Physics-Q1W1-Question Bank

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Which of the following is an area of physics that studies motion and its causes?
- a. thermodynamics
- b. mechanics
- c. quantum mechanics
- d. optics

____ 2. Listening to your favorite radio station involves which area of physics?
- a. optics
- b. thermodynamics
- c. vibrations and wave phenomena
- d. relativity

____ 3. A baker makes a loaf of bread. Identify the area of physics that this involves.
- a. optics
- b. thermodynamics
- c. mechanics
- d. relativity

____ 4. A hiker uses a compass to navigate through the woods. Identify the area of physics that this involves.
- a. thermodynamics
- b. relativity
- c. electromagnetism
- d. quantum mechanics

____ 5. According to the scientific method, why does a physicist make observations and collect data?
- a. to decide which parts of a problem are important
- b. to ask a question
- c. to make an interpretation
- d. to solve all problems

____ 6. According to the scientific method, how does a physicist formulate and objectively test hypotheses?
- a. by defending an opinion
- b. by interpreting graphs
- c. by experiments
- d. by stating conclusions

____ 7. In the steps of the scientific method, what is the next step after formulating and objectively testing hypotheses?
- a. interpreting results
- b. stating conclusions
- c. conducting experiments
- d. making observations and collecting data

____ 8. Diagrams are *not* designed to
- a. show relationships between concepts.
- b. show setups of experiments.
- c. measure an event or a situation.
- d. label parts of a model.

____ 9. Why do physicists use models?
- a. to explain the complex features of simple phenomena
- b. to describe all aspects of a phenomenon
- c. to explain the basic features of complex phenomena
- d. to describe all of reality

____ 10. Which statement about models is *not* correct?
- a. Models describe only part of reality.
- b. Models help build hypotheses.
- c. Models help guide experimental design.
- d. Models manipulate a single variable or factor in an experiment.

____ 11. What two dimensions, in addition to mass, are commonly used by physicists to derive additional measurements?
- a. length and width
- b. area and mass
- c. length and time
- d. velocity and time

____ 12. The symbol mm represents a

a. micrometer.
b. millimeter.
c. megameter.
d. manometer.

____ 13. The SI base unit used to measure mass is the

a. meter.
b. second.
c. kilogram.
d. liter.

____ 14. The SI base unit for time is

a. 1 day.
b. 1 hour.
c. 1 minute.
d. 1 second.

____ 15. The most appropriate SI unit for measuring the length of an automobile is the

a. micron.
b. kilometer.
c. meter.
d. nanometer.

____ 16. The radius of Earth is 6 370 000 m. Express this measurement in km in scientific notation with the correct number of significant digits.

a. 6.37×10^6 km
b. 6.37×10^3 km
c. 637×10^3 km
d. 63.7×10^4 km

____ 17. A lack of precision in scientific measurements typically arises from

a. limitations of the measuring instrument.
b. human error.
c. lack of calibration.
d. too many significant figures.

____ 18. How does a scientist reduce the frequency of human error and minimize a lack of accuracy?

a. Take repeated measurements.
b. Use the same method of measurement.
c. Maintain instruments in good working order.
d. all of the above

____ 19. Three values were obtained for the mass of a metal bar: 8.83 g; 8.84 g; 8.82 g. The known mass is 10.68 g. The values are

a. accurate.
b. precise.
c. both accurate and precise.
d. neither accurate nor precise.

