Case Study I: Computing Human Weight on the Moon

Engage: The lesson will begin with the teacher discussing the history of lunar exploration. The teacher will show the footage of Neil Armstrong walking on the Moon. The teacher will discuss the Apollo mission. The teacher will ask students to think of five things regarding what it would be like to be an astronaut exploring the Moon.

Explore: The teacher will begin a class discussion on the topic of weight. The concepts of weight and mass will be discussed and differentiated. The students will learn that in physics and science *weight* refers to a force and not to a mass.

The students will be referred to http://ourworld.compuserve.com/homepages/Gene_Nygaard/weight.htm#toc2b, an educational website dedicated to comparing and contrasting weight and mass. The students will be given 20 minutes to read the website and take notes. After 20 minutes, the students and the teacher will construct the KWL chart with their findings and questions.

Explain: After concluding the class discussion mentioned above and completing the KWL chart, the teacher will reinforce the difference between weight and mass. The students will learn that to convert a unit of weight to Earth to the unit of weight on the Moon, it will need to be multiplied by 1/6. In other words, a student weighting 120 pounds on Earth would weigh 20 pounds on the Moon. Of course, her mass would not change!

The students will learn that the weights would differ between Earth and the rest of the Solar System planets as explained by the force of Gravitational Attraction: $F = mg$, where g is 9.81 m/s^2 on Earth.

Extend: To further students' understanding of how weight of the person would change on various planets, the students will be asked to complete a case study worksheet (of appropriate difficulty level) where they will compute weights of different people on the Moon (and other planets).

Once the case studies are completed, the students will work in the computer lab where they will practice comparing weights of humans and objects on Earth and on the Moon (and other planets) using the WTD tool. The teacher will circulate and offer individual help as needed.

Evaluate: As students complete the case studies, their finding shall be presented to the class. The students will submit their Findings Sheets and they will be posted on the classroom walls. The teacher will proceed with re-teaching or enrichment as needed after analyzing students' work.

Lunar Habitat II

Case Study I
Level A
Student Worksheet

How Much Do You Weigh on the Moon?

In this activity you will understand that weight is a measure of gravitational attraction and that this force is not the same on each planet.

1. Write your weight (or an estimate) here: _____

2. Multiply your answer to question 1 by 1/6: _____

3. Show your final answer: _____

Congratulations, you just converted your weight on Earth to your weight on the Moon!

Now, find two friends and measure and calculate their corresponding Moon weights:

4. First Friend: Earth Weight: _____ Moon Weight: _____

5. Second Friend: Earth Weight: _____ Moon Weight: _____

Lunar Habitat II

Case Study I
Level B
Student Worksheet

How Much Do You Weigh on the Moon?

In this activity you will understand that weight is a measure of gravitational attraction and that this force is not the same on each planet.

Note that to calculate someone else's on a different planet, you need to multiply his or her weight by the given coefficient. For example, to calculate a person's weight on the Moon, you would multiply her weight on Earth by 0.17.

For this exercise you will need to get weights from two of your friends and complete the following table (remember to show all work):

Person	*Weight on Earth*	*Planet*	*Coefficient*	*"New" Weight*
Yourself		Moon	0.17	
Friend 1				
Friend 2				
Yourself		Mercury	0.40	
Friend 1				
Friend 2				
Yourself		Jupiter	2.5	
Friend 1				
Friend 2				

On what planet did each person weigh the most? Why? _____

On what planet did each person weigh the least? Why? _____

How Much Do You Weigh on the Moon?

In this activity you will understand that weight is a measure of gravitational attraction and that this force is not the same on each planet.

Note that to calculate someone else's on a different planet, you need to multiply his or her weight by the given coefficient. For example, to calculate a person's weight on the Moon, you would multiply her weight on Earth by 0.17. For this exercise you will need to get weights from two of your friends and complete the following table (remember to show all work):

Person	*Weight on Earth*	*Planet*	*Coefficient*	*"New" Weight*
Yourself		Mercury	0.40	
Friend 1				
Friend 2				
Yourself		Venus	0.90	
Friend 1				
Friend 2				
Yourself		Moon	0.17	
Friend 1				
Friend 2				
Yourself		Mars	0.40	
Friend 1				
Friend 2				
Yourself		Jupiter	2.5	
Friend 1				
Friend 2				
Yourself		Saturn	1.1	
Friend 1				
Friend 2				
Yourself		Uranus	0.8	
Friend 1				
Friend 2				
Yourself		Neptune	1.2	
Friend 1				
Friend 2				
Yourself		Pluto	0.01	
Friend 1				
Friend 2				

On what planet did each person weigh the most? Why? _____

On what planet did each person weigh the least? Why? _____

Lunar Habitat II

Case Study I
Level A
Teacher Worksheet

How Much Do You Weigh on the Moon?

