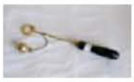
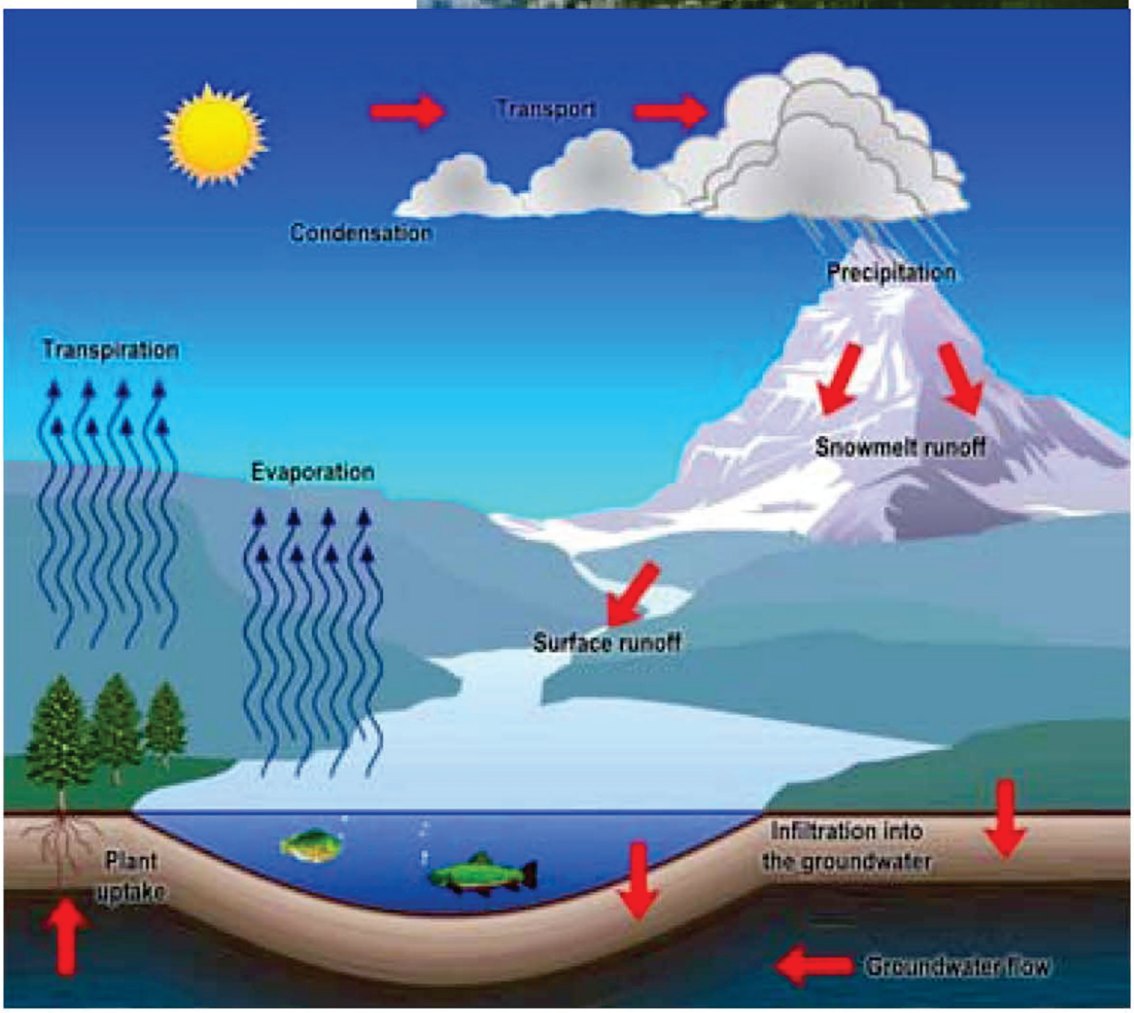
Department of Education

NATIONAL SCIENCE TEACHING INSTRUMENTATION CENTER

# SCIENCE – I
## (Integrated Science)


- Experiment Manuals (Student Worksheets)
- Repair and Maintenance Manuals of NSTIC Distributed Equipment for Integrated Science





# PREFACE

*The Integrated Science Student Worksheet and Maintenance Manual are primarily used as instructional materials by the participants of the Regional Out Training Workshop on the Use and Care of Science Equipment with Content Integration. This covers only the equipment for Integrated Science which was delivered to the public secondary schools who were beneficiaries of the Science Equipment Project implemented by the DepEd NSTIC.*

*The main content of the manual is focused on the above-mentioned science equipment. The manual has two major components, namely: (1) the student worksheets that deal with the functionality of application of the science equipment on the laboratory activities; and (2) the maintenance aspect that presents the procedural steps in conducting simple maintenance of the science equipments for their sustainability. These components make the manual inclusive and comprehensive.*

*The first component which is the student worksheet is user-friendly and experiment based. This will help facilitate the teaching-learning process.*

*The manual was initially prepared by the NSTIC personnel and presented for further suggestions and comments to the participants of the Regional Science Trainers and a representative from the Central Office. Finally, the Regional Science Supervisors, and the participants of the two-day Consultative Conference held in Lahug, Cebu City validated the contents of the manual.*

# ACKNOWLEDGEMENT

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*The personnel of NSTIC Administrative Division for their cooperation and support in the preparation and completion of the manual.*

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# Table of Contents

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# I. Measurement of Mass and Weight

**Objective:**

To measure mass and weight of various objects using triple beam and spring balance.

**Materials and Equipment:**

triple beam balance
spring balance, 2 N*
spring balance, 5 N*
spring balance, 10 N*
pencil/ball pen
thermos bottle
multi-clamp*
lever beam*

* *From the set of SciKit Basic and Mechanics*

**Instructions:**

1. Estimate the mass of items in Table 1.1.

*Table 1.1. Mass and weight of objects*

| | | Using Triple Beam Balance | Using Spring Balance |
|---|---|---|---|
| Items \ Process | Estimated Mass (g) | Measured Mass (g) | Measured Weight (N) |
| 1. pencil/ball pen | | | |
| 2. multi-clamp | | | |
| 3. lever beam | | | |
| 4. thermos bottle | | | |

2. Complete Table 1.1 by doing the processes specified.

   *Note: It is very important that you strictly follow the methods of using the triple beam balance and the spring balance to measure the mass and the weight, respectively. Refer to the following guide on "**How to use a triple beam balance**" and "**How to use a spring balance**." Ask assistance from your teacher.*

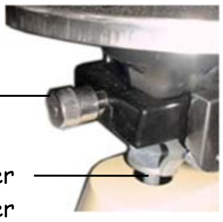
3. Select four other objects whose weight and mass you would like to measure.

4. Repeat steps 1 to 2. Complete Table 1.2.

*Table 1.2. Mass and weight of objects*

| | | Using Triple Beam Balance | Using Spring Balance |
|---|---|---|---|
| Process / Items | Estimated Mass (g) | Measured Mass (g) | Measured Weight (N) |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |

**How to use a triple beam balance**



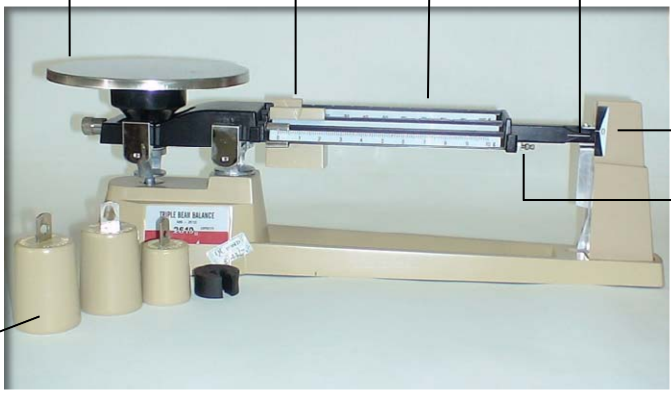




*Fig. 1.1. Parts of the triple beam balance*

**Instructions:**

1. Place the triple beam balance on a flat surface.
2. Dislodge *the slit rubber washer.*
3. *S*et the *sliding mass or riders* to zero.
4. Remove all objects from the platform.
5. Turn the *zeroing knob* either clockwise or counterclockwise until the pointer rests on the *zero indicator* or until the *pointer* swings an equal distance at each side of the zero indicator.
6. First, weigh the container together with a piece of paper that serves as protective cover of the platform whenever a spill of chemicals or substances can not be avoided*.* Place the paper and container on the platform.
7. Move the rider of greatest mass along the beam one notch at a time until the pointer drops. Then move the rider back one notch. If the pointer does not drop, hang the attachment mass on the *pivot*. Repeat this procedure with the succeeding rider of smaller mass. On the front beam which is not notched, slide the rider until the pointer rests on the zero indicator or until the pointer swings an equal distance at each side of the zero indicator.
8. Sum up the masses shown on the beams.
9. Add the object to be measured into the container and repeat step 7.
10. Compute for the mass of the object which is the sum of the masses shown on beams minus the combined mass of the container and paper.

*Example. Measuring mass*

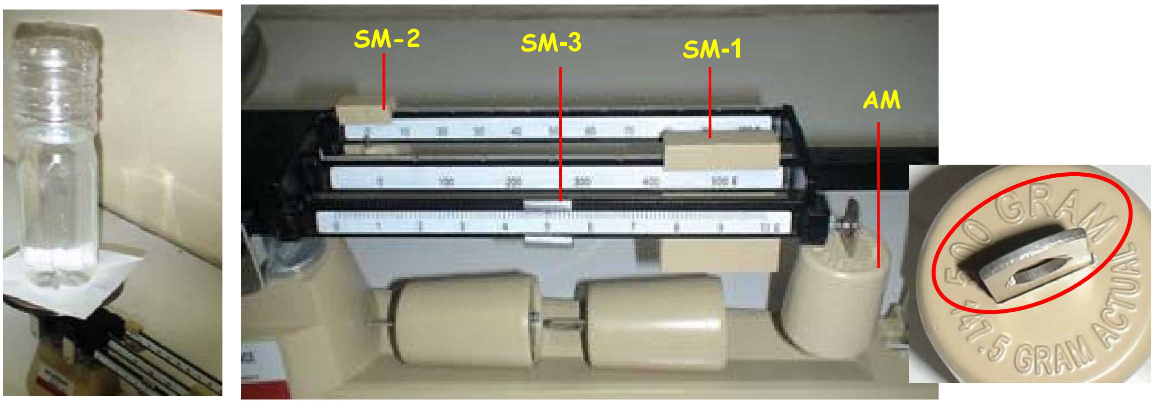



*Fig. 1.2. Position of sliding masses and attachment mass in a balance state to the combined mass of paper, container, and water*

*Table 1.3. Combined mass of paper, container, and water*

| Object | Sliding Mass1 (SM-1) g | Sliding Mass-2 (SM-2) g | Sliding Mass-3 (SM-3) g | Attachment Mass (AM) g | Total Mass (SM-1+SM-2 +SM-3+AM) g |
|---|---|---|---|---|---|
| (paper + container + water) | 500 | 0 | 5 | 500 | 1005 |

**How to use a spring balance in measuring weight**

1. Set the spring balance to zero:
   a. Hold the spring balance on the outer tube in an upright position. Refer to Figure 1.3.
   b. Turn the *zero adjustment knob* until the zero mark is at the *reference scale.*

2. Hang the object on its hook as illustrated in Figure 1.4 and take the reading.

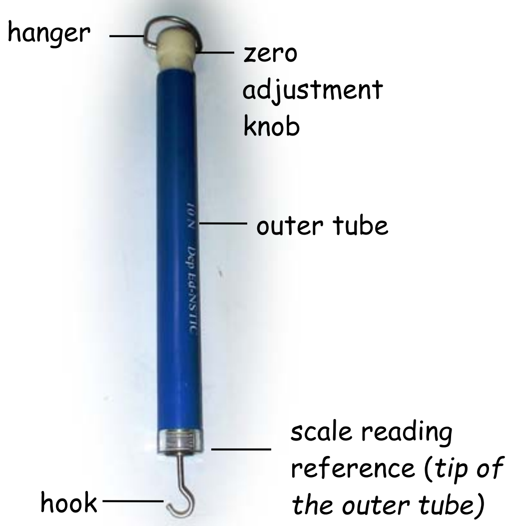



*Fig.1.3. Spring balance*

*Fig. 1.4*

NAME ______________________________ GROUP ____________

SECTION ____________________________ DATE ____________

# II. Volume Measurement - 1

**Objectives:**

1. To measure the volume of liquid using a ruler.
2. To measure the volume of liquid using a graduated cylinder.
3. To distinguish between the precision and accuracy of measurements.

**Materials and Equipment:**

ruler or equivalent (e.g., meter stick)
graduated cylinder, 100 mL**
glass funnel
beaker, 250 mL
medicine dropper
water

** *From the set of Biology Science Equipment*

**Instructions:**

1. Use centimeter (cm) unit of a ruler to measure the diameter and height of the inner part of the beaker.

2. Compute the volume of the beaker and record your measurements in Table 2.1.

3. Fill the beaker with water up to the brim. You may use a medicine dropper to adjust the amount of water.

4. Measure the water in the beaker using the graduated cylinder. (Note the reading of the lower meniscus as illustrated in Figure 2.1).

