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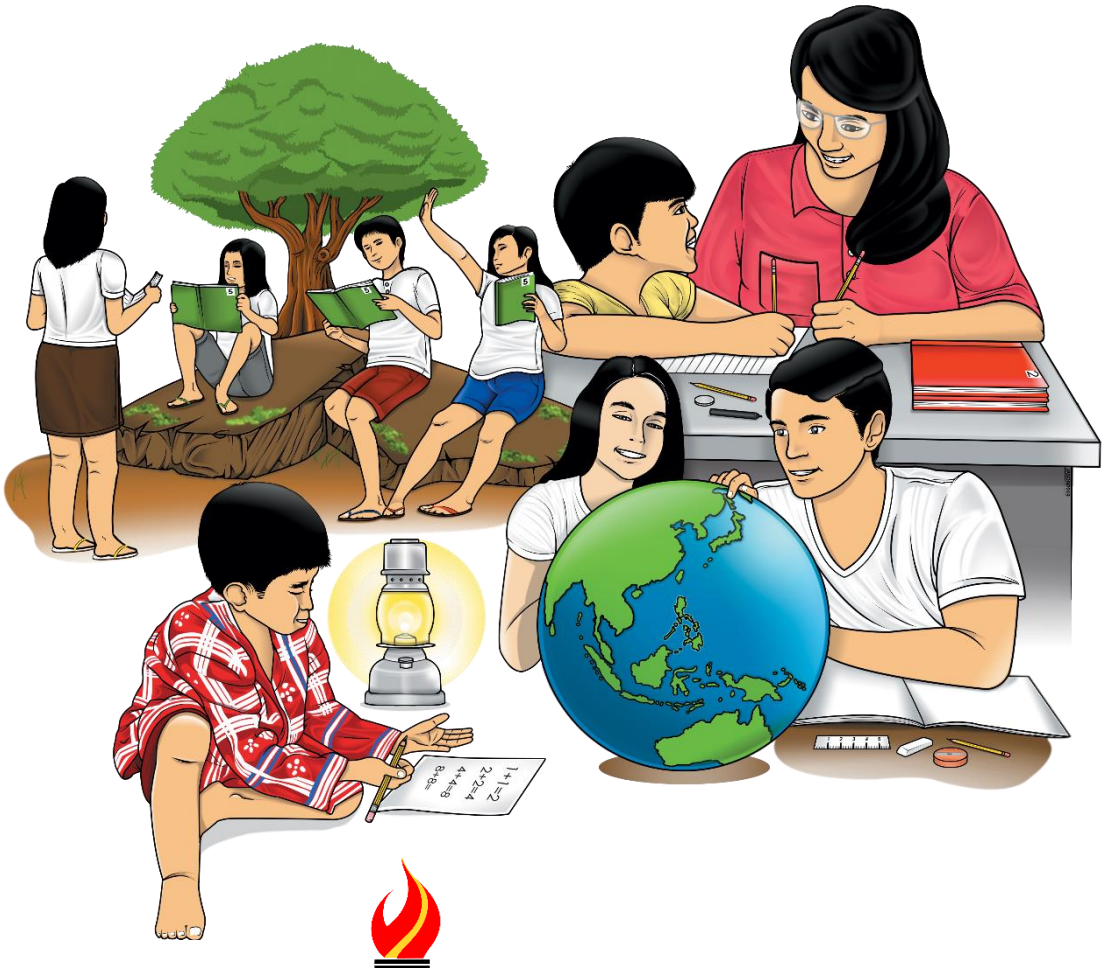
Science

Quarter 3 – Module 1:
Friction



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6

Science

Quarter 3 – Module 1:
Friction

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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 infer how friction and gravity affect movements of different objects (S6FE-IIIa-c-1). 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 two lessons, namely:

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

After going through this module, you are expected to:

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

What I Know

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

1. Which of the following statements about friction is TRUE?
   A. Friction opposes motion of objects.
   B. Friction occurs between non-rubbing surfaces.
   C. Friction causes moving objects to move faster.
   D. Friction acts in a direction similar to the direction of an object's motion.

