Review Worksheet Answers Fossilisation and Absolute Dating

1: Explain how the process of permineralisation occurs to fossilise remains.
(4 marks)

Permineralisation occurs when the remains of an organism have been buried in sediment (1). Over time, minerals from the ground water (1) are deposited in pores in bone and other tissues (1), slowly turning the remains into rock (1).

2: List the conditions required for fossilisation to occur and explain why each is important.
(9 marks)

Rapid Burial (1) – to be fossilied, remains need to be rapidly buried, for example by sediments, sands or volcanic ash (1). This prevents the remains from being destroyed (1) by scavengers or other environmental factors (1), and can delay decomposition (1).

Alkaline soil (1) – minerals are more likely to be deposited and are more difficult to dissolve in alkaline soils (1).

Low Oxygen environment (1) – low oxygen environments delay decomposition (1)

3: What age of rock is able to be measured by K-Ar dating?
(1 mark)

Rock over 200 000 years old

4: A group of palaeontologists find a fossil in a rock. They send the rock for analysis and find that it contains 25ug of K-40 and 75ug of Ar-40. How long ago was the fossil formed?
(3 marks)

The total amount of K-40 and Ar-40 is 100ug (1). The fraction of K-40 is therefore 0.25 (1). Using the graph from our notes, we can see that the rock formed 2.5 billion years ago.(1)

5: A person walking in a remote area of Australia finds a fossilised shark tooth lodged in the surrounding rock. A sample of the rock is sent for analysis. It is found to contain 96 atoms of K-40 for every 4 atoms of Ar-40. How long ago was the fossil formed?
(2 marks)

The fraction of K-40 is 0.96 (1). Using the "zoomed in" graph from the activity, we can see that the rock formed 75 million years ago. (1)

6: What is the half-life of Carbon-14?
(1 mark)

5730 years

7: What age of sample is Radiocarbon (Carbon-14) dating able to measure?
(1 mark)

Samples up to 50 000 years old

8: A skull of an adult human is found in a cave. Police are called and are unsure whether the skull is from a recent victim of crime, or is much older. Their forensic team take a small sample of the bone tissue and send it to the lab for radiocarbon dating.

The lab results show that the bone sample contains 12.5mg of carbon-14. A fresh bone sample of the same mass contains 100mg of carbon-14.

a) How many half-lives have passed since the person died?
(1 mark)

3 half-lives. (After one half-life, 50mg of C-14 would remain. After 2 half-lives, 25mg of C-14 would remain. After 3 half-lives, 12.5mg of C-14 would remain).

b) Should the police investigate the remains as a modern crime? Explain your answer.
(5 marks)

3 half-lives have gone by since the skull was last inside a living person (1). The half-life of C-14 is 5730 years (1). This means the skull is around 17000 years old (1), from well before recorded history (1). The police should leave the remains to be excavated by palaeontologists, as it is not a modern skull. (1)

9: A person has inadequate dietary intake of calcium. How does their body respond to ensure that blood calcium levels remain within homeostatic levels, and what is the long term effect on their body if they do not begin to eat enough calcium?
(6 marks)

Falling levels of Ca^{2+} in the blood are detected by the parathyroid glands (1), which release Parathyroid Hormone (PTH) (1). This stimulates the gut to absorb more Ca^{2+} (1) and increases reabsorption of Ca^{2+} from the kidneys (1). It also stimulates the release of Ca^{2+} from bone (1), causing the person's bones to become weaker over time (1).