Chapter 8: Practice Problem Answers

INTRAVENOUS FLOW RATE AND COMPOUNDING INTRAVENOUS PRODUCTS

1. If an IV fluid is ordered at 150 mL/hr, how much fluid will the patient receive in a 24-hour period?

   Insert the known values:

   $$\frac{\text{X}}{24 \text{ hrs}} = \frac{150 \text{ mL}}{1 \text{ hr}}$$

   Cross multiply:

   $$\text{X hr} = 150 \text{ mL} \times 24 \text{ hours}$$

   Divide both sides by 1 hr:

   $$\frac{\text{X } \cancel{\text{hr}}}{\cancel{\text{hr}}} = \frac{150 \text{ mL} \times 24 \cancel{\text{hrs}}}{\cancel{\text{hr}}}$$

   $$\text{X} = 150 \text{ mL} \times 24$$

   $$\text{X} = 3{,}600 \text{ mL or } 3.6 \text{ L}$$

2. The physician orders dextrose 5% in water at 70 cc/hr. How much solution will be administered each day?

$1 \text{ cc} = 1 \text{ mL} \quad \text{Therefore, the rate is } 70 \text{ mL/hour}$

Insert the known values:

$$\frac{X}{24 \text{ hr}} = \frac{70 \text{ mL}}{\text{hr}}$$

Cross multiply:

$$X \text{ hr} = 70 \text{ mL} \times 24 \text{ hrs}$$

Divide both sides by 1 hr:

$$\frac{X \cancel{\text{hr}}}{\cancel{\text{hr}}} = \frac{70 \text{ mL} \times 24 \cancel{\text{hrs}}}{\cancel{\text{hr}}}$$

$$X = 70 \text{ mL} \times 24$$

$$X = 1{,}680 \text{ mL}$$

3. The doctor orders heparin 25,000 units in 250 mL dextrose 5% in water to infuse at 1,500 units/hr. What is the correct rate of infusion in mL/hr?

$$\text{concentration of IV} = \frac{\text{total amount of drug}}{\text{total volume}}$$

$$\text{concentration} = \frac{25{,}000 \text{ units}}{250 \text{ mL}} = \frac{100 \text{ units}}{\text{mL}}$$

$$\text{IV rate} = \frac{\text{dose desired}}{\text{concentration of IV}}$$

$$\text{IV rate} = \frac{1{,}500 \text{ units/hr}}{100 \text{ units/mL}}$$

$$\text{IV rate} = \frac{1{,}500 \text{ units}}{\text{hr}} \div \frac{100 \text{ units}}{\text{mL}} = \frac{1{,}500 \text{ units}}{\text{hr}} \times \frac{\text{mL}}{100 \text{ units}}$$

$$\frac{1{,}500\ \cancel{\text{units}}}{\text{hr}} \times \frac{\text{mL}}{100\ \cancel{\text{units}}} = \frac{1{,}500\ \text{mL}}{100\ \text{hr}} = 15\ \text{mL/hr}$$

4. The doctor changes the dose of heparin to be administered at 800 units per hour using the same IV concentration of heparin 25,000 units in 250 mL. What is the new rate of infusion in mL/hr?

Concentration remains the same: 100 units/mL

$$\text{IV rate} = \frac{800\ \text{units/hr}}{100\ \text{units/mL}}$$

$$\text{IV rate} = \frac{800\ \text{units}}{\text{hr}} \div \frac{100\ \text{units}}{\text{mL}} = \frac{800\ \text{units}}{\text{hr}} \times \frac{\text{mL}}{100\ \text{units}}$$

$$\frac{800\ \cancel{\text{units}}}{\text{hr}} \times \frac{\text{mL}}{100\ \cancel{\text{units}}} = \frac{800\ \text{mL}}{100\ \text{hr}} = 8\ \text{mL/hr}$$

5. What is the flow rate (mL/hr) for 20 mL of an antibiotic IVPB infused over 60 minutes?

$$\text{flow rate} = \frac{\text{volume}}{\text{time}}$$

$$\text{flow rate} = \frac{20\ \text{mL}}{60\ \text{min}} \times \frac{60\ \text{min}}{\text{hr}} = \frac{20\ \text{mL}}{\cancel{60\ \text{min}}} \times \frac{\cancel{60\ \text{min}}}{\text{hr}} = 20\ \text{mL/hr}$$

