

CELLS AND BODY SYSTEMS

Unit Overview

Learning Outcomes Addressed in this Unit

1. *Demonstrate knowledge of the characteristics of living things*
 - identify various characteristics of living things
 - relate characteristics of living things to viruses, bacteria, plants and animals
2. *Relate the main features and properties of cells to their functions*
 - summarize the cell theory
 - accurately list similarities and differences between cell types
 - describe the structure and function of cell organelles
 - recognize and name the parts of a cell using a microscope
3. *Explain the relationship between cells, tissues, organs and organ systems*
 - define the terms tissue, organ and organ system
 - distinguish between cells, tissues, organs and organ systems based on structure and function
 - identify the main components of the human organ system
 - describe how organ systems work together to obtain and transport nutrients, remove wastes and exchange gasses
4. *Explain the functioning of the immune system, and the roles of the primary, secondary and tertiary defense systems*
 - identify components of the primary defense systems
 - identify phagocytic white blood cells as the major component of the secondary defense system
 - describe how each of the defense system components works
 - describe factors that can have a negative effect of body systems, including pathogens

Unit Outline

Below is a list of resources included for this unit.

Please note that each category will show as a separate folder in your desktop if using the CD once you have selected and opened the unit folder.

Each item is listed in the recommended order of presentation.

Templated Notes & Power Point Presentations

Note: please review each teacher master includes a list of materials needed and/or time required as well as larger copies of the notes to be copied into overheads.

Learning Outcome Addressed

- | | |
|--|---|
| <ul style="list-style-type: none"> • Cell Structure and Function – Student Notesheet • Cell Structure and Function – Teacher Master • Cell Structure and Function – Power Point Presentation | <ul style="list-style-type: none"> • 2 |
| <ul style="list-style-type: none"> • Characteristics of Living Organisms – Student Worksheet • Characteristics of Living Organisms Worksheet – Teacher Master | <ul style="list-style-type: none"> • 1 |
| <ul style="list-style-type: none"> • Moving Materials in and out of Cells – Student Notesheet • Moving Materials in and out of Cells – Teacher Master • Moving Materials in and out of Cells – Power Point Presentation | <ul style="list-style-type: none"> • 2 |

- Cells, Tissues, Organs and Organ Systems – Student Notesheet • 3
- Cells, Tissues, Organs and Organ Systems Notes – Teacher Master
- Cells, Tissues, Organs and Organ Systems – Power Point Presentation

- Respiratory System – Student Notesheet • 3
- Respiratory System – Teacher Master

- Circulatory System – Student Notesheet • 3
- Circulatory System – Teacher Master
- Circulatory System – Power Point Presentation

- Digestive System – Student Notesheet • 3
- Digestive System – Teacher Master

- Excretory System – Student Notesheet • 3
- Excretory System – Teacher Master
- Excretory System – Power Point Presentation

- Immune System – Student Notesheet • 4
- Immune System – Teacher Master
- Immune System – Power Point Presentation

Lab and Class Activities

Note: please review each teacher master if supplied for a list of materials needed and time required

Learning Outcome Addressed

- Cell Organelles Worksheet – Student Activity • 2
- Cell Organelles Worksheet – Teacher Master

- Jell-o Cell-o – Student Activity • 2
- Jell-o Cell-o – Teacher Master

- Predicting Diffusion – Student Activity • 2
- Predicting Diffusion – Teacher Master

- Diffusion Lab – Student Activity • 2

- Observing Osmosis – Student Activity • 2

- Vital Capacity – Class Activity • 3

- Digestion Travelers - A slightly scary children's story – Student Activity • 3
- Digestion Travelers – Teacher Master
- Heart Model Group Activity – Student Activity • 3
- Heart Model Group Activity – Teacher Master

- Medical Brochure Assignment – Student Activity • 4
- Medical Brochure Assignment – Teacher Master

