Makeover Challenge:
Converting a Lesson Plan into a IDEA Lesson Exemplar

Physics 4As Lesson Plan

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An lesson exemplar submitted in partial fulfillment of the requirements in
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University of the Philippines Los Baños
College of Arts and Sciences
BS Mathematics and Science Teaching Program

LESSON PLAN FOR GRAND DEMONSTRATION IN TEACHING
GRADE 10 - SCIENCE

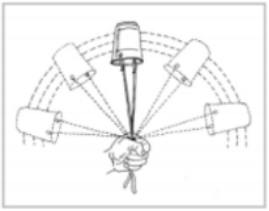
School	**University of the Philippines Rural High School**	Grade Level	**Grade 10**
Teacher	**Regine A. Vicente**	Learning Area	**Science - Physics**
Teaching Date and Time	**November 28, 2019** **12:00 - 2:00 PM**	Quarter	**Third**

I. Objectives	**Performance Standard:** The learner should be able to solve problems involving uniform circular motion using experimental and theoretical approaches. **Content Standard:** The learner demonstrates an understanding of uniform circular motion. At the end of the lesson, the students should be able to: a. Define the terms axis, rotation, revolution, center, tangent, speed, velocity, acceleration, and wheel; b. Compare linear speed from rotational speed; c. Describe uniform circular motion; d. Enumerate real life applications of uniform circular motion; and e. Clarify misconceptions about centripetal force.
A. Content Standards	The learners demonstrate an understanding of the concept of: 1. Uniform Circular Motion 2. Types of Speed 3. Relationship of Tangential and Rotational Speed
B. Performance Standards	The learners should be able to: 1. Solve problems involving uniform circular motion using experimental and theoretical approaches
C. Most Essential Learning Competencies (MELCS)	1. Infer quantities associated with circular motion such as tangential velocity, centripetal acceleration, tangential acceleration, radius of curvature (STEM_GP12KIN-Ic-25) 2. Solve problems involving two dimensional motion in contexts such as, but not limited to ledge jumping, movie stunts, basketball, safe locations during firework

	displays, and Ferris wheels (STEM_GP12KIN-Ic-26)
D. Enabling Competencies	The learners should be able to perform: 1. Problem-solving 2. Analysis and critical-thinking
E. Enrichment Competencies	The learners are recommended to: 1. Apply their understanding of the lesson to real-life situations
II. Content	Uniform Circular Motion
III. Learning Resources	
A. References	
a. Teacher's Guide Pages	Final K-12 MELCS with CG Codes, page 641 *(if under MELCS, post 2021)*
b. Learner's Material Pages	N/A
c. Textbook Pages	Hewitt, P. G. (2015). ***Conceptual Physics***, 12th Edition. City College of San Francisco: Pearson. Serway, R. (1990). ***Physics for Scientists and Engineers: With Modern Physics***, 3rd Edition. Englewood Cliffs, New Jersey: Prentice-Hall International Incorporation. Young, H. D. & Freedman, R. A. (2003). ***University Physics with Modern Physics***, 11th Edition, pp. 100-108. San Francisco: Addison Wesley.
d. Additional Materials from Learning Resources	SoftSchools. (n.d.). ***Centripetal Force Formula***. http://www.softschools.com/formulas/physics/centripetal_force_formula/43/ Solar Schools. (n.d.). ***Types of Energy***. solarschools.net/knowledge-bank/energy/types The Classroom Physics. (2019). ***Newton's Law***. http://www/physicsclassroom.com/Physics-Tutorial/Newton-sLaws.
B. List of Learning Resources for Development and Engagement Activities	Virtual experiments or simulations via online applications: - A virtual simulation on uniform circular motion where speed, radius, and mass may be set. Velocity, acceleration, and net force may be determined: https://bit.ly/2HL5wG4 Other multimedia resources (e.g. video demonstrations or animations, GIFs, and links to online applications) - A recorded video demonstration on uniform circular motion: https://bit.ly/3X7YtJT

