HW #1 - Plate Tectonics and Rocks and Minerals – ANSWER KEY

1) a) What is the average thickness of the oceanic crust - give your answer both in km and miles ***– 5 km or approx. 3 miles***

b) What is the average thickness of the continental crust - give your answer both in km and miles – ***30 to 35 km or approx. 19-22 miles***

2) a) How is the mantle different from the crust? – ***It is chemically different (made of a different composition rock) – the web site says "The mantle has more iron and magnesium than the crust, making it more dense."***

b) How is the lithosphere different from the mantle? ***– the mantle is a layer of the earth made of ultramafic rock (defined as a chemical layer), whereas the lithosphere is a MECHANICAL layer of brittle rock that includes TWO CHEMICAL layers of the Earth (the crust and uppermost mantle).***

c) How is the lithosphere different from the asthenosphere? ***– the lithosphere is BRITTLE rock and the asthenosphere is PLASTIC rock.***

d) What do we mean when we talk about a "plate"? ***– an individual piece of the lithosphere that has broken or separated from surrounding pieces of lithosphere. The web sites says "It's the lithosphere that breaks into the thick, moving slabs of rock that geologist's call tectonic plates."***

3) a) How fast do the fastest plates move - give your answer in both cm/yr and inches/yr? ***15 cm/yr or 6 inches/yr***

b) How slow do the slowest plate move - give your answer in both cm/yr and inches/yr? ***less than 2.5 cm/yr or less than 1 inch/yr***

4 a) Which young divergent plate boundary does this site mention? ***– the Red Sea***

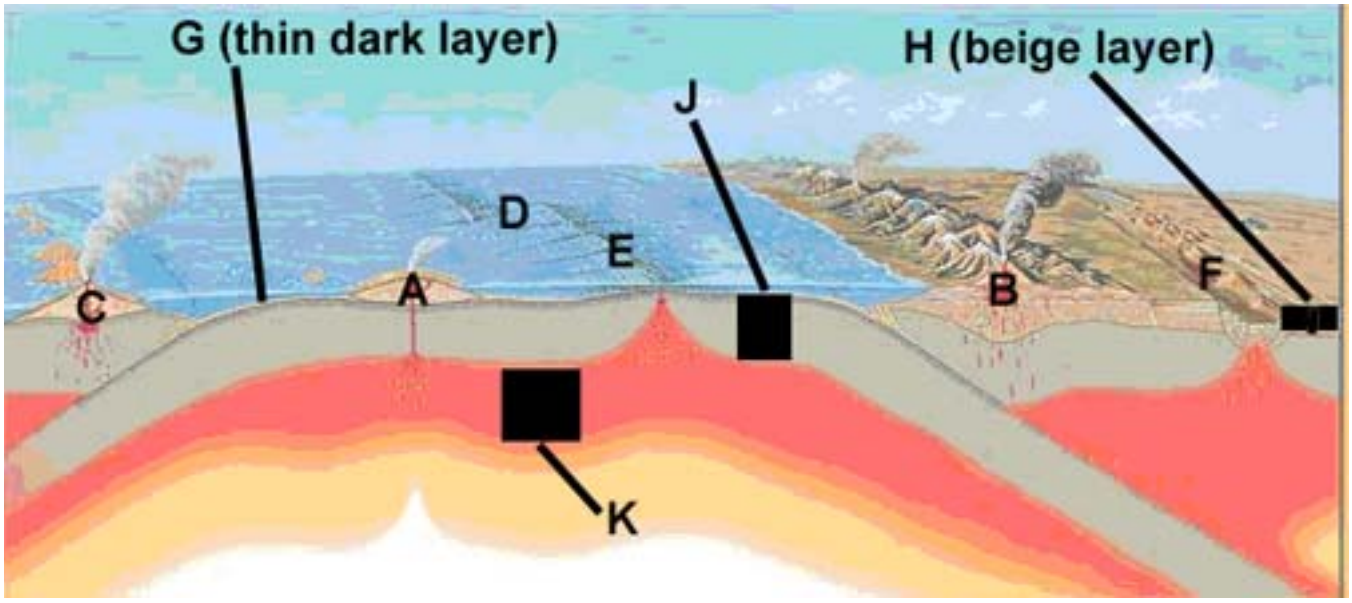
b) What type of lithosphere forms at a divergent plate boundary? ***oceanic***

c) What are the two names that this site uses to describe the chain of volcanic mountains that forms at a divergent boundary? ***- mid-ocean ridge or spreading ridge***

