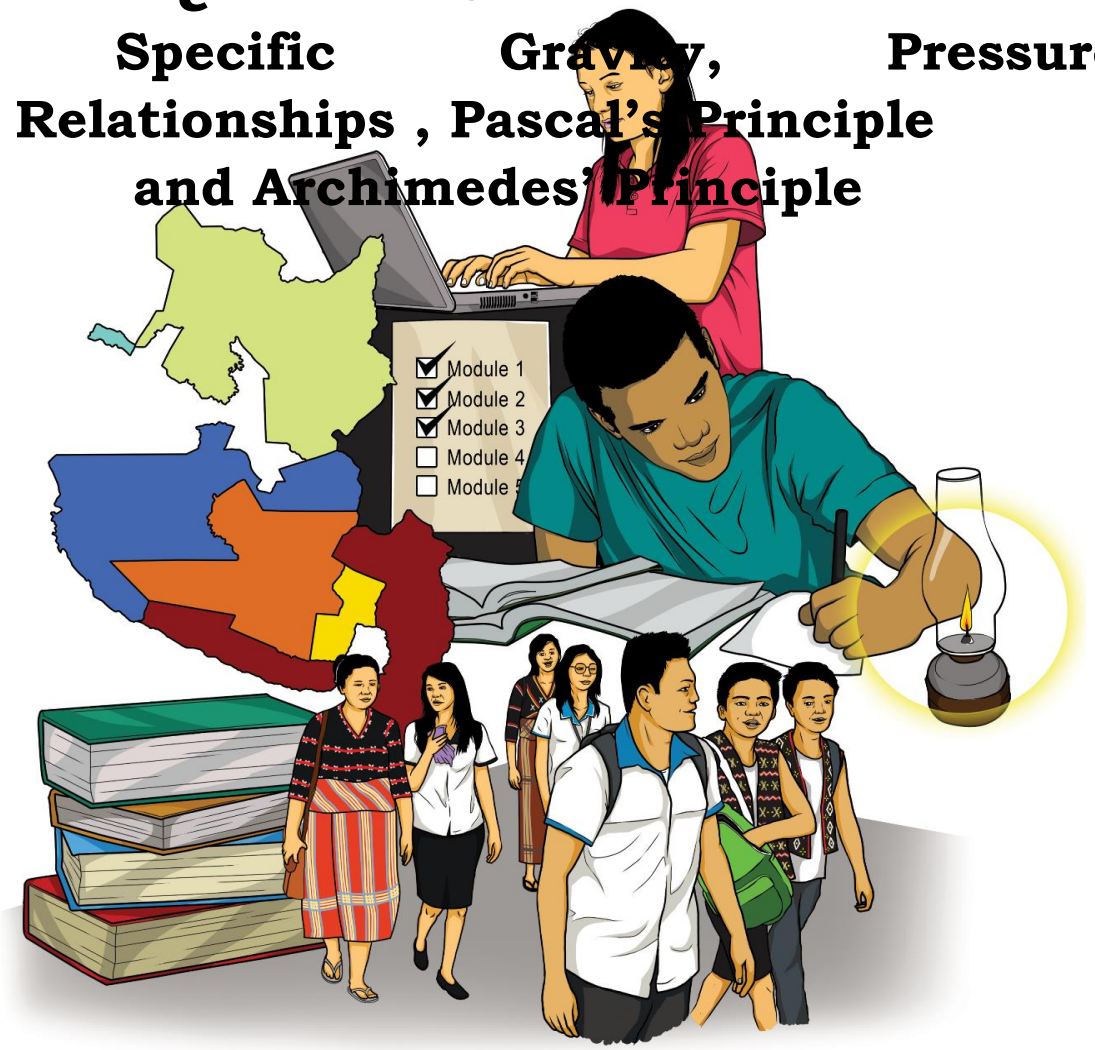
12

DepED
DEPARTMENT OF EDUCATION

General Physics 1

Quarter 2 – Module 6:
Specific Gravity, Pressure Relationships , Pascal's Principle and Archimedes' Principle



SELF-LEARNING MODULE

DEPARTMENT OF EDUCATION - SOCCSKSARGEN

General Physics 1 – Grade 12
Self-Learning Module (SLM)
Quarter 2 – Module 6: Specific Gravity, Pressure relationships with Area and Force , Fluid Density and Depth
First Edition, 2020

Writers: Florencio M. Ruaya Jr., Sheree P. Estrada, Maureen Marie F. Flame, Rosamar L. Pagulong, Maribeth A. Villanueva, Cherryll A. Bogacia

Editors: Nestor A. Raquindin, Emma T. Surita, Christine Joy G. Sua

Reviewer: Blessy Mae M. Cabayao

Illustrator: Tracy Joy D. Palmares

Layout Artist: Welmer M.Leysa

Cover Art Designer: Ian Caesar E. Frondoza

Management Team: Allan G. Farnazo PhD, CESO IV – Regional Director
Atty. Fiel Y. Almendra, CESO V – Assistant Regional Director
Ruth L. Estacio PhD, CESO VI- OIC-Schools Division Superintendent
Jasmin P. Isla - Assistant Schools Division Superintendent
Gilbert B. Barrera – Chief, CLMD
Arturo D. Tingson Jr. – REPS, LRMS
Peter Van C. Ang-ug – REPS in Science and ADM
Lalaine SJ. Manuntag PhD - CID Chief
Nelida S. Castillo PhD- EPS In-Charge of LRMS
Marichu Jean R. Dela Cruz – EPS Science

