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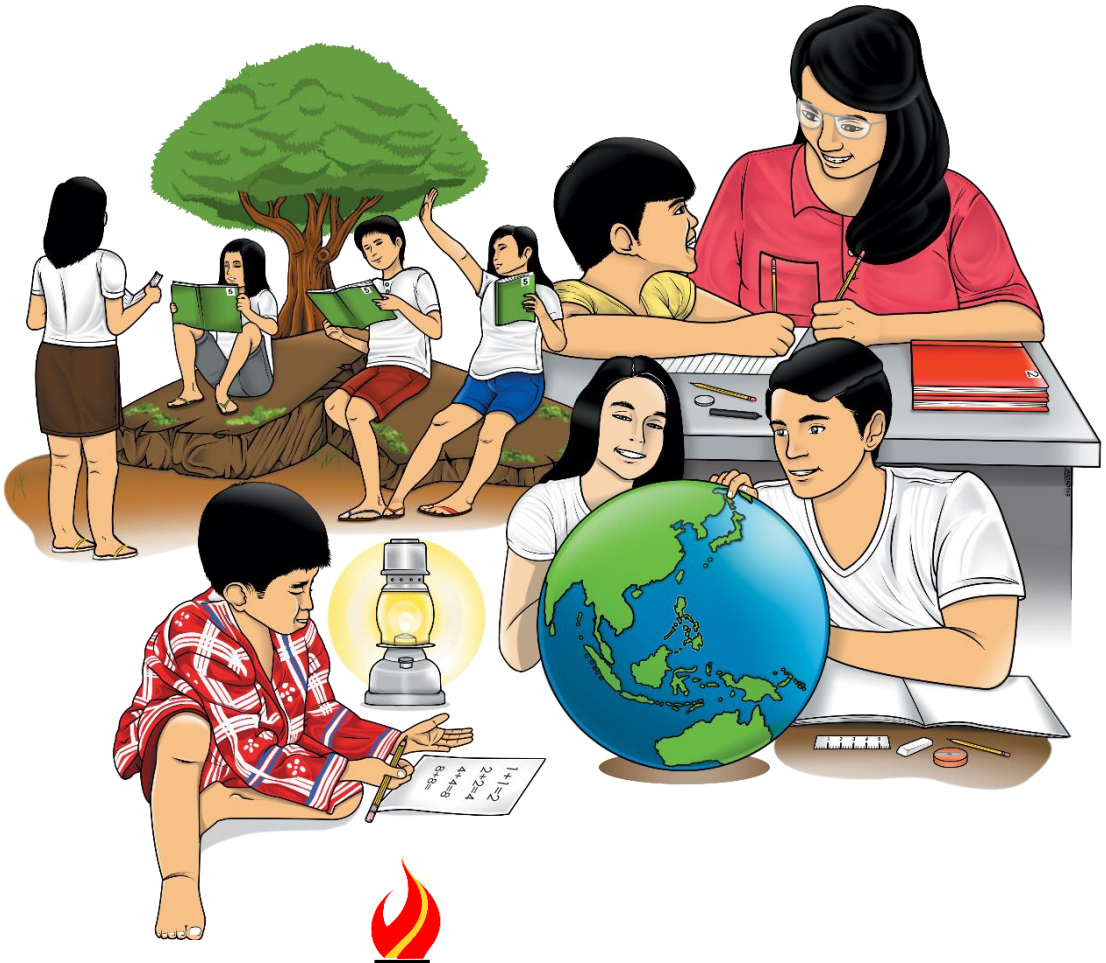
Science

Quarter 3 – Module 1A:
Gravity



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Science

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Gravity

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

This module was designed and written with you in mind. It is here to help you to infer how gravity affects movements of different objects (S6FE-IIIa-c-1). The scope of this module permits it to be used in different learning situations. The language used recognizes the diverse vocabulary level of learners. 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.