____ 20. Calculate the following, and express the answer in scientific notation with the correct number of significant figures: 21.4 + 15 + 17.17 + 4.003

a. 5.7573×10^1
b. 5.757×10^1
c. 5.75×10^1
d. 5.8×10^1

____ 21. Calculate the following, and express the answer in scientific notation with the correct number of significant figures: $10.5 \times 8.8 \times 3.14$

a. 2.9×10^2
b. 290.136
c. 2.90×10^2
d. 290

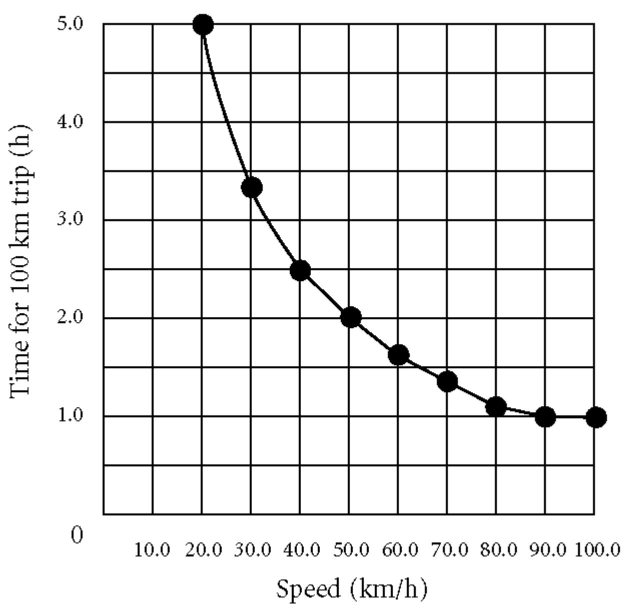
____ 22. Calculate the following, and express the answer in scientific notation with the correct number of significant figures: $(0.82 + 0.042)(4.4 \times 10^3)$

a. 3.8×10^3
b. 3.78×10^3
c. 3.784×10^3
d. 3784

Hour	Temperature (°C)
1:00	30.0
2:00	29.0
3:00	28.0
4:00	27.5
5:00	27.0
6:00	25.0

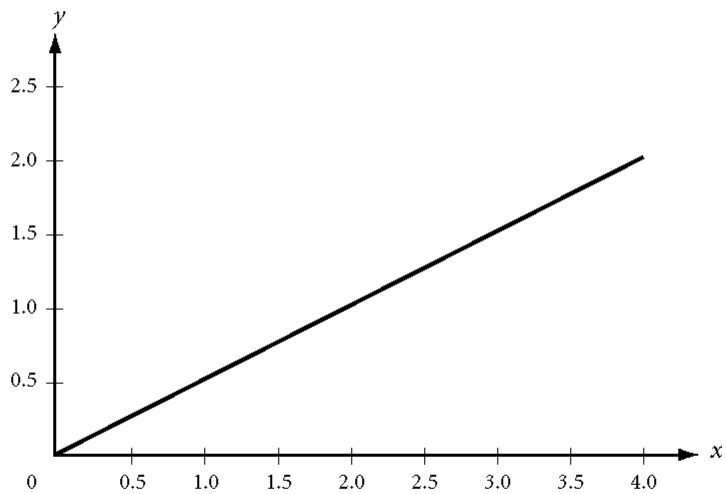
____ 23. A weather balloon records the temperature every hour. From the table above, the temperature

a. increases.
b. decreases.
c. remains constant.
d. decreases and then increases.



____ 24. The time required to make a trip of 100.0 km is measured at various speeds. From the graph above, what speed will allow the trip to be made in 2 hours?