2. Will it be easier for a person to push a table on a carpeted floorthan on tiled floor?
   A. No, because the carpeted floor is rough, so friction is lesser.
   B. No, because the carpeted floor is rough, so friction is greater.
   C. Yes, because the carpeted floor is smooth, so friction is lesser.
   D. Yes, because the carpeted floor is smooth, so friction is greater.

3. When can we say that friction on a floor is greater?
   A. If the floor is wet.
   B. If the floor is tiled.
   C. If the floor is rough.
   D. If the floor is smooth.

4. Which force causes a rolling ball to stop after a few seconds?
   A. friction
   B. gravity
   C. magnetic
   D. motion

5. Why is difficult to move heavy objects on a rough surface?
   A. rough surface is slippery
   B. there is no friction on a rough surface
   C. there is lesser friction on a rough surface
   D. there is greater friction on a rough surface

6. When you are travelling along a road, how does the wet road affect friction?
   A. It increases friction.
   B. It decreases friction.
   C. It maintains friction.
   D. It increases and decreases friction.

7. Which of the following forces causes objects to slowdown and eventually stop?
   A. air resistance
   B. friction
   C. gravity
   D. magnetic

8. What is the direction of friction between a moving object and a surface?
   A. toward the direction of object's motion
   B. similar to the direction of object's motion
   C. opposite to the direction of object's motion
   D. perpendicular to the direction of object's motion

9. Which activity below needs least friction?
   A. grinding
   B. skating
   C. climbing
   D. writing

10. Which activity is a way of reducing friction?
   A. applying lubricant
   B. using rubber shoes
   C. putting spikes on tires
   D. removing wheels on heavy cabinets

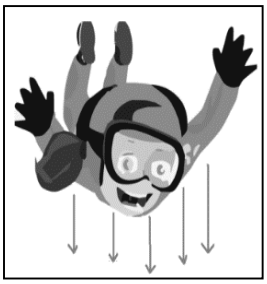
Lesson 1 Describe Friction

Friction plays a vital role in our everyday life. Whatever we do, wherever we go, friction is present. Even when we are sitting down, standing or holding a bottle or any object, friction affects us. Friction occurs between the surfaces of two objects in contact, rubbing or sliding against one another. It is sometimes considered undesirable, yet it plays an important role in our daily activities.

What's In

Study the pictures below. Identify whether the illustrations show a PUSH or a PULL to move the given objects or persons. Write your answers on your answer sheet.

_____



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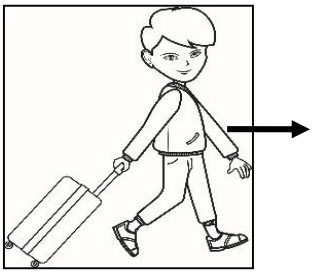

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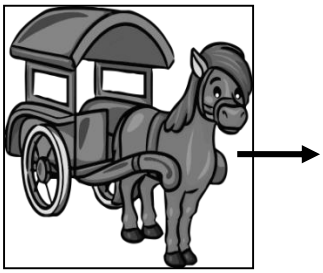
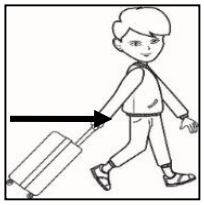


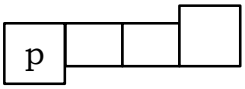
_____

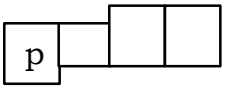
Illustrated by Ryan Oliver Arellano and Orencio D. Estrera

"Force is a _____ or a _____."

Clue 1: Force is a  or a  .

Illustrated by Ryan Oliver Arellano and Orencio D. Estrera

Clue 2: Force is a 

or a 

.

Write the complete sentence you formed on your answer sheet.

What's New

Friction is always present everywhere. It affects our daily activities. "What is friction? How does friction occur?" are just some common questions that you may want to ask. You will better understand and describe friction by doing the following activity.

Activity: Roll and Stop

In this activity, you will need any round object available at home like a ball, a tin can, or a tomato and the floor.

