

✓ **CASE IN POINT 6.1³** A patient with myasthenia gravis has undergone treatment to separate and remove certain abnormal antibodies and other unwanted elements from the blood (plasmapheresis). The desired red blood cell component is then returned back to the blood, but the patient has lost protein and blood volume.

The patient's physician orders 2000 mL of a 5% w/v solution of albumin in 0.9% w/v sodium chloride injection to replace lost protein and fluid.

In filling the order, the pharmacist decides to use a piece of automated equipment to compound the mixture. The equipment must be programmed with the specific gravities

of the solutions being mixed. The pharmacist selects to use a 25% w/v albumin solution as the source of the albumin plus a 0.9% sodium chloride injection.

From the literature, the pharmacist finds that 0.9% sodium chloride has a specific gravity of 1.05. Using a precise 25-mL pycnometer with a tare weight of 28 g, the pharmacist fills it with the 25% w/v albumin solution and determines the weight of the flask and its content to be 58 g.

- (a) What is the specific gravity of the albumin solution?
- (b) How many milliliters of the 25% w/v albumin solution are needed to make 2000 mL containing 5% w/v albumin?
- (c) What is the weight of the 25% albumin solution needed to fill the order?
- (d) If the pharmacist mixed the required number of milliliters of the 25% albumin solution with a sufficient 0.9% w/v sodium chloride injection to make the required 2000 mL mixture, what would be the specific gravity of the resultant solution?

Weight-in-Volume Calculations

- ✓ 1. CLOBEX lotion contains 0.05% w/v clobetasol propionate in 118 mL containers. Calculate the content of drug, in milligrams.

2. ~~R~~ Ofloxacin Ophthalmic Solution 0.3%
Disp. 10 mL
Sig: 2 drops into eyes q 4 hours × 2 days; then 2 drops q 6 hours × 4 days.

A pharmacist filled the prescription with OCUFLOX ophthalmic solution. How many milligrams of ofloxacin are contained in the dispensed prescription?

3. ~~8~~ ~~R~~ Dexamethasone Sodium Phosphate 100 mg
Sterile Water for Injection ad 100 mL
Sig: 2 drops into eyes q 4 hours × 2 days; then 2 drops q 6 hours × 4 days.

Calculate the percent strength of dexamethasone sodium phosphate in the prescription.

4. If 100 mL of a pharmaceutical preparation contains 20 μ L of a 50% w/v solution of benzalkonium chloride, what is the percentage strength of that agent in the solution?

5. A tissue plasminogen activator (TPA) ophthalmic solution is prepared to contain 25 μ g/100 μ L.

- (a) Calculate the percentage concentration of TPA in the solution.
(b) What volume of a solution containing TPA, 50 mg/50 mL, should be used to prepare each 100 μ L of the ophthalmic solution?

- ✓ 6. How many milligrams of methylparaben are needed to prepare

8 fluidounces of a solution containing 0.12% (w/v) of methylparaben?

7. A pharmacist emptied the contents of eight capsules, each containing 300 mg of clindamycin phosphate, into a liquid vehicle to prepare 60 mL of a suspension. Calculate the percentage strength of clindamycin phosphate in the preparation.

8. ~~R~~ ACULAR (ketorolac tromethamine) Ophthalmic Solution 0.5%
Disp. 5 mL
Sig: One drop q.i.d. prn allergic conjunctivitis

How many milligrams of the active constituent would be present in each drop of the ophthalmic solution if the dropper service delivers 20 drops per milliliter?

- (a) 0.25 mg
(b) 25 mg
(c) 0.025 mg
(d) 1.25 mg

9. A formula for an antifungal shampoo contains 2% w/v ketoconazole. How many grams of ketoconazole would be needed to prepare 25 liters of the shampoo?

10. The biotechnology drug interferon gamma-1b (ACTIMMUNE) contains 100 mcg/0.5 mL. Calculate the percentage strength of the solution.

11. NEUPOGEN (filgrastim) prefilled syringes contain 480 mcg of active constituent in each 0.8 mL. The equivalent concentration is:

- (a) 0.6%
(b) 0.384 mg/mL
(c) 0.06%
(d) 0.6 g/mL

12. LEVAQUIN (levofloxacin) injection contains 5 mg/mL of levofloxacin and 5% of dextrose. How much of each would be delivered to a patient upon the administration of a 100-mL injection?

