1. How do passive and active transport differ from each other?

<table>
<thead>
<tr>
<th><strong>Passive transport</strong></th>
<th><strong>Active Transport</strong></th>
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<tbody>
<tr>
<td>• Does not require the use of energy.</td>
<td>• Requires the use of energy.</td>
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<td>• Moves solutes and solvents across a cell membrane, from higher to lower concentration.</td>
<td>• ATP breakdown to ADP provide energy.</td>
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<td>• Simple diffusion – passive transport of small solutes thru the lipid bilayer.</td>
<td>• Moves solutes from lower to higher concentration.</td>
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<tr>
<td>• Facilitated diffusion – transfer of larger molecules thru carrier or channel proteins.</td>
<td>• Moves large molecules in and out of cell.</td>
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<td>• Osmosis – diffusion of water thru the lipid bilayer.</td>
<td>• Protein pumps move large molecules.</td>
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<td></td>
<td>• Na+K+ Pumps move ions.</td>
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<td></td>
<td>• Endocytosis moves large molecules into cell.</td>
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<td></td>
<td>• Exocytosis moves large molecules out of cell.</td>
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2. Compare and contrast simple diffusion, facilitated diffusion and osmosis?

<table>
<thead>
<tr>
<th>Simple Diffusion</th>
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<tr>
<td>• Movement of gases, small molecules and ions across the cell membrane from a region of high solute concentration to low solute concentration.</td>
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<tr>
<td>• Rate of diffusion depends on temperature, molecule size, polarity, concentration gradient etc.</td>
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<tr>
<td>• Is caused by the constant motion of particles. All particles above absolute zero are moving and colliding, so they naturally spread out until equilibrium is reached.</td>
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<table>
<thead>
<tr>
<th>Facilitated Diffusion</th>
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<tr>
<td>• Movement of larger molecule thru carrier proteins and channel proteins.</td>
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<tr>
<td>• Channel proteins randomly open and close, allowing molecules to pass passively. Like a swinging door lets flies into a house.</td>
</tr>
<tr>
<td>• Carrier proteins have specific shapes (like tetris) and open and close randomly. When a molecule that fits the shape hits the protein, the protein will close on it and pass it through.</td>
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Osmosis

- Passive transport of water across a cell membrane.
- Movement of water is from a higher concentration of water (not solute) to lower concentration of water.
- Water passes easily through the lipid bilayer.
3. Imagine you’ve got a concentrated glucose/water solution and a dilute glucose/water solution separated by a semi-permeable membrane. Fully describe the movement of the glucose and the water across the membrane. Draw diagrams to support your reasoning and make sure to identify the transport processes at work.

1st - Water will pass from the dilute concentration to the concentrated solution via osmosis, until equilibrium is reached.

2nd – Once water equilibrium has been reached, the glucose molecules will diffuse across the membrane into the cell until equilibrium has been reached.
4. Molecules that are soluble in lipids tend to move across cell membranes more quickly than those that are not. Based on this information, what could you conclude about the structure of the cell membrane?

Solutes that are similar in make up to solvents dissolve better than when they are different. This means that the structure of the cell membrane must also be lipid.
5. Since the cytoplasm of cells contains many molecules like salts, sugars, proteins and other molecules, it is almost always a more concentrated solution than the water surrounding it. What are the ways cells prevent too much osmosis from occurring?

• Central vacuole in plant cells adds pressure to the cell plant preventing excess water from entering the cell.
• Active transport to pump out water and/or solutes.
• Most cells in multicellular organisms are bathed in solutions that are not much different inside and out of the cell.
• Some unicellular organisms can move to different environments.
6. What is a solute? A solvent?

Solute is the substance that is dissolved in a mixture.

Solvent is substance that dissolves the solute to produce a solution.

Solute dissolves into the solvent.
7. Define hypotonic, hypertonic, isotonic and turgor and explain how they pertain to osmosis.

**Hypotonic** – solution of lower concentration compared to the other concentration.

**Hypertonic** – solution of higher concentration compared to the other concentration.

**Isotonic** – a solution of equal concentration. No movement of water. Water moves from a region of higher concentration of water (more dilute solution) to lower concentration of water (more concentrated solution).

OR...

Water moves from hypotonicity to hypertonicity.

**Turgor** - swollen – refers to pressure exerted by water-filled central vacuole in plant cell that helps prevent further osmosis from occurring.
8. How do differences in concentration affect the rate of osmosis?

The greater the difference in concentration, the greater the rate of osmosis.
9. What would happen to a saltwater fish and its cells if you put it into a freshwater aquarium?

- Putting a saltwater fish in a freshwater aquarium would bath the cells of the fish in fresh water.
- Due to the higher solute content inside a saltwater fish’s cells compare to the outside, osmosis would transfer fresh water into cells, which could cause them to burst.
- Also, diffusion would occur, which would transfer solutes out of the cell.
- As both of these happen, the fish would quickly die.
10. When does diffusion stop?