Printed in the Philippines by Department of Education – SOCCSKSARGEN Region

Office Address: Regional Center, Brgy. Carpenter Hill, City of Koronadal
Telefax: (083) 2288825/ (083) 2281893
E-mail Address: region12@deped.gov.ph

12

General Physics 1

Quarter 2 – Module 6:
Specific Gravity, Pressure Relationships , Pascal's Principle and Archimedes' Principle

Introductory Message

For the facilitator:

Welcome to the General Physics 1 – Grade 12 Self-Learning Module (SLM) on Specific Gravity, Pressure and Pressure relationships with area and depth, Pascal's Principle , and Archimedes' Principle !

This module was collaboratively designed, developed and reviewed by educators both from public and private institutions to assist you, the teacher or facilitator in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners into guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st century skills while taking into consideration their needs and circumstances.

In addition to the material in the main text, you will also see this box in the body of the module:

Notes to the Teacher

This contains helpful tips or strategies that will help you in guiding the learners.

As a facilitator you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to the General Physics 1 – Grade 12 Self-Learning Module (SLM) on Specific Gravity, Pressure relationships with Force and Area, Fluid Density and Depth, Pascal's Principle and Archimedes' Principle !

The hand is one of the most symbolized part of the human body. It is often used to depict skill, action and purpose. Through our hands we may learn, create and accomplish. Hence, the hand in this learning resource signifies that you as a learner is capable and empowered to successfully achieve the relevant competencies and skills at your own pace and time. Your academic success lies in your own hands!

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be enabled to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:

What I Need to Know This will give you an idea of the skills or competencies you are expected to learn in the module.

 ***What I Know***	This part includes an activity that aims to check what you already know about the lesson to take. If you get all the answers correct (100%), you may decide to skip this module.
 ***What's In***	This is a brief drill or review to help you link the current lesson with the previous one.
 ***What's New***	In this portion, the new lesson will be introduced to you in various ways such as a story, a song, a poem, a problem opener, an activity or a situation.
 ***What is It***	This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills.
 ***What's More***	This comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module.
 ***What I Have Learned***	This includes questions or blank sentence/paragraph to be filled in to process what you learned from the lesson.
 ***What I Can Do***	This section provides an activity which will help you transfer your new knowledge or skill into real life situations or concerns.
 ***Assessment***	This is a task which aims to evaluate your level of mastery in achieving the learning competency.
 ***Additional Activities***	In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned. This also tends retention of learned concepts.
 ***Answer Key***	This contains answers to all activities in the module.

At the end of this module you will also find:

References	This is a list of all sources used in developing this module.

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!

What I Need to Know

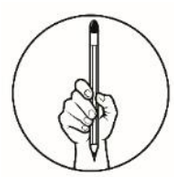
This module was designed and written with you in mind. It is here to help you master pressure, specific gravity, pressure and depth. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module is divided into three lessons, namely:

- Lesson 1 – Specific Gravity
- Lesson 2 – Pressure relationship with Force and Area , Fluid Density and Depth
- Lesson 3 – Pascal's Principle
- Lesson 4 – Archimedes Principle

After going through this module, you are expected to:

1. Relate density, specific gravity, mass, and volume to each other
2. Relate Pressure to area and force
3. Relate Pressure to fluid density and depth
4. State Pascal's principle in fluid pressure.
5. Apply Pascal's principle in analyzing fluids in various system;
6. Discuss the relationship of buoyant force to Archimedes principle.
7. Apply the concept of buoyancy and Archimedes principle;



What I Know

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. What is the S.I. unit of pressure?
   a. Ohms b. Pascal c. Joules d. Watts
2. Pressure exists when a force is _____ to the area which it is applied.
   a. Parallel c. Perpendicular
   b. The same direction d. All are correct
3. What is the unit of measurement of force?
   a. Dyne b. Kg c. Newton d. All of these
4. A force is a …
   a. Pull b. Push c. Both A and B d. None of these
5. What could be true to the resultant force applied on a system when it is to be in a state of balanced forces?
   a. Zero b. Infinite c.One d. None of these
6. What is the unit of measurement of density?
   a. grams/mL b. kg/L c.g/cubic cm. d. all are correct

7. What is the density of water?

a. 1 g /ml
b. 2g /ml
c. 3 g/cubic centimeters
d. 4 g /cubic centimeters

8. If a piece of wood floats on water, what must be its density compared to the density of water?

a. greater than b. equal c. less than d. the same

9. Which of the following is unit of measuring pressure?

a. Pa
b. mm Hg
c. N/m^2
d. All are correct

10. Which of the following materials is capable of exerting pressure?

a. air b. water c. substances d. all are correct

11. What would happen to a stone when placed on water?

a. It will float
b. It will sink
c. It cannot be determined
d. All are correct

12. Which of the following is less dense than water?

a. gold b. iron bar c. copper d. paper clip

13. Which of the following can be used to determine whether an object will float or sink on water?

a. mass
b. volume
c. density
d. specific gravity

14. If water is filled in a glass of water, which of the part of the bottle experiences the greatest pressure?

a. at the bottom
b. at the top
c. on its sides
d. all are correct

15. Which location should the water tank be constructed in order to supply household consumers?

a. At the ground level
b. below the ground level
c. highly elevated from the ground
d. all are correct

Lesson 1 Specific Gravity

After going through this lesson, you are expected to:

1. Relate density, specific gravity, mass and volume to each other.

What's In

Activity 1.1: Will it Sink or Float

Procedures:

1. The following materials or objects are commonly seen at home:
   a. plant leaf
   b. plastic bottle
   c. a piece of nail
   d. a ballpen
   e. a rubber band
   f. a bath soap
2. In the table below, put a check (√) on the column which do you think would happen if these objects will be placed on water.

