

LESSONS FOR PROMOTING SCIENTIFIC AND TECHNOLOGICAL LITERACY (STL) FOR LIFELONG LEARNING

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Abstract

These lessons highlight the need to broaden students' views on STL—its meaning in the real life context and applications in the classrooms for the improvement of the teaching-learning process. Integrated in each lesson are learning concepts and approaches on how teachers can address high order thinking skills and critical thinking (through the activities outlined). Different formats of assessing students' learning are also introduced in the lessons.

Lesson 1: Gas Pressure

Introduction

This lesson introduces the concept that air is a mixture of gases and is made up of tiny particles of matter. It includes two activities on air pressure incorporating cooperative learning where students work by groups to perform the activities. The activities will help

students understand air/gas pressure and the nature of matter as it relates to their classroom and everyday experiences.

In the first activity, students stimulate the effect of atmospheric pressure by using hot and cool air to get an egg in and out of a bottle. In the second activity, students will make use of Alka Seltzer and water to demonstrate the effect of a thrust force on a paper rocket.

Key Concepts

Pressure

Particles of hot air expand

Particles of cool air contract

Atmospheric pressure

Newton's Third law: For every action there is an opposite and equal reaction

Activity 1: Eggsperiment

Overview

This activity will demonstrate that air exerts pressure. The students will analyse evidence about particles of matter and demonstrate the role of motion in the particulate description of matter.

Focus:

Students observe a bottle that has a mouth that is too small for an egg to pass through.

Grouping:

At least 5 members per group

Time Frame:

2 periods (1 hour 30 minutes)

Intended Learning Outcomes:

Students should be able to:

- plan a method to illustrate gas pressure using an egg and a bottle
- formulate ideas and predictions based on the results of the activity
- explain the concept of gas pressure
- plan and organize investigation activities involving air pressure

Materials:

- Hard boiled eggs
- Matches
- Paper towel
- Small jar (with an opening large enough to let the egg almost pass through)

Word to Watch

High pressure Low pressure

air particles push

Instructional Procedures:

1. Tell students that today they will do the activity on air pressure.
2. Begin the activity by asking questions:
 - What is pressure?
 - What causes pressure? Discuss things that exert pressure

- Does air exert pressure?
- How do we know?

Note: The teacher should set instructions clearly to the student before starting the activity. For safety reasons it is best that the teacher perform the demonstration. The demonstration must be performed in an area visible to all students. Use a bottle with a mouth just smaller than the diameter of the egg. It is advisable to practice the demonstration before performing it in front of students.

3. Peel the egg. Set a small piece of paper on fire and drop it into the bottle. Place the hard boiled egg gently on the opening of the bottle, small end first.



The egg may “dance” and wobble on top of the opening. Then when the flame has been extinguished, the egg will appear to be pulled into the bottle.

4. In small groups, let students discuss why the egg went into the bottle.

Possible Explanation: As the flame heated the air, the air particles began to move more rapidly. Some of the air particles escaped causing the egg to wobble. When the fire was extinguished, the air particles began to slow down. The egg sealed the bottle and trapped a reduced amount of air in the bottle. This caused the air pressure inside the bottle to be less than the air pressure outside the bottle. The greater air pressure on the outside pushed the egg into the bottle equalizing the air pressure inside and outside the bottle.

5. Allow students to discuss in their groups how they could use air pressure to get the egg out of the bottle without cutting it into pieces. Keep in mind the first demonstration.
6. As a class, discuss the students' ideas. Have the students decide which ideas will work and which ideas probably will not.
7. Once students have decided on how to use air pressure to remove the egg from the bottle and have explained why they think their idea will, work, ask them to implement their plan.
8. Discuss the results with the class and relate what they did to air pressure.

- Were you able to get the egg out of the bottle?
- Why or why not?

Note: if the first attempt did not work, implement another plan. Even if the first attempt did work, try other students' ideas.

9. Demonstrate how to remove the egg from the bottle.

Hold the bottle upside down with the small end of the egg in the bottle neck. Remove any pieces of the burned paper

towel. Tilt the bottle down until there is a small opening between the neck of the bottle and the egg. Blow hard into the bottle making a closed seal with your mouth. Before you remove your mouth, tilt the bottle upside down until the egg settles in the mouth of the bottle. Move your mouth and the egg should come out.

