Unit 5 – Module 1

Circular motion with washers activity

RATIONALE

This activity explicitly connects the experience of circular motion to a force acting radially inward by way of the washers and the string. Students learn firsthand that the greater the speed at which they twirl the rubber stopper, the greater the number of washers required to maintain uniform circular motion.

The lab sheet which is in the appendix to this unit describes the activity though many slight variations are possible.

CE’s AND PE’s

1. Know that objects that move in uniform circular motion have a nonzero net force directed towards the center of the circle
2. *Identify the period as the amount of time it takes for an object to complete one cycle of motion that repeats itself (In circular motion it is the time to go around a circular path once)*
3. Know the circumference of a circle is 2\*pi\*r
4. *Calculate the speed (distance divided by time) of an object in uniform circular motion from the radius and the period (circumference divided by period)*
5. *Calculate the acceleration of an object in uniform circular motion from the speed and the radius of the circular path (Unresolved Question: Are there activities to bring this point home, or is it just a formula we give students?)*
6. Recall Newton’s 2nd Law in the context of uniform circular motion: the magnitude of the net force exerted on an object in uniform circular motion is the acceleration multiplied by its mass; the direction of the net force is towards the center of the circle
7. *Calculate the net force exerted on an object in uniform circular motion from other forces such as tension and/or weight and/or a normal force*

**Differentiation for PSP**

1. *Equate the net force exerted on an object in uniform circular motion with other forces (tension, force of friction, weight) to determine other physical characteristics (coefficient of friction, mass of object)*

Unit 5 – Module 2

Space station with artificial gravity activity

RATIONALE

Conceptualizing a space station with artificial gravity allows students to compare and contrast the perception of gravity on the surface of the Earth with the perception due to being in a rotating system.

The lab sheet which is in the appendix to this unit describes the activity though many slight variations are possible.

CE’s AND PE’s

1. *Demonstrate that in a non-accelerating reference frame (inertial) in a gravitational field a perceiver regarding him/herself at rest recognizes weight due to any contact forces that act in opposition to the field force of gravity*
2. *Demonstrate that in a rotating reference frame a perceiver regarding him/herself at rest with respect to the reference frame will perceive weight due to any contact forces that provide the net force causing the rotational motion.*
3. *Reconcile the dynamics of circular motion with the feeling of "being thrown outward" when a car moves around a curved road.*
4. *Demonstrate that in cases where the only force exerted on a perceiver in circular motion is provided by a gravitational field force, the perceiver will sense no weight*