Material	Sink	Float
A. Plant leaf		
B. Plastic bottle		
C. Nail		
D. Ballpen		
E. Rubber band		
F. Bath soap		

Guide Questions:

1. Which materials sink in water? Which materials float on water?
2. Which objects do you think have lesser density with water? greater density with water?

What's New

Activity 1.2: Tell Me: Will I Float or Sink?

Procedure:

1. The density of water is 1 g/ml, this density is constant at equilibrium state.
2. Other objects also have their distinct densities, this can be derived by dividing its mass in grams over its volume in mL, where 1 mL is equal to 1 cm^3. *If the specific gravity of an object is less than that of water, it will float on water, but if the specific gravity is greater than 1 it will sink in water.*
3. Look into each value of specific gravity of a given substance in the table. Determine which of these materials will float or sink in water by putting a check (√) on the appropriate column.

Substance	Specific Gravity	Float	Sink
1. Aluminum	2.72		
2. Alcohol	0.82		
3. Brass	8.48		
4. Carbon Dioxide	0.00198		
5. Lead	11.35		
6. Hydrogen	0.00009		
7. Steel	7.82		
8. Rubber	0.96		
9. Tin	7.28		
10. Paper clip	0.75		

Guide Questions:

1. Which objects will float on water? Which will sink?
2. What have you noticed with the specific gravity values of objects which float on water?
3. What have you noticed with the specific gravity values of objects which sink on water?

What is It

Specific Gravity Defined

The density of a substance is so important. We often want to compare the density of that substance with the density of another. Density (D) is the mass (or weight) per unit volume of a material at a given temperature. Typical units are: grams per cubic centimeter (g/cc or g/cm^3) kilograms per cubic meter (kg/m^3) pounds per cubic feet (lb/cu ft or lb/ft^3) pounds per cubic inch (lb/cu in or lb/in^3)

Specific gravity (sp gr) - AKA relative density. The ratio of the density of a material at a given temperature to the density of an equal volume of water at the same temperature. Remember, there is no unit of measure in specific gravity since it is a ratio.

Specific gravity (sp. gr.) is a ratio, expressed decimally, of the weight of a substance to the weight of an equal volume of a substance chosen as a standard, both substances at the same temperature or the temperature of each being definitely known.

Water is used as the standard for the specific gravities of liquids and solids; the most useful standard for gases is hydrogen, although sometimes air is used. It may be calculated by dividing the weight of a given substance by the weight of an equal volume of water that is:

$$\text{Specific gravity} = \frac{\text{weight of the substance}}{\text{weight of eaqual volume of water}}$$

Let us consider this as an example:

If 10 mL of sulfuric acid weigh 18 g, and 10 mL of water, under similar conditions, weigh 10 g, the specific gravity of the acid is:

specific gravity=18 (g)/10 (mL) = 1.8

Substances that have a specific gravity of less than 1 are lighter than water.

Substances that have a specific gravity greater than 1 are heavier than water.

Figure 5.1 depicts the layering of immiscible liquids due to their relative weights.

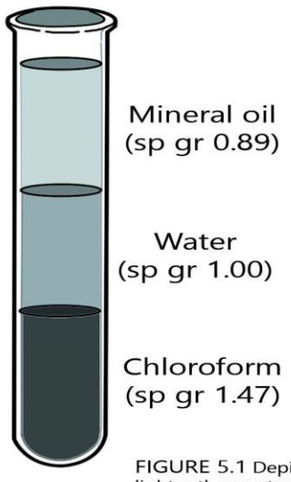


FIGURE 5.1 Depiction of layering of immiscible liquids in a test tube, mineral oil being lighter than water and chloroform being heavier.

What's More

Activity 1.3: Compute My Density

Direction: Using density as the basis in finding the value of specific gravity, solve the following problems.

1. What is the density of a rock with a volume of 15 cm^3 and a mass of 45 g?
2. From the beach, you want to bring home a boulder which is 30 centimeters by 27,000 cm^3. It is made of granite and has a typical density of 2.8 g/cm^3. How much is its mass in pounds?
3. You baked a cake that has a mass of 300 g and fits in a cake pan that is 30 by 10 by 6.0 centimeters cubed. What is the density of the cake?
4. A box of cough drops has a mass of 1.0 gram. Its dimensions are 1.0 by 5.0 by 8.5 centimeters cubed. It contains 30 cough drops, each of which has a mass of 2.2 grams. What is the density of the box when it is full of cough drops?
5. The density of gasoline is 721 kilograms per cubic meter. What is its specific gravity?

