NATURE Summer Academy 2015

Rockets

Description:

Students, working individually or in small teams, will be doing some research along with question and answer trying to understand Newton's Laws of Motion and to use the scientific method in rocketry sub-unit. They also will be constructing two different rocket, predict its performance and the chance of mission success, fly the rocket, and file a post-flight mission report. Missions include achieving high altitude records. Instructions are provided for different paper rocket construction techniques.

Objective:

Design and construct advanced high-power paper rockets for specific flight missions.

Schedule:

9:00 am – 9:30 am Cultural Connection

9:30 am – 10:15 am Power Point

10:15 am -10:45 am Activity 1

10:45 am – 11:15 am Activity 2

11:15 am – 11:45 am Activity 3

11:45 am – 12:00 pm Activity 4

12:00 pm – 12:30 pm Lunch

12:30 pm – 1:15 pm Cont. Activity 4

1:15 pm – 2:45 pm Activity 5

2:45 pm – 3:00 pm Wrap-up

Activity 1

Research on Computers the three Laws of Motion and Rockets

Procedure:

1. Research the three laws of motion and Rockets for 20 min
2. Answer questions

Questionnaire

1. What are the three Laws of Motion?

2. Please define a Rocket?

3. Please name at least 5 different types of rockets and what they are used for

4. Make sure you get a good understanding of the three laws of motion and rockets you will need to understand them for this lesson plan.

Activity 2

"VELO-CITY"

Objectives:

• Perform calculations involving velocity, time and distance (velocity = distance/time)

• Calculate averages

• Understand the relationship between velocity and acceleration and how to calculate both

Materials:

3 Stopwatches

Procedure:

Pick a motion your group wants to time (i.e. run, walk, crawl, skip, walk backwards, crab walk).

Measure out three equal segments for the activity, record the distance.

Each person does the motion the total length of the course. The other group members will be stationed at positions 1, 2 and 3 to record the split at their station. The person at each station will record the time it takes the person in motion to get to that station. Each person will perform the motion three times. Each person in the group will need to perform the motion. Share all the data collected with your whole group. Calculate the velocity at each interval for everyone in your group, using the formula at the top of the page. Calculate the average velocities and times at each interval. On the sheet at the front of the room, record the motion and time it took you to do the motion

Use your data to fill in the following worksheet concerning velocity and acceleration.

**Note to teachers: Collect all the student data to create a master sheet of activities and time. From the master sheet, student can then determine mean, median, mode, interquartile (I.Q.) range, and standard deviation (see example).

	Walk	Run	Crab Walk	Run Backward	Skip	Crawl
Velocities						
Mean						
Median						
Mode						
I.Q. Range						
Stand Dev.						

Distance from start to 1: _____

Distance from 1 to 2: _____

Distance from 2 to 3: ________________________

	T1	Velocity 1	T2	T2-T1	Velocity 2	T3	T3-T2	Velocity 3
Trial 1								
Trial 2								
Trial 3								
Average								

	T1	Velocity 1	T2	T2-T1	Velocity 2	T3	T3-T2	Velocity 3
Trial 1								
Trial 2								
Trial 3								
Average								

	T1	Velocity 1	T2	T2-T1	Velocity 2	T3	T3-T2	Velocity 3
Trial 1								
Trial 2								
Trial 3								
Average								

Math Part

1.) Create a line graph by plotting the average velocity at each time (x-axis is time and y-axis is average velocity) for each member of your group. Use graph paper, making sure to properly label and plot your data.

2.) What is velocity? ____

3.) Explain the curve (shape) of your line graph. ________________________________

____

____

4.) From your line graph, is your velocity constant while you did the activity? Explain.

____

____

5.) What is acceleration? ____

6.) Calculate your acceleration.

7.) Are you accelerating or decelerating? Is your acceleration/deceleration constant?

Explain. _____

_____

_____

8.) How does your individual data fit in with the rest of your group data? _____

_____

_____

9.) Name two things that could have caused errors within your results. _____

_____

_____

Activity 3 Rootin' Tootin' Newton

In this activity, the teacher needs to set the five different stations. During the class, students will be in groups of 2-3, and they will move from station to station after approximately 4-5 minutes at each station. The students will perform the activity specified at each station and then they will determine which of Newton's Laws apply to the motion and explain how it does. In the end, to wrap up the activity, a discussion with the class is needed to explain how Newton's Laws apply. All three of Newton's Laws apply to each activity, so the activity leads into a good discussion of forces and force diagrams (free body diagrams).

Rootin' Tootin' Newton

Medicine Ball Throw

At this station, one person will sit in the chair. Another person will throw the medicine ball to the seated person. Then, the seated person will throw the medicine ball back to the other person. Make sure your partner is ready before throwing the ball! Describe which of Newton's Laws apply to this activity. Explain your answer in detail.

_____

Vertical Jump

Jump straight up in the air near the wall to see how high you can jump. Describe which of Newton's Laws apply to this activity. Explain your answer in detail.

_____

Croquet Mallet

Place one ball under your foot with the other ball touching it on one side. Use the mallet to strike the ball under your foot. Do not hit the ball very hard! Describe which of Newton's Laws apply to this activity. Explain your answer in detail.

_____

Push-ups

Do several push-ups. Describe which of Newton's Laws apply to this activity. Explain your answer in detail.

_____

Bow and Arrow

Use the bow to shoot the arrow at the target. Do not shoot anyone! Describe which of Newton's Laws apply to this activity. Explain your answer in detail.

_____

Procedure:

1. Observe and record observations from what you learned in Activity 1.
2. Discussion of results

Activity 4

Matchbox rocket and launcher

Instructor will hand out everything you need

Activity 5

Advanced High Powered Paper Rockets

Instructor will hand out everything you need for the activity.