CHAPTER 15

INTRAVENOUS CALCULATIONS

IV CALCULATIONS: OBJECTIVES

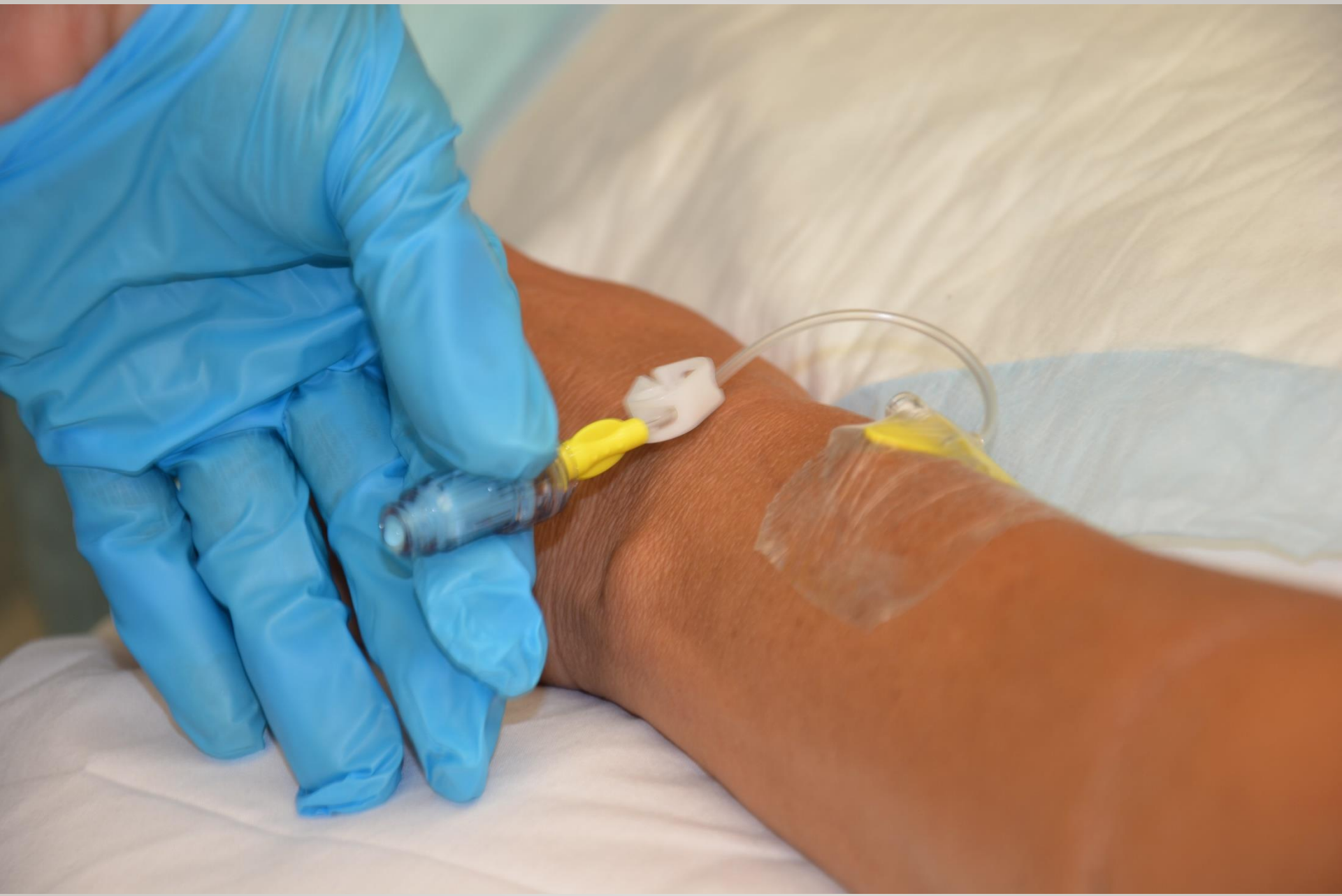
- After reviewing this chapter, you should be able to
  - calculate milliliters per hour (mL/hr).
  - identify two types of administration tubing.
  - identify from intravenous (IV) tubing packages the drop factor in drops per milliliter (gtt/mL).
  - calculate IV flow rate in drops per minute (gtt/min) using dimensional analysis.

IV CALCULATIONS: OBJECTIVES (CONT.)