a. 20.0 km/h
b. 40.0 km/h
c. 50.0 km/h
d. 90.0 km/h



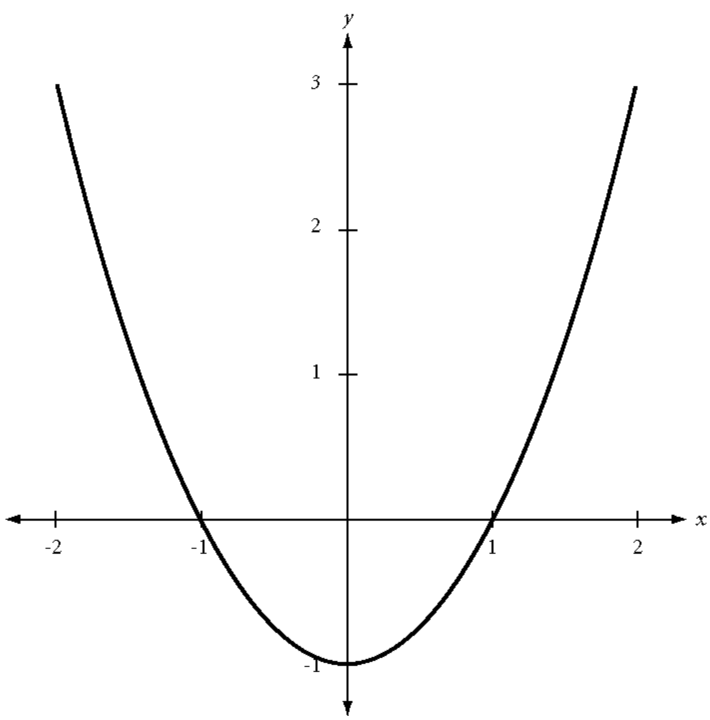
____ 25. Which of the following equations best describes the graph above?

a. $y = 2x$

b. $y = x$

c. $y = x^2$

d. $y = \frac{1}{2}x$



____ 26. Which of the following equations best describes the graph above?

a. $y = x^2 + 1$

b. $y = x^2 - 1$

c. $y = -x^2 + 1$

d. $y = -x^2 - 1$

____ 27. The Greek letter Δ *(delta)* indicates a(n)

a. difference or change.

b. sum or total.

c. direct proportion.

d. inverse proportion.

____ 28. Which expression has the same dimensions as an expression yielding a value for acceleration (m/s^2)? (Δv has units of m/s.)

a. $\Delta v / (\Delta t)^2$
b. $\Delta v / (\Delta x)^2$
c. $(\Delta v)^2 / \Delta t$
d. $(\Delta v)^2 / \Delta x$

____ 29. Which of the following expressions gives units of $kg \bullet m^2/s^2$?

a. $m^2 \bullet \Delta x / (\Delta t)^2$
b. $m \bullet (\Delta x)^2 / (\Delta t)^2$
c. $m \bullet (\Delta x)^2 / \Delta t$
d. $(\Delta t)^2 / m \bullet (\Delta x)^2$

____ 30. If the change in position Δx is related to velocity v (with units of m/s) in the equation $\Delta x = Av$, the constant A has which dimension?

a. m/s^2
b. m
c. s
d. m^2

____ 31. If a is acceleration (m/s^2), Δv is change in velocity (m/s), Δx is change in position (m), and Δt is the time interval (s), which equation is *not* dimensionally correct?

a. $\Delta t = \Delta x / v$
b. $a = v^2 / \Delta x$
c. $\Delta v = a / \Delta t$
d. $\Delta t^2 = 2\Delta x / a$

____ 32. Estimate the order of magnitude of the length of a football field.

a. 10^{-1} m
b. 10^2 m
c. 10^4 m
d. 10^6 m

____ 33. The sun is composed mostly of hydrogen. The mass of the sun is 2.0×10^{30} kg, and the mass of a hydrogen atom is 1.67×10^{-27} kg. Estimate the number of atoms in the sun.

a. 10^3
b. 10^{57}
c. 10^{30}
d. 10^{75}

Short Answer

1. Two areas within physics are mechanics and quantum mechanics. Distinguish between these two areas.
2. List the steps in the scientific method.
3. Why do physicists often use models?
4. If unexpected results are obtained and confirmed through repeated experiments, why must a model or hypothesis be abandoned or revised?
5. What are the SI base units for length, mass, and time?
6. How can only seven basic units serve to express almost any measured quantity?
7. State one reason why measurements of physical quantities are expressed in units that match the dimensions for that quantity.
8. Convert 92×10^3 km to decimeters using scientific notation.
9. Convert 1 µm to meters using scientific notation.
10. Convert 5.52×10^8 g to kilograms using scientific notation.
11. Convert 8.66×10^{-9} m to millimeters using scientific notation.