5. Record the volume in milliliter (mL) in Table 2.1.

6. Let two of your group mates do the same measurements and record their results.

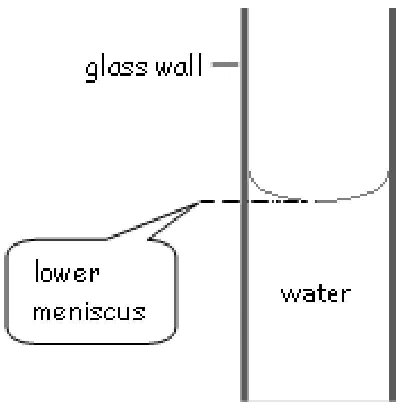



*Fig. 2.1*

*Table 2.1. Volume measurement of the beaker*

| Trial | Volume Measured with a Ruler | | | | Volume Measured with a Graduated Cylinder (mL) |
|---|---|---|---|---|---|
| | Diameter D (cm) | Area A=3.14 x $(D/2)^2$ ($cm^2$) | Height H (cm) | Volume V=H x A ($cm^3$) | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

**Questions:**

1. What are the two methods in measuring volume applied in this activity?
   a. ___________________
   b. ___________________

2. What are the units in measuring volume?
   ______________________________________________________________________________

3. Which of the two methods is more precise? Support your answer.
   ______________________________________________________________________________

4. Which of the two methods is more accurate? Why?
   ______________________________________________________________________________

NAME ______________________________ GROUP ____________

SECTION ______________________________ DATE ____________

# III. Volume Measurement - 2

**Objectives:**

1. To measure and compute the volume of regularly-shaped object by water displacement.
2. To measure the volume of irregularly-shaped object by water displacement.

**Materials and Equipment:**

graduated cylinder, 100 mL**
ruler
small metal ball*
water
modeling clay

* *From the set of SciKit Mechanics, Freefall Apparatus*
** *From the set of Biology Science Equipment*

**Instructions:**

A. Volume measurement of regularly-shaped object

1. Measure the diameter of the ball. Find the volume of the ball by using the formula $V_{sphere} = \pi d^3/6$ where d is the diameter.

2. Measure again the volume of the ball by water displacement stated in steps 3 and 4.

3. Pour exactly 50 mL of water in the graduated cylinder.

4. Safely place the ball into the graduated cylinder by dropping it with the cylinder tilted about 45 degrees. Note the increase in the volume of the water. Subtract 50 mL from this volume to get the volume of the ball.

5. Record the data in Table 3.1.

*Table 3.1. Volume of the metal ball*

| Object | Volume Measured with a Ruler ($cm^3$) | Volume by Water Displacement (mL) |
|---|---|---|
| metal ball | | |

B. Volume measurement of regular and irregularly-shaped object

6. Construct two blocks made of modeling clay having dimensions of 1cm x 1cm x 1cm (cube) and 1cm x 1cm x 5cm respectively as shown in Figure 3.1. Use a ruler to obtain the exact dimensions. Find the volume for each block.

7. Let your group mate check the dimensions of the blocks that you have constructed.

8. Measure again the volume of the same blocks by water displacement. Refer to steps 3 and 4.

9. Record the results in Table 3.2.


*Fig. 3.1*

*Table 3.2. Volume measurement of the modeling clay*

| Object | Volume Measured with a Ruler ($cm^3$) | Volume by Water Displacement (mL) |
|---|---|---|
| Clay (1 cm x 1 cm x 1 cm) | | |
| Clay (1 cm x 1 cm x 5 cm) | | |

10. Make the previous blocks of clay into irregular shapes and measure their volume by water displacement.

11. Compare their previous and present volume.

**Questions:**

1. How do you measure the volume of regularly-shaped object?

______________________________
______________________________
______________________________

2. How do you measure the volume of irregularly-shaped object?

______________________________
______________________________
______________________________

3. Can water displacement method be used in measuring volume of regularly and irregularly-shaped objects? Explain your answer.

______________________________
______________________________
______________________________

4. Does the shape of the clay affect its volume? Explain your answer.

______________________________

NAME ______________________________ GROUP ____________

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# IV. Density of Matter

**Objectives:**

1. To measure and compute the densities of solids, liquids, and gases.
2. To compare the densities of various objects.
3. To explain why some objects sink while others float in water.
4. To discuss the use of a hydrometer.

**Materials and Equipment:**

bar magnet
graduated cylinder, 100 mL**
beam balance scale
hydrometer
ruler

** *From the set of Biology Science Equipment*

plastic housing from disposable ball pen
balloon
fresh water
salty water *(400 g salt dissolved in 1600 g water)*
2 slender water containers at least 30 mm tall *(e.g., pitcher or an improvised one made of 2 L plastic cola bottle)*

**Instructions:**

A. Density of Solid

*A.1 Bar magnet*

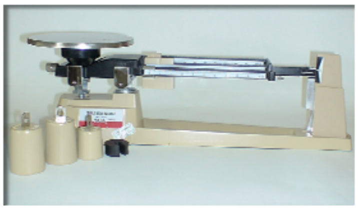
1. Measure the length, width, and height of a bar magnet in centimeter (cm).

2. Find the volume of the bar magnet in cubic centimeters ($cm^3$).

3. Weigh the mass of the bar magnet in grams (g) using the beam balance. Record your measurements in Table 4.1.

4. Determine the density which is the ratio of the mass to the volume of the bar magnet.

5. Record the data in Table 4.1.



beam balance

bar magnet

plastic

graduated cylinder

*Fig. 4.1*

*A.2 Plastic housing of disposable ball pen*

6. Repeat steps 1 to 5 for the density of plastic housing of the disposable ball pen. Since this is an irregularly-shaped object, use the water displacement method in measuring the volume.
   *Hint: In measuring this volume, use a graduated cylinder filled with 90 mL of water.*

B. Density of Liquid

*B.1 Fresh water*

1. Prepare 50 mL of fresh water in a graduated cylinder.
2. Measure the mass of this water sample and find its density.
3. Fill a water container almost to the brim with fresh water. Refer to Figure 4.2.
4. Carefully immerse the hydrometer and record the reading of hydrometer (ask assistance from the teacher on the use of hydrometer).
5. Record the data on Table 4.2.


*Fig. 4.2*

*B.2 Salty water*

6. Repeat step B.1 using salty water.

C. Density of Gas

1. Get the mass of an empty balloon.
2. Inflate the balloon and measure its mass.
   Compute the mass by using the formula below:

   mass of air = *(mass of air inflated balloon) – (mass of empty balloon).*

3. Determine the volume of air in the balloon using the formula.

   $V_{sphere} = \pi d^3/6$, where d = diameter of the air inflated balloon

4. Compute the density of air. Record the data in Table 4.3.

**Data:**

*Table 4.1. Density of solids*

| Material Observed | Mass (g) | Volume (cc) | Density (Density = Mass/Volume) (g/cc) |
|---|---|---|---|
| bar magnet | | | |
| plastic housing of disposable ball pen | | | |

*Table 4.2. Density of liquids*

| Material observed | Mass (g) | Volume (cc) | Density (Density=Mass/Volume) (g/cc) | Hydrometer Reading |
|---|---|---|---|---|
| fresh water | | | | |
| salty water | | | | |

*Table 4.3. Density of gas*

| Material observed | Mass (g) | Volume (cc) | Density (g/cc) |
|---|---|---|---|
| air | | | |

**Questions:**

1. Compare the density of a bar magnet with that of fresh water. Which of the two objects has a higher density? ___________________. Does the bar magnet float in water? ____
2. Compare the density of a plastic housing of disposable ball pen with that of fresh water and salty water. Does plastic housing of a disposable ball pen float in fresh water? How about in salty water? ____________________________________________________
3. How does the computed density in Table 4.2 compare to the hydrometer reading?
   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________
4. What is the use of a hydrometer?
   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________

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# V. Uniform Speed and Velocity

**Objectives:**

1. To describe uniform speed.
2. To calculate average speed of a moving object.
3. To determine the direction of a moving object.
4. To differentiate uniform speed from uniform velocity.

**Materials and Equipment:**

2 stand bases*
2 rails *(rods undersized on ends)**
motorized cart*
dry cell, AA
digital stopwatch
meter stick
magnetic compass
chalk

* *From the set of SciKit Basic and Mechanics*

**Instructions:**

A. Uniform Speed

The idea of this experiment is to measure how much time the cart takes to travel equal intervals of distance.

1. Set up the equipment.

2. Using a piece of chalk, put marks on the rail.
   a. start mark which is along the front side of the cart.
   b. mark the succeeding three (3) equal intervals of 20 cm as illustrated in Figure 5.1.

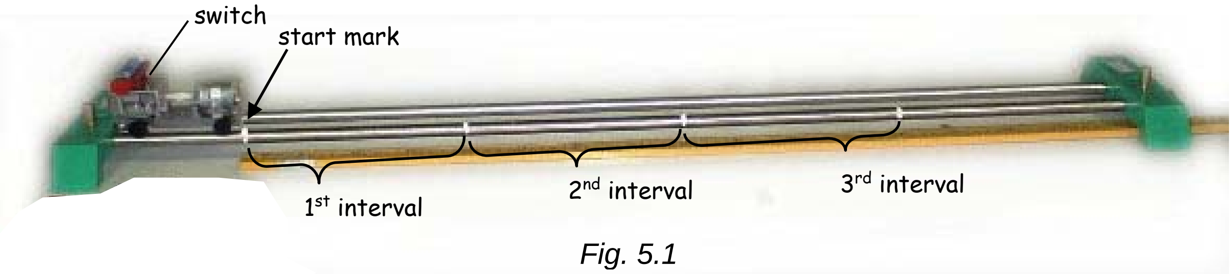



*Fig. 5.1*

3. Position the cart at the start mark. Switch on the motor then release the cart. Using the stopwatch let a member of the group measure the time it takes the cart to cover the 1st interval distance. Do it in 3 trials.

4. Compute for the quotient of the distance divided by time.

5. Repeat step 3 for the 2nd and 3rd intervals of distance.

6. Record all measurements in Table 5.1.

*Table 5.1. Speed of the cart at every interval distance*

| Distance (cm) | Time (s) | | | | Distance / Time (cm/s) |
|---|---|---|---|---|---|
| | Trial 1 | Trial 2 | Trial 3 | Average | |
| 1st interval distance, 20 cm | | | | | |
| 2nd interval distance, 20 cm | | | | | |
| 3rd interval distance, 20 cm | | | | | |

B. Velocity

The idea of this experiment is to measure how much time the cart takes to travel three equal intervals of displacement.

1. You may repeat the procedure of Part A or copy the measurements in Table 5.1 and reflect it in Table 5.2. However, this time, determine the direction of the cart using the magnetic compass. Is the cart moving towards the east, west, north, or south?

2. Record the direction in Table 5.2.

*Table 5.2. Velocity of the cart at every interval distance*

| Displacement | | Time (s) | | | | Displacement / Time, Direction (cm/s) |
|---|---|---|---|---|---|---|
| Distance (cm) , | Direction | Trial 1 | Trial 2 | Trial 3 | Average | |
| 1st interval distance, 20 cm , | | | | | | |
| 2nd interval distance, 20 cm , | | | | | | |
| 3rd interval distance, 20 cm , | | | | | | |

**Questions:**

1. In Part A, how do you compare the time it takes for the cart to travel equal intervals of distance?
   ______________________________

2. In the last column of Table 5.1, what do you call the quotient of distance divided by time? How are these quotients compared?
   ______________________________

3. Does the cart move at uniform speed? ______. When can you say an object or a body is moving with uniform speed?
   ______________________________

4. Compare Part A and Part B. How does uniform speed differ from uniform velocity?
   ______________________________

NAME ______________________ GROUP __________

SECTION ______________________ DATE __________

# VI. Uniform Acceleration

**Objectives:**

1. To describe uniform acceleration.
2. To calculate the speed of a moving object.

**Materials and Equipment:**

2 stand bases*
2 rails *(rods undersized on ends)**
digital stopwatch
meter stick
dynamic cart B*
chalk

* *From the set of SciKit Basic and Mechanics*

**Instructions:**

The idea of this experiment is to measure how much time a cart takes to travel equal intervals of distance.

1. Prepare the setup as shown in Figure 6.1. Elevate one end of the rail about 3 cm by placing a book underneath the stand base.

2. Put the dynamic cart on the elevated end of the rail. Using a piece of chalk, put marks on the rail.
   a. start mark which is along the front side of the cart.
   b. mark the succeeding three (3) equal intervals of 20 cm.