Get the ball or any available round object and put it on the floor. Push the ball gently to allow it to roll on the floor, as shown in the figure below. Observe the movement of the ball.

Figure 1. A boy pushes a ball to roll on the floor

Illustrated by Orencio D. Estrera

Based on your observations, answer the following questions.

1. What happened to the ball after it was pushed?

To answer this question, arrange the following events according to which happened first to last. Put the numbers 1 (first), 2, and 3 (last) on the blank before the sentence.

_____The ball slows down.
_____The ball stopped.
_____The ball rolled on the floor.

2. What caused the stopping of the ball?

F			c	t			n

3. Which of the following statements is/are TRUE about friction? Choose from the given statements below. Write the letter/s of your choice on your answer sheet.

A. Friction is produced by a single object.
B. Friction is a force that opposes motion.
C. Friction is an energy that moves the object.
D. Friction acts opposite to the direction of an object's motion.
E. Friction exists between the surfaces of two objects rubbing against each other.

What is It

Friction is a force that opposes an object's motion resulting in the slowing down or even stopping the moving object.

In the activity, when the ball was pushed, it rolled on the floor and stopped after a few seconds. It is the friction between the ball and the floor that caused the stopping of the ball. But how does friction occur? While the ball is rolling on the floor, the surface of the rolling ball rubs against the surface of the floor. Friction always acts opposite the direction of an object's motion. The floor exerts a frictional force opposite the ball's motion as shown in the figure below.

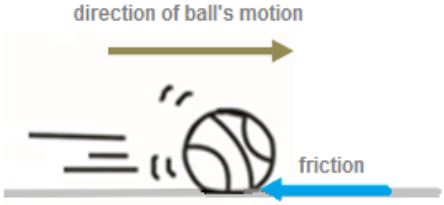
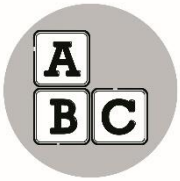


Figure 2. Frictional force acting on a rolling ball.

Illustrated by Orencio D. Estrera

Friction does not only occur on the surfaces of solid objects rubbing against one another, but it also occurs when air particles rub against objects falling down, thrown upward and flying airplanes and kites. The force that opposes the movement of objects in air is called **air friction** or **air resistance**. You will learn more about it in the next lesson.



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.

_____1. Friction acts in a direction the same as the direction of the object's motion.
_____2. Friction occurs when the surfaces of the two objects rub against each other.
_____3. Friction causes moving objects to stop.
_____4. Friction is produced by a single object.
_____5. Friction opposes motion of objects.

What I Have Learned

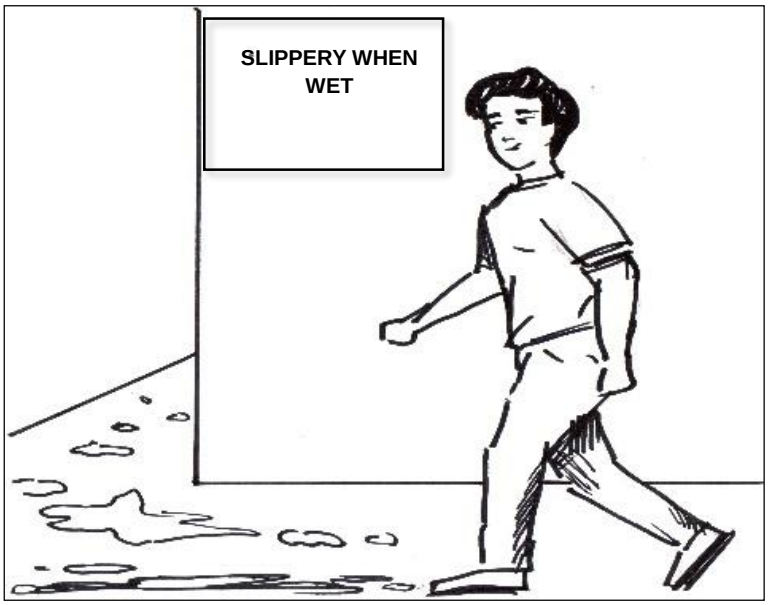
Directions: Complete the following statements by choosing the word that best completes the following sentences. Write the words you have chosen on your answer sheet.