12. Distinguish between precision and accuracy.

13. How can method error be minimized?

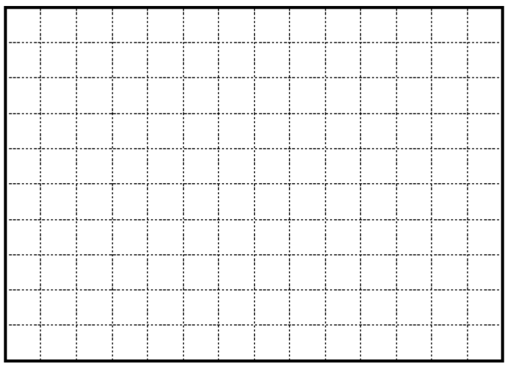
14. Why do calculators often exaggerate the precision of a final result?

15. How many significant figures does 0.050 200 mg have?

16. How many significant digits does 40.60 have?

17. Graphs often permit scientists to make ____________________ for times when there is no data.

18. What are two possible uses for physics equations?



Speedometer reading (km/h)	Time for 100 km trip (h)
20.0	5.00
30.0	3.33
40.0	2.50
50.0	2.00
60.0	1.67
70.0	1.43
80.0	1.25
90.0	1.11
100.0	1.00

19. Using the data above, construct a graph of the time required to make a trip of 100 km measured at various speeds.

20. What Greek letter is used to mean sum or total?

21. What kind of letters are used to abbreviate variables and other specific quantities?

22. What must quantities have before they can be added or subtracted?

23. Given $(\text{kg/s}) \times (\text{m/s})$, what is the resulting unit?

24. The established value for the speed of light in a vacuum is 299 792 458 m/s. What is the order-of-magnitude of this number?

Problem

1. Calculate the following, expressing the answer in scientific notation with the correct number of significant figures: $\left(8.86 + 1.0 \times 10^{-3}\right) \div 3.610 \times 10^{-3}$

2. The mass of Earth is 5.98×10^{24} kg, and the mass of a single proton is 1.673×10^{-27} kg. Assuming Earth is made entirely of protons, use an order-of-magnitude calculation to estimate the number of protons that make up Earth. Then, calculate the exact number of protons and express the answer in scientific notation with the correct number of significant digits.

3. The radius of Earth is 6.37×10^{6} m. The average Earth-sun distance is 1.496×10^{11} m. How many Earths would fit between Earth and the sun if they are separated by their average distance? Use an order-of-magnitude calculation to estimate this number. Then, determine an exact answer and express it in scientific notation with the correct number of significant digits.

	Trial 1	Trial 2	Trial 3	Trial 4
0.0 s	20.5°C	21.3°C	20.8°C	21.0°C
5.0 s	21.0°C	22.9°C	21.4°C	21.7°C
10.0 s	21.6°C	24.1°C	22.0°C	22.3°C
15.0 s	22.2°C	26.8°C	22.7°C	22.8°C
20.0 s	23.0°C	28.2°C	23.2°C	23.3°C

4. Four trials of a chemical reaction were completed, and the change in temperature (ΔT) was measured every five seconds. Based on the data in the table above, answer the following questions. Are there any unexpected or unusual results? Explain your answer. What is the general relationship between temperature and time? Disregarding any trial(s) with unexpected results, express this relationship in the form of a general equation.

5. Suppose a certain type of deciduous tree releases 7500 leaves on average each fall. If the average mass of each leaf is 1.7 g and a 135 000 acre forest has 206 of these trees per acre, how many kilograms of leaves are dropped on the forest floor each fall? Express the answer in scientific notation and with the correct number of significant digits.

6. The average mass of an automobile in the United States is about 1.440×10^{6} g. The mass of a mosquito is 10 mg. The mass of an electron is 9.109×10^{-31} kg. Use order-of-magnitude calculations to estimate how many times more massive both a mosquito and an automobile are when compared to an electron.