- (a) 5 g levofloxacin and 5 g dextrose
- (b) 50 mg levofloxacin and 5 g dextrose
- (c) 500 mg levofloxacin and 500 mg dextrose
- (d) 0.5 g levofloxacin and 5 g dextrose

13. An injection (ARANESP) contains in each milliliter, 60 µg of darbepoetin alpha, 0.05 mg of polysorbate 80, and 8.18 mg of sodium chloride. Calculate the percent of each in the injection.

14. An injection of adalimumab (HUMIRA) contains 40 mg/0.8 mL. Calculate the percentage concentration of the injection.

15.⁹ R Erythromycin
Lactobionate 500 mg
Dexamethasone Sodium
Phosphate 100 mg
Glycerin 2.5 mL
Sterile Water for
Injection ad 100 mL
M. ft. Ophthalmic Solution

- (a) What is the percentage strength of erythromycin lactobionate in the prescription?
- (b) If glycerin has a specific gravity of 1.25, what is its concentration (w/v) in the prescription?

16. How many milliliters of a 0.9% (w/v) solution of sodium chloride can be prepared from 50 tablets, each containing 2.25 g of sodium chloride?

17. The antibacterial agent moxifloxacin hydrochloride is available in 250-mL bags for intravenous infusion containing 400 mg of drug and 0.8% w/v sodium chloride. Calculate (a) the percent strength of moxifloxacin hydrochloride

and (b) the quantity of sodium chloride, in grams, in the infusion.

18. A prefilled syringe contains 50 mg of lidocaine hydrochloride per 5 mL of injection. Express the percentage concentration of lidocaine hydrochloride in the injection.

19. A blood volume expansion solution contains 6% (w/v) of hetastarch and 0.9% (w/v) of sodium chloride. How many grams of each agent would be present in 250 mL of the solution?

20. A pharmacist adds 10 mL of a 20% (w/v) solution of a drug to 500 mL of D5W for parenteral infusion. What is the percentage strength of the drug in the infusion solution?

- (a) 2% v/v
- (b) 2% w/v
- (c) 1.96% w/v
- (d) 0.39% w/v

21. Calculate the percentage strength of an injection that contains 2 mg of hydromorphone hydrochloride in each milliliter of injection.

22. VIRAMUNE Oral Suspension contains 1% w/v of nevirapine. Calculate the milligrams of nevirapine present in a 240 mL bottle of the suspension.

23. R¹⁰ Misoprostol 200-µg
tablets 12 tablets
Lidocaine
Hydrochloride 1 g
Glycerin qs ad 100 mL

Calculate the strength of misoprostol in the prescription.

- (a) 2.4% w/v misoprostol
- (b) 0.0002% w/v misoprostol
- (c) 0.024 mg/mL misoprostol
- (d) 2.4 mcg/mL misoprostol

24. R¹¹ Fentanyl Citrate 20 µg/mL
Bupivacaine
Hydrochloride 0.125%
Sodium Chloride
(0.9%) Injection ad 100 mL

Calculate the percentage concentration of fentanyl citrate in the prescription.

25. Bepotastine besilate (BEPREVE) ophthalmic solution contains 1.5% w/v of the therapeutic agent. Express this concentration in mg/mL.
26. If 100 mL of a solution for patient-controlled anesthesia contains 200 mg of morphine sulfate and 8 mg of droperidol, calculate the percentage strength of each of these ingredients in the solution.
27. Oxycodone hydrochloride oral concentrate solution (OXYFAST) contains 20 mg/1 mL. If a dose of 0.75 mL is added to 30 mL of juice prior to administration, calculate (a) the milligrams of oxycodone hydrochloride administered, and (b) the percentage concentration (w/v) of oxycodone hydrochloride in the drink.
28. A morphine sulfate extended-release liposome injection (DEPODUR) contains morphine sulfate 10 mg/mL of injection. Calculate the percentage strength of morphine sulfate in the injection.
29. A topical solution contains 3% w/v hydroquinone. How many liters of the solution can be prepared from 30 g of hydroquinone?