What I Have Learned

Activity 1.4: You Fill in My Blanks

The ratio of the mass of an object to the volume it occupies is its (1)_____. While the ratio of the density of a material compared to the density of water is called (2)_____ . The density of water is definitely _____ g/cm^3. Specific gravity can be obtained by dividing the density of the material over the density of (3)_____. One can tell whether the object may float or sink on water by knowing the specific gravity values, if the specific gravity of the object is lesser than 1 it will surely (4) _____ but when the specific gravity of the object is greater than 1 it will surely (5) _____ on water.

What I Can Do

Activity 1.5: Sink or Swim?

Materials:

2 small plastic cups, water, oil

Objects like – raisin, coins, paperclips, small cork or wood twigs

Procedures:

1. Fill in the first clear plastic cup with water up to ¾ full and the other with oil also up to ¾ full.
2. Gently set a raisin in each cup. Did it sink or float? Write down what happened to the raisin in each plastic cup.
3. Take the raisins out of the cups and try the other materials, such as a paperclip or cork. Record your observations.

Guide Questions:

1. Are your predictions correct?
2. Did the raisins and other objects sink or float as you expected them to?
3. Did they float in one liquid and sink in another?
4. Why do you think they acted the way they do?

Lesson 2 Pressure relationships with Force and Area, Fluid Density and Depth

After going through this lesson, you are expected to:

1. Relate Pressure to area and force.
2. Relate Pressure to fluid density and depth.

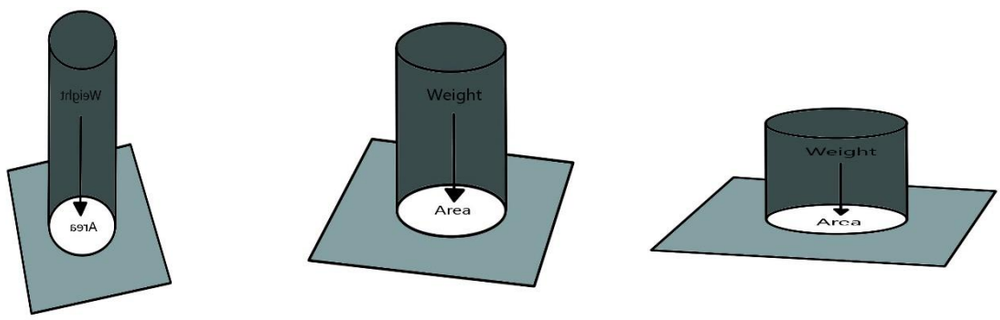
What's In

Activity 2.1: In Which Area?

Procedures:

1. The illustrations below demonstrate the varying amount of Pressure in an area as the same amount of force is exerted to it.
2. Arrange the following illustrations below from the lowest to the highest amount of Pressure experienced by an object by redrawing its proper order on your activity notebook.

A. B. C.



Guide Questions:

1. Which illustration has the lowest Pressure felt?
2. Which illustration has the highest Pressure felt?
3. What makes the Pressure felt in an area different?

What's New

Activity 2.2: Mysterious Eye Dropper

Materials:

• Two - liter bottle with cover • Eye dropper* • Water

Procedures:

1. Fill the eye dropper with water until it barely floats in an open container of water.
2. Fill the two - liter bottle almost completely full of water.
3. Lower the eye dropper into the two - liter bottle.
4. Tightly seal the two - liter bottle.
5. Squeeze the bottle.
6. Release the pressure on the two - liter bottle.

Guide Questions:

1. What happens to the dropper when it was filled into the two - liter bottle? Why?
2. What happens to the dropper after you squeezed the bottle? Why?
3. What is the role of the force exerted on the bottle to the floating and sinking of the eye dropper?

What is It

Pressure relationships with Force and Area

When you apply a force to a solid object, the pressure is defined as the force applied divided by the area of application. The equation for pressure is:

P = F/A where

- **P** is the pressure
- **F** is the applied force
- **A** is the surface area where the force is applied
- **F/A** is **F** divided by **A**

Pressure (P) is directly proportional to the force (F) Pressure (P) is inversely proportional to the area (A) Therefore, P=F/A, pressure is force per unit area and it's units are atm, bar, Pa (pascal), torr, kPa, etc.

Lesson 3 Pascal's Principle

After going through this lesson, you are expected to:

1. State Pascal's principle in fluid pressure.
2. Apply Pascal's principle in analyzing fluids in various system;

What's In

Activity 3.1: What Do You Think?

Direction: Read and analyze the given situation. Write your answer in your activity notebook.

1. Where is pressure greater, at the bottom of a swimming pool 4 feet deep or at The bottom of another swimming pool 6 feet deep? Explain your choice. You may back up your explanation with an illustration.

What's New

Activity 3.2: What Happened to Me

Direction: Refer to Figure 1. Analyze the figure and answer what is being asked.

