

ACADEMIC ELECTIVE



Learning Activity Sheets for Physics 1

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LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	1	Date	
Lesson Title/Topic:	Introduction to Physics		
Name		Grade & Section	

“Help or Harm?”

I. OBJECTIVE

1. Identify at least three benefits and two limitations of selected physics applications using information gathered from at least two secondary sources.
2. Analyze the positive and negative societal impacts of selected physics applications through completion of the investigation table and group discussion.
3. Present evidence-based recommendations or possible solutions to minimize the risks and limitations of selected physics applications during a short group presentation.

II. MATERIALS NEEDED

- Pen/Pencil
- Printed articles, journals, or online sources
- Worksheet
- Mobile phone/laptop (if available)

III. DIRECTIONS

1. Form a group as assigned by the teacher.
2. Choose two physics application from the list below:
 - a. Nuclear Energy
 - b. Artificial Intelligence
 - c. Transportation Systems
 - d. Renewable Energy
 - e. Mobile Communication
3. Gather information from at least two secondary sources.
4. Identify the:
 - benefits,
 - risks/limitations,
 - societal impact,
 - and possible solutions to minimize risks.

5. Complete the investigation table below.
6. Prepare a short evidence-based presentation of your findings.

IV. INVESTIGATION TABLE

Physics Application	Benefits to Society	Risks/Limitations	Possible Solutions	Sources Used

V. GUIDE QUESTIONS

1. What are the major benefits of this technology or application?
2. What possible risks or limitations exist?
3. How does this application affect society positively or negatively?
4. Should society continue using this technology? Why or why not?
5. How can risks or limitations be minimized?

VI. REFLECTION

Complete the statement below:

“I realized that physics applications can help society by _____, but they may also create challenges such as _____.”

VII. RUBRIC FOR GROUP PRESENTATION

Criteria	4 – Excellent	3 – Proficient	2 – Developing	1 – Beginning
Content Accuracy	Information is accurate, complete, and evidence-based	Mostly accurate with minor errors	Some inaccuracies present	Many inaccuracies present
Use of Sources	Used at least 2 reliable sources effectively	Sources used but limited explanation	Few sources used	No reliable sources evident
Analysis	Clear explanation of benefits, limitations, and solutions	Good explanation with minor gaps	Limited analysis	Very limited analysis
Presentation	Clear, organized, and engaging	Mostly clear and organized	Somewhat unclear	Difficult to understand
Collaboration	All members actively participated	Most members participated	Unequal participation	Minimal collaboration

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	2	Date	
Lesson Title/Topic:	KINEMATICS		
Name		Grade & Section	

Walk and Measure

I. Objective

1. Measure the distance and time of a moving object along a straight path using standard measuring tools
2. Compare the measurements obtained using standard and alternative measuring tools through recorded data from at least three trials.
3. Explain the importance of accurate measurement and proper use of measuring tools in describing motion and conducting scientific investigations through group discussion or written responses.

II. Materials

- Meter stick or tape measure
- Stopwatch or mobile phone timer
- Masking tape/chalk
- Alternative measuring tools (footsteps, hand spans, strings)
- Activity sheet

III. Procedure

Part A: Using Standard Measuring Tools

1. Mark a straight path inside or outside the classroom using masking tape or chalk.
2. Using a meter stick or tape measure, measure the total length of the path.
3. Assign one group member to walk from the starting point to the endpoint at a normal pace.
4. Another group member records the time using a stopwatch or mobile timer.
5. Record the measured distance and time in the data table.
6. Repeat the activity if necessary to verify the measurement.

Data Table A

Distance Measured (m)	Time Recorded (s)	Measuring Tools Used

Guide Questions

1. Was the standard measuring tool easy or difficult to use? Why?
2. What challenges did you encounter while measuring distance using the tape measure or meter stick?
3. Why is proper positioning important when using standard measuring tools?
4. Why is accurate time recording important in describing motion?
5. How do standard measuring tools help improve the accuracy of measurements?

Part B: Using Alternative Measuring Tools

1. Measure the same path using alternative measuring tools such as:
 - footsteps
 - hand spans
2. Perform three trials using the same alternative measuring tool.
3. Record the distance measured.
4. Compare the measurements from the three trials with the measurements obtained using standard tools.
5. Discuss why measurements using alternative tools may vary.

Data Table B

Alternative Tool Used	Trial 1	Trial 2	Trial 3
footsteps			
hand span			

Guide Questions for Procedure B

1. Did all three trials produce the same measurement? Why or why not?
2. What disadvantages did you observe when using alternative measuring tools?
3. Why do measurements vary when using footsteps or hand spans?
4. Which measuring tool gave more consistent results?
5. Why are standard measuring tools more reliable in scientific investigations?
6. What are other examples of alternative measuring tool used to measure distance? time?

IV. Conclusion

Reflect on the lesson and complete the following:

3 things you learned about motion and measurement

1. _____
2. _____
3. _____

2 differences between one-dimensional and two-dimensional motion

1. _____
2. _____

1 measuring skill you need to improve

1. _____

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	3	Date	
Lesson Title/Topic:	Kinematics		
Name		Grade & Section	

I. Activity: “SI Relay Challenge: Kinematics Edition”

II. Objectives:

By the end of the activity, the learners should be able to:

- identify the correct SI units and symbols for fundamental and derived quantities in kinematics (e.g., meter, second, m/s, m/s²);
- classify physical quantities such as length, time, speed, velocity, and acceleration as fundamental or derived quantities;
- match and apply appropriate formulas (e.g., speed, velocity, acceleration) to their corresponding quantities.
- explain the relationships between fundamental quantities (length and time) and derived quantities using correct reasoning;
- demonstrate teamwork and critical thinking by solving problems accurately and collaboratively within a limited time.

III. Materials Needed: Challenge station task cards, Whiteboards or mini whiteboards, Marker pens and erasers, Timer or stopwatch, Scoreboard (optional), Answer sheets for teacher reference

IV. Procedures:

A. Introduction (2–3 minutes)

The teacher briefly reviews:

- Fundamental SI quantities in kinematics:
 - Length → meter (m)
 - Time → second (s)
- Derived quantities:
 - Speed → m/s
 - Velocity → m/s
 - Acceleration → m/s²

B. Relay Mechanics

- Each group starts at an assigned station.
- Groups answer all tasks at the station within the allotted time (2–4 minutes).
- When time is called, groups rotate clockwise to the next station.
- Learners must discuss answers before writing them.
- Points are awarded for:
 - Correct answers, Clear explanations, Team collaboration

C. Challenge Stations

*STATION 1 – “Identify the SI Unit”

Task: Identify the correct SI unit and symbol for each quantity.

Guide Questions:

1. What is the SI unit of length? _____
2. What is the SI symbol for second? _____
3. What SI unit is used for speed? _____
4. What SI unit is used for acceleration? _____
5. Which quantity uses meter (m) as its SI unit? _____

***STATION 2 – “Fundamental or Derived?”**

Task: Classify each quantity as **Fundamental** or **Derived**.

Quantity	Classification
Length	
Time	
Speed	
Velocity	
Acceleration	

Processing Questions:

1. Why is time considered fundamental?

2. Why is acceleration considered derived?

***STATION 3 – “Formula Match-Up”**

Task: Match the formula to the correct derived quantity.

Formula Cards	Quantity Cards	Expected Matches
Distance ÷ Time	Speed	
Displacement ÷ Time	Acceleration	
Velocity ÷ Time	Velocity	

***STATION 4 – “Explain Your Reasoning”**

Task: Answer the questions using complete explanations.

Guide Questions:

1. Why is velocity considered a derived quantity?

2. Why do speed and velocity have the same SI unit?

3. How are length and time connected to acceleration?

4. Why are fundamental quantities important in physics?

***STATION 5 – “Challenge Round”**

Task: Answer the following questions below.

Questions:

1. Which of the following is a derived quantity: velocity or length?

2. What derived quantity uses the unit m/s^2 ?

3. Which quantities are fundamental in kinematics?

4. True or False: Speed is a fundamental quantity. _____

5. Complete the statement: “*Acceleration measures the change in _____ over time.*”

V. Synthesis and Reflection

1. How did the SI Relay Challenge help you better understand the relationship between fundamental and derived quantities in describing motion?

2. What difficulties did you encounter during the SI Relay Challenge, and how did working with your group help you correctly identify SI units and kinematic relationships?”

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	4	Date	
Lesson Title/Topic:	Kinematics		
Name		Grade & Section	

I. Activity: “*Motion Computation Stations*”

II. Objectives:

By the end of the activity, the learners should be able to:

- a. identify the given and unknown quantities in motion problems involving displacement, velocity, and acceleration;
- b. apply appropriate kinematics formulas to solve problems related to displacement, average velocity, and average acceleration;
- c. perform accurate computations using proper substitution, mathematical operations, and SI units;
- d. interpret the meaning of positive and negative signs in displacement, velocity, and acceleration; and
- e. explain and present complete solutions to motion problems collaboratively and clearly to the class.

III. Materials Needed: Scenario cards, Calculator, Graph paper (optional), Worksheet, Pencil or Ballpen

IV. Procedures:

- The teacher will form groups with 4–5 members.
- Each group rotates through six (6) computation stations.
- The learners will read the problem carefully and identify the:
 - given quantities
 - unknown quantity
- The learners will use the appropriate formula to solve the problem. Show complete solutions including:
 - formula
 - substitution
 - final answer with SI unit
- The learners will write their answers on the worksheet.

Scenario Problems

Scenario	Solution	Meaning of Positive and Negative Signs
1.) A student walks from 5 m east to 20 m east along a straight path. Find the displacement.		

2.) A car moves from 12 m to -8 m on a straight road. Find the displacement.		
3.) A cyclist travels 90 m in 15 s. Find the average velocity.		
4.) A runner covers a displacement of 200 m in 25 s. Find the average velocity.		
5.) A motorcycle increases its velocity from 8 m/s to 28 m/s in 5 s. Find the average acceleration.		
6.) A car slows down from 30 m/s to 10 m/s in 4 s. Find the average acceleration.		

Processing Questions:

1. *What similarities did you notice among the formulas for displacement, velocity, and acceleration?*

2. *Why is it important to identify the given and unknown quantities before solving the problem?*

3. *How did the SI units help in solving and interpreting the motion problems correctly?*

4. *What does a positive value of displacement, velocity, or acceleration indicate?*

5. *What does a negative value of displacement or acceleration indicate about the motion of the object?*

V. Synthesis and Reflection

1. *Which computation station was the most challenging for your group? Why?*

2. *How did working with your group help you solve the motion problems more effectively?*

3. *In real-life situations, where can displacement, velocity, and acceleration be observed or applied?*

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	5	Date	
Lesson Title/Topic:	Creating and Interpreting Motion Graphs		
Name		Grade & Section	

Note: Prior to performing the activity, study how to use the Fizziq app to study motion. Here is a helpful link: <https://tinyurl.com/fizziqguide>.

Instructions:

1. Take four videos of an object in motion as enumerated in Instruction 2. Set the camera to 30 fps (frames per second). The camera should not be moving while the videos are taken. Before taking the videos, ensure that a reference material (a ruler or meter stick is recommended) is visible in the video frame for the setting of the rule in the Fizziq app later. The reference material should be oriented parallel to the direction of motion (horizontal or vertical).
2. The videos are as follows.
 - a. Video 1: A person walking on a plain horizontal path along a straight line from left to right at a constant pace
 - b. Video 2: A person walking on a plain horizontal path along a straight line from right to left at a constant pace
 - c. Video 3: An object released from a certain height
 - d. Video 4: An object thrown directly upward
3. Trim the videos such that only the parts where the object is moving is shown. Cut the unnecessary parts before and after the essential parts as described by Instruction 2.
4. Analyze the videos one by one using the Fizziq app (Motion Analysis → Video Motion Analysis → My Videos). Ensure that the ruler length is set appropriately for each video to be analyzed. For Videos 1 and 2, the X arrow should be pointing to the right.
5. Only for Video 3: Set the rule in Video 3 to show downward as the positive direction and upward as the negative direction by reversing the start and end points of the rule. In other words, the Y arrow must be pointing downward. Do this for Video 3 only, not including Video 4.
6. Moreover, ensure that the settings are set as follows then click on “Apply”.
 - a. Frame Rate: 30 fps
 - b. Sampling: 1:11 for Videos 1 and 2, All Images for Videos 3 and 4
 - c. Origin: Detached
 - d. Image Rotation: 0
7. Drag the “Origin” circle toward the starting point of motion captured in the video.
8. Click on “Pointing” and trace the motion of the object in the video. For Videos 1 and 2, you may use the person’s head as the object to be traced. If the frame is blurry, click on the central position of the blurry object as its position at that time.
9. Only for Video 4: Start “pointing” only at the peak position of the object thrown upward. You can skip the earlier parts by clicking in the right arrow below until the object’s peak position.