Physics-Q1W1-Question Bank
Answer Section

MULTIPLE CHOICE

1.	ANS: B	PTS: 1	DIF: I	OBJ: 1-1.1
2.	ANS: C	PTS: 1	DIF: I	OBJ: 1-1.1
3.	ANS: B	PTS: 1	DIF: I	OBJ: 1-1.1
4.	ANS: C	PTS: 1	DIF: I	OBJ: 1-1.1
5.	ANS: B	PTS: 1	DIF: I	OBJ: 1-1.2
6.	ANS: C	PTS: 1	DIF: I	OBJ: 1-1.2
7.	ANS: A	PTS: 1	DIF: I	OBJ: 1-1.2
8.	ANS: C	PTS: 1	DIF: I	OBJ: 1-1.3
9.	ANS: C	PTS: 1	DIF: I	OBJ: 1-1.3
10.	ANS: D	PTS: 1	DIF: I	OBJ: 1-1.3
11.	ANS: C	PTS: 1	DIF: I	OBJ: 1-2.1
12.	ANS: B	PTS: 1	DIF: I	OBJ: 1-2.1
13.	ANS: C	PTS: 1	DIF: I	OBJ: 1-2.1
14.	ANS: D	PTS: 1	DIF: I	OBJ: 1-2.1
15.	ANS: C	PTS: 1	DIF: II	OBJ: 1-2.1

16. ANS: B

Solution

$$(6\,370\,000\text{ m})\left(\frac{1\text{ km}}{1000\text{ m}}\right) = 6.37 \times 10^3\text{ km}$$

PTS: 1 DIF: IIIA OBJ: 1-2.2

17.	ANS: A	PTS: 1	DIF: I	OBJ: 1-2.3
18.	ANS: D	PTS: 1	DIF: I	OBJ: 1-2.3
19.	ANS: B	PTS: 1	DIF: II	OBJ: 1-2.3

20. ANS: D

Solution

$$\begin{array}{r} 21.4 \\ 15. \\ 17.17 \\ +4.003 \\ \hline 57.573 \end{array}$$

Answer rounds to 58 and is written as 5.8×10^1 in scientific notation.

PTS: 1 DIF: IIIA OBJ: 1-2.4

21. ANS: A

Solution

$(10.5) \times (8.8) \times (3.14) = 290.136$

The answer rounds to 290 and is written as 2.9×10^2 in scientific notation.

PTS: 1 DIF: IIIA OBJ: 1-2.4

22. ANS: A

Solution

$(0.82 + 0.042)\left(4.4 \times 10^3\right) = (0.86)\left(4.4 \times 10^3\right) = 3784$

The answer rounds to 3800 and is written as 3.8×10^3 in scientific notation.

PTS: 1 DIF: IIIA OBJ: 1-2.4

23. ANS: B	PTS: 1	DIF: II	OBJ: 1-3.1
24. ANS: C	PTS: 1	DIF: II	OBJ: 1-3.1
25. ANS: D	PTS: 1	DIF: II	OBJ: 1-3.1
26. ANS: B	PTS: 1	DIF: II	OBJ: 1-3.1
27. ANS: A	PTS: 1	DIF: I	OBJ: 1-3.2

28. ANS: D

Solution

$$\frac{(\Delta v)^2}{\Delta x} = \frac{(\text{m/s})^2}{\text{m}} = \frac{\text{m}^2/\text{s}^2}{\text{m}} = \text{m/s}^2$$

PTS: 1 DIF: IIIA OBJ: 1-3.3

29. ANS: B

Solution

$$m\frac{(\Delta x)^2}{(\Delta t)^2} = \left(\text{kg}\right) \times \frac{\left(\text{m}^2\right)}{\left(\text{s}^2\right)} = \text{kgm}^2/\text{s}^2$$

PTS: 1 DIF: IIIA OBJ: 1-3.3

30. ANS: C

Solution

$\Delta x = Av$

Rearrange the equation to solve for A and substitute units.

$$A = \frac{\Delta x}{v} = \frac{\text{m}}{\text{m/s}} = \text{s}$$

PTS: 1 DIF: IIIA OBJ: 1-3.3

31. ANS: C

Solution

Does $\Delta v = \frac{a}{\Delta t}$?