<u>Review Games</u>	<i>Learning Outcome Addressed</i>
<ul style="list-style-type: none"> • Cell Review - Cellingo – How to Play • Cell Review - Cellingo – Playing Card • Cell Review - Cellingo – Vocabulary List 	<ul style="list-style-type: none"> • 1,2
<ul style="list-style-type: none"> • Systems Review - Systemlingo – How to Play • Systems Review - Systemlingo – Playing Card • Systems Review - Systemlingo – Vocabulary List 	<ul style="list-style-type: none"> • 3
<ul style="list-style-type: none"> • Immune System Review - Immunolingo – How to Play • Immune System Review - Immunolingo – Playing Card • Immune System Review - Immunolingo – Vocabulary List 	<ul style="list-style-type: none"> • 4
<u>Quizzes</u>	<i>Learning Outcome Addressed</i>
<ul style="list-style-type: none"> • Cell Structures and Functions Quiz – Student • Cell Structures and Functions Quiz – Teacher Master 	<ul style="list-style-type: none"> • 1, 2
<ul style="list-style-type: none"> • Respiratory System Quiz - Student • Respiratory System Quiz – Teacher Master 	<ul style="list-style-type: none"> • 3
<ul style="list-style-type: none"> • Circulatory System Quiz – Student • Circulatory System Quiz – Teacher Master 	<ul style="list-style-type: none"> • 3
<ul style="list-style-type: none"> • Digestive System Quiz – Student • Digestive System Quiz – Teacher master 	<ul style="list-style-type: none"> • 3
<u>Tests</u>	<i>Learning Outcome Addressed</i>
<ul style="list-style-type: none"> • Cell Test – Student • Cell Test – Teacher Master 	<ul style="list-style-type: none"> • 1, 2
<ul style="list-style-type: none"> • Body Systems Test - Student • Body Systems Test – Teacher Master 	<ul style="list-style-type: none"> • 3
<ul style="list-style-type: none"> • Immune System Test - Student • Immune System Test – Teacher Master 	<ul style="list-style-type: none"> • 4

The Immune System

NAME _____

DATE _____

Learning Outcomes Addressed

4. Explain the functioning of the immune system and the roles of the primary, secondary and tertiary defense system

- identify components of the primary defense systems
- identify phagocytic white blood cells as the major component of the secondary defense system
- describe how each of the defense system components works
- describe factors that can have a negative effect of body systems, including pathogens

The function of the immune system is to:

Name some types of invaders that might attack body cells

3 Levels of Defense

Primary –

Secondary –

Tertiary –

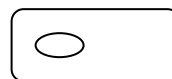
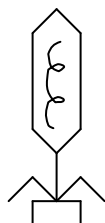
Let's take a closer look....

The most common types of invaders are:

Viruses

&

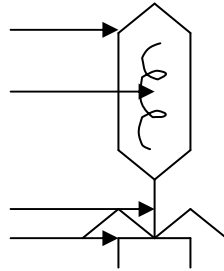
Bacteria



Viruses

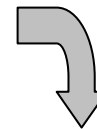
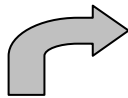
What do you remember about viruses?

What does a virus look like?



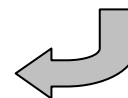
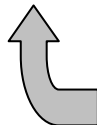
How does a virus attack cells and reproduce?

Step 1 -Virus sets down on a body cell and injects its genetic material (DNA or RNA) into the cell



Step 4 – The cell bursts and the new viruses are let out to infect other body cells

Step 2 - the viral genetic material hijacks the cell and uses the nucleus to produce more copies of the viral DNA/RNA



Step 3 – The viral DNA/RNA produces it's own proteins coats to form copies of the original virus

How does the body fight a viral infection?

Special Types of White Blood Cells (wbc's) make ANTIBODIES

Each type of virus has a _____ on the _____ that _____ are manufactured by. _____ (a type of wbc) are hanging out in the blood and recognize these special markers. They send a message to the _____ (another type of wbc) to make antibodies. There are also _____ (another type of wbc) that are able to actually destroy the viruses and sometimes the affected body cell as well.