Guide Question:

1. The water was poured from the top of the vertical tube, what happened to the barrel below when it was full of water?

_____

_____

_____

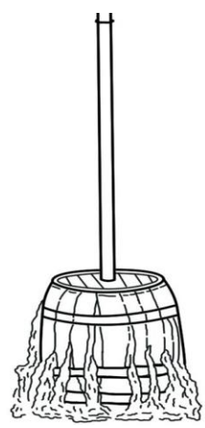


Figure – 1: Water is poured into the top of the vertical tube, the barrel begins to burst

What is It

Good day! Today we will learn about Pascal's Principle in fluid pressure. In hydraulic machines, difference in pressure is use as an advantage. It was the French scientist and mathematician, Blaise Pascal, who observed and explained the effect of

Exerting additional pressure on a non-compressible enclosed fluid at rest. Pascal noted that an increase in pressure (P) on one portion of the enclosed liquid will be transmitted everywhere throughout the fluid.

While when the weight of the fluid is not negligible, the pressure is not the same everywhere. In this case, analysis of the forces acting on the piece of fluid leads to a more general result called **Pascal's principle.**

Pascal's Principle states that, "A change in pressure at any point in a confined fluid is transmitted everywhere throughout the fluid."

Pascal's principle has many other applications such as the hydraulic brakes in cars and the hydraulic controls in airplanes, dentist's and Barber's chairs.

To analyze the forces in the hydraulic lift, let force F_1 be applied to the small piston of area A_1, causing a pressure increase:

$$\Delta P = \frac{F_1}{A_1}$$

Assuming that the two pistons to be at the same height, the force F_2 exerted by the fluid on the large piston is related to F_1 by

$$\frac{F_1}{A_1} = \frac{F_2}{A}$$

What's More

Activity 3.3: How much Force ?

Direction: Refer and follow the concept presented in the example 1 of «What is it» part of this module. Identify first the given and what is being asked on the problem before writing your formula and proceed to calculation.

The Hydraulic Lift

In a hydraulic lift, if the radius of the smaller piston is 2.50 cm and the radius of the larger piston is 30.0 cm, what weight can the larger piston support when a force of 310N is applied to the smaller piston?

Given: F_1= _____ r_1 = _____

F_2 = _____ r_2 = Solution:

Formula :_____

What I Have Learned

Activity 3.4: Complete Me

Direction: Fill in the blanks to complete the sentences of the paragraph.

Hydraulic machines use (1)_____ difference to advantage. It was French scientist and mathematician (2) _____, who observed and explained the effect of exerting additional pressure on a non-compressible enclosed (3) _____ at rest, such as water and oil. Pascal observed that an increase in pressure P on one side of the enclosed liquid will be (4)_____ undiminished to all portions of the liquid. This phenomenon is applied in several devices and machines such as the (5)_____ lift and the braking system of a vehicle.

What I Can Do

Activity 3.4: Let's Try This!

Direction: Identify the given data and what is being asked on the problem. Then, write the formula and proceed to calculation.

1. One master cylinder piston exerts a force of 5 newtons on the brake fluid. Assuming no loss due to friction, what is the magnitude of the force exerted by the wheel cylinders on each wheel? What retarding force acts on the whole car system?

Lesson 4 Buoyancy and Archimedes' Principle

After going through this lesson, you are expected to:

1. Discuss the relationship of buoyant force to Archimedes principle.
2. Apply the concept of buoyancy and Archimedes principle.

What's In

Activity 4.1: Review Me!

Direction: Apply Pascal's principle discussed in the previous lesson on the given problem. Write your answer in a separate sheet of paper.

To analyze the forces in the hydraulic lift (Pascal's principle), let F_1 be applied to the small piston of area A_1, causing a pressure increase. In symbol,

$$\Delta P = \frac{F_1}{A_1}$$

where ΔP = change in pressure
F_1 = force applied to the small piston
A_1 = area of the small piston

Consider this problem:
1. A pressure of 1500 Pascal (P_a) is transmitted through out a liquid column due to a force being applied on a piston. If the piston has an area of $0.1m^2$, what is the force applied?

Note: This can be calculated using Pascal's law, F= PA
Where, F = force applied P = pressure transmitted through out a liquid
A = area of the piston

a. identify the given: b. Solution:

Guide Questions:

1. Did the object hit the floor at the same time?

2. What could be the reason having the same or different time of hitting the floor?

What's New

Have you experience lifting a person or heavy object in a swimming pool and realizing that it is easy to lift that person/object than in the seashore?

Story Time

In the year 287 to 212 BCE, a Greek Scholar named Archimedes has a famous story about a Crown. He was given the task of determining whether a gold crown made for the king was pure gold or contained a quantity of silver. Legend has it that the solution came to him when he took a bath on a bathtub full of water.

When he immersed himself to the tub he noticed that the water overflowed the tub. It is said that Archimedes was so excited that he ran home(unclothed) shouting on the streets of the city shouting "Eureka! Eureka!" in Greek for "I have found it!"

To prove his point, quantities of pure gold and silver equal in weight to the King's crown were each put into bowls filled with water, and the silver caused more water overflow. When the crown was tested, more water overflowed than for the pure gold, which implied some silver content. Archimedes' solution to the problem involved density and volume, but it may have gotten him thinking about buoyancy.

What is It

Good day! Today we will take a look at another common force associated with fluids. Unlike solids, fluids can flow so liquids such as water and blood and the gases are fluids.

Why do some objects float in water and why some sink? Objects float in fluids because they are buoyed up. What does it mean?

Example, if you immerse a cork in water and release it the cork will go up and float in the water, it means the cork will be buoyed up to the surface and remain there.

