

Final Exam

1. (25 pts. total) Fill in the blanks! Use one letter per blank and don't skip any blanks. Use the letters that I've included as clues. When you're done, the *first letters of each answer*, read downwards, will give you the answer to this question:

Who was the 19th and early 20th-century American scientist who, among other things, gave *Tyrannosaurus rex* its name?

___ _ _ _ _ - ___ **F** ___

Length of time required for half the atoms in a sample of radioactive element to decay

___ _ _ _ _ **U** ___ _ _ _ _

Basalt and rhyolite are ___

___ _ _ _ _ ___ **D** ___

A tide that occurs around the quarter moons

___ _ _ _ _ **M** ___ _ _ _ _

Refers to a rock dating technique using natural radioactivity

___ _ **Z** ___ **O**

Branch of a stream that flows parallel to the main stream because of a natural levee

___ _ _ _ _ ___ **S** ___ _ _ _

Huge lava flow from a crack or fissure

___ _ _ _ _ **B** ___ _ _ _ _

Refers to air temperature change caused by 'expansion or compression of air

___ _ _ **O** ___ _ _ _ _

What AM radio waves bounce off

___ _ _ **T**

Divergent plate boundary

___ _ _ **N** ___

Boundary between air masses

___ _ _ **A** ___ _ _ _ _

Indonesia is one; so are the Aleutians; but *not* Hawaii!

___ _ _ _ _ **E** ___ _ _ _ _

Point on the Earth's surface lying directly over an earthquake's focus

___ _ _ **S** ___

Windblown silt

___ **E** ___ _ _ _

Sediment buildup where a stream enters the ocean

___ __ B ___ __	Type of lake produced when a stream cuts off a loop
___ __ ___ __ ___ __ ___ __ ___ __ ___ O	Repeated eruptions of felsic lavas and ash produce this (Mt. Rainier and Mt. Fuji, for example)
___ __ ___ __ N	Equivalent to a syncline, but more or less circular
___ __ E	Mineral deposit that's sufficiently rich that it can be mined profitably
___ __ ___ __ T ___ __ ___	Dating of rocks that does not give you their absolute ages
___ __ ___ __ A ___	Fault whose footwall moves upwards relative to the hanging wall
___ __ ___ I ___ __	Periodic warming of the eastern Pacific with weakening of normal circulation patterns

... and the man who named *Tyrannosaurus rex*, worked out the basic outlines of horse evolution, and helped found the American Museum of Natural History, was:

___ __ ___ __ ___ __ ___ __ ___ __ ___ __ ___ __ ___ __ ___ __

2. (50 pts.) The creationist author Walter T. Brown, in his book *In the Beginning* (7th edition, 2002), has this to say about geologists' rock dating methods:

To estimate a date prior to the beginning of written records, one must assume the dating clock has operated at a known rate, the clock's initial setting is known, and the clock has not been disturbed. These three assumptions are almost always unstated, overlooked, or invalid.

In a well-reasoned, fact-based, and thoughtful essay that will probably take you several paragraphs to do properly, explain how scientists actually deal with each of these assumptions when working on the ages of rocks.

3. (25 pts.) These are the national weather maps for Monday, Tuesday and Wednesday, December 8, 9, and 10, 2004—courtesy of the *Arkansas Democrat-Gazette*.

- a. (5 pts.) On Monday, a warm front was swinging northward through the Midwest. What weather did it leave in its wake in Arkansas, and why?
- b. (5 pts.) By Tuesday the warm front was gone; you'll note that it disappeared from the weather map. Where did it go, and why? And what appears to have been the result?
- c. (5 pts.) On Monday night we had some really heavy rain in central Arkansas (driving I-40 was *not* fun). Use the maps to explain why this happened, and why the weather was quite different from what we had earlier that day.
- d. (10 pts.) Use the weather maps to make a prediction of what Arkansas's weather will be like for the next few days, explaining *why* you make the predictions that you do. I'm not going to grade you on accuracy, but I do want well-thought-out explanations of why you make the predictions that you do.

Now answer any five of the following nine questions. (20 pts. each)

4. Basalt is commonly used as a road-building material called *aggregate* (crushed rock), especially in the western United States. Imagine that you run a rock and gravel company that just got a contract to help resurface the Interstate Highway System. You need to mine a lot of crushed basalt. In what kinds of geological settings would you want to open your quarry?

5. Here's a cross-section of a landscape in the mid-latitudes of the Northern Hemisphere:

Imagine that you are a recreational glider pilot. Where in this landscape would you want to fly so as to get the maximum amount of time aloft? What time of day would be best? What hazards might you encounter? And why would you prefer to fly at this place and time?

6. United States economic history in the 1700s and 1800s was shaped by a particular pattern of trade known as "Triangle Trade". Traders would bring molasses and sugar from the Caribbean Sea north to New England, especially to Rhode Island. Here the molasses was fermented and distilled into rum. The rum was then exported to the east coast of Africa and was traded for slaves. . . who were then shipped to the Caribbean and exchanged for molasses. . . and the cycle continued. How did the fact that the Earth is rotating make the "Notorious Triangle" possible? Explain.

7. The harshest deserts in the world include the Atacama Desert in Chile, on the South American continent; the Sonoran Desert of Mexico, especially on the Baja California peninsula; and the Kalahari Desert of southern Africa. All three deserts sometimes go for years with no rain. First, explain briefly why these three areas are deserts, using what you know about global atmospheric circulation. Second, answer me this: All three deserts happen to lie on the coast, close to major cold-water currents in the ocean just offshore. How would this situation affect these deserts?



8. When I lived in Berkeley, I used to get into debates about evolution with a local street evangelist who called himself Pastor Glen. Pastor Glen was fond of arguing that “since you use fossils to determine the age of rock layers, and the rock layers to determine the age of the fossils, the whole idea of evolution is based on circular reasoning!” Pastor Glen was a kind man who was deeply sincere in his religious views, but in this case he was just plain wrong. Explain why.

9. A rock layer called the Stirling Quartzite is exposed in the mountains of the Death Valley region. The Stirling Quartzite is mostly made up of coarse sand with some layers of rounded pebbles. Use *uniformitarianism* to come up with two possible hypotheses for how the Stirling Quartzite formed, and suggest a possible test that could support one or the other hypothesis.

10. Garnets are semiprecious stones that often form within the metamorphic rock *schist*. Use your knowledge of plate tectonics to suggest some good places to go hunting for garnets.

11. There have been times in Earth’s history when the bottom waters didn’t mix much with the surface layers of the ocean. This produced a stagnant, low-oxygen “pool” of oceanic bottom water. What could have been responsible for shutting down this mixing, and why?

12. Some coastlines on the Earth develop beautiful sandy beaches, while others never do. Describe at least three factors that determine whether or not a section of coastline develops and retains a beach.