

Biology II Study Guide for Nature of Science and Evidence for Evolution Test

The Nature of Science

1. What are the differences between a scientific theory and law?
2. What is an observation? What is an inference?
3. What is the scientific method?
4. Does a theory ever turn into a law? Why/why not?
5. Define what a hypothesis is.
6. In science, we don't seek to *confirm* ideas. Instead, what do we attempt to do?
7. Describe a situation illustrating the tentative nature of science.

Evidence for Evolution

8. There is evidence for evolution from 4 major areas. What are they?
 - 1.
 - 2.
 - 3.
 - 4.
9. How do we define a "species" in biology?
10. What is a fossil?
11. What are **homologous structures**? Give at least one example.
12. What are **analogous structures**? Give at least one example.

13. What are **vestigial structures**? Give at least one example.

14. What type of evidence for evolution is the process of DNA-DNA hybridization? How does it work?

15. Under the following scenario regarding DNA-DNA hybridization data, which species pair is most closely related? Which species pair is least related? How could you tell? (Describe why as THOROUGHLY as possible...)

Species Pair	Hybrid DNA melting temperature (°C)
A. Red-tailed Hawk --- Red-shouldered Hawk	107.4
B. Red-tailed Hawk --- Broad-winged Hawk	106.9
C. Red-shouldered Hawk --- Gray Hawk	104.3
D. Red-shouldered Hawk --- Broad-winged Hawk	107.9

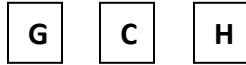
16. What is the structure of DNA? (HINT: draw its structure AND label the parts, including following the appropriate base-pairing rules for a strand at least 3 NUCLEOTIDES LONG.)

17. What is the difference between variation and diversity?

18. What are the two general terms for the ways to date (determine the age of) a fossil?

- 1.
- 2.

19. According to the DNA evidence from the Human Evolution Activity, fill in the graphic below outlining the relationships among the 4 organisms and describe what it means.



20. Which way of dating a fossil gives us its exact age? What process does this use?

21. Which way of dating a fossil uses what we know about the age of surrounding rocks? What is this process called?

22. What are the 4 types of fossils? Describe them and how they're different from each other.

1.

2.

3.

4.

23. Make sure you know how to determine the age of a fossil based on an element's half-life. (For example, how many half-lives has a fossil gone through if it contains 50% of the original element's isotopes? ____ What about 25%? ____ 12.5%? ____ Also understand that if that a substance's half-life is, say, 14,000 years, how many years old is that above fossil under the previous conditions? 50% _____ 25% _____ 12.5% _____).

24. A 200 g sample of Lawrencium is left in a container from 8:00 AM one morning until 2:00 PM the next afternoon. If the mass of the sample of Lawrencium was 25 g at 2:00 PM, what is the half-life of Lawrencium?

25. Potassium-40, a radioactive isotope with a half life of 1.3 billion years, has the daughter isotope argon-40. When potassium-40 is found in volcanic rock, geologists know that they can use the ratio of potassium-40: argon-40 in order to determine the age of the rock. Heat from the molten rock causes all gases, including argon-40, to evaporate as the rock forms.

Assuming that all gases produced during radioactive decay are trapped in the rock, how old is a rock that is found to contain 0.45 g of potassium-40 and 1.35 g of argon-40?

26. (Use chart to right.) If a sample containing As-81 is measured and found to be 25% radioactive and 75% stable, how old is the sample?

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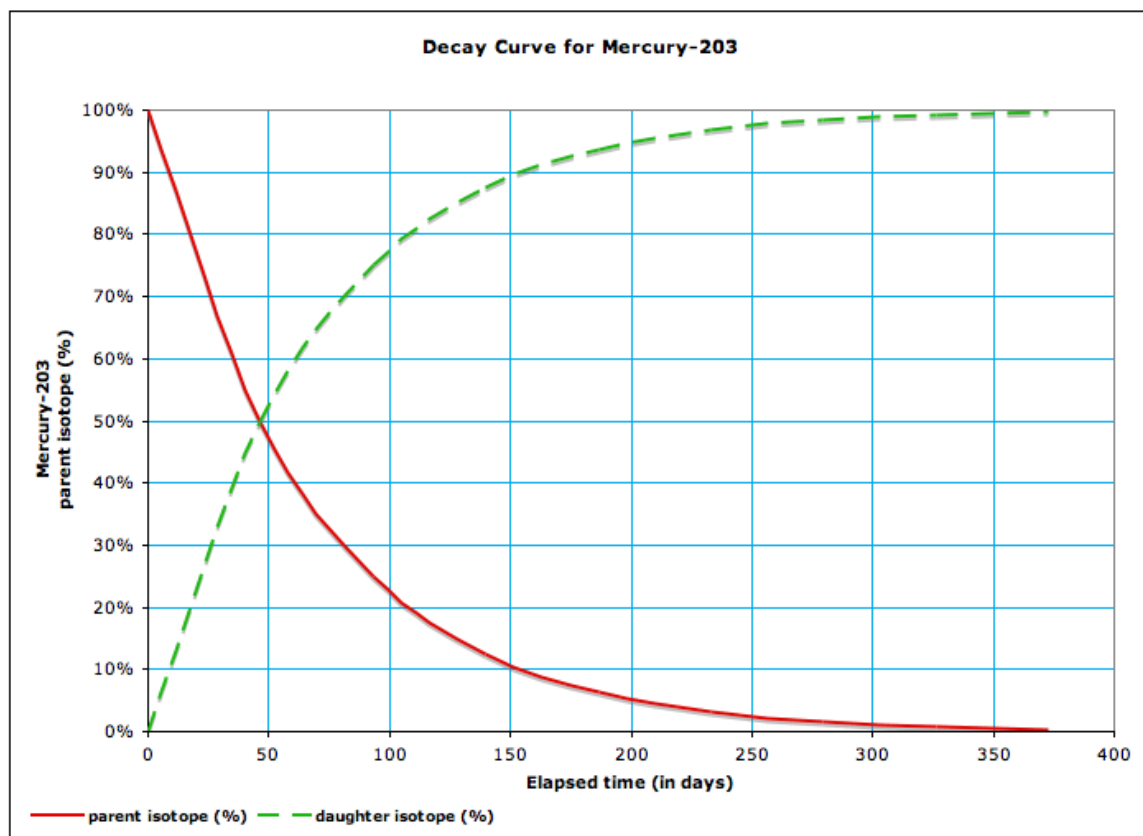
As-81 = 33 seconds

Au-198 = 2.69 days

C-14 = 5730 years

27. (Use chart to right.) If a bone sample has been measured and 93.75% of the carbon is determined to be of the stable C-12 isotope, how old is the sample?

28. The following decay curve shows the isotope mercury-203.



The daughter isotope produced by the decay of mercury-203 is thallium-203. Approximately what percentage of the total possible amount of thallium-203 has been produced after 135 days?