From our knowledge of forces, we learned that such motion requires an upward net force. For an object to come to the surface, there must be an upward force acting on it that is greater than the downward force of its weight. When the object is floating, these forces must balance each other (the object is in equilibrium-zero net force). The upward force resulting from an object being wholly or partially immersed in a fluid is called the *buoyant force.* The nature of this force is summed up by *Archimedes' principle* which states that, "An object totally or partially submerged in a fluid experiences a buoyant force equal in magnitude to the weight of the volume of fluid that is displaced(fluid overflowed from the container if the container is full but if the container is not full, the fluid displaced is the increase in the volume of the fluid/liquid).

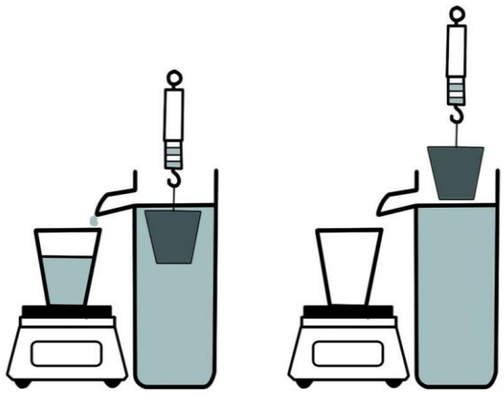


Fig. 1: Weight of water displaced

If the water displaced is weighed in weighing scale that will give you its mass in grams or in kilograms such as 2kg, get its weight by using the formula,

Weight = mass x acceleration due to gravity or Wt = mg

Where g = 9.8m/s^2

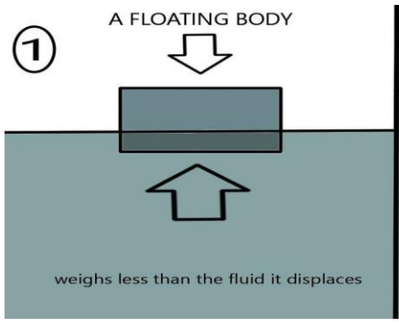
Wt = mg = (2kg)(9.8m/s^2) = 19.6 kg. m/s^2 = 19.6 newton (N)

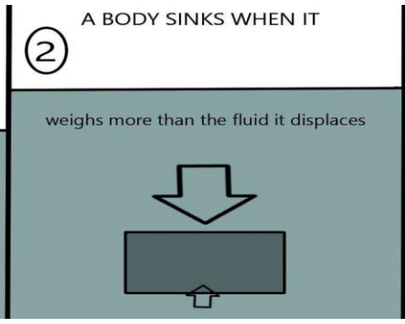
So, the weight of your 2kg displaced water is 19.6N

We can see from Archimedes' principle that the buoyant force depends on the weight of the volume of fluid displaced. Whether an object will sink or float depends on the density of the object (ρ_o) relative to that of the fluid(ρ_f).

There are 3 conditions to consider:

1. An object will float in a fluid if its average density is less than the density of the fluid.(object is less dense than the fluid).
2. An object will sink if its average density is greater than the density of the fluid.
3. An object will be in equilibrium at any submerged depth in a fluid if the average density of the object and the density of the fluid are equal.





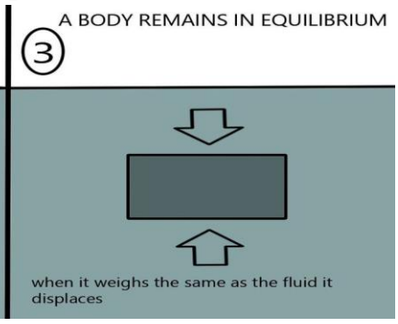


Figure 2.7: for condition 1 Figure 2.8: Condition 2 Figure 2.9: Condition 3

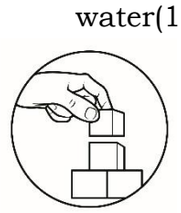
- If the buoyant force is greater than the object's weight, the object will rise to the surface and float.
- If the buoyant force is less than the object's weight, the object will sink.
- If the buoyant force equals the object's weight, the object will remain suspended at that depth.
- The buoyant force is always present in a fluid, whether an object floats, sinks or remains suspended.

The net force due to gravity and buoyancy acting on an object totally or partially immersed/submerged in a fluid is $\mathbf{F = mg + F_B}$

Where: F = net force acting on the object
m = mass of the object
g = acceleration due to gravity
F_B = buoyant force

Note to Remember:

- The buoyant force is equal in magnitude (amount) to the weight of the volume of fluid an object displaces.
- An object with an average density greater than $1.0g/cm^3$ or $1kg/m^3$(the density of water) will sink in water, if it is less than the density of water($1.0g/cm^3$) the object will float.



What's More

Activity 4.2: Explain to Me!

Direction: Explain briefly what is being ask. You may research on the internet for your answer.

1. A 2.0lb piece of iron or steel readily sinks in water, yet Ocean Liner made of iron and steel weigh thousands of tons float in the ocean. Why?

Activity 4.3: You Complete Me!

Direction: Fill in the blanks to complete the sentence.

1. The upward force resulting from an object being wholly or partially immersed in a fluid is called the _____.
2. An object will_____ in a fluid if its average density is _____ the density of the fluid.
3. An object totally or partially submerged in a fluid experiences a buoyant force equal in magnitude to the weight of the volume of_____ that is displaced.
4. An object will sink if its average density is _____ the density of the fluid.
5. A fluid exerts an upward _____ on a submerged object_____ in magnitude to the weight of the volume of fluid displaced by the object.