I have learned that:

1. Friction is a (force, energy) that opposes the motion of objects.
2. When two surfaces of two objects rub against each other, (friction, mass) exists.
3. Friction always acts (opposite, the same) the direction of the object's motion.
4. With friction we can do many things like: (choose as many correct examples)
   - ☐ speaking on a phone
   - ☐ holding an apple
   - ☐ sitting on a chair
   - ☐ walking properly
   - ☐ listening to a radio

What I Can Do

Study the picture and answer the questions below. Write your answers on your answer sheet.



Illustrated by Orencio D. Estrera

1. What accident do you think might happen if the boy walked on the wet floor?

_____
_____
_____

2. How can you prevent the possible accident from happening? Why?

_____
_____
_____

Assessment

Directions: Answer the following questions carefully by choose the letter of your choice. Write your chosen letter on your answer sheet.

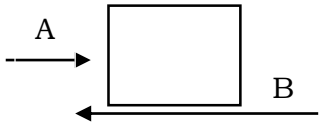
1. A ball rolled after being kicked and slowed down until it stopped. Which of the following forces caused the ball to slow down?
   A. electrical
   B. friction
   C. gravity
   D. magnetic

2. Is friction between the floor and a cabinet present when a person pushes the cabinet?
   A. Yes, because the bottom surface of the cabinet is in contact with the floor.
   B. Yes, because the bottom surface of the cabinet does not rub against the floor.
   C. No, because the bottom surface of the cabinet has nothing to do with the floor.
   D. No, because the bottom surface of the cabinet is only rubbing against the floor.

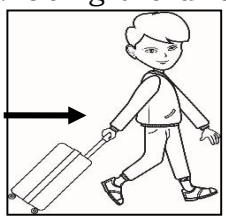
3. Which of the following is NOT TRUE about friction?
   A. Friction opposes motion of objects.
   B. Friction occurs between non-rubbing surfaces.
   C. Friction causes moving objects to slow down and stop.
   D. Friction acts in a direction opposite to the direction of an object's motion.

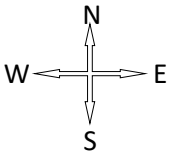
4. Which of the following can friction do to a glass of water on a table?
   A. It moves the glass.
   B. It allows the glass to slide.
   C. It does not affect the glass.
   D. It prevents the glass from sliding.

5. Study the diagram, which force does B represents?
   A. friction
   B. gravity
   C. magnetic
   D. motion



6. The boy in the illustration pulls a stroller. Using the directions shown, which direction does the frictional force act?





   A. East
   B. North
   C. South
   D. West

7. Which of the following actions is difficult to do with friction?
   A. writing on a paper
   B. holding a banana
   C. playing basketball
   D. pushing a heavy cabinet

8. Which of the following statements is TRUE?
   A. Friction makes objects move.
   B. Friction stops moving objects.
   C. Friction has no effect on moving objects.
   D. Friction allows moving object to continue moving.

9. Which of the following statements describe friction?
   A. It slows down motion.
   B. It pulls objects downward.
   C. It does not oppose motion.
   D. It moves along with the object.

10. Which force is present when two objects rub against each other?
   A. friction
   B. gravity
   C. magnetic
   D. motion

Additional Activities

Directions: Describe friction by completing the following graphic organizer. Fill in the blanks with the words listed inside the box to complete the given sentences. Write your answers on your answer sheet.

rub	***opposes***	***opposite***	***stop***

FRICTION

1. is a force that _____ motion of an object.

2. acts _____ to the direction of moving objects.

3. exists when two surfaces _____ against each other.

4. can cause moving objects to _____.

Lesson 2 How Friction Affects Movement of Objects

Friction is a force that occurs between the surfaces of two objects in contact or rubbing against each other. It may vary depending on the type of surface an object comes in contact with. With this, friction brings advantages and disadvantages to moving and non-moving objects. Let us learn and discover how friction affects moving objects.

