PHYS 112 **Nov. 1st , 2001**

2. Midterm Exam **Name:**

1. What are the lower and upper limits of metamorphism? (3 points)

lower limits: Diagenesis (T < 100°C - 200°c, p = 10 Mpa (few km depth)

upper limit: (wet) partial melting (T = 800°C - 1000°C)

2. Metamorphic minerals that form at high pressures and temperatures are generally not stable under surface conditions (low p, T). Considering that it takes millions of years for deeply buried rocks to reach the surface, why do we still see these minerals in surface outcrops. (3 points)

During burial many sediments and rocks contain water, which speeds up the processes that form metamorphic minerals (prograde metamorphism). This water is expelled during burial, so during the following uplift the rocks are dry, and metamorphic minerals take much longer to revert into stable surface minerals (retrograde metamorphism).

3. What is the main difference between **gneiss** and **granite** in a hand specimen? What does it tell you about the history of the rock? (3 points)

Gneiss has a well developed foliation, which shows that it is a metamorphic rock that formed under differential stress.

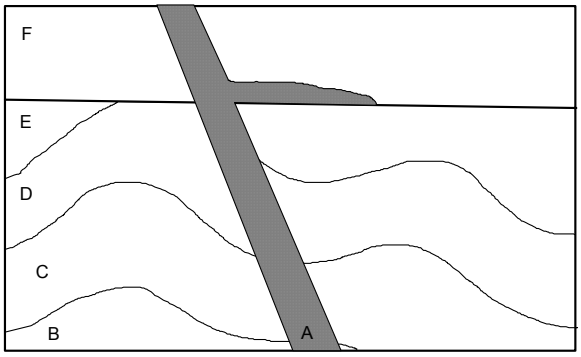
4. What is an index fossils, in which environment did most index fossils live? Why? (4 points)

*index fossils are species that have undergone **rapid evolution**, so they only existed for a short period of time (millions of years), are **widespread**. they are mostly **marine** species, which allows to move freely across the earth without being trapped in some terrestrial ecosystem*

5. Which species are likely to be preserved in the fossil record? (2 points)

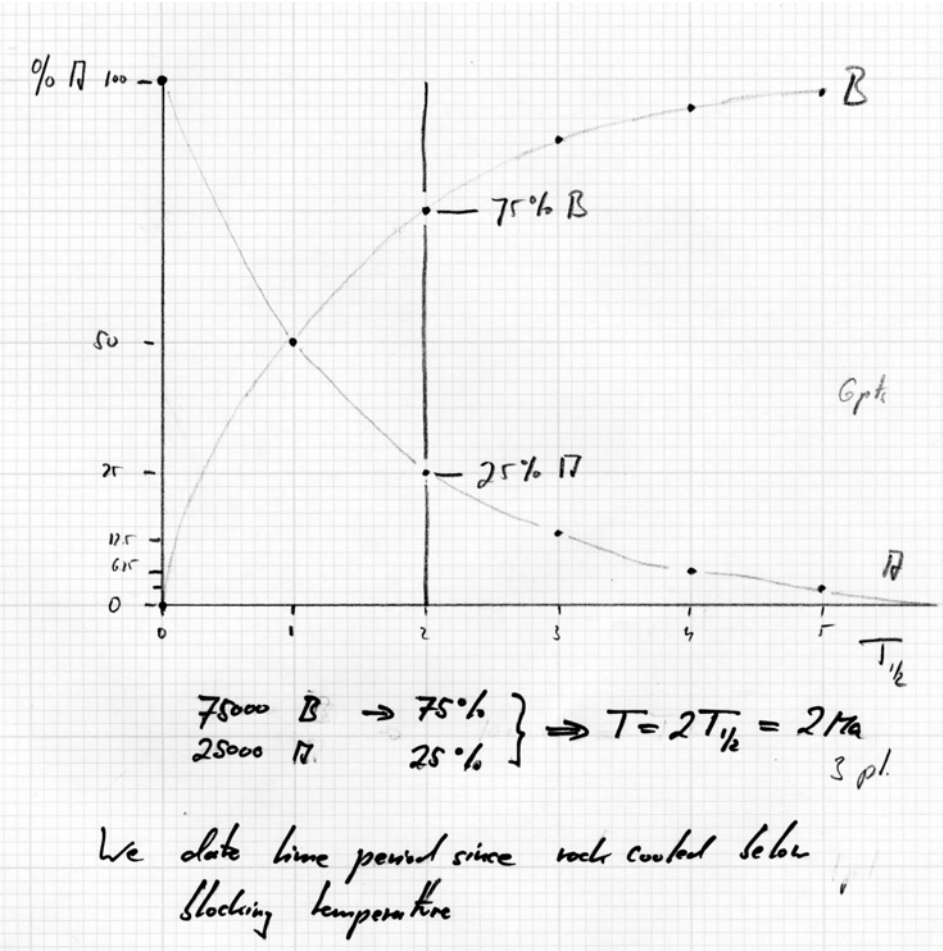
species that contain hard body parts and live close to water or other sediment traps