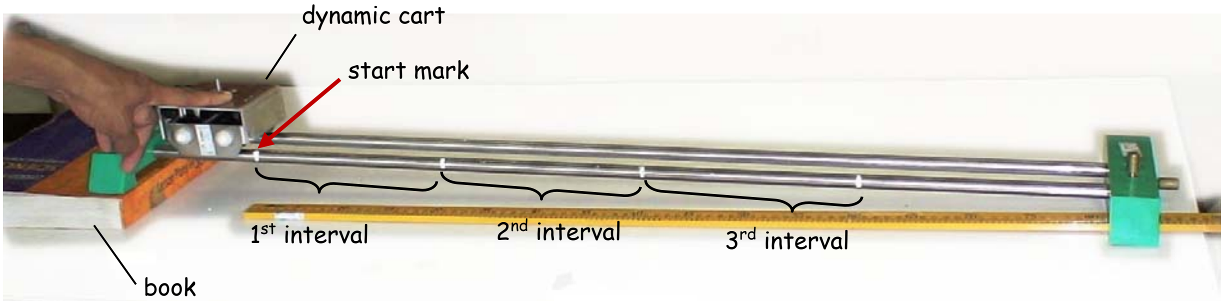



*Fig. 6.1*

3. Hold the cart at the start mark then release.

4. Using the stopwatch let a member of the group measure the time it takes the cart to cover the first interval distance. Do it in three (3) trials.

5. Compute for the quotient of the distance divided by time.

6. Repeat steps 3 to 5 for the second interval and third interval distance.

7. Record all measurements in Table 6.1.

**Data:**

*Table 6.1. Speed of the cart at every interval distance*

| Distance (cm) | Time (s) | | | | Distance / Time (cm/s) |
|---|---|---|---|---|---|
| | Trial 1 | Trial 2 | Trial 3 | Average | |
| 1st interval distance, 20 cm | | | | | |
| 2nd interval distance, 20 cm | | | | | |
| 3rd interval distance, 20 cm | | | | | |

**Questions:**

1. How do you compare the time it takes for the cart to travel equal intervals of distance?
______________________________________________________________

2. In the last column of Table 6.1, what do you call the quotient of distance divided by time?
______________________________________________________________

3. How do you describe the motion of the cart?
______________________________________________________________

NAME ______________________________ GROUP ____________

SECTION ____________________________ DATE ____________

# VII. Free Fall

**Objectives:**

1. To describe the effect of an object dropped at different heights.
2. To describe the motion of a free falling body.
3. To demonstrate the effect of air resistance.

**Materials and Equipment:**

modeling clay, *about the size of a match box*
book (at least 15 mm thick)

*To be brought by each group:*
thin plastic sheet (from discarded plastic bag)
fine string or sewing thread, 1 m long

**Instructions:**

A. Free Falling Body

The idea of this experiment is to drop a clay ball freely at a fixed height or distance above the floor and let it collide on a thick book placed at different locations along its path.

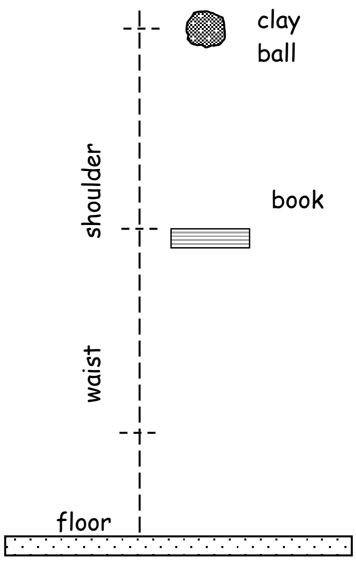


*Fig. 7.1*

1. Shape the modeling clay into a ball.

2. Position the clay ball above the floor as far as your hand can reach.

3. Ask a group mate to place a thick book along the ball's path at the following distances (*shoulder, waist,* and *floor)* every time you drop the ball freely as illustrated in Figure 7.1.

4. Observe what happens to the ball as it collides on the book.

   Is there a visible deformation of the ball because of the fall? _____.

   Which distance of fall has lesser effect on the ball? ______________________

   Which distance of fall has greater effect on the ball? ______________________

B. Effect of Air Resistance

1. Construct a small parachute using a thin plastic sheet and attach the clay ball to it as illustrated in Figure 7.2.

2. Drop the ball with an open parachute on it as far as your hand can reach.

3. Observe and describe how the ball falls. Write your observation in the blank space below.

_______________________________________________

_______________________________________________

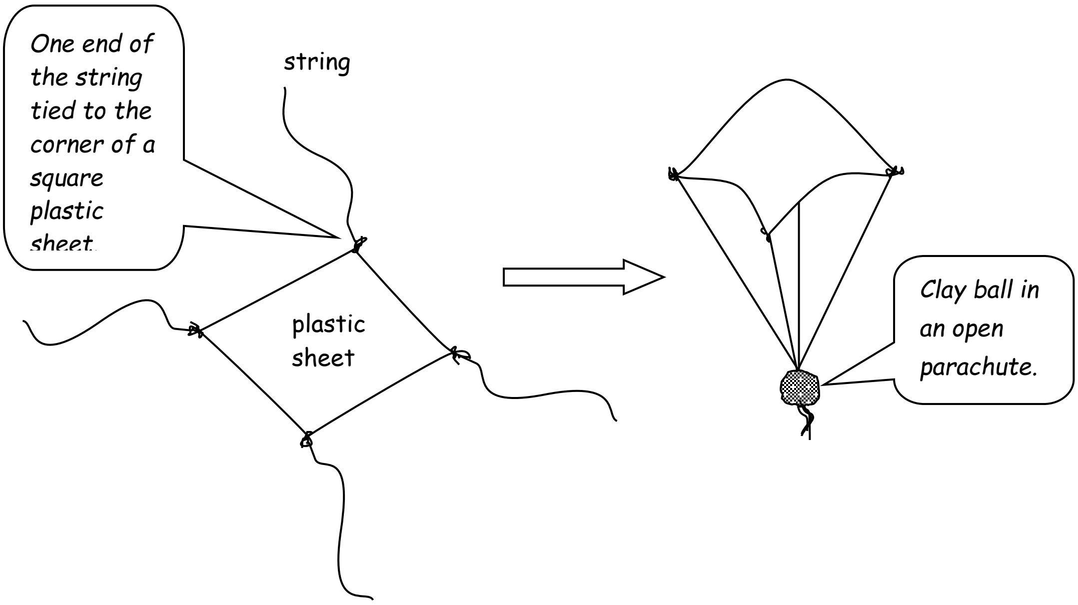



*Fig. 7.2*

**Questions:**

1. Based on the observation in Part A and Part B, does a free falling body move in the air at uniform speed or at increasing speed? What is its direction? Describe the motion of a free falling body.

_______________________________________________

2. How does air affect the movement of a free falling body?

_______________________________________________

3. What causes the body to fall down to Earth?

_______________________________________________

NAME ______________________ GROUP __________

SECTION ______________________ DATE __________

# VIII. Capillarity and Surface Tension

**Objectives:**

1. To relate capillarity to the size of a hole in the tube.
2. To cite other situations where capillarity takes place.
3. To explain why a needle floats on water.

**Materials and Equipment:**

glass tube, hematocrit
glass tube, 6 mm hole diameter, 75 mm long
glass tube, 3 mm hole diameter, 75 mm long
Petri dish
graduated cylinder, 10 mL
needle
clean cloth or tissue paper
fresh water
colored water

**Instructions:**

A. Capillarity

1. Fill the Petri dish with 10 mL colored water.

2. Dip one end of each of the three glass tubes having different hole sizes in the Petri dish with colored water as illustrated in Figure 8.1.

3. Compare and take note the heights of water in each tube.

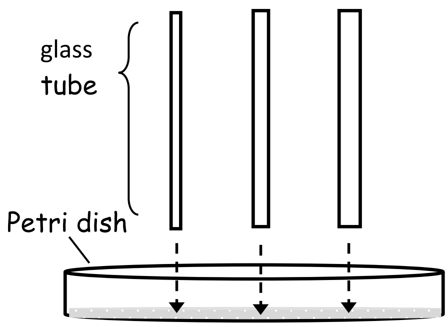



*Fig. 8.1*

**Questions:**

1. In which tube did the water rise the highest? Relate the level of water to the size of tubes.
   ______________________________________________

2. What do you call of the spontaneous rise of liquid (like water) in a narrow tube or space?
   ______________

3. Cite a situation wherein you observe a liquid rising in a small tube.
   ______________________________________________

B. Surface Tension

1. Fill the Petri dish completely with water.

2. Gently place a dry needle horizontally on the surface of the water as illustrated in Figure 8.2. Observe what happens to the needle.

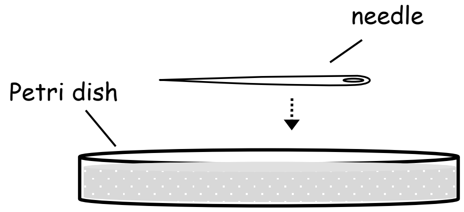



*Fig. 8.2*

**Question:**

Did the needle float in water? Why?

NAME ________________________ GROUP ____________

SECTION ________________________ DATE ____________

# IX. Newton's First Law of Motion
## (Law of Inertia)

**Objective:**

To describe Newton's First Law of Motion on the Law of Inertia.

**Materials and Equipment:**

2 stand bases*
2 rails *(rods undersized on ends)**
dynamic cart B*
match box
modeling clay

* *From the set of SciKit Basic and Mechanics*

**Instructions:**

A. Inertia of Object at Rest

Place a match box on the cart as shown in Figure 9.1. Apply a quick push on the cart and observe what happens to the match box.

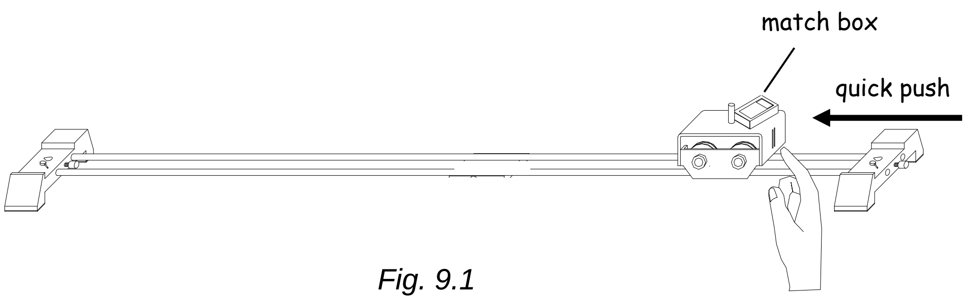



*Fig. 9.1*

**Observation:**

______________________________________________

______________________________________________

**Question:**

1. Why does the match box tend to stay at rest even though the cart has moved forward? Explain according to Newton's First Law.

______________________________________________

______________________________________________

B. Inertia of Object in Motion

1. Transfer the match box as shown in Figure. 9.2.
2. Push the cart to move it at a moderate speed. See to it that while the cart is moving, the match box keeps its position with respect to the cart.
3. Observe what happens to the match box as the cart suddenly stops at one end of the rail.

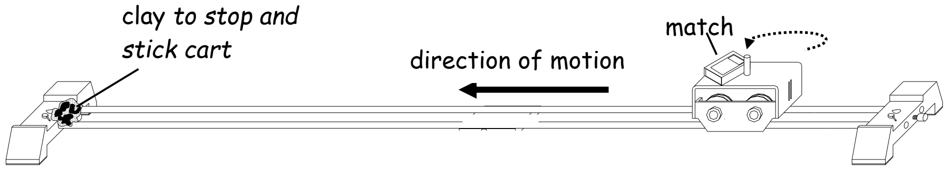



*Fig. 9.2*

**Observation:**

________________________________________

**Question:**

Why does the match box tend to continue moving even though the cart has stopped? Explain according to Newton's First Law.

________________________________________

C. Effect of Friction on the inertia of an object in motion

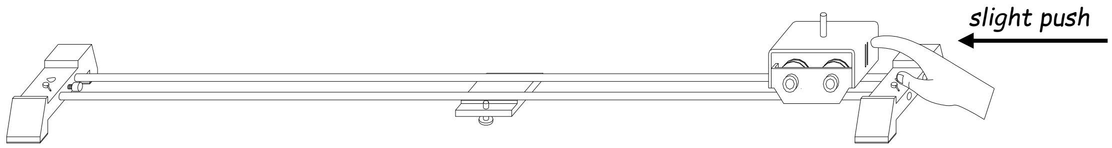



*Fig. 9.3*

1. Let the cart rest on one end of the rail. Give a slight push so that the cart reaches about midway on the rail as illustrated in Figure 9.3.
2. Observe and describe the cart's motion.

**Observation:**

________________________________________

**Questions:**

1. What opposing force makes the cart slow down and finally stop?___________
2. If there are no opposing forces acting on the cart, what would be its motion after being given a slight push?

________________________________________

NAME ______________________ GROUP __________

SECTION ______________________ DATE __________

# X. Newton's Second Law of Motion
## (Law of Acceleration)

**Objective:**

To illustrate Newton's Second Law of Motion.

**Materials and Equipment:**

2 stand bases*
2 rails (*rods undersized on ends)**
dynamic cart B*
spring balance, 2 N*

* *From the set of SciKit Basic and Mechanics*

**Instructions:**

1. Setup the equipment as shown in Figure 10.1. Adjust the spring balance to "zero" in upright position and attach it through the slot of the cart.

*Fig. 10.1*

*Fig. 10.2*

2. While holding the cart, pull the spring balance with a force of 0.1 N as illustrated in Figure 10.2.

3. Release the cart. As the cart moves, continue to pull keeping a 0.1 N force. While doing this, take note of the motion of the cart and let the other members of the group observe.

---

**Questions:**

.

1. How much net force is acting on the cart?

   ______________________________

2. How are the direction of the net force and the direction of the motion of the cart compared?

   ______________________________

3. Does the cart move in the state of accelerated motion? Describe the motion of the cart according to Newton's Second Law of Motion.

