Reproducible

ACTIVITY 3

Name_____ Date_____

Lesson Scenario

Time: Sometime in the next century
Place: Earth

National and international space agencies are cooperating to plan for human exploration of the outer Solar System. Their intention is to send expeditions to the moons of Jupiter, Saturn, Uranus, and Neptune to explore, collect samples, and search for clues to the beginnings of the Solar System. It is impractical to send all the rocket fuel and consumables (drinking water, air, food) from the Earth because they are heavy, bulky items. Therefore, the space agencies are looking for sources of rocket fuel and consumables at an intermediate destination, the asteroid belt. Your class has been selected to plan a prospecting expedition to the asteroids to look for resources that could be turned into rocket fuel, drinking water, etc.

What can we get from an asteroid?
Two types of materials on asteroids appear to be attractive for mining: metals and volatiles. Both of these are essential for space travel. The cost of launching any material from the Earth is extremely high, so useful materials that are already in space can be very valuable. Most of the asteroids are found in orbits between Mars and Jupiter. However, several hundred have orbits that bring them close to the Earth. Rocket trips to some of these "near-Earth" asteroids would use even less fuel than a trip to the Moon, though the travel time to an asteroid might be much longer because the asteroid is not orbiting Earth.

Metals—An asteroid of the composition of an ordinary chondrite could be processed to provide very pure iron and nickel. Valuable by-products would include cobalt, platinum, gallium, and germanium. These metals are basic to the production of steel and electronic equipment. Some metals from an asteroid mine might even prove valuable enough to be returned to Earth. Iron meteorites are high-grade ores.

Volatiles—Water, oxygen, and carbon compounds are useful in any space settlement, both for life support and for producing rocket fuel. These volatiles could be found in an asteroid that resembles a carbonaceous chondrite or the nucleus of a former comet. Water contents may range from 5–10% by weight for a chondrite to 60% by weight for a comet nucleus. In some asteroids large quantities of sulfur, chlorine, and nitrogen may also be available.

This educational content developed by NASA.