Date _____ Period _____ Name _____

CHAPTER 1

Study Guide

A Physics Toolkit

Vocabulary Review

Write the term that correctly completes the statement. Use each term once.

accuracy	independent variable	measurement	significant digits
dependent variable	inverse relationship	physics	scientific law
dimensional analysis	line of best fit	precision	scientific method
hypothesis	linear relationship	quadratic relationship	scientific theory

1. _____ The study of matter and energy is _____.
2. _____ The _____ is a systematic way to observe, experiment, and analyze the world.
3. _____ The valid digits in a measurement are called the _____.
4. _____ A(n) _____ describes the relationship between two variables in which an increase in one variable results in the decrease of another variable.
5. _____ On a graph, the _____ is the line drawn as close as possible to all of the data points.
6. _____ A(n) _____ is an educated guess about how variables are related.
7. _____ The _____ is the factor that is changed or manipulated during an experiment.
8. _____ A(n) _____ is description of a rule of nature.
9. _____ A(n) _____ is a comparison between an unknown quantity and a standard.
10. _____ A straight line on a graph shows that there is a(n) _____ between the two variables.
11. _____ A(n) _____ is an explanation supported by experimental results.
12. _____ _____ describes how well the results of a measurement agree with the real value.
13. _____ The _____ is the factor that depends on the independent variable.
14. _____ The method of treating units as algebraic quantities, which can be cancelled, is called _____.

15. _____ A(n) ____ exists when one variable depends on the square of another.

16. _____ The degree of exactness of a measurement is called ____.

Section 1.1 Mathematics and Physics

In your textbook, read about mathematics in physics on pages 4–5.

Write the term that correctly completes the statement. Use each term once.

dimensional analysis	**experiments**	**theories**
equations	**graphs**	**units**
experimental data	**results**	

Physicists do **(1)** _____, make observations, and collect **(2)** _____. They predict the **(3)** _____ using different models. They create **(4)** _____ to describe their observations. Due to the mathematical nature of their work, physicists can enter numbers into **(5)** _____ to model observations and make predictions. The numerical values in an equation are also described by **(6)** _____, such as amperes, ohms, and volts. **(7)** _____ is the method of treating the units as algebraic quantities, which can be cancelled. Varying numerical results from equations can be plotted as **(8)** _____.

In your textbook, read about SI units on pages 5–6.

For each term on the left, write the letter of the matching item on the right.

_____ **9.** base quantity of temperature

_____ **10.** base quantity of electric current

_____ **11.** base quantity of length

_____ **12.** base quantity of time

_____ **13.** base amount of a substance

_____ **14.** pico

_____ **15.** centi

_____ **16.** micro

_____ **17.** mega

a. meter

b. 10^{-2}

c. kelvin

d. 10^{-12}

e. ampere

f. second

g. 10^{6}

h. mole

i. 10^{-6}

Name _____

In your textbook, read about significant digits on page 7.
For each of the statements below, write* true *or rewrite the italicized part to make the statement true.

18. _____ When you perform any arithmetic operation and round off the last digit, this is the *most* precise part of the measurement.

19. _____ The figure 0.0730 has *two* significant digits.

20. _____ Answers derived with a calculator should be written *exactly as they appear on the calculator.*

In your textbook, read about scientific methods on pages 8–10.
Number the following steps in the order in which scientists study problems.

_____ **21.** Draw a conclusion.

_____ **22.** Compare experimentation with careful measurements and analyses of results.

_____ **23.** Test deductions to determine if they are valid.

Indicate which step in the scientific method best describes the statements in questions 24–29. Explain your answers. Use complete sentences.

24. A basketball is rolling on the ground. It continues to move even though no one is pushing it.

_____

_____

25. The velocity of the rolling basketball is 0.5 m/s.

_____

_____

26. In an isolated system, momentum does not change. For example, when a bowling ball hits a rolling basketball, the bowling ball slows down and the basketball speeds up. The increase in momentum of the basketball equals the decrease in momentum of the bowling ball.

_____

_____

27. There are two tracks that you can roll the basketball on. One track is very steep and the other is nearly flat. You guess that the basketball will travel faster down the steep track.

_____

_____

28. After recording the speeds of a basketball rolling down a steep track and on a flat track, you repeat the experiment, timing the ball a second time.