IV. Procedures	
A. Introduction	**RECALL ACTIVITY** **Activity No. 1: FACT or BLUFF!** The students will be divided into 14 groups (3 members each). Each of the groups will have a FACT (Rodrigo Duterte) and BLUFF (Xi Jinping) cards that they need to raise as the questions are flashed. The recall activity is composed of five (5) questions from the past lesson/s. Another four (4) questions will be prepared in case of ties. The scores of each group will be tallied at the end of the game. The winning team will receive a prize. No notes should be opened in the duration of the recall game. The questions are as follows: 1. Impulse is also defined as the product of mass and the change in velocity. (FACT) 2. There are four categories of collisions such as: elastic collisions, inelastic collisions, perfectly elastic collisions, and perfectly inelastic collisions (BLUFF – *perfectly elastic is not included*) 3. According to the law of conservation of mechanical energy, the sum of the kinetic energy and potential energy in a conservative system is changing and not equal to the total mechanical energy of the system. (BLUFF – *is constant and equal to the total mechanical energy of the system*) 4. Power is the rate of doing work (FACT) 5. When you go up the stairs fast, you expend more energy in shorter time than when you go slowly (FACT — *This is true based on the equation of power = W/t*) TIE BREAKER QUESTIONS: 1. It is always true that heavy or massive objects have a greater momentum even if they are moving slowly. (BLUFF – *A light object can have as much momentum as a heavy object, depending on how fast it moves, example bullet*) 2. When you push with the same force for twice the contact time, you impart twice the impulse and produce twice the change in momentum.

	(FACT) 3. Anything that is moving has kinetic energy. (FACT) 4. The sum of kinetic energy and potential energy is called elastic potential energy. (BLUFF – *mechanical energy*) **PRIMING ACTIVITY** **Activity No. 2: 4 pics 1 word!** Four pictures will be shown to the students. They will be asked to guess which particular word best describes the theme of the images. All of the images will be based on concepts to be discussed in the session.
	Goal Orientation: The teacher will state the lesson's objectives and the strategies for achieving each one. a. Define the terms axis, rotation, revolution, center, tangent, speed, velocity, acceleration, and wheel; b. Compare linear speed from rotational speed; c. Describe uniform circular motion; d. Enumerate real life applications of uniform circular motion; and e. Clarify misconceptions about centripetal force.
B. Development	**Activity No. 3: Swing all you can!** The class will be divided into six (6) groups. The teacher will discuss the objectives of the activity, and introduce its materials and procedure. Each group shall create a mini-bucket (using a cup) with a marble inside. They will swing the mini-bucket in a small circle, mimicking a loop-the-loop roller coaster. A representative from each group will go in front of the class to get their materials. Before they proceed to the activity, the teacher will ask them questions while demonstrating the experiment. The teacher will tell the students to observe properly what will happen to the marbles inside the mini-bucket. First, the students will try the experiment with only one marble inside the mini-bucket. After that, they will add one more marble and repeat the experiment. Afterwards, the marble will be replaced by five-peso coins, repeating the process. A finished product will be presented to serve as a model. Instructions: 1. Make your own mini-bucket. With the stick, poke a hole near the rim of the cup. Poke another hole directly across from the

	first hole, on the other side of the cup. 2. Cut two pieces of string about 2 feet (60 cm) long each. Attach each string to a side of the cup by looping it through the hole and tying a knot.  3. Take the ends of the strings, and whip the bucket around in a circle over your head. Be sure to stand far away from your classmates and other objects. You may have swayed the bucket back and forth before you can make a full circle.  The teacher will now ask the students with the following questions: 1. What do you think will happen to the marble? Will it fall out or not? Explain. 2. Why did not the marble fall out when you whipped the cup around over your head? 3. How is this similar to a loop-the-loop roller coaster? 4. What do you think is the outside force responsible at work in this activity or on the roller coaster? 5. What do you think will happen if we try the activity with water inside the cup? **Activity No. 4: Time to wrap!** The teacher will now define the terms related to the experiment pertaining to uniform circular motion. **AXIS** - is the straight line around which rotation takes place. **ROTATION** - when an object turns about an internal axis—that is, an axis located within the body of the object **REVOLUTION** - when an object turns about an external axis **REMARKS!** *You rotate about an internal axis when you spin. You revolve around an internal axis when you circle about that axis.*

1. Earth undergoes both types of rotational motion.
   - It revolves around the sun once every 365 1⁄4 days.
   - It rotates around an axis passing through its geographical poles once every 24 hours.

