1. If an insulin injection contains 100 units of insulin in each milliliter, how many milliliters should be injected to receive 40 units of insulin?

2. An injection contains 3 mg of medication in each milliliter (mL). If a physician prescribes a dose of 0.5 mg to be administered to a hospital patient three times daily, how many milliliters of injection will be required over a 5-day period?

3. In a clinical study, a drug produced drowsiness in 30 of the 1500 patients studied. How many patients of a certain pharmacy could expect similar effects, based on a patient count of 100?

4. A formula for 1250 tablets contains 6.25 grams of diazepam. How many grams of diazepam should be used in preparing 350 tablets?

5. If 100 capsules contain 500 mg of an active ingredient, how many milligrams of the ingredient will 48 capsules contain?

6. Each tablet of TYLENOL WITH CODEINE contains 30 mg of codeine phosphate and 300 mg of acetaminophen. By taking two tablets daily for a week, how many milligrams of each drug would the patient take?

7. A cough syrup contains 10 mg of dextromethorphan hydrobromide per 5 mL. How many milligrams of the drug are contained in a 120-mL container of the syrup?

8. If an intravenous fluid is adjusted to deliver 15 mg of medication to a patient per hour, how many milligrams of medication are delivered per half minute?

9. The biotechnology drug filgrastim (NEUPOGEN) is available in syringes containing 480 micrograms (mcg) of filgrastim per 0.8 mL. How many micrograms of the drug would be administered by each 0.5 mL injection?

10. A prescription drug cost the pharmacist $42.00 for a bottle of 100 tablets. What would be the cost for 24 tablets?

11. How many 0.1-mg tablets will contain the same amount of drug as 50 tablets, each of which contains 0.025 mg of the identical drug?

12. Acyclovir (ZOVIRAX) suspension contains 200 mg of acyclovir in each 5 mL. How many milligrams of acyclovir are contained in a pint (473 mL) of suspension?

13. A metered dose inhaler contains 225 mg of metaproterenol sulfate, which is sufficient for 100 inhalations. How many micrograms (mcg) of metaproterenol sulfate would be administered with each inhalation if there are 1000 micrograms in each milligram?

14. A pediatric vitamin drug product contains the equivalent of 0.5 mg of fluoride ion in each milliliter. How many milligrams of fluoride ion would be provided by a dropper that delivers 0.6 mL?

15. If a pediatric vitamin contains 1500 units of vitamin A per milliliter of solution, how many units of vitamin A would be administered to a child given 2 drops of the solution from a dropper calibrated to deliver 20 drops per milliliter of solution?

16. An elixir contains 40 mg of drug in each 5 mL. How many milligrams of the drug would be used in preparing 4000 mL of the elixir?

17. An elixir of ferrous sulfate contains 220 mg of ferrous sulfate in each 5 mL. If each milligram of ferrous sulfate contains the equivalent of 0.2 mg of elemental iron, how many milligrams of elemental iron would be represented in each 5 mL of the elixir?

18. An estradiol transdermal patch is available in various patch sizes. The patch size is closely proportional to the amount of drug contained in the patch. If the patch containing 0.025 mg of estradiol is 6.5 cm² in size, calculate the approximate size of the patch containing 0.1 mg of estradiol.

19. If an ophthalmic solution contains 1 mg of dexamethasone phosphate in each milliliter of solution, how many milligrams of dexamethasone phosphate would be contained in 2 drops if the eyedropper used delivered 20 drops per milliliter?

20. A 15-mL package of nasal spray delivers 20 sprays per milliliter of solution, with each spray containing 1.5 mg of drug. (a) How many total sprays will the package deliver? (b) How many milligrams of drug are contained in the 15-mL package of the spray?

21. A penicillin V potassium preparation provides 400,000 units of activity in each 250-mg tablet. How many total units of activity would a patient receive from taking four tablets a day for 10 days?

