

**STUDY GUIDE - Ch. 7.3 - Passive Transport is Diffusion of a Substance
Across a Membrane with NO energy Investment**

NAME: _____

- **PHYSICALLY PRINT OUT** this PDF and **HANDWRITE** (with a black or blue pen) your answers directly on this PDF. Typed or digitally-written work is not accepted. Do not answer questions on separate paper.
- **Importantly, study guides are NOT GROUP PROJECTS!!!** You, and you alone, are to answer the questions as you **read** your assigned textbook. You are not to share answers with other students. You are not to copy any answers from any other source, including the internet.
- **Get in the habit of writing LEGIBLY, neatly, and in a medium-sized font.** AP essay readers and I will skip grading anything that cannot be easily read so start perfecting your handwriting, and don't write so large you can't add all the relevant details and key elaborations in the space provided.
- **SCAN** physical documents in color and with good resolution. Then, upload your final work as **PDFs** to Archie. Avoid uploading dark, shaded, washed-out, sideways, or upside-down scans of homework. Keep completed physical study guides organized in your biology binder to use as future study and review tools.
- **READ FOR UNDERSTANDING** and not merely to complete an assignment. *First*, read a section quickly to get an overview of the topic covered. Then, read it a **second** time slowly, paraphrasing each paragraph **out loud** and analyzing every figure. Finally, read it a **third** time as you answer the study guide questions if assigned and start building your memory. Try to write answers out in your own words, when possible, and try to purposefully and accurately use all new terminology introduced.

1. a. What is **diffusion**?

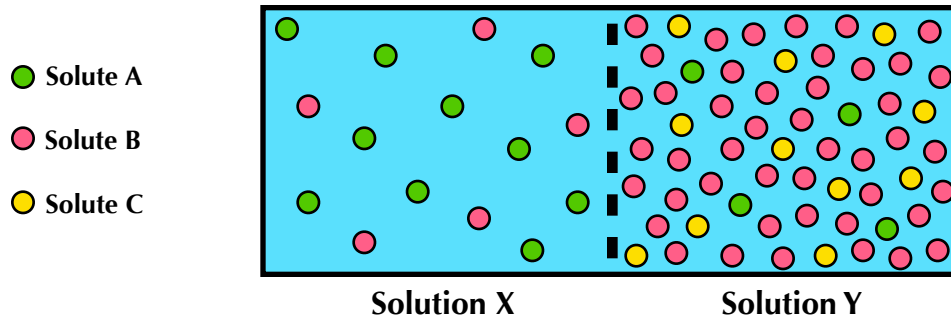
b. What **causes diffusion**?

c. Explain what we mean when we say that during **diffusion**, "**each molecule moves randomly, but the movement of a population of molecules may be directional?**"
2. a. What is meant by the term **concentration gradient**?

b. What does a **solute's concentration gradient have to do with the diffusion of that solute?** Specifically, **how does a solute diffuse in relation to its concentration gradient?**
3. a. Read and study Figure 7.11 a. and b. When does **diffusion of a solute stop?** Remember, diffusion is the **NET movement of solute molecules from an area of high concentration to an area of low concentration (of that solute)**. The number of the molecules moving in one direction minus the number of the molecules moving in other direction is the **net** movement of the molecules.

b. Explain what behavior solute particles exhibit when **DYNAMIC equilibrium** is reached?

4. Diffusion is a **spontaneous** process. Does diffusion require or not require an additional input of energy to take place?
5. Solute A is found in medium concentration in solution X, which is separated from solution Y by a semipermeable membrane. Solution X also contains a low concentration of Solute B and no Solute C. Solution Y contains a low concentration of Solute A, but an extremely high concentration of Solute B. It also contains a medium amount of Solute C. Overall, the total solute concentration in Solution Y is much higher than the total solute concentration in Solution X. Assume all three types of solute can cross the semipermeable membrane. Will Solute A diffuse? **If yes, why, and if not, why?**



6. **Small non-polar substances can easily cross cell membranes.** A cell needs a constant input of oxygen gas (O_2), for example, to perform the biochemistry known as **Cellular Respiration**, during which the cell extracts the potential energy stored in the bonds of high-energy organic molecules like fats and sugars (carbohydrates) in order to store that energy in molecules of ATP. A waste product of this chemistry is CO_2 . How do you think the **cell gets rid of this accumulating intracellular CO_2** ? Explain your full reasoning.

(Check your answer by going to the **Ch.7.3 Concept Check Question #1** answer in Appendix A)

7. a. Why is **diffusion** considered a form of **Passive Transport**?
- b. If **NO** extra energy has to be added to cause diffusion of a substance across a membrane (*assuming it can cross the membrane*), where is the energy stored that causes the random motion of particles that leads to diffusion of the substance?
8. a. What is **Osmosis**?

