CHAPTER 3

1) Features seen in all embryos shown in Figure 3.2 include head with eye, tail, and somites. Other common features not seen externally include dorsal neural tube and notochord, heart and ventral gut. Limb buds are apparent in the chick, mouse and human embryos.
2) 1st and 2nd cleavages in *Xenopus* are along the plane of the animal-vegetal axis, the 3rd is at right angles. Cleavage in the chick embryo is affected by the massive amount of yolk in the fertilized egg compared to *Xenopus* and mouse eggs. You may want to draw diagrams of cleavage in all three model organisms to illustrate your answer.
3) The essential features of the blastula in amphibian embryos (for the blastula in sea urchin embryos see chapter 6), the blastoderm in bird and fish embryos (note you will have already come across the blastoderm in *Drosophila* in Chapter 2), and the blastocyst in mammalian embryos are defined in the glossary.
4) Germ layers = ectoderm, mesoderm, and endoderm (see also glossary). Refer to Figure 3.6. The archenteron will become the gut.
5) Many of these terms refer specifically to regions in the early chick embryo (see also glossary). Koller's sickle is a crescent shaped ridge of cells that defines the position in which the primitive streak will form. It is useful to distinguish between endoblast and endoderm and mesenchyme and mesoderm. Endoderm and Mesoderm are two of the three germ layers of all triploblasts. Endoblast denotes a layer of cells that forms in the chick embryo. Mesenchyme denotes loose connective tissue which is usually but not always of mesodermal origin. It is important to become familiar with all these terms as they will come up in later chapters, especially chapter 5.
6) Emphasise that the shape of the early embryo is very different in *Xenopus* and the chick. (a) Ingression and involution: see also definitions in glossary. Details of these different cell behaviours will be described in Chapter 7. (b) Node regression in the chick: laying down of notochord and somites; contrast with the way in which notochord and somites are laid down in *Xenopus.*
7) For neural plate, intermediate mesoderm, notochord – see also glossary. Neural plate–nervous system (see nervous system development chapter 11), intermediate mesoderm–kidney (see on-line material S2 associated with Chapter 10), splanchnopleural mesoderm–the outer layer of lateral plate mesoderm associated with ectoderm that gives rise to the limb buds, notochord–contributes to vertebral column (see Chapter 5). Early development of the mouse is complicated by the need to produce the placenta and protective extra-embryonic membranes. Inner cell mass and trophectoderm–two distinct cell populations in the early mammalian embryo with different fates; see also Glossary. Epiblast arises from inner cell mass and primitive streak arises at posterior margin of the epiblast; see also Glossary. Epiblast is cup-shaped in the mouse.
8) You will find the information to answer this question summarized in Figures 3.31 and 3.35. Both chicken and frog are attractive models for classical embryological manipulation but not for genetic-based techniques–these latter techniques are very highly developed in mice.
9) For definition of transgenic see the glossary. Two techniques should be outlined for mouse- injection of transgene into male pronucleus of fertilized egg and injection of genetically manipulated embryonic stem cells into an inner cell mass of a blastocyst. Include discussion of recent advances in transgene design.
10) Chick embryos are ideal for experimental embryological manipulations. Mice are very good for genetics-based techniques. You could design experiments in both chick and mouse embryos to find out the fate of the cells expressing the transcription factor. Experiments in mice to test function of transcription factor include making transgenic knock-out mice (conditional mutants might be needed). Experiments in chick embryos to explore how expression of the gene is regulated include transplantation experiments, applying inhibitors of signaling pathways on beads.

11) The early stages of development of mouse and human embryos are very similar up to the blastocyst stage but the processes of implantation and formation of the placenta differ. You also need to include the details of how the topology of the embryos just prior to gastrulation differs.
12) The information to answer this question can be found in Box 3D.