6. If a physician orders 70 units of insulin in 70 mL of 0.9% NaCl to be administered over 30 minutes, what is the flow rate in mL/hour?

$$\text{flow rate} = \frac{70\ \text{mL}}{30\ \text{min}} \times \frac{60\ \text{min}}{\text{hr}} = \frac{70\ \text{mL}}{30\ \cancel{\text{min}}} \times \frac{60\ \cancel{\text{min}}}{\text{hr}} = \frac{4{,}200\ \text{mL}}{30\ \text{hr}} = 140\ \text{mL/hr}$$

7. Using the information from problem #6, how much insulin will be delivered in the first 15 minutes of the infusion?

$$\text{concentration of solution} = \frac{70 \text{ units}}{70 \text{ mL}} = 1.4\ \frac{\text{units}}{\text{mL}}$$

$$\frac{100 \text{ mL}}{60 \text{ min}} \times \frac{1 \text{ units}}{\text{mL}} \times 15 \text{ min} = \frac{100\ \cancel{\text{mL}}}{60\ \cancel{\text{min}}} \times \frac{1 \text{ units}}{\cancel{\text{mL}}} \times \frac{15\ \cancel{\text{min}}}{1}$$

$$\frac{2{,}100 \text{ units}}{60} = 35 \text{ units}$$

OR:

$$\frac{70 \text{ units}}{30 \text{ min}} = \frac{Z}{15 \text{ min}}$$

$$30 \text{ min} \times Z = 70 \text{ units} \times 15 \text{ min}$$

$$Z = \frac{70 \text{ units} \times 15 \text{ min}}{30 \text{ min}} = \frac{70 \text{ units} \times 15\ \cancel{\text{min}}}{30\ \cancel{\text{min}}} = \frac{1{,}050 \text{ units}}{30} = 35 \text{ units}$$

8. Determine the infusion time of 1 L of D5W if a control flow set is at 21 mL/hour.

$$\text{flow rate} = \frac{\text{volume}}{\text{time}}$$

$$\frac{21 \text{ mL}}{\text{hr}} = \frac{1{,}000 \text{ mL}}{Z}$$

$$21 \text{ mL} \times Z = 1{,}000 \text{ mL} \times \text{hr}$$

$$Z = \frac{1{,}000 \text{ mL} \times \text{hr}}{21 \text{ mL}} = \frac{1{,}000\ \cancel{\text{mL}} \times \text{hr}}{21\ \cancel{\text{mL}}} = \frac{1{,}000 \text{ hrs}}{21} = 47.6 \text{ hours}$$

9. Determine the infusion time of 500 mL 0.9% NaCl IV if an infusion is ordered to run at 80 mL/hour.

$$\text{flow rate} = \frac{\text{volume}}{\text{time}}$$

$$\frac{80\text{ mL}}{\text{hr}} = \frac{500\text{ mL}}{\text{time}}$$

$$80\text{ mL} \times \text{time} = 500\text{ mL} \times \text{hr}$$

$$\text{time} = \frac{500\text{ mL} \times \text{hr}}{80\text{ mL}} = \frac{500\ \cancel{\text{mL}} \times \text{hr}}{80\ \cancel{\text{mL}}} = \frac{500\text{ hrs}}{80} = 6.25\text{ hours}$$

10. The pharmacy stocks a premixed lidocaine IV containing 2 g of lidocaine in 500 mL of D5W. The physician orders a lidocaine drip at an infusion rate of 6 mg/min. What is the IV flow rate in mL/hr?