_____

_____

29. You observe multiple collisions between a basketball and a bowling ball and record data on their post collision velocities and directions. You explain your idea that since the bowling ball has a greater mass and is moving at greater velocity, it can always change the direction of the basketball that has a smaller mass and is moving at a slower velocity.

_____

_____

Section 1.2 Measurement

In your textbook, read about measurement on pages 11–14.

Circle the letter of the choice that best completes the statement.

1. The apparent shift in position of an object when it is viewed from various angles is called _____.
   - **a.** parallax
   - **b.** margin of error
   - **c.** calibration
   - **d.** accuracy
2. A device with very small divisions on its scale can measure with _____.
   - **a.** scientific notation
   - **b.** agreement
   - **c.** precision
   - **d.** fundamental units
3. An atomic mass unit is measured at 1.660×10^{-27} kg, a number that has _____ significant digits.
   - **a.** 1
   - **b.** 2
   - **c.** 3
   - **d.** 4
4. The NIST-F1 Cesium Fountain clock in Colorado is our standard for _____.
   - **a.** significant digits
   - **b.** accuracy
   - **c.** measuring instruments
   - **d.** calculating errors
5. A comparison between an unknown quantity and a standard is referred to as a _____.
   - **a.** margin of error
   - **b.** consistency
   - **c.** measurement
   - **d.** variables
6. _____ is a technique used to assure the accuracy of a measuring instrument.
   - **a.** Two-point calibration
   - **b.** Precision
   - **c.** Analysis
   - **d.** Dimension
7. The degree of possible error in a measurement is called its _____.
   - **a.** fundamental unit
   - **b.** mechanical quantity
   - **c.** precision balance
   - **d.** margin of uncertainty

Date _____ Period _____ Name _____

CHAPTER 1

Chapter Assessment

A Physics Toolkit

Understanding Physics Concepts

Circle the letter of the choice that best completes the statement or answers the question.

1. The base SI unit for length is the _____.
   - **a.** foot
   - **b.** inch
   - **c.** meter
   - **d.** kilogram
2. The metric prefix that means 1×10^6 is _____.
   - **a.** pico
   - **b.** mega
   - **c.** nano
   - **d.** giga
3. To avoid parallax errors, laboratory instruments should be read _____.
   - **a.** at eye level
   - **b.** from the side
   - **c.** below eye level
   - **d.** at all of these positions
4. How many significant digits are in the measurement 2.560×10^4?
   - **a.** 1
   - **b.** 2
   - **c.** 3
   - **d.** 4
5. A sample weighs 28.40 g. Which is the estimated digit?
   - **a.** 2
   - **b.** 8
   - **c.** 4
   - **d.** 0

For each of the statements below, write true *or rewrite the italicized part to make the statement true.*

6. _____ In a scientific method, conclusions are tested to find out whether they are *valid*.
7. _____ The degree of exactness of a measurement is called *accuracy*.
8. _____ Other scientists must be able to recreate an experiment and obtain similar *data*.
9. _____ The last digit in any measurement is the *significant* digit.
10. _____ Zeros at the *end* of the number locate the decimal point.

Name _____

1 Chapter Assessment

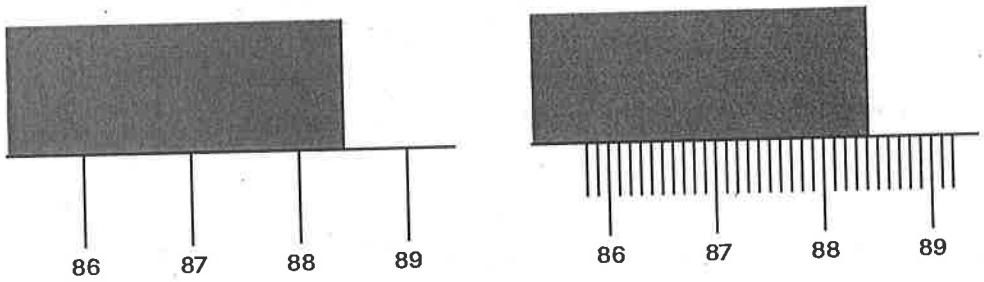
continued

Answer the following questions. Use complete sentences.

11. Describe the method that physicists use to study problems.

12. Describe two applications that resulted from the work of physicists.

13. Which of the following is a more precise measurement—the length of a tabletop measured with a stick calibrated in centimeters as shown on the left or the length measured with a stick calibrated in millimeters as shown on the right? Why?



