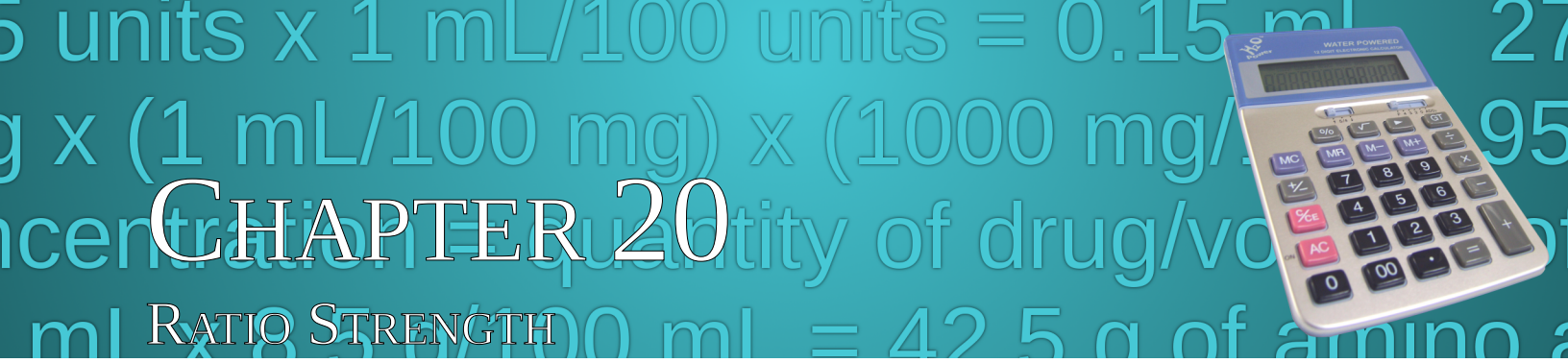

Chapter 20

Ratio Strength

When it comes to the ratio of technicians to pharmacists some might find it interesting that there are 16 states that have no limits on this ratio, 6 states allow a 4 to 1 ratio, and all the others allow either 3 to 1 or 2 to 1 technicians to pharmacist ratios.

--National Association of Boards of Pharmacy

Ratios are sometimes used to express the concentrations of particular drugs and are primarily used with very dilute solutions (although it may be used with creams and other mixtures as well). Similar to the three major types of percentage strength, we also have three types of ratio strength in pharmacy:

- **weight : weight** (w:w) ~ This is typically expressed as grams of active ingredient to grams of mixture. This is sometimes referred to as *solids in solids*.
- **volume : volume** (v:v) ~ This is typically expressed as milliliters of active ingredient to milliliters of solution. This is sometimes referred to as *liquids in liquids*.
- **weight : volume** (w:v) ~ This is always expressed as grams of active ingredient to milliliters of solution. This is sometimes referred to as *solids in liquids*.

You have already learned about various other ways to measure the concentration of various preparations. In the previous chapter we looked at percentage strength which expressed concentration per 100. Ratio strength is merely another way of expressing concentration. A 5% concentration could be expressed as a ratio by saying 5:100; although, you will typically see ratios expressed a one to something. Therefore, 5:100 would be reduced down to 1:20. Let's look at some examples of concentrations in various preparations and look at the corresponding ratio strength.

Examples

1) Determine the ratio strength of 20% mannitol.

$$\frac{20\text{ g}}{100\text{ mL}} = \frac{1\text{ g}}{\text{N}}$$

N = 5 mL

The ratio strength is **1:5**.

2) A cefazolin vial has a concentration of 500 mg/10 mL. What is the ratio strength of the cefazolin solution?

First we need to convert our milligrams into grams:

$$\frac{500\text{ mg}}{1} \times \frac{1\text{ g}}{1000\text{ mg}} = 0.5\text{ g}$$

Now we can set-up our ratio:

$$\frac{0.5\,\text{g}}{10\,\text{mL}} = \frac{1\,\text{g}}{\text{N}}$$

N=20 mL

The ratio strength is **1:20**.