10. Click on “Results”.
11. For Videos 1 and 2, check the boxes for $t(s)$ and $x(m)$. For Videos 3 and 4, check the boxes for $t(s)$ and $y(m)$. The values of $y(m)$ in Video 3 should be positive. If not, review item 4 of the Instructions.
12. Copy the data generated by the Fizziq app to the table in the attached template. Use the values of $x(m)$ or $y(m)$ for $d(m)$.
13. Create a d - t graph for the motion of the object using the blank coordinate plane in the same attached template. Label the axes and the tick marks correctly.

Guide Questions:

1. Describe the pattern shown by Graph 1.

2. Explain this pattern in relation to the values in the table and the actual motion of the object.

3. Describe the pattern shown by Graph 2.

4. Explain this pattern in relation to the values in the table and the actual motion of the object.

5. Describe the pattern shown by Graph 3.

6. Explain this pattern in relation to the values in the table and the actual motion of the object.

7. Describe the pattern shown by Graph 4.

8. Explain this pattern in relation to the values in the table and the actual motion of the object.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	5	Date	
Lesson Title/Topic:	Creating and Interpreting Motion Graphs		
Name		Grade & Section	

Instructions:

- Here are photos showing four actual experiments on motion. The motion of the object was observed and captured on video, and position measurements were taken in every video frame. The corresponding position measurements for every experiment are also shown in tabular form.

Motion 1 and Table 1 (A person walking from left to right at constant pace)



t(s)	0.0	0.367	0.733	1.1	1.467	1.833	2.2	2.567	2.933	3.3	3.3667
d(m)	1.383	1.738	2.143	2.594	3.017	3.458	3.907	4.354	4.761	5.198	5.675

Motion 2 and Table 2 (A person walking from right to left at constant pace)



t(s)	0.0	0.367	0.733	1.1	1.467	1.833	2.2	2.567	2.933	3.3	3.3667
d(m)	-1.44	-1.80	-2.21	-2.69	-3.12	-3.60	-4.07	-4.49	-4.91	-5.39	-5.88

Motion 3 and Table 3 (An object dropped from a height)



t(s)	0.0	0.033	0.067	0.1	0.133	0.167	0.2	0.233	0.267	0.3	0.333
d(m)	0.00	0.06	0.13	0.22	0.31	0.42	0.54	0.68	0.82	0.98	1.15

Note: For Motion 3, we assume downward as the positive direction and upward as the negative.

Motion 4 and Table 4 (An object thrown directly upward)



t(s)	0.567	0.6	0.633	0.667	0.7	0.733	0.767	0.8	0.833	0.867	0.9
d(m)	1.838	1.839	1.821	1.792	1.759	1.702	1.636	1.56	1.457	1.356	1.234

2. Copy the data in the table above to the table in the attached template.
3. Create a **d-t** graph for the motion of the object using the blank coordinate plane in the same attached template. Label the axes and the tick marks correctly.

Guide Questions:

1. Describe the pattern shown by Graph 1.

2. Explain this pattern in relation to the values in the table and the actual motion of the object.

3. Describe the pattern shown by Graph 2.

4. Explain this pattern in relation to the values in the table and the actual motion of the object.

5. Describe the pattern shown by Graph 3.

6. Explain this pattern in relation to the values in the table and the actual motion of the object.

7. Describe the pattern shown by Graph 4.

8. Explain this pattern in relation to the values in the table and the actual motion of the object.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	6	Date	
Lesson Title/Topic:	The Four Kinematic Equations		
Name		Grade & Section	

Problem 1: A jeepney traveling along Commonwealth Avenue in Quezon City starts from a speed of 8 m/s. As traffic clears, the driver accelerates uniformly at 1.5 m/s^2 for 6 seconds. What will be the jeepney's final velocity after 6 seconds?

Guide Questions:

1. Enumerate the given quantities.

2. What is required or asked in the problem?

3. Can the problem be solved using the basic formulas for displacement, velocity, or acceleration? Why or why not?

Derivation of the Kinematic Equation:

1. Write down the formula for average acceleration during a time interval showing both initial and final quantities instead of delta symbols.
Equation 1:
2. In the given problem, the initial and final time are not given, but the time interval is given. We can replace the expression $t_f - t_i$ with just t in the formula for acceleration. Rewrite the formula using t instead of $t_f - t_i$ as the time interval.

Equation 2:

3. Cross multiply.
Equation 3:
4. Solve for v_f .
Equation 4:
5. Now can you solve the problem using this new equation? Why or why not?

6. Solve the problem.

7. Write Equation 4 again.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No	6	Date	
Lesson Title/Topic:	The Four Kinematic Equations		
Name		Grade & Section	

Problem 2: During a basketball training session in Cebu City, a player performs a sprint drill from rest. The player accelerates uniformly at 2.4 m/s^2 for 5 seconds. How far has the player sprinted after 5 seconds?

Guide Questions:

1. Enumerate the given quantities.

2. What is required or asked in the problem?

3. Can the problem be solved using the basic formulas for displacement, velocity, or acceleration? Why or why not?

Derivation of the Kinematic Equation:

1. Write down the formula for average velocity during a time interval using delta symbols instead of initial and final quantities.
Equation 1:
2. Solve the equation for Δd .
Equation 2:
3. Since the problem involves uniform acceleration, the average velocity can also be expressed as the sum of the initial and final velocities divided by two, or $v = \frac{v_i + v_f}{2}$. Use this to replace v in Equation 2. Moreover, simply use t instead of Δt for the time interval as the time interval is given in the problem instead of initial and final time values.

Equation 3:

4. Now, write the formula for average acceleration during a time interval showing both initial and final quantities instead of delta symbols.

Equation 4:

5. In the given problem, the initial and final time are not given, but the time interval is given. We can replace the expression $t_f - t_i$ with just t in Equation 4. Rewrite Equation 4 using t instead of $t_f - t_i$ as the time interval.

Equation 5:

6. Cross multiply.

Equation 6:

7. Solve for v_f .

Equation 7:

8. Use Equation 7 to replace v_f in Equation 3.

Equation 8:

9. Simplify by adding the two v_i and write the sum as the first term of the numerator.

Equation 9:

10. Multiply the numerator with the t .

Equation 10:

11. Separate the two terms in the numerator. Recall the rule $\frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}$.

Equation 11:

12. Simplify the first term and isolate the $\frac{1}{2}$ of the second term.

Equation 12:

13. Now can you solve the problem using this new equation? Why or why not?

14. Solve the problem.

15. Write Equation 12 again.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	6	Date	
Lesson Title/Topic:	The Four Kinematic Equations		
Name		Grade & Section	

Problem 3: At a construction site in Davao City, a steel beam is lifted upward by a crane. The beam initially moves upward at 2 m/s and continues accelerating uniformly upward at 1.5 m/s² over a vertical distance of 18 meters. What is the beam's final velocity after being lifted 18 meters?

Guide Questions:

1. Enumerate the given quantities.
2. What is required or asked in the problem?
3. Can the problem be solved using the basic formulas for displacement, velocity, or acceleration? Why or why not?

Derivation of the Kinematic Equation:

1. Write down the formula for average acceleration during a time interval showing both initial and final quantities instead of delta symbols.
Equation 1:
2. We can replace the expression $t_f - t_i$ with just t in Equation 1. Rewrite Equation 1 using t instead of $t_f - t_i$ as the time interval.
Equation 2:
3. Cross multiply.
Equation 3:
4. Solve for a .
Equation 4:
5. Now, write the formula for average velocity during a time interval using delta symbols instead of initial and final quantities.
Equation 5:
6. Solve for Δd .
Equation 6:
7. Since the problem involves uniform acceleration, the average velocity can also be expressed as the sum of the initial and final velocities divided by two, or $v = \frac{v_i + v_f}{2}$. Use this to replace v in Equation 6. Moreover, simply use t instead of Δt for the time interval as the time interval is given in the problem instead of initial and final time values.
Equation 7:

8. Substitute t in Equation 7 with the value of t in Equation 4.
Equation 8:
9. Multiply the two terms and simplify.
Equation 9:
10. Cross multiply. This time, instead of Δd , simply use d to represent the displacement.
Equation 10:
11. Solve for v_f^2 . In the right side of the equation, write the velocity term as the first term.
Equation 11:
12. Now can you solve the problem using this new equation? Why or why not?
-
13. Solve the problem.

14. Write Equation 11 again.

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LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	7	Date	
Lesson Title/Topic:	Two-Dimensional Motion: Projectile Motion & Circular Motion		
Name		Grade & Section	

I. Activity No. 1: Drop and Launch

II. Objective(s): At the end of the activity, students should be able to explain the independence of the horizontal and vertical components of projectile motion through observation and investigation.

III. Materials Needed: Projectile and Free Fall Apparatus Kit, Two Steel Balls, Flat Table or Desk, Measuring Tape or Ruler, and Carbon paper/chalk (optional for landing mark)

IV. Instructions:

1. Place the apparatus securely at the edge of a table.
2. Insert the two steel balls properly:
 - One ball in the launcher
 - One ball on the drop holder
3. Pull the trigger/release mechanism.
4. Observe the motion of the two balls.
5. Repeat the activity at least three times.
6. Record your observation on the table below:



Projectile and Free-Fall Apparatus Kit

Trial	Path of Launched Ball	Path of Dropped Ball	Did the balls hit the floor at the same time?
1			
2			
3			

Guide Questions:

1. How do the paths followed by the launched ball and the dropped ball differ?

2. Which ball reached the floor first? What does this suggest about their vertical motion?

3. Is the vertical motion of the launched ball accelerated? Why?

4. Is the horizontal motion of the launched ball accelerated? Why?

5. Based on the activity, what can you conclude about the horizontal and vertical components of projectile motion?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	7	Date	
Lesson Title/Topic:	Two-Dimensional Motion: Projectile Motion & Circular Motion		
Name		Grade & Section	

I. Activity No. 2: Investigating Projectile Motion

II. Objective(s): At the end of the activity, students should be able to investigate how the angle of projection (launch angle) and initial velocity affect the range and maximum height of a projectile.

III. Materials Needed: Computer/Tablet, Internet Access, PhET Projectile Simulation (https://phet.colorado.edu/sims/html/projectile-motion/latest/projectile-motion_all.html)

IV. Instructions

PART A: Which Angle Goes Farthest?

1. Open the PhET Projectile Motion simulation.
2. Choose pumpkin as the projectile and keep air resistance off.
3. Set the following values:
 - Height = 0 m
 - Initial velocity = 15 m/s.
4. Change the launch angle to 15°, 30°, 45°, 60°, and 75°.
5. Launch the projectile for each angle and record the range it reached.

Table 1: Effect of Launch Angle on Projectile Range

Trial	Object	Mass of the Projectile (kg)	Initial Velocity (m/s)	Launch Angle (°)	Range (m)
1					
2					
3					
4					
5					

Guide Questions:

1. Which launch angle produced the greatest range?
2. Which pairs of angles produced similar ranges?
3. How does the angle of projection affect the range in projectile motion?

PART B: How Does Speed Affect Motion?

1. Keep the following values constant:
 - Height = 0 m
 - Launch angle = 60°
2. Choose pumpkin as the projectile.
3. Change the initial velocity to 5 m/s, 10 m/s, 15 m/s, 20 m/s, and 25 m/s for each trial. the initial velocity for each trial.
4. Launch the projectile and observe its motion.
5. Record the maximum height and range reached for every trial.

Table 2: Effect of Initial Velocity on Range and Maximum Height

Trial	Mass of the Projectile (kg)	Initial Velocity (m/s)	Launch Angle (°)	Range (m)	Maximum Height (m)
1					
2					
3					
4					
5					

Guide Questions

1. Why do we need to keep other variables constant while studying the effect of initial velocity on a projectile's range and maximum height?
2. How did increasing the initial velocity affect the projectile's range? maximum height?
3. What relationships can you infer between initial velocity and the projectile's range and maximum height?

PART C: Does Mass Matter?