10. Have the students, either as a group or as individuals, explain the results of this activity in their own words.

- What evidence does the demonstration give that air is made of tiny particles?
- What evidence does the demonstration give that particles move?
- What is the effect of heat on the motion of particles?

The particles gain more energy and travel faster

- What is air pressure?

Air pushes on all surfaces that it touches. This push is called air pressure.

11. Ask the students to design an experiment that demonstrates the motion of particles.

Extensions:

Talk about things that would cause differences in air pressure. For example, deserts are very hot. Air over a desert would be heated and would rise. You could also discuss what type of weather accompanies a rise or fall in air pressure. For example, high pressure usually means good weather.

Assessment Plan**Criterion-based Assessment****Social Values**

- able to make right decisions and use materials correctly (25 marks)
- able to choose the materials but not able to use them correctly (15 marks)
- able to work with others cooperatively (5 marks)

Science Methods

- able to plan methods to remove the egg out of the bottle (25 marks)
- able to give ideas or suggestions on how to remove the egg out of the bottle (15 marks)
- not able to give any insightful ideas or response (5 marks)

Personal Skills

- willing to give an idea and discuss how it works (25 marks)
- gets involve in the discussion and gives ideas (15 marks)
- takes little part in the discussion but do not elaborate any ideas (5 marks)

Science Method

- explains correctly the terms on pressure related to the activity (25 marks)
- explains partially about the term pressure on eggsperiment (15 marks)
- not able to explain how the egg got in and out of the bottle (5 marks)

Grading:

61 -100 = Excellent

21 - 60 = Good

5 - 20= Not satisfactory

Activity 2: Alka Rocket

Overview

This activity simulates the effect of a “thrust” force on a paper rocket using Alka Seltzer and water. When Alka Seltzer is mixed with water inside a closed canister can, gas bubbles are produced. As the bubbles of gas increase, a high pressure is created inside the canister. This leads to the popping up of the canister lid. As a result, the thrust force that is produced causes the paper rocket to fly high.

Students will predict, observe and explain the pressure exerted by the reaction of Alka Seltzer with water inside a closed canister can. They will investigate the effect of using different amounts of Alka Seltzer and water on the flight of the rocket.

Purpose:

To design a paper rocket propelled by Alka Seltzer and water to demonstrate Newton's third law of motion.

Grouping:

Students form small group of 4 persons

Time allotted:

2 periods (1 hour 30 minutes)

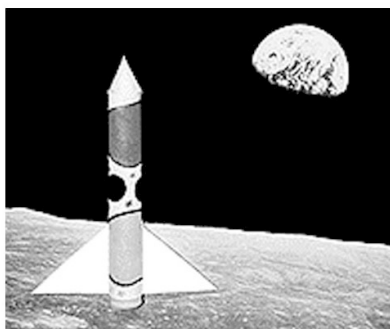
Intended Outcomes:

The students are able to:

- relate and apply the principles of NASA rocket on toys
- perform the experiment on paper rocket correctly
- investigate the effect of varying amount of Alka Seltzer and water on the flight of the paper rocket
- make predictions based on the activity
- explain concepts about pressure and Newton's third law of motion

Materials:

- Index card 5 x 8 in.)
- Empty film canister with lid that snaps inside
- Markers, crayons, or coloured pencils
- Tape
- Scissors
- Alka Seltzer tablets
- Water
- Measuring tape

**Keywords:**

- Rocketry
- Launch
- Pressure
- For every action there is an opposite and equal reaction

Procedure:

1. Decorate the index card to form the body of the rocket.
2. Roll the index card into an 8-inch-tall tube. Slide an empty film canister into the tube such that the canister opens at one end of the tube. Tape the paper tube securely onto the canister.
3. Tape the 8-inch-long seam of the paper tube.
4. Cut two triangular paper fins and tape these to the rocket. What is the function of the rocket fins?

To make the rocket fly straight up

5. Make a small paper cone and tape it to the top of the rocket to appear like a nose cone. What is the function of the nose cone?

To streamline the air to the rocket (aerodynamic)

6. Hold the rocket upside down. Pour water into the canister until it is one-quarter full.
7. Add half a tablet of alka seltzer to the film canister and quickly snap off the lid.
8. Place the rocket on the ground, lid down. Stand back and count down while you are waiting for the “launch!”.