This module is divided into the following lessons:

- **Lesson 1** – Describe Gravity
- **Lesson 2** – How Gravity Affects Movement of Objects

After going through this module, you are expected to:

1. describe gravity;
2. explain how gravity affects movement of different objects;
3. identify the factors affecting the motion of falling objects;
4. demonstrate how the movement of moving objects are affected by gravity; and
5. explain how gravity affects the motion of objects around you.

What I Know

Directions: Infer how gravity affects movements of different objects. Read and answer the questions below. Write the letter of your answers on a separate sheet of paper.

1. Which force does NOT act on falling leaves?
   A. friction
   B. gravity
   C. magnetic
   D. air resistance

2. Which effect does gravity have on how high a person jumps?
   A. The weaker the gravity, the lower the jump.
   B. The weaker the gravity, the higher the jump.
   C. The stronger the gravity, the higher the jump.
   D. Gravity does not influence how high a person jumps.

3. Which of the following objects would have the greatest gravitational pull exerted on another object on earth?
   A. sun
   B. moon
   C. stone
   D. earth

4. Which of the following is an example of resisting gravity?
   A. a rock rolling down a hill
   B. a coconut falling from a tree
   C. pouring water into the glass
   D. an airplane taking off from the ground

5. What is the direction of gravity between two objects?
   A. sideways
   B. toward each other
   C. away from each other
   D. perpendicular to each other

6. What happens to the gravitational attraction between objects when the distance between them is increased?

   A. lesser
   B. nearer
   C. farther
   D. greater

7. In which heavenly body will an object hit its surface last when dropped at the same height and the same time?
    A. Earth
    B. moon
    C. Jupiter
    D. Saturn

8. Three 1-kg stones are thrown upward at the same height and the same time in different places, moon, earth, and Jupiter. In which place will the stone hit the ground first?
    A. moon
    B. Earth
    C. Jupiter
    D. meteor

9. Which action opposes gravity?
    A. skating downhill
    B. dropping a stone into a pond
    C. hammering a nail into a wooden plank on the floor
    D. lifting a box from the floor and placing it on top of the table

10. Which object has the weakest gravitational pull?
    A. fist-sized rock
    B. piece of paper
    C. huge truck
    D. the moon

Lesson 1

Describe Gravity

The theory of gravity was proposed by Sir Isaac Newton in 1687 in his book *Principia Mathematica*. He saw an apple falling from a tree, and it got him thinking about the mysterious force that pulls objects to the ground. Newton named this mysterious force "gravity".

Gravity puts all things on Earth and the universe in order. Cars, water in the ocean, rocks, houses, tables, chairs, plates, appliances, and other things stayed on its place. They do not float away. Gravity helps keep the planets orbiting around the sun and moons revolving around the planets. Objects that are thrown upward on Earth eventually fall down. This is because the Earth is exerting an attractive force on us and to all things around us.

Without gravity, everything on the Earth's surface will float in the atmosphere, just like astronauts floating in their spaceship. While traveling in the outer space, sun, planets and other heavenly bodies in the solar system will bump at each other. Stones thrown upward will never fall down.

Thank you, gravity!

What's In

Determine if gravity is acting on the object from the pictures. Analyze them carefully. Answer the questions that follow.

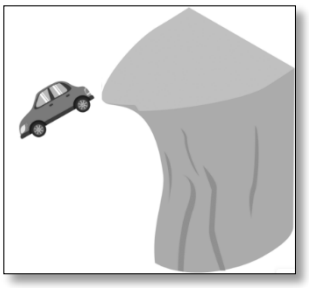


Figure 1. A car falls from a cliff.

Figure 2. An astronaut experiencing weightlessness in space.

Photo credit to https://www.canva.com

1. Is gravity acting on the car that falls off a cliff (Figure 1)? _____
2. Is gravity acting on the astronaut experiencing weightlessness in space (Figure 2)? _____

What's New

Activity 1: THE FALL

After this simple activity, you will be able to describe gravity.

You will need any handy object (ball/notebook/small stone or crumpled paper).