For every type of _____ your wbc's must make a matching _____. For example, for the chicken pox virus, _____, your body must make a _____ antibody. That antibody can only disable the chicken pox virus.

Once the _____ are manufactured in large quantities they travel around in the bloodstream and _____.

Example:

How do we protect our bodies from viral infections?

VACCINES!!

However, the body still manufactures antibodies against this weakened virus from the special markers on the protein coat. Those antibodies quickly destroy the virus and are then kept in the bloodstream for the rest of your life. The next time that virus enters your body the antibodies in the bloodstream are ready to attack and disable the virus before it has a chance to multiply enough to cause infection/ disease.

Then why can't we just make a vaccine for HIV? (the AIDS virus)

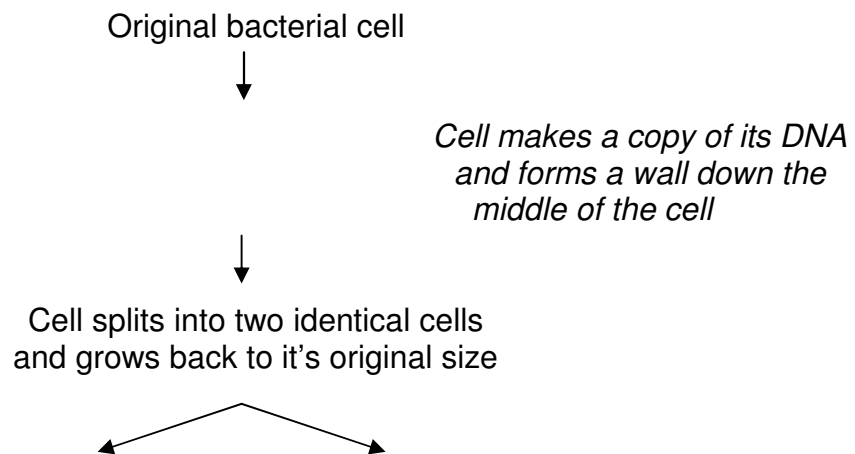
(changing the shape of its protein coat markers) Antibodies that are made at one time will later no longer be able to bind to the special markers after it has mutated. As well, HIV attacks the cells of the immune system (the wbc's!) so it becomes very hard for the immune system to keep up with the attack!

Bacteria

What do you already know about bacteria?

How do bacteria reproduce inside the body?

Bacteria reproduce using a method called **BINARY FISSION**.



How does the body protect against bacterial infections?

_____ (another type of wbc) detect, capture and destroy the foreign bacterial cells. Phagocytic wbc's have many _____ inside them that are used to destroy.

FACT: If you have ever seen pus before (like on a cut or in the back of your throat when you have a sore throat) you have actually been looking at destroyed bacterial cells and wbc's that have given their life for you....

A person with a bacterial infection can also take _____ which attack only bacterial cells. Although these will not attack body cells they will often also attack the good bacteria within the body.

The Immune System

Learning Outcomes Addressed

4. Explain the functioning of the immune system and the roles of the primary, secondary and tertiary defense system

- identify components of the primary defense systems
- identify phagocytic white blood cells as the major component of the secondary defense system
- describe how each of the defense system components works
- describe factors that can have a negative effect of body systems, including pathogens

- Recommended time required for this activity: 30-45 minutes

- Special Notes:
 - The teacher master starts on the next page and has been typed in larger font to be easily made into an overhead
 - For the section on viral replication space has been left for you to draw the diagram in. Consult a resource if you need help with this.
 - There is lots of room in these notes for you as the teacher to ask questions and fill in the spaces together with your class
 - these notes will often stir up many questions about disease in students and are an excellent lead in to the Medical Brochure Activity supplied.

THE IMMUNE SYSTEM

The function of the immune system is to:

Detect and destroy foreign invaders in the human body

Name some types of invaders that might attack body cells

Viruses, Bacteria, Protists, Fungi....