1. Keep the following values constant:
 - Height = 0 m.
 - Launch angle = 60°
 - Initial velocity = 15 m/s
2. Change the projectile object for each trial (e.g., pumpkin, baseball, car, human, piano).
3. Launch the projectile for each object.
4. Record the mass and the corresponding range reached.

Table 3: Effect of Mass on Projectile's Range

Trial	Object	Mass of the Projectile (kg)	Initial Velocity (m/s)	Launch Angle (°)	Range (m)
1					
2					
3					
4					
5					

Guide Questions

1. Did changing the mass affect the range of the projectile?
2. What can you conclude about the effect of mass on projectile motion?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	7	Date	
Lesson Title/Topic:	Two-Dimensional Motion: Projectile Motion & Circular Motion		
Name		Grade & Section	

I. Activity No. 3: What Keeps It Turning?

II. Objective(s): At the end of the activity, students should be able to identify the type of force that causes an object to move in circular motion.

III. Materials Needed: Worksheet and Pen

IV. Instructions: Analyze the situations where circular motion is observed. Then, answer the questions.

1. A flying swing ride in an amusement park spins rapidly, causing the chairs to move outward while rotating in a circular path. As the ride speeds up, the chains tilt at an angle, and the riders feel pushed away from the center. What force keeps the riders moving in a circular path instead of flying off in a straight line?



Canva.com

2. Why do Earth and other planets remain in their orbits and tend to keep revolving within their respective orbits forever?



<https://cnes.fr/sites/default/files/2024-06/systeme-solaire-illustration.jpg>

3. When a car goes around a curved road at high speed, what force keeps the car moving along the curved path instead of continuing in a straight line?



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LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	7	Date	
Lesson Title/Topic:	Two-Dimensional Motion: Projectile Motion & Circular Motion		
Name		Grade & Section	

I. Activity No. 4: Exploring Circular Motion

II. Objective(s): At the end of the activity, students should be able to investigate how mass, radius, and speed affect centripetal acceleration and centripetal force in circular motion.

III. Materials Needed: Computer, laptop, or tablet, Internet Access, GeoGebra Circular Motion Simulation (<https://www.geogebra.org/m/suk8p6Je>)

IV. Instructions:

1. Open the GeoGebra circular motion simulation.
2. Set constant values for radius and speed.
3. Change the mass of the object for each trial.
4. Record the centripetal force and centripetal acceleration shown in the simulation.
5. Keep mass and speed constant.
6. Change the radius. Record the changes in centripetal force and acceleration.
7. Keep mass and radius constant.
8. Change the velocity. Record the effects on centripetal force and acceleration.
9. Organize the collected data in the tables below.
10. Analyze the relationships among mass, radius, speed, and centripetal force.

Table 1: Effect of Mass on Centripetal Acceleration and Centripetal Force

Trial	Velocity (m/s)	Mass (kg)	Radius (m)	Centripetal Acceleration (m/s ²)	Centripetal Force (N)
1					
2					
3					

Table 2: Effect of Radius on Centripetal Acceleration and Centripetal Force

Trial	Velocity (m/s)	Mass (kg)	Radius (m)	Centripetal Acceleration (m/s ²)	Centripetal Force (N)
1					
2					
3					

Table 3: Effect of Velocity on Centripetal Acceleration and Centripetal Force

Trial	Velocity (m/s)	Mass (kg)	Radius (m)	Centripetal Acceleration (m/s ²)	Centripetal Force (N)
1					
2					
3					

Guide Questions:

1. What happened to the centripetal force when the mass of the object is changed?

2. How did the centripetal force change when you changed the radius while keeping mass and speed constant? Explain the trend you observe.

3. When you increase the speed, how do the centripetal force and centripetal acceleration change? Does the change appear linear or faster than linear?

4. Based on your findings, what are the relationships among mass, radius, speed, and centripetal force? Which factor has the greatest effect on the required centripetal force?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	8	Date	
Lesson Title/Topic:	Relative Motion		
Name		Grade & Section	

I. Activity No. 1: Describing Motion

II. Objective(s): At the end of the activity, students should be able to define reference frame and relative motion.

III. Materials Needed: Worksheet and Pen

IV. Instructions

1. Read and study the selection below.
2. Answer the guide questions.
3. Draw conclusions based on the guide questions.

You were standing by the roadside when a bus passed by. Inside the bus, you saw your classmate Pedro traveling from Monumento to Pasay City. From your point of view, Pedro was moving because his position changed over time. This shows that motion is the change in an object's position with respect to a reference point.

Now, let us look at the same situation from inside the bus. Pedro is sitting in his seat, and his position inside the bus does not change. To another passenger on the bus, Pedro appears at rest. This situation shows that motion depends on the observer or reference frame. An object may appear moving to one observer but at rest to another.

Guide Questions:

1. Where were you standing when the bus passed by?
2. Who did you see inside the bus?
3. Was your classmate seated inside the bus?
4. From your point of view, can you say that your classmate was in motion? Why?
5. Did the observer inside the bus notice that your classmate was just seated?
6. Why do you think your observation and the observer's observation inside the bus were not the same?
7. What is the difference between your frame of reference and the frame of reference of the observer inside the bus?
8. Can an object be at rest and in motion at the same time? Explain how.
9. What is a reference frame (frame of reference)?
10. What is relative motion?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	8	Date	
Lesson Title/Topic:	Relative Motion		
Name		Grade & Section	

I. Activity No. 2: Complete Me

II. Objective(s): At the end of the activity, students should be able to explain how motion changes when observed from different frames.

III. Materials Needed: Worksheet and Pen

IV. Instructions: Check the appropriate motion of the object in each situation based on the frame of reference of the observer.

Situation	Observer's Frame of Reference	Motion of the Object	
		At Rest	In Motion
A passenger in a helicopter	with respect to the ground		
	with respect to the helicopter		
A crow on a cow	with respect to the ground		
	with respect to the cow		
A child standing on the ground	with respect to the ground		
	with respect to the Sun		

Guide Questions:

1. How does the motion of an object change when viewed from different frames of reference?

2. Which objects appear at rest to one observer but in motion to another?

3. Why is it important to identify the observer's frame of reference before describing motion?

4. What can you conclude about the state of motion based on the given situations?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	8	Date	
Lesson Title/Topic:	Relative Motion		
Name		Grade & Section	

I. Activity No. 3: Picture Analysis on Relative Motion

II. Objective(s): At the end of the activity, students should be able to describe the motion of real-life scenarios (e.g., moving vehicles, walking inside a bus) using the concept of relative velocities.

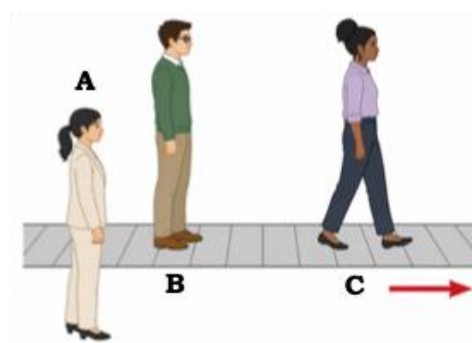
III. Materials Needed: Worksheet and Pen

IV. Instructions: Study the pictures and answer the guide questions that follow.

Situation 1: Two observers (A and B) are watching a woman walking on a moving beltway at an airport.

Guide Questions:

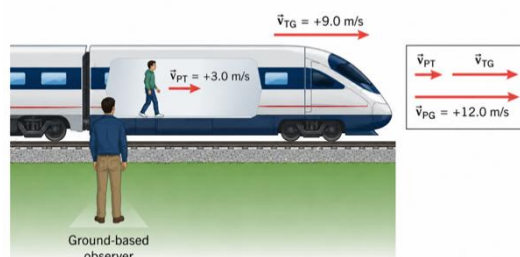
1. How would Observer A describe the woman's motion relative to the ground?
2. How would Observer B describe the woman's motion relative to the moving beltway?
3. How would the woman's speed appear to differ to Observers A and B? Explain briefly.
4. What does this situation show about motion and frames of reference?



Situation 2: A passenger is walking inside a moving train. Analyze and describe the passenger's velocity relative to a ground-based observer.

Guide Questions:

1. What is the velocity of the train relative to the ground? the passenger relative to the train? the passenger relative to the ground?
2. What expression gives the passenger's velocity relative to the ground?
3. How would your answer change if the passenger walked opposite the train's motion?
4. Based on the illustration, what general conclusion can you state about finding relative velocity in one dimension?



LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	8	Date	
Lesson Title/Topic:	Relative Motion		
Name		Grade & Section	

I. Activity No. 4: Video Analysis on Relative Motion

II. Objective(s): At the end of the activity, students should be able to describe the motion of real-life scenarios (e.g., moving vehicles, walking inside a bus) using the concept of relative velocities.

III. Materials Needed: Computer/Tablet/Cellphone, Internet Access

IV. Instructions: Watch the video clips using the provided links to learn how relative motion is determined in moving reference frames.

- https://www.youtube.com/watch?v=lQ_tQYLbVwE
- <https://www.youtube.com/watch?v=ExZGkhZYHIY>

Guide Questions:

1. If two objects move in the same direction, how can you determine their relative motion?

2. If two objects move in opposite directions, how does their relative speed change?

3. What happens to the relative motion when both objects move at the same speed and in the same direction?

4. How do you decide whether to add or subtract velocities when finding relative velocity in one dimension?

5. What does a relative velocity of zero mean? Give an example from the clips (or from daily life).

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	9	Date	
Lesson Title/Topic:	Uniformly Accelerated Motion, Projectile Motion, Circular Motion, Relative Motion (Problem Solving).		
Name		Grade & Section	

Read the problem situation carefully, answer the guide questions and fill the tables in this activity sheet. Use a separate activity sheet for each problem set.

Situation: A jeepney heading north through the next barangay accelerates at a constant rate of 2.00 m/s^2 after it passes the welcome signpost. At $t = 0$, the jeepney is 8.00 m from the signpost, moving north at 5.00 m/s . Where is the jeepney and what is its velocity at $t = 3\text{s}$?

A. Answer the following questions.

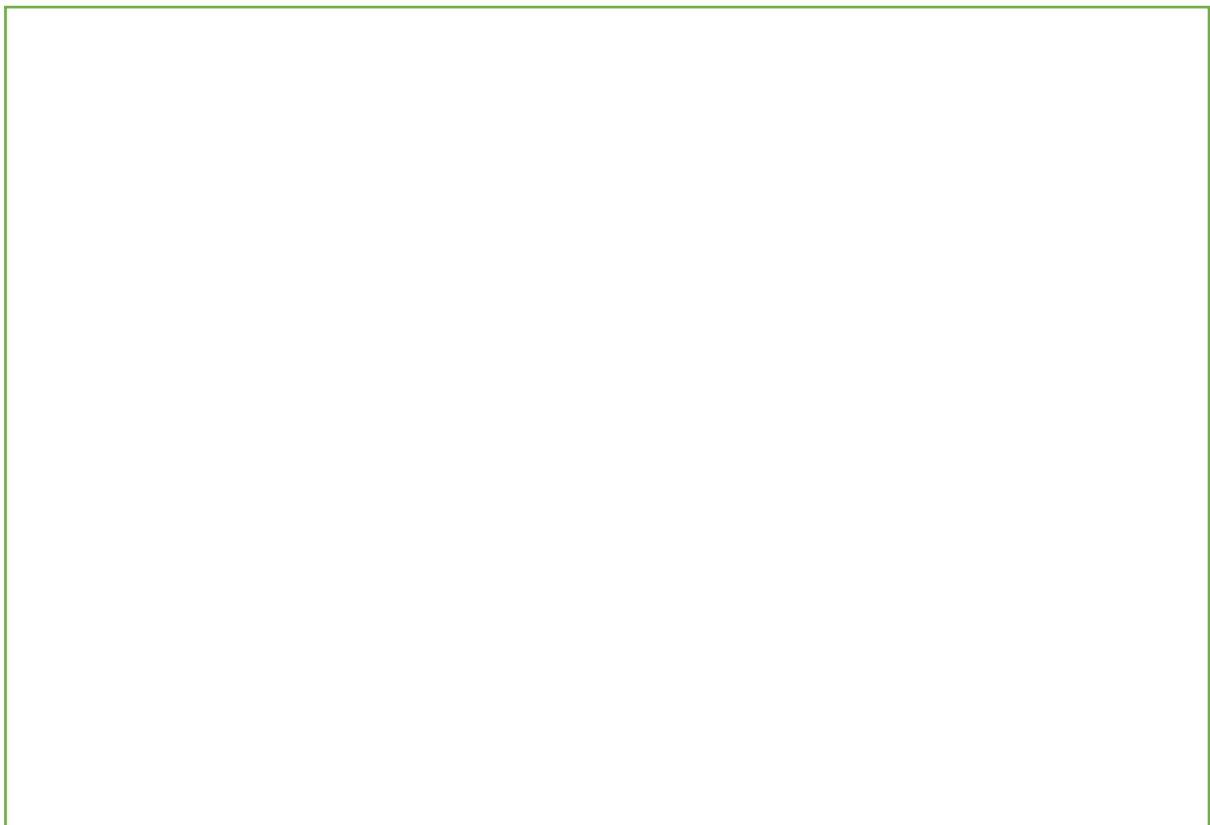
1. In which direction is the jeepney moving?
2. Is the jeepney speeding up, slowing down, or moving at constant velocity? How do you know?
3. What does it mean that the jeepney has a constant acceleration of 2.00 m/s^2 ?
4. Where is the reference point in this problem?
5. At $t = 0$, is the jeepney exactly at the signpost? If not, where is it relative to the signpost?
6. Why is it important to know the initial position?
7. What happens to the jeepney's position as time passes?
8. What quantity or quantities does the problem ask for?