What I Can Do

Activity 4.4 : Let's Try it!

Direction: Do the procedure given below, record your observation and answer the guide questions in your activity notebook.

Procedures:

1. Choose any irregular object available in your surroundings like stone, nail, etc. (smaller than your container), transparent glass, measuring cup available in your home, digital weighing scale(if available) .
2. Full glass with water and drop your object inside the glass with full of water (see to it that you have another container to catch the overflowed water). Record what will happen.
3. Measure the volume of water that had overflowed using the measuring cup available in your home or you may borrow from your neighbor.
4. Weigh the water that had overflowed using a weighing scale. You may request your parents to weigh it in the market using a digital weighing scale if possible.

Guide Questions:

a. What is the volume of your object? How did you find its volume?

b. What is the weight of the water displaced (overflowed water from the container)?

c. How much do you think is the buoyant force exerted by the water to your irregular object?

Assessment

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. The ratio of force, acting perpendicular to the area, on which it acts known as…
   a. Friction b. Pressure c. Force d. Density
2. The pressure of the water at the bottom of the pond is …… at the surface of the pond.
   a. Higher than b. Same c. Lower than d. either lower or higher
3. As we go to higher altitude, the atmospheric pressure …….
   a. Decreases c. Increases
   b. Remains same d. Cannot say
4. Barometers modified to measure the height above the sea level are called
   a.Altimeters c.Sphygmomanometers
   b.Manometers d.Hydrometers
5. What is the cause of change in motion or change in state of motion?
   a. Atmospheric Pressure c. Pressure
   b. Friction d. Force
6. Which fluid principle states that, a change in pressure at any point in a confined fluid is transmitted in all directions throughout the fluid.
   a. Archimedes' b. Bernoulli's c. Buoyant d. Pascal's
7. Which term defined as the sum of forces due to fluid pressure.
   a. Buoyant force b. net force c. Resultant force d. Pressure
8. Which fluid mechanics principle states that, a fluid exerts an upward buoyant forceon a immersed object the same in magnitude to the weight of the volume of fluid displaced by the object.
   a. Archimedes' b. Bernoulli's c. Buoyancy d. Pascal's
9. Which of the given mathematical expressions can be used to find the magnitude of the buoyant force?
   a. $F_B = \rho gV$ b. $F_B = mgV$ c. $F_B = gAd$ d. FB =ρmV
10. A paper boat floats in a swimming pool. Which volume does the buoyant force exerted on the paper boat depend on?
    a. water in the pool c. the water displaced
    b. the pool d. the toy under water
11. If an object submerged in a liquid displaces a volume of liquid equal to its weight and is then release, what will the object do?
    a. goes up to the surface c. sink
    b. remain at its submerged position d. nothing happened.

12. What working principle is behind sprayers such as the one the farmers are using in their farm or the one you are using to spray insects?
    a. Archimedes' b. Bernoulli's c. Buoyancy d. Pascal's
13. Which of the following concepts is the application of Archimedes' principle?
    a. How insects can walk on the surface of a pond.
    b. Stream of water is narrower where the flow speed is faster.
    c. Ship floats, the buoyant force acting on the ship is equal to ship's weight.
    d. Fluid flows faster where the pressure is lower.
14. Which fluid mechanics principle explained in terms of the law of conservation of energy?
    a. Archimedes' b. Bernoulli's c. Pascal's d. Poiseuille's
15. A toy robot floats in a swimming pool. Which volume the buoyant force exerted on the toy robot depends on?
    a. water in the pool c. the water displaced
    b. the pool d. the toy under water

Additional Activities

Activity 4. 5 – Blow!

Direction: Read, understand and follow the given procedure below. Write your observations/answers in your activity notebook.

Procedure:

1. Fold a piece of paper in ½ lengthwise and make a paper tent.
2. Predict what will happen when you blow the paper tent. Will it appear to get larger? Will it remain the same?(nothing happened)?, or will it bend down toward the table?
3. Alternately turn the paper tent upside down and blow through the V-shaped paper. What have you noticed? Does it flatten? Why?
4. You may repeat the procedure 1,2 & 3 as much as you can to have a reliable observation.

Guide Question:

1. Which of the three principles of fluid mechanics explains your observation? Explain why.

Answers Key

Lesson 1: Specific Gravity

What's I Know

1. b
2. c
3. c
4. c
5. a
6. d
7. a
8. c
9. d
10. d
11. b
12. c
13. d
14. a
15. c

What' In

1. **A.Plant leaf-float**
B.Plastic bottle-float
C.Nail-sink
D.Ballpen-float
E.Rubber band-float
F.Bath Soap-sink

Guide questions:
1.Sink- nail, bath soap
Float-plant leaf, plastic bottle, ball pen, rubber band
2. -Materials with lesser density will float
- Materials which are denser with water sink

What's New

1.Aluminum- Sink
2.Alcohol – Float
3.Brass – Sink
4.carbon dioxide– Float
5.lead – Sink
6.Hydrogen – Float
7.Steal – Sink
8.Rubber – Float
9.Tin – Sink
10.Paper Clip – Float

Guide Question:
2. Specific Gravity of materials that float is less than 1.
3. Specific Gravity of material that sink is greater than 1.

