1. The skull above is from a pelycosaur. From what is visible in the picture, what is the most mammal-like feature visible in the pelycosaur?

2. Characterize the pelycosaurs. How do they differ from more primitive amniotes? How do they differ from therapsids. What special adaptation(s)/feature(s) do they have?

3. What is the most likely function of the sail-like fin in *Dimetrodon*? Why is this important?

4. What is a therapsid? List and discuss four mammalian characteristics that were present in therapsids?

5. What are the three most important differences between pelycosaurs and therapsids?

6. What happened to pelycosaurs and therapsids as a result of the Permo-Triassic Extinction?

7. How have the jaw musculature and associated skull and jaw structure changed in the therapsid from its pelycosaur ancestors?

8. The figure below is the skeleton of a therapsid that is close to the ancestry of mammals.
   a. To which groups of therapsids does it belong?
   b. What two bones are involved in articulating the lower jaw with the skull?
   c. What is the most mammal-like feature that can be seen as shown in the picture? Explain how is this feature related to endothermy
   d. List 5 “reptilian” characters found in an advanced therapsid such as *Thrinaxodon*.

9. Contrast respiration in a pelycosaur and in a mammal.

10. What bones articulate the jaw to the skull in a pelycosaur? In a mammal?

11. Why are therapsids described as having an intermediate jaw and middle ear morphology relative to pelycosaurs and mammals?

12. What bones are involved in jaw articulation in reptiles and primitive synapsids? What do these bones become in mammals.
13. Describe the changes in jaw structure and hearing apparatus that accompanied the evolutionary transition from pelycosaurs to mammals. What was the advantage of these changes?
14. List the four bones of the middle ear region of mammals discussed in lecture. What is the function of each? What is the reptilian homolog of each?
15. Describe the state of JAW ARTICULATION and MIDDLE EAR BONES in a pelycosaur, a therapsid, and a mammal. Note the probable functional reason for the change.
16. What developmental changes can we observe in the jaw of newly born opossums that is similar to what we see in the evolution from cynodonts to mammals?
17. Regarding the mammal middle ear bones, what is the origin of the malleus and incus bones from the bones in a therapsid? What can we observe in the jaw of newly born opossums that supports this interpretation?
18. What other major changes were taking place during this transition from pelycosaur to mammal? What was the advantage of each?
19. Compare (i.e., tell how they are similar) and contrast (i.e., tell how they are different) pelycosaurs, therapsids, and Mesozoic mammals for the following features: secondary palate; temporal fossa; posture; jaw articulation; tooth replacement; middle ear bones; hair; lower jaw bones; tooth differentiation (Kinds and shape of teeth); tooth replacement; growth; respiration; metabolism.
20. What is a heterodont dentition? Discuss how this term relates to pelycosaurs, therapsids, and mammals. What is the relationship between a heterodont dentition and endothermy?
21. What is a secondary palate? In which taxon does it first appear? What is its function?
22. What is the role of the secondary palate in mammals?
23. What mammal-like features are present in advanced therapsids that indicates that they may have been endotherms? Explain.
24. List and discuss 3 different skeletal characters you would use to recognize Mesozoic mammals and, thus, separate them from their therapsid ancestors.
25. Discuss the significance of the very primitive mammal *Morganucodon* to the evolution of the modern mammalian jaw articulation and the middle ear region.
26. Compare and contrast the kinds of teeth and the method of tooth replacement found in pelycosaurs, therapsids, and mammals.
27. Characterize tooth differentiation and replacement in therapsids.
28. Compare and contrast the kinds of teeth and the method of tooth replacement found in pelycosaurs, therapsids, and mammals.
29. Define diphyodonty. Why did it evolve in mammals?
30. List three distinctive facts/features about/of multituberculates.
31. What are multituberculates? Why are multituberculates considered the most successful group of mammals?
32. What are multituberculates? How are they related to other synapsids? What ecological niche do they occupy? What is the evidence for this?
33. Why are multituberculates used as example of both ecomorphy and competitive replacement?
34. Why can multituberculates be regarded as the most successful group of mammals? What caused them to go extinct?
35. Why are multituberculates such a good example of competitive replacement by ecomorphs?
36. Primitive marsupial and placental mammals have tribosphenic molars. What are they and why were they advantageous.
37. What is a tribosphenic molar? What diet is associated with this type of tooth? What is its advantage for this diet?
38. When did the tribosphenic molar first appear and which for which mammal groups is it primitive.
39. What is the adaptive advantage of a tribosphenic molar over the teeth found in more primitive mammals?
40. Which two major groups of mammals are derived from a tribosphenic ancestor
41. Discuss the relationship of the appearance and disappearance of dinosaurs relative to the evolution of mammals.
42. What caused mammalian diversity to remain relatively low during the first 120 million years of their existence?
43. What enabled mammals to diversify rapidly about 65 million years ago. What caused this?
44. For the following extinct and living taxa, be able to characterize the significant features, and explain their importance as discussed in class
   a. Amniote
   b. Tetrapod
   c. Anapsid
   d. Diapsid
   e. Synapsid
   f. Pelycosaur
   g. Dimetrodon
   h. Therapsid
   i. Cynodont
   j. Thrinaxodon
   k. Probainognathus
   l. Stem mammals
   m. morganucadont
   n. Theria
   o. Multituberculates

45. The following figures are among those used in past exam questions. What is the figure showing? If relevant to what taxonomic group does it belong? What is the importance of the figure to material discussed in lecture?