3 Levels of Defense

Primary

- Physical Barriers
- First part of the body the invaders usually come into contact with before they enter the bloodstream
- Ex. Skin, tears, earwax, saliva, gastric juice, mucus, cilia (how might each of these keep out the invaders?)

Secondary

- Phagocytic (phago = eating, cytic = of the cell) White blood cells (wbc's) which are found in the blood circulating throughout the body
- Most invaders send off chemical signals that attract the wbc's which engulf and destroy the invaders.

Tertiary

- Special white blood cells can also make antibodies that can protect against certain invaders

Let's take a closer look....

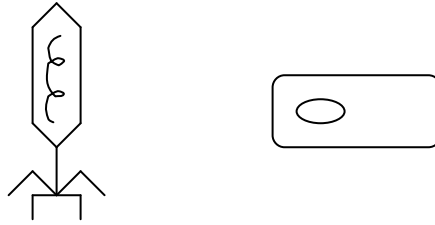
The most common types of invaders are:

Viruses

&

Bacteria

(as a class brainstorm some examples)

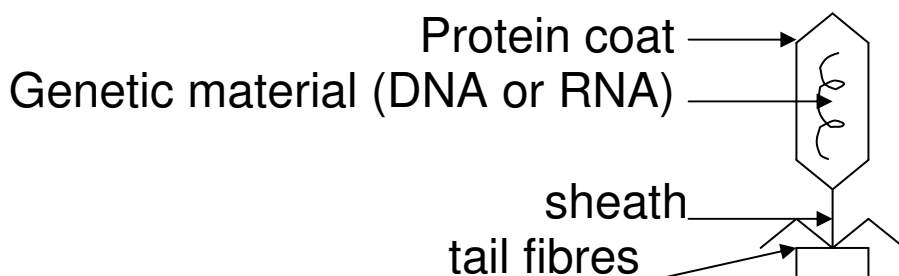


Viruses

What do you remember about virus'?

- not a living cell
- need another living cell to reproduce
-
-

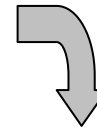
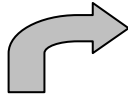
What does a virus look like?



This is just an example of one type of virus, there are many different shapes and forms but all have genetic material and a protein coat.

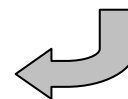
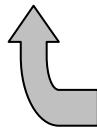
How does a virus attack cells and reproduce?

Step 1 -Virus sets down on a body cell and injects its genetic material (DNA or RNA) into the cell



Step 4 – The cell bursts and the new viruses are let out to infect other body cells

Step 2 - the viral genetic material hijacks the cell and uses the nucleus to produce more copies of the viral DNA/RNA



Step 3 – The viral DNA/RNA produces it's own proteins coats to form copies of the original virus

How does the body fight a viral infection?

Special Types of White Blood Cells (wbc's) make ANTIBODIES

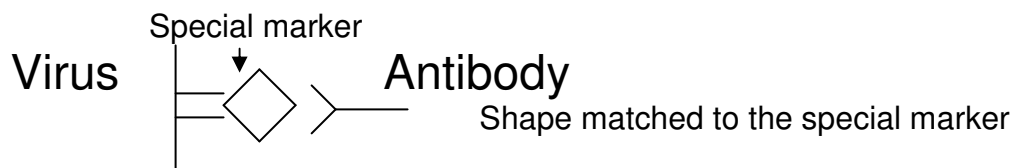
Each type of virus has a **special marker** on the **protein coat** that **antibodies** are manufactured by. **Helper T cells** (a type of wbc) are hanging out in the blood and recognize these special markers. They send a message to the **B cells** (another type of wbc) to make antibodies. There are also **Killer T-cells** (another type of wbc) that are able to actually destroy the virus' and sometimes the affected body cell as well.

TEACHER MASTER

For every type of **foreign invader** your wbc's must make a **matching antibody**. For example, for the chicken pox virus, **varicella zoster**, your body must make a **varicella zoster** antibody. That antibody can only disable the chicken pox virus.

