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# SIMPLE MOVEMENT OF MOLECULES

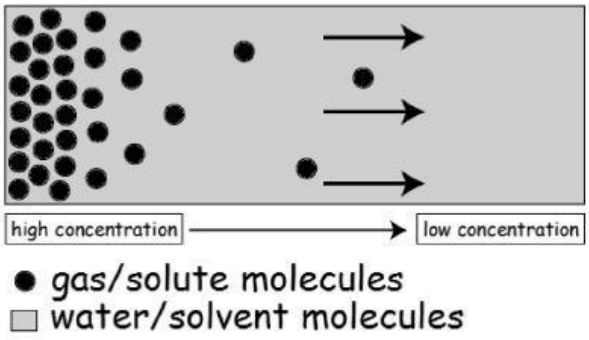
Recall that the order of the makeup of a complex organism from smallest to largest is: organelles → cells → tissues →organs→systems→organism. But how do these individual cells all communicate with one another as well as with the environments surrounding them? How do they get water and dissolved food from the environment as well as release any waste product? The answer lies with the processes osmosis, diffusion and active transport.

## DIFFUSION

**Let's relate Science to life**. If all you students were put to stand in one corner of the class for the day, unsupervised you would complain about being too closely packed. There would be a high concentration of students in one place. Eventually, some of you would start to wander away from the rest and start spreading around the rest of the empty room where there is a lower concentration of students. By the end of the day, you would be spread evenly about the class. This type of behavior is the foundation of diffusion.

***REAL*** **Definition of Diffusion**

*Diffusion is the movement of gaseous or dissolved particles from an area of high concentration to an area of low concentration until they are evenly distributed.*



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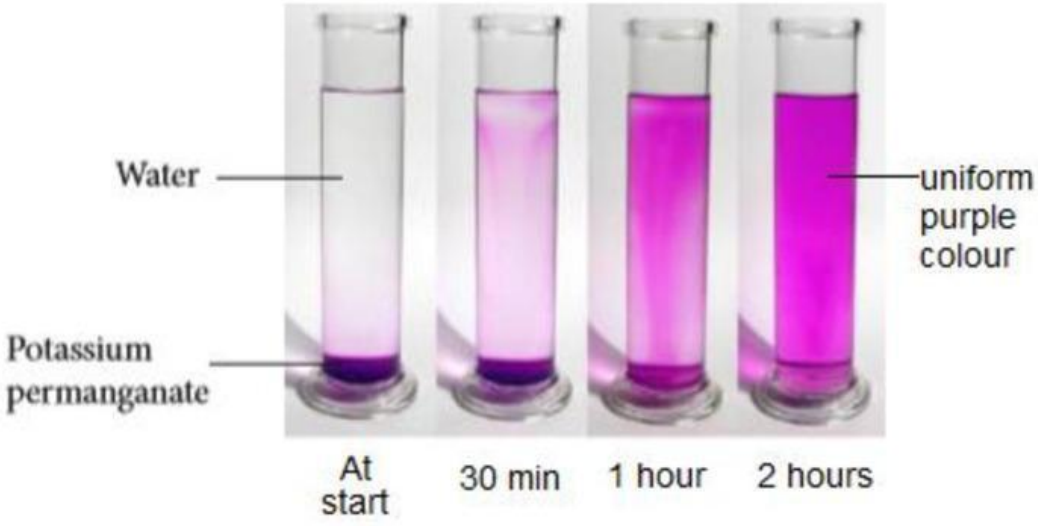
Both diffusion of gases and diffusion within liquids occur. Since diffusion is a natural process, it requires no energy and takes a very long time for even distribution to occur.

Examples of diffusion of a gas which we can see in EVERYDAY LIFE would be if perfume, bug spray or a bad smelling item like rotten eggs is released or placed in one corner of a room we can soon smell it all over the entire room.

Examples of diffusion in liquids, which we can see in EVERYDAY LIFE, would be if solids like sugar, salt, cool aid or any other solid soluble substance is placed gently in one spot into a container of water. Over time, and without stirring it or disturbing the water in any way, the solids would dissolve and the particles will spread out until the water takes on the colour of the particles.

Since all of the water will take on the same shade of the colour of the particles, we say that the water will eventually have a uniform colour. In the lab, we can observe this with purple crystals of potassium permanganate. This is shown below.



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## Student's Work

1. On the diagrams above:

   a) Place an L at TWO places that you would find a low concentration of potassium permanganate particles.
   b) Place an H at TWO places that you would expect to find a high concentration of potassium permanganate particles.
   c) Place an E at ONE place that you would expect to find an even distribution of potassium permanganate particles.

2. a) Does the area with a higher concentration of potassium permanganate crystals have a darker or lighter colour?

   Circle your answer. DARKER LIGHTER

   b) Explain your answer.

