

Chapter 1

Reviewing Math Fundamentals and Physics Measurements

Physics explains how the world works. You can use physics to predict how objects move and interact. This process often involves some basic algebra and trigonometry. To check these predictions, you can make a measurement. Sometimes you need to convert units to compare different measurements.

The Problems You'll Work On

Here are some of the things you'll do in this chapter:

- » Solving for an unknown variable with basic algebra
- » Using basic trigonometry to determine side lengths and angles
- » Converting between different types of units
- » Writing numbers in scientific notation
- » Understanding unit prefixes in the metric system
- » Rounding to the correct number of significant digits

What to Watch Out For

Be sure to remember the following:

- » Making sure your answer has the right units
- » Using conversion factors correctly
- » Checking that your answers make sense physically

Equipping Yourself with Basic Algebra

1-3

1. Solve the equation $y = 2m + 3$ for m .
2. You are given that $I = \frac{1}{2}mr^2$ and $m = m_0 + m_1$. Solve this expression for $m_0 + m_1$.
3. Solve the equation $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$ for v .

Tackling a Little Trigonometry

4-5

4. If $\cos \theta = 0.8$ and the hypotenuse of a right triangle is 8 meters long, how long is the adjacent side of the right triangle?

5. A pool is 2.0 meters deep. You dive in at an angle of 35 degrees to the surface of the water. If you continue in this direction, how far from the edge of the pool will you hit the bottom?

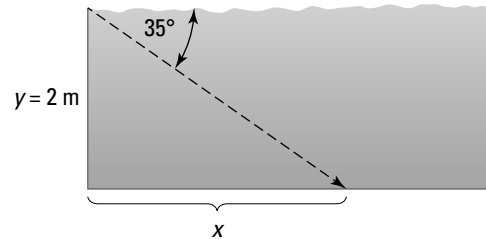


Illustration by Thomson Digital

Converting between Units

6-10

6. A jet plane flies at about 10,000 meters. If 1 meter is 3.3 feet, how high does the plane fly in feet?
7. When you drive into Canada, the speed limit sign says 100 kilometers per hour. What is the speed limit in miles per hour? One mile consists of 1.6 kilometers.
8. You hire 5 painters to paint your house, which has a surface of 200 square meters. If each painter can paint 10 square meters per hour, how long does it take for them to paint the entire house?

9. Your dog eats a quarter pound of dog food each day. How often (in days) do you have to buy a 10-pound bag of dog food?

10. Your grandmother can knit a sweater in 3 days if she works 8 hours per day. She uses one bobbin of yarn every 2 hours, and each bobbin has 10 yards of yarn. How long is all the yarn in the sweater?

Practicing Scientific Notation

11–14

11. The speed of light is about 300,000,000 meters per second. Write this speed in scientific notation.
12. A femtosecond is 1 millionth of 1 billionth of a second. What is a femtosecond in scientific notation?
13. The radius of the sun is $r = 6.955 \times 10^8$. Using the formula $V = \frac{4}{3}\pi r^3$ for the volume of a sphere of radius r , what is the volume of the sun in scientific notation?

14. Assume there are 7 billion people on Earth. If each person has a mass of 70 kilograms and the Earth has a mass of 6×10^{24} kilograms, what fraction of the mass of Earth is due to humans?

Understanding Unit Prefixes

15–16

15. A recipe calls for 500 milligrams of salt. You're serving a large group, so you want to triple the portions of the recipe. How many grams of salt are required?
16. How many milliwatts are in 1 megawatt? Give the answer in scientific notation.

Spotting the Number of Significant Digits

17–20

17. How many significant digits are in the number 303.4?
18. Calculate the sum $21.21 + 4.8 + 2.33$ to the correct number of significant digits.

19. How many significant digits are in the number 5,003?

20. How many significant digits can you retain for $\sqrt{45.365 + 29.821}$?

Rounding to the Correct Number of Digits

21–25

21. Calculate the sum $98.374 + 28.56$ to the correct number of significant digits.

22. A physicist adds 0.25 gallons of paint to a container that already holds 10 gallons of paint. Given the significant digits of the quantities added, how much paint can the physicist say is in the container?

23. Evaluate the equation $t = (5.01 \times 4.4) + (3.2 \times 18)$ to the correct number of significant digits, and express the answer using the appropriate notation.

24. You measure the height of your apartment to be 2.6 meters high. If the apartment building has 8 floors, what is the height of the apartment building?

25. What is the result of $63.005 \times \left(18.54 + \frac{65}{4}\right)$ to the correct number of significant digits?