Math Review & Problem-Solving 3

DIRECTIONS

Work in small groups to solve the following problems. Ask questions of one another first, and if you cannot determine the answer as a group, consult with the instructor. Your group may be asked to present a problem to the full class. Show all units and express answers to the correct number of significant digits.

SIGNIFICANT DIGITS

1. 80 cm + 13.0 cm =

   80 + 13.0 = 93 ← 90 cm

2. 3.4×10^{-9} m + 1.27×10^{-7} m =

   1.30×10^{-7} m

3. 750. g + 677.4 g =

   750. + 677.4 = 1427.4 → 1427 g

4. 1100 cm + 8 cm =

   1100 + 8 = 1108 = 1100 cm

5. 0.7600 mm^3 / 0.0152 mm =

   50.0 mm^2

6. 3 cm x 6 cm =

   20 cm^2

7. (8.6 g + 7.8 g) / 23.51 cm^3 =

   8.6 + 7.8 = 16.4 g; $\frac{16.4\ g}{23.51\ cm^3} = 0.698\ g/cm^3$

8. 6.000×10^{-3} m x 0.0020 m =

   $1.2 \times 10^{-5}\ m^2$

SCIENTIFIC NOTATION

Express the following numbers in scientific notation with the proper number of significant digits:

9. 0.000 002 158

   2.158×10^{-6}

10. 6,024,000

    6.024×10^{6}

11. 500.0

    5.000×10^{2}

12. 0.00120

    1.20×10^{-3}

13. 125.2 x 10^{-2}

    1.252×10^{0}

14. 0.0000552 x 10^{3}

    5.52×10^{-2}

15. 35.882 x 10^{-6}

    3.5882×10^{-5}

Express the following numbers in long form with the proper number of significant digits:

16. 3.56 x 10^{-3}

    0.00356

17. 6.85 x 10^{5}

    685 000

18. 9.500 x 10^{2}

    950.0

19. 3.000 x 10^{3}

    3000. or $3000\bar{}$

20. 1.20 x 10^{-2}

    0.0120

21. 5.00 x 10^{5}

    $500\bar{}$,000

DIMENSIONAL ANALYSIS

22. Convert 32.5 oz to cg

$$32.5\text{ oz}\left|\frac{28.35\text{ g}}{1\text{ oz}}\right|\frac{1\text{ cg}}{1\times10^{-2}\text{ g}} = \boxed{9.21\times10^{4}\text{ cg}}$$

23. Convert 3.55 mL to gallons

$$3.55\text{ mL}\left|\frac{1\text{ L}}{1000\text{ mL}}\right|\frac{1\text{ qt.}}{0.9464\text{ L}}\left|\frac{1\text{ gal}}{4\text{ qt}}\right. = \boxed{9.38\times10^{-4}\text{ gal}}$$

24. Convert 8.6 μg to dg

$$8.6\,\mu\text{g}\left|\frac{1\times10^{-6}\text{ g}}{1\,\mu\text{g}}\right|\frac{1\text{ dg}}{1\times10^{-1}\text{ g}} = \boxed{8.6\times10^{-5}\text{ dg}}$$

25. Convert 9.86×10^{8} dm^2 to km^2

$$9.86\times10^{8}\,\text{dm}^2\left|\frac{1\text{ m}^2}{100\,\text{dm}^2}\right|\frac{1\text{ km}^2}{1\times10^{6}\,\text{m}^2} = \boxed{9.86\text{ km}^2}$$

26. Convert 65 mi/hr to m/s

$$\frac{65\text{ mi}}{\text{hr}}\left|\frac{1.609\text{ km}}{1\text{ mi}}\right|\frac{1000\text{ m}}{1\text{ km}}\left|\frac{1\text{ hr}}{3600\text{ s}}\right. = \boxed{29\text{ m/s}}$$

27. Convert 13.6 g/mL to lb/ft^3 $(2.54\text{ cm})^3 = (1\text{ in})^3$

$$\frac{13.6\text{ g}}{1\text{ mL}}\left|\frac{1\text{ mL}}{1\text{ cm}^3}\right|\frac{16.39\text{ cm}^3}{1\text{ in}^3}\left|\frac{(12)^3\text{ in}^3}{1\text{ ft}^3}\right|\frac{1\text{ g}}{28.35\text{ g}}\left|\frac{1\text{ lb}}{16\text{ oz}}\right. = \boxed{849\text{ lb/ft}^3}$$

MOLES & DENSITY

28. If 5.25 g of silver is added to a graduated cylinder containing 11.2 mL of water, to what level will the water level rise? (You can find the density of silver on the Sargent-Welch Periodic Table.)

$$5.25\text{ g}\left|\frac{1\text{ cm}^3}{10.49\text{ g}}\right. = 0.504\text{ cm}^3 \text{ or mL}$$

$$11.2\text{ mL} + 0.504\text{ mL}$$

$$\boxed{11.7\text{ mL}}$$

29. Wood floats on water because it is less dense than water. If a cubic piece of metal has sides of 1.25 cm and a mass of 37.7 g, will the metal float on a pool of mercury?

$$D = \frac{37.7\text{ g}}{(1.25\text{ cm})^3} = 19.3\text{ g/cm}^3 \longrightarrow$$

Will NOT float on Mercury, as it is more dense than Hg. ($D_{Hg} = 13.55\text{ g/cm}^3$)

30. Convert 15.22 g $Ba(NO_3)_2$ to formula units.

$$15.22\text{ g Ba(NO}_3)_2\left|\frac{1\text{ mol}}{261.32\text{ g}}\right|\frac{6.022\times10^{23}\text{ form. un.}}{1\text{ mol}} = \boxed{3.507\times10^{22}\text{ form. units}}$$

31. What mass is equal to 63.2 mmol (millimole) of benzoic acid, $C_7H_6O_2$?

$$63.2\text{ mmol}\left|\frac{1\times10^{-3}\text{ mol}}{1\text{ mmol}}\right|\frac{122.12\text{ g C}_7\text{H}_6\text{O}_2}{1\text{ mol}} = \boxed{7.72\text{ g}}$$