Observations:

9. How high did the rocket go?
10. What happened when the alka seltzer was added to the water?
(Bubbles of gas were produced)
11. What action happened inside the film canister?
The gas produced inside the canister created high pressure
12. What was the effect of this on the rocket?
The high pressure created inside the canister produced a “down thrust” and thus, the rocket up.
13. Experiment using different amounts of water or alka seltzer to see how it affects the height of the rocket.

Interpretations:

14. What is the best combination of alka seltzer and water to produce the maximum launch height? What is your evidence?

Extensions:

1. Design and launch a rocket powered by two, three or more film canister.
2. Design a rocket that could be launched in two stages.
3. Allow the students to work on the Word Search game.
4. Complete the written word exercises.

Assessment Plan

Criterion-based assessment:

Social Values

- able to relate the alka seltzer rocket with the NASA rocket and put forward ideas that work (25 marks)
- able to choose appropriate materials to construct the rocket (15 marks)
- able to work with others cooperatively (5 marks)

Science Method

- able to design and change variables to make the rocket fly higher (25 marks)
- able to give ideas or suggestions on how to make the rocket fly (15 marks)
- able to make a rocket but unable to make it fly (5 marks)

Personal Skills

- able to lead the experiment and willing to explain how it works (25 marks)
- gets involve in the activity and able to give ideas (15 marks)
- takes little part in the discussion but do not elaborate any ideas (5 marks)

Science Concept

- explains correctly the term about pressure, reaction involved and Newton's third law (25 marks)
- explains partially the term about pressure, reaction involved and Newton's third law (15 marks)
- not able to explain how rocket works (5 marks)

Grading:

61 - 100 = Excellent

21 - 60 = Good

5 - 20 = Not satisfactory

N	R	E	T	E	M	O	R	A	B	E	C	R	O	F
S	U	Y	G	W	S	C	G	I	X	S	B	R	N	S
I	Z	P	R	D	D	R	F	Y	R	U	C	R	E	M
Y	X	J	A	T	P	D	E	B	C	C	V	D	C	Q
X	H	Z	B	O	R	O	X	Y	G	E	N	P	G	Z
F	Q	C	I	R	E	H	P	S	O	M	T	A	C	T
I	C	V	L	R	S	E	L	U	C	E	L	O	M	F
K	T	B	L	I	S	Y	T	H	T	J	P	X	C	Q
T	O	R	I	C	U	E	N	A	C	I	R	R	U	H
K	R	D	M	E	R	W	E	A	T	H	E	R	T	J
Y	N	G	D	L	E	A	K	D	D	C	D	I	D	U
L	A	K	K	L	R	G	O	N	J	G	J	E	F	T
T	D	U	Z	I	K	I	P	I	Y	J	L	B	J	Y
M	O	F	W	F	C	D	A	W	K	O	H	T	T	E
R	E	R	U	T	A	R	E	P	M	E	T	A	Q	L

Word Search Game

Find the required term/word. The word are either arranged horizontally or vertically, and can be read either forward or backward. The number of letter for each word is indicated inside the bracket.

1. Weather forecaster measure air pressure with a (9) _____.
2. Is equivalent to force divided by area. (8) _____
3. Covers the earth surface. (3) _____
4. Needed for human respiration. (6) _____
5. Another name of moving air. (4) _____

6. A violent rotating column of air and often visible as a funnel cloud. (7) _____
7. A tropical storm with excess of 75 mph. (9) _____
8. Push or pull. (5) _____
9. Degree of hotness or coldness .(11) _____
10. Unit of pressure. (7) _____
11. High and low pressure systems have important effects on our (7) _____.
12. Common liquid use in thermometer. (7) _____
13. Inventor of barometer. (10) _____

Written Exercises

Choose the suitable words from the list and write in the space provided.

volume
collisions
atmospheric pressure
temperature
decrease
air pressure

1. _____ is caused by _____ of air particles against the wall of a container.
2. _____ and _____ are two factors that affect air pressure.
3. A person climbing a mountain will experience a _____ in air pressure.
4. The pressure that is acting on all the objects on earth is called _____.

