

## Chapter 1—Introduction

### MULTIPLE CHOICE

1. Since 1983 the standard meter has been defined in terms of which of the following?

a. <input type="checkbox"/> specific alloy bar housed at Sevres, France
b. <input type="checkbox"/> wavelength of light emitted by krypton-86
c. <input type="checkbox"/> distance from the Earth's equator to the North Pole
d. <input type="checkbox"/> the distance light travels in a certain fraction of a second

ANS: D                    PTS: 1                    DIF: 1  
TOP: 1.1 Standards of Length, Mass, and Time

2. Since 1967 the standard definition for the second has been based on which of the following?

a. <input type="checkbox"/> characteristic frequency of the cesium-133 atom
b. <input type="checkbox"/> average solar day
c. <input type="checkbox"/> sidereal day
d. <input type="checkbox"/> Greenwich Civil Time

ANS: A                    PTS: 1                    DIF: 1  
TOP: 1.1 Standards of Length, Mass, and Time

3. In mechanics, physicists use three basic quantities to derive additional quantities. Mass is one of the three quantities. What are the other two?

a. <input type="checkbox"/> length and force
b. <input type="checkbox"/> power and force
c. <input type="checkbox"/> length and time
d. <input type="checkbox"/> force and time

ANS: C                    PTS: 1                    DIF: 1  
TOP: 1.1 Standards of Length, Mass, and Time

4. The prefixes which are abbreviated p, n, and G represent which of the following?

a. <input type="checkbox"/> $10^{-2}$ , $10^{-6}$ , and $10^{15}$
b. <input type="checkbox"/> $10^{-9}$ , $10^6$ , and $10^{10}$
c. <input type="checkbox"/> $10^{-12}$ , $10^{-9}$ , and $10^9$
d. <input type="checkbox"/> $10^{-15}$ , $10^{-6}$ , and $10^{12}$

ANS: C                    PTS: 1                    DIF: 1  
TOP: 1.1 Standards of Length, Mass, and Time

5. The ratio M/m of the prefixes M and m has what value?

a. <input type="checkbox"/> $10^3$
b. <input type="checkbox"/> $10^6$
c. <input type="checkbox"/> $10^9$
d. <input type="checkbox"/> $10^{18}$

ANS: C                    PTS: 1                    DIF: 2  
TOP: 1.1 Standards of Length, Mass, and Time

6. One year is about \_\_\_\_ seconds while one day is exactly \_\_\_\_ seconds.

- |   |
|---|
| a. <input type="checkbox"/> $3.16 \times 10^7$ , 86 400 |
| b. <input type="checkbox"/> $5.26 \times 10^5$ , 86 400 |
| c. <input type="checkbox"/> $3.16 \times 10^7$ , 8 640  |
| d. <input type="checkbox"/> $1.04 \times 10^6$ , 36 000 |

ANS: A                    PTS: 1                    DIF: 2  
TOP: 1.1 Standards of Length, Mass, and Time

7. The nuclei of atoms contain

- |  |
|--|
| a. <input type="checkbox"/> electrons only.        |
| b. <input type="checkbox"/> neutrons only.         |
| c. <input type="checkbox"/> protons and electrons. |
| d. <input type="checkbox"/> protons and neutrons.  |

ANS: D                    PTS: 1                    DIF: 1  
TOP: 1.2 The Building Blocks of Matter

8. When was the existence of the neutron confirmed?

- |  |
|--|
| a. <input type="checkbox"/> in ancient times |
| b. <input type="checkbox"/> in 1895          |
| c. <input type="checkbox"/> in 1932          |
| d. <input type="checkbox"/> in 1969          |

ANS: C                    PTS: 1                    DIF: 1  
TOP: 1.2 The Building Blocks of Matter

9. The proton contains which of the following combination of quarks?

- |   |
|---|
| a. <input type="checkbox"/> two up quarks and one down quark    |
| b. <input type="checkbox"/> one up quark and two down quarks    |
| c. <input type="checkbox"/> one top quark and two bottom quarks |
| d. <input type="checkbox"/> two top quarks and one bottom quark |

ANS: A                    PTS: 1                    DIF: 2  
TOP: 1.2 The Building Blocks of Matter

10. Which formula is dimensionally consistent with an expression yielding a value for velocity? ( $a$  is acceleration,  $x$  is distance, and  $t$  is time)

- |                                     |
|-------------------------------------|
| a. <input type="checkbox"/> $v/t^2$ |
| b. <input type="checkbox"/> $vx^2$  |
| c. <input type="checkbox"/> $v^2/t$ |
| d. <input type="checkbox"/> $at$    |