   ______________________________

NAME ______________________________ GROUP ____________

SECTION ____________________________ DATE ____________

# XI. Newton's Third Law of Motion

## (Law of Interaction)

**Objectives:**

1. To identify and describe action and reaction forces.
2. To state and explain Newton's Third Law of Motion.

**Materials and Equipment:**

spring balance, 5 N*

spring balance, 10 N*

* *From the set of SciKit Mechanics*

**Instructions:**

The idea of this experiment is to find out whether two spring balances attached to each other show the same reading if one of them is pulled actively.

1. Find a partner and let him/her hold the other spring balance.
2. Attach the spring balances as illustrated in Figure 11.1.

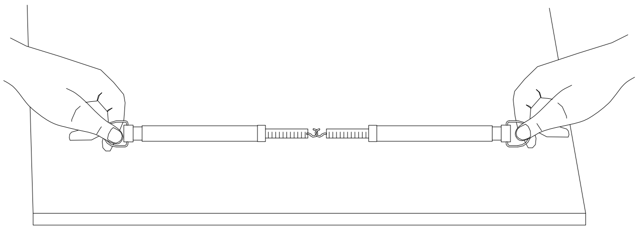


*Fig. 11.1*

3. Pull your spring balance. Take note of your observation through the guide questions below.

   Did you feel your partner was pulling on your balance too? ______

   What are the readings of the two balances? Compare. ____________________________

4. Let your partner pull his/her spring balance and take note of your observation through the guide questions below.

   Did you feel pulling your partner's balance too? __________________

   What are the readings of the two balances? Compare. ____________________________

**Question:**

What does Newton's Third Law of Motion state? ________________________________

________________________________________________________________________

NAME ______________________ GROUP __________

SECTION ______________________ DATE __________

# XII. Momentum

**Objective:**

To relate magnitude of momentum of the object to its mass and velocity.

**Materials and Equipment:**

2 stand bases*
2 rails *(rods undersized on ends)**
dynamic cart A *(with spring)**
dynamic cart B *(without spring)**
5 cylindrical masses*
leveling pad*
plastic hammer*
modeling clay*

* *From the set of SciKit Basic and Mechanics*

**Instructions:**

A. Collision

*A.1. Collision of two carts of the same mass, moving in velocities of equal speed but in opposite direction:*

1. Prepare the setup as shown in Figure 12.1 and see to it that the rail is horizontally level.

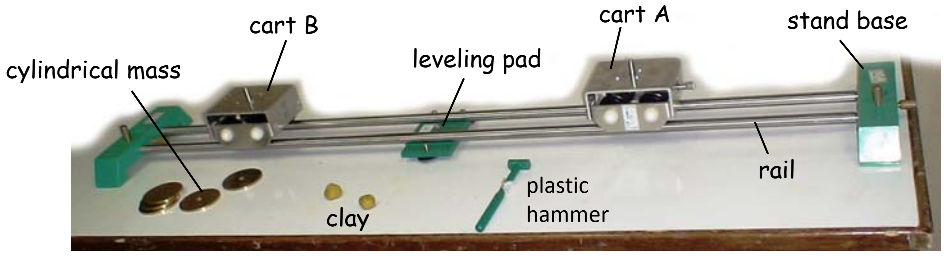



*Fig. 12.1*

2. Stick equal amount of clay on the front end of each cart. Position the carts on the ends of the rail as illustrated in Figure 12.1. Let them approach each other with equal speed. (If the two carts meet at the middle, starting from the ends at the same time, you can be certain that the carts moved with approximately the same speed.)

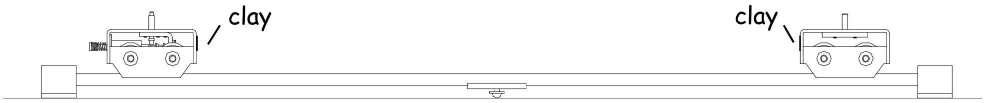



*Fig. 12.2*

What happened to the cart after the collision? ______________________________

______________________________________________________________

*A.2. Collision of bigger and smaller masses moving in velocities of equal speed but in opposite directions:*

3. Repeat step 2 but place the five (5) cylindrical masses to the other cart to make its mass bigger as shown in Figure 12.3.

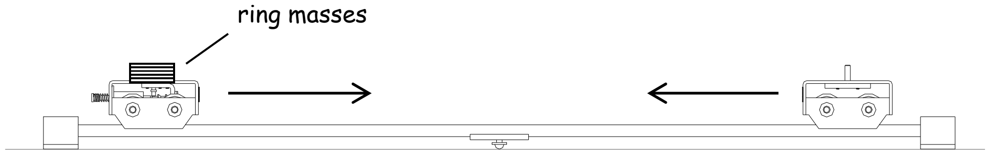



*Fig. 12.3*

What happened to the two carts after collision? ______________________________

C. Collision of two carts of the same mass, moving in different velocities (one has greater speed and takes opposite direction than the other cart):

4. Take out all the cylindrical masses from cart A. Repeat step 2 but let one of the carts move faster than the other.

What happened to the two carts after collision? ______________________________

B. Explosion

1. Compress the spring attached to cart A. Position the two carts to face each other at the middle of the rail. Release spring by striking push rod on cart A with the plastic hammer as illustrated in Figure 12.4.

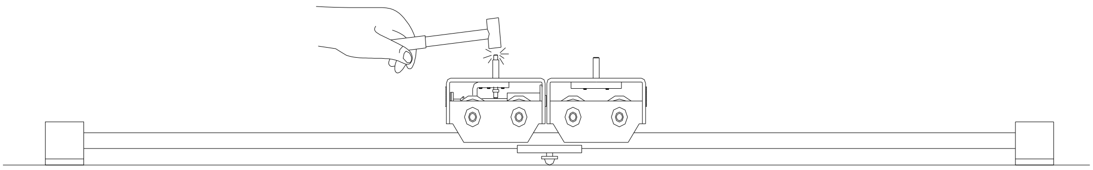


*Fig. 12.4*

What happened to the two carts after explosion? ______________________________

2. Repeat step 5 and add five (5) cylindrical masses to cart A.

What happened to the two carts after explosion? ______________________________

**Question:**

Does the momentum of an object depend on its mass and velocity? How?

______________________________________________________________________

______________________________________________________________________

NAME ______________________ GROUP ____________

SECTION ______________________ DATE ____________

# XIV. Heat Transfer

**Objectives:**

1. To distinguish the three ways to transfer heat.
2. To identify heat conductors and insulators.
3. To describe the flow of heat.

**Materials and Equipment:**

| | | |
|---|---|---|
| wooden rod, 20 cm long | stand rod, 250 mm long* | graduated cup |
| plastic rod, 20 cm long | stand rod, 500 mm long* | match |
| copper rod, 20 cm long | bosshead* | rubber band |
| glass rod, 20 cm long | convection tank | cold water |
| steel rod, 20 cm long | Erlenmeyer flask, 250 mL | hot colored water |
| aluminum rod, 20 cm long | vial | rag |
| stand base* | stirring rod | candle |
| stand support* | alcohol lamp | |

* *From the set of SciKit Basic*

**Instructions:**

***Safety Reminders!***

*Take precautions when working with hot materials.*
*Use gloves or rag in handling these materials.*

A. Conduction

*Setup A.1.*


*Fig. 14.1*

1. Feel how cold or warm each end of the wooden, glass, plastic, copper, steel, and aluminum rods.

2. Fill the graduated cup with 250 mL hot water. Simultaneously dip one end of each rod touching the bottom of the cup.

3. After a minute or two, feel the upper end of each rod. Compare how cold or warm each rod is with that in step 1.

4. Record whether each material is a conductor or an insulator.

   a) wood ____________________ d) glass ____________________
   b) plastic ____________________ e) steel ____________________
   c) copper ____________________ f) aluminum ____________________

*Setup A.2*

1. Assemble the setup as shown in Figure 14.2. Put 3 drops of melted wax from a lighted candle 4 cm from one end (call it end A) of the copper rod. Put 3 more similar amount of wax on the rod, arranged 3 cm apart.

2. Place the alcohol burner such that its flame is below end A of the rod. Observe the order in which the wax balls melt.

   Which wax ball melts first, the one which is closer or farther from the flame? ____________
   Which wax ball melts the last? ______________

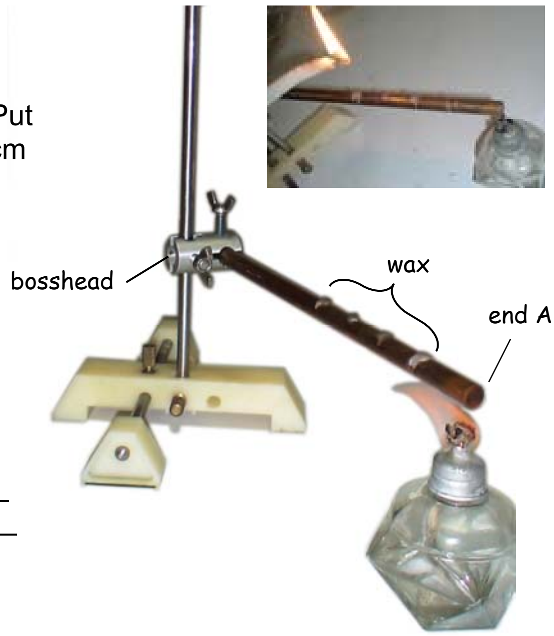



*Fig. 14.2*

B. Radiation

1. Light the candle.

2. Put your palm on the side (near but not touching) of the flame. Describe what you feel. Record your observation on the blank space below.

______________________________________________________________________
______________________________________________________________________

## C. Convection

*Setup C.1*

1. Attach the vial to the stirring rod using a rubber band. Stirring rod will serve as the handle as shown in Fig. 14.3.

2. Fill the vial up to the brim with colored hot water. Also fill the Erlenmeyer flask up to its neck with cold water.

3. Fully immerse the vial into the cold water. Record your observation on the blank space below.

__________________________________________
__________________________________________

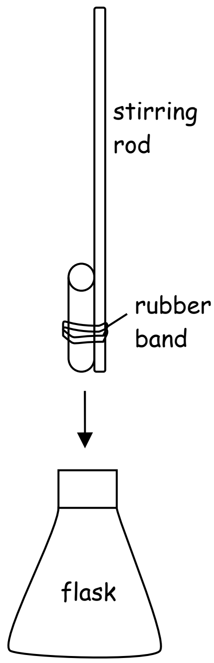



*Fig. 14.3*

*Setup C.2*

1. Prepare the convection tank as shown in Figure 14.4 *(convection tank has two chambers with a slit on its middle wall).*

2. Prepare about 175 mL cold water in an Erlenmeyer flask and the same amount of colored hot water in a graduated cup.

3. Quickly pour the cold water and colored hot water at the same time in each chamber of the convection tank. Record your observation on the space provided below.

______________________________________________

______________________________________________

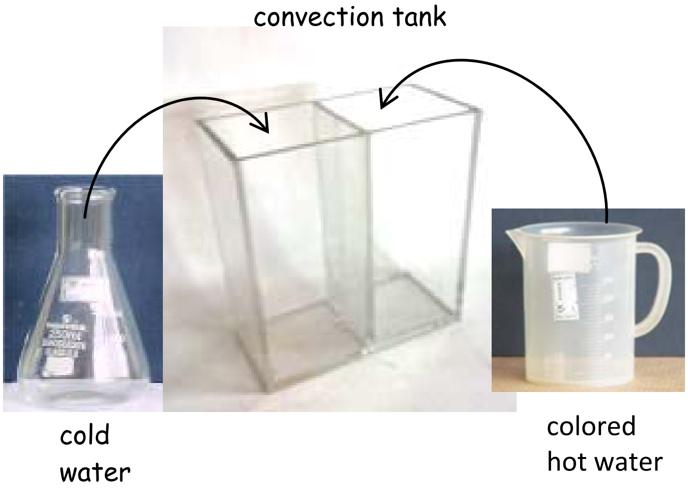



*Fig. 14.4*

**Questions:**

1. What are the three ways to transfer heat? ______________________________ How do they differ from each other?

   ______________________________________________

   ______________________________________________

2. How do they determine whether a material is a conductor or an insulator? Describe the procedure.

   ______________________________________________

   ______________________________________________

   ______________________________________________

NAME ______________________________ GROUP ____________

SECTION ____________________________ DATE ____________

# XV. Effect of Heat on Matter

**Objectives:**

1. To describe the volume of solid, liquid, and gas when heated.
2. To state the effect of heat on matter.

**Materials and Equipment:**

| | | |
|---|---|---|
| test tube | alcohol burner | stand base* |
| Erlenmeyer flask, 250 mL | marking pen | stand support* |
| beaker, 250 mL | hot water *(in thermos bottle)* | bosshead* |
| rubber stopper #1 with one hole | cold water | universal clamp* |
| ring and ball apparatus | matches | rod, 500 mm long* |
| glass tubing, 3 mm-diameter, 100 mm long | | rod, 250 mm long* |

**From the set of SciKit Basic*

**Instructions:**

A. Heat on Liquid

***Safety Reminders!***
*a. Use gloves or rag in handling hot objects.*
*b. Never light an alcohol burner with another alcohol burner.*

1. Fill an Erlenmeyer flask with 250 mL hot water. Fill the beaker with 200 mL cold water.

2. Insert the glass tubing into the rubber stopper as shown in Figure 15.1.

3. Fill the test tube with colored water up to the brim and cover it with the rubber stopper-glass tubing assembly as shown in Figure 15.2. *(This setup has to be air tight. See to it that the rubber stopper is properly fixed on the mouth of the test tube).*

4. Dip the test tube in the flask containing hot water for a few minutes. Take note of the water level. Record your observation.