Instructions:

1. Get any handy object near you. Raise the object at a certain height, as shown in Figure 3 below.

Figure 3. Raising an object to a certain height

Illustrated by Ryan Oliver S. Arellano

2. Quickly release the object. Observe what happens to the object. Repeat the step two more times and observe.

3. Using the same object, throw it upward, as shown in Figure 4 below. Observe what happens to the object. Repeat the step two more times and observe.

Figure 4. Throwing an object up

Illustrated by Ryan Oliver S. Arellano

Answer the questions below by writing the letter of the correct answer. Write the letter of your answers on a separate sheet of paper.

1. In Figure 3, what happened to the object when it was released?

   A. It fell to the ground.

   B. It floated in the air.

2. In Figure 4, what happened to the object after it was thrown upward?

   A. It flew up and eventually falls after some time.

   B. It flew all the way into the air and never fell back.

3. Based on the two activities, what was common in what happened to the objects?

   A. The objects fell to the ground.

   B. The objects stayed in the air.

4. Why did the objects behave the way they did in the two activities?

   A. Gravity pulls the object downward.

   B. Air pulls the object downward.

5. How do you describe gravity?

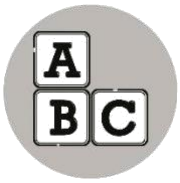
   A. Gravity is a force that pulls objects towards each other.

   B. Gravity is a force that keeps objects float in the air.

What is It

In **Activity 1**, whether the object is dropped or thrown upward, the object tends to go back to the ground. There is a force that pulls all objects towards the ground. This force is called gravity or also known as the **gravitational force.**

Gravity is a force of attraction that exists between any two objects. This gravitational force between the two objects acts towards each other. The two objects are attracting or pulling one another towards each other. Also, there is a gravitational force between Earth and us, between two people, between two marbles, and even between two atoms or particles.



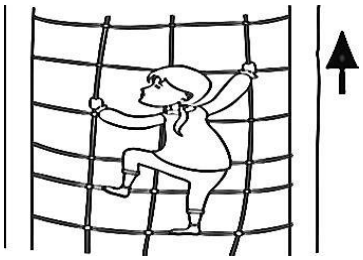
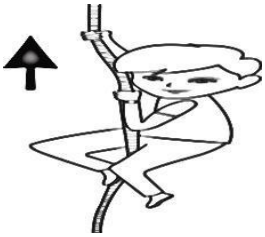
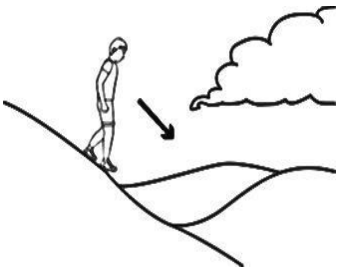
What's More

Directions: Read the following items carefully and tell whether the statements are True or False. On your answer sheet, write **True** if the statement is correct and **False** if the statement is incorrect.

Statements	True or False
1. All objects on Earth fall towards the center of the Earth.	
2. Gravity is the attraction of two objects towards each other.	
3. Gravitational force on Earth pulls all things on Earth downward.	
4. An Object remains on air when it is thrown upward.	
5. Gravity only affects solid objects.	

Activity 2: Towards or Against Gravity

Directions: Examine the following pictures. Write Against if the picture illustrates moving *against* gravity and Towards, otherwise. Write your answers on your answer sheet.

Illustration	Moving ***against*** or towards Gravity
1. 	
2. 	
3. 	
4. 	
5. 	

Illustrated by Raymond Michael A. Gayatin

What I Have Learned

Directions: Complete the following statements by choosing the word that best completes the following sentences. Write the words you have chosen on your answer sheet.

I learned that:

1. (**Gravity, Air**) is a force that pulls all objects downward or towards the center of the Earth.

2. Gravity is a force of (**attraction, repulsion**) that exists between two objects which act towards each other.

3. Earth's (**mass, gravity**) keeps us and all objects on the ground.

4. Gravity is a (**force, energy**) that affects all objects in the universe.

What I Can Do

Directions: Draw a simple illustration of what will happen around us if there is no gravity. Write your answers on your answer sheet.

Assessment

Directions: Infer how gravity affects movements of different objects. Read and answer the questions below. Write the letter of your answers on a separate sheet of paper.