$$2\text{ g} = 2{,}000\text{ mg}$$

$$\text{concentration} = \frac{\text{total amount of drug}}{\text{total volume}}$$

$$\text{concentration} = \frac{2{,}000\text{ mg}}{500\text{ mL}} = \frac{4\text{ mg}}{1\text{ mL}}$$

$$\text{IV rate} = \frac{\text{dose desired}}{\text{concentration of IV}}$$

$$\frac{6\text{ mg/min}}{4\text{ mg/mL}} = \frac{\cancel{6\text{ mg}}}{\text{min}} \times \frac{\text{mL}}{\cancel{4\text{ mg}}} = \frac{6\text{ mL}}{4\text{ min}} = 1.5\text{ mL/hr}$$

Convert to mL/hr.

$$1.5\text{ mL/ min} = \frac{1.5\text{ mL}}{\cancel{\text{min}}} \times \frac{60\ \cancel{\text{min}}}{1\text{ hr}} = 90\text{ mL/hr}$$

11. The doctor orders a nitroprusside drip 60 mg in 250 mL D5W to run 6 mcg/kg/min. For a 60 kg patient, what is the IV flow rate in mL/hr?

First: Convert mg to mcg (Multiply by 1,000 mcg/mg.)

$$60 \text{ mg} \times \frac{1{,}000 \text{ mcg}}{\text{mg}} = 60{,}000 \text{ mcg}$$

The concentration of the solution is:

$$\frac{60{,}000 \text{ mcg}}{250 \text{ mL}} \text{ or } \frac{250 \text{ mL}}{60{,}000 \text{ mcg}}$$

For dosing by infusion rate:

$$\text{IV flow rate in } {}^{\text{mL}}/_{\text{hr}} = \frac{\text{dose}}{\text{min}} \times \frac{\text{volume of IV}}{\text{concentration of IV}} \times \frac{60 \text{ min}}{\text{hr}}$$

$$\text{IV flow rate} = \frac{6 \text{ mcg/kg}}{\text{min}} \times 60 \text{ kg} \times \frac{250 \text{ mL}}{60{,}000 \text{ mcg}} \times \frac{60 \text{ min}}{\text{hr}}$$

$$\frac{6\ \cancel{\text{mcg/kg}}}{\cancel{\text{min}}} \times 60\ \cancel{\text{kg}} \times \frac{250 \text{ mL}}{60{,}000\ \cancel{\text{mcg}}} \times \frac{60\ \cancel{\text{min}}}{\text{hr}} = \frac{6 \times 60 \times 250 \times 60 \text{ mL}}{60{,}000 \text{ hrs}}$$

$$\frac{5{,}400{,}000 \text{ mL}}{60{,}000 \text{ hrs}} = 90 \text{ mL/hr}$$

OR:

$$\text{Convert } \frac{250 \text{ mL}}{60{,}000 \text{ mcg}} \text{ to } \frac{1 \text{ mL}}{240 \text{ mcg}}$$

$$\frac{6 \text{ mcg}}{\text{kg}} \times \frac{1}{\text{min}} \times 60 \text{ kg} \times \frac{1 \text{ mL}}{240 \text{ mcg}} \times \frac{60 \text{ min}}{\text{hr}}$$

$$\frac{6\ \cancel{\text{mcg}}}{\cancel{\text{kg}}} \times \frac{1}{\cancel{\text{min}}} \times 60\ \cancel{\text{kg}} \times \frac{1 \text{ mL}}{240\ \cancel{\text{mcg}}} \times \frac{60\ \cancel{\text{min}}}{\text{hr}} = \frac{6 \times 1 \times 60 \times 60 \text{ mL}}{240 \text{ hr}}$$

$$\frac{21{,}600 \text{ mL}}{240 \text{ hr}} = 90 \text{ mL/hr}$$

12. If the contents of a vial of cefazolin in its dry powder form occupies 1.2 mL and the total volume of its reconstituted solution is 30 mL, what amount of sterile water is needed to prepare the solution?

$$\text{diluent volume} = \text{final volume} - \text{powder volume}$$

$$\text{diluent volume} = 30 \text{ mL} - 1.2 \text{ mL} = 28.8 \text{ mL}$$

13. If the final volume of amoxicillin reconstituted suspension should be 200 mL and the instructions indicate to add 123 mL of water to the dry powder, what is the powder volume of the amoxicillin?