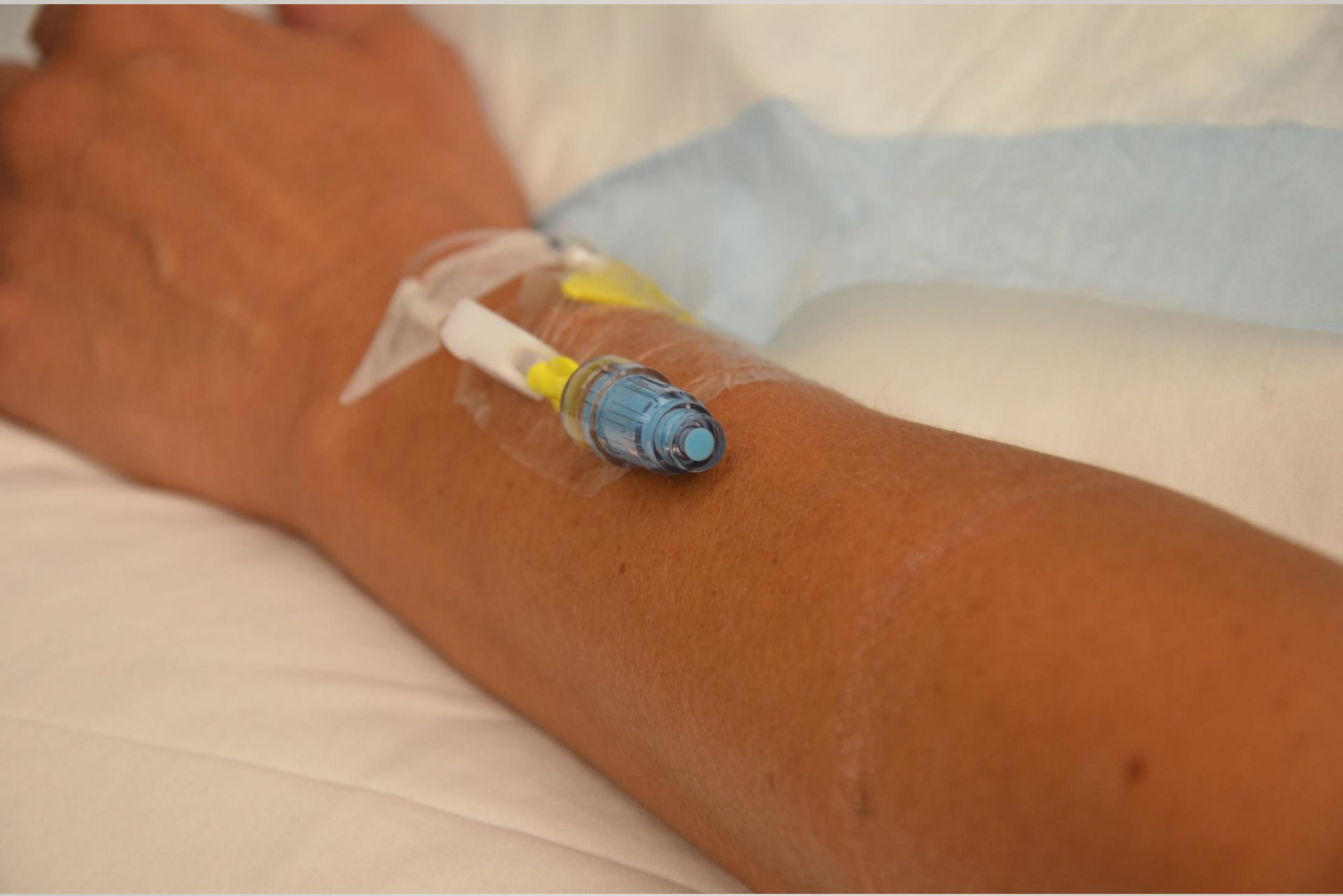
- calculate IV flow rate in gtt/min using a shortcut method (mL/hr and constant drop factor).
- calculate infusion times and completion times.

IV FLOW RATE CALCULATION

- Nurse is responsible for ensuring that the IV fluid infuses at the correct rate.
- Rate is usually expressed in mL per hr.
- If the infusion is managed without an electronic pump, the rate is calculated in drops per min (gtt/min).
- Some IV pumps are capable of delivering IV fluids in tenths of a milliliter. Always be familiar with the IV equipment being used at the institution before rounding.