_____

_____

Diffusion not only occurs in our everyday life activities, but in living organisms in nature as well. The table below outlines the occurrence of diffusion in plants and animals.

| WHERE DIFFUSION TAKES PLACE | SUBSTANCE THAT IS DIFFUSED | HOW SUBSTANCES MOVE |
|---|---|---|
| Stomata of leaves | Oxygen | Out of the leaves by way of the stomata. |
| Stomata of leaves | Carbon dioxide | Into the leaves by way of the stomata. |
| Lungs | Oxygen (breathed in from the air) | From the lungs into the bloodstream. |
| Lungs | Carbon dioxide (from the air) | From the bloodstream into the lungs (to be breathed out into the atmosphere). |
| Small intestines | Glucose and amino acids from dissolved food | From small intestines into the bloodstream (to nourish the body). |



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# Cranium Builder

**Factors Affecting the Speed at Which Diffusion Occurs**

**Use the words FASTER or SLOWER to complete the sentences below.**

1. Concentration of particles – the more particles there are, the faster they spread out and diffuse, therefore the _____ the rate of diffusion.
2. Temperature – the higher the temperature, the more energy the diffusing particles will have, therefore the _____ the rate of diffusion.
3. Size of space - the smaller the space in which the substances are expected to diffuse, the _____ is the diffusion rate.
4. Distance – the shorter the distance the substance diffuses across, the _____ is the diffusion rate.
5. Type of substance – Gases diffuse _____ than solids which diffuse _____ than liquids.
6. Size of particles – Larger particles are heavier and will diffuse _____ than smaller particles.
7. Solubility – Substances that dissolve easier in water will diffuse _____ that those that do not.



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## Student's Work

**Diffusion Worksheet**

Multiple Choice: Circle the letter of the correct answers below.

**1. What is the correct definition of diffusion?**
A. Movement of solids from low to high concentration
B. Movement of particles using energy
C. Movement of particles from high to low concentration until evenly spread
D. Movement of particles through active transport

**2. Which statement best describes diffusion in liquids?**
A. Solids dissolve and spread without stirring
B. Solids are stirred to mix into water
C. Liquids only mix with shaking
D. Water evaporates to spread solids

**3. Diffusion is described as a natural process because:**
A. It only happens in the lab
B. It requires energy from the body
C. It happens on its own without energy
D. It is a man-made process

**4. Where does the diffusion of glucose into the bloodstream occur in humans?**
A. Lungs
B. Small intestines
C. Stomach
D. Brain

**5. In plants, which gas diffuses into the leaves for photosynthesis?**
A. Oxygen
B. Hydrogen
C. Carbon dioxide
D. Nitrogen

**6. Which of the following is NOT an example of gaseous diffusion in everyday life?**
A. Smelling perfume across a room
B. Hearing a loud sound from a distance
C. Smelling rotten eggs from another corner
D. Spraying bug spray and detecting it elsewhere

**True and False.** Write TRUE if the statement is true and FALSE if it is false.

7. Diffusion always requires energy to take place. _____

8. Tea, Kool-Aid, or salt can show diffusion in liquids when placed in still water. _____

9. Carbon dioxide leaves the lungs during diffusion in breathing. _____

10. Oxygen enters the leaves of a plant through the stem. _____

11. Diffusion can occur in both plants and animals. _____



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**Fill in the Blanks**

Use the words in the box below to complete the sentences.

| | | | | | |
|---|---|---|---|---|---|
| **Amino acids** | **Carbon dioxide** | **Faster** | **Faster** | **Glucose** | **High** |
| **Low** | **Oxygen** | **Potassium permanganate** | **Slower** | **Slower** | **Stomata** |

12. Diffusion is the movement of particles from an area of _____ concentration to an area of _____ concentration.

13. If a space is larger, diffusion of a substance around this space will be _____.

14. In the lungs, _____ diffuses into the bloodstream, while _____ diffuses out.

15. Hot water will cause a substance to diffuse _____.

16. In the lab, purple crystals of _____ can be used to observe diffusion in water.

17. In the small intestines, _____ and _____ diffuse into the bloodstream.

18. Smaller particles will diffuse _____.

19. In plants, carbon dioxide enters through small openings called _____.

20. If fewer particles are present, they will diffuse _____.



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## Student's Work

**Complete the paragraph using the correct key word.**

| Lower concentration | Concentration | Particle | Diffusion | High concentration |
|---|---|---|---|---|

| | |
|---|---|
| | The net movement of particles from an area of high concentration to an area of lower concentration. |
| | What all substances are made of |
| | When there are lots of particles in one place |
| | When there are not many particles in one place |
| | The amount of particles of a substance |

**Complete the paragraph using the correct key word.**

| oxygen | movement | out | in | lots |
|---|---|---|---|---|
| blood | membrane | little | diffusion | |

Diffusion is the [ ] of substances from where there is a high concentration ( [ ] ) to where there is a low concentration (very [ ]). Substances move [ ] and out of cells through the cell [ ] by the process of [ ]. For example, [ ] diffuses into our red [ ] cells to be carried around the body. It then diffuses [ ] of the red blood cells when it reaches cells that need it.