ANS: D                    PTS: 1                    DIF: 1                    TOP: 1.3 Dimensional Analysis

11. Which expression is dimensionally consistent with an expression that would yield a value for time<sup>-1</sup>? ( $v$  is velocity,  $x$  is distance, and  $t$  is time)

- |                                     |
|-------------------------------------|
| a. <input type="checkbox"/> $v/x$   |
| b. <input type="checkbox"/> $v^2/x$ |
| c. <input type="checkbox"/> $x/t$   |
| d. <input type="checkbox"/> $v^2t$  |

ANS: A                      PTS: 1                      DIF: 1                      TOP: 1.3 Dimensional Analysis

12. If the displacement of an object,  $x$ , is related to velocity,  $v$ , according to the relation  $x = Av$ , the constant,  $A$ , has the dimension of which of the following?

- |  |
|--|
| a. <input type="checkbox"/> acceleration |
| b. <input type="checkbox"/> length       |
| c. <input type="checkbox"/> time         |
| d. <input type="checkbox"/> area         |

ANS: C                      PTS: 1                      DIF: 1                      TOP: 1.3 Dimensional Analysis

13. The speed of a boat is often given in knots. If a speed of 5 knots were expressed in the SI system of units, the units would be:

- |                                   |
|-----------------------------------|
| a. <input type="checkbox"/> m.    |
| b. <input type="checkbox"/> s.    |
| c. <input type="checkbox"/> m/s.  |
| d. <input type="checkbox"/> kg/s. |

ANS: C                      PTS: 1                      DIF: 1                      TOP: 1.3 Dimensional Analysis

14. If  $a$  is acceleration,  $v$  is velocity,  $x$  is position, and  $t$  is time, then which equation is not dimensionally correct?

- |  |
|--|
| a. <input type="checkbox"/> $t = x/v$    |
| b. <input type="checkbox"/> $a = v^2/x$  |
| c. <input type="checkbox"/> $v = a/t$    |
| d. <input type="checkbox"/> $t^2 = 2x/a$ |

ANS: C                      PTS: 1                      DIF: 1                      TOP: 1.3 Dimensional Analysis

15. Suppose an equation relating position,  $x$ , to time,  $t$ , is given by  $x = bt^3 + ct^4$ , where  $b$  and  $c$  are constants. The dimensions of  $b$  and  $c$  are respectively:

- |  |
|--|
| a. <input type="checkbox"/> $T^3, T^4$ .       |
| b. <input type="checkbox"/> $1/T^3, 1/T^4$ .   |
| c. <input type="checkbox"/> $L/T^3, L/T^4$ .   |
| d. <input type="checkbox"/> $L^2T^3, L^2T^4$ . |

ANS: C                      PTS: 1                      DIF: 2                      TOP: 1.3 Dimensional Analysis

16. Areas always have dimensions \_\_\_\_ while volumes always have dimensions \_\_\_\_.

- |   |
|---|
| a. <input type="checkbox"/> $m^2, m^3$                                    |
| b. <input type="checkbox"/> $L^2, L^3$                                    |
| c. <input type="checkbox"/> Both a and b are correct.                     |
| d. <input type="checkbox"/> No answer is correct because of the "always." |

ANS: B

PTS: 1

DIF: 1

TOP: 1.3 Dimensional Analysis

17. Which one of the choices below represents the preferred practice regarding significant figures when adding the following:  $12.4 + 11 + 67.37 + 4.201$ ?

a. <input type="checkbox"/> 94.971
b. <input type="checkbox"/> 94.97
c. <input type="checkbox"/> 95.0
d. <input type="checkbox"/> 95

ANS: D

PTS: 1

DIF: 1

TOP: 1.4 Uncertainty in Measurement and Significant Figures

18. Which one of the choices below represents the preferred practice regarding significant figures when multiplying the following:  $10.5 \times 8.8 \times 3.14$ ?

a. <input type="checkbox"/> 290
b. <input type="checkbox"/> 290.136
c. <input type="checkbox"/> 290.1
d. <input type="checkbox"/> 300

ANS: A

PTS: 1

DIF: 1

TOP: 1.4 Uncertainty in Measurement and Significant Figures

19. Calculate  $(0.82 + 0.042) \times (4.4 \times 10^3)$ , keeping only significant figures.

a. <input type="checkbox"/> 3 800
b. <input type="checkbox"/> 3 784
c. <input type="checkbox"/> 3 793
d. <input type="checkbox"/> 3 520

ANS: A

PTS: 1

DIF: 1

TOP: 1.4 Uncertainty in Measurement and Significant Figures

20. The length and width of a standard sheet of paper is measured, and then the area is found by calculation to be  $93.50 \text{ in}^2$ . The number of significant figures in the width measurement must be at least:

a. <input type="checkbox"/> 1.
b. <input type="checkbox"/> 2.
c. <input type="checkbox"/> 3.
d. <input type="checkbox"/> 4.