Once the **antibodies** are manufactured in large quantities they travel around in the bloodstream and **latch onto the matching virus, disabling and destroying them.**

Example:



How do we protect our bodies from viral infections?

VACCINES!!

We inject our bodies with very weak or dead virus' that are not strong enough to actually cause an infection.

However, the body still manufactures antibodies against this weakened virus from the special markers on the protein coat. Those antibodies quickly destroy the virus and are then kept in the bloodstream for the rest of your life. The next time that virus enters your body the antibodies in the bloodstream are ready to attack and disable the virus before it has a chance to multiply enough to cause infection/ disease.

Then why can't we just make a vaccine for HIV? (the AIDS virus)

The HIV virus is a tricky virus in that it is constantly mutating. (changing the shape of its protein coat markers) Antibodies that are made at one time will later no longer be able to bind to the special markers after it has mutated. As well, HIV attacks the cells of the immune system (the wbc's!) so it becomes very hard for the immune system to keep up with the attack!

Bacteria

What do you already know about bacteria?

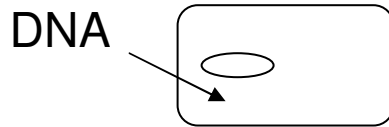
- living things
- single celled
- can be shaped as rods (bacilli) , cocci, or spirilla



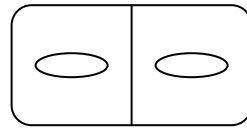
How do bacteria reproduce inside the body?

Bacteria reproduce using a method called **BINARY FISSION**.

See next page....

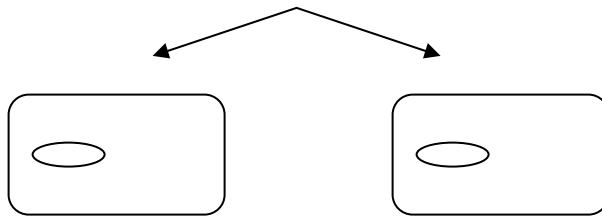


Original bacterial cell



Cell makes a copy of its DNA and forms a wall down the middle of the cell

Cell splits into two identical cells and grows back to its original size



How does the body protect against bacterial infections?

WHITE BLOOD CELLS TO THE RESCUE!!

Phagocytic white blood cells (another type of wbc) detect, capture and destroy the foreign bacterial cells. Phagocytic wbc's have many **lysosomes** inside them that are used to destroy.

TEACHER MASTER

FACT: If you have ever seen pus before (like on a cut or in the back of your throat when you have a sore throat) you have actually been looking at destroyed bacterial cells and wbc's that have given their life for you....

A person with a bacterial infection can also take **ANTIBIOTICS** which attack only bacterial cells. Although these will not attack body cells they will often also attack the good bacteria within the body.

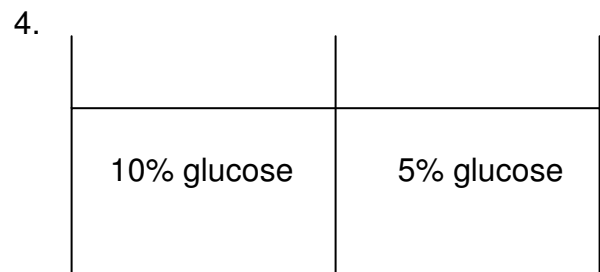
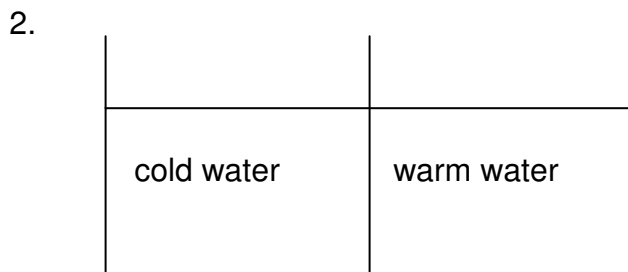
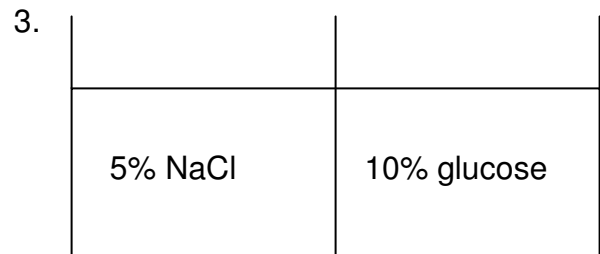
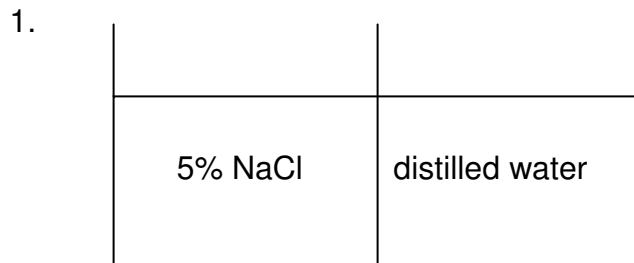
Predicting Diffusion - Activity