ANSWERS:

Word Search

1. barometer
2. pressure
3. air
4. oxygen
5. wind
6. tornado
7. hurricance
8. force
9. temperature
10. millibar

Written Exercises

1. air pressure, collisions
2. temperature, volume
3. decrease
4. atmospheric pressure

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Lesson 2: Human Blood Groups

Overview

In this lesson students will learn STL concepts on human blood groups, terminologies related to human blood groups and blood transfusion. They will understand why blood typing is necessary; when blood test is needed; and the importance of blood transfusion to people's life.

Three activities related to blood types are included in the lesson plan. The first activity introduces vocabularies that will expand students' knowledge about blood groups and blood transfusion. The second activity provides students an opportunity to critically discuss among themselves social issues and problems related to blood donation, blood types and blood transfusion. The activity will enable students to recognize potential dangers and problems posed on human lives as a result of wrong blood transfusion and blood typing.

The third activity will enable students to improve their ability to predict, observe and explain as they watch a demonstration on blood typing.

The active and collaborative learning strategies introduced in the lessons will enable students to construct knowledge and thinking skills effectively. These strategies are meant to make science teaching and learning more interesting, fun, meaningful and relevant to students' lives.

General Objective

To introduce the base concept of human blood types and blood transfusion.

Specific Objectives

Students will be able to:

- show an understanding of the concept of human blood types;
- illustrate the procedures involved in blood testing blood transfusion.

Behavioural Objectives

Students will be able to:

1. define terms related to blood types and blood transfusion;
2. classify the four major human blood groups;
3. differentiate the characteristic of each blood type;
4. explain the need for blood test;
5. construct a concept map illustrating the process of blood transfusion;
6. design and develop procedure for a blood type test; and
7. predict, observe and explain the result of a blood typing test.

Key Concepts

- The blood is made up of four components, namely: plasma, red blood cells (RBC), white blood cells (WBC), and platelets.
- There are four different blood types which are *A*, *B*, *AB*, and *O*. Blood is also classified by the presence and absence of *Rh factor*.
- Blood typing is done before a person receives a blood transfusion; before donating blood, before surgery; to determine whether two people have the same blood origin; or to identify a person suspected of committing a crime.

Activity 1: Matching Cards

Time: 30 minutes

Materials needed:

- cards (vocabularies and their explanation)
- A4 papers
- Double-sided tapes
- Scissors

Procedures:

1. Begin the lesson by asking the following questions:
What comes into your mind when you hear or see the word blood?
Can you name some vocabularies or terms related to blood, blood types and blood transfusion?
2. Write on the board the various ideas expressed by the students.
3. Divide the students into two groups of five. Provide each group a set of cards, a double-sided tape, scissor, and a piece of A4 paper.
4. Ask students to draw two columns on the blank paper. Allow each group to match the vocabularies with their corresponding explanation and stick these on the appropriate columns using the double-sided tape.
Allow students to discuss among themselves first before sticking their cards.
5. Encourage the students to compare their work with the other groups.

6. Inspect each group work results and explain other terms which students find difficult and confusing.

Evaluation:

Use the following three-point rubric to evaluate how well students participate in group and class discussions to answer the assigned questions.

3 points

Actively participates in group discussion; puts forward ideas clearly, logically, and persuasively; able to define all the terms correctly.

2 points

Participate and puts forward ideas, but is easily persuaded by other's ideas; able to define most of the terms.

1 point

Does not participate in the discussion; the ideas contributed is poor and lacks clarity; not able to define the terms.

Activity 2: Group Discussion

Time: 90 minutes

Materials needed:

- Reading materials about Human Blood, Blood Types and Blood Transfusion (given two days before the activity)
- Worksheets

Procedures:

1. Ask the students to work in groups of five.
2. Provide worksheets to each group. Give one set of worksheet to each student, and one more set or worksheet for group results.
3. Give time for the group to read the materials and ask students to answer all the questions on the worksheet individually. Allow students to share and discuss their answers with their group.
4. Write down the groups' answers based on their discussions.
5. Allow each group to present their results to the class.
6. Encourage each student to ask questions if they have different answers.

Evaluation:

Use the following three-point rubric to evaluate students on social values and science concepts objectives:

Social Values:**3 points**

Able to recognize and discuss societal problems and issues related to blood type and blood transfusion.

2 points

Able to recognize and discuss societal problems and issues related to the topic with help.