6. Reconstruct the geological history of the stratigraphic section shown below. (5 points)



1. *deposition of sedimentary layers B,C,D,E*
2. *folding of these layers*
3. *erosion along boundary between E - F*
4. *deposition of F*
5. *intrusion of A*

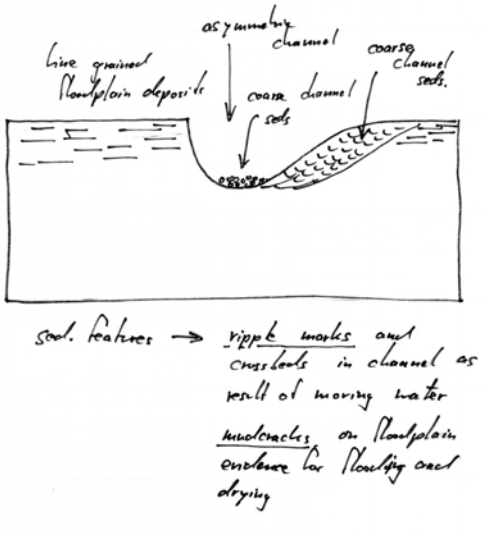
7. A radioactive element A has a half life of $T_{1/2} = 1 \times 10^6$ years and decays into a stable doughter isotope B. At t = 0, the rock cools just below its blocking temperature and begins to trap the daughter isotope B, which would otherwise be lost.
On the provided sheet of graph paper **carefully** plot the relative abundance of A and B from T = 0 to T = 5 $T_{1/2}$.
The analysis of a high grade metamorphic rock specimen yields 25000 isotopes of A and 75000 isotopes of B. How old is the rock? What are you actually dating?
(10 points)



8.. Describe the influence of water on slope stability for unconsolidated sediments.
(3 points)

dry sediments: *shear strength is relatively low, slope will be at angle of repose*
moist sediments: *shear strength increases due to capillary forces between sediment particles*
wet sediments: *abundant water between particles lubricates particles, shear strength decreases*

9. Draw a (detailed) sketch of the type and distribution of the various sediments associated with a meandering stream. Which sedimentary structures are you likely to find and why? (6 points)



10. What is the difference between porosity and permeability? (2 points)

porosity tells you how much of the rock is made up of voids, permeability describes how well those voids are connected.

11. What are some of the potential effects of overpumping on aquifers? (2 points)

Draw down of the water table, all the way to total depletion of the aquifer, encroaching of sea water on freshwater aquifer (in coastal aquifers)

12. On the world map below sketch the distribution of major deserts and explain the processes that lead to the formation of deserts in these places. (8 points)

Deserts that should be mentioned:
Sahara, central America, Graet Astralian Desert, all between 20° - 30° latitude in downward branch of Hadley cell, (horse latitudes)

Deserts in Central Asia, are dry because they are far from any moisture source and often downwind from large mountain ranges

N. American deserts, in rain shadow of Rocky mountains

Polar Deserts: extremely cold air holds only very little moisture

13. In the table below describe the sediments you are likely to find in the various environments given in column 1. (10 points)

Environment	**Mineralogy**	**Grain Size**	**Angularity**	**Sorting**
Landslide	mixed	coarse	angular	poor
Braided Stream	mixed	often coarse	high	poor
Meandering Stream	mixed, more towards quartz	finer (sand to silt)	medium	medium well
Floodplain	mixed, many clay minerals,	fine (silt and clay)	medium	good
Sand Dunes	quartz	fine sand	very well rounded	extremely well