IV Lock



IV Lock


IV Hep-Lock or
Saline Lock
Port

IV PUMP

(mL per hour)
(mL/hr)

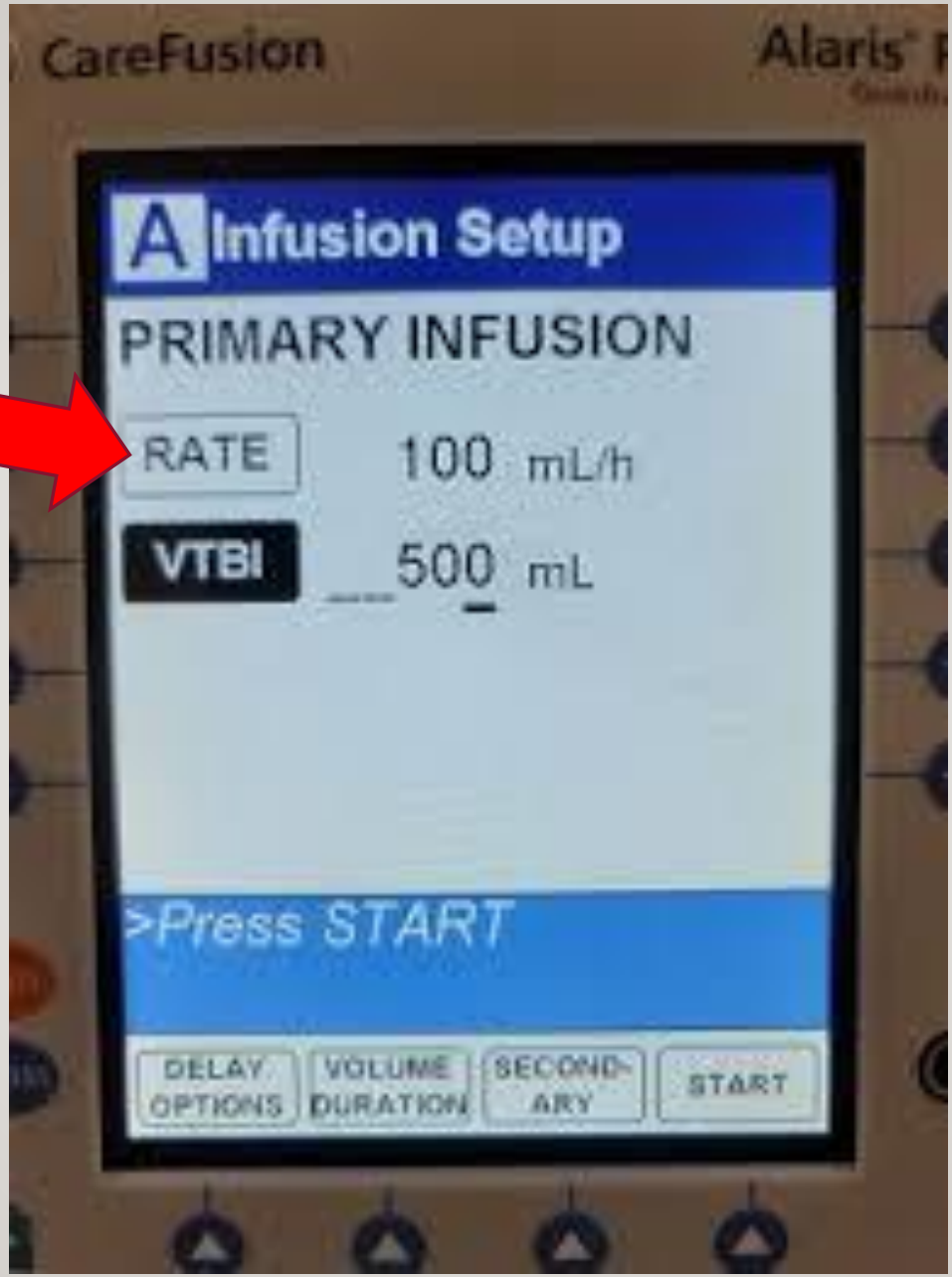
(requires electricity)
(consistent flow rate)
(warning alarm)