ANS: D

PTS: 1

DIF: 1

TOP: 1.4 Uncertainty in Measurement and Significant Figures

21. The number 0.000 17 has how many significant figures?

a. <input type="checkbox"/> 2
b. <input type="checkbox"/> 3
c. <input type="checkbox"/> 5
d. <input type="checkbox"/> 6

ANS: A

PTS: 1

DIF: 2

TOP: 1.4 Uncertainty in Measurement and Significant Figures

22. Multiplying a 2 significant figure number by a 3 significant figure number and then dividing the product by a six significant figure number yields a number with how many significant figures?

a. <input type="checkbox"/> 5/6
b. <input type="checkbox"/> 1
c. <input type="checkbox"/> 2
d. <input type="checkbox"/> 11

ANS: C                    PTS: 1                    DIF: 3  
TOP: 1.4 Uncertainty in Measurement and Significant Figures

23. Assume when using a meter stick measuring can be done so that the last significant figure is in the tenth of a millimeter digit. If you are measuring an object with length between 6 and 7 cm, how many significant figures will result if you only use the part of the meter stick between the 1-cm and 9-cm positions?

a. <input type="checkbox"/> 2
b. <input type="checkbox"/> 3
c. <input type="checkbox"/> 4
d. <input checked="" type="checkbox"/> more than 4

ANS: B                    PTS: 1                    DIF: 1  
TOP: 1.4 Uncertainty in Measurement and Significant Figures

24. Assume when using a meter stick measuring can be done so that the last significant figure is in the tenth of a millimeter digit. If you are measuring an object with length between 6 and 7 cm, how many significant figures will result if you only use the part of the meter stick between the 82- and 95-cm positions?

a. <input type="checkbox"/> 2
b. <input type="checkbox"/> 3
c. <input type="checkbox"/> 4
d. <input type="checkbox"/> more than 4

ANS: B                    PTS: 1                    DIF: 2  
TOP: 1.4 Uncertainty in Measurement and Significant Figures

25. Assume when using a meter stick measuring can be done so that the last significant figure is in the tenth of a millimeter digit. If you are measuring an object with length between 25 and 57 cm, how many significant figures will result if you only use the part of the meter stick between the 2- and 95-cm positions?

a. <input type="checkbox"/> 2
b. <input type="checkbox"/> 3
c. <input type="checkbox"/> 4
d. <input checked="" type="checkbox"/> more than 4

ANS: C                    PTS: 1                    DIF: 2  
TOP: 1.4 Uncertainty in Measurement and Significant Figures

26. How many significant figures does the number 1 700 have?

a. <input type="checkbox"/> 2
b. <input type="checkbox"/> 3
c. <input type="checkbox"/> 4

d.  One cannot tell with certainty when the number is written in the given form, but it will be one of the other given answers.

ANS: D                      PTS: 1  
TOP: 1.4 Uncertainty in Measurement and Significant Figures

27. In the text are the following conversion factors:

- i.  $1 \text{ mi} = 1\,609 \text{ m}$
- ii.  $1 \text{ m} = 39.37 \text{ in.}$
- iii.  $1 \text{ ft} = 30.48 \text{ cm}$
- iv.  $1 \text{ in.} = 2.54 \text{ cm}$

The 1 on the left hand side is assumed to have the same number of significant figures as the number on the right hand side of each of these equations. However, 2 of these conversion factors are exact, and this means they have the equivalent of an unlimited number of significant figures when used in calculations. Which 2 are the exact conversion factors?

- |  |
|--|
| a. <input type="checkbox"/> i and ii   |
| b. <input type="checkbox"/> i and iii  |
| c. <input type="checkbox"/> ii and iii |
| d. <input type="checkbox"/> iii and iv |

ANS: D                      PTS: 1  
TOP: 1.4 Uncertainty in Measurement and Significant Figures | 1.5 Conversion of Units

28. On planet Q the standard unit of volume is called the guppy. Space travelers from Earth have determined that one liter = 38.2 guppies. How many guppies are in 150 liters?