9. Which equation(s) may be used to solve this problem?

A. Fill in the table using the information given in the problem.

Given quantity	Symbol	Values

C. Use this space to draw an illustration to represent the situation in the problem.



D. Solution

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	10	Date	
Lesson Title/Topic:	Introduction to Forces		
Name		Grade & Section	

Materials

1 toy car	meter stick
2 eye hook screw	Stopwatch
4 m string	pencil or masking tape
Masses	pulley
(50 g, 100g, 150 g, 200 g, 250 g)	graduated cylinder

Procedure A

1. Prepare the toy car.
Identify the center point on the front and rear ends of the toy car. Using an appropriate hand drill (with supervision if needed), carefully drill a small hole at each center point.
2. Install the eye hook screws.
Screw one eye hook securely into each drilled hole, ensuring both hooks are firmly attached and aligned with the length of the car.(attaching the hook at the rear may be opt out but it can be useful in another activity in the lesson exemplar)
3. Attach the string.
Tie one end of a string to the eye hook at the front of the toy car.
4. Measure the string length.
Using a meter stick or measuring tape, measure and cut exactly 1 meter of string from the tied end.
5. Check the setup.
Ensure the string is securely tied and the eye hooks are firmly attached before using the toy car in the experiment.
6. Set up the pulley.
Securely install a pulley at the edge of the table. The table should be at least 1 meter wide to ensure sufficient distance for the cart's motion.
7. Mark reference lines.
Using a pencil or masking tape, draw or place two parallel lines on the table surface: The first line should be 20.00 cm from the table edge where the pulley is mounted. The second line should be 70.00 cm from the same edge, making the distance between the two lines 50.00 cm (0.5000 m).
8. Prepare the system.
Attach a 50 g mass to the free end of the string hanging over the pulley. Gently pull the toy car backward until the front of the car aligns with the line farther from the pulley. Ensure the string remains straight and perpendicular to the marked lines.

9. Release and start timing.

Release the toy car smoothly without pushing it and start the timer immediately at the moment of release.

10. Stop timing and ensure safety.

Stop the timer when the front of the toy car crosses the second line (the line closer to the pulley). A group member should be ready to catch or stop the car to prevent it from falling off the table. Perform 3 trials and report the average.

11. Record the data.

Record the time measured in the data table provided (Table B).

12. Repeat the experiment.

Repeat steps 8–11 using the remaining masses, keeping all other conditions (distance, setup, and release method) the same.

Procedure B

1. Set up the apparatus as described in Steps 1–7 of the original procedure, ensuring the pulley, string, and toy car are properly aligned.
2. Securely attach an empty water bottle to the toy car.
3. Using a graduated cylinder, measure 50.0 mL of water and carefully pour it into the water bottle. Ensure the bottle is tightly sealed to prevent leakage.
4. Attach a 200 g mass to the free end of the string hanging over the pulley.
5. Gently pull the toy car backward until the front of the car aligns with the line farthest from the pulley. Make sure the string is straight, taut, and perpendicular to the marked lines.
6. Release the toy car and repeat the procedure described in Steps 9–11 of the original experiment, Procedure A (such as timing, measuring distance, or recording observations).
7. Repeat Steps 2–6, increasing the volume of water in the bottle to 100.0 mL, 150.0 mL, 200.0 mL, 250.0 mL while keeping all other variables constant.
8. Record all observations and measurements for each water volume on Table B.

Procedure C.

1. Repeat Procedure A but assign one member of the group to measure the distance between the two marked lines using a hand span. Measure three hand spans between the lines.

Table A: Time for the Toy Car to Travel 0.50 m at Different Masses

Mass added (g)	Time (s) for cart to travel 0.5000 m	Average speed (m/s)
50		
100		
150		
200		
250		

2. Copy table A and C on a manila paper and post them on the board.

Guide Questions

1. Use the graphing paper to graph the mass (x-axis) attached to the string against the time (y-axis) for the toy car to travel 0.5000 m.

2. How does increasing the mass (50g to 250g) affect the time it takes for the toy car to travel 0.5000 m?
3. Describe the motion of the toy car as you added more mass?
4. The force on the toy car is due to the masses attached. It is an unbalanced force. What is the relationship between the unbalanced force and the average speed of the toy car?
5. Explain any pattern in the average speed of the toy car.
6. How could you increase the accuracy of your measurements?

Table B. Time for Cart to Travel 0.5000 m at Different Volumes of Water.

Volume of Water (ml)	Time (s) for cart to travel 0.5000 m	Average speed (m/s)
50		
100		
150		
200		
250		

7. Use the graphing paper to graph the volume (x-axis) of water against the time (y-axis) for the toy car to travel 0.5000 m.
8. How does increasing the volume (50.0ml to 250.0ml) affect the time it takes for the toy car to travel 0.5000 m?
9. Describe the motion of the toy car as you added more water?
10. The force on the toy car is due to the masses attached. It is unbalanced force and has remained constant in this set-up. Each milliliter load of water is approximately 1g in mass. What is the relationship between the mass of the load on the toy car and the average speed of the toy car?
11. Explain any pattern in the average speed of the toy car.

Table C: Time for the Toy Car to Travel 3 Hand Spans at Different Masses

Mass added (g)	Time (s) for cart to travel 3 hand spans	Average speed (hand spans/s)
50		
100		
150		
200		
250		

12. How does increasing the mass (50g to 250g) affect the time it takes for the toy car to travel in 3 hand spans?
13. Describe the motion of the toy car as you added more mass?
14. The data you gathered while conducting procedure A was obtained using a standard measuring tool. How would you compare your data in Table A with the data from other groups?
15. The data you gathered while conducting procedure C was obtained using an alternative, non-standard measuring tool. How would you compare your data in Table C with Table A and with the data from Table C of other groups?
16. Which procedure produced more reliable data? Explain your reasoning.
17. What role does standardization play in scientific experiments?
18. If all groups used the same non-standard tool, would the results be easier to compare? Why or why not

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	11	Date	
Lesson Title/Topic:	Resultant Vectors		
Name		Grade & Section	

I. Activity No. 1: Walking the Path of Vectors

II. Objective: At the end of the activity, students should be able to understand that the resultant vector is the single vector that represents the sum of two or more vectors.

III. Materials Needed: Worksheet, Floor Space, Tape or Chalk

IV. Instructions:

Part 1: Walking in the Same Direction

1. Mark a clear starting point on the floor.
2. Ask one member to stand at the starting point.
3. Give the following instructions:
 - Walk 3 steps forward (North).
 - Walk 2 more steps forward (North).

Part 2: Walking in Opposite Directions

1. Return to the same starting point.
2. Ask another member to stand at the starting point.
3. Give the following instructions:
 - Walk 4 steps forward (North).
 - Walk 2 steps backward (South).

Part 3: Walking in Perpendicular Directions

1. Return to the same starting point.
2. Ask another member to stand at the starting point.
3. Give the following instructions:
 - Walk 3 steps forward (North).
 - Walk 4 steps to the right (East).
1. Draw or point to the straight line from the starting point to the final position.

Guide Questions: (Provide an answer for each part)

1. In your own words, what is a resultant vector?
2. How are the initial and final positions related to the resultant vector?
3. In which case does the resultant equal the sum of the two values?
4. Why is it important to describe motion using both magnitude and direction??

Reflection Questions

1. How can two separate movements be thought of as one single movement from the starting point to the final position?
2. What similarities or differences did you notice when comparing the final positions in the same, opposite, and perpendicular walking cases?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	11	Date	
Lesson Title/Topic:	Solving Resultant Vectors in One to Two Dimensions		
Name		Grade & Section	

I. Activity No. 2: Equation Explorers: Tackling Resultants in 1D and 2D

II. Objective: At the end of the activity, students should be able to calculate resultant vectors in one dimension and two dimensions.

III. Materials Needed: Worksheet and pen

IV. Instructions:

1. Solve the problems below and provide what is being asked.
2. Provide a complete solution.

Problem 1. Two people push a car along an east-west road. One pushes with a force of 200 N to the east, and the other pushes with a force of 150 N to the east. What is the resultant vector?

Given:	Direction:	Equation:
Solution:		
Final Answer:		

Problem 2. Anna pushes a box with 10 N to the right, and her friend pushes the same box with 5 N down. Calculate the net force acting on the box.

Components	Head-to-Tail Diagram	Opposite side = Adjacent side =
Solution - Magnitude		Solution - Direction
Final Answer		

Problem 3. Two men pull a crate with forces of 50 N at 70° above the positive x-axis and 40 N at 20° below the positive x-axis; find the magnitude and direction of the resultant force.

Given:	Direction:	
Resolve F_1 :	Resolve F_2 :	
Resultant - Horizontal Components		Resultant - Vertical Components
Resultant Vector	Direction	Diagram:
Final Answer:		

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	12	Date	
Lesson Title/Topic:	Solving Vectors in One to Two Dimensions		
Name		Grade & Section	

I. Activity No. 3: Straight-Line Vectors: Predict, Test, Discover

II. Objective: At the end of the activity, students should be able to determine the magnitude and direction of the resultant vector in one and two dimensions.

III. Materials Needed: Vector Addition Simulation, Worksheet, and pen

IV. Instructions:

Part 1: Vector Addition in One Dimension

- Go to https://phet.colorado.edu/sims/html/vector-addition/latest/vector-addition_all.html
- Select Explore 1D. Turn on the Graph and Values features.
- Click the “a” button to add the first vector.
 - Drag the head of the arrow to adjust its length (magnitude) and direction.
 - Right of zero → positive direction.
 - Left of zero → negative direction.

Task 1. Same Direction

- Add Vector A pointing right.
- Add Vector B also pointing right (tail at the head of A).
- Calculate the resultant. Write your answer.
- Use the Sum feature to check.

Task 2. Opposite Direction

- Keep Vector A pointing right.
- Drag Vector B to point left.
- Calculate the resultant. Write your answer.
- Use the Sum feature to check.

Task 3. Multiple Vectors

- Clear all vectors.
- Add Vector A pointing right.
- Add Vector B pointing right.
- Add Vector C pointing left (tail at zero).
- Calculate the resultant. Write your answer.
- Use the Sum feature to check.

Guide Questions

- What happens to the resultant when all vectors point in the same direction?
- What happens when two vectors point in opposite direction?
- How does the sign (positive or negative) of a vector affect the sum?
- If two vectors are equal in size but opposite in direction, what is the resultant?

Part 2: Vector Addition in Two Dimensions

1. In the same simulation, select Explore 2D.
2. Turn on the Grid, Values, and Angle features.
3. Add vectors by clicking the “a” button and dragging arrows in different directions.
 - Place tails at the origin (0,0).
 - Adjust magnitude and angle freely.

Task 1. Perpendicular Vectors

1. Add Vector A pointing right (positive x-axis).
2. Add Vector B pointing upward (positive y-axis).
3. Calculate the resultant vector's direction (angle) and magnitude.
4. Use the Sum feature to check.

Task 2. Non-Perpendicular Vectors

1. Add Vector A pointing right.
2. Add Vector B pointing diagonally (45° upward).
3. Calculate the resultant vector's approximate angle and magnitude.
4. Use the Sum feature to check.