5. Dip the test tube in cold water. Take note of the water level. Record your observation.

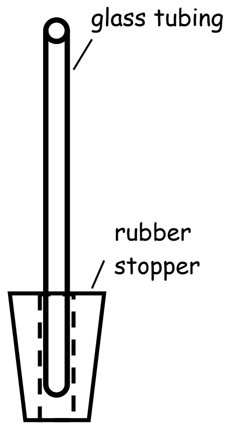



*Fig. 15.1*

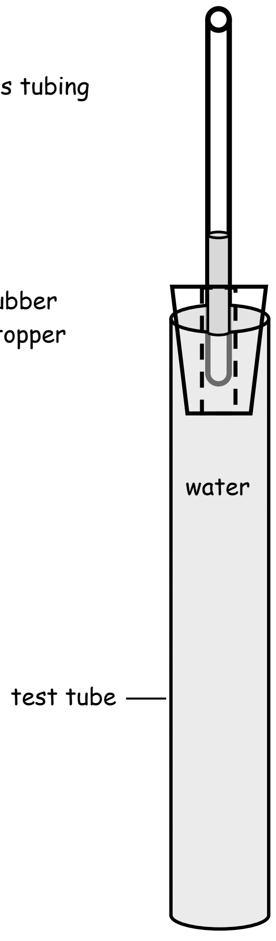



*Fig. 15.2*

**Observation:**

______________________________________________

______________________________________________

**Questions:**

1. What happened to the temperature and volume of water in the test tube as it was dipped in hot water? ____________________________________________

2. What happened to the temperature and volume of water as it was dipped in cold water? ____________________________________________

3. How does heat affect the volume of water? ____________________________

B. Heat on Gas

1. Use the setup in Part A (Figure 15.1). In an upright position, carefully remove the rubber stopper-glass tubing assembly and keep it steadily upright to retain the remaining small amount of water in the lower end of glass tubing.

2. Remove the water in the test tube and slowly put back the rubber-glass tubing assembly. *(A trapped water should be visible in the glass tubing as illustrated in Figure 15.3).*

3. Dip the test tube in the flask containing hot water for a few minutes. Take note of the trapped water. Record your observation.

4. Dip the test tube in cold water. Take note of the trapped water. Record your observation.

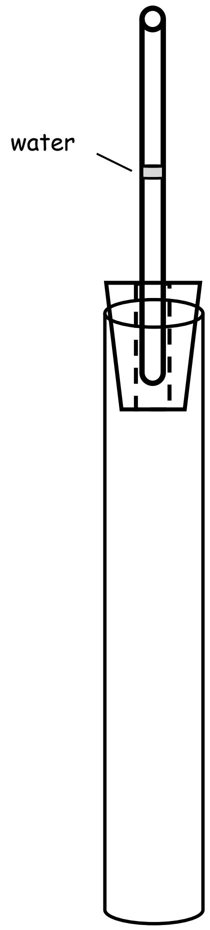


*Fig. 15.3*

**Observation:**

____________________________________________
____________________________________________
____________________________________________

**Questions:**

1. Was air present and confined in the test tube? ____
Support your answer. ________________________________
________________________________________________

2. Did the rise of water in the tube indicates an increase in volume of air? ____

3. What happened to the volume of air as the water went down in the tube?
________________________________________________

4. What happened to the *temperature* and *volume* of air inside the test tube when it was dipped in hot water?
________________________________________________

5. How does heat affect the volume of a gas? ______________________

C. Heat on Solid

1. Assemble the setup as shown in Figure 15.4. See to it that the ring is horizontally level and the ball hangs just over the wick of the alcohol lamp.

2. Insert the ball into the ring as illustrated in Figure 15.5. Record your observation in the blank space below.

   ______________________________
   ______________________________

3. Light the alcohol lamp with a match.

4. Place the ball on the flame for about 4 minutes and immediately insert the ball again into the ring. Record your observation below.

   ______________________________
   ______________________________
   ______________________________
   ______________________________

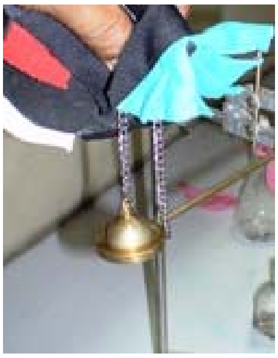


*Fig. 15.5*

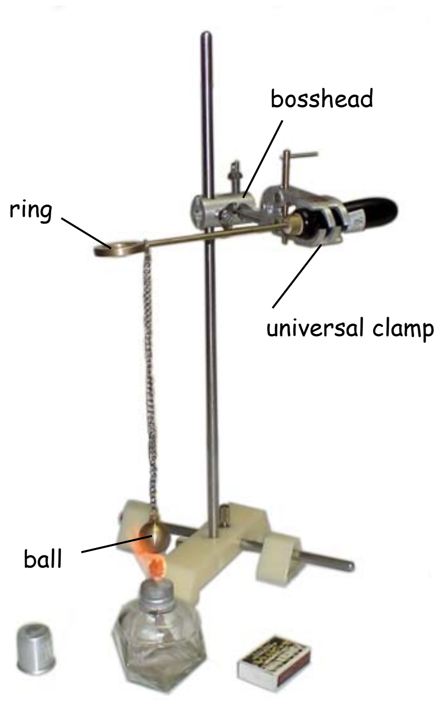



*Fig. 15.4*

**Questions:**

1. What part of the apparatus determines the increase or decrease of the volume of the metal ball? ________________

2. At what instance does the volume of the metal ball increase? __________________

3. How does heat affect the volume of a metal? _________________________________

Ms. Chadee,

(please replace what is in the TG with this highlighted activity. Change “remember” to “teaching chart”

**Denotation and Connotation**

Find Out and Learn:

Study the picture. What do you think is happening in the picture? Is there a celebration? What kind of a celebration it is?

(Remove the second picture)

Read the sentences below:

1. Feast is a celebration or a festival.
2. Feast is a happy occasion.
3. We hang buntings during festival.
4. Feast is a time to eat different and delicious foods.

Which of the sentences gave the direct meaning of the word **feast**?
Which of the sentences gave the words that can be associated with the word **feast**?
Which of the sentences expressed your emotions about the word **feast**?

Sentence number 1 gave the dictionary meaning of the word **feast**. This is called **denotation.**
Sentences 3 and 4 gave some words that can be associated with the word **feast**, such as; buntings and eat different and delicious foods. This is called **connotation**.
Sentence 2 expressed an emotion, one felt during feast day **“happy occasion”**. This is another way of giving the connotation of a word.

Remember:

We can understand a word is several ways. Using denotation and connotation is one of the ways that we can use to understand the meaning of a word.

**Denotation** is the exact, “dictionary” meaning of a word.
**Connotation** is the emotions and associations attached to a word. These may not necessary be the proper definition found in the dictionary.

**Try and Learn:**

Fill in the chart with the appropriate word/s. The first one is done for you.

| Given Word | **Denotation** (dictionary meaning of the word) | **Connotation** (word/s and feeling/s that can be associated to a given word |
|---|---|---|
| 1. student | A person who attends school | reader, carries a bag, happy, play, study |
| 2. home | | |
| 3. park | | |
| 4. school | | |
| 5. market | | |
| 6. hospital | | |

**Do and Learn**

Read the words and its meaning. Write letter **D** if the meaning provided is a **D**enotation and **C** if it is a **C**onnotation.

1. doctor
   _________a. a person who is licensed to treat sick and injure people.
   _________b. a loving and friendly person

2. teacher

   _________a. a person who teaches students
   _________b. a person who is calm and giving

3. mother

__________a. loving, cooks food
__________b. a female parent

4. cat

__________a. playful, soft, and hairy
__________b. a small domestic animal with fur

5. horse

__________a. runs fast, used by cowboys
__________b. animal use for riding

**Learn Some More**

Sometimes words have different connotations to different people because of their experiences. A **Connotation** can be **positive and negative.**

Example:
The word **study,** for some people it has positive connotation because this can mean they will pass the test or get a high grade but for others it can be negative because this means that they have to sleep late and that they can't watch their favorite TV program.

Let's do these:

Which of the words below have positive connotations?
Which words have negative connotations?
Copy these words in your notebook. Write the word **positive** across the given word if it has positive connotation and the word **negative** if it is so.

1. Monster
2. Circus
3. Sunday
4. Holiday
5. Horror film
6. TV
7. Cellphone
8. Cleaning the house
9. Gardening
10. Going to a party
11. Friends

12. Worm
13. Flu
14. Liar
15. Success

On Index - page 318

Change Try and Learn to Do and Learn this should be written after the Remember.

a. Study the data in the Index below. What is wrong with this Index, copy this in your notebook and do the necessary changes.

Pollution, 109 – 120
    Effect, 111 – 114
Craters, 336 – 338
Butterflies, 77 – 79
Animals, 20 – 46
    Habitats, 21 – 23, 34, 40
    Life cycles, 24, 26, 29
Clouds, 310 – 315
    Kinds, 312 – 314
Climate, 253 – 268
Earth, 387 – 406
    Air, 400 – 404
    Land, 389 – 394
    Water, 395 - 399

b. From the given book information. Make an Index following the correct format. Do this in your notebook.

1. Kinds of Sentences: command page 73, declarative pages 65 – 66, exclamatory page 74, interrogative pages 67 – 68
2. Syllables: stress pages 10 – 11, unstressed pages 10 – 11
3. Adjectives: comparison pages 146 – 148, order of adjectives pages 149 – 150
4. Nouns: count nouns page 57, mass nouns page 56, singular and plural pages 50 -54
5. Adverbs: manner pages 174 – 176, 178, place pages 172 – 173, 176, time pages 170 – 171, 176

6. Prepositions pages 183, 185 – 187
7. Telephone conversations pages 33 – 35
8. Verbs pages 120 – 135

NAME ______________________ GROUP __________

SECTION ______________________ DATE __________

# XVII. Efficiency of a Machine

**Objectives:**

1. To determine the work input and work output of an inclined plane.
2. To compute the efficiency.
3. To cite ways of increasing the efficiency.

**Materials and Equipment:**

| | | |
|---|---|---|
| friction board* | hooked mass, 500 g* | books |
| spring balance, 10 N* | meter stick | |

* *From the set of SciKit Mechanics*

**Instructions:**

*Note: Set the spring balance to zero before using.*

A. Work Input

1. Set up the equipment as shown in Figure 17.1. Elevate one end of the board using books. Use a string to attach the spring balance to the load or resistance.

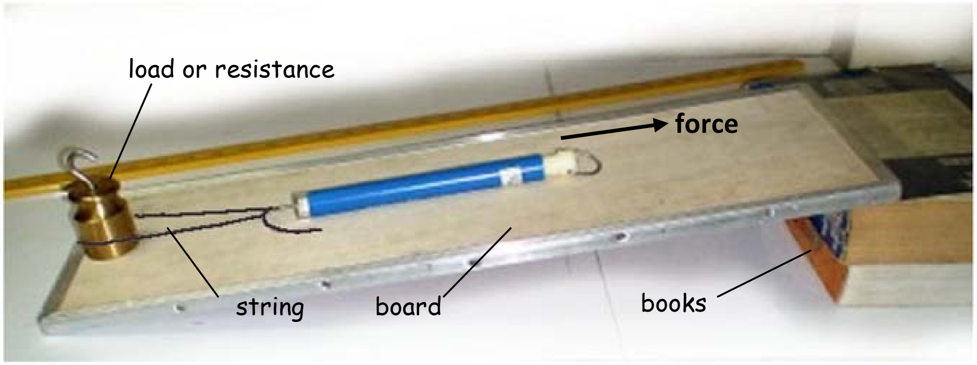



*Fig. 17.1*

2. Pull slowly and in uniform motion the load or resistance towards the upper end of the board using the spring balance. Take the reading of the spring balance.

3. Measure the length of the board, in meters.

4. Record the data in Table 17.1.

B. Work Output

1. Measure the weight, in Newtons, of the load or resistance.
2. Measure the height or distance of the elevated end of the board from the table.
3. Record the data in Table 17.2.

**Data:**

*Table 17.1. Work input*

| Force (N) | Length of board (m) | Work input = effort force x length of board (N.m or Joule) |
|---|---|---|
| | | |

*Table 17.2. Work output*

| Weight of load or resistance (N) | Height (m) | Work output = effort force x height (N.m or Joule) |
|---|---|---|
| | | |

**Questions:**

1. How does work input compare to work output?
_____________________________________________

2. What is the quotient of work output divided by work input? ____________. When can a machine be called more efficient?
_____________________________________________

3. How can a machine like an inclined plane increase its efficiency?
_____________________________________________

NAME ______________________ GROUP ____________

SECTION ______________________ DATE ____________

# XVIII. Strength of Earthquakes

**Objectives:**

1. To illustrate how a seismograph detects an earthquake.
2. To interpret the effects of earthquakes of different intensities.
3. To differentiate earthquake intensity from magnitude.