What's In

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. Friction is an energy that moves objects.

_____2. Friction causes moving objects to stop.

_____3. Friction occurs when two surfaces rub against each other.

_____4. Friction allows objects to continue moving.

_____5. Friction acts in a direction opposite the direction of an object's motion

What's New

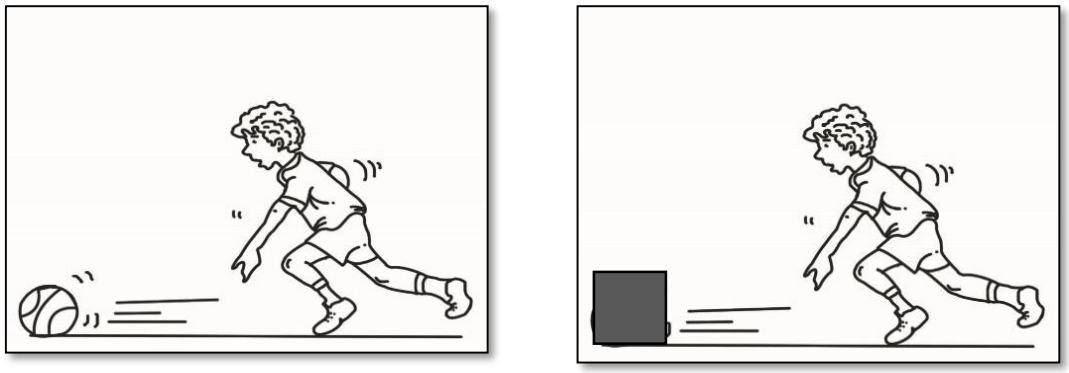
Activity 1. Rolling and Sliding

In this activity, you will observe how friction affects the movement of objects. You will also identify the factors affecting it.

You will need a ball and a box with almost the same mass as the ball.

Instruction:

1. Perform this activity on a floor or on a long table.
2. Put a mark on the floor. Place the ball on the mark.
3. Push the ball gently, as shown in Figure 1 below. Mark the point where the ball stopped. Repeat the steps two more times.
4. Replace the ball with a small box. Place it on the same mark where the ball was initially placed.
5. Apply the same amount of push to the box as was given to the ball, as shown in Figure 2. Put a mark on the point where the small box stopped. Repeat the steps two more times.



Illustrated by Ryan Oliver Arellano and Orencio D. Estrera

Answer the following questions by choosing between the ball and the box. Write your answers on your answer sheet.

Questions	Write BALL or BOX
1. Which object has the longer distance traveled?	
2. Which object has bigger surface area in contact with the floor?	
3. Which object was acted on by greater friction?	

Based on the activity, complete the following statements by choosing the word that best completes the following sentences. Write the words you have chosen on your answer sheet.

1. Why does the ball and the box travel at different distances?
   The ball and the box travelled different distances because of the difference in their (shape/surface area, push applied).

2. How does friction affect the movement of objects with big or small surface areas?
   An object with a bigger surface area, experiences a(greater, lesser) friction while an object with a smaller surface area has a(greater, lesser) friction.

3. How does friction affect the movement of objects such as the ball and the box? Friction makes moving objects (slowdown, get faster). It can also (stop, move) moving objects.

4. In this activity, what is the factor affecting friction? (shape/surface area, distance travelled)

Activity 2. Falling Objects

Does air affect the movement of falling objects? In this activity, you will be able to observe how air affects the movement of falling objects.

You will need 2 identical sheets of paper.

Instruction:

1. Perform the activity in your room.
2. Prepare two sheets of identical papers. Crumple one of the papers.
3. Raise the two pieces of paper to the same height, as shown in the figure below.
4. Drop the papers at the same time. Observe which object reached the floor first. This will be your first trial. Repeat dropping the papers two more times and observe. These will be your second and third trials.

Figure 3. Raising two pieces of paper, one crumpled, to the same height
Illustrated by Ryan Oliver Arellano

Fill in Table1 by writing the word "**First**" or "**Last**" according to the order the paper fell on the ground per trial.

