NAME_____ **ANSWER KEY** _____

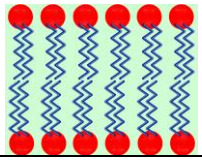
DATE_____ PERIOD_____

Cell Membrane & Tonicity Worksheet

Composition of the Cell Membrane & Functions

The cell membrane is also called the **PLASMA** membrane and is made of a phospholipid **BI-LAYER**. The phospholipids have a hydrophilic (water attracting) **HEADS** and two hydrophobic (water repelling) **TAILS.** The head of a phospholipid is made of an alcohol and **GLYCEROL** group, while the tails are chains of **FATTY ACIDS.** Phospholipids can move **SIDEWAYS** and allow water and other **NON-POLAR** molecules to pass through into or out of the cell. This is known as simple **PASSIVE TRANSPORT** because it does not require **ENERGY** and the water or molecules are moving **WITH** the concentration gradient.

SKETCH AND LABEL a phospholipid coloring the heads red and the tails blue.



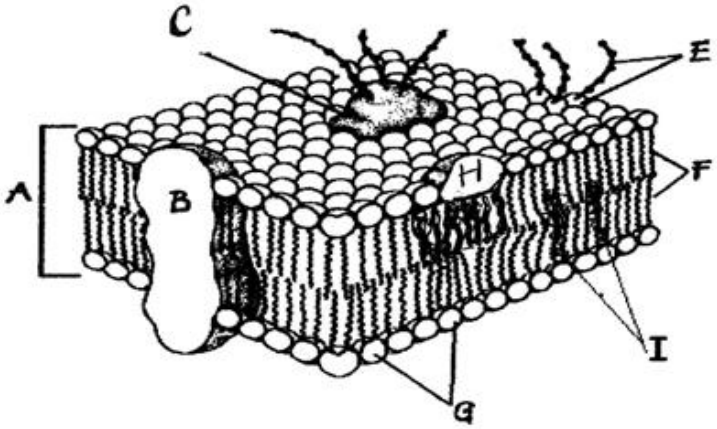
Another type of lipid in the cell membrane is **CHOLESTEROL** that makes the membrane more fluid. Embedded in the phospholipid bilayer are **PROTEINS** that also aid in diffusion and in cell recognition. Proteins called **INTEGRAL** proteins go all the way through the bilayer, while **PERIPHERAL** proteins are only on one side. Large molecules like **PROTEINS** or carbohydrates use proteins to help move across cell membranes. Some of the membrane proteins have carbohydrate **PARTS** attached to help cells in recognize each other and certain molecules.

List 4 functions of the cell or plasma membrane:

a. **CELL SIGNALING**
b. **SELECTIVE TRANSPORT**
c. **EXCRETION OF WASTES**
d. **STRUCTURAL SUPPORT**

Correctly ***color code and identify*** the name for each part of the cell membrane.

Letter	Name/Color	Letter	Name/Color
__ **A** ___	Phospholipid bilayer (no color)	__ **H** ___	Peripheral protein (red)
__ **B** ___	Integral protein (pink)	__ **I** ____	Cholesterol (blue)
__ **F** ___	Fatty acid tails (orange)	__ **C**___	Glycoprotein (green)
__ **G** ___	Phosphate heads (yellow)	__ **E** ___	Glycolipids (purple)



Match the cell membrane structure or its function with the correct letter from the cell membrane diagram.

Letter	Structure/Function	Letter	Structure/Function
__ **G** ___	**Attracts water**	__ **F**__	**Repels water**
__ **I** ___	**Helps maintain flexibility of membrane**	_ **G & F**	**Make up the bilayer**
__ **C & E**___	**Involved in cell-to-cell recognition**	__ **B**__	**Help transport certain materials across the cell membrane**

Define osmosis. **THE MOVEMENT OF WATER ACROSS A SELECTIVELY PERMEABLE MEMBRANE FROM AN AREA OF HIGH CONCENTRATION TO AN AREA OF LOW CONCENTRATION.**

In which direction does water move across membranes, up or down the concentration gradient?