 NAME _____
 DATE _____

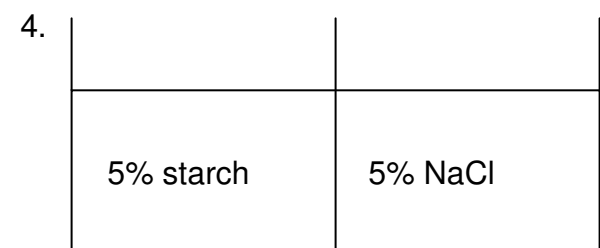
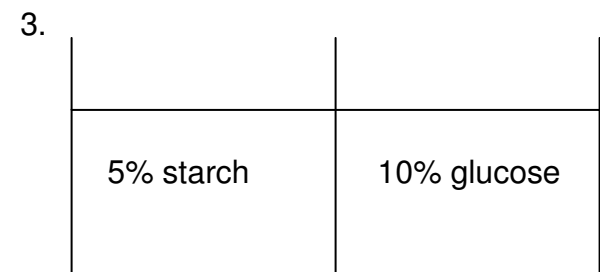
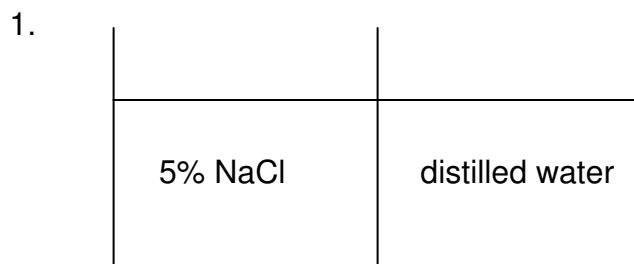
Learning Outcomes Addressed

2. Relate the main features and properties of cells to their functions
 - relate the concepts of osmosis and diffusion to transport of materials across cell membranes

Each of the four aquariums below has an **impermeable** partition that can be removed. Use arrows to show the movement of solutes (a substance dissolved in water) when the partition is removed and write the final concentration of each solute(s).



Each of the four aquariums below has a **semi-permeable** partition that prevents the flow of starch but allows glucose and NaCl to pass freely. Use arrows to show the movement of solutes and water and write the final concentration of the solute(s).



Predicting Diffusion - Class Activity

Learning Outcomes Addressed

2. Relate the main features and properties of cells to their functions

- relate the concepts of osmosis and diffusion to transport of materials across cell membranes

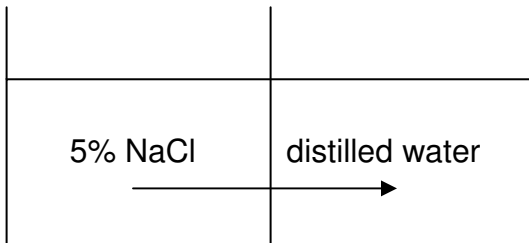
- Recommended time required for this activity: 15 minutes

- Special Notes: would be a good idea to complete a few with the students and then have them try some on their own and students often have a hard time understanding the idea of a solute. Answers are on the next page so they can easily be made into an overhead.