1. Why does a ball thrown into the air tend to fall back to the ground?
   A. Gravity causes the ball to fall.
   B. The air pulls the ball to the ground.
   C. Acceleration causes the ball to move faster.
   D. The mass of the ball causes the ball to drop.

2. What is the direction towards which objects on Earth are pulled by the Earth?
   A. back
   B. center
   C. front
   D. side

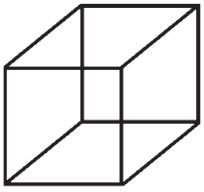
3. In order to jump, what force do we need to overcome?
   A. friction
   B. gravity
   C. mass
   D. wind

4. Which will happen if a ball is thrown upward?
   A. The ball remains in the air.
   B. The ball moves in a curve path.
   C. The ball will go back to the ground.
   D. The ball continues to move upward.

5. Based on the figure below, to which direction should the force be applied to overcome the force of gravity?

A. 

B. 



C. 

Illustrated by Raymond Michael A. Gayatin

D. 

6. Imagine the Earth lost its gravity. What will happen to objects on it?
   A. All objects will float in the air.
   B. All objects will fall on the ground.
   C. Everything will just stay in place.
   D. Only the lighter objects will float in the air.

7. Which of the following keeps all objects on Earth stay on the ground?
   A. energy
   B. gravity
   C. mass
   D. speed

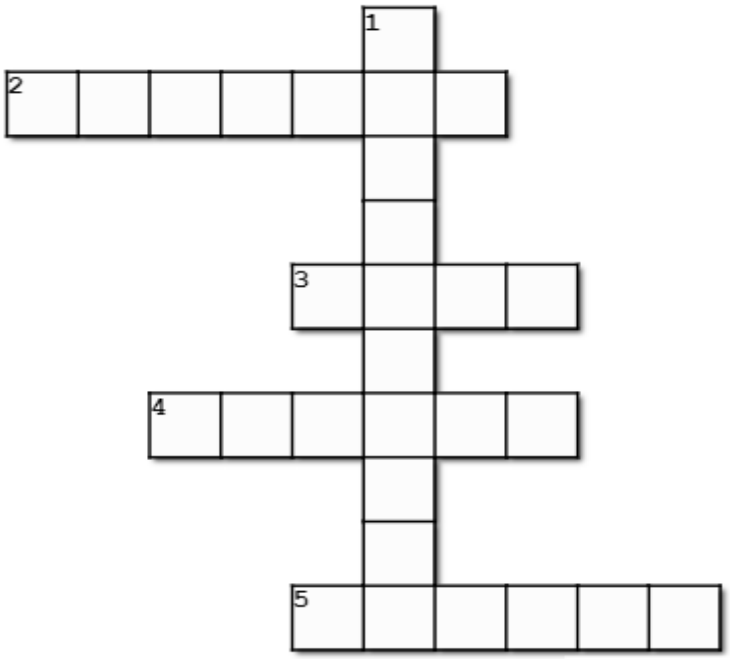
8. How will planets move if there is no gravity in the universe?
   A. Nothing will happen.
   B. Planets will stay in orbit.
   C. Planets will not be attracted to each other.
   D. All planets will move to the eastern direction.

9. Who discovered gravity when he saw an apple falling to the ground?
   A. Albert Einstein
   B. Galileo Galilei
   C. Isaac Newton
   D. Nicholas Copernicus

10. Gravity affects all objects in the universe.
   A. true
   B. false
   C. maybe
   D. it depends

Additional Activities

Directions: Read the clues in the box and fill in the puzzle below. Write only one letter of the word per box.Write your answers on a separate sheet of paper.



Down

1. Gravity is an _____ force.

Across

2. The force of _____ causes objects on earth to fall to the ground.
3. Anything that has _____ possesses gravity.
4. Gravity pulls objects toward the _____ of the earth.
5. He discovered gravity when he saw a falling apple.