1 point

Not able to recognize and discuss societal problems and issues related to the topic.

Science Concepts:**3 points**

Understand the concept and recognize the importance of blood type and blood transfusion in daily living.

2 points

Partly understand the concept and recognize the importance of blood type and blood transfusion in daily living with help.

1 point

Do not understand the concept and could not see the importance of blood type and blood transfusion in daily living.

Activity 3: Blood Typing Test

Time: 60 minutes

Materials needed:

- Video presentation on Blood Typing
- Blood test cards
- Anti-A serum
- Anti-B serum
- Anti-Rh serum
- NaCl 0.9% (control)
- Blood lancets
- Sterile cotton
- Alcohol 70%
- Worksheets
- Toothpicks
- Hand gloves

Procedures:

1. Ask students to work in groups of five, and design the steps for the blood type test. Supervise the students in designing the procedure.
2. Show students the video presentation on blood typing test.
3. Ask students to **predict** what will happen when the blood mixes with each serum. Write down all the answers in their worksheets.
4. Ask 4 students who possess *A*, *B*, *AB* and *O* blood type as volunteers for the sample.

5. Demonstrate the blood type test on student with blood type A.
6. Ask students to **observe** carefully what happens.
7. Ask students to **explain** what was observed.
8. Do similar demonstrations on the other blood types.

Evaluation:

Use the following three-point rubric to evaluate students on personal skills and scientific method objectives:

Personal Skills:**3 points**

Willing to participate in group work and take on a leadership role.

2 points

Willing to participate in group work and to play a significant role but leadership skills may not be highly developed.

1 point

Little attempt to participate in a cooperative activity and not able to take on a leadership role.

Scientific Method

3 points

Show evidence of being able to plan a correct procedure, make prediction, observe, analyse and make conclusion on the blood type test principle.

2 points

Is capable to plan procedure, make prediction, observe, analyse and make conclusion with guidance.

1 point

Little evidence of higher order scientific thinking.

When only factual information with explanations copied or based on the textbook.

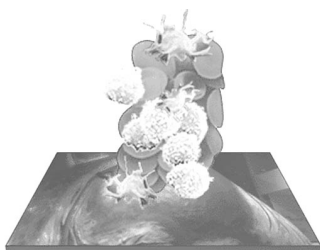
Material for Activity 1

Copy on Concorde papers and cut along the line to make cards.
Place randomly inside an envelope.

A	B
Homozygous Gene	Gene that shows alleles which are identical (TT or tt)
Heterozygous	A genotype expression that includes both a dominant and a recessive allele (Tt)
Genotype	Genetic characteristic of organism; represented as homozygous or heterozygous genes
Phenotype	Physical description of the trait observed in an organism
Dominant	A trait that masks the expression of another character; represented by a capital letter
Recessive	A trait that is masked or prevented in the expression; usually in the homozygous form; represented by a small letter
Allele	A gene occurring in pairs; represented by symbols
Antigen	Any substance that will trigger an immune response by a host organism
Antibodies	Compounds produced by plasma cells that react with specific antigens invading a body
Agglutination	The clumping together of blood cells in response to a specific antibody
Plasma	The fluid portion of blood that contains proteins and salts, and in which blood cells and platelets are suspended
Platelets	Cell fragments that causes clotting
Blood Transfusion	The process of giving blood from one individual to another
Donor	An individual who gives blood to another person
Recipient	An individual who receives blood from a donor

Reading Materials for Activity 2

1. The Human Blood



The average adult has about five liters of living blood inside of its body, flowing through the vessels, delivering essential elements, and removing harmful wastes. Without blood, the human body stops working.

Blood is considered the fluid of life, transporting oxygen from the lungs to body tissues and carbon dioxide from the body tissues to the lungs. Blood is also a fluid of growth, transporting nutrients from digestion, hormones from glands throughout the human body. It is also the fluid of health, transporting disease fighting substances to the tissues and waste to the kidneys.

Because it contains living cells, blood is alive. Red blood cells (RBC) and white blood cells (WBC) are responsible for nourishing and cleansing the body. Since the cells are alive, they too need nourishment. Vitamins and Minerals keep the blood healthy. The blood cells have a definite life cycle, just as all living organisms do.