Guide Questions

1. What happens when vectors are perpendicular to each other?
2. Why is vector addition in two dimensions more complex than in one dimension?
3. In what everyday situations (e.g., forces, motion, navigation) can vector addition be applied, and how does it help with decision-making?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	12	Date	
Lesson Title/Topic:	Analyzing Equilibrium and Non-equilibrium Cases		
Name		Grade & Section	

I. Activity No. 1: Equilibrium or Not? Motion Uncovered

- II. Objective:** At the end of the activity, students should be able to analyze real-life motion scenarios to determine whether an object is in equilibrium or not by identifying the state of motion and checking if forces are balanced or unbalanced.

III. Materials Needed: Worksheet and Pen

IV. Instructions:

1. Review each of the four scenarios provided. Visualize or discuss what is happening to the object.
2. For each scenario, complete the Analysis Table by:
 - Identifying the state of motion.
 - Deciding if the object is in equilibrium.
 - Explaining briefly why it is or isn't in equilibrium.
3. Answer the Guide Questions using examples from the scenarios.

Scenarios

- a) **Book on Desk:** A 2-kg physics textbook rests on a wooden classroom desk during a quiet lesson. The desk surface is level, and no one pushes or pulls the book. It stays perfectly still for 10 minutes, even as students walk by nearby.
- b) **Car on Highway:** A family sedan cruises at a steady 90 km/h on a straight, flat interstate highway. The driver maintains constant throttle, with engine power exactly balancing rolling friction, air drag, and slight road resistance. The speedometer shows no change over 5 km.
- c) **Ball Down Ramp:** A soccer ball is released from the top of a 1-meter-long concrete playground ramp tilted at 20 degrees. It starts from rest but accelerates smoothly, reaching 3 m/s at the bottom after 2 seconds, due to gravity pulling it downward while friction slows it slightly.
- d) **Skateboarder on Path:** A 50-kg skateboarder glides at 4 m/s along a flat, paved park path on a breezy day. A steady 5 N wind from behind precisely counters 5 N air resistance and wheel friction, keeping her speed and direction constant for 20 meters.

Analysis Table

Scenario	State of Motion	Equilibrium? Yes/No	Reason
1			
2			
3			
4			

Guide Questions:

1. What defines the state of motion of an object?

2. How do you determine if forces acting on an object are balanced or unbalanced?

3. What is the relationship between net force and an object's motion?

4. When does Newton's First Law apply to an object's motion?

5. When does Newton's Second Law explain changes in motion?

ARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	12	Date	
Lesson Title/Topic:	Free-Body Diagram Construction		
Name		Grade & Section	

I. Activity No. 2: Equilibrium and Non-Equilibrium in Action

II. Objective: At the end of the activity, students should be able to solve both equilibrium and non-equilibrium problems by applying Newton's Laws of Motion.

III. Materials Needed: Worksheet and pen

IV. Instructions:

1. Solve the problems below and provide what is being asked.
2. Provide a complete solution.

Problem 1: A body of mass 100 kg rests on a horizontal surface. If the frictional force is equal to 196 N, calculate the force required to slide the body at a constant velocity.

FBD:	Directions:
Horizontal Components (x-axis)	Vertical Components (y-axis)
Solution:	Solution:

Problem 2: A car with a mass of 1500 kg is towed at a steady speed by a rope held 200 from the horizontal. A friction force of 320 N opposes the car's motion. What is the tension in the rope?

FBD:	Directions:
Horizontal Components (x-axis)	Vertical Components (y-axis)
Solution:	Solution:

Problem 3: A 1.2 kg box is pulled with a force of 3 N at an angle of 32 degrees above the positive x-axis. What is the acceleration? What is the normal force on the box? No friction

FBD:	Directions:
Horizontal Components (x-axis)	Vertical Components (y-axis)
Solution:	Solution:

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	13	Date	
Lesson Title/Topic:	Work and Power		
Name		Grade & Section	

I. Activity no. 1: SPORTS SCIENCE SPOTLIGHT

II. Objective: At the end of the activity, the students should be able to:

- (a) identify and describe the presence of force in different sports situations and determine the source of the applied force;
- (b) analyze and explain the relationship between force and displacement by determining whether the applied force results in movement in each situation;
- (c) express the formula for work mathematically.

III. Materials Needed:

- GIF or video clip or still image of the following:

- Softball player



<https://tenor.com/view/hits-the-ball-major-league-baseball-batting-justin-turner-seattle-mariners-gif-1524781298760373605>

- Bowler



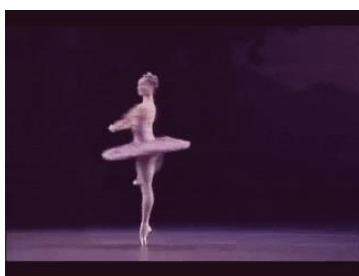
<https://giphy.com/gifs/benglabs-yes-aJK8VdphlCcta>

- Weightlifter



<https://giphy.com/gifs/allroundchampiontv-arc-allroundchampion-all-roundchampion-1XM1HRyc3txTJ64OLi>

- Ballet Dancer



<https://giphy.com/gifs/dance-amazing-what-1V2FG0Lt0ayvC>

IV. INSTRUCTIONS

Part 1: Preparation

- 1) Divide the class into 10 groups.
- 2) The teacher will either provide the still image or GIF of the sports mentioned above.

Part 2. Activity Proper

Task 1

1. Examine carefully the different pictures of sports activities.
2. Explore real-life movements depicted in the different sports where force is applied to make the body or object move.
3. Focus on what the athlete is doing and how movement happens.

Guide Questions:

- a) Do the different sports situations involve the presence of Force?
 - b) What force/s is/are being applied in each situation?
 - c) Is there movement or displacement of the object due to these forces?
4. Investigate further by completing the table below.

OBJECTS	Who Applied the Force?	Did the Applied Force Cause Displacement? (Yes/No)	What is the Direction of the Applied Force?	What is the Direction of the Displacement?	Is the Direction of the Applied Force Parallel to the displacement? (Yes/No)
1) Baseball Ball					
2) Bowling Pins					
3) Barbell					
4) Ballet Dancer					

- a) Based on the results in the table, what relationship can you observe between the direction of the applied force and the direction of displacement?
-
- b) If force is applied and the object moves in the same direction, what concept in Physics does this situation represent?
-
- c) How can we define work based on the relationship between the applied force and the displacement of an object?

Task 2 (Pair-Think-Share)

- 1) Form pairs within your group.
- 2) Recall: ***When the force applied is the same direction with the displacement, the force does work on the object.***

- Let us translate this statement into a mathematical expression.
- Think individually first, then share your ideas with your partner before presenting your group's response. Then complete the table below.

Object	Who Applied the Force?	Does the Object Displace? (Yes/No)	Are Force and Displacement Parallel? (Yes/No)	Is Work Done? (Yes/No)
Baseball Ball				
Bowling Pins				
Barbell				
Ballet Dancer				

3) Let's go back to the different sports presented in Task No. 1.

- When is work done on an object in relation to force and displacement?

- Based on the patterns observed in the table, how can the formula for work be derived from the relationship between force, displacement, and their direction?

- How can work be expressed mathematically in terms of force, displacement and direction? Write the formula.

- Using the derived formula, why is no work done when force and displacement are not parallel?

- What happens to the value of work when the angle between force and displacement increases?

4) Let's use the barbell again as an example. Draw a barbell on your paper. Then, draw a red arrow to represent the force applied to the barbell and a blue arrow to represent its displacement.

- Why do you think the force arrow and the displacement arrow point in the same direction when lifting a barbell?

- If the barbell did not move even though force was applied, how would you represent this in your drawing? Explain your answer.

Reflection Questions:

- a) How did identifying the source of force in different sports situations help you understand how objects move?
- b) What did you realize about the relationship between force and displacement after analyzing the different situations?
- c) How does expressing work mathematically help explain real-life activities in sports and everyday motion?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	13	Date	
Lesson Title/Topic:	Work and Power		
Name		Grade & Section	

I. Activity no. 2: Time, Work, Power Connection

- II. Objective:** At the end of the activity, the students should be able to
- compare how long it takes to perform the same amount of work;
 - explain how time affects how fast work is done; and
 - relate work, time, and power in real-life situations.

- III. Material Needed:**
- Scientific calculator
 - Video Clip or Still Image of a Person Lifting a Barbell

IV. Instructions:

Part 1: Preparation Before the Activity

- Be sure to prepare the image or video clip of a person lifting a barbell ahead of time.
- For this activity, you will work using the **Pair-Think-Share** strategy. First, think individually about your answer to the given questions. Then, discuss and compare your ideas with your partner. Finally, share your agreed answer with the class.

Situation 1: Equal Work, Changing Time

Lifting a Barbell (same work and height)

- Complete the table below.

Given: $m_{\text{barbell}} = 10.0\text{ kg}$ Height = 1.00 m	Student A	Student B
Work done	98.0 J	98.0 J
Time	2.00 seconds	5.00 seconds
Power	1.1 _____	1.2 _____

2. Questions:

- How does the time taken by each student affect the power output?
- Who has greater power based on the results? Why?
- What can you conclude about power when work is the same, but time is different?

Situation 2: Different Work, Same Time Challenge

Running Upstairs (Different Work, Same Time)

- Supply the missing information in the table below.

<i>Same height</i>	<i>Student A</i>	<i>Student B</i>
<i>Work done</i>	<i>500.0 J</i>	<i>200.0 J</i>
<i>Time</i>	<i>10.00 seconds</i>	<i>10.00 seconds</i>
<i>Power</i>	_____	_____

- Answer the following questions.

- Who did more work in the same amount of time?
- Who has greater power? How do you know?
- How does doing more work at the same time affect power?
- What can you conclude about power when time is constant, but work is different?

Reflection Questions:

- If two people do the same amount of work but finish at different times, what differences did you observe and what can you conclude about their performance?
- How does the time spent doing work affect how fast the work is completed?
- How do work and time together help us understand power in everyday activities like lifting, running, or using machines?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	13	Date	
Lesson Title/Topic:	Work and Power		
Name		Grade & Section	

I. Activity no. 3: Work and Power Mastery

II. Objective: At the end of the activity, the students should be able to solve problems involving work and power.

III. Material Needed: Activity sheets, Scientific calculator

IV. Instructions:

Part 1: Preparation Before the Activity

1. Prepare all the materials needed for each Learning Station. Be sure to create two venues for each learning station to accommodate all the groups.

Learning Station 1: • Printed picture of the block on the table
• Velcro arrows/magnetic arrows/sticky notes
• Labels: Applied Force, Normal Force, Gravity, Friction

Learning Station 2: Printed Activity Sheet

Learning Station 3: Printed Activity Sheet

2. Divide the students into pairs.
3. Assign each pair to a starting station
4. Explain the rotation process and time allotment.

Task 1. Learning Station 1: “Build the Free-Body Diagram” Challenge

1. Place a copy of the problem on the table. You may have it laminated using hard paper.

A block of mass 2.50 kg is pushed 2.20 m along a frictionless horizontal table by a constant 16.0-N force directed 25.0° below the horizontal.

- a) What is the work done on the block by the applied force, normal force, and gravitational force?
 - b) Determine the total work done on the block.
2. Students physically place force arrows on the diagram. Take a picture of your final output.
 3. Learners analyze the diagram and complete the table below.

Forces Present	Direction of Force	Symbol Used	Does it contribute to horizontal Motion?
1)			
2)			
3)			
4)			

4. Compute the horizontal component of the applied force using:

$$F_x = F \cos \theta$$

5. Answer the questions below.

Guide Questions:

- What forces are acting on the block?

- Which force acts upward? downward? horizontally?

- Why is the applied force drawn at an angle below the horizontal?

- Which force causes the block to move along the table?

- Why does the block not move vertically?

- Which force component is parallel to the displacement?

- Which forces do not do work on the block? Why?

- How does the free-body diagram help explain the motion of the object?

- What will happen to the motion of the block if the applied force increases?

- Why is it important to correctly represent the forces in a free -body diagram?

Task 2. Learning Station 2: Crane Power Challenge

1. Place a copy of the problem at the station.

A crane lifts a steel beam using a force of 500 N to a height of 8 m in 4 seconds.

- How much work is done?
- What is the power generated by the crane?

2. Read and analyze the situation given. Take note important details.
3. Be sure each member is working well with their group mates to achieve the desired goal.
4. Answer the questions below.