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## OSMOSIS

**Let's relate Science to life**. There are ants of many different sizes just as there are different size molecules. In this example, the smaller ants will be the water molecules and the larger ants will be sugar molecules. Imagine that the hole leading out of the ants nest was very small and that one day a candy bar lands near the nest and all the ants try to leave the nest to get at it.

Only the smaller ants could pass through the hole. Eventually all the smaller ants will be able to go squeeze out of the nest and get some of the candy, while the larger ants would be trapped inside. This is the principle behind osmosis.

**Definition of Osmosis**

*Osmosis is the movement of **WATER** molecules along a concentration gradient from an area of high concentration to an area of low concentration through a partially permeable membrane until evenly distributed.*

Osmosis is a naturally occurring process and therefore, like diffusion, does not require energy.



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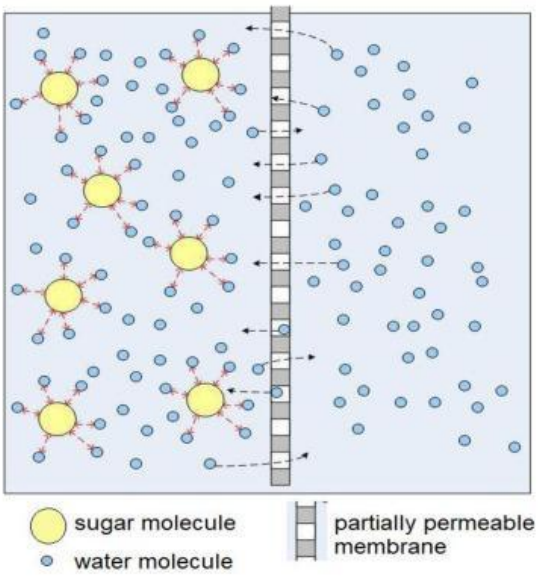
Examples of osmosis in plants are the way in which water molecules enter plant roots from the wet soil or when a wilted plant regains its shape after being watered. An example of osmosis in animals occurs when the skin of the fingers become wrinkled after having spent time swimming in the ocean or washing dishes. Can you explain why these changes occur? Discuss with your classmates and teacher.




Notice in the diagram to the left that there is a structure separating both sides of the container.

The structure has pores (small holes) that are all of the same specific size. These pores are large enough to only allow the water molecules to pass through, but too small for the sugar molecules to pass through.

The structure is called a membrane and it is described as being partially permeable.

**Partially, Fully and Impermeable Membranes**

A partially permeable membrane has tiny pores that only let small particles through. A fully permeable membrane has large pores that let all particles through. An impermeable membrane has no pores, so nothing can pass through.



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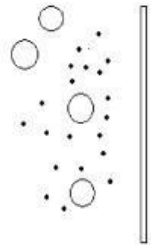
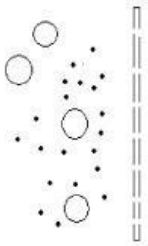
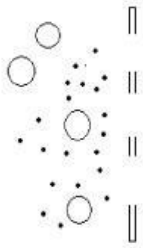
## Student's Work

1. a). Draw what you would expect to see on the other side of each membrane after a few hours.
   b). Use the following words to label the diagrams of the three types of membranes. [6 marks]

**partially permeable** **fully permeable** **impermeable**







_____ _____ _____

**Multiple Choice. Circle the letter of the correct answers below.**

**1. What is osmosis?**
A. Movement of particles from low to high concentration
B. Movement of water molecules from high to low concentration through a partially permeable membrane
C. Movement of gases across any membrane
D. Movement of nutrients from roots to leaves

**2. Why do fingers wrinkle after being in water for a long time?**
A. Due to osmosis
B. Due to high temperature
C. Due to dry skin
D. Because the skin absorbs salt

**3. Which membrane allows only small particles to pass through?**
A. Fully permeable membrane
B. Impermeable membrane
C. Partially permeable membrane
D. Selectively sealed membrane

**4. Which of the following best describes a fully permeable membrane?**
A. Has no pores
B. Has small pores that block large particles
C. Only lets gases pass
D. Has large pores that allow all particles through

**True and False.** Write TRUE if the statement is true and FALSE if it is false.

1. Osmosis is a type of diffusion that involves water. _____
2. An impermeable membrane lets small particles pass through. _____
3. Osmosis needs energy to move water molecules. _____
4. Wrinkled fingers after swimming are an example of osmosis. _____
5. A fully permeable membrane only allows water molecules to pass. _____



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