DOWN

Define these 3 terms:

a. isotonic- **THE CONCENTRATION OF DISSOLVED PARTICLES ARE THE SAME INSIDE AND OUTSIDE THE CELL – THERE IS NO OVERALL CHANGE IN THE CELL SIZE**

b. hypertonic **THE CONCENTRATION OF DISSOLVED PARTICLES ARE HIGHER OUTSIDE THE CELL THAN INSIDE THE CELL– WATER WILL LEAVE THE CELL IN AN ATTEMPT TO DILUTE THE OUTSIDE CONCENTRATION**

c. hypotonic **THE CONCENTRATION OF DISSOLVED PARTICLES ARE LOWER OUTSIDE THE CELL THAN INSIDE THE CELL– WATER WILL ENTER THE CELL IN AN ATTEMPT TO DILUTE THE INSIDE CONCENTRATION**

Use arrows to show the direction of water movement into or out of each cell. ***Color and label*** the cell in an isotonic environment light blue, the hypotonic environment yellow, and the hypertonic environment light green.

Match the description or picture with the osmotic condition:

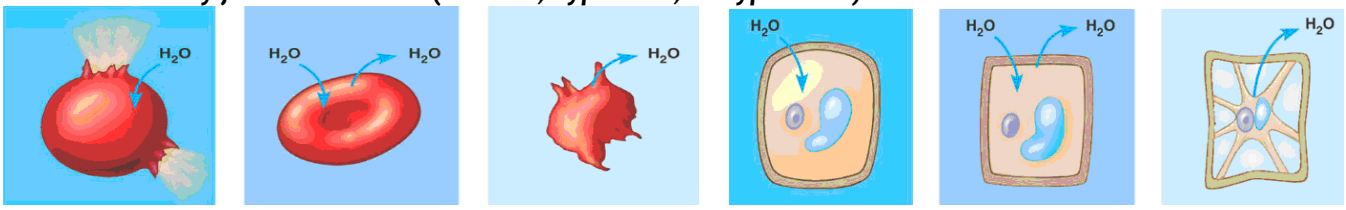
A. Isotonic

B. Hypertonic

C. Hypotonic

__ C __ solution with a lower solute concentration
__A __ solution in which the solute concentration is the same
__ A__ condition plant cells require
__ A__ condition that animal cells require
__ C __ red blood cell bursts (cytolysis)
__ C ___ plant cell loses turgor pressure (Plasmolysis)
__ B ___ solution with a higher solute concentration
__ A __ plant cell with good turgor pressure
__ C___ solution with a high water concentration

Label the tonicity for each solution (isotonic, hypotonic, or hypertonic):



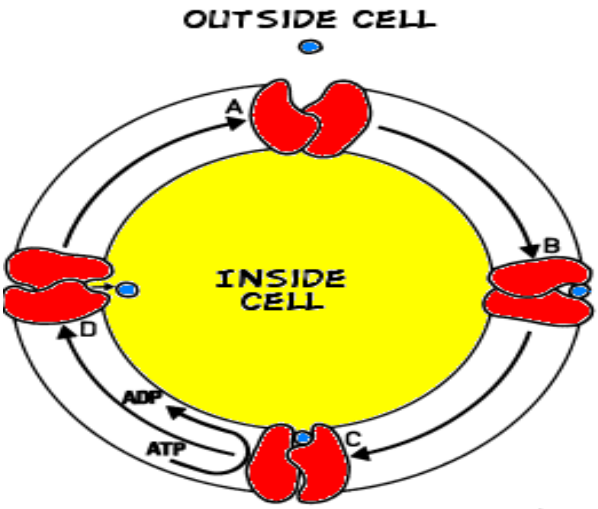
HYPOTONIC ISOTONIC HYPERTONIC HYPOTONIG ISOTONIC HYPERTONIC

Transport Requiring Energy

What type of transport is represented by the following picture? **ACTIVE**

What energy is being used? **ATP**

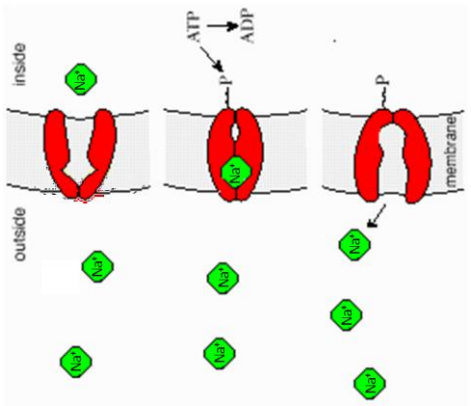
In which direction (concentration gradient), is the movement occurring? **AGAINST**



