

## Principles of Paleontology (ES4202)

End-term exam, Total points: 50

- Write no more than 5 lines for any question.
- Draw diagrams/figures/graphs if required

1. You have studied the following fossil assemblages.

Assemblage A, Number of individual = 75

Assemblage B, Number of individual = 300

Assemblage C, Number of individual = 400

a) If the above graph is a correct rarefaction curve at various taxonomic levels for one of the assemblages, which one (A, B, C) did you use to construct it? (1)

b) Mark the lines with corresponding taxonomic level (order, family, genus, species). (2)

c) For assemblage B, the species number at various individual level are the following

Species = 30, Individual = 300;

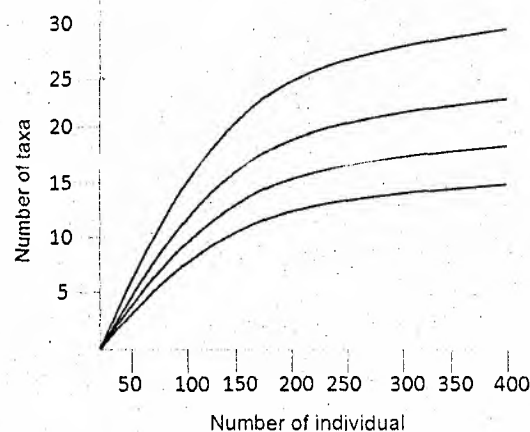
Species = 28, Individual = 250;

Species = 25, Individual = 200

What would be the species completeness (%) when the number of individuals is 200 (please show the calculation)? (2)

d) We find dragon-fly fossils from Carboniferous which is five times than the normal size. Why do we find them during this time (and not in any other time)? (3)

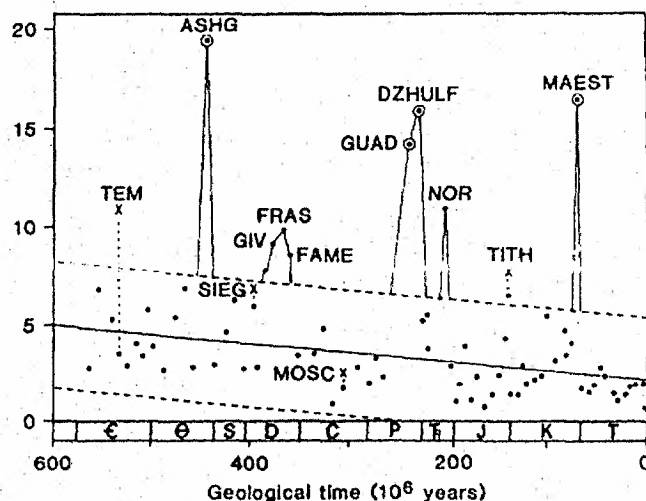
e) State two difference between the responses observed during "Mid-Paleozoic Marine Revolution" and "Mesozoic Marine Revolution"? (2)



2. a) The following figure from Raup and Sepkoski (1982) captures the extinction events in the geologic past.

- What does the Y-axis represent? (1)
- What is represented by the two dashed lines. (2)
- Explain the meaning of the symbols "x" and "o" in the figure. (2)

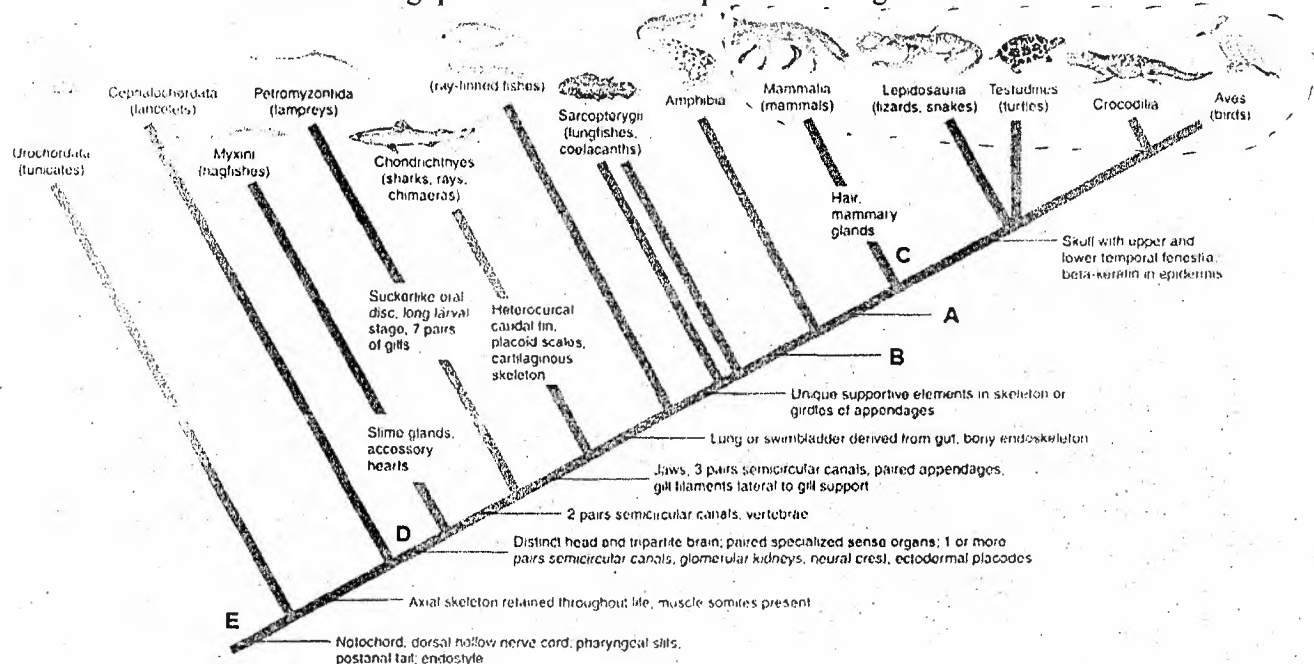
b) What is the nature of origination rate during Phanerozoic? In order to have the increasing trend in diversity, what should be the nature of extinction rate during Phanerozoic? (1+3)



c) "99.9% of all species that have ever lived on the earth are extinct". Explain this statement with the help of a rudimentary marine diversity curve where the Recent species richness correspond to 1,75,000 and average duration of species is 5my. (3)

d) What factors resulted in the initial drop and subsequent increase in temperature during K-Pg extinction? (3)

3. Please answer the following questions with the help of the cladogram.



- State the characters denoted by A and B? (2+2)
- State the geologic period when the divergence marked by C took place? (2)
- State the name of the monophyletic clade that can be defined based on A as synapomorphy. How would you distinguish the early members of this clade from amphibians in the fossil record? (2+3)
- What would be the name of the group if you include amphibians into it? (2)
- When did the divergence marked by D happened? (1)
- State a fossil organism that represents the basal stock of this entire cladogram. (1)

4. a) Between "overkill hypothesis" and "climate change", which one is better supported as a probable mechanism for Pleistocene megafaunal extinction? Provide two separate lines of evidence to justify your answer. (1+3)

b) State two physical and two chemical conditions that make the hydrothermal vent a likely candidate for the birth place of first life? What is the identified problem with this setting? (2+1)

c) Using the fossilized leg bone of and one set of track ways of *T. rex*, it be possible to reconstruct the speed of this species. Explain. (3)