar adaptations/features fit

   (a) organisms that reproduce together to form fertile offspring

   (b) (i) fossils of P and Q in same stratum / layer / level / height

   (ii) earlier – fossil in deeper layer / further down

   (iii) the fossils of animals S and T have many features in common, but T is more
complex that S

   the fossil of animal S was found in a deeper layer of rock than the fossil of
animal T
(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

(ii) two (ancestral) populations separated / isolated (by geographical barrier / by canyon / river)

genetic variation (in each population) / different alleles / different genotypes / (different) mutation(s)

different environmental conditions / example described
   allow abiotic or biotic example

the better adapted survive / natural selection occurs
   allow survival of the fittest
   ignore they adapt to the environment

so (different / favourable) alleles / genes passed on (in each population)

eventually two types cannot interbreed successfully
   allow to produce fertile offspring

(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.

(a) three billion

(b) mutation(s)

breed / reproduce
   in this order only
   allow pass on their genes
(a) any two from:
  • larger / longer / thicker
    allow examples eg fewer toes or bones fused
  • fewer (bones in total)
    allow smaller surface area touching the ground
  • fewer bones touching the ground

(b) (i) large(r) surface / area in contact with the ground

  or

  low / less pressure on ground

  (so) less likely to sink into mud / ground

  or

  (so) could run fast(er)
    allow easy / easier to escape predators

(ii) variation (in size / number / arrangement of bones)

  allow mutation(s) (in size / number / arrangement of bones)

  (and) those with large(r) / few(er) bones more suited to running or run faster (on harder / drier ground)

  these survive and breed

  allow ref to offspring for breed

  (so) genes / DNA (for larger / fewer bones) passed on

  allow alleles passed on