$$\text{powder volume} = \text{final volume} - \text{diluent volume}$$

$$\text{powder volume} = 200 \text{ mL} - 123 \text{ mL} = 77 \text{ mL}$$

14. a) If the final volume of 1 gram vancomycin reconstructed solution should be 12 mL and the instructions indicate to add 9.6 mL of water to the dry powder, what is the powder volume of the vancomycin?

$$\text{powder volume} = 12 \text{ mL} - 9.6 \text{ mL} = 2.4 \text{ mL}$$

b) If your IV order is for 1 gram of vancomycin in 500 mL of saline, how much saline will be needed to complete the IV solution?

$$\text{total volume of IV} = \text{additive volume} + \text{base solution}$$

$$500 \text{ mL} = 12 \text{ mL} + \text{base solution}$$

$$\text{base solution} = 500 \text{ mL} - 12\text{mL} = 488 \text{ mL}$$

488 mL of saline will be added to 12 mL of a vancomyacin 1 gm reconstituted vial to make the final IV solution of 1 g vancomyacin in 500 mL saline.

Total compound values: 2.4 mL powder volume
9.6 mL diluent volume
488 mL base solution
= 500 mL

15. The doctor orders a dopamine drip at 25 mcg/kg/min for an 75 kg woman. Using a standard dopamine solution of 400 mg in 250 mL of D5W, what would the IV flow rate be in mL/min?

$$\text{IV flow rate(mL/hr)} = \frac{\text{dose}}{\text{kg/min}} \times \text{weight in kg} \times \frac{\text{volume of IV}}{\text{concentration of IV}} \times \frac{60\text{ min}}{\text{hr}}$$

Convert 25 mcg to 0.025 mg.

Insert known values:

$$\text{IV flow rate} = \frac{0.025\text{ mg}}{\text{kg/min}} \times 75\text{ kg} \times \frac{250\text{ mL}}{400\text{ mg}} \times \frac{60\text{ min}}{\text{hr}}$$

$$\frac{0.025\ \cancel{\text{mg}}}{\cancel{\text{kg/min}}} \times 75\ \cancel{\text{kg}} \times \frac{250\text{ mL}}{400\ \cancel{\text{mg}}} \times \frac{60\ \cancel{\text{min}}}{\text{hr}} = \frac{0.025 \times 75 \times 250 \times 60\text{ mL}}{400\text{ hr}}$$

$$\frac{28{,}125\text{ mL}}{400\text{ hr}} = 70.3 \approx 70\text{ mL/hr}$$

Convert rate from hours to minutes.

$$\frac{70\text{ mL}}{\cancel{\text{hr}}} \times \frac{1\ \cancel{\text{hr}}}{60\text{ min}} = \frac{70\text{ mL}}{60\text{ min}} = 1.17\text{ mL/min}$$

16. The doctor has ordered 1,000 mL of 0.9% NaCl administered over 12 hours. If the administration set has been calibrated to deliver 60 gtt/mL, at what flow rate (gtt/min) should this IV be administered?

Convert 12 hours to minutes.

$$12\ \cancel{\text{hr}} \times \frac{60\text{ min}}{\cancel{\text{hr}}} = 12\text{ x }60\text{ min} = 720\text{ min}$$

$$\text{IV flow rate (gtt/min)} = \frac{\text{gtt}}{\text{mL}} \times \frac{\text{mL}}{\text{min}}$$

$$\text{IV flow rate} = \frac{60\text{ gtt}}{\text{mL}} \times \frac{1{,}000\text{ mL}}{720\text{ min}} = \frac{6\cancel{0}\text{ gtt}}{\cancel{\text{mL}}} \times \frac{1{,}000\ \cancel{\text{mL}}}{72\cancel{0}\text{ min}}$$

$$= \frac{6{,}000\text{ gtt}}{72\text{ min}} = 83.3\text{ gtt/min}$$

17. An IV piggyback of 75 mL is ordered for a newborn infant at 20 gtt/min. If the administration set is calibrated to deliver 10 gtt/mL, how long will it take to deliver the IV piggyback?

