DIMENSIONAL ANALYSIS

1

OBJECTIVES

- Understand what a conversion factor is
- Use factors to convert quantities

2

UNITS

- Dimensional analysis is all about units
- Cancel out units until you get the ones you want

3

CONVERSION FACTORS

- 12 inches = 1 foot
- $\frac{1\ foot}{12\ inches} = \frac{12\ inches}{1\ foot} = 1$
- How many inches are in 3.4 feet?

4

PRACTICE

1. How many miles are in 4500 feet?
2. How many eggs are in 4.5 dozen?
3. If 2.54 cm = 1 inch, how many cm are in a 12 inch-long sandwich?

5

CONVERSION FACTORS

- Other numbers can be used as conversion factors:
  - Speeds (55 mph = $\frac{55\ miles}{1\ hour}$)
  - Densities (1.00 g/mL = $\frac{1.00\ g}{1\ mL}$)
  - "Pers" (2 cookies per student, $\frac{2\ cookies}{1\ student}$)

6

PRACTICE

1. If you drive 75 mi/hr down the interstate, how long will it take you to get to Pueblo (84 miles)?
2. If you run for 5.6 hours at 7.1 mi/hr, how far have you gone?

7

METRIC UNITS

1. How many L are in 4.3×10^4 pL?
2. How many cm are in 6.0 m?
3. How many g are in 9.0×10^{12} ng?
4. How many μm are in 4.0 m?

8

TWO STEP PROBLEMS

1. How many inches are in 0.64 miles?
2. How many teaspoons are in 5 cups of flour? (1 c = 16 T, 1 T = 3 t)
3. The sun is 1.5×10^8 kilometers away from Earth. How many micrometers is this?

9

MORE PROBLEMS

1. I drive 19 miles to get home. If I drive at 55 mi/hr (the speed limit), how many minutes does it take me?
2. The cruising speed of a C-17 is 8.33×10^5 m/hr. If this plane flies for 10.3 hours, how many km has it flown?

10

MORE PROBLEMS

1. The density of water is 1.00 g/mL. If you have 5.0 L of water, what is the mass in kg?
2. What is the volume of 1.0 kg of gold? (d_{Au} = 19.3 g/cm^3)

11

MORE PROBLEMS

1. If you drive at 40 km/hr, how many cm/s is this?
2. The speed of light is 3×10^8 m/s. What is the speed in km/hr?
3. An ant crawls at a rate of 36 cm/s. What is this speed in miles/hr? (1.6 km = 1 mi)

12

MORE PROBLEMS

1. You run down an 18.0 m hallway. If you run at 9.40 m/s, how many minutes does it take?
2. Light travels at 3.00×10^8 m/s. How many hours does it take light to travel from the sun to Pluto 5.9×10^8 km away?

13

EXPONENT PROBLEMS

1. You measure the volume of the classroom to be 3.4×10^2 m^3. Calculate the volume in cm^3.
2. An M&M has a volume of 0.65 cubic centimeters. Determine the volume in cubic meters.

14

CHALLENGE PROBLEM

The distance between the Earth and the moon is 384 000 km. If you drove at a constant 55 mi/hr, how many years would it take you to get there? (1.61 km = 1 mi)

15