Lesson 2 How Gravity Affects Movement of Objects

In the previous lesson, you have learned that gravity is a force of attraction that exists between any two objects. These two objects are pulling one another towards each other. Does gravity affect moving objects?

In this lesson, you will learn how gravity affects the movement of objects.

What's In

Directions: Read the following items carefully and tell whether the statements are True or False. Write **TRUE** if the statement is correct and **FALSE** if it is wrong. Write your answers on your answer sheet.

_____1. Gravity is a force pulling two objects towards each other.

_____2. Gravity keeps all objects on Earth on the ground.

_____3. An object thrown upward flies upward and never comes back.

_____4. Only bigger objects have gravity.

_____5. Gravitational force is always an attractive force.

What's New

In the activity on Lesson 1, you have observed that when an object is thrown upward, after reaching a certain height, it goes down. You have learned that gravity pulls the object down until it reaches the ground. In this activity, you will observe and describe motion of an object thrown upward.

Activity 1: A Great Come Back

You will need a crumpled paper (or any light object).

Instruction:
1. Prepare a crumpled paper.
2. Throw it upward. Please see Figure 1.
3. Observe the movement or motion of the crumpled paper while going up and down.
4. Repeat the procedure until you get a clear observation of the paper's motion.

Figure 1. Throwing an object up

Illustrated by Ryan Oliver S. Arellano

Answer the questions below. Choose the correct answer.

1. What can you say about the movement or motion of the crumpled paper as it goes up?
   A. The crumpled paper moves faster as it goes up.
   B. The crumpled paper slows down as it goes up.

2. What did you observe about the movement or motion of the crumpled paper as it goes down?
   A. The crumpled paper moves faster as it goes down.
   B. The crumpled paper slows down as it goes down.

3. How does gravity affect the movement or motion of the crumpled paper as it goes upward?
   A. Gravity increases the motion of crumpled paper as it goes up.
   B. Gravity slows down the motion of crumpled paper as it goes up.

4. How does gravity affect the movement or motion of the crumpled paper as it goes down?
   A. Gravity increases the motion of crumpled paper as it goes down.
   B. Gravity slows down the motion of crumpled paper as it goes down.

What is It

Earth's gravity pulls all objects down towards its center regardless of the objects' position or state of motion. Thus, gravity affects the movement of all objects on Earth and the universe as a whole.

In the activity, gravity affects the movement or motion of the crumpled paper as it moves up and down. As the object goes up, the movement of the crumpled paper slows down because gravity pulls it towards the ground. The direction of the gravitational force is towards the ground opposite the direction of the paper's motion, which is upward. As the object goes down, the movement or motion of the crumpled paper increases or becomes faster because the Earth pulls the paper in the same direction of the paper's motion.

As a summary, if the object moves opposite the direction of gravity, it slows down, but if the object moves in the same direction of gravity, it moves faster.

What's More

Activity 2: Big and Strong

Gravity is the universal force that affects all objects in the universe. It holds together the entire solar system, the Milky Way galaxy and other galaxies. It is the same force that keeps the planets revolving around the sun and the moon orbiting the earth.

Study Table I below.

Table I: Values of Mass and Acceleration due to gravity, Gravitational Force of Moon, Earth, and Jupiter, and Object's Motion

Heavenly Body	Mass (x 10^{24} kg)	Acceleration Due to gravity (m/s^2)	Gravitational Force (x10^{23} N)	Movement of Object A on the heavenly body
Moon	0.0736	1.62	1.1776	Slow
Earth	5.9720	9.80	585.2560	Fast
Jupiter	1900.0000	25.95	493,050.0000	Fastest

I. Based on **Table I**, answer the questions below by choosing the heavenly body from the heavenly bodies listed in the box. Write your answers on your answer sheet.

Moon	Earth	Jupiter

1. Which heavenly body has the smallest mass?
2. Which heavenly body has the greatest mass?
3. Which heavenly body has the smallest value of gravitational force?
4. Which heavenly body has the biggest value of gravitational force?
5. On which heavenly body does object move slowest?
6. On which heavenly body do objects move fastest?