Guide Questions:

- a) What object is being lifted? _____
- b) What force is applied? _____
- c) What distance is covered? _____
- d) How long did the lifting take? _____
- e) What quantities are being asked in the problem? _____

Task 3. Jump Force and Power in Motion

1. Place a copy of the scenario on the table.

A basketball player applies an average force of 150 N to jump upward while taking a shot. The player's center of mass rises by 0.6 m in 0.5 seconds.

- a) How much work is done by the player during the jump?
 - b) What is the power output during the takeoff?
 - c) What does this tell you about explosive movements in sport?
2. Read and analyze the situation given. Take note important details.
 3. Be sure each member is working well with their group mates to achieve the desired goal.
 4. Answer the guide questions below.

Guide Questions

- a) What sport situation is being described?
- b) What force is applied by the player?
- c) How high is the center of mass rise?
- d) How long does the movement take?
- e) What quantities are required to solve?

Reflection Questions

- a) What information did you identify first before solving the problem on work and power?
- b) What difficulties did you encounter while solving the problem? How did you overcome them?
- c) How are work and power applied in real-life activities or sports?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	14	Date	
Lesson Title/Topic:	Energy		
Name		Grade & Section	

I. Activity no. 1: TRACK the ENERGY

II. Objective: At the end of the activity, the students should be able to:

- (a) explain the relationship between potential and kinetic energy; and
- (b) describe how energy changes at different points on a roller coaster (A, B, C).

III. Materials Needed:

- short video clip of a roller coaster ride/roller coaster simulation
- Marker and Manila Paper

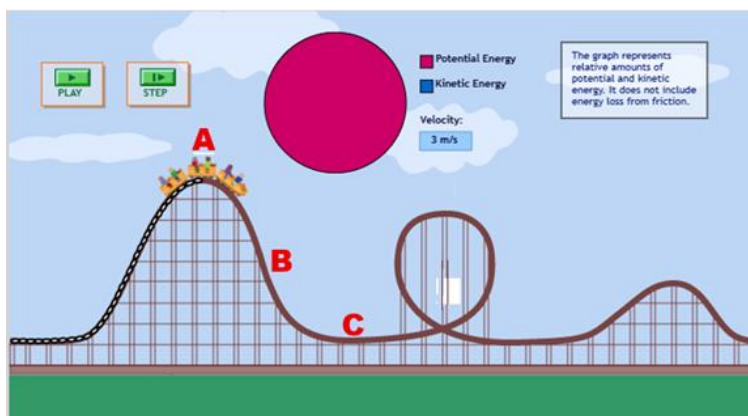
IV. Instructions:

Part 1: Preparation

1. Divide the learners into small groups
2. The teacher will show the roller coaster ride using the simulation below.
<https://www.pbslearningmedia.org/resource/hew06.sci.phys.maf.rollercoaster/energy-in-a-roller-coaster-ride/>

Task 1. Explore the Simulation

1. The teacher plays the simulation to let the whole class observe the different positions of the roller coaster in the track. See figure below as guide.



- 2) Guide the learners to carefully observe what happens to the potential energy (represented by the magenta color) and kinetic energy (represented by the blue color) in the pie chart as the roller coaster moves from Point A to Point C. As the coaster cars move up and down the hills and around the loop of the track, the pie chart shows the continuous transformation between gravitational potential energy and kinetic energy.

3. Let the learners accomplish the table below by describing the relative magnitudes of Potential Energy (PE) and Kinetic Energy (KE) at each position of the roller coaster.

Position of the Roller Coaster on the Track	Potential Energy	Kinetic Energy
Top of the Hill		
Middle		
Bottom		

4. Briefly explain:

- Potential Energy (PE) = energy due to height
- Kinetic Energy (KE) = energy due to motion
- Total energy remains constant (if friction is ignored)

5. The teacher runs again the simulation by doing the following:

- Press Play or Step.
- Let students observe how energy changes as the car moves.

Observation: **At high points → PE is high, KE is low**

At low points → KE is high, PE is low

6. Summarize your observations by answering the Guide Questions below.

Guide Questions

- In a roller coaster system, what component performs work against gravity to raise the cars to the highest starting point?
- What is the key factor that drives the motion of the roller coaster after it reaches the top of the first hill?
- At the highest point of the roller coaster, what type of energy is greatest? What evidence supports your answer?
- As the roller coaster moves down the track, how does potential energy change into kinetic energy?
- At what point in the ride is kinetic energy at its maximum? Why do you think this happens?

Reflection Questions

- How does the idea of energy changing from potential to kinetic energy help you understand moving objects in everyday life?
- How can the concept of energy conservation help engineers design safer and more efficient rides or vehicles?
- How does understanding energy transformation help you improve performance in sports or physical activities?
- In what ways can the conservation of mechanical energy explain movement in nature (e.g., waterfalls, falling leaves, or bouncing balls)?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	14	Date	
Lesson Title/Topic:	Energy		
Name		Grade & Section	

I. Activity no. 2: The Rolling Cart Energy Quest

II. Objectives: At the end of the activity, the students should be able to:

- explain how energy transforms between PE and KE at different points (A, B, C);
- apply the Law of Conservation of Mechanical Energy in a frictionless system; and
- Analyze motion and velocity changes based on height differences.

III. Materials Needed:

- Laptop/Cellphone/Tablets
- Roller Coaster Simulation

IV. Instructions:

Part 1: Preparation

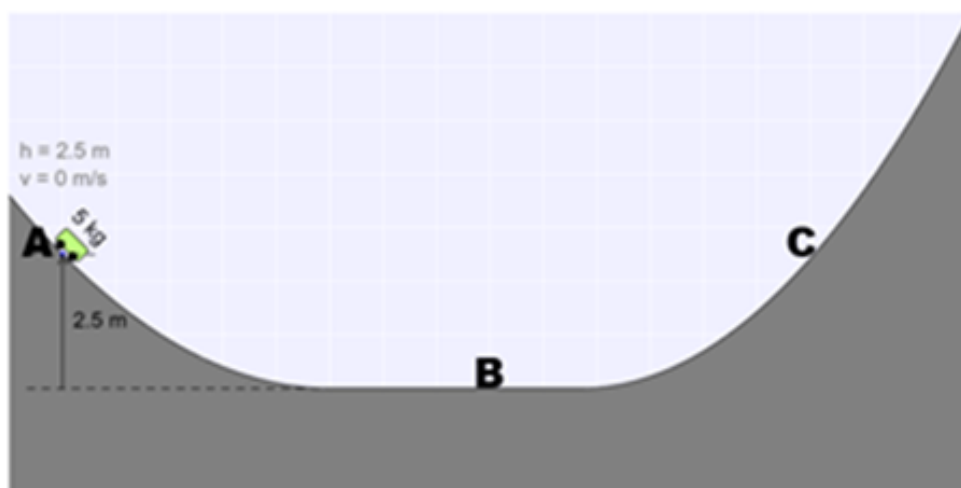
1. Divide the class into 10 groups.
2. The group leader will access and open the simulation using the URL provided below.

https://javalab.org/en/mechanical_energy_en/

Task 1. Explore the Simulation

1. Instruct each group to run the simulation and thoroughly explore all of its features.
2. Each member should carefully observe the cart's height and speed throughout its entire motion as it travels downhill and uphill along the track, especially at the labeled locations on the track. See the figure below as guide.

Conservation of Mechanical Energy



3. Repeat if necessary to explore further.

Observations:

- Fastest at B
- More stored energy at A

4. Describe each point and complete the table below.

POINT	HEIGHT	SPEED
A		
B		
C		

5. Answer the questions below.

Guide Questions:

- What do you think will happen when the cart is released?
- Why does the cart move faster as it goes downhill?
- At which point will the cart move fastest?
- At what point is kinetic energy greatest? Explain your answer.
- At which point will the cart have the greatest stored energy?
- What happens to the cart's potential energy as its kinetic energy increases?
- If the height at A is doubled, what happens to the total mechanical energy?
- If mass increases, does the speed at point B change? Explain.

Reflection Questions:

- Why is it important to understand energy conservation in real-life situations such as transportation or amusement park rides?
- If you were to redesign the track, what changes would you make to maximize the speed at point B while still reaching point C? Explain your reasoning.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	14	Date	
Lesson Title/Topic:	Energy		
Name		Grade & Section	

I. Activity no. 3: Conservation Law Unlocked

II. Objectives: At the end of the activity, the students should be able to:

- describe how potential energy (PE) and kinetic energy (KE) change at points A, B, and C;
- explain the Law of Conservation of Mechanical Energy;
- analyze motion based on height and velocity;
- construct visual models (diagrams/graphs) to represent energy transformation; and
- Apply equations ($PE = mgh$, $KE = \frac{1}{2}mv^2$) to explain the system.

II. Materials Needed:

- Laptop/Cellphone/Tablets
- Roller Coaster Simulation

IV. Instructions:

Part 1: Preparation

- You are engineers analyzing how an object moves along a track without energy loss.”
- The group leader will access and open the simulation using the URL provided below.

https://javalab.org/en/mechanical_energy_en/

Phase 1. Mission Briefing

- Today, you will become Energy Detectives and unlock how energy is conserved in a roller coaster ride.
- Why does a roller coaster move fast at the bottom but slow down at the top?

Phase 2. Simulation Exploration

- Open the roller coaster simulation by clicking the link below:

<https://www.pbslearningmedia.org/resource/hew06.sci.phys.maf.rollercoaster/energy-in-a-roller-coaster-ride/>

- Run the simulation several times. Observe the motion of the roller coaster.
- Walk through the motion step-by-step:

Focus on:

- Height of the roller coaster
- Speed
- The amount of PE and KE at different points on the track.

4. Be sure to take note of your observations.
5. Complete the table below based on observations from the simulation using descriptive words only.

Position	Height	Speed	Potential Energy (PE)	Kinetic Energy (KE)
1				
2				
3				
4				
5				
6				

6. Elicit further observations by asking the following questions:
 - (a) Why does the roller coaster move fastest at the lowest point of the track?
 - (b) What happens to the roller coaster's potential energy as it moves downward?
 - (c) Why does the coaster slow down as it climbs upward?
 - (d) How are height and speed related in the roller coaster ride?
 - (e) What evidence from the simulation supports that energy is not lost but transformed?
 - (f) What law explains this transformation?
 - (g) How does the simulation demonstrate the law of conservation of energy?

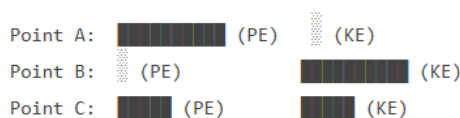
Phase 3: Concept Construction

- 1) Draw the energy transformations of the roller coaster at the following points and intervals:

- 1.1 Point 1
- 1.2 Points 1 - 2
- 1.3 Point 2
- 1.4 Points 2-4
- 1.5 Point 4
- 1.6 Point 2 4-5
- 1.7 Point 5
- 1.8 Point 5 to point 6

EXPECTED STUDENT DRAWINGS

1. Energy Bar Diagram



Phase 4: Equation Connection

1. Introduce Formulas

- Potential Energy:

$$PE = mgh$$

- Kinetic Energy:

$$KE = \frac{1}{2}mv^2$$

Reflection Questions:

1. What challenges did you encounter when explaining why the object speeds up and slows down, and how did you overcome them?
2. In what ways can the Law of Conservation of Mechanical Energy be applied to real-life situations such as transportation or amusement rides

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	15	Date	
Lesson Title/Topic:	Impulse and Momentum		
Name		Grade & Section	

I. Activity 1: Investigating Momentum

II. Objective: At the end of the activity, the students should be able identify the different factors affecting momentum.

III. Materials Needed: Board or plank (at least 1.0 m long), books, block of wood, masking tape, protractor, ruler/ meter stick, toy cars (one at least twice as heavy as the other)

IV. Instructions:

1. Place several books on top of the table and position the plane board at an angle of about 15 degrees from the horizontal.
2. Using the masking tape and marker, label distances of every 20 cm starting from the lower portion of the inclined plane up to the other edge of the inclined plane.
3. Place the block of wood about 10 cm from the foot of the inclined plane. Label this as the block's initial position.
4. Measure how far the block moved. Record this as the stopping distance.
5. Repeat steps 3 and 4 while varying only the initial position / distance for 40 cm, 60 cm, and 80 cm.
6. Do steps 3 to 5, using the heavy toy car. Record your data in the table given below.

