

# Marking Key

Question	Answer	Explanation
1	A	Many vertebrates share similar traits in the early stages of development.
2	D	The principle of superposition describes fossil layers closer to the surface as younger than fossils further down.
3	A	Index fossils are located in one layer of strata, are widespread across the globe and are present for only a short period of time.
4	C	Tree-ring dating is an absolute technique.
5	D	Potassium-argon dating ages fossils in volcanic rock.
6	B	The record of fossils is incomplete as fossilisation is a highly improbable occurrence, fossils have been destroyed, not discovered yet or are inaccessible.
7	B	Fossilisation requires anaerobic conditions, mineral-rich and alkaline soil, rapid burial and a long period of non-disturbance.
8	C	Vestigial adaptations no longer serve a function.
9	D	Vestigial organs reduce in size and complexity, and can sometimes adopt a new function.
10	C	There has been sufficient time to remove the appendix, but this has not occurred because a small appendix predisposes an individual to infection.
11	A	Homologies include the genetic code and are common in species with a recently shared common ancestor.
12	D	Porpoises, sharks and ichthyosaurs are a result of analogous evolution.

# Question 13.

13a) Site C.

13b) Site B.

13c) Index fossils are preserved remains that provide information about the environment. (1)  
13d)

- Located within one layer of sedimentary rock. (1)
- Continental fossils. (1)

13e) Stratigraphy. (1)

13f)

- Relative method. (1)
- No absolute ages are given/can only state that rock layers below a reference layer is older than another rock layer. (1)

# Question 14.

14a)

- Rely on unstable isotope/radioisotope decaying to another form. (1)
- Quantities of isotope remaining and the initial quantity can be determined. (1)
- Quantity of isotope remaining can be linked to decay graph and number of half-lives/time since the death of the specimen can be determined. (1)

14b)

Any one mark:

- Radiocarbon dating/carbon dating. (1)
- Potassium-argon dating. (1)

14c)

- Dendrochronology: absolute. (1); tree/wooden material. (1)
- Stratigraphy: relative. (1); fossils within sedimentary rock. (1)
- Carbon dating: absolute. (1); organic material. (1)
- Potassium-argon dating: absolute. (1); fossils located within igneous/volcanic rock. (1)

# Question 15.

15a)

- Yes. (1)
- Natural selection has not had time/limited by previous ancestry to change the trait. (1)
- Vertebrae forelimb is used for different functions, despite similar bone structure. (1)

**15b) i)**

- Gene sequence would be similar/similar sequence of bases or identical. (1)
- Chimpanzees and humans have evolved recently from a common ancestor so there has been no time to significantly alter DNA sequence. (1)

**15b) ii)**

- Chimpanzees and humans have evolved recently from a common ancestor. (1)

**15b) iii)**

Any two marks:

- Humans and gibbons are more distantly related/further apart on the phylogenetic tree. (1)
- Gibbons and gorillas are more closely related/closer on the phylogenetic tree. (1)
- Gibbons and gorillas share a common ancestor more recently than humans and gibbons. (1)

**Question 16.**

**16a)** Homology/comparative anatomy of homologous organs. (1)

**16b)**

- Common ancestor was recently shared by the vertebrates. (1)
- Natural selection has not had sufficient time to alter the bone structure of the individual species. (1)
- So, forelimb bones have remained despite different function. (1)

**16c)**

Any two examples:

- Coccyx. (0.5)
- Canines. (0.5)
- Body hair. (0.5)
- Male nipples. (0.5)

**16d)**

Any two marks:

- Natural selection is not perfect. (1)
- Small appendix confers a greater risk of infection. (1)
- Natural selection has not had time to eliminate the organ entirely. (1)
- Natural selection is constrained by what is already present. (1)

**16e)** Energy cost to maintain a large organ. (1)

**Question 17.**

**17a)**

Any three marks:

- Potassium-argon dating used. (1)
- Volcanic/igneous rocks contain potassium-40/K-40. (1)
- Potassium-40 in the rock will decay, transmuting into argon-40, remaining trapped within the rock. (1)
- Levels of Ar-40 and K-40 can be detected by the dating technique. (1)

**17b)**

- Absolute dating method/can determine the exact age of the fossil. (1)

Any four marks:

- Fossils located within igneous rock can be dated. (1)
- Potassium-40 decays to the inert, trapped gas, Argon-40, at a half-life of 1.3 billion years. (1)
- At the end of 1.3 billion years, half of the K-40 has decayed to Ar-40. (1)
- Rock can be analysed for detection of potassium and argon levels. (1)
- The levels can be compared to the potassium-40 decay curve and the number of half-lives that have elapsed can be found. (1)
- Computing the number of half-lives against the length of the half-life offers the age of the rock, and the age of the fossil within it. (1)

**17c)**

- Can only date materials that are located in igneous rock. (1)
- Fossils must be older than 100,000 years old. (1)



17d)

Any ten marks:

- Fossilisation is the process of preserving the traces of a living organism. (1)
- Most often via the process of permineralisation. (1)
- Likely to find the hard parts of the skeleton/parts that fossilise the easiest. (1)
- Teeth/bone/no soft tissues. (1)
- Unlikely to have a complete fossil as fossilisation is a chance occurrence, with many conditions required. (1)
- Fossils must be rapidly buried so that vultures do not compromise the fossil.
- Mineral-rich sediment so that minerals can replace the soft parts of the bone. (1)
- The soil must also be alkaline (not acidic) to preserve the bone. (1)
- Anaerobic burial as no bacteria can survive and degrade the fossil. (1)
- Organism must remain undisturbed for many years. (1)
- May not have discovered the entire fossil. (1)
- Other parts of the fossil might have been destroyed by human activity. (1)
- Fossil may have been obtained from a largely inaccessible area. (1)