

## Cells, Membranes and Membrane Transport Concept Questions

1. What evidence suggests that eukaryotic cells are more recent than prokaryotic cells? (Eukaryotic cells are more complex than prokaryotic. They have a nucleus, generally larger genomes, and membrane-bound organelles.)
2. How does the endosymbiont theory explain the progression from prokaryotic to eukaryotic cells? Make sure your answer mentions the evidence. (The theory describes how small prokaryotes were taken in by larger ones to live there in a cooperative relationship. These became organelles such as ribosomes and chloroplasts. Evidence includes mitochondria having their own ribosomes and DNA, the mitochondrial double membrane, mitochondria being similar to bacteria in size and shape, and mitochondria divide autonomously.)
3. As a cell gets larger, volume increases faster than surface area. Why is this a problem? (Transport proteins are found in the cell membrane. Cells need sufficient surface area to ensure enough transport proteins to acquire materials from the environment and to eliminate wastes.)
4. Why do we use the term 'fluid mosaic model' to describe the cell membrane? (A membrane is a mosaic of proteins and phospholipids. These components can move around in the membrane.)
5. How are glycoproteins like team jerseys? (Glycoproteins allow cells to identify one another.)
6. Why is a membrane important for a cell? (The membrane separates the cell from the extracellular environment and controls the passage of materials into and out of the cell.)
7. Why is it important for the cell membrane to be selectively permeable? (The membrane must allow required nutrients in and wastes out, while excluding other molecules and ions.)
8. How is the structure of the phospholipid important for its function? (Phospholipids are amphipathic. The polar head and nonpolar tail cause them to form bilayers spontaneously. The nonpolar region of the membrane excludes polar molecules and ions, adding to the selective permeability of the membrane.)
9. In general, what kinds of things pass easily through the membrane and which do not? (Nonpolar and very small polar pass through; ions, polar molecules, and large molecules cannot pass through easily.)
10. Hormones are chemical messengers that travel in the blood throughout the body. Protein hormones (polar) attach themselves to receptors on the cell surface while lipid hormones (nonpolar) actually enter the cell. Explain this difference. (Lipid hormones are hydrophobic so can pass through the nonpolar part of the membrane; protein hormones are hydrophilic and cannot.)
11. You are given food coloring and three beakers of water. Design an experiment to determine the effect of temperature on the rate of diffusion. Be sure to have a hypothesis and a control. (In three separate beakers, have ice water, room temperature water and hot water. Add a drop of food coloring to each and observe the rate of diffusion. Hypothesis - diffusion will occur fastest at the highest temperature. A control could be to use a beaker with room temperature water.)
12. As waste products build up, homeostasis is threatened. How does diffusion help avoid this? (As waste products build up, they continually diffuse away from where they are produced. This avoids them accumulating to harmful concentrations)
13. Suppose that the concentration of carbon dioxide in the fluid outside a cell became higher than that on the inside. Predict what would happen. What prevents this from happening normally? (If the concentration outside became higher, carbon dioxide would diffuse into the

cell. This is prevented we exhale, expelling carbon dioxide.)

14. How is facilitated diffusion a benefit to cells? (It is faster, allowing cells to get required nutrients more quickly.)

15. Imagine that a cell has been in a slightly hypotonic solution for some time and is now isotonic with the solution. Has the movement of water molecules stopped? Explain. (At equilibrium, molecules are still moving but they enter and leave the cell at the same rate.)

16. A dog pees on your lawn. What do you expect to observe over the next few days? Explain. (The urine creates a hypertonic solution so cells will lose water and die. A few days later, rain might dilute the urine allowing the grass to grow back. It will be greener than the surrounding grass because of the fertilizing effect of the urine.)

17. Why is turgor pressure not used in reference to animal cells? (Animal cells have no cell wall.)

18. Explain why it is not a good idea to drink distilled water or saltwater. (Distilled water is hypotonic to your cells and can cause them to lyse while saltwater is hypertonic causing you to lose water.)

19. A marathon runner collapses after running on a hot day. Although the runner consumed adequate water along the route, blood testing showed that many of his red blood cells had burst. Why was this the case? (hint: on hot days, runners normally drink fluids that contain sugar and salt.) (The runner had lost electrolytes during sweating, making the blood hypotonic to the blood cells. Drinking water, exacerbated the problem to the point where the blood cells burst.)

20. Gardens always have lots of insects and these insects get onto the plants. When gardeners bring in fresh vegetables from the garden, they sometimes soak them in saltwater before rinsing them and soaking them in freshwater. Why would they do this? (Salt water is hypertonic to insects and kills them. The gardener would then rinse off the salt in freshwater.)

21. Grocery stores spray their vegetables with water to preserve their freshness. Explain how this makes the vegetables appear fresh. (Water is hypotonic and causes cells in the vegetables to absorb water, making them crisp and plump, appearing fresh.)