Initial Distance (cm)	Stopping Distance (cm) of Light Toy Car	Stopping Distance (cm) of Heavy Toy Car
20		
40		
60		
80		

Guide Questions:

1. How will you compare their stopping distances?

2. Did the two toy cars immediately stop as they hit the block or the wood? Describe the stopping distances of the two toy cars as their point of release increases.

3. If momentum is a measure of how difficult it is to stop a moving object, which of the two cars had greater momentum for the same point of release?

4. Given the following data, solve for the momentum of the following objects that are seen in our community by completing the table below.

Object	Mass (kg)	Velocity (km/h)	Momentum(kg.km/h)
San Fabian BFP Fire Truck	5000 kg	70km/h	
San Fabian Ambulance	4000 kg	100 km/h	
San Fabian Police Patrol Car	3000 kg	45 km/h	
San Fabian MDRRMO Mobile	3000 kg	60 km/h	
Motorcycle	120 kg	55 km/h	

Guide Question:

1. What can you infer about the data presented above?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	16	Date	
Lesson Title/Topic:	ROTATIONAL MOTION		
Name		Grade & Section	

I. Activity No. 1: “Spin and Describe”

II. Objective: Learners will identify and describe the different quantities used in rotational motion.

III. Materials Needed:

- Toy wheel/electric fan/bicycle wheel
- Stopwatch
- Pictures or videos of rotating objects
- Activity sheet

IV. Instructions:

1. Show learners several rotating objects (fan, clock hands, Ferris wheel, spinning top).
2. Ask learners to observe how the objects move.
3. Divide the class into groups.
4. Each group fills out a table describing:

Rotational Aspect Observed	Correct Rotational Quantity
How far an object rotates	
How fast it rotates	
Change in speed of rotation	
Number of rotations per second	

5. Discuss the rotational quantities.

Guide Questions:

1. Which quantity describes the angle covered by the object?

2. Which quantity describes how fast the object rotates?

3. Which quantity describes the change in rotational speed?

4. Which quantity describes the number of rotations per second?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	17	Date	
Lesson Title/Topic:	ROTATIONAL DYNAMICS		
Name		Grade & Section	

I. Activity No. 1: Exploring Torque, Moment of Inertia, and Angular Momentum

II. Objective: By the end of this activity, learners should be able to:

- Analyze torque acting on a rigid body and determine its magnitude and rotational direction.
- Apply conservation of angular momentum to real-life rotational systems.
- Compute moment of inertia for composite objects and explain how mass distribution affects rotational motion.
- Connect concepts of torque, inertia, and angular momentum in practical scenarios.

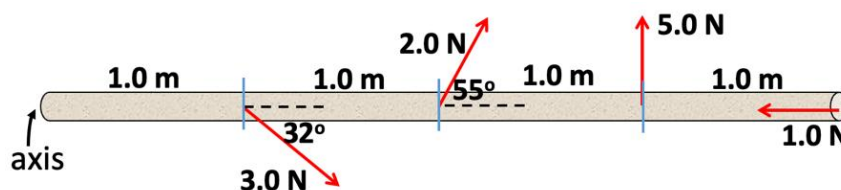
III. Materials Needed: Worksheet and Pen

IV. Instructions:

In this learning activity sheet, you are tasked to solve three problems involving torque, angular momentum, and moment of inertia. You should compute each step carefully, explain the physical meaning of your answers, and present clear solutions with final statements for every activity.

Activity 1: Net Torque Analysis of a Non-Uniform System

Study the diagram of the rigid rod with forces applied. Resolve angled forces into perpendicular components. Indicate the direction (clockwise/counterclockwise) of each torque. Sum all torques to find the net torque. Present a clear solution and state the magnitude and rotational direction.



A. List of Forces and Distances

- Force 1: _____ N at _____ m, angle _____°
- Force 2: _____ N at _____ m, angle _____°
- Force 3: _____ N at _____ m, angle _____°
- Force 4: _____ N at _____ m, angle _____°

B. Torque Calculations Show your work here:

Torque	Calculation	Direction
τ_1		
τ_2		
τ_3		
τ_4		

C. Show addition/subtraction clearly: $\tau_{\text{net}} =$ _____**D. Final Statement:**

The net torque is _____ N·m, acting in the _____ direction.

Activity 2: Angular Momentum of a Rotating Disk

A playground merry-go-round is modeled as a solid disk of mass 120 kg and radius 2.0 m. It rotates at an angular velocity of 3 rad/s. A child of mass 30 kg runs and jumps onto the edge of the disk, sticking to it.

Compute the initial angular momentum of the merry-go-round.

Compute the new angular velocity of the system after the child jumps on.

State whether angular momentum is conserved and explain briefly.

Activity 3: Moment of Inertia of a Wagon Wheel

What is the moment of inertia of a wagon wheel with 8 spokes, each of length is 0.5 m and mass 0.75 kg and a rim of 2.8 kg?



Solution:

If the engineers moved 0.5 kg of mass from the spokes to the rim, would the wheel become easier or harder to start spinning? Justify your answer using the concept of mass distribution.

Solution:

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	18	Date	
Lesson Title/Topic:	ROTATIONAL MECHANICS		
Name		Grade & Section	

I. Activity: Practical Applications of Rotational Dynamics

II. Objective: By the end of this activity, learners should be able to:

- Apply the concepts of torque, moment of inertia, and angular momentum to real systems.
- Create simple representations (sketch, poster, infographic, or role play) that show how these principles solve practical problems.
- Present and explain solutions that improve efficiency, stability, and safety in chosen fields.

III. Materials Needed:

- Markers, pens, or coloring materials
- Bond paper or cartolina
- Optional: props for role play, digital tools for poster/infographic creation
- Calculator (if needed for explanation)

IV. Instructions:

We have examined torque, moment of inertia, and angular momentum, and applied them to real systems. Now, let's move to the next stage: developing initial representations such as sketches, posters, infographics, or short role plays that show how these principles solve practical problems in chosen fields.

A. Students form small groups and select a field.

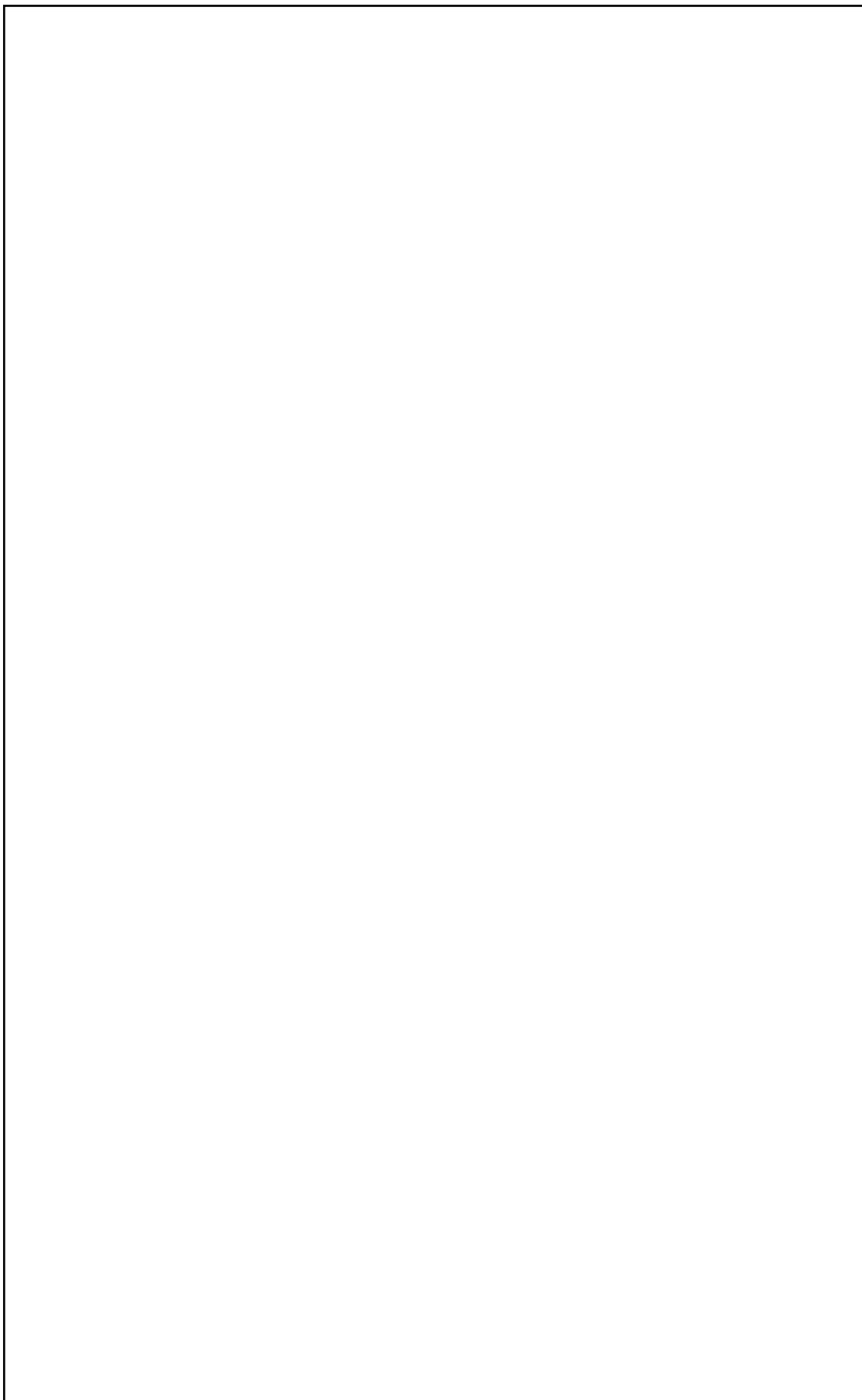
- Automotive industry
- Amusement park ride
- Manufacturing systems (e.g., cranes, conveyor belts, rotating machinery)

Chosen Field: _____

B. Model Design Guidelines

- Prepare an initial representation of your chosen system.
- This may be a sketch, poster, infographic, or short role play.
- Your design must clearly illustrate:
 - Torque – how forces cause rotation.
 - Moment of Inertia – how mass distribution affects stability.
 - Angular Momentum – how motion is sustained or controlled.

Design:



C. Presentation:

State the practical problem.

Explain how torque, inertia, and angular momentum interact to solve the problem.

Suggested improvements for efficiency, stability, or safety

RUBRIC:

Criteria	Excellent (3)	Satisfactory (2)	Needs Improvement (1)
Group Design	Design is clear, creative, and well-constructed (sketch, poster, infographic, or role play).	Design is understandable but lacks detail or creativity.	Design is incomplete, unclear, or missing.
Explanation of Concepts	Clear and accurate explanation of torque, inertia, and angular momentum applied to real systems.	Partial explanation; some concepts are correct but not fully connected to real systems.	Minimal or incorrect explanation; concepts not applied to real systems.
Improvement Ideas	Practical, relevant suggestions for efficiency, stability, or safety improvements.	Suggestions are somewhat relevant but lack depth or feasibility.	Suggestions are vague, unrealistic, or missing.
Group Presentation	Presentation (5–7 minutes) is clear, organized, and shows balanced participation.	Presentation is understandable but lacks organization or balanced participation.	Presentation is unclear, too short/long, or shows minimal participation.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	19	Date	
Lesson Title/Topic:	Simple Harmonic Motion		
Name		Grade & Section	

The "Variable Control" Lab (The Eureka Challenge)

I. OBJECTIVE

- To identify which variables (mass, length, or amplitude) affect the period of a pendulum or spring.

II. MATERIALS NEEDED

- For Pendulums:** Abaca twine or sewing thread, different-sized stones or fishing sinkers (*plomo/bob*), and a bamboo stick for support.
- For Springs:** Improvised metal springs or heavy-duty rubber bands.
- Smartphone stopwatch or a wall clock with a second hand.
- Ruler or measuring tape.

III. DIRECTIONS

- Before starting, write an **"If-Then" statement** predicting how one variable will affect the speed of the cycle.
- Test Variable A (Mass): Keep the length/spring constant but change the weight. Time 10 full cycles (back and forth), then divide by 10 to find the Period (**T**).
- Test Variable B (Length/Stiffness): Keep the weight constant but change the string length or the spring. Time 10 cycles and calculate **T**.
- Test Variable C (Amplitude): Release the mass from a small angle/stretch, then from a much larger one. Observe the time.
- Document your expectations vs. reality in a "Mistake Log."

IV. INVESTIGATION TABLE

Fill in the data for your assigned system (Pendulum or Spring).