$$\text{IV flow rate} = \frac{\text{gtt}}{\text{mL}} \times \frac{\text{mL}}{\text{min}}$$

$$\frac{20\text{ gtt}}{\text{min}} = \frac{10\text{ gtt}}{\text{mL}} \times \frac{75\text{ mL}}{\text{Z min}}$$

$$\frac{20\text{ gtt}}{\text{min}} = \frac{10\text{ gtt}}{\cancel{\text{mL}}} \times \frac{75\ \cancel{\text{mL}}}{\text{Z min}}$$

$$\frac{20\text{ gtt}}{\text{min}} = \frac{750\text{ gtt}}{\text{Z min}}$$

$$\text{Z min} \times 20\text{ gtt} = 750\text{ gtt}$$

$$\frac{\text{Z min} \times \cancel{20\text{ gtt}}}{\cancel{20\text{ gtt}}} = \frac{750\ \cancel{\text{gtt}}}{20\ \cancel{\text{gtt}}}$$

$$\text{Z min} = 37.5\text{ min}$$

18. Determine the infusion time of 1 L of lactated ringers solution if an infusion set delivering 30 gtt/mL is set at 12 gtt/min.

$$\text{IV flow rate (gtt/min)} = \frac{\text{gtt}}{\text{mL}} \times \frac{\text{mL}}{\text{min}}$$

$$\frac{12\text{ gtt}}{\text{min}} = \frac{30\text{ gtt}}{\text{mL}} \times \frac{1{,}000\text{ mL}}{\text{Z}}$$

$$\frac{12\text{ gtt}}{\text{min}} = \frac{30\text{ gtt}}{\cancel{\text{mL}}} \times \frac{1{,}000\ \cancel{\text{mL}}}{\text{Z}}$$

$$\frac{12\text{ gtt}}{\text{min}} = \frac{30{,}000\text{ gtt}}{\text{Z}}$$

$$12\text{ gtt} \times \text{Z} = 30{,}000\text{ gtt} \times \text{min}$$

$$\frac{\cancel{20\text{ gtt}} \times \text{Z}}{\cancel{20\text{ gtt}}} = \frac{30{,}000\ \cancel{\text{gtt}} \times \text{min}}{12\ \cancel{\text{gtt}}}$$

$$\text{Z} = \frac{30{,}000\text{ min}}{12} = 2{,}500\text{ min}$$

$$\text{infusion time in hours} = 2{,}500\text{ min} \div \frac{60\text{ min}}{\text{hr}} = 2{,}500\text{ min} \times \frac{\text{hr}}{60\text{ min}}$$

$$2{,}500\ \cancel{\text{min}} \times \frac{\text{hr}}{60\ \cancel{\text{min}}} = \frac{2{,}500\text{ hr}}{60} = 41.7\text{ hrs}$$

19. Determine the infusion time in hours of a 2 L hydrating fluid if an infusion set delivering 30 gtt/mL is set at 50 gtt/min.

Convert 2 L to milliliters.

$$2\text{ L} \times \frac{1{,}000\text{ mL}}{\text{L}} = 2{,}000\text{ mL}$$

$$\text{IV flow rate (gtt/min)} = \frac{\text{gtt}}{\text{mL}} \times \frac{\text{mL}}{\text{min}}$$

$$\frac{50\text{ gtt}}{\text{min}} = \frac{30\text{ gtt}}{\text{mL}} \times \frac{2{,}000\text{ mL}}{\text{Z}}$$

$$\frac{50\text{ gtt}}{\text{min}} = \frac{30\text{ gtt}}{\cancel{\text{mL}}} \times \frac{2{,}000\ \cancel{\text{mL}}}{\text{Z}}$$

$$\frac{50\text{ gtt}}{\text{min}} = \frac{60{,}000\text{ gtt}}{\text{Z}}$$

$$50\text{ gtt} \times \text{Z} = 60{,}000\text{ gtt} \times \text{min}$$

$$\frac{\cancel{50\ \text{gtt}} \times Z}{\cancel{50\ \text{gtt}}} = \frac{60{,}000\ \cancel{\text{gtt}} \times \text{min}}{50\ \cancel{\text{gtt}}}$$

$$Z = \frac{60{,}000\ \text{min}}{50} = 1{,}200\ \text{min}$$

$$\text{infusion time in hours} = 1{,}200\ \text{min} \div \frac{60\ \text{min}}{\text{hr}} = 1{,}200\ \text{min} \times \frac{\text{hr}}{60\ \text{min}}$$

$$1{,}200\ \cancel{\text{min}} \times \frac{\text{hr}}{60\ \cancel{\text{min}}} = \frac{1{,}200\ \text{hrs}}{60} = 20\ \text{hrs}$$