- b. What is meant by the term "free water?"
- c. Why is free water concentration the driving force in osmosis?
- d. Complete these statements: **Osmosis occurs from a region of _____ concentration of (FREE) water to a region of _____ concentration of (FREE) water. Osmosis, therefore, also occurs from a region of _____ (TOTAL) solute concentration to a region of _____ (TOTAL) solute concentration.**
- e. When does osmosis stop in terms of free water concentrations of two solutions?
- f. When does osmosis stop in terms of total solute concentrations of two solutions?
9. a. What does tonicity refer to?
- b. What does the tonicity of a solution depend on?
10. a. Cells without cell walls can lyse or shrivel. What does it mean when a cell experiences lysis?
- b. Cells with cell walls can become turgid. What does being turgid mean?
- c. Cells with cell walls can become flaccid. What does being flaccid mean?
- d. Cells with cells walls can become plasmolyzed. What does it mean when a cell experiences plasmolysis?

11. When a solution is **isotonic** to another solution, both solutions have the **SAME concentration of solutes**. When a solution is **hypertonic** compared to another, that first solution has a **GREATER concentration of solutes** compared to the second solution. The second solution is said to be **hypotonic** compared to the first, meaning the second solution has a **SMALLER concentration of solutes** compared to the first.

Study figures 7.12 and 7.13. Then, explain what happens to the following cells when moved from an isotonic environment into the following new aqueous environments:

1. **A liver cell placed in another isotonic environment.**

Describe the direction of osmosis:

Describe the change to cell volume:

Term that describes this cell after it has been in this new environment for a significant amount of time?

2. **A bacteria placed in an hypotonic environment** (*remember, bacteria have cells walls outside their plasma membranes*).

Describe the direction of osmosis:

Describe the change to cell volume:

Term that describes this cell after it has been in this new environment for a significant amount of time?

3. **An amoeba placed in an hypertonic environment** (*an amoeba is a type of single-celled protist that does **not** have a cell wall outside its plasma membrane*)

Describe the direction of osmosis:

Describe the change to cell volume:

Term that describes this cell after it has been in this new environment for a significant amount of time?

4. **A potato cell placed in an isotonic environment.**

Describe the direction of osmosis:

Describe the change to cell volume:

Term that describes this cell after it has been in this new environment for a significant amount of time?

5. **A animal skin cell placed in an hypotonic environment.**

Describe the direction of osmosis:

Describe the change to cell volume:

Term that describes this cell after it has been in this environment for a significant amount of time?

6. **An apple cell placed in an hypertonic environment.**

Describe the direction of osmosis:

Describe the change to cell volume:

Term that describes this cell after it has been in this new environment for a significant amount of time?

12. Why does a **plant cell not burst if immersed in a hypotonic solution?**

13. Describe, using the words Passive Transport, Osmosis, and Concentration Gradient of Free Water, why a carrot left on the counter overnight would become limp.

14. a. What is meant by the term **Osmoregulation?**

b. How does a **Paramecium** (*a single-celled eukaryotic protist without a cell wall*) avoid lysing while living in fresh water (hypotonic) environments?

- c. If that paramecium swims from a hypotonic to an isotonic environment, will its contractile vacuole become more or less active? Why? *(Check your answer by going to the [Ch.7.3 Concept Check Question #2](#) answer in Appendix A)*
15. a. **Hydrophilic substances** *(those substances that are partially or fully charged)* still need to **diffuse** through membranes of cells and organelles sometimes. They do so by a process called **Facilitated Diffusion**. What does this type of diffusion mean?
- b. Is this an **active or passive process**? Why?
16. The **two types of passive transport proteins are Carrier Proteins and Channel Proteins**.
- a. What is a **Channel Protein**?
- b. How does their structure fit their function?
- c. Provide an **example of a channel protein**.
- d. One category of Channel Protein is an Ion Channel, which lets certain ions through. Some of these ion channels also are **Gated Ion Channels**. What is special about these and how do they work?
- e. What is a **Carrier Protein**?
- f. What **triggers the change in shape in carrier proteins engaged in passive transport of solutes** across a membrane?
- g. Provide an example of a **passive transport carrier protein**.
17. Let's take a look at the **SCIENTIFIC SKILLS EXERCISE: Interpreting a Scatter Plot with Two Sets of Data**.
1. a.
- b.
- c.
- d.

2. Draw your table below of the data presented to you in the graph. *Your table should be clearly labeled.*

3. In analyzing the graph, compare and contrast glucose uptake in red blood wells from 15-day-old and 1-month-old guinea pigs. *Remember, compare AND contrast means discuss the 1. similarities AND 2. differences.*

Similarities:

Differences:

4. Write your **hypothesis** below to explain the difference between glucose uptake in red blood cells from 15-day-old and 1-month-old guinea pigs. *Remember, a hypothesis is an explanatory statement. (Do not write an "if...then" statement - that is a prediction not a hypothesis. Write an **explanation of how the independent variable affects the dependent variable** in the 15-day-old and 1-month-old guinea pigs).*

5. !!! Design your **CONTROLLED** experiment to test your hypothesis. *Always identify your **subjects, Independent vs dependent variables**, at least three of your **constants (controlled variables)** - variables that could influence your dependent variable so you want to make sure they are experienced in the same way in both the control and the experimental/treatment groups, what would make up your **treatment (experimental) group(s) vs control group**, and the **number of subjects** in each group (ideally 30 subjects or more per group).*