Substitute units into the right side of the equation.

$$\frac{a}{\Delta t} = \frac{\text{m/s}^2}{\text{s}} = \frac{\left(\frac{\text{m}}{\text{s}^2}\right)\left(\frac{1}{\text{s}}\right)}{(\text{s})\left(\frac{1}{\text{s}}\right)} = \frac{\text{m}}{\text{s}^3}$$

Substituting units into both sides of the equation yields the following result:

$$\frac{\text{m}}{\text{s}} \neq \frac{\text{m}}{\text{s}^3}$$

PTS: 1 DIF: IIIA OBJ: 1-3.3

32. ANS: B PTS: 1 DIF: II OBJ: 1-3.4

33. ANS: B

Given

$m_{sun} = 2.0 \times 10^{30}$ kg

$m_{Hatom} = 1.67 \times 10^{-27}$ kg

Solution

Estimate the answer using an order-of-magnitude calculation.

$$\frac{10^{30}}{10^{-27}} = 10^{57}$$

PTS: 1 DIF: IIIB OBJ: 1-3.4

SHORT ANSWER

1. ANS:
Answers may vary. Sample answer: Mechanics studies the interactions of large objects, while quantum mechanics studies the behavior of subatomic (or very small) particles.

PTS: 1 DIF: I OBJ: 1-1.1

2. ANS:
The steps in the scientific method include making observations and collecting data that lead to a question, formulating and objectively testing hypotheses by experiments, interpreting results and revising hypotheses if necessary, and stating conclusions in a form that can be evaluated by others.

PTS: 1 DIF: I OBJ: 1-1.2

3. ANS:
Answers may vary. Sample answer: to explain the most basic features of phenomena

PTS: 1 DIF: I OBJ: 1-1.3

4. ANS:
Answers may vary. Sample answer: The model or hypothesis is unable to make reliable predictions.

PTS: 1 DIF: II OBJ: 1-1.3

5. ANS:
meter (m), kilogram (kg), and second (s)

PTS: 1 DIF: I OBJ: 1-2.1

6. ANS:
The basic units can be combined to form derived units for other quantities.

PTS: 1 DIF: II OBJ: 1-2.1

7. ANS:
Answers may vary. Sample answer: Only units of the proper dimension will provide a meaningful measurement. For example, you cannot measure length in units of time, such as seconds; you must use a unit of length, such as meters.

PTS: 1 DIF: I OBJ: 1-2.1

8. ANS:
$9.2 \times 10^{8}\,\text{dm}$

Solution

$$\left(92 \times 10^{3}\ \text{km}\right)\left(\frac{10^{4}\ \text{dm}}{1\ \text{km}}\right) = 92 \times 10^{7}\ \text{dm} = 9.2 \times 10^{8}\ \text{dm}$$

PTS: 1 DIF: IIIA OBJ: 1-2.2

9. ANS:
$1 \times 10^{-6}\,\text{m}$

Solution

$$\left(1\ \mu\text{m}\right)\left(\frac{10^{-6}\ \text{m}}{1\ \mu\text{m}}\right) = 1 \times 10^{-6}\ \text{m}$$

PTS: 1 DIF: IIIA OBJ: 1-2.2

10. ANS:
$5.52 \times 10^{5}\ \text{kg}$

Solution

$$\left(5.52 \times 10^{8}\ \text{g}\right)\left(\frac{1\ \text{kg}}{10^{3}\ \text{g}}\right) = 5.52 \times 10^{5}\ \text{kg}$$

PTS: 1 DIF: IIIA OBJ: 1-2.2

11. ANS:
$8.66 \times 10^{-6}\ \text{mm}$

Solution

$$\left(8.66 \times 10^{-9}\ \text{m}\right)\left(\frac{10^3\ \text{mm}}{1\ \text{m}}\right) = 8.66 \times 10^{-6}\ \text{mm}$$

PTS: 1 DIF: IIIA OBJ: 1-2.2

12. ANS:
Precision is the degree of exactness or refinement of a measurement. Accuracy is the extent to which a reported measurement approaches the standard or accepted value of the quantity measured.