PREDICTING DIFFUSION

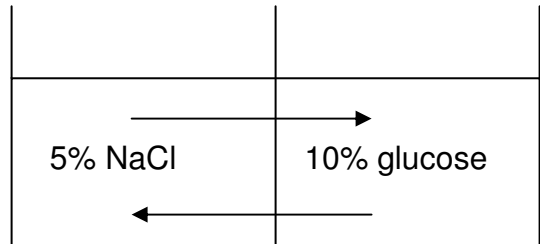
Each of the four aquariums below has an **impermeable** partition that can be removed. Use arrows to show the movement of solutes (a substance dissolved in water) when the partition is removed and write the final concentration of each solute(s).

1.



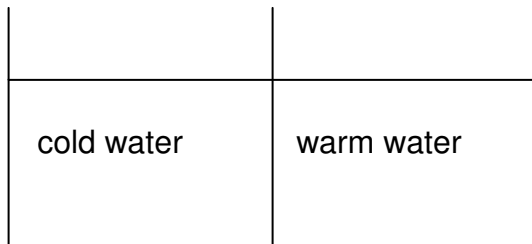
The final concentration of NaCl would be 2.5%

3.



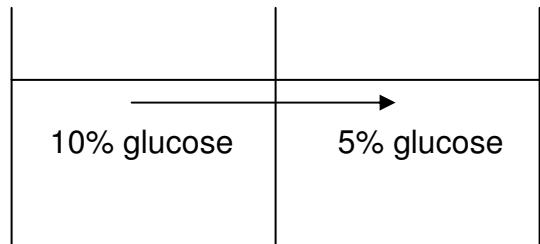
NaCl would diffuse to the right, with a final concentration of 2.5% and Glucose would diffuse to the left with a final concentration of 5%.

2.



No net movement as there is no solute!

4.

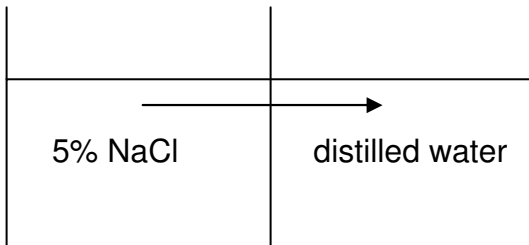


The final concentration of glucose would be 7.5%.

TEACHER MASTER

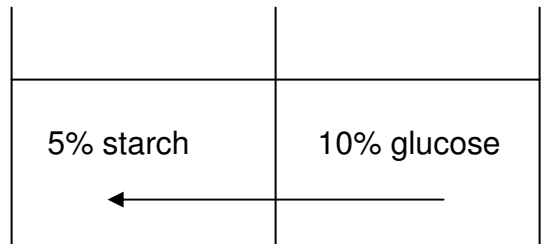
Each of the four aquariums below has a **semi-permeable** partition that prevents the flow of starch but allows glucose and NaCl to pass freely. Use arrows to show the movement of solutes and water and write the final concentration of the solute(s).

1.



The final concentration of NaCl would be 2.5%

3.



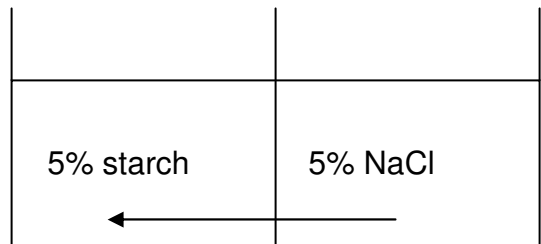
The starch would not move and the final concentration of glucose would be 5%.

2.



There would be no movement as the Membrane is not permeable to starch

4.



Starch would not move and the final The final concentration of NaCl would be 2.5%.