**Materials and Equipment:**

seismograph set

poster, The Richter Magnitude Scale

**Instructions:**

A. Seismograph

1. Assemble the setup as shown in Figure 18.1. Fix the seismograph on a portable table or on an arm chair using a clamp. See to it that the pen rests at the middle part of the paper, otherwise put something underneath the seismograph base until pen rests at the middle part of paper.

2. Adjust the pen in a way that it can easily swing and be able to mark the paper.

3. Mildly shake the table and at the same time, let the other member of the group pull the paper slowly at uniform speed. Shaking of the table or arm chair should be in horizontal position and parallel to the direction of the pencil's swing. (Arrows in Figure 18.1 show the direction of motion)

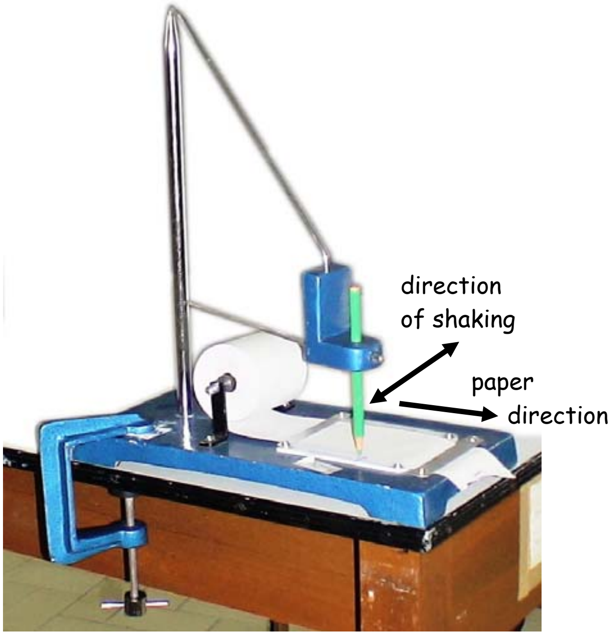



*Fig. 18.1*

4. Repeat step 3 but this time shake the table a little harder.

5. Take note of the marks on the paper and copy them in the space below.

Which mark on a paper shows the shaking is at its highest? ____________________
What does the shaking of the table represent? ____________________
How does a seismograph detect and measure earthquake? ____________________
____________________

B. Earthquake Intensity

1. Observe each picture.

2. Match every picture with Phivolcs Earthquake intensity scale. Connect the picture and corresponding intensity scale with a line by using a pencil as illustrated in the example.

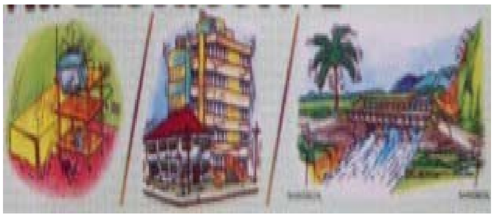
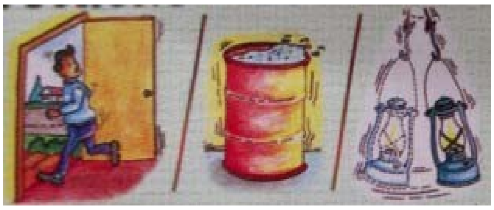
*Example. The first picture below matches with the intensity scale IV.*

Picture

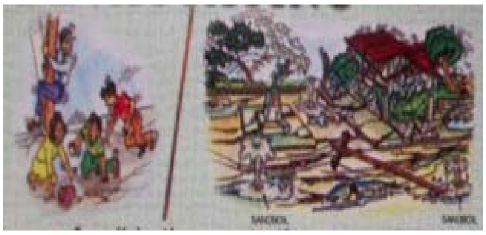
*Phivolcs earthquake intensity scale*

| Intensity Scale | Description |
|---|---|
| I | **Scarcely Perceptible** - Perceptible to people under favorable circumstances. Delicately balanced objects are disturbed slightly. Still water in containers oscillates slowly. |
| II | **Slightly Felt** - Felt by few individuals at rest indoors. Hanging objects swing slightly. Still water in containers oscillates noticeably. |
| III | **Weak** - Felt by many people indoors especially in upper floors of buildings. Vibration is felt like one passing of a light truck. Dizziness and nausea are experienced by some people. Hanging objects swing moderately. Still water in containers oscillates moderately. |
| IV | **Moderately Strong** - Felt generally by people indoors and by some people outdoors. Light sleepers are awakened. Vibration is felt like a passing of heavy truck. Hanging objects swing considerably. Dinner, plates, glasses, windows, and doors rattle. Floors and walls of wood framed buildings creak. Standing motor cars may rock slightly. Liquids in containers are slightly disturbed. Water in containers oscillate strongly. Rumbling sound may sometimes be heard. |

*Phivolcs earthquake intensity scale*

| Picture | Intensity Scale | Description |
| --- | --- | --- |
|  | V | **Strong** - Generally felt by most people indoors and outdoors. Many sleeping people are awakened. Some are frightened, some run outdoors. Strong shaking and rocking felt throughout the building. Hanging objects swing violently. Dining utensils clatter and clink; some are broken. Small, light, and unstable objects may fall or overturn. Liquids spill from filled open containers. Standing vehicles rock noticeably. Shaking of leaves and twigs of trees is noticeable. |
|  | VI | **Very Strong**- Many people are frightened; many run outdoors. Some people lose their balance. Motorists feel like driving in flat tires. Heavy objects or furnitures move or may be shifted. Small church bells may ring. Wall plaster may crack. Very old or poorly built houses and man-made structures are slightly damaged though well-built structures are not affected. Limited rockfalls and rolling boulders occur in hilly to mountainous areas and escarpments. Trees are noticeably shaken. |
|  | VII | **Destructive** - Most people are frightened and run outdoors. People find it difficult to stand in upper floors. Heavy objects and furnitures overturn or topple. Big church bells may ring. Old or poorly-built structures suffer considerably damage. Some well-built structures are slightly damaged. Some cracks may appear on dikes, fish ponds, road surface, or concrete hollow block walls. Limited liquefaction, lateral spreading, and landslides are observed. Trees are shaken strongly. (Liquefaction is a process by which loose saturated sand lose strength during an earthquake and behave like liquid). |

*Phivolcs earthquake intensity scale*

| Picture | Intensity Scale | Description |
|---|---|---|
|  | VIII | **Very Destructive** - People panick and find it difficult to stand even in outdoors. Many well-built buildings are considerably damaged. Concrete dikes and foundation of bridges are destroyed by ground settling or toppling. Railway tracks are bent or broken. Tombstones may be displaced, twisted, or overturned. Utility posts, towers, and monuments mat tilt or topple. Water and sewer pipes may be bent, twisted, or broken. Liquefaction and lateral spreading cause man-made structure to sink, tilt, or topple. Numerous landslides and rockfalls occur in mountainous and hilly areas. Boulders are thrown out from their positions particularly near the epicenter. Fissures and faults rapture may be observed. Trees are violently shaken. Water splash or stop over dikes or banks of rivers. |
|  | IX | **Devastating** - People are forcibly thrown to ground. Many cry and shake with fear. Most buildings are totally damaged. Bridges and elevated concrete structures are toppled or destroyed. Numerous utility posts, towers, and monument are tilted, toppled, or broken. Water sewer pipes are bent, twisted, or broken. Landslides and liquefaction with lateral spreadings and sandboils are widespread. The ground is distorted into undulations. Trees are shaken very violently, some are toppled, or broken. Boulders are commonly thrown out. River water splashes violently on slops over dikes and banks. |
|  | X | **Completely Devastating** - Practically all man-made structures are destroyed. Massive landslides and liquefaction, large scale subsidence and uplifting of land forms, and many ground fissures are observed. Changes in river courses and destructive seiches in large lakes occur. Many trees are toppled, broken, and uprooted. |

C. Earthquake Richter Magnitude

1. Go to the board and examine the poster (an illustration of determining the Richter Magnitude of Earthquake). You may ask the assistance of your teacher.

2. Based on the illustration, what is the Magnitude Scale of the Earthquake? In the table below, encircle its magnitude scale and description.

*Phivolcs Richter magnitude scale*

| Magnitude Scale | Description |
|---|---|
| 1 | Earthquakes with **M below 1** are only detectable when an ultra sensitive seismometer is operated under favorable conditions. |
| 2 | Most earthquakes with **M below 3** are the "**hardly perceptible shocks**" and are not felt. They are only recorded by seismographs of nearby stations. |
| 3 | Earthquakes with **M 3 to 4** are the "**very feeble shocks**" and only felt near the epicenter. |
| 4 | Earthquakes with **M 4 to 5** are the "**feeble shocks**" where damages are not usually reported. |
| 5 | Earthquakes with **M 5 to 6** are the "**earthquakes with moderate strength**" and are felt over the wide areas; some of them cause small local damages near the epicenter. |
| 6 | Earthquakes with **M 6 to 7** are the "**strong earthquakes**" and are accompanied by local damages near the epicenters. First class seismological stations can observe them wherever they occur within the earth. |
| 7 | Earthquakes with **M 7 to 8** are the "**major earthquakes**" and can cause considerable damages near the epicenters. Shallow-seated or near-surface major earthquakes when they occur under the sea, may generate tsunamis. First class seismological stations can observe them wherever they occur within the earth. |
| 8 | Earthquakes with **M 8 to 9** are the "**great earthquakes**" occurring once or twice a year. When they occur in land areas, damages affect wide areas. When they occur under the sea, considerable tsunamis are produced. Many aftershocks occur in areas approximately 100 to 1,000 kilometers in diameter. |
| 9 | Earthquakes with **M over 9** have **never occurred** since the data based on the seismographic observations became available. |

*Note: Magnitude,* usually expressed as an Arabic numeral that is 1, 2, 3, 4, 5, 6, 7, 8, 9, used to express the total amount of energy released by an earthquake.

NAME ______________________ GROUP __________

SECTION ______________________ DATE __________

# XIX. Volcanoes of the Philippines

**Objective:**

To identify the active and inactive volcanoes of the Philippines.

**Material:**

map of Philippine volcanoes

**Instructions:**

1. Make use of the map of Philippine volcanoes. Identify how many active and inactive volcanoes in every major geographical division of the Philippines.
2. Record the data in Table 19.1.

*Table 19.1. Number of active and inactive volcanoes of the Philippines*

| Geographical Divisions | Active Volcanoes | Inactive Volcanoes |
|---|---|---|
| Luzon | | |
| Visayas | | |
| Mindanao | | |

**Questions:**

1. Which of the Philippines' geographical divisions has the highest number of active volcanoes? __________________
2. Which geographical division has the highest number of inactive volcanoes? ___________
3. How many active volcanoes are there in the Philippines? ____________________
4. How many inactive volcanoes are there in the Philippines? ____________________

NAME ______________________________ GROUP ____________

SECTION ____________________________ DATE ____________

# XX. Earth's Formation of Rocks

**Objectives:**

1. To identify the names of minerals and rock samples.
2. To familiarize with the features of the samples.

**Materials and Equipment:**

rock samples    hand lens

**Instructions:**

1. Get the samples in the box as shown in Figure 20.1. Take note of the name on the label for each sample. *Do not detach the labels and return the samples to their designated place in the box after use.*

   What are the features of each rock? Refer to the Data Sheet as described by the geologists. (See attached *data sheet* next page).

2. Using the hand lens, observe the actual image of the terms or descriptions that you encountered in the Data Sheet like the following examples:

   *(1) fine-grained; (2) coarse-grained; (3) glassy luster; (4) high porosity; and (5) perfect cleavage.*


*Fig. 20.1*

Name an object similarly described as to the above terms or description:

a. fine-grained ______________
b. coarse-grained ______________
c. glassy luster ______________
d. high porosity ______________
e. perfect cleavage ___________

**Questions:**

1. What are the common features of igneous rocks?
   ________________________________________________
2. What are the common features of sedimentary rocks?
   ________________________________________________
3. What are the common features of metamorphic rocks?
   ________________________________________________

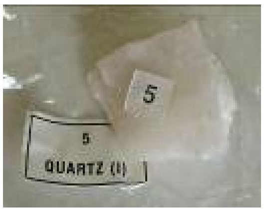
# Data Sheet

## Minerals and Rocks

**Minerals**

- A mineral is made up of one substance that under normal circumstances would form crystals. Minerals are the building blocks of rock. The crystals may be too tiny to see, and if the mineral cooled too quickly glass might form instead of crystals.

Samples (label #)




*Quartz* (5) common color is clear followed by white or cloudy (milky quartz). Purple (Amethyst), pink (Rose Quartz), gray or brown to black (Smoky Quartz) are also common. Cryptocrystalline varieties can be multicolored. Luster is glassy to vitreous as crystals, while cryptocrystalline forms are usually waxy to dull but can be vitreous. Crystals are transparent to translucent, cryptocrystalline forms can be translucent or opaque.


