70. a. $5\text{ mg}:1\text{ mL} = 20\text{ mg}:x\text{ mL}$

$$\frac{5x}{5} = \frac{20}{5}$$

$$x = 4\text{ mL}$$

Answer: 4 mL. The dosage ordered is greater than the available strength; therefore more than 1 mL is needed to administer the dosage ordered.

or

$$\frac{20\text{ mg}}{5\text{ mg}} \times 1\text{ mL} = x\text{ mL}$$

$$x\text{ mL} = \frac{1\text{ mL}}{5\,\cancel{\text{mg}}} \times \frac{20\,\cancel{\text{mg}}}{1}$$

b. $5\text{ mg}:1\text{ min} = 20\text{ mg}:x\text{ min}$

$$\frac{5x}{5} = \frac{20}{5}$$

$$x = 4\text{ min}$$

c. $5\text{ mg}:60\text{ sec} = x\text{ mg}:15\text{ sec}$

$$\frac{60x}{60} = \frac{15}{60}$$

$$x = 1.25\text{ mg per }15\text{ sec}$$

71. a. $250\text{ mg}:5\text{ mL} = 150\text{ mg}:x\text{ mL}$

$$\frac{250x}{250} = \frac{750}{250}$$

$$x = 3\text{ mL}$$

or

$$\frac{150\text{ mg}}{250\text{ mg}} \times 5\text{ mL} = x\text{ mL}$$

Answer: 3 mL. The dosage ordered is less than the available strength; therefore you would need less than 5 mL to administer the dosage ordered.

b. $50\text{ mg}:1\text{ min} = 150\text{ mg}:x\text{ min}$

$$\frac{50x}{50} = \frac{150}{50}$$

$$x = 3\text{ min}$$

72. a. 10 mL diluent

b. $1\text{ mg}:60\text{ sec} = x\text{ mg}:30\text{ sec}$

$$\frac{60x}{60} = \frac{30}{60}$$

$$x = 0.5\text{ mg/30 sec}$$

Answers to Clinical Reasoning Questions

a. The nurse was accustomed to using 20 gtt/mL and calculated the IV rate using 20 gtt/mL. The tubing used at the institution delivered 10 gtt/mL, and the nurse did not check the drop factor on the IV set package. Failure to check the drop factor of the IV tubing resulted in an incorrect IV rate.

b. Because of the excessive IV rate, the client developed signs of fluid overload and could have developed congestive heart failure.

c. The nurse should never assume what the drop factor for IV tubing is for macrodrop administration sets because they can vary. The nurse should have checked the IV tubing package for the drop factor, which is printed on the package.

Answers to Chapter Review

NOTE

Many of the IV problems involving gtt/min could also be done by using the shortcut method or dimensional analysis.

NOTE

Some answers in the Chapter Review reflect the number of drops rounded to the nearest whole number and the rate in mL/hr.

1. a. Determine mL/hr

$$x\text{ mL/hr} = \frac{1{,}000\text{ mL}}{8\text{ hr}};\ x = 125\text{ mL/hr}$$

b. Calculate gtt/min.

$$x\text{ gtt/min} = \frac{125\text{ mL} \times 20\text{ gtt/mL}}{60\text{ min}}$$

$$x = 42\text{ gtt/min};\ 42\text{ macrogtt/min}$$

2. a. Determine mL/hr.

$$x\text{ mL/hr} = \frac{2{,}500\text{ mL}}{24\text{ hr}};\ x = 104\text{ mL/hr}$$

b. Calculate gtt/min.

$$x\text{ gtt/min} = \frac{104\text{ mL} \times 10\text{ gtt/mL}}{60\text{ min}}$$

$$x = 17\text{ gtt/min};\ 17\text{ macrogtt/min}$$

3. a. Determine mL/hr.

$$x\text{ mL/hr} = \frac{500\text{ mL}}{4\text{ hr}};\ x = 125\text{ mL/hr}$$

b. Calculate gtt/min.

$$x\text{ gtt/min} = \frac{125\text{ mL} \times 15\text{ gtt/mL}}{60\text{ min}}$$

$$x = 31\text{ gtt/min};\ 31\text{ macrogtt/min}$$

4. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{300 \text{ mL}}{6 \text{ hr}}; x = 50 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{50 \text{ mL} \times 60 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 50$ gtt/min; 50 microgtt/min

5. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{1{,}000 \text{ mL}}{24 \text{ hr}} = 41.6 = 42; x = 42 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{42 \text{ mL} \times 60 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 42$ gtt/min; 42 microgtt/min

6. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{500 \text{ mL}}{12 \text{ hr}} = 41.6 = 42; x = 42 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{42 \text{ mL} \times 20 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 14$ gtt/min; 14 macrogtt/min

7. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{1{,}000 \text{ mL}}{10 \text{ hr}}; x = 100 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{100 \text{ mL} \times 20 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 33$ gtt/min; 33 macrogtt/min

8. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{1{,}500 \text{ mL}}{12 \text{ hr}}; x = 125 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{125 \text{ mL} \times 10 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 21$ gtt/min; 21 macrogtt/min

9. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{500 \text{ mL}}{4 \text{ hr}}; x = 125 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{125 \text{ mL} \times 10 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 21$ gtt/min; 21 macrogtt/min

10. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{250 \text{ mL}}{4 \text{ hr}}; x = 63 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{63 \text{ mL} \times 10 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 11$ gtt/min; 11 macrogtt/min

11. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{1{,}500 \text{ mL}}{8 \text{ hr}}; x = 188 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{188 \text{ mL} \times 20 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 63$ gtt/min; 63 macrogtt/min

12. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{3{,}000 \text{ mL}}{24 \text{ hr}}; x = 125 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{125 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 31$ gtt/min; 31 macrogtt/min

13. 1 L = 1,000 mL

2 L = 2,000 mL

a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{2{,}000 \text{ mL}}{24 \text{ hr}}; x = 83 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{83 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 21$ gtt/min; 21 macrogtt/min

14. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{500 \text{ mL}}{4 \text{ hr}}; x = 125 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{125 \text{ mL} \times 60 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 125$ gtt/min; 125 microgtt/min

15. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{1{,}000 \text{ mL}}{6 \text{ hr}}; x = 167 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{167 \text{ mL} \times 20 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 56$ gtt/min; 56 macrogtt/min

16. a. Determine mL/hr.

$$x \text{ mL/hr} = \frac{250 \text{ mL}}{8 \text{ hr}}; x = 31 \text{ mL/hr}$$

b. Calculate gtt/min.

$$x \text{ gtt/min} = \frac{31 \text{ mL} \times 60 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 31$ gtt/min; 31 microgtt/min

17. $$x \text{ gtt/min} = \frac{50 \text{ mL} \times 60 \text{ gtt/mL}}{60 \text{ min}}$$

$x = 50$ gtt/min; 50 microgtt/min

18. $x \text{ gtt/min} = \dfrac{150 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$

$x = 38$ gtt/min; 38 macrogtt/min

19. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{500 \text{ mL}}{6 \text{ hr}}$; $x = 83$ mL/hr

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{83 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$

$x = 21$ gtt/min; 21 macrogtt/min

20. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{1{,}500 \text{ mL}}{12 \text{ hr}}$; $x = 125$ mL/hr

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{125 \text{ mL} \times 10 \text{ gtt/mL}}{60 \text{ min}}$

$x = 21$ gtt/min; 21 macrogtt/min

21. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{1{,}500 \text{ mL}}{24 \text{ hr}}$; $x = 63$ mL/hr

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{63 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$

$x = 16$ gtt/min; 16 macrogtt/min

22. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{2{,}000 \text{ mL}}{16 \text{ hr}}$; $x = 125$ mL/hr

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{125 \text{ mL} \times 20 \text{ gtt/mL}}{60 \text{ min}}$

$x = 42$ gtt/min; 42 macrogtt/min

23. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{500 \text{ mL}}{8 \text{ hr}}$; $x = 63$ mL/hr

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{63 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$

$x = 16$ gtt/min; 16 macrogtt/min

24. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{250 \text{ mL}}{10 \text{ hr}}$; $x = 25$ mL/hr

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{25 \text{ mL} \times 60 \text{ gtt/mL}}{60 \text{ min}}$

$x = 25$ gtt/min; 25 microgtt/min

25. $x \text{ gtt/min} = \dfrac{75 \text{ mL} \times 60 \text{ gtt/mL}}{60 \text{ min}}$

$x = 75$ gtt/min; 75 microgtt/min

26. $x \text{ gtt/min} = \dfrac{125 \text{ mL} \times 20 \text{ gtt/mL}}{60 \text{ min}}$

$x = 42$ gtt/min; 42 macrogtt/min

27. $x \text{ gtt/min} = \dfrac{40 \text{ mL} \times 60 \text{ gtt/mL}}{60 \text{ min}}$

$x = 40$ gtt/min; 40 microgtt/min

28. $x \text{ gtt/min} = \dfrac{50 \text{ mL} \times 60 \text{ gtt/mL}}{45 \text{ min}}$

$x = 67$ gtt/min; 67 microgtt/min

29. $x \text{ gtt/min} = \dfrac{90 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$

$x = 23$ gtt/min; 23 macrogtt/min

30. $x \text{ gtt/min} = \dfrac{150 \text{ mL} \times 10 \text{ gtt/mL}}{60 \text{ min}}$

$x = 25$ gtt/min; 25 macrogtt/min

31. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{2{,}500 \text{ mL}}{24 \text{ hr}}$; $x = 104$ mL/hr

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{104 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$

$x = 26$ gtt/min; 26 macrogtt/min

32. $x \text{ gtt/min} = \dfrac{50 \text{ mL} \times 10 \text{ gtt/mL}}{40 \text{ min}}$

$x = 13$ gtt/min; 13 macrogtt/min

33. $x \text{ gtt/min} = \dfrac{100 \text{ mL} \times 20 \text{ gtt/mL}}{30 \text{ min}}$