3) Epinephrine is available as a 1:1000 w:v solution. If the patient dose is 0.5 mg, how many mL are needed?

First we need to convert our milligrams into grams:

$$\frac{0.5\,\text{mg}}{1} \times \frac{1\,\text{g}}{1000\,\text{mg}} = 0.0005\,\text{g}$$

Now we can set-up our ratio:

$$\frac{0.0005\,\text{g}}{\text{N}} = \frac{1\,\text{g}}{1000\,\text{mL}}$$

N=0.5 mL

The volume that needs withdrawn to fill this order is **0.5 mL**.

Now that you have seen some examples you should attempt the following practice problems.

Practice Problems

1) You need to prepare 1.5 liters of a 1:1000 neomycin bladder irrigation. How many grams of neomycin are required?

2) If you added 500 mcg of octreotide to a minibag with a final volume of 50 mL what would be both the resulting percentage strength and ratio strength? (*Hint: You are looking for two different answers.*)

3) If 150 mg of strychnine sulfate is intimately mixed with 7.35 g of lactose, what is the ratio strength of the strychnine sulfate compared to the total mixture?

1) 1.5 g of neomycin 2) 0.001%; 1:100,000 3) 1:50

Worksheet 20-1

Name:

Date:

Solve the following problems.

1) A physician orders a 1 liter polymixin-b sulfate bladder irrigation with a concentration of 1:1000. How many grams of polymyxin-b sulfate will be needed for the irrigation?

2) A technician is to prepare 200 mL of a 1:10,000 w/v solution. How many mg of the required drug will be needed to prepare the solution?

3) A drug solution is labeled 1:40 w/v. What is the percentage strength of the solution?

4) A medication is labeled with a 0.05% concentration.

   a) What is the ratio strength of this solution?

   b) What is the concentration of this solution in mcg/mL?

5) An order for 500 mL of a 1:1000 w:v solution is received in the pharmacy. There are 0.55 g of this medication available in the pharmacy. Will the pharmacy be able to prepare this order?

6) An order for 1 liter of a 1:2000 w:v solution is received in the pharmacy. In stock is 480 mg of the powdered drug. Will the technician be able to fill this order?

7) An order is received in the pharmacy for 5 mL of a 1:100,000 w:v solution. How many mcg are needed to fill this order?

8) An order is received in the pharmacy for 22.5 mL of a 1:50,000 solution. How many mcg of active ingredient are required to fulfill this request.

9) A physician uses the hospital's CPOE software to prescribe Racepinephrine inhale 0.5 mg per neb q3h prn asthma attack. If Racepinephrine has a concentration of 1:1000, how many milliliters will be required for a dose?

10) A patient is ordered 16 mg of norepinephrine in 250 mL of D5W. There are 4 mL ampules of norepinephrine with a concentration of 1:1000 available.

    a) How many mL of norepinephrine will you need to add to the D5W bag?

    b) How many ampules of norepinephrine will you need to prepare this solution?

11) The OR needs 0.5 mg of neostigmine to reverse the rocuronium that was used during surgery. The neostigmine you have on hand has a concentration of 1:2000 and comes in 10 mL vials. How many milliliters of neostigmine will you need?

12) You need to add 1.3 mg of a medication to a 50 mL bag of half-normal saline (0.45% NaCl), if the 2 mL ampule of this particular medication on your shelf has a ratio strength of 1:750, how many mL will you need to add to the half-normal saline bag?

13) If you have a 1:50 dilution of hydrocortisone lotion, what is the percentage strength?

14) If you have a 1:60 dilution of atropine in a petrolatum ointment, what is its percentage strength?

15) If you have 100 mg of drug dissolved in 100 mL of solution, what is its ratio strength?

16) If a particular vaccine contains 50 mcg of thimerosal in 0.5 mL of solution, answer the following.

    a) What is the percentage strength?

    b) What is its ratio strength?

17) Four hundred milligrams of drug is mixed with 4600 milligrams of sterile ophthalmic ointment base.

    a) How many grams is the final mixture?

    b) What is the resulting ratio strength?