*Mica White* (3) is usually silvery-grey in color, sometimes tinted with green, brown, or pink. It is one of the mica minerals consisting of potassium aluminosilicate, a group of the silicate minerals known by their thin cleavage sheets. It is used in electronic insulators (mainly in vacuum tubes), ground mica in paint, as joint cement, as a dusting agent, in well-drilling mud, and in plastics, roofing, rubber, and welding rods.


*Calcite* (8) is a commonly white or colorless, but appearing in a great variety of colors owing to impurities, very widely distributed mineral. Calcite also occurs in a number of massive forms, in which it may be coarsely to finely granular (as in marble), compact (as in limestone), powdery (as in chalk), or fibrous. Its crystals are characterized by highly perfect cleavage. Chemically, it is calcium carbonate, with chemical symbol of $CaCO_3$, but it frequently contains manganese, iron, or magnesium in place of the calcium.


*Chalk* (17) is a mineral of calcium carbonate, similar in composition to limestone, but it is softer. It is characteristically a marine formation and sometimes occurs in great thickness. The chief constituents of these chalk deposits are the shells of minute animals called foraminiferans.


*Feldspars* (21) usually are white or nearly white, though they may be clear or light shades of orange or buff. They are hard minerals (hardness lies between of a steel knife and quartz) and usually have glassy luster.


*Pyrophyllite* (11) is commonly white, grayish, greenish, or brownish, with a pearly to waxy appearance and greasy feel. It has easy cleavage parallel to the structural layers. The mineral is highly stable to acids.


*Serpentine* (14) is a major rock forming mineral and is found as a constituent in many metamorphic and weather igneous rocks. Color is olive green, yellow or golden, brown, or black. The structure is composed of layers of silicate tetrahedrons linked into sheets. Luster is greasy, waxy or silky. Crystals are translucent and usually compact masses are opaque or fibrous.

**Rocks**

Rocks are made up of minerals. Most rocks have several types of minerals in them, but some have only one type of mineral. For example, sandstone is mostly quartz.

**Types of Rocks**

Geologists classify rocks in three groups according to the major Earth processes that formed them. The three rock groups are ***igneous, sedimentary,*** **and** ***metamorphic*** **rocks.**

***Igneous rocks*** are formed from melted rock that has cooled and solidified.There are two basic types: 1) ***intrusive igneous rocks*** that solidify below Earth's surface; and 2) **extrusive igneous rocks** that solidify on or above Earth's surface. When rocks are buried deep within the Earth, they melt because of the high pressure and temperature; the molten rock (called magma) can then flow upward or even be erupted from a volcano onto the Earth's surface. When magma cools slowly, usually at depths of thousands of feet, crystals grow from the molten liquid, and a *coarse-grained rock forms*. When magma cools rapidly, usually at or near the Earth's surface, the crystals are extremely small, and a *fine-grained rock results*. A wide variety of rocks are formed by different cooling rates and different chemical compositions of the original magma.

Samples (label #)


*Basalt* (1) is a common gray to black volcanic rock. It is usually fine-grained due to rapid cooling of lava on the Earth's surface. This is an extrusive igneous rock. It is the bedrock of the ocean floor and also occurs on land in extensive lava flows.


*Granite* (2) is a light colored, coarse-grained, intrusive igneous rock that contains mainly quartz and feldspar minerals.


*Pumice* (4)is a light-colored vesicular igneous rock. It forms through very rapid solidification of a melt. The vesicular texture is a result of gas trapped in the melt at the time of solidification.


*Rhyolite* (6) is a light-colored, fine-grained, extrusive igneous rock that typically contains quartz and feldspar minerals.


*Biotite* (7) is a common rock-forming silicate mineral. It is a mica found in many types of igneous rocks and in some metamorphic rocks. It is easily recognized because of its perfect cleavage that allows it to separate into thin, black, flexible sheets.

***Sedimentary rocks*** are formed at the surface of the Earth, either in water or on land. They are layered accumulations of sediments-fragments of rocks, minerals, or animal or plant material. Temperatures and pressures are low at the Earth's surface, and sedimentary rocks show this fact by their appearance and the minerals they contain. Most sedimentary rocks become cemented together by minerals and chemicals or are held together by electrical attraction; some, however, remain loose and unconsolidated. The layers are normally parallel or nearly parallel to the Earth's surface; if they are at high angles to the surface or are twisted or broken, some kind of Earth movement has occurred since the rock was formed.

Samples (label #)


*Bituminous coal or black coal* (16) is usually black, sometimes dark brown, often with well- defined bands of bright and dull material. Bituminous coal seams are stratigraphically identified by the distinctive sequence of bright and dark bands and are classified accordingly as either "dull, bright-banded" or "bright, dull-banded" and so on. Relatively soft coal containing a tarlike substance called bitumen.


*Diatomite or kieselgur* (18), is a naturally occurring, soft, siliceous sedimentary rock that is easily crumbled into a fine white to off-white powder. This powder has an abrasive feel, similar to pumice powder, and is very light, due to its high porosity.


*Dolomite* (19) is usually white, cream or grey, but often weathers brown or pinkish. The texture is coarse, medium or fine; compact, sometimes earthy.


*Beryl* (20) is usually white, yellow, green, blue, or colorless, commonly used as a gemstone. Extremely hard, occurring in hexagonal crystals that may be of enormous size. The most valued variety of beryl is emerald. An aquamarine is a blue to sea-green beryl; morganites are rose-red beryls. It is the principal raw material for the element beryllium and its compounds.


*Halite* (22) is better known as rock salt, an evaporative sedimentary rock, can easily be distinguished by its taste.


*Shale* (24) is a fine-grained sedimentary rock that forms from the compaction of silt and clay-sized mineral particles that we commonly call "mud". This composition places shale in a category of sedimentary rocks known as "mudstones". "Fissile" means that the rock readily splits into thin pieces along the laminations. Shale is distinguished from other mudstones because it is fissile and laminated. "Laminated" means that the rock is made up of many thin layers.


*Sandstone* (23) is a very common sedimentary rock with variable color, frequently red, brown, greenish, yellow, grey, white. As the name implies, sandstone is composed of sand. Sand is characterized by any grain that is 0.1 mm to 2.0 mm in size. The grains can be composed of individual crystals of various minerals such as quartz or feldspar or even be a sand-sized fragment of another rock such as a granite or slate.

***Metamorphic rocks*** are sometimes sedimentary and igneous rocks subjected to pressure so intense or heat so high that they are completely changed. They are formed while deeply buried within the Earth's crust. The process of metamorphism does not melt the rocks, but instead transforms them into denser, more compact rocks. New minerals are created either by rearrangement of mineral components or by reactions with fluids that enter the rocks.

Samples (label #)


*Biotite* (7) is a common rock-forming silicate mineral. It is a mica found in many types of igneous rocks and in some metamorphic rocks. It is easily recognized because of its perfect cleavage that allows it to separate into thin, black, flexible sheets.


*Garnet* (9) has pretty colors, is wonderfully transparent, lacks cleavage, and is durable; possesses high indices of refraction, is hard enough thus making good candidate for gemstones. Garnets as a group are relatively common in highly metamorphosed rocks and in some igneous formations. They form under the high temperatures and/or pressures that those types of rocks must endure. Garnets can be used by geologists as a gauge of how much temperature and pressure the rock has endured.


*Marble* (10) is composed of recrystallized carbonate minerals, most commonly calcite or dolomite. Pure white marble is the result of metamorphism of a very pure (silicate-poor) limestone or dolomite protolith. Green coloration is often due to serpentine resulting from originally high magnesium limestone or dolostone with silica impurities. It is commonly used for sculpture and as a building material.


*Mica Schist* (12) has a silvery black color and comes from biotite mica. It is a shiny, smooth, greasy-feeling rock with red garnets throughout. Stack, or “book” of thin sheets of silvery white, shiny mica with vitreous luster. It peels off easily. Single sheets bend and are transparent or translucent.


*Quartzite* (13) is white, grey, or reddish. It is usually massive but primary sedimentary features may be preserved, such as bedding, graded bedding or current bedding. Coarse-grained metamorphic rock derived from sandstone. It has a uniform texture (non-foliated) and is very hard. Heat and pressure combine to fuse grains of quartz sand to make up the composition of quartzite. It is resistant to weathering.


*Slate* (15) is black and has shades of blue, green, brown, and buff. It is characterized by a single, perfect cleavage (slaty cleavage), enabling it to be split into parallel-sided slabs. On the cleavage surfaces, sedimentary structures such as bedding and graded bedding can often be seen. Fossils may be preserved but are invariably distorted. Folds are often apparent in the field.

NAME ______________________ GROUP __________

SECTION ______________________ DATE __________

# XXI. Weather Observation

**Objectives:**

1. To measure and record the atmospheric condition.
2. To present the atmospheric condition in a graph.
3. To predict the weather condition.

**Materials and Equipment:**

anemometer with wind vane
aneroid barometer
2 thermometers
rain gauge
multi-clamp*
beaker, 250 mL
2 strings, 200 mm long
2 stand supports*
stand base*
stand rod, 500 mm long*
stand rod, 250 mm long*
cloth, 50 mm x 100 mm
colored pen/pencils
water

* *From the set of SciKit Basic*

**Instructions:**

1. Go to the designated stations where the instruments are located. Refer to the instructions posted in each station.

   *Station 1.* Air Temperature
   *Station 2.* Air Pressure
   *Station 3.* Relative Humidity
   *Station 4.* Wind Speed and Wind Direction
   *Station 5.* Cloud Cover
   *Station 6.* Rainfall

2. Get the readings of these instruments and record the observed atmospheric conditions in Table 21.1 of the weather chart on page 54. (Refer to Table 21.2 of the sample weather chart on page 55).
   *Note: If possible, make measurements at different times of the day for several days.*

3. Prepare a graph of temperature, relative humidity, and pressure. Plot these variables on the same graph (Graph 21.1 of the weather chart on page 54) for easier comparison.

4. Use a different axis and pen color for each variable. Plot the time on the X-axis. (Refer to Graph 21.2 in the weather chart sample on page 55).

5. Discuss with your group and make a prediction for the weather for the next day. Cite the basis for your prediction.

**Questions:**

1. Which variable shows a regular daily pattern? How would you explain this?
   ___
   ___
2. How does the temperature change from day to day?
   ___
   ___
3. Is there a relationship between temperature and pressure? What happens to the temperature when the pressure decreases or increases?
   ___
   ___
4. Which do you think is more difficult, making an accurate forecast for upcoming weather for the next few hours, or a forecast for the entire week? Explain.
   ___
   ___

Ms. Chadee,

(please replace what is in the TG with this highlighted activity. Change "remember" to "teaching chart"

**Denotation and Connotation**

Find Out and Learn:

Study the picture. What do you think is happening in the picture? Is there a celebration? What kind of a celebration it is?

(Remove the second picture)

Read the sentences below:

1. Feast is a celebration or a festival.
2. Feast is a happy occasion.
3. We hang buntings during festival.
4. Feast is a time to eat different and delicious foods.

Which of the sentences gave the direct meaning of the word **feast**?
Which of the sentences gave the words that can be associated with the word **feast**?
Which of the sentences expressed your emotions about the word **feast**?

Sentence number 1 gave the dictionary meaning of the word **feast**. This is called **denotation.**
Sentences 3 and 4 gave some words that can be associated with the word **feast**, such as; buntings and eat different and delicious foods. This is called **connotation**.
Sentence 2 expressed an emotion, one felt during feast day **"happy occasion"**. This is another way of giving the connotation of a word.

Remember:

We can understand a word is several ways. Using denotation and connotation is one of the ways that we can use to understand the meaning of a word.

**Denotation** is the exact, "dictionary" meaning of a word.
**Connotation** is the emotions and associations attached to a word. These may not necessary be the proper definition found in the dictionary.

**Try and Learn:**

Fill in the chart with the appropriate word/s. The first one is done for you.

| Given Word | **Denotation** (dictionary meaning of the word) | **Connotation** (word/s and feeling/s that can be associated to a given word |
|---|---|---|
| 1. student | A person who attends school | reader, carries a bag, happy, play, study |
| 2. home | | |
| 3. park | | |
| 4. school | | |
| 5. market | | |
| 6. hospital | | |

**Do and Learn**

Read the words and its meaning. Write letter **D** if the meaning provided is a **D**enotation and **C** if it is a **C**onnotation.

1. doctor
   _________a. a person who is licensed to treat sick and injure people.
   _________b. a loving and friendly person

2. teacher

   _________a. a person who teaches students
   _________b. a person who is calm and giving

3. mother

__________a. loving, cooks food
__________b. a female parent

4. cat

__________a. playful, soft, and hairy
__________b. a small domestic animal with fur

5. horse

__________a. runs fast, used by cowboys
__________b. animal use for riding

**Learn Some More**

Sometimes words have different connotations to different people because of their experiences. A **Connotation** can be **positive and negative.**

Example:
The word **study,** for some people it has positive connotation because this can mean they will pass the test or get a high grade but for others it can be negative because this means that they have to sleep late and that they can't watch their favorite TV program.

Let's do these:

Which of the words below have positive connotations?
Which words have negative connotations?
Copy these words in your notebook. Write the word **positive** across the given word if it has positive connotation and the word **negative** if it is so.