20. If an IV fluid is ordered at 90 mL/hr, how many liters of fluid will the patient receive in a 24-hour period?

$$\frac{90\ \text{mL}}{\text{hr}} \times 24\ \text{hrs} = \frac{90\ \text{mL}}{\cancel{\text{hr}}} \times 24\ \cancel{\text{hr}} = 90\ \text{mL} \times 24 = 2{,}160\ \text{mL}$$

$$2{,}160\ \text{mL} \div \frac{1{,}000\ \text{mL}}{\text{L}} = 2{,}160\ \text{mL} \times \frac{\text{L}}{1{,}000\ \text{mL}} = 2{,}160\ \cancel{\text{mL}} \times \frac{\text{L}}{1{,}000\ \cancel{\text{mL}}}$$

$$\frac{2{,}160\ \text{L}}{1{,}000} = 2.16\ \text{L}$$

21. The doctor orders heparin 25,000 units in 500 mL dextrose 5% in water to infuse at 1,100 units/hr. What is the correct rate of infusion in mL/hr?

$$\text{IV rate (mL/hr)} = \frac{\text{dose desired}}{\text{concentration of IV}}$$

$$\text{concentration of IV} = \frac{25{,}000\ \text{units}}{500\ \text{mL}} = \frac{500\ \text{units}}{\text{mL}}$$

$$\text{IV rate} = \frac{1{,}100\ \text{units}}{\text{hr}} \div \frac{50\ \text{units}}{\text{mL}} = \frac{1{,}100\ \text{units}}{\text{hr}} \times \frac{\text{mL}}{50\ \text{units}}$$

$$\text{IV rate} = \frac{1{,}100\ \cancel{\text{units}}}{\text{hr}} \times \frac{\text{mL}}{50\ \cancel{\text{units}}} = \frac{1{,}100\ \text{mL}}{50\ \text{hr}} = 22\ \text{mL/hr}$$

22. The doctor orders 500 mL of 0.9% NaCl administered over eight hours. If the administration set has been calibrated to deliver 60 gtt/mL, at what flow rate in drops per minute should this IV be administered?

$$\text{IV flow rate (gtt/min)} = \frac{\text{gtt}}{\text{mL}} \times \frac{\text{mL}}{\text{min}}$$

Convert hours to minutes:

$$8 \text{ hrs} \times \frac{60 \text{ min}}{\text{hrs}} = 8 \cancel{\text{hrs}} \times \frac{60 \text{ min}}{\cancel{\text{hrs}}} = 480 \text{ min}$$

$$\text{gtt/min} = \frac{60 \text{ gtt}}{\text{mL}} \times \frac{500 \text{ mL}}{480 \text{ min}} = \frac{60 \text{ gtt}}{\cancel{\text{mL}}} \times \frac{500 \cancel{\text{mL}}}{480 \text{ min}} = \frac{30{,}000 \text{ gtt}}{480 \text{ min}}$$

$$= 62.5 \text{ gtt/min}$$

23. What is the flow rate for the 75 mL of an antibiotic IVPB infused over 30 minutes if the administered set is calibrated to deliver 10 gtt/mL?

$$\text{IV flow rate (gtt/min)} = \frac{\text{gtt}}{\text{mL}} \times \frac{\text{mL}}{\text{min}}$$

$$\text{IV flow rate} = \frac{10 \text{ gtt}}{\text{mL}} \times \frac{75 \text{ mL}}{30 \text{ min}} = \frac{10 \text{ gtt}}{\cancel{\text{mL}}} \times \frac{75 \cancel{\text{mL}}}{30 \text{ min}} = \frac{750 \text{ gtt}}{30 \text{ min}}$$

$$= 25 \text{ gtt/min}$$

Use the following scenario to solve problems 24-26.