$x = 67$ gtt/min; 67 macrogtt/min

34. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{250 \text{ mL}}{5 \text{ hr}}$; $x = 50$ mL/hr

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{50 \text{ mL} \times 20 \text{ gtt/mL}}{60 \text{ min}}$

$x = 17$ gtt/min; 17 macrogtt/min

35. $x \text{ gtt/min} = \dfrac{80 \text{ mL} \times 20 \text{ gtt/mL}}{60 \text{ min}}$

$x = 27$ gtt/min; 27 macrogtt/min

36. $x \text{ gtt/min} = \dfrac{150 \text{ mL} \times 10 \text{ gtt/mL}}{30 \text{ min}}$

$x = 50$ gtt/min; 50 macrogtt/min

37. $x \text{ gtt/min} = \dfrac{50 \text{ mL} \times 60 \text{ gtt/mL}}{30 \text{ min}}$

$x = 100$ gtt/min; 100 microgtt/min

38. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{500 \text{ mL}}{3 \text{ hr}}; x = 167 \text{ mL/hr}$

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{167 \text{ mL} \times 10 \text{ gtt/mL}}{60 \text{ min}}$

$x = 28$ gtt/min; 28 macrogtt/min

39. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{250 \text{ mL}}{2 \text{ hr}}; x = 125 \text{ mL/hr}$

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{125 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$

$x = 31$ gtt/min; 31 macrogtt/min

40. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{1{,}750 \text{ mL}}{24 \text{ hr}}; x = 73 \text{ mL/hr}$

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{73 \text{ mL} \times 10 \text{ gtt/mL}}{60 \text{ min}}$

$x = 12$ gtt/min; 12 macrogtt/min

41. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{150 \text{ mL}}{1.5 \text{ hr}}; x = 100 \text{ mL/hr}$

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{100 \text{ mL} \times 60 \text{ gtt/mL}}{60 \text{ min}}$

$x = 100$ gtt/min; 100 microgtt/min

42. 1 L = 1,000 mL

2 L = 2,000 mL

$x \text{ mL/hr} = \dfrac{2{,}000 \text{ mL}}{16 \text{ hr}}; x = 125 \text{ mL/hr}$

43. $x \text{ mL/hr} = \dfrac{500 \text{ mL}}{4 \text{ hr}}; x = 125 \text{ mL/hr}$

44. $x \text{ mL/hr} = \dfrac{200 \text{ mL}}{2 \text{ hr}}; x = 100 \text{ mL/hr}$

45. $x \text{ mL/hr} = \dfrac{500 \text{ mL}}{8 \text{ hr}}; x = 63 \text{ mL/hr}$

46. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{1{,}100 \text{ mL}}{12 \text{ hr}}; x = 92 \text{ mL/hr}$

47. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{500 \text{ mL}}{6 \text{ hr}}; x = 83 \text{ mL/hr}$

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{83 \text{ mL} \times 10 \text{ gtt/mL}}{60 \text{ min}}$

$x = 14$ gtt/min; 14 macrogtt/min

48. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{3{,}000 \text{ mL}}{20 \text{ hr}}; x = 150 \text{ mL/hr}$

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{150 \text{ mL} \times 20 \text{ gtt/mL}}{60 \text{ min}}$

$x = 50$ gtt/min; 50 macrogtt/min

49. a. Determine mL/hr.

$x \text{ mL/hr} = \dfrac{500 \text{ mL}}{6 \text{ hr}}; x = 83 \text{ mL/hr}$

b. Calculate gtt/min.

$x \text{ gtt/min} = \dfrac{83 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$

$x = 21$ gtt/min; 21 macrogtt/min

50. Time remaining = 7 hr

Volume remaining = 300 mL

a. Determine mL/hr for remaining solution.

$x \text{ mL/hr} = \dfrac{300 \text{ mL}}{7 \text{ hr}}; x = 43 \text{ mL/hr}$

b. Determine gtt/min (recalculated rate).

$x \text{ gtt/min} = \dfrac{43 \text{ mL} \times 15 \text{ gtt/mL}}{60 \text{ min}}$

$x = 11$ gtt/min

Answer: 11 macrogtt/min; 11 gtt/min

c. Determine the percentage change.

$\dfrac{11 - 13}{13} = \dfrac{-2}{13} = -0.153 = -15\%$

The −15% is within the acceptable 25% variation. Assess if client can tolerate adjustment in rate.

Negative percentage of variation (−15%) indicates the adjusted rate will be decreased. Assess client, check institution policy, and continue to assess client during rate change.

Determine accepted range of variation.

$13 + (13 \div 4) = 13 + 3.25 = 16.25 = 16$ gtt/min (macrogtt/min)

$13 - (13 \div 4) = 13 - 3.25 = 9.75 = 10$ gtt/min (macrogtt/min)

The acceptable range is 10–16 gtt/min (macrogtt/min). The recalculated rate is 11 gtt/min (macrogtt/min). It is safe to slow the IV rate to 11 gtt/min (macrogtt/min), which is in the safe range. It is below 25%.