1. Monster
2. Circus
3. Sunday
4. Holiday
5. Horror film
6. TV
7. Cellphone
8. Cleaning the house
9. Gardening
10. Going to a party
11. Friends

12. Worm
13. Flu
14. Liar
15. Success

On Index - page 318

Change Try and Learn to Do and Learn this should be written after the Remember.

a. Study the data in the Index below. What is wrong with this Index, copy this in your notebook and do the necessary changes.

Pollution, 109 – 120
    Effect, 111 – 114
Craters, 336 – 338
Butterflies, 77 – 79
Animals, 20 – 46
    Habitats, 21 – 23, 34, 40
    Life cycles, 24, 26, 29
Clouds, 310 – 315
    Kinds, 312 – 314
Climate, 253 – 268
Earth, 387 – 406
    Air, 400 – 404
    Land, 389 – 394
    Water, 395 - 399

b. From the given book information. Make an Index following the correct format. Do this in your notebook.

1. Kinds of Sentences: command page 73, declarative pages 65 – 66, exclamatory page 74, interrogative pages 67 – 68
2. Syllables: stress pages 10 – 11, unstressed pages 10 – 11
3. Adjectives: comparison pages 146 – 148, order of adjectives pages 149 – 150
4. Nouns: count nouns page 57, mass nouns page 56, singular and plural pages 50 -54
5. Adverbs: manner pages 174 – 176, 178, place pages 172 – 173, 176, time pages 170 – 171, 176

6. Prepositions pages 183, 185 – 187
7. Telephone conversations pages 33 – 35
8. Verbs pages 120 – 135

Ms. Chadee,

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|---|---|---|
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| 2. home | | |
| 3. park | | |
| 4. school | | |
| 5. market | | |
| 6. hospital | | |

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Read the words and its meaning. Write letter **D** if the meaning provided is a **D**enotation and **C** if it is a **C**onnotation.

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   _________a. a person who is licensed to treat sick and injure people.
   _________b. a loving and friendly person

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   _________a. a person who teaches students
   _________b. a person who is calm and giving

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__________a. loving, cooks food
__________b. a female parent

4. cat

__________a. playful, soft, and hairy
__________b. a small domestic animal with fur

5. horse

__________a. runs fast, used by cowboys
__________b. animal use for riding

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3. Sunday
4. Holiday
5. Horror film
6. TV
7. Cellphone
8. Cleaning the house
9. Gardening
10. Going to a party
11. Friends

12. Worm
13. Flu
14. Liar
15. Success

On Index - page 318

Change Try and Learn to Do and Learn this should be written after the Remember.

a. Study the data in the Index below. What is wrong with this Index, copy this in your notebook and do the necessary changes.

Pollution, 109 – 120
    Effect, 111 – 114
Craters, 336 – 338
Butterflies, 77 – 79
Animals, 20 – 46
    Habitats, 21 – 23, 34, 40
    Life cycles, 24, 26, 29
Clouds, 310 – 315
    Kinds, 312 – 314
Climate, 253 – 268
Earth, 387 – 406
    Air, 400 – 404
    Land, 389 – 394
    Water, 395 - 399

b. From the given book information. Make an Index following the correct format. Do this in your notebook.

1. Kinds of Sentences: command page 73, declarative pages 65 – 66, exclamatory page 74, interrogative pages 67 – 68
2. Syllables: stress pages 10 – 11, unstressed pages 10 – 11
3. Adjectives: comparison pages 146 – 148, order of adjectives pages 149 – 150
4. Nouns: count nouns page 57, mass nouns page 56, singular and plural pages 50 -54
5. Adverbs: manner pages 174 – 176, 178, place pages 172 – 173, 176, time pages 170 – 171, 176

6. Prepositions pages 183, 185 – 187
7. Telephone conversations pages 33 – 35
8. Verbs pages 120 – 135

NAME ______________________________ GROUP ____________

SECTION ____________________________ DATE ____________

# XXII. Constellations

**Objectives:**

1. To identify and locate constellations.
2. To describe the apparent shift of positions of the stars over time.

**Materials and Equipment:**

| | |
|---|---|
| map of stars | paper |
| celestial globe model | pencil |

**Instructions:**

A. Sketching Constellations

1. Make use of the map of stars poster and celestial globe model. Draw one constellation with corresponding name from the Northern Hemisphere and another one from the Southern Hemisphere in a separate sheet of paper.
   *Note: Bring these drawings with you while observing the stars on a clear night*.


*Poster of map of stars*

B. Home Activity

2. Go outside your house tonight or on a clear night. Observe the stars in the sky. Take note of the date and time of observation.

3. Try to locate the constellation you have chosen in part A.

4. After an hour or so, observe again the stars.

   *Date and Time of Observation:* ______________________________

   *Were you able to see the constellations that you have chosen?* ____

   *What did you observe about the position of the stars after an hour or so?*
   ______________________________________________________________

Celestial globe

**Question:**

1. Is it possible to see all the constellations? Why? ___________________________________
   ______________________________________________________________

NAME ______________________________ GROUP ____________

SECTION ____________________________ DATE ____________

# XXIII. The Telescope

**Objectives:**

1. To identify the parts of the telescope.
2. To focus and view distant land objects during daytime.
3. To operationally define telescope.

**Materials and Equipment:**

Telescope (refracting) pencil

**Instructions:**

***Warning!***

- ***Never use the telescope or its finder scope to look at or near the Sun! It will cause instant and irreversible damage to the eye, as well as physical damage to the telescope itself.***

1. Examine the telescope and identify its parts. Make use of the illustration in Figure 23.1 as guide.

2. Ask the teacher of two distant objects to be viewed.

3. Set up the telescope outside the room where the object to be viewed is free from any obstructions.

4. Slightly loosen the *azimuth lock* (16, Inset A, Figure 23.1) and the *altitude lock* (17, Inset A, Fig. 23.1). Aim the telescope in the direction of the object to be observed by looking along the tube. Look through the aligned *finder scope* (10, Figure 23.1) and adjust the aim of the telescope until the desired object is in the center of the finder scope.

   *Note: - The image in the finder scope is normally upside-down and inversed from left to right.*
   *- When the object is centered in the aligned finder scope, it should be in the main telescope's field of view.*

4. Look through the *eyepiece* (6, Figure 23.1). Center the object in the main telescope's field of view, and sharply focus the image by turning the *focus ring* (2, Figure. 23.1).

5. Take note of the different features of this object and draw the image as it appears in the telescope's field of view in the observation log below.

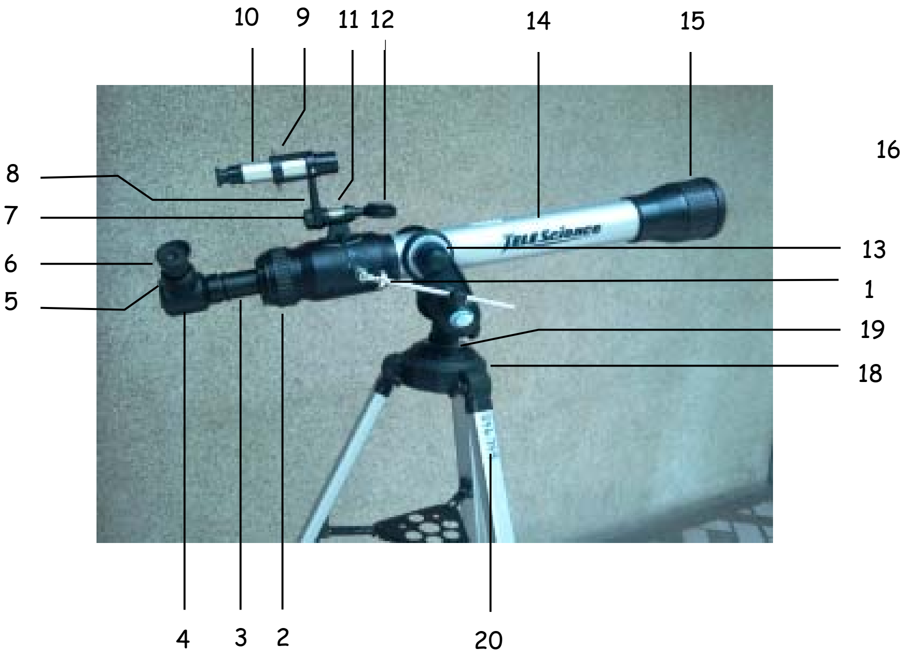
| Object 1 | Object 2 |
| --- | --- |
| *Observation Log* | *Observation Log* |
| *Drawing of Image* | *Drawing of Image* |
| *Object Name:* ______________________ | *Object Name:* ______________________ |
| *Date & Time Observed:* ______________ | *Date & Time Observed:* ______________ |
| *Notes:* ______________________________ | *Notes:* ______________________________ |

**Questions:**

1. What happen to the size of the observed distant object as it appear in the telescope's field of view? What is/are the essential component/s in this telescope to form such image?
   ______________________________________________________________

2. What is a telescope? ____________________________________________
   ______________________________________________________________
   ______________________________________________________________

### *Fig. 23.1. The Telescope (refracting)*





*Inset A*

1. *Fine Adjustment Altitude Control Knob*
2. *Focusing Ring*
3. *Focusing Tube*
4. *Diagonal Mirror*
5. *Fine Focus Adjustment Control*
6. *Eyepiece*
7. *Finder Scope Position Adjustment Control*
8. *Finder Scope Bracket*
9. *Finder Scope Alignment Screw*
10. *Finder Scope*
11. *Spirit Level*
12. *Compass*
13. *Altitude Scale*
14. *Telescope Tube*
15. *Lens Hood*
16. *Altitude Locking Control Knob*
17. *Azimuth Locking Control Knob*
18. *Mount*
19. *Azimuth Scale*
20. *Tripod*

***Setting up the telescope:***

1. *Assemble the telescope (refer to The Telescope, Repair and Maintenance Manual).*
2. *Align the finder scope as follows:*

   2.1. *Point the telescope at an easy-to-find distant land object such as the top of a telephone pole or a distant mountain or tower. Look through the eyepiece and turn the focusing ring (2) until the image is sharply focused. Center the object precisely in the eyepiece's field of view.*

   2.2. *Look through the finder scope(10). Turn one or more of the viewfinder's alignment screws (9) until the intersect of the horizontal and vertical hairlines is precisely over the same object as it is centered in the eyepiece.*

***Some operation tips:***

*<u>Eyepieces</u>: Always begin your observations using the low-power eyepiece (20mm). It delivers a bright, wide field of view and is the best to use for most* viewing conditions. *Use the high-power eyepiece to view details of the observed object like the Moon and planets (changing eyepieces changes the power or magnification). If the image become fuzzy, switch back down to a lower power.*

*<u>Barlow lens</u>: The magnification can also be changed by using the Barlow. as shown at the right. Remove the eyepiece, slide in the Barlow, and then place the eyepiece into the Barlow. Tighten the thumbscrew to secure the Barlow lens and the eyepiece in place.*


*Attachment of Barlow lens to increase magnification*

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# Glass Tube Preparation for Experiment Setup

**Materials and Equipment:**

match
glass tube, 6 mm hole diameter
glass tube, 3 mm hole diameter
rag
Bunsen burner
LPG in a tank
regulator and hose assembly
triangular file, small

**Instructions:**

***Safety reminders:***

*a. Wear laboratory coat/gown and safety goggles.*
*b. Keep flammable chemicals, books, and papers from the flame.*
*c. Tie long hair back.*
*d. Be vigilant.*

1. Measure and mark the following length for a specified size/diameter of the glass tubes.

   a. capillarity set-up: 1 pc 3.0mm diameter glass tube, 75.0mm long and 1 pc 6.0mm diameter glass tube, 75.0mm long;

   b. effect of heat set-up: 1pc 100mm long from a 3.0mm diameter glass tube.

2. Make a deep scratch-on mark of the glass tube using a triangular file.

3. To cut the glass tube, bend opposite the scratch mark as illustrated on Figure A.1.

   *Caution: Be mindful of the sharp edges on the glass tube!*

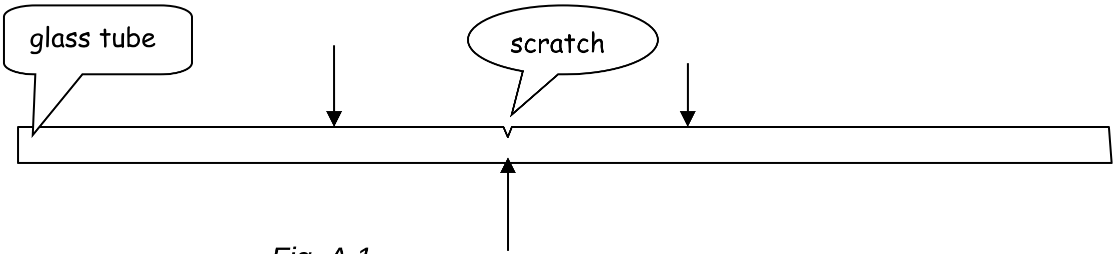


*Fig. A.1*

4. Polish the cut edge of glass tube by placing it at the hottest region of the flame of a Bunsen burner for a minute. *(If you are not familiar with using a Bunsen burner, please refer to Appendix “B” - **Installation and Operation of a Bunsen Burner**).*

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# Repair and Maintenance Manual

Integrated Science