- |   |
|---|
| a. <input type="checkbox"/> 5 730 guppies |
| b. <input type="checkbox"/> 0.255 guppies |
| c. <input type="checkbox"/> 3.93 guppies  |
| d. <input type="checkbox"/> 188 guppies   |

ANS: A                      PTS: 1                      DIF: 1                      TOP: 1.5 Conversion of Units

29. On planet Z, the standard unit of length is the foose. Ann the Astronaut is 5.90 feet tall on earth. She lands on planet Z and is measured to be 94 foosi tall. Her partner Rachael is 88 foosi tall. How tall is Rachael on Earth?

- |                                      |
|--------------------------------------|
| a. <input type="checkbox"/> 5.2 feet |
| b. <input type="checkbox"/> 5.5 feet |
| c. <input type="checkbox"/> 5.8 feet |
| d. <input type="checkbox"/> 6.3 feet |

ANS: B                      PTS: 1                      DIF: 2                      TOP: 1.5 Conversion of Units

30. A furlong is a distance of 220 yards. A fortnight is a time period of two weeks. A race horse is running at a speed of 5.00 yards per second. What is his speed in furlongs per fortnight?

- |   |
|---|
| a. <input type="checkbox"/> 27 500 furlongs/fortnight |
| b. <input type="checkbox"/> 13 700 furlongs/fortnight |
| c. <input type="checkbox"/> 6 220 furlongs/fortnight  |
| d. <input type="checkbox"/> 2 750 furlongs/fortnight  |

ANS: A                      PTS: 1                      DIF: 2                      TOP: 1.5 Conversion of Units

31. A cereal box has the dimensions of  $0.19 \text{ m} \times 0.28 \text{ m} \times 0.070 \text{ m}$ . If there are 3.28 feet per meter, then what is the volume of the box in cubic feet?

a. <input type="checkbox"/> 0.13 cubic feet
b. <input type="checkbox"/> 0.040 cubic feet
c. <input type="checkbox"/> 0.012 cubic feet
d. <input type="checkbox"/> 0.003 7 cubic feet

ANS: A                      PTS: 1                      DIF: 1                      TOP: 1.5 Conversion of Units

32. The distance to the Andromeda Galaxy is estimated at about  $2 \times 10^6$  light years. A light year is the distance traveled by light in one year; if the speed of light is  $3 \times 10^8 \text{ m/s}$ , about how far is it from our galaxy to Andromeda? (1 year =  $3.15 \times 10^7 \text{ s}$ )

a. <input type="checkbox"/> $10 \times 10^{15} \text{ m}$
b. <input type="checkbox"/> $1 \times 10^{18} \text{ m}$
c. <input type="checkbox"/> $2 \times 10^{22} \text{ m}$
d. <input type="checkbox"/> $6 \times 10^{12} \text{ m}$

ANS: C                      PTS: 1                      DIF: 2                      TOP: 1.5 Conversion of Units

33. A cement truck can pour 20 cubic yards of cement per hour. Express this in  $\text{ft}^3/\text{min}$ .

a. <input type="checkbox"/> $1/3 \text{ ft}^3/\text{min}$
b. <input type="checkbox"/> $1.0 \text{ ft}^3/\text{min}$
c. <input type="checkbox"/> $3 \text{ ft}^3/\text{min}$
d. <input type="checkbox"/> $9 \text{ ft}^3/\text{min}$

ANS: D                      PTS: 1                      DIF: 1                      TOP: 1.5 Conversion of Units

34. Water flows into a swimming pool at the rate of  $8.0 \text{ gal/min}$ . The pool is 16 ft wide, 32 ft long and 8.0 ft deep. How long does it take to fill? (1 U.S. gallon = 231 cubic inches)

a. <input type="checkbox"/> 32 hours
b. <input type="checkbox"/> 64 hours
c. <input type="checkbox"/> 48 hours
d. <input type="checkbox"/> 24 hours

ANS: B                      PTS: 1                      DIF: 2                      TOP: 1.5 Conversion of Units

35. When NASA was communicating with astronauts on the moon, the time from sending on the Earth to receiving on the moon was 1.28 s. Find the distance from Earth to the moon. (The speed of radio waves is  $3.00 \times 10^8 \text{ m/s}$ .)

a. <input type="checkbox"/> 240 000 km
b. <input type="checkbox"/> 384 000 km
c. <input type="checkbox"/> 480 000 km
d. <input type="checkbox"/> 768 000 km

ANS: B                      PTS: 1                      DIF: 2                      TOP: 1.5 Conversion of Units

36. The mass of the sun is  $2.0 \times 10^{30} \text{ kg}$ , and the mass of a hydrogen atom is  $1.67 \times 10^{-27} \text{ kg}$ . If we assume that the sun is mostly composed of hydrogen, how many atoms are there in the sun?

a. <input type="checkbox"/> $1.2 \times 10^{56}$ atoms
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