

PRACTICE PROBLEMS

1. A pharmacist needs to prepare 100 tablets, each containing 20 mcg of a therapeutic agent. How many milligrams of the therapeutic agent will be needed?
2. Add 2.25 L and 875 mL. Express the result in liters.
3. Add 0.0025 kg, 1750 mg, 2.25 g, and 825,000 μg , and express the answer in grams.
4. Convert 1.256 g to micrograms, to milligrams, and to kilograms.
5. Are the terms mcg/mL and mg/L equivalent or not equivalent?
6. A low-strength aspirin tablet contains 81 mg of aspirin per tablet. How many tablets may a manufacturer prepare from 0.5 kg of aspirin?
7. Adhesive tape made from fabric has a tensile strength of not less than 20.41 kg/2.54 cm of width. Convert these quantities to grams and millimeters.
8. In a clinical study, the drug methotrexate produced a blood level of 6.6 μg of methotrexate in each milliliter of blood (6.6 $\mu\text{g}/\text{mL}$). Express the methotrexate blood level in terms of mg/dL.
9. An inhalation aerosol contains 5.28 mg of fluticasone propionate, which is sufficient for 120 inhalations. How many micrograms of fluticasone propionate would be contained in each inhalation?
10. TRIVORA-28 birth control tablets are taken sequentially, 1 tablet per day for 28 days, with the tablets containing the following:
 - Phase 1*—6 tablets, each containing 0.05 mg levonorgestrel and 0.03 mg ethinyl estradiol
 - Phase 2*—5 tablets, each containing 0.075 mg levonorgestrel and 0.04 mg ethinyl estradiol
 - Phase 3*—10 tablets, each containing 0.125 mg levonorgestrel and 0.03 mg ethinyl estradiol; then, 7 inert tablets (no drug)How many total milligrams each of levonorgestrel and ethinyl estradiol are taken during the 28-day period?
11. COLCRYS scored tablets each contain 0.6 mg of colchicine. How many micrograms of colchicine would a patient take by administering one-half tablet?
12. The following clinical laboratory data are within normal values for an adult. Convert each value to mcg/mL:
 - a. Ammonia, 30 mcg/dL
 - b. Folate, 18 pg/mL
 - c. Serum creatinine, 1.0 mg/dL
 - d. Prostate-specific antigen (PSA), 3 ng/mL
 - e. Cholesterol, total, 150 mg/dL
13. Older labeling for NITROSTAT nitroglycerin sublingual tablets may indicate the tablet strength in both milligrams and grains. One strength of these tablets is 1/150 grain of nitroglycerin per tablet. Refer to Appendix A and calculate the milligrams of nitroglycerin present in each tablet.
14. Levothyroxine sodium tablets (SYNTHROID) are available in 12 different strengths ranging from 25 to 300 μg . Express this range in milligrams.
15. Norgestrel and ethinyl estradiol tablets are available containing 0.5 mg of norgestrel and 50 μg of ethinyl estradiol. How many grams of each ingredient would be used in making 10,000 tablets?