What's More

1. 3 g/cm^3
2. 166.32 lbs
3. 0.166 g/cm^3
4. 1.57 g/cm^3
5. 721

What's More

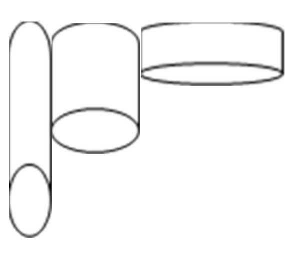
1.Density
2.Specific Gravity
3.Water
4.Float
5. Sink

Lesson 2: Pressure Relationships with Force and Area, Fluid Density and Depth

What's In

Activity 2.1

3. Redrawn :



1. C
2. A
3. Area

What's New

Activity 2.2

Guide Questions:

1. Eye dropper – Floats
2. Eye Dropper – Sinks
3. Force by squeezing increases the pressure on the dropper

Lesson 3: Pascal's Principle

What's In
Activity 3.1

1. **Pressure is greater at the bottom of a swimming pool 6ft deep -** The pressure exerted by the liquid at the bottom of its container depends on the depth of the liquid and not on the amount. The deeper you are in the swimming pool, the greater water pressure you will experience

What's New

Activity 3.2: What Happened To Me!

1.Pascal's law was discovered during an experiment that was allegedly performed by Blaise Pascal in 1600's. A 10 m long pole was vertically inserted into a barrel that was filed with water. As the water was poured into the vertical tube, Pascal noticed that the pressure from the water caused the barrel to burst.

What I have Learned Activity 3.3

1. pressure
2. Blaise Pascal
3. fluid
4. transmitted
5. hydraulic

Lesson 4 Buoyancy and Archimedes' Principle

What's In

Activity 4.1: Review Me!

1. $F = PA = (1500Pa)(0.1m^2)$

F = 150N

since $Pa = N/m^2$, so we can cancel the m^2

What's More

Activity 4.2 – Explain to Me

Answer: Because an Ocean Liner floats, its average density must be less than that of the seawater. An ocean liner is made of iron and steel but overall most of its volume is occupied by air. Thus, its average density is less than that of seawater. Displacing a large amount or volume of water, it floats. Similarly, the human body has air-filled spaces, in particular the lungs,so we can float in the water.

What I have Learned

Activity 3.3: You Complete Me

1. buoyant force
2. float – less than
3. fluid
4. greater than
5. buoyant force - equal

References:

2020. [online] Available at: <https:// www.engineeringtoolbox.com> [Accessed 16 December 2020].

2020. [online] Available at: <https://www.mcqslearn.com>mcq> [Accessed 16 December 2020].

2020. [online] Available at: <https://lumenlearning.com/> [Accessed 16 December 2020].

Byjus.com. 2020. *GDPR*. [online] Available at: <https://byjus.com/physics/properties-of-fluids/> [Accessed 16 December 2020].

Byjus.com. 2020. *GDPR*. [online] Available at: <https://byjus.com/physics/archimedes-principle/> [Accessed 16 December 2020].

College of Engineering & Applied Science. 2020. *Meet The Outstanding Graduates Of Fall 2020*. [online] Available at: <https://www.colorado.edu/engineering/meet-outstanding-graduates-fall-2020> [Accessed 16 December 2020].

dummies. 2020. *Dummies - Learning Made Easy*. [online] Available at: <https://www.dummies.com/> [Accessed 16 December 2020].

Encyclopedia Britannica. 2020. *Archimedes' Principle | Description & Facts*. [online] Available at: <https://www.britannica.com/science/Archimedes-principle> [Accessed 16 December 2020].

Encyclopedia Britannica. 2020. *Pascal'S Principle | Definition, Example, & Facts*. [online] Available at: <https://www.britannica.com/science/Pascals-principle> [Accessed 16 December 2020].

Encyclopedia Britannica. 2020. *Pascal'S Principle | Definition, Example, & Facts*. [online] Available at: <https://www.britannica.com/science/Pascals-principle> [Accessed 16 December 2020].

physicsabout. 2020. *Applications Of Pascal Law In Daily Life*. [online] Available at: <https://physicsabout.com/pascal-law/> [Accessed 16 December 2020].

Tunnel, W., 2020. *Windy Tunnel - Activity*. [online] TeachEngineering.org. Available at: <https://www.teachengineering.org/activities/view/cub_airplanes_lesson02_activity1> [Accessed 16 December 2020].

EDITOR'S NOTE

This Self-learning Module (SLM) was developed by DepEd SOCCSKSARGEN with the primary objective of preparing for and addressing the new normal. Contents of this module were based on DepEd's Most Essential Learning Competencies (MELC). This is a supplementary material to be used by all learners of SOCCSKSARGEN Region in all public schools beginning SY 2020-2021. The process of LR development was observed in the production of this module. This is version 1.0. We highly encourage feedback, comments, and recommendations

For inquiries or feedback, please write or call:

Department of Education – SOCCSKSARGEN
Learning Resource Management System (LRMS)

Regional Center, Brgy. Carpenter Hill, City of Koronadal

Telefax No.: (083) 2288825/ (083) 2281893

Email Address: region12@deped.gov.ph