UNIFORM CIRCULAR MOTION
- is the motion of an object traveling at a constant (uniform) speed on a circular path

TYPES OF SPEED

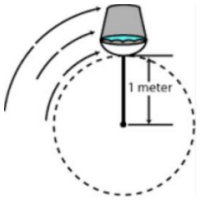
1. LINEAR SPEED (TANGENTIAL SPEED)
- distance traveled per unit of time.
- a point on the outer edge of the turntable travels a greater distance in one rotation than a point near the center.
- the linear speed is greater on the outer edge of a rotating object than it is closer to the axis.
- the speed of something moving along a circular path can be called tangential speed because the direction of motion is always tangent to the circle

2. ROTATIONAL SPEED (ANGULAR SPEED)
- the number of rotations per unit of time.
- all parts of the rigid turntable rotate about the axis in the same amount of time.
- all parts have the same rate of rotation, or the same number of rotations per unit of time. It is common to express rotational speed in revolutions per minute (RPM).

Example:
All parts of the turntable rotate at the same rotational speed.
a. A point farther away from the center travels a longer path at the same time and therefore has a greater tangential speed.
b. A ladybug sitting twice as far from the center moves twice as fast.

Relationship Between Tangential and Rotational Speed
1. Tangential speed and rotational speed are related.
2. Tangential speed is directly proportional to the rotational speed and the radial distance from the axis of rotation.
3. Tangential speed ~ radial distance × rotational speed

NOTE!
~ is the symbol for directly proportional
In symbol form,

	$$v \sim r\omega$$ where **v** is tangential speed and **ω** is rotational speed a. You move faster if the rate of rotation increases (bigger ω). b. You move faster if you are farther from the axis (bigger r)
C. Engagement	**Activity No. 5: Rotate in real-life!** Prompt: At an amusement park, you and a friend are sitting on a large rotating disk. You sit at the edge, giving you a rotational speed of 4 RPM and a linear speed of 6 m/s. Your friend sits halfway to the center. What is your friend's rotational speed? What is your friend's linear speed? **ANSWER:** Your friend's rotational speed is also 4 RPM, while the linear speed is 3 m/s.
D. Assimilation	**Activity No. 6: Check your understanding** The following questions regarding uniform circular motion will be answered by the students. They will write their answers on a paper, have them checked, and then lead the class in reviewing their answers. The questions are as follows: 1. Centripetal acceleration always points _____. a. In the direction of the object's motion b. In the opposite direction of the object's motion c. Towards the center of the circle d. Towards the outside of the circle 2. The velocity is always _____ to the line of a circle. a. Outwards b. Towards the center c. Tangent d. Faster 3. You swing a bucket of water attached to a string in a circle above your head. What keeps the water in the bucket? Refer to the illustration below. 

	a. Friction b. Gravity c. Centripetal force d. Inertia 4. Centrifugal force is a _____. a. Force that pushes you to the outside of a circle during uniform circular motion b. The force that keeps the planets in orbit c. Fictitious force that is really just the linear momentum of an object in uniform circular motion d. The force directed toward a fixed center that causes an object to follow a circular path 5. A 400-g rock attached to a 1.0 m string is whirled in a horizontal circle at the constant speed of 10.0 m/s. Neglecting the effects of gravity, what is the centripetal force acting on the rock? Given: $v = 10.0\frac{m}{s}$ $r = 1.0\ m$ $m = 400\ g\ x\ \frac{1\ kg}{1000\ g} = 0.4\ kg$ Find: Fc Solution: $F_c = \frac{mv^2}{r}$ $F_c = \frac{(0.4kg)(\frac{10.0m}{s})^2}{1.0m}$ $F_c = \frac{(0.4kg)\frac{10.0m^2}{s^2}}{1.0m}$ $F_c = 40kg\ x\ m/s^2$ $F_c = 40N$
V. Reflection	Before the session, I already knew that _____. During the session, I want to know _____. In today's session, I learned that _____. The muddiest point in today's session is _____. In line with this, I will _____.

Prepared by:

REGINE A. VICENTE
Student Teacher

Recommending Approval by:

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Noted by:

_____
Cooperating Teacher

Approved by:

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