In this activity you will understand that weight is a measure of gravitational attraction and that this force is not the same on each planet.

1. Write your weight (or an estimate) here: X lbs

2. Multiply your answer to question 1 by 1/6: X / 6

3. Show your final answer: X / 6 (lbs)

Congratulations, you just converted your weight on Earth to your weight on the Moon!

Now, find two friends and measure and calculate their corresponding Moon weights:

4. First Friend: Earth Weight: Y lbs Moon Weight: Y / 6 (lbs)

5. Second Friend: Earth Weight: Z lbs Moon Weight: Z / 6 (lbs)

Lunar Habitat II

Case Study I
Level B
Teacher Worksheet

How Much Do You Weigh on the Moon?

In this activity you will understand that weight is a measure of gravitational attraction and that this force is not the same on each planet.

Note that to calculate someone else's on a different planet, you need to multiply his or her weight by the given coefficient. For example, to calculate a person's weight on the Moon, you would multiply her weight on Earth by 0.17.

For this exercise you will need to get weights from two of your friends and complete the following table (remember to show all work):

Person	*Weight on Earth*	*Planet*	*Coefficient*	*"New" Weight*
Yourself	X lbs	Moon	0.17	0.17X
Friend 1	Y lbs			0.17Y
Friend 2	Z lbs			0.17Z
Yourself	X lbs	Mercury	0.40	0.40X
Friend 1	Y lbs			0.40Y
Friend 2	Z lbs			0.40Z
Yourself	X lbs	Jupiter	2.50	2.50X
Friend 1	Y lbs			2.50Y
Friend 2	Z lbs			2.50Z

On what planet did each person weigh the most? Why?

Jupiter / Because of the highest coefficient.

On what planet did each person weigh the least? Why?

Moon / Because of the lowest coefficient.

How Much Do You Weigh on the Moon?

In this activity you will understand that weight is a measure of gravitational attraction and that this force is not the same on each planet.

Note that to calculate someone else's on a different planet, you need to multiply his or her weight by the given coefficient. For example, to calculate a person's weight on the Moon, you would multiply her weight on Earth by 0.17. For this exercise you will need to get weights from two of your friends and complete the following table (remember to show all work):

Person	*Weight on Earth*	*Planet*	*Coefficient*	*"New" Weight*
Yourself	X lbs	Mercury	0.40	0.40X
Friend 1	Y lbs			0.40Y
Friend 2	Z lbs			0.40Z
Yourself	X lbs	Venus	0.90	0.90X
Friend 1	Y lbs			0.90Y
Friend 2	Z lbs			0.90Z
Yourself	X lbs	Moon	0.17	0.17X
Friend 1	Y lbs			0.17Y
Friend 2	Z lbs			0.17Z
Yourself	X lbs	Mars	0.40	0.40X
Friend 1	Y lbs			0.40Y
Friend 2	Z lbs			0.40Z
Yourself	X lbs	Jupiter	2.50	2.50X
Friend 1	Y lbs			2.50Y
Friend 2	Z lbs			2.50Z
Yourself	X lbs	Saturn	1.10	1.10X
Friend 1	Y lbs			1.10Y
Friend 2	Z lbs			1.10Z
Yourself	X lbs	Uranus	0.80	0.80X
Friend 1	Y lbs			0.80Y
Friend 2	Z lbs			0.80Z
Yourself	X lbs	Neptune	1.20	1.20X
Friend 1	Y lbs			1.20Y
Friend 2	Z lbs			1.20Z
Yourself	X lbs	Pluto	0.01	0.01X
Friend 1	Y lbs			0.01Y
Friend 2	Z lbs			0.01Z

On what planet did each person weigh the most? Why?

Jupiter / Because of the highest coefficient.

On what planet did each person weigh the least? Why?

Pluto / Because of the lowest coefficient.

Lunar Habitat II
Case Study I
Findings Sheet

Name(s): _____
Level: ____B or C_____
Period: _____
Date: _____

Directions: Fill out this sheet completely and turn it in with all work to your teacher.

Question	Answer	Reasoning
Question 1: On what planet did each person weigh the most?		
Question 2: On what planet did each person weigh the least?		