Principles of Flight

Lesson Plan: Balancing Acts

Grade Level: K-1

Subject Area: Science

Time Required: ***Preparation:*** 20 minutes
Activity: 30-45 minutes

National Standards Correlation: ***Science (grades K-4)***

- Science as Inquiry Standard: Abilities necessary to do scientific inquiry.
- Unifying Concepts and Processes Standard: Evidence, models, and explanation.

Objectives: Students will:

- Make observations
- Balance various objects
- Predict why objects balance
- Discuss successes and failures

Background: There are various types of motion such as linear, free-fall, projectile, circular and rotary. Though each is distinctively different, all can be described in terms of displacement, velocity and acceleration. When it comes to rotary motion, it is described in terms of angular displacement, angular velocity and angular acceleration. Angular displacement is the angle about the axis of rotation through which the object turns and can be expressed in the units of revolutions, degrees or radians. Angular velocity is defined as the time rate change in angular displacement. Angular acceleration is the constant rate in change of angular velocity. Eve though the equations for each type of motion are specific, the basic means of description remains the same.

Materials: You will need:

- Gyrocopters
- Pencil
- Paper
- Metersticks or metric tape measure
- Calculators
- Stopwatches

Safety Instructions: Follow all pre-established lab safety guidelines and expectations.

Procedure: ***A. Warm-up***

1. Review briefly the equation for calculation angular velocity

2. Review unit conversion factors between revolutions, degrees, and radians

3. Obtain the three gyrocopters from the previous lesson extensions made of different materials but of the same size.

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B. Activity

1. Lab partners are to select a set release height for the gyrocopters and record it in the unit of meters.

2. One partner is to release the gyrocopter from the selected height and count the number of revolutions or spins the gyrocopter undergoes and it "falls" to the floor. The number of spins is to be recorded as the "angular displacement" in the unit of revolutions. Repeat this step three times for each of the three gyrocopters.

3. The other partner is to record the total time of the gyrocopters descent from the moment it is released until it touches the floor. Record this time in the unit of seconds.

4. Noting the direction of spin for each gyrocopter, apply the "right-hand" rule to determine the direction of the angular velocity.

5. Calculate and record the magnitude of the average angular velocity for each of the three gyrocopters in the unit of revolutions per second.

6. Perform unit conversions from revolutions per second to evolutions per minute and radians per second.

7. Vary the release height for the gyrocopters at least twice, repeating steps 2-6 with each variation. Be sure to record the heights chosen again in the unit of meters.

C. Wrap-up

1. Analyze all recorded observations, collected data, and calculations.

2. Discuss and compare results with other lab groups.

3. Write a conclusion based on the analysis of your results. Within your conclusion compare and contrast calculated average angular accelerations for each gyrocopter. Formulate possible explanations for how differences in construction material affect rates of rotation.

4. Also formulate possible explanations for how differences in release height affect rates of rotation.

Assessment/ Evaluation:

Students will be evaluated on the collection and organization of data, calculation performances, and conclusion responses.

Resources/ References:

Trinklein, Frederick E. "Rotary Motion." Modern Physics, Holt, Rhinehart and Winston. Austin TX 78741, 1990.

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