# Orion's Path Teacher's Guide

This course is designed to enhance 6th grade science understanding and practice math skills. There are three lessons, with representing math problems of various complexity.

## Lab 1: Packing for Your Trip

| Vocabulary | Science & Conceptual | Math |
|---|---|---|
| Expedition<br>Lunar | Deductive reasoning<br>Energy efficiency<br>Atoms and Molecules<br>Logistics for space travel | Addition<br>multiplication |

In this lesson, students use **addition** and **multiplication** to determine whether it is more efficient to carry water, or carry water-making equipment to the moon.

The correct answers are:

Calculation 1

Total amount of oxygen needed = 60 pounds

Total amount of water needed = 180 pounds

Total weight combined = 240 pounds

The weight of the equipment is 1000 pounds, so for the first scenario, the correct option is to carry the water, since the water is lighter than the equipment.

Calculation 2

Total amount of oxygen needed = 320 pounds

Total amount of water needed = 960 pounds

Total weight combined = 1280 pounds

The weight of the equipment is 1000 pounds, so for the first scenario, the correct option is to pack the equipment, since it is lighter than carrying water.

## Lab 2: Mining for Iron Oxide

This lesson includes two exercises; the second one is more advanced and may require more teacher guidance.

In the **Lab 2, Part 1**, students will calculate how much soil of several different iron-oxide concentrations they will need to collect in order to create 8 pounds of water. They will have to use **decimals**, **percents**, and **division** to determine the amount of soil that would be required from each site. They will also have to consider other constraints, including the Rover's weight capacity and energy stores.

| **Vocabulary** | **Science & Conceptual** | **Math** |
|---|---|---|
| Reduction<br>Resources<br>Watts<br>Generate<br>Concentration<br>Yield<br>Chemical reaction<br>Survey<br>Equation | Deductive reasoning<br>Energy Usage<br>Space Exploration Logistics | Decimals<br>Percents<br>Multiplication by Percentage |

Vocabulary:

The correct answers are:

> Site 1 has a yield of 2% and is 400 yards away. It would take **400 lbs.** of soil to make 8 lbs of water. The rover only holds 300 pounds, so this is not a viable option.
>
> Site 2 has a yield of 5% and is 600 yards away. It would take **160 lbs.** of soil to make 8 lbs of water.
>
> Site 3 has a yield of 8% and is 700 yards away. At 8% they will need to pick up **100 lbs.** to make 8 lbs of water.
>
> Site 4 has a yield of 10% and is 800 yards away. At 10% they will need to pick up **80 lbs**. to make 8 lbs of water.

In the advanced section or Part 2, students will determine the MAXIMUM amount of soil they can collect without running out of power. The goal is for the rover to successfully make it back to base with the largest load of soil possible. To do this, students need to calculate the rover's energy requirements in terms of distance the rover has to travel and the weight of the load. This exercise requires the use of **multiplication**, **division**, **addition**, and **subtraction**. The multiplication will require use of **decimal percentages** (less than 1%, such as .5%) They will also have to convert percentages to decimals in order to perform the calculations.

Vocabulary:

| Vocabulary | Science & Coceptual | Math |
|---|---|---|
| Efficiency<br>Watts<br>Yards<br>Payload<br>Energy consumption<br>Maximum | Deductive reasoning<br>Energy Usage<br>Space Exploration Logistics | Addition<br>Subtraction<br>Multiplication<br>Division |

The correct answers are:

For 400 yards, 800 watts are consumed for transport, leaving 1200 watts of energy. It would take 2 watts to transport each pound of soil back to base. The amount of soil that could be carried would be **600** pounds. But this one has a trick answer because the Rover only holds 300 pounds, so while there is enough energy to haul 600 pounds of soil back to base, there is only **capacity** for 300.

For 600 yards, 1200 watts are consumed for transport, leaving 800 watts. It would take 3 watts to transport each pound of soil back to base. Thus the amount of soil that can be carried is **266** pounds.

For 700 yards, 1400 watts are consumed for transport, leaving 600 watts. It would take 3.5 watts to transport each pound of soil back to base. Thus the amount of soil that can be carried is **171** pounds.

For 800 yards, 1600 watts are consumed for transport, leaving 400 watts of energy. It would take 4 watts to transport each pound of soil back to base. Thus the amount of soil that can be carried is **100** pounds.

## Lab 3: Making a Day's Worth of Water

In this lesson, students are introduced to the concept of breaking and reformation of chemical bonds. The objective of this lesson is to determine the optimum temperature where iron oxide is broken down to iron and oxygen, and where oxygen and hydrogen are bonded to create water. Students will need to figure out the optimum temperature settings for the Hydrogen Reduction reactor to create 8 pounds of water in the shortest amount of time. Although this lesson doesn't require students to perform much math, the key point of this lesson is to teach about energy efficiency.

Vocabulary:

Optimal
Efficient
Lunar
Molecule

The correct answer is:

850 degrees

**Note:** students must test each available temperature before they will be able select the correct temperature setting.