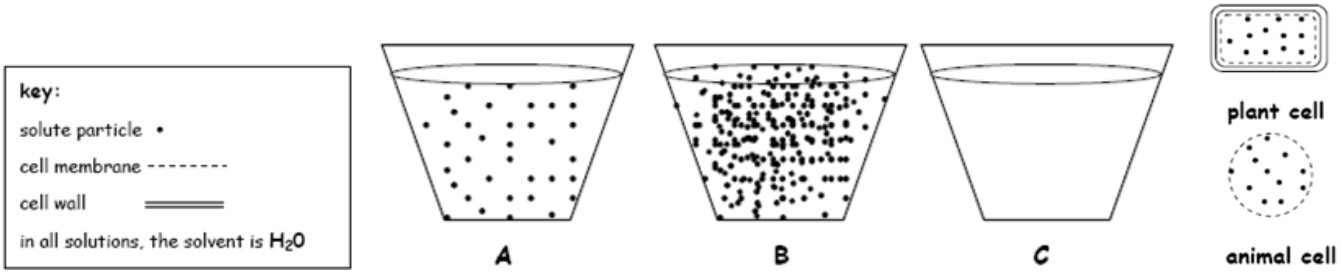
Color the internal environment of the cell yellow.
Color and Label the transport proteins red and the substance being moved blue.

One type of active transport is called the **SODIUM-POTASSIUM** pump which helps muscle cells contract. This pump uses **PROTEINS** to move ions **AGAINST** the concentration gradient. The protein that is used to pump the ions through is called a **TRANSMEMBRANE (INTEGRAL)** protein and it changes its **SHAPE** to move the ions across the cell membrane.

Label and color the carrier proteins red and the ions green.



TONICITY AND OSMOSIS



Part I – Fill in the blanks.

A **SOLVENT** is a fluid in which a substance is dissolved.
A **SOLUTE** is a substance dissolved in a solvent.
A **SOLUTION** is a combination of solute and solvent.
The process by which water diffuses across a membrane called **OSMOSIS**

Part II – Look at the solutions illustrated above and fill in the blanks.

1. **Solution B** is **HYPERTONIC** to **Solution A**. This is because **Solution B** has a greater concentration of **SOLUTES** in it than does **Solution A**. **Solution C** has no solutes dissolved in it, therefore it is **HYPOTONIC** to both **Solutions A and B**.

2. As a relative concentration of solutes in two solutions increases, of necessity the concentration of water in the same two solutions **INCREASES.** **Solution A** has a lower concentration of **SOLUTE** than does **Solution C; Solution A** is also **hypertonic** to **Solution C**.

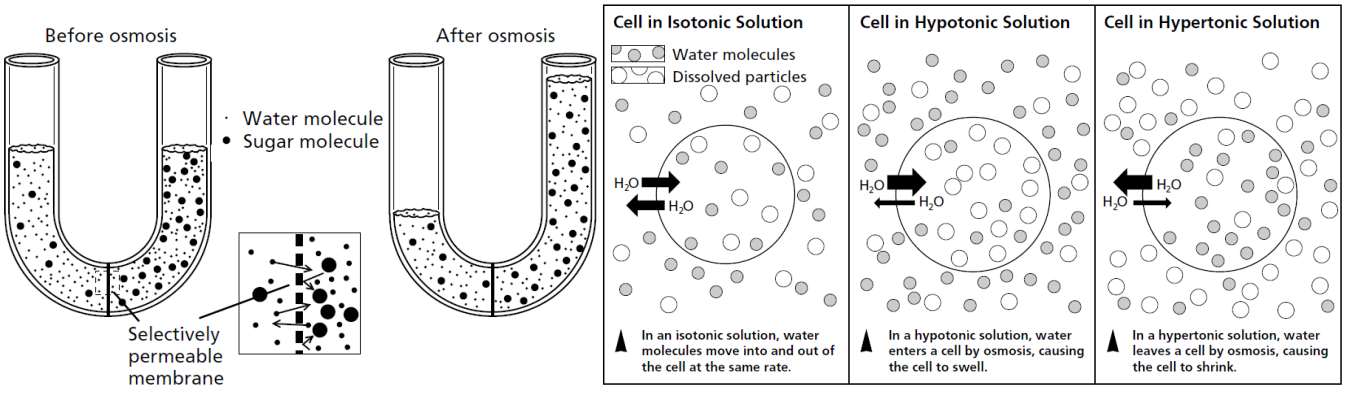
3. If you wanted to make **Solution A isotonic** to **Solution B**, you could add water to **Solution B** or you could add solute to **Solution A.** If you took all three solutions, put them into a large container and mixed them thoroughly, then redistributed the solution among three containers, **Solution A** would be **ISOTONIC** to **Solution B**. **Solution A** would also be **ISOTONIC** to **Solution C,** and **Solution C** would be **ISOTONIC** to **Solution B**.