16. Approximately 0.02% of a 100-mg dose of the drug miglitol (GLYSET) has been shown to appear in human breast milk. Calculate the quantity of drug detected, in milligrams, following a single dose.
17. How many grams of digoxin (LANOXIN) would be required to make 25,000 tablets each containing 250 mcg of digoxin?
18. Adalimumab (HUMIRA), a recombinant human monoclonal antibody, is available in a prefilled syringe containing 40 mg/0.8 mL of injection. Calculate the concentration of drug on a mg/mL basis.
19. If an injectable solution contains 25 μg of a drug substance in each 0.5 mL, how many milliliters would be required to provide a patient with 0.25 mg of the drug substance?
20. A patient is instructed to take one tablet containing 50 μg of drug each day for the first two days of treatment; 150 $\mu\text{g}/\text{day}$ on the third, fourth, and fifth days of treatment; 250 $\mu\text{g}/\text{day}$ on the sixth, seventh, and eighth days; and 350 μg on the ninth day and return to the physician for assessment. During this treatment period, how many milligrams of drug were taken?
21. Treatment with the drug carvedilol for heart failure is initiated with a dose of 3.125 mg twice daily and then increased every two weeks with twice-daily doses of 6.25 mg, 12.5 mg, and 25 mg. How many of each of these tablet strengths should be dispensed for this protocol?
22. Digoxin (LANOXIN) is available for parenteral pediatric use in a concentration of 0.1 mg/mL. How many milliliters would provide a dose of 40 μg ?
23. ROXANOL oral solution contains 0.6 g of morphine sulfate in each 30-mL bottle affixed with a calibrated dropper. Calculate (a) the concentration of morphine sulfate on a mg/mL basis and (b) the milligrams of morphine sulfate delivered by a 0.6-mL dose.
24. The starting dose of sodium oxybate oral solution (XYREM) is 4.5 g/night divided into two equal doses and administered 2.5 to 4 hours apart. How many milliliters of the oral solution containing sodium oxybate, 500 mg/mL, should be administered in each divided dose?
25. An intravenous solution contains 500 μg of a drug substance in each milliliter. How many milligrams of the drug would a patient receive from the intravenous infusion of a liter of the solution?
26. If an intravenous solution containing 123 mg of a drug substance in each 250-mL bottle is to be administered at the rate of 200 μg of drug per minute, how many milliliters of the solution would be given per hour?
27. An oral inhalation (DULERA) to treat asthma provides, in each inhalation, 100 μg of mometasone furoate and 5 μg of formoterol fumarate. The recommended dose is “two inhalations twice daily (morning and evening).” Calculate the quantity of each drug inhaled daily and express the answers in milligrams.
28. An injection contains 50 mcg/0.5 mL of drug. How many μL of the injection should be administered to deliver 0.04 mg of drug?
29. An injection containing 7.5 mg of leuprolide acetate is administered to a patient weighing 25 kg. Calculate the dose on a mcg/lb basis if 1 kg = 2.2 lb.
30. A gas chromatograph column measures 1.8 m in length and 3 mm in internal diameter. Convert these measurements to inches.

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31. A prefilled syringe contains 20 mg of drug in 2 mL of solution. How many micrograms of drug would be administered by an injection of 0.5 mL of the solution?
32. A vial contains 80 mg of drug in 2 mL of injection. How many milliliters of the injection should be administered to obtain 0.02 g of drug?
33. One-half liter of solution for intravenous infusion contains 2 g of drug. How many milliliters of the solution would contain 0.5 mg of drug?
34. A 125-mL container of amoxicillin contains 600 mg/5 mL. How many milliliters would be used to administer 400 mg of amoxicillin?
35. An effervescent tablet has the following formula:

Acetaminophen	325 mg
Calcium carbonate	280 mg
Citric acid	900 mg
Potassium bicarbonate	300 mg
Sodium bicarbonate	465 mg

 - a. Calculate the total weight, in grams, of the ingredients in each tablet.
 - b. How many tablets could be made with a supply of 5 kg of acetaminophen?
36. A new analytic instrument is capable of detecting picogram quantities of a chemical substance. How many times more capable is this instrument than one that can detect nanogram quantities of the same chemical?
37. The rate of drug delivered to the skin by fentanyl transdermal patches is directly proportional to the dimension of the patch. If a patch size of 5.5 cm² delivers 12.5 mcg/hour of fentanyl, calculate the delivery rate of drug expected from a 33-cm² patch.
38. If an albuterol inhaler contains 18 mg of albuterol, how many inhalation doses can be delivered if each inhalation dose contains 90 µg?
39. Acetaminophen, in amounts greater than 4 g per day, has been associated with liver toxicity. What is the maximum number of 500-mg tablets of acetaminophen that a person may take daily and not reach the toxic level?
40. A lung tumor measuring 2.1 cm was detected in a patient. What are the equivalent dimensions in millimeters and in inches?
41. The recommended dose for a brand of nicotine patch is one 21-mg dose per day for 6 weeks, followed by 14 mg per day for 2 weeks, and then 7 mg per day for 2 more weeks. What total quantity, in grams, would a patient receive during this course of treatment?
42. A medical device is sterilized by gamma radiation at 2.5 megarads (Mrad). Express the equivalent quantity in rads.
43. A round transdermal patch measures 4.3 cm in diameter. Convert this dimension to inches and millimeters.
44. A solution for direct IV bolus injection contains 125 mg of drug in each 25 mL of injection. What is the concentration of drug in terms of µg/µL?
45. SK is a 55-year-old male patient who is 1.85 m tall. What is his height in centimeters?
46. Conjugated estrogen tablets (PREMARIN) are available in strengths of 0.3 mg, 0.45 mg, 0.625 mg, 0.9 mg, and 1.25 mg. If patient "A" took one tablet daily of the lowest dose and patient "B" took one tablet daily of the highest dose, what is

