CANADA LEARNING CODE

Taking Off (with Scratch)

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Duration: 60 minutes

LEVEL	SUBJECTS	PROVINCES / TERRITORIES	TOOL
Grade 7-8, 9-12	Science, Math	Across Canada	Scratch

Overview

Students will use Scratch to create simulation-based games of rockets/shuttles leaving the surface of the Earth, the Moon, or other planets with varying gravitational fields. Students will use what they know about ratios and gravitational fields.

Prep Work

- Scratch account and basic understanding for students
- Table of planets and their relative gravitational fields
- Practice using ratios

Lesson

Complete Mass & Weight: Gravity on Planets homework sheet (http://bit.ly/gravity-on-planets-q) and review solutions as a class.

Have students remix this previously created Scratch game: Lunar Lander (https://scratch.mit.edu/projects/72798680/)

Key Coding Concepts

- Algorithms
- Debugging
- Functions
- Loops

Curricular Connections

Astronomy, Physics, mass, gravitational fields, forces of gravity, projectile motion, rocketry, launch mechanics (thrust, launch angle, payload)

References

Lunar Lander by dixiklo https://scratch.mit.edu/projects/72798680/

Have students use information from the homework sheet to remix the game using different forces of gravity and incorporate a take-off aspect.

Assessment

Checklist for understanding of Math and Science outcomes.

Extensions

Increase or decrease the number of planets in the game.

Gravity on Planets Homework

http://bit.ly/gravity-on-planets-q

Year 9 Mass & Weight Homework

The mass of an object ***does not change*** if it were to visit another planet. This is because the number of atoms in the object stays the same. The weight of an object does vary from planet to planet due to varying ***gravitational field strength, g***. The larger the gravitational field strength, the more an object will weigh.

Below is a table showing the gravitational field strength of the 8 planets in our Solar System.

Planet	Diameter (Compared to Earth)	Gravitational Field Strength
Mercury	0.4	4 N/kg
Venus	0.9	9 N/kg
Earth	1	10 N/kg
Mars	0.5	4 N/kg
Jupiter	11	23 N/kg
Saturn	9	9 N/kg
Uranus	4	9 N/kg
Neptune	4	11 N/kg

Weight (N) = Mass (kg) x Gravitational Field Strength (N/kg)

1. Which planet has the largest gravitational field strength?

2. Which planet has the smallest gravitational field strength?

3. An object has a mass of 10 kg. How much will it weigh on:
    a. Earth?

    b. Mars?

    c. Jupiter?

4. Calculate the mass of each of the following objects when the weight on Earth is:
    a. 20 N

    b. 100 N

    c. 2000 N

5. If someone has a mass of 65 kg, what will their mass be on:
    a. Mars?

    b. Venus?

    c. Mercury?

Answers

Planet	Diameter (Compared to Earth)	Gravitational Field Strength
Mercury	0.4	4 N/kg
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Mars	0.5	4 N/kg
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Neptune	4	11 N/kg

The weight of an object is calculated using the formula:

Weight (N) = Mass (kg) x Gravitational Field Strength (N/kg)

1. Which planet has the largest gravitational field strength?

Jupiter

2. Which planet has the smallest gravitational field strength?

Mars and Mercury

3. An object has a mass of 10 kg. How much will it weigh on:
   a. Earth – **10 kg x 10 N/kg = 100 N**
   b. Mars – **10 kg x 4 N/kg = 40 N**
   c. Jupiter – **10 kg x 23 N/kg = 230 N**

4. Calculate the mass of each of the following objects when the weight on Earth is:
   a. 20 N **20 N / 10 N/kg = 2 kg**
   b. 100 N **100 N / 10 N/kg = 10 kg**
   c. 2000 N **2000 N / 10 N/kg = 200 kg**

5. An object weighs 500 N on Earth.
   a. What is the mass of the object? **500 N / 10 N/kg = 50 kg**
   b. How much would it weigh on Neptune? **50 kg x 11 N/kg = 550 N**

6. An object weighs 230 N on Jupiter.
   a. What is the mass of the object? **230 N / 23 N/kg = 10 kg**
   b. How much would it weigh on Earth? **10 kg x 10 N/kg = 100 N**

7. If someone has a mass of 65 kg, what will their mass be on:
   a. Mars? **65 kg**
   b. Venus? **65 kg**
   c. Mercury? **65 kg**