Table 1

Object	Observation (Write First or Last)		
	Trial 1	Trial 2	Trial 3
Crumpled Paper			
Plain Paper			

Answer the questions below. Write your answers on your answer sheet.

1. Based on your answer in Table 1, between the crumpled paper and the uncrumpled one, which object reached the floor first?
   A. crumpled paper
   B. plain paper

2. Does air affect the falling of the two papers? Why?
   A. Yes, the air opposes the movement of the two papers.
   B. No, the air does not oppose the movement of the two papers.

3. Which object experienced the greater opposing force of the air? Why?
   A. The crumpled paper because it has a small surface area in contact with the air.
   B. The plain paper because of its wide or big surface area in contact with the air.

4. How does air friction affect the movement of falling objects? Choose the correct answer inside the parenthesis.

   Air friction (slows down, increases) the motion of falling objects.

What is It

In the two activities that you have conducted, you have observed that friction affects the movement of the ball, box, and falling pieces of paper. You were also able to identify the factors affecting it.

In Activity 1, the ball and the box covered different distances. The ball traveled longer distance than the box. It is because of their different shapes or surface area in contact with the floor. The surface area of the ball in contact with the floor is smaller, while the box has a bigger or greater surface area.

Objects with bigger surface areas, like a box, are easier to stop; thus, it travels a shorter distance because greater friction acts on it. Objects with smaller surface areas, like a ball, are harder to stop; thus, it travels a longer distance because lesser friction acts on it. Therefore, surface area of contact affects friction. The bigger or greater the surface area of objects in contact with the floor, the greater the friction. The smaller surface area of objects in contact with the floor, the lesser the friction.

In Activity 2, air resists the movement of the falling pieces of paper. This air resistance is also known as **air friction** or **air resistance** introduced in lesson 1. It acts opposite the direction of motion of falling objects as shown in the figure below

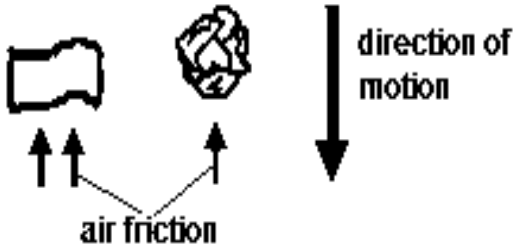


Figure 4. Air friction acting on the crumpled and plain paper
Illustrated by Ryan Oliver Arellano

The bigger or greater the surface area of falling objects, the greater the air friction. The smaller the surface area of falling objects, the lesser the air friction.

What's More

Activity 3. Rough and Smooth

Friction also varies on the type of surfaces of the two objects rubbing against each other. To observe how objects' different textures of surfaces affect friction, do the activity below.

You will need any round object like a ball, a marble, or a tomato and a piece of cloth (like towel).

Instruction:

1. Perform this activity on a long table or the floor.
2. Set up all the materials, as shown in Figure 5 below.
3. Cover one side of the table with a cloth (like towel). The covered portion will represent rough surface and the uncovered portion, a smooth surface.
4. Place the ball at the starting line of the smooth surface.
5. Push the ball gently. Mark the point where the ball stopped. Repeat two more times.
6. Do the same for the rough surface this time. Repeat two more times.

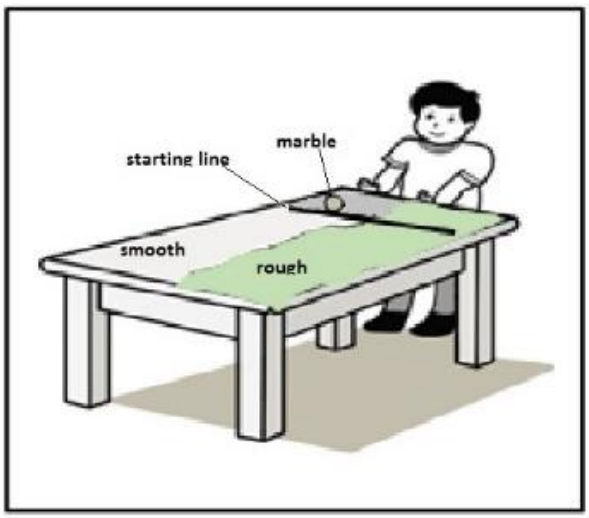


Figure 5. A boy pushes the ball on an uncovered and covered table.
Illustrated by Orencio D. Estrera

Answer the following questions by completing Table 2.Write your answers on your answer sheet.