Volume-in-Volume Calculations

30. What is the percentage strength (v/v) if 225 g of a liquid having a specific gravity of 0.8 is added to enough water to make 1.5 liters of the solution?
31. How many liters of a mouthwash can be prepared from 100 mL of cinnamon flavor if its concentration is to be 0.5% (v/v)?
32. A lotion vehicle contains 15% (v/v) of glycerin. How much glycerin should be used in preparing 5 gallons of the lotion?

- (a) 2271 g glycerin
- (b) 3339.7 mL glycerin
- (c) 2671.8 g glycerin
- (d) 3548.4 g glycerin

33. The formula for 1 liter of an elixir contains 0.25 mL of a flavoring oil. What is the percentage (v/v) of the flavoring oil in the elixir?
34. A dermatologic lotion contains 1.25 mL of liquefied phenol in 500 mL. Calculate the percentage (v/v) of liquefied phenol in the lotion.

Weight-in-Weight Calculations

35. Each gram of LOTRISONE lotion contains 10 mg of clotrimazole and 0.643 mg of betamethasone dipropionate. Calculate the percent concentration of each of these two agents in the lotion.
36. A hemorrhoidal ointment contains, on a weight-in-weight basis, 46.6% mineral oil, 1% pramoxine HCl, and 12.5% zinc oxide in an ointment base. Calculate the grams of each ingredient, including the ointment base, in each 30-g tube.
37. What is the percentage strength (w/w) of a solution made by dissolving 62.5 g of potassium chloride in 187.5 mL of water?
38. If 500 g of dextrose are dissolved in 600 mL of water with a resultant final volume of 1 liter, what is the percentage strength of dextrose in the solution on a w/w basis?
39. Hydromorphone hydrochloride suppositories contain 3 mg of active ingredient and weigh approximately 2 grams each. What is the equivalent percentage strength?
 - (a) 1.5%
 - (b) 0.15%
 - (c) 0.015%
 - (d) none of the above

40. A metronidazole vaginal gel contains 0.75% of drug in 70-g tubes. An applicator will hold 5 g of gel for each administration. How much drug will be contained in each application?

- (a) 0.0375 mg metronidazole
- (b) 3.75 mg metronidazole
- (c) 37.5 mg metronidazole
- (d) 375 mg metronidazole

41. ~~R~~ ZOVIRAX (acyclovir) 5% Cream
Lidocaine 4% Cream aa. 15 g

The percent of acyclovir and quantity of lidocaine in the filled prescription are:

- (a) 3.75% acyclovir, 0.3 g lidocaine
- (b) 5% acyclovir, 1.2 g lidocaine
- (c) 2.5% acyclovir, 0.6 g lidocaine
- (d) 2.5% acyclovir, 1.2 g lidocaine

42. How many grams of hydrocortisone should be used in preparing 120 suppositories, each weighing 2 g and containing 1% of hydrocortisone?

43. If a topical cream contains 1.8% (w/w) of hydrocortisone, which of the following strengths is equivalent?

- (a) 2.7 mg hydrocortisone in 15 g of cream
- (b) 27 mg hydrocortisone in 15 g of cream
- (c) 0.54 g hydrocortisone in 30 g of cream
- (d) 54 mg hydrocortisone in 30 g of cream

44.¹² ~~R~~ Benzoin Tincture 18 mL
Peru Balsam 10 g
Cold Cream 70 g
Sig: cold sore ointment

If benzoin tincture has a specific gravity of 0.88, calculate its percentage strength (w/w) in the mixture.

- (a) 1.26% w/w
- (b) 25.7% w/w
- (c) 22.5% w/w
- (d) 16.5% w/w

45. Alclometasone dipropionate (ACLOVATE) ointment contains 0.05% w/w of the drug in 15-g and 45-g tubes. Calculate the difference in the quantity of drug between the two tube sizes.

46. How many grams of azelaic acid (FINACEA) are contained in 50-g tubes of the 15% w/w gel?

47. Tretinoin gel (RETIN-A-MICRO) is available in a 0.04% w/w concentration. Which of the following represents an equivalent strength?