II. **Directions**: Answer the following questions. Write your answers on your answer sheet. For numbers 1 to 4, choose your answers from the word list in the given box.

fast	slow	strong	weak

1. If the mass of the object is small, the gravitational force is _____.
2. If the mass of the object is big, the gravitational force is _____.
3. If the gravitational force on a heavenly body is weak, the movement or motion of object dropped is _____.
4. If the gravitational force on a heavenly body is strong, the movement or motion of the object is _____.

For numbers 5 and 6, choose the correct word from the parentheses.

5-6. What is the effect of mass on the gravity or gravitational force of an object?

5. If the mass of an object is (**bigger, smaller**), the gravity or gravitational force is (**stronger, weaker**).
6. **Conclusion:** Make your conclusion by choosing the correct word from the parentheses. If the gravity or gravitational force between two objects is (**stronger, weaker**), the movement or motion of the object is (**faster, slower**).

What I Have Learned

Directions: Complete the following statements by choosing the word that best completes the following sentences from the parenthesis per item. Write the words you have chosen on your answer sheet.

Choose the correct answer.

I learned that:

1. Gravity (**increases, decreases**) the motion of objects going down.

2. Gravity (**increases, decreases**) the motion of objects going upward.

3. Gravity is (**greater, lesser**) if the mass of the object is (**bigger, smaller**).

4. If gravity between two objects is (**greater, lesser**), the movement or motion of the object is (**faster, slower**).

What I Can Do

Activity 3: Gravity in Action

A. **Directions:** Read and analyze the scenario given below. Answer the question and write your answer on your answer sheet.

A stone is dropped from a height of 20 meters on the Earth's surface, and an identical stone is dropped from the same height at the same time on the moon. Which stone will hit the ground first - the stone on Earth or the stone on the moon? Select your answer below.

a. The stone dropped on the Earth will fall faster because the Earth has bigger gravity than the moon.

b. The stone dropped on the moon will fall faster because the moon has smaller gravitation or gravity than the Earth.

B. **Directions:** Read the following items carefully and tell whether the statements are True or False. On your answer sheet, write True if the statement is correct and False if the statement is incorrect.

_____1. Gravity is a force that pulls all objects on Earth, towards the Earth's center.

_____2. Objects with greater gravitational pull slow down the movement or motion of another object near it.

_____3. Objects with more mass have greater gravity (or gravitational pull) than those of less massive objects.

_____4. An object that is thrown up and moves away from the Earth, slows down.

_____5. An object that is dropped from the top of a building and moves towards the Earth, speeds up.

Assessment

Directions: Infer how gravity affects movements of different objects. Read and answer the questions below. Write the letter of your answers on a separate sheet of paper.

1. How do you describe the gravity that an object on earth experiences if its mass is greater?
    A. farther
    B. greater
    C. lesser
    D. smaller

2. Which of the following keeps all objects on the ground?
    A. acceleration
    B. friction
    C. gravity
    D. inertia

3. Which characteristic of an object affects its gravity?
    A. color
    B. mass
    C. position
    D. shape

4. How does gravity affect the movement of falling objects?
    A. It increases the movement of falling objects.
    B. It slows down the movement of falling objects.
    C. It does not affect the movement of falling objects.
    D. It neither slows down nor increases the movement of falling objects.

5. Which of the following is NOT true about gravity?
    A. It is an attractive force.
    B. It slows down the movement of falling objects.
    C. It pulls the two objects toward each other.
    D. It is the force that keeps all planets on its orbits.

6. How does gravity affect the motion of objects moving upward?
    A. It slows down the motion of objects.
    B. It increases the motion of the objects.
    C. It does not affect the motion of objects.
    D. It neither slows down nor increases the motion of objects.

7. When a rock is dropped on different planets, which of the following will most likely happen to the rock?
    A. The rock's movement will be the same on all planets.
    B. The rock will move slowest on the planet nearest to the sun.
    C. The rock will move fastest on the planet farthest from the sun.
    D. The rock's movement will vary due to the different masses of the planets.

For items 8-10, refer to the table below.