Approximately 55 percent of blood is plasma, a straw-colored clear liquid. The liquid plasma carries the solid cells and the platelets which helps the blood to clot. Without the blood platelets, an individual will bleed to death.

When the human body loses a little bit of blood through a minor wound, the platelets causes the blood to clot so that the bleeding stops. Because new blood is always made in the bone marrow, the body can replace any lost blood. When the human body loses a lot of blood through a major wound, the blood has to be replaced through a blood transfusion from other people.

However, every individual's blood is not also the same. There are four different blood type. The blood has *Rh factors* which make it even more unique. Patients who are scheduled to have major surgery make autologous blood donations (donations of their own blood) so that they can have a perfect match.

Source: <http://sln.fi.edu/biiosci.blood/blood.html>

2. Blood Types

Everyone has a blood type. The most common blood type classification system is the *ABO* (say "A-B-O") system discovered by Karl Landsteiner in the early 1900s. There are four types of blood in the *ABO* system: *A*, *B*, *AB*, and *O*. Your blood type is established before you are born by specific genes inherited from your parents. You receive one gene from your mother and one from your father; these two combine to establish your blood type. These two genes determine your blood type by causing proteins called *agglutinogens* to exist on the surface of all of your red blood cells.

There are three *alleles* or versions of the blood type gene: *A*, *B*, and *O*. Since everybody has two copies of these genes, there are six possible combinations; *AA*, *BB*, *OO*, *AB*, *AO*, and *BO*. In genetic terms, these combinations are called *genotypes*, which describe the genes you got from your parents.

In addition to the *proteins* (*agglutinogens*) existing on your red blood cells, other genes make proteins called agglutinins that circulate in your blood plasma. *Agglutinins* are responsible for ensuring that only the blood cells of your blood type exist in your body.

Your genotype determines your blood type.

The *agglutinin* produced by the *O allele* has no special enzymatic activities. However the *agglutinogens* produced by the *A* and *B alleles* do have enzymatic activities, which are different from each other. Therefore people whose genotype is *OO* are said to have *type O* blood, meaning the *agglutinin* on their red blood cells doesn't have any enzymatic activity. People with *Type O* blood have *agglutinins a* and *b* in their blood plasma. *Agglutinin a* helps the body destroy any *type A* blood cells that might enter the circulation system. *Agglutinin b* helps the body destroy any *type B* blood cells that might enter the circulation system.

People who have an *AA* genotype are said to have *Type A* blood because *agglutinin* on their red blood cells has the enzyme activity associated with the *A allele*. It is important to recognize that people with the *AO* genotype also have the enzyme activity associated with the *A allele*, so they are also said to have *Type A* blood. (Remember the *O allele* doesn't have any enzyme activity associated with it!) People with *Type A* blood have *agglutinin b* in their blood plasma. *Agglutinin b*

helps the body destroy any *Type b* blood cells that might enter the circulation system.

Likewise, people with the *BB* and the *BO* genotypes are said to have *Type B* blood. These people have *agglutinin a* in their blood plasma. *Agglutinin a* helps the body destroy any *Type A* blood cells that might enter the circulation system.

People who have the *AB* genotype have the enzyme activity associated with both the *A* and *B alleles*. These people have no *agglutinins* in their blood plasma.

The concepts of *genotype* and *phenotype* can be easily understood in the case of blood type. *Genotype* refers the actual genes an individual possesses that determine a particular trait. *Phenotype* refers to the characteristics of that trait an individual displays. In the case of blood type, both the *AA* and *AO* genotypes cause individuals to display the *A* blood type phenotype. Similarly, both the *BB* and *BO* genotypes cause individuals to display the *B* blood type *phenotype*. Individuals who are *phenotypically type O* or *type AB* have only one possible *genotype*, *OO* and *AB*, respectively.

In different parts of the world, the fraction of individuals with blood *type A*, *B*, *O*, or *AB* differs. The frequency with which blood types are observed is determined by the frequency with which the three alleles of the ABO gene are found in different parts of the world (*allele frequency*). Variation in the *allele frequency* at the ABO gene reflects the social tendency of populations to marry and reproduce with a national, regional, or ethnic group. As people throughout the world intermingle to a greater extent, the distribution of the different blood types will become more uniform throughout the world.

In general, however, it is still best to mix blood of matching types and *Rh factors*.

