

CELL PROCESSES ANSWERS

1. Membranes are a bilayer of fluid phospholipid molecules that are interspersed with many protein molecules. The water-soluble or hydrophilic region is towards the outside of the membrane, whereas the oil-soluble or hydrophobic region is in the middle.
2. A differentially permeable membrane means that only some substances, such as oil-soluble ones, can pass through easily, whereas water-soluble ones may diffuse at a very slow rate or use an energy-requiring form of transport to pass through the membrane.
3. * Oil-soluble substances diffuse from high to low concentrations.
 - * Water may either diffuse slowly or go through protein channels.
 - * Glucose requires active transport to allow hydrogen ions to pass out through the membrane first, then attach themselves to the glucose molecule to transport it through the proteins in the membrane.
 - * Mineral ions, such as sodium, potassium and calcium ions, may either diffuse very slowly from high to low concentrations or use an active transport mechanism.
4. Yes. The structure is the same, but cell membranes have a thickness of about 7 to 9 nanometres and organelle membranes are about 5 to 7 nanometres thick.
5. The cell membrane allows the concentrations of substances on each side of the membrane to differ. This allows the intake of nutrients and oxygen and the outflow of wastes. It also allows cells and their organelles to be specialised.
6. Diffusion is the movement of substances from areas of high concentration to areas of low concentration. Osmosis is diffusion of only one substance, water.
7. The plant cell in distilled water has a higher concentration of salts inside the cell than its surroundings, so water will move into the cell to swell it, and some salts will move out of the cell. The plant cell in a very salty solution will have a greater concentration of salts outside the cell than inside, so the water in the cytoplasm will move out of the cell and the cell will shrink away from the rigid cell wall, and some salt from the outside will move into the cell.
8. Active transport requires energy from the energy-rich compound ATP. Passive transport requires no energy.

9. All these processes involve movement of large quantities of substances in vesicles which temporarily combine with the cell membrane to carry the substances into or out of the cell. Endocytosis takes chemicals into the cell, whereas exocytosis removes chemicals from the cell. Two forms of endocytosis are phagocytosis (i.e. engulfing and intaking chemicals such as invading bacteria into a white blood cell) and pinocytosis (i.e. taking in droplets of chemicals).

10. Catalysts are substances which regulate the rate of chemical reactions. They are not used up in the reaction and can be used over and over.

11. (a) An enzyme is a large globular protein made within a living cell which acts as a catalyst. Each enzyme is specific for each reaction, and has a shape that fits its substrate like a lock and key.

11. (b) The active site is the small part of an enzyme where it attaches to its substrate for the duration of the reaction.

11. (c) The substrate is the reactant chemical which will be changed in the chemical reaction after attachment of the enzyme.

11. (d) The activation energy is the amount of energy required for the reaction to proceed. When an enzyme forms an enzyme-substrate complex, less activation energy is needed for the reaction to proceed.

12. Part of the enzyme has the exactly opposite shape to part of the substrate. They fit together like a key in a lock.

13. * Temperatures affect enzymes. Very low temperatures slow down the activity of enzymes. Temperature 50 to 60°C inactivates enzymes irreversibly because they are proteins which coagulate above this temperature.

*A low acidic pH may be required for certain digestive enzymes in the stomach to work, whereas an alkali pH may be required for other enzymes in other parts of the digestive tract to function.

* A higher concentration of an enzyme will increase the rate of reaction, and vice versa.

* Co-enzymes are chemicals such as vitamins and some minerals which aid enzymes to regulate reactions.

14. Respiration and many other cellular processes are enzyme-activated. Enzymes function best at certain warmer temperatures, so the lizards are more active as they would have more ATP available from respiration for other reactions.

15. The smaller enzyme would break down the lining of the gut cell membranes since membranes are about half- protein. Therefore the enzyme is inactivated until it is required.
16. Movement, metabolism, reproduction, response to stimuli, and growth all require energy.
17. Exergonic reactions give off energy (e.g. respiration), whereas endergonic reactions take in energy for the reaction to occur (e.g. photosynthesis).
18. (a) ATP (adenosine triphosphate)
18. (b) $\text{ADP (adenosine diphosphate) + H}_2\text{PO}_4^- \text{ (phosphate) } \rightarrow \text{ ATP (adenosine triphosphate)}$
19. The phosphate would be needed to make the energy-rich ATP used to activate many cell reactions.
20. Aerobic respiration requires oxygen, and produces 38 ATP molecules per glucose molecule.
- Anaerobic respiration does not require oxygen, and produces only 2 ATP molecules per glucose molecule.
21. The amount of carbon dioxide produced will be proportional to the amount of ATP produced in either aerobic respiration if the yeast cell has sufficient oxygen or in anaerobic respiration if there is insufficient oxygen. Greater amounts of ATP available will then lead to more cellular activity.
22. They are getting their limited energy from anaerobic respiration.
23. It is correct to say that plants photosynthesise when there is sufficient light in the day. However plants respire day and night as they require energy from the respiration process all the time.
24. Greater intensity of light, particularly red and blue light, increase the rate of photosynthesis. Since photosynthesis is enzyme-regulated, warm temperatures less than about 50 to 60°C would also speed it up, and cold temperatures would slow it down. Increased amounts of carbon dioxide also increase the reaction rate.
25. The light-dependent reaction (Light Reaction) involves the absorption of light by chlorophyll which in turns drives the production of ATP and NADPH. The light-independent reaction (Dark Reaction) uses ATP and NADPH from the light reaction to convert carbon dioxide into glucose.
26. The same chemicals required for respiration and photosynthesis to occur in some eukaryote cells are also available in the cytoplasm of the prokaryotes such as cyanobacteria.