Heavenly Body	**Mass (x 10^{24} kg)**	**Acceleration Due to gravity (m/s^2)**	**Gravitational Force (x10^{23} N)**
Moon	0.0736	1.62	1.1776
Earth	5.9720	9.80	585.2560
Jupiter	1900.0000	25.95	493,050.0000

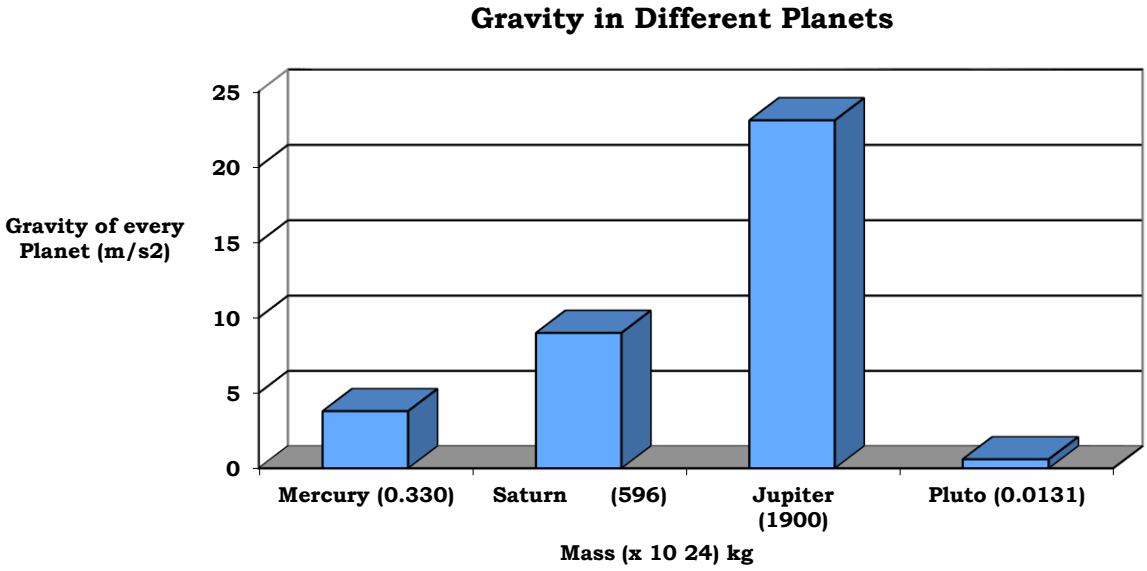
8. If you drop an object, on which heavenly bodies listed in the table above will the object hit the ground last?
    A. Earth
    B. moon
    C. Jupiter
    D. none of the above

9. On which heavenly body will the object move fastest?
    A. moon
    B. Jupiter
    C. Earth
    D. none of the above

10. On which heavenly body will an object on earth when released, move slowest?
    A. Earth
    B. Jupiter
    C. moon
    D. none of the above

Additional Activities

Study the graph below. The graph shows the gravity versus mass of different planets.



Mercury	Saturn	Jupiter	Pluto

Answer the questions based on the graph above**. Choose your answer from the options in the box.**

1. Which planet has the strongest gravitational force?
2. Which planet has the weakest gravity?
3. Which heavenly body has the biggest mass?
4. Which heavenly body has the smallest mass?
5. In which heavenly body do objects move fastest?
6. In which heavenly body do objects move slowest?

Answer Key

Lesson 1: Describe Gravity

What I Know	What's More	Assessment
1. C. 2. B. 3. D. 4. D. 5. B. 6. A. 7. B. 8. C. 9. D. 10. B. **What's In** 1. Yes 2. Yes **What'sNew** **Activity 1** 1. A. 2. A. 3. A. 4. A. 5. A.	**Activity 1.1** 1. true 2. true 3. true 4. false 5. false **Activity 1.2** 1. Against 2. Against 3. Towards 4. Against 5. Towards **What I have Learned** 1. Gravity 2. Attraction 3. Gravity 4. Force	1. A. 2. B. 3. B. 4. C. 5. D. 6. A. 7. B. 8. C. 9. C. 10. A. **Additional Activities** Down 1. ATTRACTIVE Across 2. GRAVITY 3. MASS 4. CENTER 5. NEWTON

What's In

1. true
2. true
3. false
4. false
5. true

What's New

1. B
2. A
3. B.
4. A

What's More

I.

