Year 13 Science: Trends in human biological evolution

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Using the table, find the percentage increase in cranial capacity from Homo habilis to Homo erectus, to the nearest whole number.

2. Where is the foramen magnum in a fully bipedal hominin?

3. Explain how the angled femur helps bipedal walking.

4. Which grip is used to hold a pen?

5. Is a chimpanzee a hominid, a hominin, or both?

Exam-style question: three skulls

Skull A has a cranial capacity of about 430 cm³, a projecting face, large canines and a U-shaped tooth row. Skull B has about 1050 cm³, a large brow ridge, a lower, longer braincase and no chin. Skull C has about 1300 cm³, a flat face, a high rounded braincase, a small brow ridge and a chin.

6. Describe two trends shown by the teeth and jaws from A to C.

7. Calculate the percentage increase in cranial capacity from B to C, to the nearest whole number.

8. Explain why the brain could only enlarge after the diet changed.

9. Discuss one advantage and one disadvantage of a larger brain for hominins, linking each to a selection pressure.

Fix the mistake

10. Correct this statement: "Humans evolved from chimpanzees."

11. Correct this statement: "The foramen magnum moved to the back of the skull in bipeds."

12. Correct this statement: "Hominins became bipedal because their brains got bigger."

13. Correct this statement: "The opposable thumb means apes cannot grip at all."

Answer key (for parents and tutors)

1. Using the table, find the percentage increase in cranial capacity from Homo habilis to Homo erectus, to the nearest whole number.
   1050 − 610 = 440, and 440 ÷ 610 × 100 = 72%.
2. Where is the foramen magnum in a fully bipedal hominin?
   Central, underneath the skull, so the head balances on the spine.
3. Explain how the angled femur helps bipedal walking.
   It brings the knees and feet under the body's centre of gravity, so the body does not sway sideways with each step.
4. Which grip is used to hold a pen?
   The precision grip: thumb tip against the fingertips.
5. Is a chimpanzee a hominid, a hominin, or both?
   A hominid only: hominins are the human line after the split from chimpanzees.
6. Describe two trends shown by the teeth and jaws from A to C.
   The tooth row changed from a U-shape with parallel sides to a parabolic curve; canines became smaller with no diastema; jaws and teeth became smaller and the face flatter (Achieved for two).
7. Calculate the percentage increase in cranial capacity from B to C, to the nearest whole number.
   1300 − 1050 = 250, and 250 ÷ 1050 × 100 = 24% (Achieved).
8. Explain why the brain could only enlarge after the diet changed.
   Brain tissue uses a lot of energy (about 20% of a resting human's energy for about 2% of body mass), so a bigger brain could only be supported once hominins ate energy-rich food such as meat and marrow, cut with tools and later cooked, which also meant smaller teeth and jaws were enough (Merit).
9. Discuss one advantage and one disadvantage of a larger brain for hominins, linking each to a selection pressure.
   Advantage: a larger brain allowed planning, better tools, cooperation and language, so individuals could hunt, share food and survive changing climates, and these were selected in a variable, competitive environment. Disadvantage: the large head makes birth difficult through a pelvis narrowed for bipedal walking, so babies are born helpless and need long care, and the brain's energy demand risks starvation when food is short. The trend continued because the survival benefit outweighed these costs (Excellence: links both sides to selection and to bipedalism).
10. Correct this statement: "Humans evolved from chimpanzees."
    Humans and chimpanzees share a common ancestor that lived about 6 to 7 million years ago; neither is the other's ancestor.
11. Correct this statement: "The foramen magnum moved to the back of the skull in bipeds."
    It moved forward to a central position under the skull, so the head balances on top of the spine.
12. Correct this statement: "Hominins became bipedal because their brains got bigger."
    Bipedalism came first: australopithecines walked upright with brains of about 430 cm^3, millions of years before brains expanded.
13. Correct this statement: "The opposable thumb means apes cannot grip at all."
    Apes have opposable thumbs too, but they are short and weak, so apes lack the strong, precise grip of the fingertip pads.