22. If a 5-g packet of a potassium supplement provides 20 milliequivalents of potassium ion and 3.34 milliequivalents of chloride ion, (a) how many grams of the powder would provide 6 milliequivalents of potassium ion, and (b) how many milliequivalents of chloride ion would be provided by this amount of powder?

23. If a potassium chloride elixir contains 20 milliequivalents of potassium ion in each 15 mL of elixir, how many milliliters will provide 25 milliequivalents of potassium ion to the patient?

24. The blood serum concentration of the antibacterial drug ciprofloxacin increases proportionately with the dose of drug administered. If a 250-mg dose of the drug results in a serum concentration of 1.2 micrograms of drug per milliliter of serum, how many micrograms of drug would be expected per milliliter of serum following a dose of 500 mg of drug?

25. The dosage of the drug thiabendazole (MINTEZOL) is determined in direct proportion to a patient's weight. If the dose of the drug for a patient weighing 150 pounds is 1.5 grams, what would be the dose for a patient weighing 110 pounds?

26. If 0.5 mL of a mumps virus vaccine contains 5000 units of antigen, how many units would be present in each milliliter if the 0.5 mL of vaccine was diluted to 2 mL with water for injection?

27. A sample of Oriental ginseng contains 0.4 mg of active constituents in each 100 mg of powdered plant. How many milligrams of active constituents would be present in 15 mg of powdered plant?

Alligation

PRACTICE PROBLEMS

1. State the number of significant figures in each of the *italicized* quantities:

   (a) One fluidounce equals *29.57* milliliters.
   (b) One liter equals *1000* milliliters.
   (c) One inch equals *2.54* centimeters.
   (d) The chemical costs *$1.05* per pound.
   (e) One gram equals *1,000,000* micrograms.
   (f) One microgram equals *0.001* milligram.

2. Round each of the following to three significant figures:

   (a) 32.75
   (b) 200.39
   (c) 0.03629
   (d) 21.635
   (e) 0.00944

3. Round each of the following to three decimal places:

   (a) 0.00083
   (b) 34.79502
   (c) 0.00494
   (d) 6.12963

4. If a mixture of seven ingredients contains the following approximate weights, what can you validly record as the approximate total combined weight of the ingredients?
   26.83 grams, 275.3 grams, 2.752 grams, 4.04 grams, 5.197 grams, 16.64 grams, and 0.085 gram.

5. Perform the following computations, and retain only significant figures in the results:

   (a) $6.39 - 0.008$
   (b) $7.01 - 6.0$
   (c) 5.0×48.3 grams
   (d) 24×0.25 gram
   (e) $56.824 \div 0.0905$
   (f) $250 \div 1.109$

ANSWERS TO "CASE IN POINT" AND PRACTICE PROBLEMS

Case in Point 1.1

1. teaspoonful = 5 mL
   Adult dose = 2 teaspoonfuls = 10 mL

(a) Child's dose = 1/4 × 10 mL (2 tea-spoonfuls) = 2.5 mL, *answer.*

(b) ? mg dextromethorphan HBr

$$= \frac{10 \text{ mg} \times 2.5 \text{ mL}}{5 \text{ mL}} = 5 \text{ mg}$$

dextromethorphan HBr, and

$$? \text{ mg guaifenesin} = \frac{100 \text{ mg} \times 2.5 \text{ mL}}{5 \text{ mL}}$$
$$= 50 \text{ mg guaifenesin,}$$
$$\textit{answers.}$$

Proof of calculations: child's dose is ¼ of adult dose:

Child's calculated dose of cough syrup/adult dose = 2.5 mL/10 mL = ¼ √

Child's calculated dose of dextro-methorphan HBr/adult dose = 5 mg/20 mg = ¼ √

Child's calculated dose of guaifenesin/adult dose = 50 mg/200 mg = ¼ √

Common Fractions, Decimal Fractions, and Percent

1. 2000 doses

2. (a) 0.029 or 2.9%
   (b) 0.43 or 43%
   (c) 0.004 or 0.4%
   (d) 0.0025 or 0.25%