Part III – Look at the solutions and cells illustrated above and fill in the blanks.

1. Because the **cytoplasms** of the plant and the animal cell have **equal** concentrations of solutes, we can say their cytoplasms are **ISOTONIC** to each other. If we put both the plant and the animal cells into **Solution A**, we would expect **no change** in the cells, because **Solution A** is **ISOTONIC** to the cytoplasm of each cell.

2. Let's put both cells into **Solution B**. Because **Solution B** is **hypertonic** to the cytoplasms of the cells, we would expect **water** to **LEAVE** the cells through the process of **OSMOSIS.** This would result in the cytoplasm of both cells shrinking.

3. Now we'll put both the plant and animal cell into **Solution C**, which, because it contains **no solutes** at all, is **HYPOTONIC** to the cytoplasm of both cells. **WATER** will enter both cells through **osmosis**. The **animal cell** is likely to **BURST,** unfortunately. The **plant cell**, however, is protected from this because of the presence of its **CELL WALL.**



Refer to the U-tube pictures above when answering the questions below.

1. Why did the number of water molecules on each side of the membrane change, whereas the number of sugar molecules stayed the same? **WATER MOLECULES ARE SMALL ENOUGH TO PASS THROUGH THE PORES OF THE MEMBRANE, HOWEVER, THE SUGAR MOLECULES ARE NOT.**

2. How does the plasma membrane of a cell compare with the membrane in the U-shaped tube? **THEY ARE BOTH SELECTIVELY PERMEABLE BASED ON SIZE OF PARTICLES**

3. Explain the behavior of water molecules in the isotonic solution. **WATER MOLECULES WILL MOVE INTO AND OUT OF THE CELL CONTINUOUSLY, HOWEVER, THERE WILL BE NO OVERALL CONCENTRATION CHANGE SINCE THE MOVEMENT SHOULD BE EQUAL.**

4. Does osmosis occur if a cell is placed in an isotonic solution? **NO, BECAUSE THERE IS NO CONCENTRATION GRADIENT (AREA OF HIGH TO AREA OF LOW – ISOTONIC IMPLIES EQUAL CONCENTRATIONS)**

5. Why does water enter a cell that is placed in a hypotonic solution? **BECAUSE THE CONCENTRATION OF SOLUTE IS LOWER OUTSIDE THE CELL THAN IT IS INSIDE THE CELL, SO THE WATER ENTERS THE CELL TO TRY TO DECREASE/EQUALIZE THE CONCENTRATIONS ON BOTH SIDES OF THE MEMBRANE.**

6. What happens to the pressure inside a cell that is placed in a hypertonic solution? **THE PRESSURE DECREASES AS THE WATER LEAVES THE CELL.**

7. What can happen to animal cells when placed in a hypotonic solution? Explain. **ANIMAL CELLS IN HYPOTONIC SOLUTIONS CAN RUPTURE AS MORE AND MORE WATER RUSHES INTO THE CELL. PLANT CELLS WILL NOT HAVE THIS ISSUE BECAUSE THE CELL WALL PROTECTS THE PLANT CELLS FROM RUPTURING.**

8. What causes a plant to wilt? **PLANTS PLACED IN A HYPERTONIC SOLUTION WILL WILT AS WATER IS REMOVED FROM THEM RESULTING IN PLASMOLYSIS.**