PTS: 1 DIF: I OBJ: 1-2.3

13. ANS:
by standardizing the method of taking measurements

PTS: 1 DIF: I OBJ: 1-2.3

14. ANS:
They return answers with as many digits as the display can show.

PTS: 1 DIF: I OBJ: 1-2.4

15. ANS:
five

PTS: 1 DIF: II OBJ: 1-2.4

16. ANS:
four

PTS: 1 DIF: II OBJ: 1-2.4

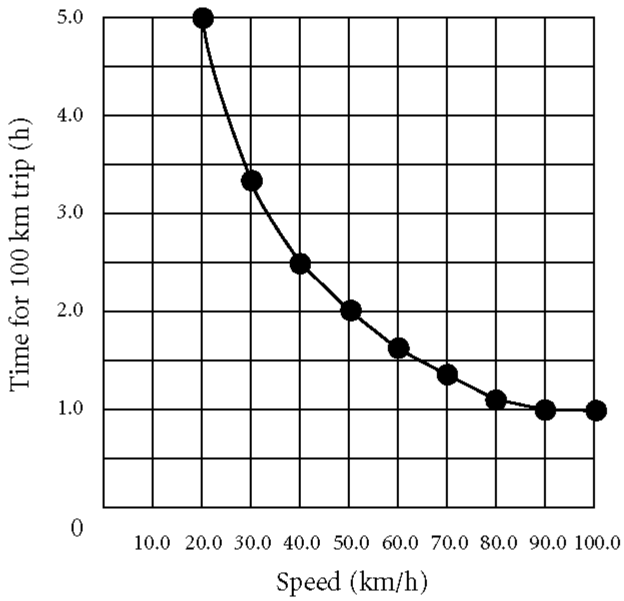
17. ANS:
estimations (or predictions)

PTS: 1 DIF: I OBJ: 1-3.1

18. ANS:
Any two of the following: summarize data; describe the relationship between variables; reproduce a graph; make predictions

PTS: 1 DIF: I OBJ: 1-3.1

19. ANS:



PTS: 1 DIF: II OBJ: 1-3.1

20. ANS:
Σ (or sigma)

PTS: 1 DIF: I OBJ: 1-3.2

21. ANS:
Bold-faced or *italicized* letters

PTS: 1 DIF: I OBJ: 1-3.2

22. ANS:
the same dimensions (or units)

PTS: 1 DIF: I OBJ: 1-3.3

23. ANS:
kgm/s^2

PTS: 1 DIF: II OBJ: 1-3.3

24. ANS:
10^8

Solution
Since the speed of light is approximately 300 000 000 m/s, which is 3×10^8 m/s,

the order-of-magnitude is 10^8.

PTS: 1 DIF: II OBJ: 1-3.4

PROBLEM

1. ANS:

2.45×10^3

Solution

$$\frac{\left(8.86 + 1.0 \times 10^{-3}\right)}{\left(3.610 \times 10^{-3}\right)} = \frac{(8.86)}{\left(3.610 \times 10^{-3}\right)} = 2.45 \times 10^3$$

PTS: 1 DIF: IIIA OBJ: 1-2.4

2. ANS:

10^{51} protons; 3.57×10^{51} protons

Given

$m_{Earth} = 5.98 \times 10^{24}$ kg

$m_{proton} = 1.673 \times 10^{-27}$ kg

Solution

Using an order-of-magnitude calculation, the proton number estimate is

$$\frac{\left(10^{24}\ \text{kg}\right)}{\left(10^{-27}\ \text{kg/proton}\right)} = 10^{51}\ \text{protons.}$$

The exact proton number is $\left(5.98 \times 10^{24}\ \text{kg}\right)\left(\frac{1\ \text{proton}}{1.673 \times 10^{-27}\ \text{kg}}\right) = 3.57 \times 10^{51}$ protons.