- (a) 30 mg tretinoin/30 g gel
- (b) 0.06 g tretinoin/15 g gel
- (c) 60 mg tretinoin/15 g gel
- (d) 6 mg tretinoin/15 g gel

Mixed Percent Calculations

48.¹³ ~~R~~ Progesterone, micronized 4 g
Glycerin 5 mL
Methylcellulose (1%)
Solution 50 mL
Cherry Syrup ad 100 mL

- (a) What is the percentage concentration (w/v) of progesterone in the prescription?
- (b) What is the percentage concentration (w/v) of methylcellulose in the prescription?
- (c) What is the percentage concentration (v/v and w/v) of glycerin (sp gr 1.25) in the prescription?

49.¹⁴ ~~R~~ Lactic Acid 4 g
Salicylic Acid 5 g
Trichloroacetic Acid 2 g
Flexible Collodion
q.s. ad 100 g
Sig: wart remover. Use as directed.

- (a) Flexible collodion contains 20% w/w camphor and 30% w/w castor oil. How many grams of each would be contained in 30 g of the mixture?
- (b) The specific gravity of castor oil is 0.955. How many milliliters of the oil are contained in 30 g of the mixture?

- (c) If the specific gravity of the mixture is 0.781, what are the w/v concentrations of lactic acid, salicylic acid, and trichloroacetic acid in the mixture?

Ratio Strength Calculations

50. Express each of the following as a percentage strength:

- (a) 1:1500 (d) 1:400
(b) 1:10,000 (e) 1:3300
(c) 1:250 (f) 1:4000

51. Express each of the following as a ratio strength:

- (a) 0.125% (d) 0.6%
(b) 2.5% (e) $\frac{1}{3}\%$
(c) 0.80% (f) $\frac{1}{2}\%$

52. Express each of the following concentrations as a ratio strength:

- (a) 2 mg of active ingredient in 2 mL of solution
(b) 0.275 mg of active ingredient in 5 mL of solution
(c) 2 g of active ingredient in 250 mL of solution
(d) 1 mg of active ingredient in 0.5 mL of solution

53. A doxycycline calcium syrup is preserved with 0.08% (w/v) of methylparaben, 0.02% (w/v) of propylparaben, and 0.1% (w/v) of sodium metabisulfite. Express these concentrations as ratio strengths.

54. An injection contains 0.5% (w/v) of lidocaine hydrochloride and 1:200,000 (w/v) of epinephrine. Express the concentration of lidocaine hydrochloride as a ratio strength and that of epinephrine as a percentage.

55. A sample of white petrolatum contains 10 mg of tocopherol per kilogram as a preservative. Express the amount of tocopherol as a ratio strength.

56. \mathcal{R} Potassium Permanganate
Tablets 0.2 g
Disp. #100

Sig: two tablets in 4 pt of water and use as directed.

Express the concentration, as a ratio strength, of the solution prepared according to the directions given in the prescription.

57. A skin test for fire ant allergy involves the intradermal skin prick of 0.05 mL of a 1:1,000,000 (w/v) dilution of fire ant extract. How many micrograms of extract would be administered in this manner?

58. In acute hypersensitivity reactions, 0.5 mL of a 1:1000 (w/v) solution of epinephrine may be administered subcutaneously or intramuscularly. Calculate the milligrams of epinephrine given.

- 59.¹⁵ \mathcal{R} Tetracaine Hydro-
Chloride 0.75%
Epinephrine Hydro-
Chloride 1:4000
Cocaine Hydro-
Chloride 3%
Sodium Chloride, qs
Sterile Water ad 30 mL

How many milligrams each of tetracaine hydrochloride, epinephrine hydrochloride, and cocaine hydrochloride are needed to fill the prescription?

Parts per Million Calculations

60. Purified water contains not more than 10 ppm of total solids. Express this concentration as a percentage.

61. How many grams of sodium fluoride should be added to 100,000 liters of drinking water containing 0.6 ppm of sodium fluoride to provide a recommended concentration of 1.75 ppm?

62. If a commercially available insulin preparation contains 1 ppm of proinsulin, how many micrograms of proinsulin would be contained in a 10-mL vial of insulin?