Table 2

Questions	Answer (Smooth or Rough)		
	Trial 1	Trial 2	Trial 3
1. In which surface did the ball travel a longer distance?			
2. In which surface did the ball travel a shorter distance?			
3. Which surface has a greater friction?			
4. Which surface has a lesser friction?			

Based on the activity, Answer the following questions by choosing the word that best complete the following sentences. Write the words you have chosen on your answer sheet.

1. How does friction differ in a smooth surface from a rough surface?

"Friction is (greater, lesser) in smooth surface, while friction is (bigger, smaller) in rough surface.

2. How does friction affect the movement of objects in smooth and rough surfaces?

Objects move (faster, slower) in smooth surface. Object moves (faster, slower) in rough surface.

3. In this activity, what is the factor affecting friction? (surface texture, mass).

What I Have Learned

Directions: Complete the following statements by filling in the blanks with the appropriate words listed inside the given box. Write your answers on your answer sheet.

friction	***greater***	***slows***	***lesser***

I have learned that:

1. _____ affects the movement of objects.
2. Friction _____ the movement of objects in motion.
3. Friction is _____ in rough surface and object with bigger surface area.
4. Friction is _____ in smooth surface and object with smaller surface area.

What I Can Do

I. Directions: Write "**MF**" if more friction or "**LF**" if less friction is needed on the following activities or objects. Write your answers on your answer sheet.

_____1. walking a smooth surface
_____2. writing on a paper-covered surface
_____3. skating
_____4. grinding
_____5. sliding door
_____6. holding a glass of water
_____7. pushing a heavy cabinet
_____8. rotating gears of bicycle
_____9. pole climbing
_____10. setting of glass and plates on top of a table

II. Directions: Answer the question below. Write your answer on your answer sheet.

Cristy wants to move her heavy cabinet, what do you think must she do to easily move the heavy cabinet on her own?

_____
_____
_____
_____

Assessment

Directions: Infer how friction affects movement of objects by analyzing and answering the following questions. Write your answers on your answer sheet.

1. Why do drivers drive their car slowly during rainy days?
   A. Drivers drive slowly because the windshield is blurred.
   B. Drivers drive slowly because they are afraid of the rain.
   C. Drivers drive slowly because the road is wet so there is less friction.
   D. Drivers drive slowly because the road is wet so there is more friction.

2. Which is NOT a way of reducing friction?
   A. applying lubricant
   B. putting spikes on tires
   C. making the floor smooth
   D. putting grease on bicycle gears

3. Why do you need to put rollers under the cabinets when you want to move them?
   A. to apply more force
   B. to stop the movement of the cabinet
   C. to slow down the movement of the cabinet
   D. to minimize friction through the small surface of contact of the rollers.

4. Why do badminton players use rubber shoes while playing?
   A. to slide since the badminton court is slippery
   B. to glide faster since the badminton court is slippery
   C. to have lesser friction between their shoes and the floor.
   D. to have greater friction between their shoes and the floor.

5. Which of the following situations shows that friction is increased?
   A. Ana uses rubber shoes while jogging.
   B. Ruben puts rollers on heavy cabinets.
   C. Naldo puts grease on his bicycle gears.
   D. Belle puts floor wax to make the floor smooth.