The pharmacy stocks penicillin G vials with 9 million units in dry powder form. The reconstitution directions on the vial are as follows:

Desired Concentration (units/mL)	Solvent for Vial (mL)
250,000	30.2
500,000	12.2
750,000	6.8
1,000,000	3.2

24. What volume of dry powder is contained in this container of penicillin G?

$$\text{powder volume} = \text{final volume} - \text{diluent volume}$$

Solve for final volume:

$$\frac{250{,}000 \text{ units}}{\text{mL}} = \frac{9{,}000{,}000 \text{ units}}{Z}$$

$$250{,}000 \text{ units} \times Z = 9{,}000{,}000 \text{ units} \times \text{mL}$$

$$Z = \frac{250{,}000\ \cancel{\text{units}} \times \text{mL}}{250{,}000\ \cancel{\text{units}}} = \frac{9{,}000{,}000 \text{ mL}}{250{,}000} = 36 \text{ mL}$$

Solve for powder volume:

$$\text{powder volume} = 36 \text{ mL} - 30.2 = 5.8 \text{ mL}$$

25. If the vial was diluted with 8.2 mL of sterile water, what would the volume needed for 3 million units of penicillin G be?

$$\text{Adding 8.2 mL equals a solution of } \frac{500{,}000 \text{ units}}{\text{mL}}$$

$$\frac{500{,}000 \text{ units}}{\text{mL}} = \frac{3{,}000{,}000 \text{ units}}{Z}$$

$$500{,}000 \text{ units} \times Z = 3{,}000{,}000 \text{ units} \times \text{mL}$$

$$Z = \frac{3{,}000{,}000\ \cancel{\text{units}} \times \text{mL}}{500{,}000\ \cancel{\text{units}}} = \frac{3{,}000{,}000\ \text{mL}}{500{,}000} = 6\ \text{mL}$$

26. If the vial was diluted with 4.8 mL, what would the volume needed for 3 million units of penicillin G be?

$$\text{Adding 4.8 mL equals a solution of } \frac{750{,}000\ \text{units}}{\text{mL}}$$

$$\frac{750{,}000\ \text{units}}{\text{mL}} = \frac{3{,}000{,}000\ \text{units}}{Z}$$

$$750{,}000\ \text{units} \times Z = 3{,}000{,}000\ \text{units} \times \text{mL}$$

$$Z = \frac{3{,}000{,}000\ \cancel{\text{units}} \times \text{mL}}{750{,}000\ \cancel{\text{units}}} = \frac{3{,}000{,}000\ \text{mL}}{750{,}000} = 4\ \text{mL}$$

Use the following scenario to solve problems 27 and 28.

A 121 lb nursing home patient is prescribed a medication at 0.1 mg/kg/min. The technician prepares an IV with a concentration of 1 g of medication in 1,000 mL of 0.9% NS.

27. How long will the 1,000 mL IV bag last for this patient?

First, convert lb to kg.

$$121\ \text{lb} = 121\ \text{lb} \times \frac{\text{kg}}{2.2\ \text{lb}} = 121\ \cancel{\text{lb}} \times \frac{\text{kg}}{2.2\ \cancel{\text{lb}}} = \frac{121\ \text{kg}}{2.2} = 55\ \text{kg}$$

$$\text{dose} = 0.1\ \text{mg/kg/min}$$

$$\text{dose} = \frac{0.1\ \text{mg}}{\text{kg/min}} \times 55\ \text{kg} = \frac{0.1\ \text{mg}}{\cancel{\text{kg}}/\text{min}} \times 55\ \cancel{\text{kg}} = 0.1\ \text{mg/ min} \times 55 = 5.5\ \text{mg/min}$$

$$\text{Bag contains 1 gram} = 1{,}000\ \text{mg}$$

$$1{,}000\ \text{mg} \div \frac{5.5\ \text{mg}}{\text{min}} = 1{,}000\ \cancel{\text{mg}} \times \frac{\text{min}}{5.5\ \cancel{\text{mg}}} = \frac{1{,}000\ \text{min}}{5.5} = 181.8 \approx 182\ \text{min}$$

$$182 \text{ min} \times \frac{\text{hr}}{60 \text{ min}} = 182 \cancel{\text{min}} \times \frac{\text{hr}}{60 \cancel{\text{min}}} = \frac{182 \text{ hrs}}{60} = 3.03 \text{ hours}$$