Case in Point 6.2

- (a) $30 \text{ g} \times 0.015 \text{ (1.5\% w/w)} = 0.45 \text{ g}$
hydrocortisone needed, *answer*.
- (b) $\frac{0.1 \text{ g}}{1 \text{ mL}} = \frac{0.45 \text{ g}}{x \text{ mL}}$; $x = 4.5 \text{ mL}$
hydrocortisone injection, *answer*.
- (c) $4.5 \text{ mL} \times 1.5 \text{ (specific gravity)} = 6.75 \text{ g}$
(weight of hydrocortisone injection);
 $30 \text{ g} - 6.75 \text{ g} = 23.25 \text{ g}$ cold cream
needed, *answer*.

Practice Problems

1. 59 mg clobetasol propionate
2. 30 mg ofloxacin
3. 0.1% w/v dexamethasone sodium phosphate
4. 0.01% w/v benzalkonium chloride
5. (a) 0.025% w/v TPA
(b) 0.025 mL
6. 283.9 mg methylparaben
7. 4 % w/v clindamycin phosphate
8. (a) 0.25 mg ketorolac tromethamine
9. 500 g ketoconazole
10. 0.02% w/v interferon gamma-1b
11. (c) 0.06%
12. (d) 0.5 g levofloxacin and 5 g dextrose
13. 0.006% w/v darbepoetin alpha,
0.005% w/v polysorbate 80, and
0.818% w/v sodium chloride
14. 5% w/v adalimumab
15. (a) 0.5% w/v erythromycin
lactobionate
(b) 3.125% w/v glycerin
16. 12,500 mL
17. (a) 0.16% moxifloxacin
hydrochloride
(b) 2 g sodium chloride
18. 1% w/v lidocaine hydrochloride
19. 15 g hetastarch
2.25 g sodium chloride
20. (d) 0.39% w/v
21. 0.2% w/v hydromorphone
22. 2400 mg nevirapine
23. (c) 0.024 mg/mL misoprostol
24. 0.002% w/v fentanyl citrate
25. 15 mg bepotastine besilate/mL
26. 0.2% w/v morphine sulfate and
0.008% w/v droperidol
27. (a) 15 mg oxycodone hydrochloride
(b) 0.049% w/v oxycodone hydro-
chloride
28. 1% w/v morphine sulfate
29. 1 liter
30. 18.75% v/v
31. 20 liters
32. (d) 3548.4 g glycerin
33. 0.025% v/v flavoring oil
34. 0.25% v/v liquefied phenol
35. 1% w/w clotrimazole
0.0643% w/w betamethasone dipro-
pionate
36. 13.98 g mineral oil
0.3 g pramoxine HCl
3.75 g zinc oxide
11.97 g ointment base
37. 25% w/w potassium chloride
38. 45.45% w/w dextrose
39. (b) 0.15%
40. (c) 37.5 mg metronidazole
41. (c) 2.5% acyclovir, 0.6 g lidocaine
42. 2.4 g hydrocortisone
43. (c) 0.54g hydrocortisone in 30 g of
cream
44. (d) 16.5% w/w
45. 15 mg alclometasone dipropionate
46. 7.5 g azelaic acid
47. (d) 6 mg tretinoin/15 g gel
48. (a) 4% w/v progesterone
(b) 0.5% w/v methylcellulose
(c) 5% v/v and 6.25% w/v glycerin
49. (a) 5.34 g camphor and 8.01 g castor oil
(b) 8.39 mL castor oil
(c) 3.12% w/v lactic acid, 3.91% w/v
salicylic acid, and 1.56% w/v
trichloroacetic acid

50. (a) 0.067%
(b) 0.01%
(c) 0.4 %
(d) 0.25%
(e) 0.03%
(f) 0.025%
51. (a) 1:800
(b) 1:40
(c) 1:125
(d) 1:166.67 or 1:167
(e) 1:300
(f) 1:2000
52. (a) 1:1000
(b) 1:18,182
(c) 1:125
(d) 1:500
53. 1:1250 w/v methylparaben
1:5000 w/v propylparaben
1:1000 w/v sodium metabisulfite
54. 1:200 w/v lidocaine hydrochloride
0.0005% w/v epinephrine
55. 1:100,000 w/w tocopherol
56. 1:4730 w/v potassium permanganate
57. 0.05 µg fire ant extract
58. 0.5 mg epinephrine
59. 225 mg tetracaine hydrochloride
7.5 mg epinephrine hydrochloride
900 mg cocaine hydrochloride
60. 0.001% w/v
61. 115 g sodium fluoride
62. 10 µg proinsulin