GEOS 112L **Introduction to Earth Science**

First Hour Exam **Name: _____**

Please answer all questions.

A gentle warning: I don't think that the answer to any of the questions is trivial. Only well reasoned answers will receive full credit.

1. The Planets and Their Formation

a) List the important physical and chemical properties for the planets of the solar system (4 points)

b) Come up with a model that describes the formation of the solar system. Make sure to explain how the similarities and differences between the planets follow from your model. (6 points)

a)

inner planets (Mercury, Venus, Earth, Mars)

- *small*
- *rocky*

outer planets (Jupiter, Saturn, Uranus, Neptune)

- *large*
- *gaseous atmospheres (gas giants)*

b)

collapsing solar nebula contracts into central bulge and protoplanetary disk, spins faster due to conservation of angular momentum
explains: all planets in one plane, same sense of revolution, most same sense of rotation

most mass ends up in center, formation of central star, cuses thermal gradient across disk, which causes light elements to accumulate in outer regions
explains: chemical composition of inner/outer planets

planetary disk collapses into chunks of matter, collisions form protoplanets, further collisions form remaining planets
explains: heavy cratering obs. on Mars, Mercury, Venus, Moon

2. North American Volcanoes

a) Describe the plate tectonic setting of Mauna Loa (Hawaii) and Mount Saint Helens (Washington State). (2 points)

b) How is magma generated under these volcanoes ? (5 points)

c) Which magma type and eruptive style would you expect for these volcanoes ? (3 points)

a)
Mauna Loa - hotspot
Mt. Saint Helens - subduction zone

b)
Hawaii:
*decompression melting due to rapidly rising magma (can explain decompression melting further, see book_*
Washington:
wet-partial melting of subducted slab (discuss depression of melting point due to presence of water)

c)
Hawaii:
basaltic shield volcanoes, large lava fountains, mostly non-explosive eruptions

Washington:
variety of magma types, depending on degree of partial melting. higher viscosity and high gas content leads to more explosive eruptions, stratovolcanoes

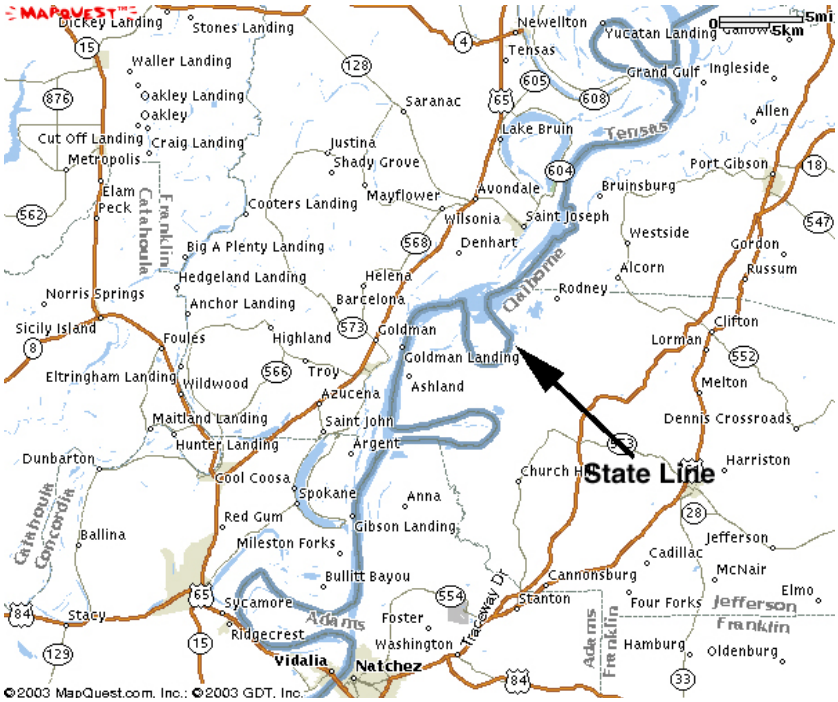
3. Mass Wasting and Fluvial Systems

a) What properties are used to classify clastic sedimentary rocks? What do these properties tell us about the sedimentary environment? (2 points)

b) How can sediment properties be used to reconstruct fluvial environments? (3 points)

c) How do sediments change along the course of a stream ? (3 points)

d) The figure to the right shows part of the state line between Louisiana and Alabama, which in some locations coincides with the course of the Mississippi river. Why is the state line so crooked? Can you explain what happened? (2 points)



a)

particle size, roundness, sorting, mineralogy

all tell us about transport history, can expand on how different parameters are influenced by transport

b)

distinct differences between coarse-grained, poorly sorted channel sediment and fine-grained floodplain deposits, channel geometry, some current indicators (ripple marks, imbricated pebbles)

c)

from source to mouth sediment properties change in the following way:

- *grain-size decreases*
- *roundness increases (angularity decreases)*
- *sorting increases*
- *mineralogy shifts to more mature minerals*

d)

state line followed Mississippi, but M. is meandering stream, which shifts over time. state line stayed in place.

4. Evidence for Plate Tectonics

a) It took over 50 years to develop the theory of Plate Tectonics. What were the key pieces of evidence that convinced most scientists? (3 points)

b) What are the basic premises of Plate tectonics ? (5 points)

c) Wegener's hypothesis of Continental Drift was ultimately rejected and replaced by Plate Tectonics. Was it a bad scientific hypothesis? Why or why not? (2 points)

a)

note: Wegener's evidence and arguments do NOT answer this question.

- *ocean bathymetry (mid oceanic ridges)*
- *ocean ages (younger than continents)*
- *magnetic stripe pattern*
- *direct reconstruction of continent movement through paleomagnetics*

b)

- *lithosphere is divided into discrete rigid plates, these plates move with respect to each other*
- *plates ride on weak asthenosphere (upper part of mantle)*
- *mid-oceanic ridges ➜ generation of new lithosphere*
- *subduction zones ➜ destruction of old lithosphere*

c)

no, it was pretty good. It produced testable predictions and was supported by quite a bit of observational evidence.

5. Multiple Choice (2 points each)

a) Reversals of the earth's magnetic field

- ☐ occur on average every few hundred thousand years
- ☐ are characterized by a decrease in the Earth's magnetic field strength
- ☐ last about a thousand years
- ☐ **all of the above**

b) The thickness of marine sediment is greatest

- ☐ along mid-oceanic ridges
- ☐ along fracture zones
- ☐ **at the edges of ocean basins**
- ☐ at continental rises

c) The idea that continents have maintained fixed positions throughout time

- ☐ was accepted by scientists until the late 1960's
- ☐ was replaced by the theory of Plate Tectonics
- ☐ was incorporated within the theory of Plate tectonics
- ☐ **A and B**

d) The breakdown of exposed rock into smaller fragments is called

- ☐ deposition
- ☐ erosion
- ☐ **weathering**
- ☐ fractionation

e) Basaltic lavas

- ☐ **contain more iron and magnesium than rhyolithic lavas**
- ☐ contain more silica than rhyolithic lavas
- ☐ are more viscous than rhyolithic lavas
- ☐ contain a greater proportion of trapped gasses than rhyolithic lavas