- the difference in the total quantities taken between patients “A” and “B” over a period of 30 days?
- 2.85 mg
 - 285 mcg
 - 28.5 mg
 - 0.285 g
- Teratogenic studies of insulin glargine were undertaken in rats at doses up to 0.36 mg/kg/day. This is equivalent to which of the following?
 - 360 g/lb/day
 - 792 mcg/lb/day
 - 360 mg/lb/day
 - 163.6 mcg/lb/day
 - Pharmacy students, traveling to attend a national pharmacy meeting, were on an airplane with an average air speed of 414 miles per hour. Which is the closest equivalent air speed?
 - 6 mi/min
 - 257 km/h
 - 666 km/h
 - 180 m/s
 - The product of biotechnology, filgrastim (NEUPOGEN), is available in vials containing 0.3 mg of drug in each milliliter. Which choice is equivalent in concentration?
 - 0.03 mg/0.1 dL
 - 300 mcg/0.01 dL
 - 3 mcg/L
 - 300 mcg/0.1 L
 - In a clinical study of finasteride (PROSCAR), a single oral dose of 5 mg resulted in an average blood concentration of 37 ng of drug per milliliter (37 ng/mL) of blood plasma. This is equivalent to which of the following?
 - 37,000 mcg/mL
 - 0.037 mcg/mL
 - 0.000037 mg/L
 - 0.0037 mcg/dL

CALCQUIZ

- A health news story that received widespread attention in recent years involved the successful premature birth of octuplets. The eight babies ranged in weight from 1 lb 8 oz to 3 lb 4 oz. Using the equivalents for the avoirdupois system given in this chapter, calculate the babies' range in weight, in grams, and in kilograms.
- Fentanyl transdermal systems are available in six different strengths, ranging from 12.5 mcg to 0.1 mg. Calculate the difference, in micrograms, between the highest and lowest strengths.
- A pharmacist purchased a 10-g container of progesterone to use in compounding. The compounding log indicates that the following amounts were used:
 - Monday: 40 mg
 - Tuesday: 4.7 g

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Wednesday: 850 mcg

Thursday: 2.4 g

Friday: 500 mg

How much progesterone should remain in the container at the end of the week?

- 2.D. A 0.5-mL container of an investigational ophthalmic solution contains a drug in a concentration of 0.01 mg/mL. How many micrograms of drug would be administered in a 50- μ L drop?
- 2.E. A long-acting formulation of leuprolide acetate requires injection only once every 3 months. Clinical studies revealed that 4 hours following a single injection, the mean blood plasma level of leuprolide was 36.3 ng/mL and dropped over the next month to a steady level of 23.9 ng/mL. Express the difference between these the two values in μ g/dL.

ANSWERS TO "CASE IN POINT" AND PRACTICE PROBLEMS

Case in Point 2.1

$$25 \text{ mcg} \times \frac{1 \text{ g}}{1 \times 10^6 \text{ mcg}} \times \frac{1000 \text{ mg}}{\text{g}} \times \frac{1 \text{ mL}}{0.1 \text{ mg}} = 0.25 \text{ mL}$$

Case in Point 2.2

Concentration of infusion, mcg/mL:

$$\frac{400 \text{ mg}}{250 \text{ mL}} \times \frac{1000 \text{ mcg}}{\text{mg}} = 1600 \text{ mcg/mL}$$

mg, dopamine, first hour:

$$\frac{500 \text{ mcg}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ h}} \times \frac{1 \text{ mg}}{1000 \text{ mcg}} = 30 \text{ mg/h}$$

Infusion duration:

$$400 \text{ mg} \times \frac{1 \text{ min}}{500 \text{ mcg}} \times \frac{1000 \text{ mcg}}{1 \text{ mg}} = 800 \text{ min} = 13 \text{ h, } 20 \text{ min}$$