18) If 140 mg of strychnine sulfate is intimately mixed with 1.26 g of lactose, what is the w/w ratio strength of the strychnine sulfate compared to the total mixture?

19) How many liters of a 1:5000 solution of cinnamon oil in alcohol can be made from 5 mL of cinnamon oil?

20) What is the ratio strength of a liquid in liquid solution if 130 mL of solution contains 0.65 mcL of active ingredient?

Worksheet 20-2

Name:

Date:

Solve the following problems.

1) A physician orders a 1 liter irrigation with 50 mg of amphotericin b. What is the ratio strength of this irrigation?

2) A technician is to prepare 250 mL of a 1:100,000 w/v solution. How many mg of the required drug will be needed to prepare the solution?

3) A drug solution is labeled 1:250 w/v. What is the percentage strength of the solution?

4) A medication is labeled with a 0.025% concentration.

   a) What is the ratio strength of this solution?

   b) What is the concentration of this solution in mcg/mL?

5) An order for 150 mL of a 1:1000 w:v solution is received in the pharmacy. There are 150 mg of this medication available in the pharmacy. Will the pharmacy be able to prepare this order?

6) An order for two bags, each bag being 1 liter in size, with a concentration of a 1:2000 w:v solution is received in the pharmacy. In stock is 960 mg of the powdered drug. Will the pharmacy be able to fill this order?

7) An order is received in the pharmacy for 7.5 mL of a 1:100,000 w:v solution. How many mcg are needed to fill this order?

8) An order is received in the pharmacy for 15 mL of a 1:50,000 solution. How many mcg of active ingredient are required to fulfill this request.

9) A physician uses the hospital's CPOE software to prescribe Racepinephrine inhale 1 mg per neb q3h prn asthma attack. If Racepinephrine has a concentration of 1:1000, how many milliliters will be required for a dose?

10) A patient is ordered 16 mg of epinephrine in 250 mL of NS. There are 30 mL vials of epinephrine with a concentration of 1:1000 available.

    a) How many mL of epinephrine will you need to add to the NS bag?

    b) How many vials of epinephrine will you need to prepare this solution?

    c) What is the ratio strength of epinephrine in the final NS bag?

11) The OR needs 1.5 mg of neostigmine to reverse the vecuronium that was used during surgery. The neostigmine you have on hand has a concentration of 1:2000 and comes in 10 mL vials. How many milliliters of neostigmine will you need?

12) You need to add 2.5 mg of a medication to a 100 mL bag of half-normal saline (0.45% NaCl), if the 2 mL ampule of this particular medication on your shelf has a ratio strength of 1:750, how many mL will you need to add to the half-normal saline bag?

13) If you have a 1:40 dilution of hydrocortisone lotion, what is the percentage strength?

14) If you have a 1:80 dilution of atropine in a petrolatum ointment, what is its percentage strength?

15) If you have 200 mg of drug dissolved in 100 mL of solution, what is its ratio strength?

16) If a particular vaccine contains 5 mcg of thimerosal in 0.5 mL of solution, answer the following.

    a) What is the percentage strength?

    b) What is its ratio strength?

17) Two hundred fifty milligrams of drug is mixed with 4750 milligrams of sterile ophthalmic ointment base.

    a) How many grams is the final mixture?

    b) What is the resulting ratio strength?

18) If 1400 mg of strychnine sulfate is intimately mixed with 12.6 g of lactose, what is the w/w ratio strength of the strychnine sulfate compared to the total mixture?

19) How many liters of a 1:5000 solution of cinnamon oil in alcohol can be made from 2.5 mL of cinnamon oil?

20) What is the ratio strength of a liquid in liquid solution if 250 mL of solution contains 0.5 mcL of active ingredient?

21) The OR wants you to make 25 phenylephrine syringes (10 mL/syringe) with a concentration of 1:12,500. You are to mix the phenylephrine (which is available in 10mg/mL 1 mL vials) with normal saline.

a) How many vials of phenylephrine will you need to make these syringes?

b) How many mL of normal saline will you need to make these syringes?

c) What is the final concentration of the phenylephrine in the syringes in mcg/mL?