1. What are the factors affecting the rate of diffusion?
Solution: Factors affecting the rate of diffusion are:

- Density - Rate of diffusion of a substance is inversely proportional to square root of its relative density (Graham's Law).
- Permeability of medium - Rate of diffusion decreases with density of the medium.
- Temperature - A rise in temperature increases the rate of diffusion with Q_{10} = 1.2 -1.3. Because of it sugar crystals do not dissolve easily in ice cold water while they do so easily in warm water.
- Diffusion pressure gradient - Rate of diffusion is directly proportional to the difference of diffusion pressure at the two ends of a system and inversely proportional to the distance between the two.

2. What are porins? What role do they play in diffusion?
Solution: The porins are proteins that form huge pores in the outer membranes of the plastids, mitochondria and some bacteria allowing molecules up to the size of small proteins to pass through. Thus they play an important role in facilitated diffusion.

3. Describe the role played by protein pumps during active transport in plants.
Solution: Active transport uses energy to pump molecules against a concentration gradient. Active transport is carried out by membrane play a major role in both active as well as passive transport. Pumps are proteins that use energy to carry substances across the cell membrane. These pumps can transport substances from a low concentration to a high concentration ('uphill' transport). E.g.,H^+ pump,K^+ pump, Cl^- pump, Na^+-K pump.The pumps operate with the help of ATP. K^+-H^+ exchange pump occurs in guard cells. Na^+-K^+ exchange pump operates across many animal membranes. Transport rate reaches a maximum when all the protein transporters or pumps are being used or are saturated.Like enzymes these carrier proteins are very specific in what they carry across the membrane. These proteins are sensitive to inhibitors that react with protein side chains.

4. Explain why pure water has the maximum water potential.
Solution: Water molecules possess kinetic energy. In liquid and gaseous form they are in random motion that is both rapid and constant. The greater the concentration of water in a system, the greater is its kinetic energy or 'water potential'. Hence, it is obvious that pure water will have the greatest water potential. Water potential is denoted by the Greek symbol Psi or ψ and is expressed in pressure units such as pascals (Pa). By convention, the water potential of pure water at standard temperatures, which is not under any pressure, is taken to be zero. If some solute is dissolved in pure water, the solution has less free water and the concentration of water'decreases, reducing its water potential. Hence, all solutions have a lower water potential than pure water.

5.Briefly describe water potential. What are the factors affecting it?

Solution: The term water potential was first used by Slatyer and Taylor (1960). The free energy per mole of any particular chemical species in a multicomponent system is defined as the chemical potential of that species. The chemical potential of water is referred to as the water potential (ψ_w). Since the ψ of pure water is zero (0), the presence of solute particles reduces the free energy of water, thus decreases the water potential (negative value). Therefore,ψ of solution is always less than zero or its highest value is zero.
For solutions water potential is determined by three internal factors, i.e.,$\psi_w = \psi_m + \psi_s + \psi_p$ (where ψ_m is matric potential which is used for the surface such as soil particles or cell wall to which water molecules are absorbed, ψ_s is solute potential, also called osmotic potential, the amount by which water potential is reduced and ψ_p is pressure potential such as TP and WP). Since in plant system ψ_m is disregarded the equation may be simplified as:
$\psi_w = \psi_s + \psi_p$

6. What happens when a pressure greater than the atmospheric pressure is applied to pure water or a solution?
Solution: If a pressure greater than atmospheric pressure is applied to pure water or a solution, its water potential increases. It is equivalent to pumping water from one place to another. Pressure can build up in a plant system when water enters a plant cell due to diffusion causing a pressure built up against the cell wall, it makes the cell turgid.

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