

Worksheet for the week of 9/13/04

Problem 1: Estimation (a) How much money can you possibly gain by successfully robbing an armored truck? Estimate an answer by considering the volume of the truck, and (harder to estimate) the volume of a 20-dollar bill. State your assumptions and explain your work, but please don't attempt an experiment. Be sure to explain exactly how you estimated the volume of a 20-dollar bill. *Hint: think of a stack.*

(b) Would the truck weigh more or less if it contained the same amount of money but in the form of gold bars instead of 20-dollar bills?

Problem 2: Unit Conversions Given that 0.394 miles = 0.634 kilometers (km) answer the following questions.

(a) Which is larger, a mile or a kilometer? State your reasoning without doing any unit conversions.

(b) How many miles in 1 kilometer?

(c) How many kilometers in 1 mile?

Problem 3: Unit Conversions 1 degree = 60 arc-minutes and 1 arc-minutes = 60 arc-seconds. What are the number of arc-minutes and arc-seconds in 27 degrees?

Problem 4: Scientific notation

| Number | Number expressed in Scientific notation |
|-----------------|---|
| 40,000 | |
| 540,000,000 | |
| 0.0000000000034 | |
| 0.02 | |

Problem 5: Arithmetic with numbers in scientific notation

(a) $(2.1 \times 10^{30}) \times (3.0 \times 10^{-27}) =$

(b) $(4.8 \times 10^{-7}) \times (8.5 \times 10^{-2}) =$

(c) $(6.2 \times 10^{12}) / (5.2 \times 10^{-4}) =$

Problem 6: It takes the Earth about 24 hours to spin 360 degrees on its axis. (a) How many minutes does it take the Earth to spin 1 degree on its axis? Express this length of time in seconds.

(b) The radius of the Earth is about 6.37×10^6 meters. What is the circumference of the Earth?

(c) What distance does a point on the equator turn through (due to the Earth's rotation on its axis) in the course of 24 hours?

(d) Suppose one starts on the equator and sails in a direction along the equator. What distance would one sail if it equaled the distance a point on the Earth's equator turns through in 1 minute?

(e) From *Understanding Physics*, page 8: "Since the Earth turns through 360 degrees in 24 hours, a precise chronometer can be set so that it reads exactly noon when the Sun is at its highest point in a port with known longitude. Out at sea, the clock time that was set in port will differ from the local solar time by 4 minutes for each degree of longitude difference." "A ship embarks from Southampton, England where its clock was set to 12:00:00 at local noon. After 14 days under sail its chronometer reads 12 h 20 min 10 s at the moment the Sun is highest in the sky (local noon). By how many degrees has the ship's longitude changed?"

(f) Suppose the clock is not precise and has gained 2 minutes out of the 20,160 minutes that have elapsed since it set sail. How far off will the longitude measurement be?