1. Match the following terms with appropriate descriptions.

1. A measure of disorder.
2. Reaction that is \( \Delta G < 0 \) and thus spontaneous.
3. The movement of a substance across a membrane against its concentration or electrochemical gradient with the help of energy input and transport proteins.
4. Synthesis reactions that build complex molecules from simple molecules with energy input.
5. The diffusion of a substance across a membrane down its concentration or electrochemical gradient.
6. Reaction that is \( \Delta G > 0 \) and thus non-spontaneous.
7. Reactions that break down complex molecules to simple molecules and release energy.
8. The coupling of the "downhill" diffusion of one substance to the "uphill" transport of another against its own concentration gradient.
9. Chemical concentration gradient + electrical gradient.

2. Small (hydrophilic, hydrophobic) molecules need transport proteins in order to diffuse through the plasma membrane. Hydrophobic molecules cannot simply go through plasma membrane because of the hydrophobic tails of phospholipid bilayer. Their movement is facilitated by transport proteins.

3. The cytoplasm of a cell is (negative, positive) in charge compared to the outside. Excess cations present in a cell creates negative membrane potential which enables electrolytes to establish their electrochemical gradient.

4. A non-electrolyte (uncharged solute) diffuses through plasma membrane down its concentration gradient. An electrolyte (charged solute) on the other hand, diffuses down its electrochemical gradient. Electrolytes have electrical gradient in addition to concentration gradient due to their charged nature.
5. What are the key differences between passive transport and active transport? (Hint: solute concentration, energy input)

Active transport uses energy input to move a substance against its concentration or electrochemical gradient. In passive transport, there is no energy input and a substance moves across a membrane from high concentration side to low concentration side.

6. In plant cells, protons (H+) are pumped out of the cell to create strong, inward H+ electrochemical gradient. What is the purpose of doing so?

Maintaining the H+ gradient is important because the diffusion H+ down its strong electrochemical gradient can be coupled to the active transport of other substances (sugar, amino acid etc). This is called cotransport.

7. What causes sodium-potassium pump to change its conformation and ion affinity?

\[ \text{Phosphorylation/Dephosphorylation} \]

\[ \Theta = \text{Na}^+ \]

\[ \Phi = \text{K}^+ \]

Phosphorylation caused the pump to release Na+ ions by conformation change and to have higher affinity to K+ in order to transport them to the other side. Dephosphorylation causes the opposite effect.

8. In biological system, the molecule that is responsible for delivering energy from ____________ pathways to ____________ pathways is ATP (adenosine triphosphate).

\[ \text{Catabolic} \]

\[ A \rightarrow \text{ADP + Pi} \leftarrow \text{E} \text{anabolic; energy required} \]

\[ \text{Catabolic; energy released} \]

\[ \text{ATP} \]