5) a) Explain what is meant by "subduction" ***– this is the process at a convergent plate boundary whereby oceanic lithosphere descends/sinks into the Earth's interior.***

b) What happens when two oceanic plates collide? ***– the denser of the two plates is subducted***

c) Why don't we have subduction when two continents collide? ***– because the continental plates are too buoyant.***



The image above is from:
http://www.nature.nps.gov/geology/usgsnps/pltec/vigilim.html

Please print out this picture and label the following: A - a hot spot volcano; B - a subduction zone volcano at an oceanic/continent collision; C- a subduction zone volcano at an ocean/ocean collision; D - a transform plate boundary; E - a divergent plate boundary with a mid-ocean ridge; F - a divergent plate boundary with a rift valley on a continent; G - oceanic crust; H - continental crust; J - lithosphere; K - asthenosphere.

Section II: Rocks and Minerals

6) Figure out what part of the paragaph on the page given above is the actual definition of a mineral and type that definition up word for word (giving me neither too much information nor too little). "***Minerals are crystalline substances, meaning that the atoms of their constituent elements are arranged in a definite geometric structure.***"

7) Once you have looked at the pages above, give me a brief explanation of how a rock is different from a mineral. ***– a single mineral grain is essentially a single large molecule, whereas a rock is made up of a lot of individual minerals and/or other materials such as rock or shell fragments or pieces of compressed plants.***

8) a) What is an igneous rock? ***– a rock that form from the solidification of magma***

b) How does an extrusive rock differ from an intrusive rock? (Hint -

there is a nice diagram at
http://www.nature.nps.gov/geology/usgsnps/noca/nocageol2a.html)
Besides the obvious fact that extrusive means formed above ground and intrusive means formed below ground, the difference between the two is grain size (as clearly shown in the diagram I referred you to). Extrusive rocks are finer grained than instrusive rocks.

9) For this one, look at the charts at
http://www.nature.nps.gov/geology/usgsnps/rxmin/igclass.html# and tell me

a) How does a basalt differ from a gabbro? ***– same exact composition (mafic) and mineralogy – the difference is in grain size as basalt is extrusive and gabbro is intrusive.***

b) How does a tonalite differ from a granite? – ***in chemistry and mineralogy – the diagram shows that tonalite has more plagioclase feldspar and less potassium feldspar (orthoclase) than a granite – both are intrusive rocks, so it is NOT grain size.***

10) a) What is a sedimentary rock? ***– The important point here is that sedimentary rocks are formed (with the exception of coal) from sediments, which is material derived from a pre-existing rock by WEATHERING. If you didn't make it past the first sentence: "Sedimentary rocks are formed from pre-existing rocks or pieces of once-living organism" of the web site, then you didn't get the very important WEATHERING idea. That first sentence is also true for igneous and metamorphic rocks if you follow the sentence with a correct modifier such as "by melting" or "by metamorphism".***

b) How does a clastic rock differ from a chemical rock? ***Clastic rocks are made from fragments (rock fragments of mineral grains) from pre-existing rocks, whereas chemical rocks form from the precipitation of atoms dissolved in water.***

11) a) What is a metamorphic rock? ***– Metamorphic rocks are formed by the alteration of pre-existing rocks in the solid state by a combination of pressure, temperature, or hot mineral-rich fluids.***

b) How does a foliated rock differ from a nonfoliated rock? ***In a foliated rock, the flat, platy, or elongated minerals are aligned. They are not aligned in a nonfoliated rock.***