14. Express the measurements in the diagram above in centimeters.

15. How many significant digits are in each of the following measurements?

a. 3809 m _____

b. 9.013 m _____

c. 0.0045 m _____

16. What is the difference between accuracy and precision?

Thinking Critically

Circle the letter of the choice that best completes the statement or answers the question.

1. The slope of a straight-line graph is the rise _____ the run.
   - **a.** added to
   - **b.** subtracted from
   - **c.** multiplied by
   - **d.** divided by

2. A _____ is the current best explanation for why things work they way they do.
   - **a.** theory
   - **b.** hypothesis
   - **c.** method
   - **d.** prediction

3. A line drawn as close as possible to all data points is called the _____.
   - **a.** linear relationship
   - **b.** line of best fit
   - **c.** vertical value
   - **d.** parabola

4. One of the scientist's most useful tools for making predictions is the _____.
   - **a.** SI unit
   - **b.** significant digit
   - **c.** graph
   - **d.** measurement

5. Which equation is most closely associated with an inverse relationship.
   - **a.** $y = mx + b$
   - **b.** $m = \frac{\Delta y}{\Delta x}$
   - **c.** $y = ax^2 + bx + c$
   - **d.** $y = \frac{a}{x}$

6. Which of the following must be included in the horizontal-axis label of a graph?
   - **a.** the graph title
   - **b.** the variable "time"
   - **c.** a unit of measurement
   - **d.** the slope

7. Which of the following is not an SI base unit?
   - **a.** meter
   - **b.** kilogram
   - **c.** kelvin
   - **d.** second

For each of the statements below, write true *or rewrite the italicized part to make the statement true.*

8. _____ The units used to label the answer to a physics problem may change when you *multiply or divide*.

9. _____ A graph in the shape of a parabola represents an *inverse* relationship.

10. _____ The factor that is changed or manipulated during an experiment is the *independent* variable.

11. _____ When constructing a graph from data, the range of the *x*-axis is determined by the range of the *dependent* variable.

12. _____ A graph in the shape of a hyperbola represents an *inverse* relationship.

13. _____ A straight line represents a *quadratic* relationship.

Answer the following questions.

14. Express the measurements in scientific notation.

a. 142000 s

b. 0.00809 kg

c. 501 000 000 m

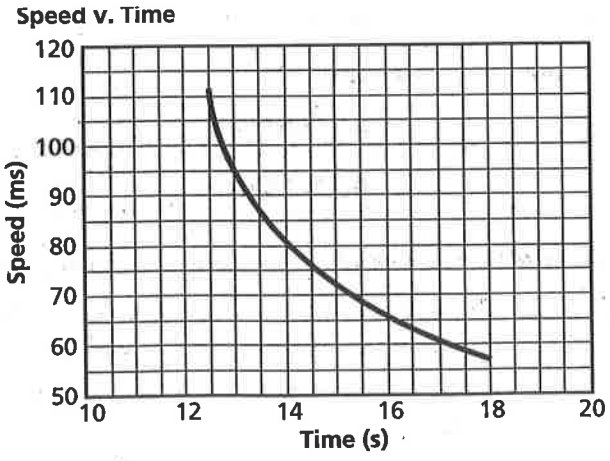
15. Simplify the following expressions. Give your answers in scientific notation, using the correct number of significant digits.

a. $(2\times10^6\ \text{m})(5\times10^5\ \text{m})$

b. $\dfrac{12\times10^6\ \text{m}}{4\times10^2\ \text{s}}$

c. $(5.06\times10^2\ \text{m}) + (8.124\ \text{km})$

16. Describe the relationship between the variables shown in the graph below. What is the general equation that is used to represent this type of relationship?



Applying Physics Knowledge

Answer the following questions. Use complete sentences.

1. Which of the following measurements contains zeros that are not significant? Give a reason for your answer.

3.050×10^5 mm 0.0053 m 45.020 cm 101.2 g

2. How are independent and dependent variables related? Identify the graph axis on which each type of variable would be plotted.

Answer the following questions. Show your calculations.

3. The total mass of four containers is 5.000 kg. If the mass of container A is 256 mg, container B is 5117 cg, and container C is 382 g, what is the mass of container D?

4. Show that the measurements below are equivalent.

5687 nm, 0.000 056 87 dm