6. In which of the following situations would friction most likely pose a problem?
   A. holding a pen to write
   B. striking a match to cook
   C. walking on a slippery floor
   D. rubbing your hands to warm them

7. Which of the following shows that friction could be harmful?
   A. writing on the board
   B. holding a piece of paper
   C. tearing out of bicycle gears
   D. using breaks when stopping

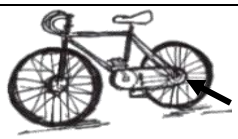
8. How do you describe the friction between a surface and an object with greater surface area?
   A. greater
   B. equal
   C. smaller
   D. the same

9. A crumpled and an uncrumpled paper were dropped at the same height and time, which paper will reach the ground first?
   A. The crumpled paper because it has a smaller surface area.
   B. The uncrumpled paper because it has a bigger surface area.
   C. Crumpled paper because it is heavier compared to the uncrumpled paper.
   D. None, because both the crumpled and uncrumpled paper have same masses.

10. A boy is playing with a toy car. In which surface will it travel faster?
   A. cemented floor
   B. carpeted floor
   C. grassy surface
   D. polished floor

Additional Activities

I. Directions: Determine which activities o features of objects below illustrate a benefit or harm of friction. Draw a smiley face ☺ if the given shows a potential benefit and a sad face ☹ if it shows potential harm.

Activities / Features	**Draw: ☺ If potential benefit ☹ If potential harm**
1.  bicycle brakes	

2.  striking a match for cooking	
3.  no oil in a car engine	
4.  rusty padlock	
5.  holding a soda can	

Illustrated by Ryan Oliver Arellano and Orencio D. Estrera

II. Directions: Identify the activities below that show a way of reducing friction. Put a tick mark (✓) in the box if it shows reducing friction and cross (**X**) if not.

☐ 1. Nestor puts rollers under his heavy cabinet.

☐ 2. Erol uses rubber shoes while playing basketball.

☐ 3. Andrea applies floor wax to make the floor smooth.

☐ 4. Nelmar puts grease on his bicycle gears.

☐ 5. Rose mops the wet floor

Answer Key

Lesson 1: Describe Friction

What I Know

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

What's In

1. PUSH
2. PULL
3. PUSH
4. PULL
5. PULL

Define "force" based on the examples above.
Force is a push or pull
Write the complete sentence.
Force is a push or a pull.

What's New

Activity 1: Roll and Stop

1. 2
3
1
2. Friction
3. B
D
E

What's More

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

What I Have Learned

1. force
2. friction
3. opposite
4. holding an apple
sitting on a chair
walking properly

What I Can Do

(Possible Answers):

1. He might slip and hurt himself.
2. Mopping the floor to make it dry might prevent the possible accident to happen. Since, there is greater friction on dry floor possible accidents might be prevented.

Assessment

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

Additional Activities

1. opposes
2. opposite
3. rub
4. stop

Lesson 2: How Friction Affects Movement of Objects

What's In

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

What's New

Activity 1: Rolling and Sliding

I. Fill in the table

1. Ball
2. Box
3. Box

II. Questions

1. shape/surface area
2. greater
   lesser
3. slowdown
   stop
4. shape/surface area

Activity 2: Falling Objects

I. Fill in the table

Crumpled paper – first
Plain Paper – last

II. Questions

1. A. crumpled paper
2. A. Air opposes the movement of the two papers.
3. B. The plain paper, because of its wide or big surface area
4. slows down

What's More

Activity 3: Rough and Smooth

I. Fill in the table (same answers for all trials)

1. Smooth
2. Rough
3. Rough
4. Smooth

II. Questions

1. smaller
   bigger
2. faster
   slower
3. surface texture

What I Have Learned

1. Friction
2. slows
3. greater
4. lesser

What I Can Do

I. More Friction or Less Friction

1. LF
2. MF
3. LF
4. MF
5. LF
6. MF
7. LF
8. LF
9. MF
10. MF

II. Answer the question (Possible Answers):

She should put rollers under her cabinet to easily move it.

She should put floor wax on the floor to make it slippery and to easily move the cabinet

Assessment

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

Additional Activities

I. Advantage and Disadvantage

1. ☺
2. ☺
3. ☹
4. ☹
5. ☺

II. Ways of Reducing Friction

1. ✓
2. **X**
3. ✓
4. ✓
5. **X**

References

NOTE: All texts and illustrations in this SLM were originally developed and created.

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