Convert 0.03 hours to minutes.

$$0.03 \text{ hours} = 0.03 \text{ hrs} \times \frac{60 \text{ min}}{\text{hr}} = 0.03 \cancel{\text{hrs}} \times \frac{60 \text{ min}}{\cancel{\text{hr}}}$$

$$= 0.03 \times 60 \text{ min} = 1.8 \approx 2 \text{ min}$$

1 L Bag lasts 3 hrs and 2 min

28. If the dose for this patient was 2.5 mg/min, what would the IV flow rate be in mL/hr?

2.5 mg/min (Note: this is NOT based on weight of patient.)

$$\frac{1{,}000 \text{ mg}}{1{,}000 \text{ mL}} = \frac{1 \text{ mg}}{1 \text{ mL}} \qquad \text{(Note: invert fraction below)}$$

$$\frac{1 \text{ mL}}{1 \text{ mg}} \times \frac{2.5 \text{ mg}}{\text{min}} = \frac{1 \text{ mL}}{\cancel{1 \text{ mg}}} \times \frac{2.5 \cancel{\text{mg}}}{\text{min}} = \frac{2.5 \text{ mL}}{\text{min}}$$

$$\frac{2.5 \text{ mL}}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}} = \frac{2.5 \text{ mL}}{\cancel{\text{min}}} \times \frac{60 \cancel{\text{min}}}{\text{hr}} = \frac{2.5 \text{ mL} \times 60}{\text{hr}} = 150 \text{ mL/hr}$$

Use the following scenario to solve problems 29 and 30.

The doctor orders 3 mg/kg/hr of phenobarbital IV for a 156-lb patient who is seizing. The pharmacist instructs the technician to put 500 mg of phenobarbital in 300 mL of D5W.

29. What would the IV flow rate be in mL/hr for this preparation?

First, convert lb to kg.

$$156 \text{ lb} \times \frac{\text{kg}}{2.2 \text{ lb}} = 156 \cancel{\text{lb}} \times \frac{\text{kg}}{2.2 \cancel{\text{lb}}} = \frac{156 \text{ kg}}{2.2} = 70.9 \text{ kg}$$

$$\frac{3\text{ mg}}{\text{kg/hr}} \times 70.9\text{ kg} = \frac{3\text{ mg}}{\cancel{\text{kg}}/\text{hr}} \times 70.9\ \cancel{\text{kg}} = \frac{3\text{ mg} \times 70.9}{\text{hr}} = 212.7\ \approx 213\text{ mg/hr}$$

$$\text{flow rate (mL/hr)} = \text{dose} \times \frac{\text{volume of IV}}{\text{concentration of IV}}$$

$$\text{mL/hr} = \frac{213\text{ mg}}{\text{hr}} \times \frac{250\text{ mL}}{500\text{ mg}} = \frac{142\ \cancel{\text{mg}}}{\text{hr}} \times \frac{250\text{ mL}}{500\ \cancel{\text{mg}}} = \frac{213 \times 300\text{ mL}}{500\text{ hrs}}$$

$$\frac{63{,}900\text{ mL}}{500\text{ hrs}} = 127.8\ \approx 128\text{ mL/hr}$$

30. How many hours would one IV bag last?

$$300\text{ mL} \div \frac{128\text{ mL}}{\text{hr}} = 300\text{ mL} \times \frac{\text{hr}}{128\text{ mL}} = 300\ \cancel{\text{mL}} \times \frac{\text{hr}}{128\ \cancel{\text{mL}}}$$

$$= \frac{300\text{ hrs}}{128} = 2.344 \approx 2.3\text{ hrs}$$