Hypothesis: If _____, then _____.

For **PENDULUM** Groups:

Test Parameter	Variable Changed	Total Time (10 Swings)	Period (Total Time ÷ 10)
Test 1: Base Test	Short String (approx. 30cm) + Light Weight		
Test 2: Change Mass	Short String (approx. 30cm) + Heavy Weight		
Test 3: Change Length	Long String (approx. 90cm) + Light Weight		
Test 4: Change Angle	Short String + Light Weight + Pull back very far		

For **SPRING / RUBBER BAND** Groups:

Test Parameter	Variable Changed	Total Time (10 Bounces)	Period (Total Time ÷ 10)
Test 1: Base Test	Single Rubber Band + Light Weight		
Test 2: Change Mass	Single Rubber Band + Heavy Weight		
Test 3: Change Stiffness	Double/Thicker Rubber Bands + Light Weight		
Test 4: Change Stretch	Single Rubber Band + Light Weight + Pull down very far		

V. GUIDE QUESTIONS

1. **The "Eureka" Moment:** Which variable did you *think* would change the period but actually had little to no effect?

2. For **Pendulums**: Does adding a heavier *plomo* make the swing faster, slower, or stay the same?

3. For **Springs**: What happened to the speed of the "bounce" when you used a shorter string/stiffer band?

4. Why is it important to change only **one** variable at a time while keeping the others constant?

VI. REFLECTION

In your "Mistake Log," what was your biggest surprise? Explain how your initial intuition about "how things move" changed after seeing the data.

VII. RUBRIC / SCORING GUIDELINES

Criteria	5 - Excellent	3 - Satisfactory	1 - Needs Improvement
Hypothesis	Clearly stated "If-Then" format based on logic.	Stated a prediction but lacks clear "If-Then" structure.	No prediction made before testing.
Variable Control	Conducted tests by changing only one variable at a time.	Mostly controlled variables, but some inconsistencies.	Multiple variables changed at once; data is unreliable.
Accuracy of Period	Calculations (<i>Time/10</i>) are correct and precise.	Calculations are mostly correct.	Calculation errors throughout.
Presentation	Clearly explained what did and did not work to the class.	Shared results with minor gaps in explanation.	Unable to explain the findings clearly.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	20	Date	
Lesson Title/Topic:	Simple Harmonic Motion		
Name		Grade & Section	

The "Motion Mapping" Discovery Lab

I. OBJECTIVE

By the end of this activity, students should be able to:

- Visualize and graph the movement of a mass on a spring over time.
- Identify and define the four pillars of periodic motion: Amplitude (**A**), Period (**T**), Frequency (**f**), and Phase (**Φ**).
- Analyze the mathematical relationship between period and frequency.
- Compare how changing physical variables alters the shape of a wave graph.

II. MATERIALS NEEDED

- Laptop, Tablet or Cellular phone (Access to PhET Simulation: Masses and Springs)
- Stopwatches and Rulers
- Graph paper (or provided "Graphing Guides")
- Colored pens (Red, Blue, Green)

III. DIRECTIONS

A. Guided Exploration: Mapping the Motion

1. Open the simulation. Select the "Intro" or "Lab" screen. Hang a **100g mass** on the spring.
2. Pull the mass down and release it. Use the "**Slow Motion**" and "**Pause**" buttons.
3. Every **0.1 seconds** (simulated time), mark the vertical position of the mass on your graphing paper.
4. Connect your dots with a smooth line. Use a **Blue pen** for this initial curve.

B. The "Four Pillar" Variables

Perform the following "What If" tests and record your findings:

1. **Amplitude (A):** Pull the spring down **5cm** and graph the motion in **Red**. Then, pull it down **20cm** and graph it in **Green**.
2. **Period (T) & Frequency (f):** Use the stopwatch to time **10 full cycles** (one cycle is down, up, and back to start).
 - Calculate $T = \text{Total Time} / 10$
 - Calculate $f = 10 / \text{Total Time}$
3. **Phase (Φ):** Observe two different springs. Start one from the bottom (stretched) and the other from the equilibrium (middle) at the same time. Compare their starting points on the graph.

C. Peer Interaction

Find a partner from another group. Compare your graphs where the **Amplitude** was different, but the **Frequency** remained the same. Discuss how the physical "hills" and "valleys" look compared to each other.

IV. INVESTIGATION TABLE

Variable	Trial 1 (Small Pull)	Trial 2 (Large Pull)
Amplitude (cm)	5 cm	20 cm
Total Time (10 cycles)		
Period (T = sec/cycle)		
Frequency (f = cycles/sec)		

Graphing Space (Use your graphing paper to plot Position vs. Time. Ensure the x-axis represents Time and the y-axis represents Displacement.)

V. GUIDE QUESTIONS

1. Look at your connected dots. Does the motion form a straight line, a circle, or a wave? What is the scientific name for this shape?
2. How did changing the pull distance (5cm vs 20cm) affect the "height" of the peaks on your graph?
3. Based on your calculations in the table, what happens to the Frequency (f) if the Period (T) increases?

4. Phase Shift: When the two springs started at different positions, did the peaks of the graphs line up? How would you describe the horizontal "shift" between them?

VI. REFLECTION

In your own words, explain why we use a "wave" to represent the motion of something moving up and down in a straight line. If you were to increase the mass to 300g, how do you predict the **Period** of the graph would change (would the wave stretch out or squish together)?

VII. RUBRIC / SCORING GUIDELINES

Criteria	4 - Excellent	3 - Proficient	2 - Developing	1-Beginning
Graphing Accuracy	Dots are precisely plotted; curve is smooth and color-coded correctly.	Most dots are accurate; curve clearly shows a wave pattern.	Dots are inconsistent; wave shape is difficult to identify.	Graph is incomplete or incorrect.
Data Collection	Table is fully completed with accurate ΔT and Δx calculations.	Table is mostly complete; minor errors in calculation.	Table is halfway finished; calculations are missing.	Table is blank or contains random numbers.
Analysis (Guide Qs)	Answers show deep understanding of the 4 pillars and their relationships.	Answers are correct but lack detailed explanation.	Some answers are incorrect or show confusion about variables.	Answers are missing or irrelevant.
Collaboration	Actively engaged with peers; contributed meaningful comparisons.	Participated in peer discussion.	Observed peers but did not contribute much.	Did not interact with other groups.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar No.	21	Date	
Lesson Title/Topic:	Simple Harmonic Motion		
Name		Grade & Section	

Motion Snapshot Analysis

I. OBJECTIVE

- Analyze the kinematics of a mass-spring system using static snapshots.
- Distinguish between displacement, velocity, and acceleration at key points (Equilibrium vs. Maximum Amplitude).

II. MATERIALS NEEDED

- **Snapshot Cards:** A set of 5 images showing a mass-spring system at $t = 0, 1, 2, 3, 4$ seconds.
- **Marking Pens:** Red (for Velocity arrows) and Blue (for Force/Acceleration arrows).
- **Ruler:** For marking the equilibrium line.

III. DIRECTIONS

Part A: Mapping the Snapshot

1. Identify Zero: Draw a horizontal dashed line across all five snapshots to mark the Equilibrium Position.
2. Assign Signs: Label the region above equilibrium as (+) Displacement and the region below as (-) Displacement.
3. Vector Sketch: Using the Red Pen, draw an arrow indicating the direction of movement. If the object is momentarily stopped, mark it with an 'X'.
 - Using the Blue Pen, draw an arrow pointing toward the equilibrium line to represent the Restoring Force.

Snapshot Cards:

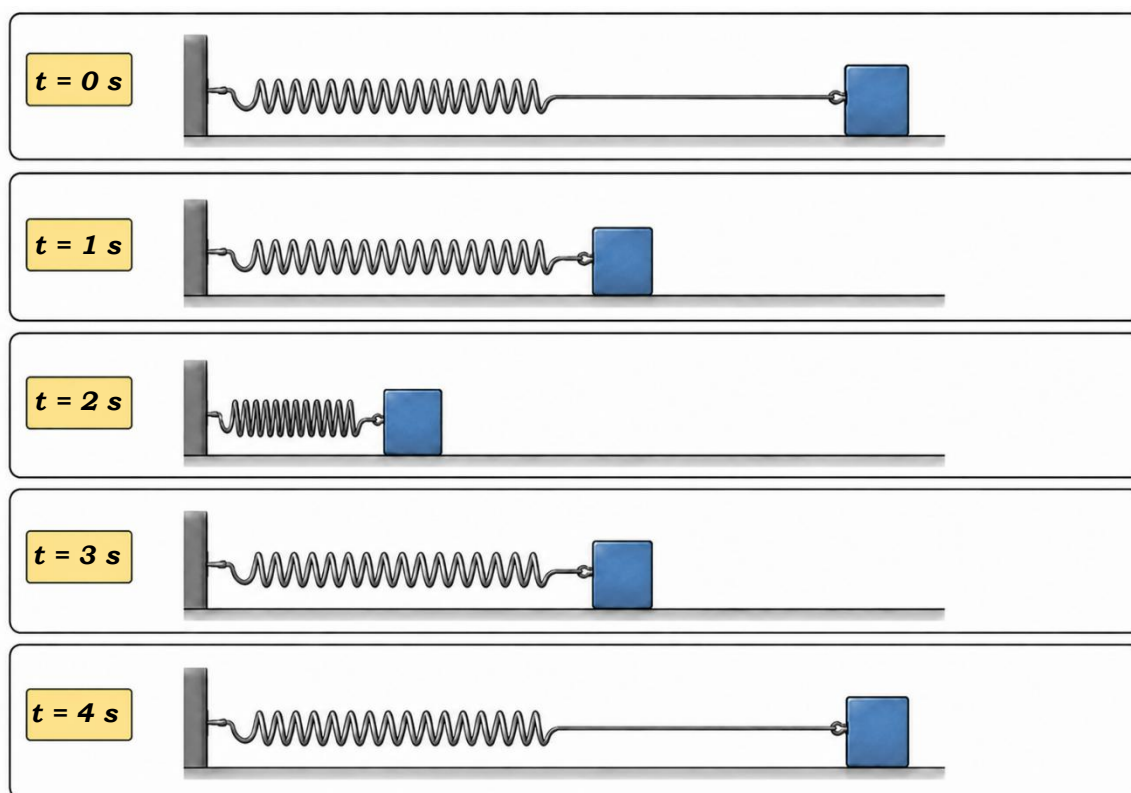


Illustration created using chatgpt

Part B: Interpretation

- Review your snapshots and identify the "Speed Peak." Note the position of the mass.
- Identify the "Turning Points" where displacement is at its maximum.

IV. INVESTIGATION TABLE

Fill out this "State of Motion" table for your presentation:

Time Step	Position (x)	Velocity (v)	Acceleration (a)	Physical Interpretation
0	+A (Max)			
1	0 (Equilibrium)			
2	-A (Max)			
3	0 (Equilibrium)			
4	+A (Max)			

V. GUIDE QUESTIONS

1. In which snapshot(s) is the mass exactly at equilibrium? Based on the "State of Motion" table, what is the magnitude of velocity at this point?
2. Which snapshot shows the Maximum Displacement (**A**)? What is the velocity at this exact moment, and why?
3. Identify the snapshot where the object is about to change direction. What happens to the Restoring Force (acceleration) at this point? Is it at its strongest or weakest?
4. When the displacement (**x**) is at its maximum positive value, what is the sign/direction of the acceleration?

VI. REFLECTION

How does looking at "frozen" snapshots help you understand a "moving" system differently than just watching the spring bounce? Explain how the relationship between position and acceleration changed your perspective on "speeding up" vs. "slowing down."

VII. RUBRIC / SCORING GUIDELINES

Criteria	4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Vector Mapping	All velocity and force arrows are correctly drawn and color-coded.	Most arrows are correct; minor direction errors.	Arrows are present but frequently point in wrong directions.	Vectors are missing or show no understanding of motion.
Data Accuracy	Table is 100% accurate with correct signs and terms.	Table has 1-2 minor errors in signs or interpretations.	Table is incomplete or has several conceptual errors.	Table is largely incorrect or left blank.
Analysis	Guide questions show deep insight into the x vs. a relationship.	Questions answered correctly with basic explanations.	Answers are brief and show some confusion.	Answers are incorrect or irrelevant.
Reflection	Thoughtful connection between static data and dynamic motion.s	Clear reflection on the learning process.	Superficial reflection with little detail.	No reflection provided.