Rh blood type checks for the presence (+) or absence (-) of the *Rh antigen* (also called the *Rh factor*). If your red blood cells:

- Contain the *Rh antigen*, your blood is *Rh-positive*.
- Do not contain the *Rh antigen*, your blood is *Rh-negative*.
- Contain the A and *Rh* antigens, your blood type is *A-positive* (A+). If your blood contains the B antigen but not the *Rh antigen*, your blood type is *B-negative* (B-).

3. Blood Transfusion

Because there are only four types of blood, it is possible to take blood from one person and donate it to another person in a process called *transfusion*. In order for a transfusion to work it is essential that the *agglutinogens* on the surface of the donor's blood cells match the *agglutinogens* on the surface of the recipient's blood cells. In other words, the blood type of the donor and the blood type of the person receiving the transfusion must be compatible. If the blood type don't match, special antibodies in the recipient's blood, called *agglutinins*, will attack the donated blood causing blood clots to form in a reaction called *agglutination*.

Someone with *Rh-positive* can receive blood both from *Rh-positive* and *Rh-negative*, but someone with *Rh-negative* can receive only from *Rh-negative* one.

If you ever need a blood transfusion, someone will take a sample of your blood in order to determine your blood type and the genotypes of matching blood types. Someone with type A blood can receive blood from people with the AA, AO, and

OO genotypes. People with *type B* can receive blood from people with the *BB*, *BO*, and *OO* genotypes. Someone with *Rh+* blood can receive blood from people with the *++* and *+-* genotypes while someone with *Rh-* only can receive blood from people with the *--* genotype.

There are two special genotypes when it comes to blood transfusions: *OO* and *AB*.

The first special genotype is *OO*. People with *type O* blood are said to be universal donors because they can donate blood to everybody. However, people with *type O* blood can only receive transfusions from other *type O* donors. Because *type O* blood does not carry either the *A* or *B agglutinogens*, the immune system of a person with *O* blood views these *agglutinogens* as foreign. People with *type O* blood have *agglutinins* in their plasma that will react against the *A* and *B agglutinogens*. Therefore, *type O* blood will undergo *agglutination* if exposed to *A*, *B*, or *AB* blood.

The second special genotype is *AB*. People with *Type AB* blood are said to be universal recipients because they can receive blood from people with all four blood types. Since in *AB* blood both the *A* and *B agglutinogens* are presented on the surface of the red blood cells, the immune system of a person with *AB* blood views both of these molecules as part of itself, not as something foreign. *AB* blood does not produce *agglutinins* against either the *A* or *B agglutinogens*, and therefore does not undergo *agglutination* when exposed to *A*, *B*, *AB*, or *O* blood.

Source: <http://gslc.genetics.utah.edu>

Activity 2: Worksheet 1

After reading the material, provide a summary on the following sheet.

1. Blood is made of four components, which are:

- a.
- b.
- c.
- d.

2. What are the various blood types?

ABO Blood Type	Genotypes
1.	
2.	
3.	
4.	
Rh Blood Type	Genotypes
1.	
2.	

- 3. Why is blood typing important? Why is it done?
- 4. What is blood transfusion?
- 5. When does a person need blood transfusion? How can it be done?
- 6. How can one persuade the community to donate blood?

Worksheet 2

Provide the correct answer in each column

Type	Has antigen	Has antibody
A		
O		
B		
AB		
Rh +		
Rh -		

Worksheet 3

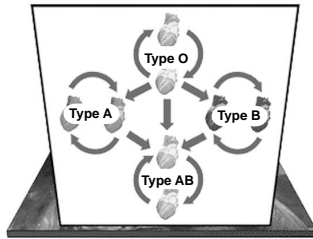
Write the correct answer in each column

Type	Can give blood to	Can receive blood from
A+		
O+		
B+		
AB+		
A-		
O-		
B-		
AB-		

