

(10% each)

1. Why is it important for an experiment to have a control, and how does a hypothesis affect a scientific investigation?
2. How is the smooth endoplasmic reticulum able to detoxify drugs and poisons?
3. No nucleus is found in the outermost layer of skin cells that cover your body. A moisturizer claims to restore and rejuvenate these cells. Would these skin cells be capable of producing other skin cells?
4. During replication, DNA makes an exact copy of itself so that after mitosis the two daughter cells have the same genetic information and are exact copies of the parent cell. How then do the cells in a developing embryo become different from each other and specialized?
5. What are the functions of DNA polymerase I, II, and III, respectively? Which one(s) function in mismatch repair and how?
6. How does the structure of the extracellular matrix in animals determine its functions?
7. Dominant negative mutants of both Ras and Raf block growth factor-stimulated cell proliferation. The inhibitory effects of dominant negative Ras are overcome by expression of activated Raf. Would you expect activated Ras similarly to overcome the inhibitory effects of dominant negative Raf? How about activated MEK (MAP kinase kinase)?
8. Cells and their interiors are so compartmentalized! Cells are separated from one another by membranes, and the interiors of eukaryotic cells are further compartmentalized by organelles. How do cells communicate with one another?
9. The Cdk inhibitor p16 binds specifically to Cdk4/cyclin D complexes. What would be the predicted effect of overexpression of p16 on cell cycle progression? Would overexpression of p16 affect a tumor cell lacking functional Rb protein?
10. You are studying the pathway of pigment synthesis in the fictitious bacterium, *Bacterium colorificus*. Wild-type bacteria are red. You have three mutant strains, with altered colors.

Genotype	Color	Phenotype
m1 ⁺ m2 ⁺ m3 ⁺	red	(wild-type)
m1 ⁻ m2 ⁺ m3 ⁺	orange	
m1 ⁺ m2 ⁻ m3 ⁺	yellow	
m1 ⁺ m2 ⁺ m3 ⁻	colorless	
m1 ⁻ m2 ⁻ m3 ⁺	orange	
m1 ⁺ m2 ⁻ m3 ⁻	colorless	
m1 ⁻ m2 ⁺ m3 ⁻	colorless	

Based on this information, determine the order of the enzymes and intermediates in this pathway.