Answers from CK-12 Life Science For Middle School Teacher's Edition
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Day 62

1. The cell membrane consists of two phospholipid layers. The interior of the membrane (lipid tails) is hydrophobic, or "water fearing." The exterior of the membrane (lipid heads) is hydrophilic, or "water loving." Proteins are also embedded in the lipid layers.

2. Diffusion is the natural movement of a substance down the concentration gradient from an area of higher concentration to an area of lower concentration.

3. Simple diffusion occurs when a small molecule moves through a cell membrane from an area of higher to lower concentration without help from transport proteins. The molecule simply squeezes between phospholipid molecules in the membrane. An example of simple diffusion is the diffusion of oxygen out of the lungs and into the blood.

4. Osmosis is the special case of the diffusion of water.

5. Passive transport of the substance will occur out of the cell because the concentration of the substance is greater inside than outside the cell. Transport out of the cell will occur naturally by diffusion down the concentration gradient, and this requires no energy.

6. Passive and active transport are the two basic ways that substances may pass through cell membranes. Passive transport does not require energy. It occurs when a substance diffuses across a cell membrane from an area of higher to lower concentration. It may or may not need to be facilitated by transport proteins. Active transport requires energy. It occurs when a substance crosses a cell membrane from an area of lower to higher concentration or when the molecules of the substance are very large. Active transport up the concentration gradient is by a protein pump, such as the sodium-potassium pump. Active transport of very large molecules is by vesicles.

7. Channel proteins form tiny holes called pores in the cell membrane. This allows water or hydrophilic molecules to cross the cell membrane without coming into contact with the hydrophobic interior of the membrane. Carrier proteins bind with diffusing molecules. This causes the proteins to change shape and carry the diffusing molecules across the membrane.

Day 63

1. Cellular respiration is the process in which cells break down glucose, release the stored energy, and use it to make ATP. Cellular respiration begins in the cytoplasm of cells. It is completed in mitochondria.

2. The three stages of cellular respiration are glycolysis, the Krebs cycle, and electron transport. Two molecules of ATP are produced in glycolysis, and two more are produced in the Krebs cycle. Up to 34 molecules of ATP are produced in the electron transport stage.

3. Fermentation is a process in which some organisms produce ATP from glucose without oxygen. In other words, fermentation is an anaerobic process. There are two types of fermentation: lactic acid fermentation and alcoholic fermentation.

4. Sample answer: I think that bacteria that live in the human intestines use anaerobic respiration to obtain ATP from glucose. That's because there is little or no oxygen in the human intestines, and anaerobic respiration does not require oxygen.

5. Cellular respiration and photosynthesis are closely related. They are like two sides of the same coin. The products of photosynthesis are needed for cellular respiration, and the products of cellular respiration are needed for photosynthesis. Together, the two processes store and release energy in virtually all living things.

6. Both aerobic and anaerobic respiration release energy from glucose and use it to make ATP. Aerobic respiration requires oxygen. Anaerobic respiration does not require oxygen. Aerobic respiration produces more molecules of ATP than anaerobic respiration does. However, anaerobic respiration occurs more quickly than aerobic respiration. It also allows organisms to live in places where there is little or no oxygen, such as deep under water or soil or inside other living things.

Day 64

1. DNA replication is the process in which DNA is copied. It occurs before a cell divides. It must occur so that each daughter cell will have a complete copy of the parent cell's genetic material.

2. Chromosomes are structures formed of DNA and protein molecules that are coiled into a definite shape. Chromosomes form from a cell's DNA when the cell prepares to divide.

3. In a prokaryotic cell, the steps of cell division are DNA replication, when the cell's chromosome is copied; chromosome segregation, when the two copies of the chromosome move to opposite poles of the cell; and cytokinesis, when the cytoplasm splits apart and the cell pinches in two to form new daughter cells.

4. The phases of mitosis are prophase, metaphase, anaphase, and telophase. In prophase, chromosomes form, the nuclear membrane breaks down, centrioles move to opposite poles, and spindles start to form. In metaphase, spindle fibers attach to the centromeres of sister chromatids, and sister chromatids line up at the center ofthe cell. In anaphase, spindle fibers shorten and pull the sister chromatids to opposite poles. In telophase, chromosomes uncoil, spindle fibers break down, and new nuclear membranes form.

5. The single-celled organism belongs to the Eukarya domain so it has a nucleus. When the organism divides, DNA replication will be followed by the four phases of mitosis, in which the nucleus and chromosomes divide. Then the rest of the cell will divide by cytokinesis.

6. Cell division is more complicated in eukaryotic than prokaryotic cells because eukaryotic cells have multiple chromosomes, a nucleus, and other organelles. When eukaryotic cells divide, the nucleus and other organelles must be copied and divided so that each daughter cell will end up with all the needed structures. The multiple chromosomes also must be separated in mitosis so that each daughter cell will have copies of all the chromosomes.

7. A prokaryotic cell has a simpler cell cycle than a eukaryotic cell. A prokaryotic cell grows in size, replicates its DNA, and then divides, typically by binary fission. A eukaryotic cell goes through two main stages in its lifetime: interphase and mitotic phase. Interphase is longer than mitotic phase and divided into growth phase 1, synthesis, and growth phase 2. Mitotic phase consists of mitosis and cytokinesis.