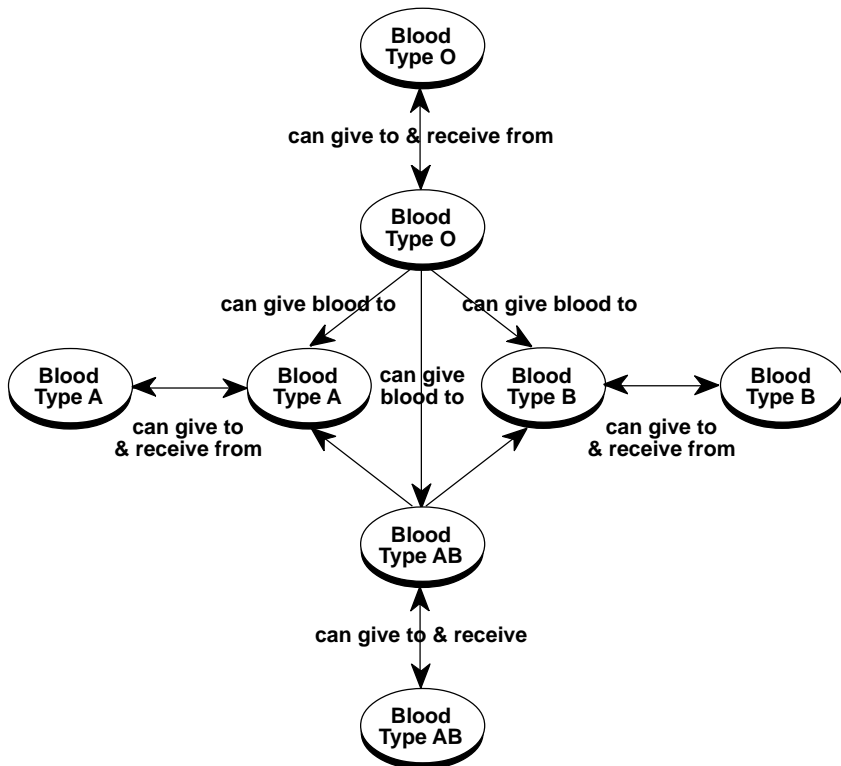
Worksheet 4

Use the space below to create a map summarizing the key points in a blood transfusion.

Sample Concept Map of Blood Transfusion



Source: <http://sln.fi.edu/biosci/blood/types.html>



Activity 3





































Sample Procedures for Blood Typing

Precaution: Do not reuse blood lancet.

1. Prepare all the listed materials needed.
2. Use hand gloves when working with blood.
3. To obtain blood smears, swab the finger tip with alcohol and puncture with a blood lancet. (All lancets must be discarded after each use).
4. Put a drop or two of blood on each of the 4 circles on the card.
5. Cotton moist with alcohol should be applied and pressed on the punctured site after the lancet is withdrawn to stop bleeding.
6. Put one drop of anti-serum on the first circle, anti-B serum on the second circle, anti-Rh serum on the third circle, and control on the fourth serum.
7. Mix the blood and the serum in each circle with clean tooth picks. Do not use the same tooth pick in each of the blood sample.
8. Wait for 10 minutes and observe the reactions.

Activity 3: Worksheet 5

If the blood is mixed with serum (anti-A, anti-B, anti-Rh) and the results will be similar to the ones reflected in the figures, predict what blood type it is. Compare your results with the observations during the demonstration.

Anti-A	Anti-B	Anti Rh	Control	Blood Type	
				Prediction	Observation
					
					
					
					
					
					
					
					
					

Legend:

 = agglutinin  no agglutinin

Answer key for Worksheet 2





































Type	Has antigen	Has antibody
A	A antigen	Anti B
O	Neither A nor B antigen	Both anti A and B
B	B antigen	Anti A
AB	Both A and B antigen	Neither anti A nor anti B
Rh +	Rh antigen	Absence of anti Rh
Rh -	Absence of Rh antigen	Anti Rh

Worksheet 3

Answer key for Worksheet 3

Type	Can give blood to	Can receive blood from
A+	A+ AB+	A+ A- O+ O-
O+	O+ A+ B+ AB+	O+ O-
B+	B+ AB+	B+ B- O+ O-
AB+	AB+	Everyone
A-	A+ A- AB+ AB-	A- O-
O-	Everyone	O-
B-	B+ B- AB+ AB-	B- O-
AB-	AB+ AB-	AB- A- B- O-

Answer key for Worksheet 5

Anti-A	Anti-B	Anti Rh	Control	Blood Type
				O-positive
				O-negative
				A-positive
				A-negative
				B-positive
				B-negative
				AB-positive
				AB-negative
				Not Valid

Legend:

 = agglutinin  no agglutinin

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