NAME _____ LAB TIME/DATE _____

REVIEW SHEET
exercise
5A

The Cell: Transport Mechanisms and Permeability—Wet Lab

Choose all answers that apply to items 1 and 2, and place their letters on the response blanks to the right.

1. Molecular motion *a, d*

a. reflects the kinetic energy of molecules.
b. reflects the potential energy of molecules.
c. is ordered and predictable.
d. is random and erratic.

2. Velocity of molecular movement *b, c*

a. is higher in larger molecules.
b. is lower in larger molecules.
c. increases with increasing temperature.
d. decreases with increasing temperature.
e. reflects kinetic energy.

3. The following refer to Activity 4, the laboratory experiment using dialysis sacs to study diffusion through nonliving membranes:

Sac 1: 40% glucose suspended in distilled water

Did glucose pass out of the sac? *yes*

Test used to determine presence of glucose: *Benedict's test*

Did the sac weight change? *yes*

If so, explain the reason for its weight change: *Glucose was passing out of the sac (simple diffusion), but, more importantly, water was moving into the sac (osmosis) to the area of its lower concentration.*

Sac 2: 40% glucose suspended in 40% glucose

Was there net movement of glucose in either direction? *no*

Explanation: *Net movement occurs only when there is a concentration gradient.*

Did the sac weight change? *no* Explanation: *Water concentration on both sides of the membrane was the same; thus, no net osmosis occurred.*

Sac 3: 10% NaCl in distilled water

Was there net movement of NaCl out of the sac? *yes*

Test used to determine the presence of NaCl: *silver nitrate for the presence of Cl^-*

Direction of net osmosis: *into the sac*

Sac 4: Sucrose and Congo red dye in distilled water

Was there net movement of dye out of the sac? *no*

Was there net movement of sucrose out of the sac? *no*

Test used to determine sucrose movement from the sac to the beaker and rationale for use of this test: *Upon boiling, some of the sucrose bonds are hydrolyzed, releasing glucose and fructose. Using Benedict's test then indicates the presence of glucose if sucrose passed through the membrane.*

Direction of net osmosis: *into the sac*

4. What single characteristic of the differentially permeable membranes used in the laboratory determines the substances that can pass through them? *Size of pores*

In addition to this characteristic, what other factors influence the passage of substances through living membranes?

Solubility in the lipid portion of the membrane and/or presence of membrane "carriers" for the substance(s).

5. A semipermeable sac containing 4% NaCl, 9% glucose, and 10% albumin is suspended in a solution with the following composition: 10% NaCl, 10% glucose, and 40% albumin. Assume that the sac is permeable to all substances except albumin. State whether each of the following will (a) move into the sac, (b) move out of the sac, or (c) not move.

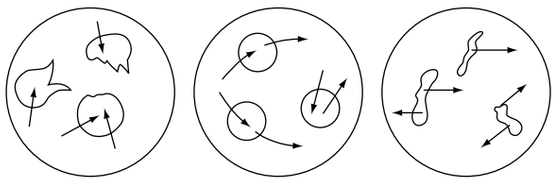
glucose: *a; moves into sac* albumin: *c; does not move*

water: *b; moves out of sac* NaCl: *a; moves into sac*

6. The diagrams below represent three microscope fields containing red blood cells. Arrows show the direction of net osmosis.

Which field contains a hypertonic solution? *c* The cells in this field are said to be *crenated*.

Which field contains an isotonic bathing solution? *b* Which field contains a hypotonic solution? *a* What is happening to the cells in this field? *Hemolysis; they are bursting as excessive water entry occurs.*



(a) **(b)** **(c)**

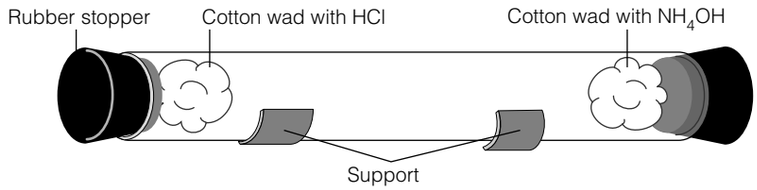
7. Assume you are conducting the experiment illustrated in the next figure. Both hydrochloric acid (HCl) with a molecular weight of about 36.5 and ammonium hydroxide (NH_4OH) with a molecular weight of 35 are volatile and easily enter the gaseous state. When they meet, the following reaction will occur:

$$HCl + NH_4OH \rightarrow H_2O + NH_4Cl$$

Ammonium chloride (NH_4Cl) will be deposited on the glass tubing as a smoky precipitate where the two gases meet. Predict which gas will diffuse more quickly and indicate to which end of the tube the smoky precipitate will be closer.

a. The faster diffusing gas is *NH_4OH*.

b. The precipitate forms closer to the *HCl* end.



8. What determines whether a transport process is active or passive? *Whether or not the cell must provide ATP for the process; if so, the process is active.*

9. Characterize membrane transport as fully as possible by choosing all the phrases that apply and inserting their letters on the answer blanks.

Passive processes: *a, c, e* Active processes: *b, d, f*

a. account for the movement of fats and respiratory gases through the plasma membrane
b. explain solute pumping, phagocytosis, and pinocytosis
c. include osmosis, simple diffusion, and filtration
d. may occur against concentration and/or electrical gradients
e. use hydrostatic pressure or molecular energy as the driving force
f. move ions, amino acids, and some sugars across the plasma membrane

10. For the osmometer demonstration (Activity 5), explain why the level of the water column rose during the laboratory session.

The thistle tube was immersed in a dialysis sac which, in turn, was immersed in water. Since water will move down its concentration gradient if it is able, water diffused from the beaker into the sac, where its concentration was much lower. As a result, the fluid column (molasses and entering water) rose in the thistle tube.

11. Define the following terms:

diffusion: *Movement of molecules from a region of their higher concentration to an area where they are in lower concentration.*

osmosis: *Diffusion of water through a semipermeable or differentially permeable membrane.*

simple diffusion: *Diffusion of solutes through a semipermeable membrane.*

filtration: *Passage of substances across a membrane from an area of higher hydrostatic pressure to an area of lower hydrostatic pressure.*

active transport: *A transport system that requires that the cell provide ATP. One such system moves substances across the cell membrane attached to a carrier molecule called a solute pump.*

phagocytosis: *Engulfment of extracellular particles by pseudopod formation. "Cell eating."*

bulk-phase endocytosis: *Intake of extracellular fluids by vesicle formation. "Cell drinking."*