
circle will represent the orbit of the GRACE satellites around the Earth. The scale of this model is 1 cm = 100 km.

2. Measure the total distance traveled by the GRACE satellites, which is the circumference of the circle. To do this, place the string on the circle and then measure its length with the meter stick. *Record your measurement in centimeters!* Convert this measurement into kilometers. Remember, the scale of this model is 1 cm = 100 km.
3. To find the speed, divide the distance by the time. The orbital period of the GRACE satellites is approximately 90 minutes. Your answer will be the speed of the GRACE satellites in kilometers per minute. Convert this to kilometers per second! (1 minute = 60 seconds).

Extensions:

Have the student's research information about the GRACE satellites including the type of orbit.

Show the path of GRACE on their circle (which now represents Earth).

Assign a time of day to each student. Have the student make a poster that shows where the GRACE satellite would be at a given time.

References / Resources:

GRACE web site: <http://www.csr.utexas.edu/grace>. You will find such materials as: GRACE Brochure, GRACE lithograph, GRACE fact sheet, etc.

Data Entry Sheet

Round All Measurements to the Nearest Whole Number!

DATA	
Circumference of the Circle in Centimeters	
Distance GRACE Satellites Travels Around the Earth in Kilometers	
Speed of GRACE Satellites in Kilometers per Minute	
Speed of GRACE Satellites in Kilometers per Second	

Conclusions:

Answer each of the following using *complete sentences*!

1. Scientists use the following equation to calculate the speed of satellites in Earth orbit: **Speed (in km/sec) = square root [398,600 / (6378 + h)]** where h is the height of the satellite above the Earth in kilometers.

Calculate the orbital speed of the GRACE satellites if they are traveling at a height of 500 kilometers.

2. Compare the two speeds. List three possible errors made in this method of calculating the GRACE satellites' speed.

- a) _____
b) _____
c) _____
-

3. Why do scientists create models to study certain aspects of science?

4. Why are satellites important in the study of the Earth?

5. List two things that the GRACE satellites will study.

a) _____

b) _____

Data Entry Sheet

Round All Measurements to the Nearest Whole Number!

DATA	
Circumference of the Circle in Centimeters	440 cm
Distance GRACE Satellites Travels Around the Earth in Kilometers	44,000 km
Speed of GRACE Satellites in Kilometers per Minute	489 km/min
Speed of GRACE Satellites in Kilometers per Second	8 km/sec

Conclusions:

Answer each of the following using *complete sentences*!

2. Scientists use the following equation to calculate the speed of satellites in Earth orbit:
- $$\text{Speed (in km/sec)} = \text{square root } [398,600 / (6378 + h)]$$
- where h is the height of the satellite above the Earth in kilometers.

$$7.6 \text{ km/sec}$$

Calculate the orbital speed of the GRACE satellites if they are traveling at a height of 500 kilometers.

2. Compare the two speeds. List three possible errors made in this method of calculating the GRACE satellites' speed.
- Circle is drawn completely round, the Earth is not perfectly round**
 - Possible measurement errors with the string**
 - Errors in rounding numbers**
-

3. Why do scientists create models to study certain aspects of science?

When objects are as large as the Earth, a smaller model can be helpful.

4. Why are satellites important in the study of the Earth?

Satellites provide a different point of view.

5. List two things that the GRACE satellites will study.

a) **geophysics**

b) **oceanography** **atmospheric science**