- Never!
- Even after equilibrium is reached, solutes are continuing to cross the membrane, just at equal rates in and out of the cell.
11. What would happen to a slug if salt is sprinkled on it? Why?

- Water would diffuse out of its cells due to osmosis. It would shrink and likely die as its cells would crenate.
1. Please answer the following questions regarding if a red blood corpuscle were placed in sea water.

I. Where is the greatest concentration of water?
   a. inside the cell
   b. outside the cell
   c. equal inside and outside the cell

II. Which way is water moving?
   a. more into than out
   b. more out than in
   c. water is not moving
   d. both directions in equal amounts

III. The content of the cell is _______ to the outside environment.
   a. hypotonic
   b. isotonic
   c. hypertonic
2. An artificial cell can be made with a short length of dialysis tubing filled with liquid and clamped on each end. Answer the following question about an artificial cell and fill it with 80% sucrose solution, then place it in a beaker of 40% sucrose solution.

I. The effect the movement of water will have on the size of this cell:
   
   a. no change  
   **b. cell gets bigger**  
   c. cell gets smaller

II. The solution surrounding the cell is ____ to the inside of the cell.
   
   a. hypotonic  
   **b. hypertonic**  
   c. isotonic
3. What will happen to an onion cell in a hypotonic environment?

a. fills up with water
b. It puckers up
c. plasmolysis
d. cell ruptures
5. If a beet that has been frozen is placed in water the water will turn pink. Why?

   a. osmosis
   b. disruption of the membrane
   c. diffusion
   d. high membrane integrity
6. Larger molecules will diffuse more [quickly / slowly] than smaller molecules.
7. Match each term in the left column with the most appropriate information from the right column

___e___ plasmolysis
___b___ turgor
___c___ osmosis
___a___ concentration gradient
___d___ isotonic

a. The difference between regions of high and low concentration
b. Natural state of plant cells in which the vacuole contents exert pressure against the cell wall
c. The diffusion of water through a selectively permeable membrane from an area of higher concentration to an area of lower concentration
d. When the external environment is the same concentration as the cell’s internal environment
e. When a plant cell loses water, causing the cell membrane to shrink away from the cell wall
8. Diffusion is when molecules of a substance move from a higher concentration to a lower concentration. Which of the following factors do NOT affect the rate of diffusion?

a. particle color
b. particle size
c. temperature
d. concentration gradient
9. Why is it a bad idea to give a person an IV of pure water?
   a. The water in the IV is hypotonic compared to the environment within their cells.
   b. Their red blood cells will explode.
   c. Their red blood cells will shrink.
   d. The water in the IV is hypertonic compared to the environment within their cells.
   e. Choices 3 & 4 are correct.
   f. Choices 1 & 2 are correct.
   g. Water is isotonic to the internal environment of a red blood cell, so the patient's cells would neither expand nor shrink.
10. Excessive irrigation in arid regions can cause salts to accumulate in the soil. (The water contains low concentrations of salts, but when the water evaporates from the fields, the salts are left behind and thus, concentrate in the soil). Do you expect that the increasing salinity/saltiness of the soil would have an adverse effect on agriculture?

a. Yes. Salt easily crosses the cell wall/plasma membrane of a plant cell. Having too much salt inside the cell is deleterious to its function.  
b. No. We all know that you need to use extensive irrigation in dry regions. Therefore, salt accumulation must not be a problem.  
c. Yes. Due to the selective permeability of the cell membrane, water can cross, but salt cannot. When salt concentrations outside the cell rise, water rushes out of the cell causing plasmolysis (when the cell membrane pulls away from the cell wall).  
d. No. Due to the selective permeability of the cell membrane, water can cross, but salt cannot. When salt concentrations outside the cell rise, water rushes into the cell causing it to be turgid.  
e. No. Salt easily crosses the membrane while water does not. Thus, the salt concentrations inside and outside the cells are able to become isotonic. The plant suffers no adverse reaction.
11. An artificial cell consisting of an aqueous solution enclosed in a selectively permeable membrane has just been immersed in a beaker containing a different solution. The membrane is permeable to water and to simple sugars such as fructose and glucose, but completely impermeable to disaccharides such as sucrose. The concentrations of the solutes inside the “cell” are as follows: 0.05 M sucrose; 0.01 M fructose and 0.02 M glucose. The concentrations of the solutes outside of the cell are 0.04 M sucrose; 0.01 M fructose and 0.03 M glucose. Which of the following sentences best describes what will happen?

a. Water will move out of the cell  
b. Water will move into the cell  
c. Fructose and glucose will move into the cell  
d. There will be no net movement of solutes  
e. There will be no net movement of water