Practice Problems

- 2 mg
- 3.125 L
- 7.325 g
- 1,256,000 mcg
1256 mg
0.001256 kg
- Equivalent
- 6172 aspirin tablets

7. 20,410 g/25.4 mm
8. 0.66 mg/dL
9. 44 mcg fluticasone propionate
10. 1.925 mg levonorgestrel
0.68 mg ethinyl estradiol
11. 300 mcg colchicine
12. a. Ammonia, 0.3 mcg/mL
b. Folate, 0.000018 mcg/mL
c. Serum creatinine, 10 mcg/mL
d. Prostate-specific antigen (PSA), 0.003 mcg/mL
e. Cholesterol, 1500 mcg/mL
13. 0.43 mg nitroglycerin
14. 0.025 to 0.3 mg levothyroxine sodium
15. 5 g norgestrel
0.5 g ethinyl estradiol
16. 0.02 mg miglitol
17. 6.25 g digoxin
18. 50 mg/mL
19. 5 mL
20. 1.65 mg
21. 28 carvedilol tablets of each strength
22. 0.4 mL
23. a. 20 mg/mL morphine sulfate
b. 12 mg morphine sulfate
24. 4.5 mL sodium oxybate oral solution
25. 500 mg
26. 24.39 mL
27. 0.4 mg mometasone furoate and 0.02 mg formoterol fumarate
28. 400 μ L
29. 136.36 mcg/lb
30. 70.87 inches
0.12 inches
31. 5000 mcg
32. 0.5 mL
33. 0.125 mL
34. 3.33 mL
35. a. 2.27 g
b. 15,384 tablets
36. 1000 times
37. 75 mcg/hour
38. 200 doses
39. 8 tablets
40. 21 mm and 0.83 inches

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41. 1.176 g nicotine
42. 2,500,000 rads
43. 1.69 inches and 43 mm
44. 5 $\mu\text{g}/\mu\text{L}$
45. 185 cm
46. c. 28.5 mg
47. d. 163.6 mcg/lb/day
48. c. 666 km/hour
49. b. 300 mcg/0.01 dL
50. b. 0.037 mcg/mL

.....AUTHOR'S EXTRA POINT.....

PHARMACOPEIAS

The *United States Pharmacopeia* and the *National Formulary* (USP-NF) is a combination of two books of standards, designated under the U.S. Federal Food, Drug, and Cosmetics Act as the official compendia for drugs marketed in the United States.^{c,d} The *United States Pharmacopeia* (USP) contains monographs for drug substances, dosage forms, compounded preparations, and dietary supplements whereas the *National Formulary* (NF) contains monographs for pharmaceutical excipients. The combined volume is published annually in hard copy and online with the standards under continual revision through the issuance of supplements, bulletins, and announcements.

The USP-NF is published by the *United States Pharmaceutical Convention*, comprised of representatives of more than 400 member organizations representing academic institutions, health practitioners, scientific associations, consumer groups, manufacturers, governmental bodies, and other interested groups. The established standards are enforced in the United States under the authority of the federal Food and Drug Administration.

Although the USP-NF standards are used in more than 140 countries, there are a number of other pharmacopeias published around the world. Among the countries issuing national pharmacopeias are Argentina, Brazil, China, Egypt, France, Germany, India, Indonesia, Japan, Mexico, Philippines, Russia, Spain, Switzerland, and the United Kingdom (*British Pharmacopoeia*). In addition, there are regional pharmacopeias, namely, the *European Pharmacopoeia* and the *African Pharmacopoeia*. Internationally, there is *The International Pharmacopoeia*, published by the World Health Organization.^e

Canada, under its "Food and Drugs Act," utilizes a number of pharmacopeias, including the USP-NF, *European Pharmacopoeia* (Ph.Eur), *Pharmacopée française* (Ph.F), the *British Pharmacopoeia* (BP), and *The International Pharmacopoeia* (Ph. Int.).

^c<http://www.uspnf.com>.

^dThe term pharmacopeia comes from the Greek *pharmakon*, meaning "drug," and *poiein*, meaning "make," the combination indicating any recipe, formula, or standard required to make a drug or drug product.

^ehttp://www.who.int/medicines/publications/pharmacopoeia/WHOPSMQSM2006_2_IndexPharmacopoeiasUpdated.pdf.

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