LESSON 7.11

Using Large Numbers

TRAVELING IN THE SOLAR SYSTEM

The table below gives the diameter and average distance from the Sun in kilometers (km) of each of the planets in the solar system. The Sun's diameter is also shown.

	Diameter	Distance from Sun	Moons
Sun	$1.39(10^6)$		
Mercury	$4.88(10^3)$	57,700,000	0
Venus	$1.21(10^4)$	108,150,000	0
Earth	$1.23(10^4)$	150,000,000	1
Mars	$6.79(10^3)$	227,700,000	2
Jupiter	$1.43(10^5)$	778,300,000	17
Saturn	$1.20(10^5)$	1,427,000,000	22
Uranus	$5.18(10^4)$	2,870,000,000	15
Neptune	$4.95(10^4)$	4,497,000,000	3
Pluto	$6.00(10^3)$	5,900,000,000	1

1. Convert the diameters to normal decimal notation.

2. Convert the distances to scientific notation.

3. Divide the planets into groups according to:

a. their diameters. How many groups are there? Explain.

b. their distance from the Sun. How many groups are there? Explain.

c. their number of moons. How many groups are there? Explain.

4. Compare the groups you created in problem 3. Find a way to combine your decisions into an overall division of the planets into two or three groups, by *type of planet.* Name each group, and list its characteristics in terms of the data in the table.

5. Light travels approximately 299,793 kilometers per second. Show your calculations, and give your answers in scientific notation. How far does light travel in

a. one minute? b. one hour?

c. one day? d. one year?

6. Abe remembers learning in elementary school that it takes about eight minutes for light to travel from the Sun to the Earth. Figure out whether he remembers correctly. Show your calculations.

7. Light from the Sun takes more than one day to reach which planets, if any?

8. When Pluto is at its mean distance from the Sun, how long does it take light from the Sun to reach it?

9. An *Astronomical Unit* is the distance from the Earth to the Sun. What is Pluto's distance from the Sun in Astronomical Units?

SCALE MODELS

10. Make a scale drawing showing the distances of the planets from the Sun. Tell what your scale is, and explain why you chose it.

Project

11. Decide what would be a good scale for a scale model of the solar system, so you could fit the model in your classroom. How large would each planet be? How far would each planet be from the Sun?

12. Decide what would be a good scale for a scale model of the solar system, so you could clearly see even the smallest planet. How far would each planet be from the Sun? How large would each planet be? What objects could you use to represent the planets?

13. Using a map of your town, figure out where you might place the planets and the Sun. Use the scale you calculated in problem 12.

14. The nearest star, Alpha Centauri, is 40 trillion kilometers away from the Sun. Where would it be in your model?

DOWN TO EARTH

15. In 1986 people in the U.S. threw away about 64.7 million tons of paper and cardboard. Write this number in scientific notation.

The number 64.7 million is too large to mean anything to most people. The following problems illustrate some ways of bringing large numbers "down to earth."

For example, to understand how much paper and cardboard was thrown away in the U.S. in 1986, it helps to figure out how much was thrown away *per person.*

Since there are 2000 pounds in a ton, 64.7 million tons is

$(6.47 \cdot 10^7 \text{ tons}) \cdot (2 \cdot 10^3 \text{ lbs/ton})$

$= 12.94 \cdot 10^{10} \text{ lbs.}$

16. The U.S. population in 1986 was about 240 million people. Write this number in scientific notation. Then calculate how many pounds of paper and cardboard were thrown away *per person.*

17. The distance around the equator of the Earth is about 24,900 miles. Al bikes to and from school every day, about five miles each way. Biking back and forth to school, about how many school years would it take Al to cover the distance around the equator? (A school year has about 180 days.)

18. Biking back and forth to school, about how many school years would it take Al to cover

a. the distance from the Earth to the moon?

b. the distance from the Earth to the Sun?

19. The population of the U.S. was about 250 million in 1990. Approximately $5 \cdot 10^{11}$ cigarettes were smoked in the U.S.

a. About how many cigarettes were smoked *per person*?

b. About how many were smoked *per person, per day*?

c. If 186 million U.S. residents did not smoke any cigarettes, how many cigarettes were smoked *per smoker, per day*?