3. 0.69 or 69%

4. 1⅛ or 1.25 ounces hydromorphone hydrochloride

5. 4.416 grams codeine sulfate

6. 0.012 or 1.2%

Exponential Notations

1. (a) 1.265×10^4
   (b) 5.5×10^{-9}
   (c) 4.51×10^2
   (d) 6.5×10^{-2}
   (e) 6.25×10^8

2. (a) 4,100,000
   (b) 0.0365
   (c) 0.00000513
   (d) 250,000
   (e) 8,695.6

3. (a) $17.5 \times 10^7 = 1.75 \times 10^8$
   (b) $16.4 \times 10^{-4} = 1.64 \times 10^{-3}$
   (c) $6.0 \times 10^0 = 6.0$
   (d) $12 \times 10^7 = 1.2 \times 10^8$
   (e) $36 \times 10^2 = 3.6 \times 10^3$

4. (a) 3.0×10^3
   (b) 3.0×10^{-10}
   (c) 3.0×10^9

5. (a) 8.52×10^4, or 8.5×10^4
   (b) 3.58×10^{-5}, or 3.6×10^{-5}
   (c) 2.99×10^3, or 3.0×10^3

6. (a) 6.441×10^6, or 6.4×10^6
   (b) 6.6×10^{-3}
   (c) 6.94×10^3, or 6.9×10^3

Ratio, Proportion, and Dimensional Analysis

1. 0.4 mL insulin injection

2. 2.5 mL

3. 2 patients

4. 1.75 g diazepam

5. 240 mg

6. 420 mg codeine phosphate
   4200 mg acetaminophen

7. 240 mg dextromethorphan hydro-bromide

8. 0.125 mg

9. 300 mcg filgrastim

10. $10.08

11. 12½ tablets

12. 18,920 mg acyclovir

13. 2250 mcg metaproterenol sulfate

14. 0.3 mg fluoride ion

15. 150 units vitamin A

16. 32,000 mg

17. 44 mg elemental iron

18. 26 cm²

19. 0.1 mg dexamethasone phosphate

20. (a) 300 sprays
    (b) 450 mg

21. 16,000,000 units

22. (a) 1.5 g
    (b) 1 milliequivalent chloride ion

23. 18.75 mL

24. 2.4 mcg ciprofloxacin

25. 1.1 g thiabendazole

26. 2500 units antigen

27. 0.06 mg

Significant Figures

1. (a) four
   (b) four
   (c) three
   (d) three
   (e) seven
   (f) one

2. (a) 32.8
   (b) 200
   (c) 0.0363
   (d) 21.6
   (e) 0.00944

3. (a) 0.001
   (b) 34.795
   (c) 0.005
   (d) 6.130

4. 330.8 g

5. (a) 6.38
   (b) 1.0
   (c) 240 g
   (d) 6.0 g
   (e) 628
   (f) 225

Estimation

1. (a) 20,500 (*19,881*)
   (b) 14,500 (*14,320*)
   (c) $240.00 (*$253.19*)

2. (a) $40 \times 40 = 1600$ (*1638*)
   (b) $600 \times 200 = 120,000$ (*121,584*)
   (c) $8000 \times 10,000 = 80,000,000$
       (*82,286,560*)
   (d) $(7 \times 70) = 490$ (*504.6426*)
   (e) $6 \times 70 = 420$ (*411.079*)

3. (a) $170 \div 20 = 8.5$ (*9.0*)
   (b) $180 \div 2000 = 0.09$ (*0.08*)
   (c) $9800 \div 5 = 1960$ (*2000*)
   (d) $0.01 \div 5 = 0.002$ (*0.002149*)
   (e) $460 \div 8 = 57.5$ (*57.3*)