PTS: 1 DIF: IIIB OBJ: 1-3.4

3. ANS:

10^4 Earths; 1.17×10^4 Earths

Given

$R_{Earth} = 6.37 \times 10^6$ m

$Average\ Earth\text{–}sun\ distance = 1.496 \times 10^{11}$ m

N_{Earths} between Earth and the sun = ?

Solution

$Diameter_{Earth} = 2\left(R_{Earth}\right) = (2)\left(6.37 \times 10^6 \text{ m}\right) = 1.27 \times 10^7$ m

Therefore, using an order-of-magnitude calculation, the estimate for the number of Earths that would fit between Earth and the sun is $\dfrac{\left(10^{11}\text{ m}\right)}{\left(10^7\text{ m}\right)} = 10^4$.

The exact number of Earths is $\dfrac{\left(1.496 \times 10^{11}\text{ m}\right)}{(2)\left(6.37 \times 10^6\text{ m}\right)} = 1.17 \times 10^4$.

PTS: 1 DIF: IIIB OBJ: 1-3.4

4. ANS:
Yes; trial 2 has a much greater ΔT over the same period of time.
Temperature increases as time increases.
Since the table indicates a direct relationship between ΔT and Δt, the general form of the equation is $y = mx$. If ΔT is graphed on the y-axis and Δt is graphed on the x-axis, m represents the slope or $\dfrac{\Delta T}{\Delta t}$.

In this instance, the average of $\dfrac{\Delta T}{\Delta t}$ is 0.12. Therefore, the equation would be: $\Delta T = 0.12\Delta t$.

PTS: 1 DIF: IIIC OBJ: 1-3.1

5. ANS:

3.5×10^8 kg

Given

$N_{leaves/tree}$ = 7500 leaves/tree

m_{leaf} = 1.7 g/leaf

$size_{forest}$ = 135 000 acres

$N_{trees/acre}$ = 206 trees/acre

Solution

Use dimensional analysis to determine mass of leaves in grams dropped on the forest floor each autumn.

$$m_{leaves\ dropped\ each\ fall} = \left(size_{forest}\right)\left(N_{trees/acre}\right)\left(N_{leaves/tree}\right)\left(m_{leaf}\right)$$

$$= (135\ 000 \text{ acres})(206 \text{ trees/acre})(7500 \text{ leaves/tree})\left(1.7 \text{ g/leaf}\right) = 3.5 \times 10^{11} \text{ g}$$

Convert grams of leaves to kilograms.

$$\left(3.5 \times 10^{11} \text{ g}\right)\left(\frac{1 \text{ kg}}{10^3 \text{ g}}\right) = 3.5 \times 10^8 \text{ kg}$$

PTS: 1 DIF: IIIC OBJ: 1-3.3

6. ANS:

mosquito: 10^{25} times more massive than the electron

auto: 10^{33} times more massive than the electron

Given

$m_{auto} = 1.440 \times 10^{6}$ g

$m_{mosquito} = 10$ mg $= 1 \times 10^{-2}$ g

$m_{electron} = 9.109 \times 10^{-31}$ kg $= 9.109 \times 10^{-28}$ g

Solution

After converting all masses to the same dimension (i.e., grams), order-of-magnitude calculations are:

The order-of-magnitude mass for an electron is approximately 10^{-27} g, since 9.109 is close to 10.

$\frac{m_{mosquito}}{m_{electron}} = \frac{10^{-2}\ \text{g}}{10^{-27}\ \text{g}} = 10^{25}$; therefore, the mosquito is 10^{25} times more massive than the electron.

$\frac{m_{auto}}{m_{electron}} = \frac{10^{6}\ \text{g}}{10^{-27}\ \text{g}} = 10^{33}$; therefore, the auto is 10^{33} times more massive than the electron.

PTS: 1 DIF: IIIC OBJ: 1-3.4