**Name:** _____

# Skill Builder — Working with Quantities and Rates

Practice with quantities and rates

Knowing how to work with quantities and rates is important for solving equations. This skill sheet will help you solve the equations you encounter in your physical science class.

## 1. What is a quantity?

A quantity describes an amount of something. It has two parts: a number, and a unit. The number tells "how many." The unit tells "of what." For example, **10 apples** is a quantity. *10* is the number, *apples* is the unit. You have been using quantities ever since you learned to count!

## 2. Practice solving problems with quantities

When you solve problems with quantities, remember that you can't combine quantities unless they have the same unit. For example, 5 apples + 5 pears can't be combined, but 5 apples + 5 apples can be combined to make 10 apples.

When you multiply or divide quantities, the units get multiplied or divided too. For example, 10 cm × 10 cm = 100 cm × cm, or 100 $cm^2$.

Practice your skills with quantities in the problems below. Make sure that you include units in your answer. If the quantities can't be combined, write "can't combine" in the answer space.

1. 5 inches × 4 inches =

_____

2. 12 eggs + 12 eggs =

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3. 12 cookies – 5 candy bars =

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4. 12 cookies – 5 cookies =

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5. 120 erasers ÷ 12 erasers =

_____

## 3. What is a rate?

A rate describes a relationship between two quantities. Rates are commonly described as something "per" something, like "50 miles *per* hour." *Per* means "for every" or "for each." In science, we often use a fraction bar or slash to represent the word per, as in 10 cookies/dollar. Rates are usually written in the fraction's lowest terms. For example, if you received $100 for working 10 hours, you could write:

$$\frac{100 \text{ dollars}}{10 \text{ hours}} = \frac{10 \text{ dollars}}{1 \text{ hour}}$$

Sometimes you will be asked to multiply two rates. This is often done to change one unit to another. For example, if you wanted to know how much you were paid per minute, you could set up a problem like this:

$$\frac{10 \text{ dollars}}{1 \text{ hour}} \times \frac{1 \text{ hour}}{60 \text{ minutes}} = \frac{10 \text{ dollars}}{60 \text{ minutes}} = \frac{0.17 \text{ dollar}}{1 \text{ minute}}$$

Notice that the rules for multiplying fractions apply to units, too. Since "hour" appears in the numerator and the denominator, the "hour" unit is cancelled.

## 4. Practice solving problems with rates

Practice your skills with rates in the problems below. Some of the units you will see are real (like seconds) and some are made up (like blinks). Even with made up units, the rules for algebra and arithmetic still apply. Make sure that you reduce fractions to their lowest terms and include units in your answer.

1. $\frac{\$36}{3 \text{ hours}} =$

2. $\frac{48 \text{ students}}{2 \text{ classrooms}} =$

3. $\frac{10 \text{ meters}}{\text{second}} \times \frac{60 \text{ seconds}}{1 \text{ minute}} =$

4. $\frac{15 \text{ winks}}{5 \text{ clinks}} \times \frac{10 \text{ blinks}}{5 \text{ winks}} =$

## 5. Practice with units

In the next practice set, the numbers have been eliminated so that you can focus on the units. In the space provided, write the unit that should go in the parentheses so that each side of the equation is equal. Use the example to help you get started. Note that singular and plural units **do** cancel one another.

**Problem:** $\frac{\text{miles}}{(\quad)} \times \text{hours} = \text{miles}$ **Answer:** $\frac{\text{miles}}{(\text{hour})} \times \text{hours} = \text{miles}$

1. $\frac{\text{cm}}{\text{second}} \times \text{seconds} = (\qquad)$

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2. $\frac{\text{commercials}}{(\qquad)} \times \text{program} = \text{commercials}$

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3. $\frac{(\qquad)}{\text{pound}} \times \text{pound} = \text{shrimp}$

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4. $\text{seconds} \times (\qquad) = \text{seconds}^2$

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5. $\text{cm}^2 \times (\qquad) = \text{cm}^3$

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6. $\frac{(\qquad)}{(\qquad)} \times \text{pencils} = \text{boxes}$

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7. $\frac{(\text{kg} \times \text{m})}{s^2} \times (\qquad) = \text{m}$

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8. $(\text{clinks})(\text{winks}) \times \frac{1}{\text{blinks}} = (\quad)$

9. $\frac{\text{miles}}{\text{hours}} \times \frac{\text{hours}}{\text{minute}} \times \frac{\text{minutes}}{\text{second}} = (\quad)$

10. $\frac{\text{centimeter}}{\text{hour}} \times \frac{\text{millimeter}}{\text{centimeter}} = (\quad)$

11. $(\quad) \times \frac{\text{pizzas}}{\text{person}} \times \frac{\text{dollars}}{\text{pizza}} = \text{dollars}$

12. $\frac{\text{calories}}{\text{minute}} \times \frac{\text{minute}}{\text{hour}} \times (\quad) = \text{calories}$

13. $\frac{\text{games}}{\text{year}} \times \frac{\$}{(\quad)} \times \text{years} = \$$

14. $\frac{\text{heartbeats}}{\text{minute}} \times \frac{\text{minute}}{(\quad)} \times \frac{\text{hour}}{\text{day}} \times \text{days} = \text{heartbeats}$

15. $\frac{\text{centimeters}}{\text{second}} \times \frac{\text{second}}{\text{hour}} \times \frac{\text{meter}}{(\quad)} \times \frac{\text{kilometer}}{\text{meter}} \times \frac{\text{miles}}{\text{kilometer}} = \frac{\text{miles}}{\text{hour}}$