1. Moon
2. Jupiter
3. Moon
4. Jupiter
5. Moon
6. Jupiter

II.

1. *weak*
2. *strong*
3. *Slow*
4. *Fast*
5. Bigger, stronger/ smaller, weaker

Conclusion:
Stronger, faster/ weaker, slower

What I have Learned

1. increases
2. decreases
3. greater, bigger/lesser, smaller
4. greater, faster/ lesser, slower

What can I do

A.

a. The stone dropped on Earth will fall faster because the Earth has bigger gravitation or gravity than the moon.

B.

1. True
2. False
3. True
4. True
5. True

Assessment

1. B.
2. C.
3. B
4. A
5. B
6. A.
7. D.
8. B.
9. B.
10. C.

Additional Activities

1. Jupiter
2. Pluto
3. Jupiter
4. Pluto
5. Jupiter
6. Pluto

References

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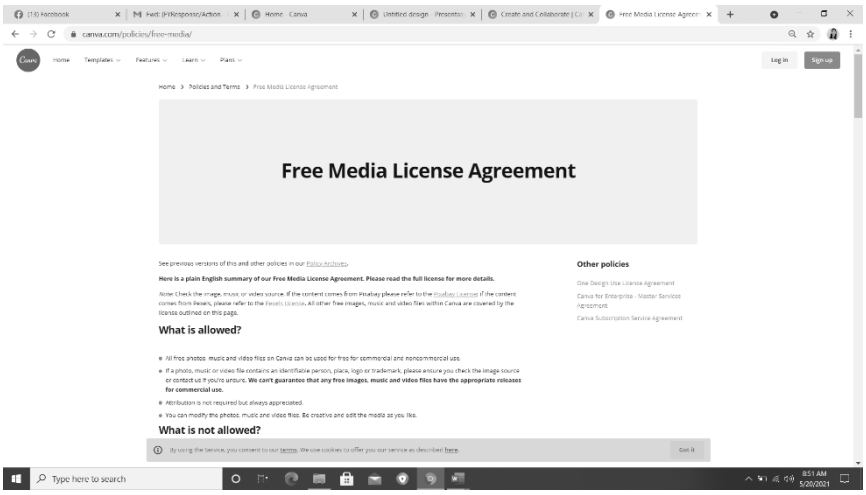

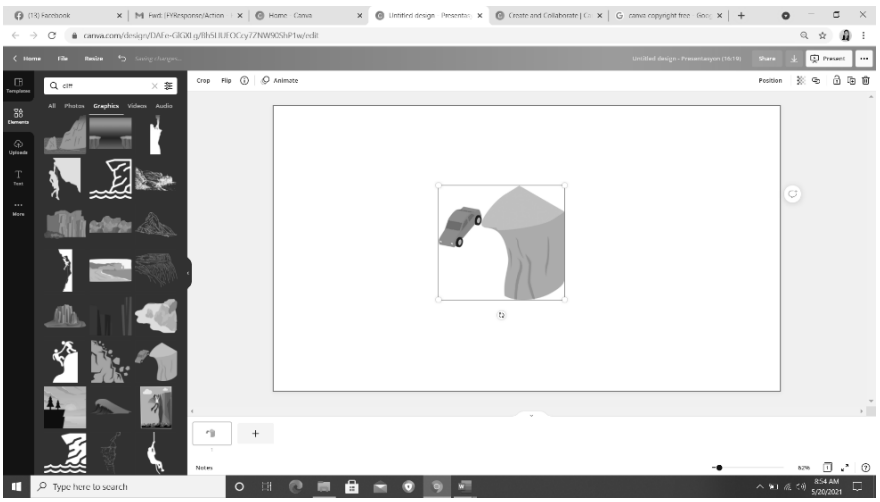

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