

Astro 10 Worksheet
February 27, 2006
Solar System Hodgepodge¹

Tidal Forces

A couple weeks ago in class you heard about the origin of the tides on Earth.

1. Briefly explain the key effects. As always, include a diagram.

Today you heard about one of Jupiter's moons, Io. It almost always keeps one face towards Jupiter and is famous for its extreme volcanic activity. However, it is only about the size of our moon, and we saw in class that the interior of the moon has cooled since its birth due to its large surface area-to-volume ratio.

2. Using tides caused by Jupiter and the other Galilean moons, explain how Io's interior temperature is hot enough to produce the observed volcanism?

Half Lives and Carbon Dating

All living creatures have two main types of carbon in them, carbon-14 and carbon-12. Carbon-12 is extremely stable and the amount in a creature stays pretty much constant forever. Carbon-14 is radioactive with a half-life of about 5,700 years. When a creature is alive and eating it ingests carbon-14 through plants, but the amount of carbon-14 in their body stays roughly constant since they are always losing some of the carbon-14 as it radioactively decays into other elements.

1. What happens to the amount of carbon-14 in a creature after it dies? Why?

¹ Thanks to Holly for parts of this worksheet.

Suppose you find some old chicken bones buried in your backyard and you have a machine that tells you how much carbon-14 is in a sample (called a mass spectrometer) and you have a live chicken.

2. How could you use all this stuff to calculate the age of the chicken bones?¹

You find a mosquito in petrified amber (ala Jurassic Park) on your way to class. You rush back to your room and bust out your mass spectrometer and it tells you that there is only 12.5% of the original carbon-14 left in the mosquito.

3. How old is the mosquito? Is it possible that the little guy has some “dino DNA” in it?

The Greenhouse Effect

In class you heard about the greenhouse effect on Earth.

1. Briefly summarize the key steps. Definitely include a figure.

Suppose the Earth were transparent to infrared radiation and opaque to visible radiation (the opposite of the actual situation).

2. Would the surface temperature of this hypothetical Earth be cooler or warmer than our Earth? Explain.

¹ This is called Carbon Dating and is extremely useful and accurate for dating once-living creatures back about 50,000 years. Other radioactive elements with longer half lives can be used in exactly the same way to date things back even further.