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What Does a Can of Soft Drink Weigh on Other Planets?

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The activity explained in this article was developed at the Harvard-Smithsonian Center for Astrophysics by the authors for SPICA Activities. SPICA is the acronym for the Support Program for Instructional Competency in Astronomy and is funded by the National Science Foundation. Thirty-three astronomy and science educators were selected from throughout the United States to be involved in the three-week SPICA astronomy education workshop during August 1989. They developed over 60 astronomy education activities for use in grades K-12. SPICA activities were selected to address ideas that were frequently misunderstood, not understood and/or seldom taught (other than as facts). Each activity was designed to provide a learning experience that (1) was hands-on activity based, (2) developed conceptual understanding and (3) used varied learning strategies. The activities were edited by SPICA staff and are currently being field tested in schools across the country.

Each workshop participant is now a SPICA agent for his/her area and is obligated to serve as an astronomy resource person, conduct local astronomy workshops and field test the activities. If your district has specific astronomy education needs, contact one of the authors. A workshop may be organized and your needs will be forwarded to the SPICA director in Cambridge.

If you use this activity in your class, SPICA would appreciate your evaluation, feedback and/or suggestions. Send feedback to your nearest SPICA agent.

What Does a Can of Soft Drink Weigh on Other Planets?

Suggested Grade Level
K-12

Curriculum Connections
Mathematics

Correlated Topics
Gravity
Laws of Nature
Mass
Space Travel

Objectives

Students will: Organize ten soft drink cans according to their weights.

Infer which soft drink can will best represent the weight of a full soft drink can on the Moon and which will represent the weights of full soft drink cans on the planets.

Processes Illustrated

Observing
Classifying
Inferring
Predicting
Using Numbers
Controlling Variables
Interpreting Data
Using Logic

Class of Activity

Exploration and Application

Materials Needed

Nine empty soft drink cans
One full soft drink can
Marking pen
Masking tape

Procedures

Advanced Preparation: Label the full soft drink can "Earth."

Label the nine empty soft drink cans with the names of the other planets and the Moon.

Place pennies into each of the empty cans according to the chart below:

Planet	*% of Jupiter's Mass*	*# of Pennies*
Earth	395.000	0
Moon	0.063	12
Mercury	0.150	38
Venus	0.359	101
Mars	0.150	38
Jupiter	1.000	293
Saturn	0.420	119
Uranus	0.364	102
Neptune	0.466	133
Pluto	0.019	0

Classroom Activity:

Starting with the Earth can, have each student hold the ten cans individually and compare what the Earth can would weigh on each body in the solar system. Alternately, code the cans, but do not label them and have the students guess which can represents the weight of a full soft drink can on each of the planets.

As a variation on the activity, have a set of models prepared and coded, but not labeled. Have the students line up the cans in order of their masses and ask them to guess which can represents the weight of a can of soft drink for a particular planet. For example, can students guess that the can representing Neptune's gravity will weigh more than the one which represents Saturn's gravity? It is true that Saturn is 95 times as massive as the Earth and that Neptune is only 17 times as massive as the Earth, so why does the can weigh more on Neptune? (It is because Neptune has only 4 times the radius of the Earth and Saturn has 10 times the radius of the Earth. Hence, the additional mass possessed by Saturn is off-set by its much greater radius.)

Special Notes

The mass of the planets relative to Jupiter as outlined in the table will not be appropriate for use in the lower elementary grades, but the different number of pennies in each of the cans is a concrete example of the concept being studied.

Altering the described procedure to have the students make predictions before beginning the activity may be appropriate.

Some teachers may want to relate the Earth's "weight" to pennies rather than to a full soft drink can.

This is a purist's activity--use Classic Coke, not Diet Coke.

Some teachers may prefer to use juice cans, but any variation in can size or material will require new calculations for the number of pennies to be used for each can.

Explanation

The "pull of gravity" is commonly known as the weight of an object. Weight is the name we give to the force of gravity acting in a direction toward the center of the planet. The force depends on both the mass of the planet and its diameter. For example, a planet having twice the mass of the Earth and the same radius as the Earth would have a surface gravity twice that of the Earth. On the other hand, if the planet had the same mass as the Earth, but only one-half the radius, the force of gravity at the surface of this planet would be four times the force at the surface of the Earth due to the inverse square law of gravity. (Recall the inverse square effect of a planet's radius on its surface gravity.)

This activity will help you compare the various relative weights of an item if placed on the "surface" of other planets and the Moon. As future astronauts venture to the other bodies in our solar system, they will experience different "pulls" of gravity. The difference in the pull of gravity on other planets will result in a difference in an astronaut's weight. On some planets, an astronaut may weigh more or less than what he or she does on Earth. For instance, an astronaut who weighs 180 pounds on Earth will weight only 30 pounds on the Moon. On Mars, the same astronaut will weigh approximately 72 pounds.

Since the concept of astronauts' weights on other planets is rather exotic, we have chosen this more familiar example. "What does a can of soft drink weigh on other planets?"

Extensions

Middle and upper grade students can prepare or help prepare the cans.

Upper grade students could calculate the numbers of pennies needed and/or the percentage of gravity of each planet given Jupiter or the Earth.

If the cans are coded but not labeled and the students guess which can represents the weight on each of the planets, they will not necessarily arrange the cans in the order of the planet masses. This can lead to a discussion of density and the inverse square effect of a planet's radius on its surface gravity.

Students can calculate their own weight on each of the planets.

Subject Bibliography

DeBruin and Murad. *1988. Look to the Sky.* Good Apple, Inc., Carthage, IL.