Alaris IV Pump

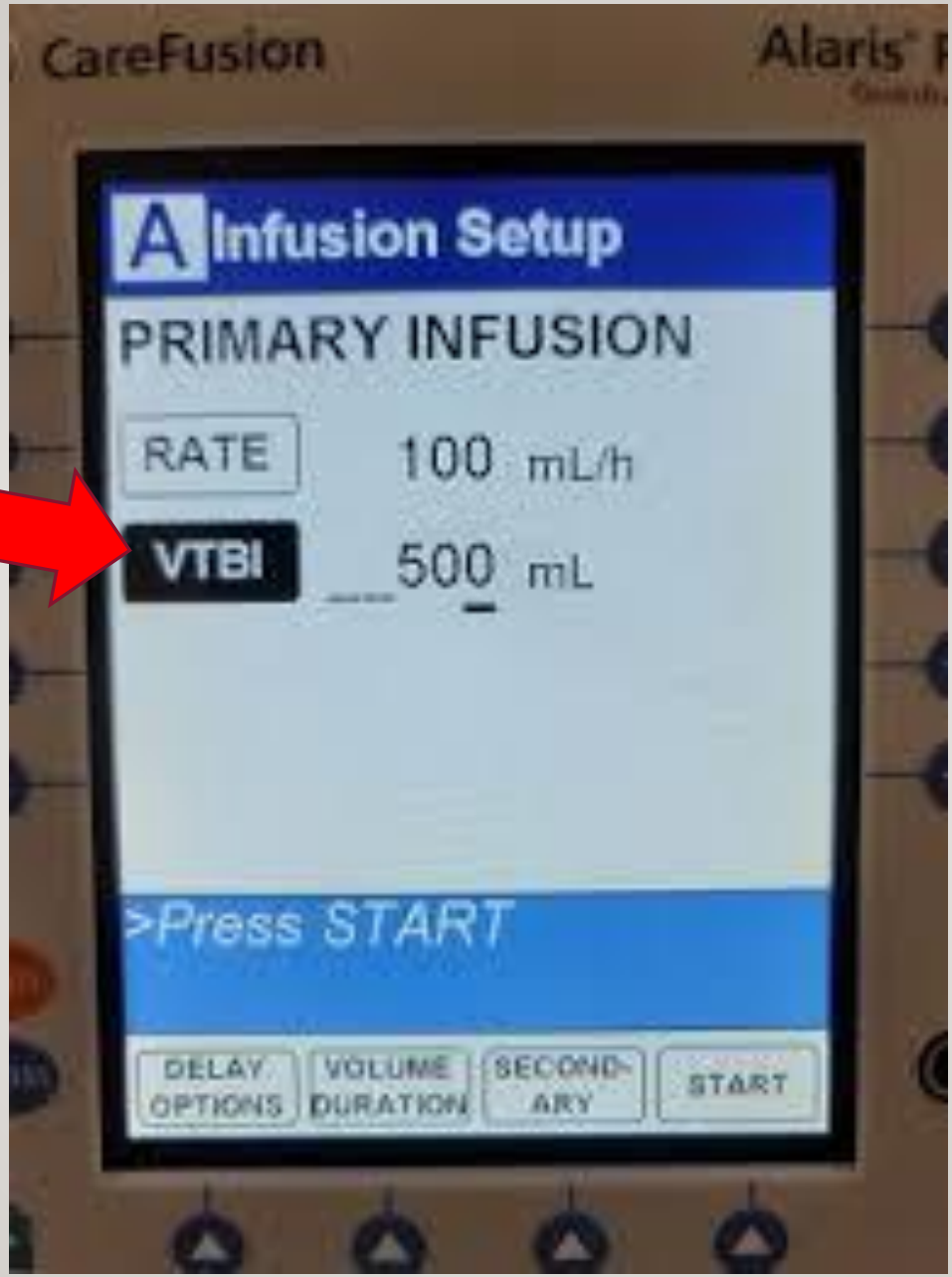

ALARM
INFUSE
STANDBY
Alaris® Pump
CHANNEL SELECT
CareFusion


BD Alaris™ PCU
A
B
C
D


ALARM
INFUSE
STANDBY
Alaris Pump
RATE (mL/h)
CHANNEL SELECT
Close clamp before opening door
PAUSE
CHANNEL OFF
RESTART
CardinalHealth
Fusion
Alaris PC
Guardrails
A VTBI = 510.8 mL
B VTBI = 524.5 mL
C VTBI = 207.4 mL
VOLUME INFUSED
AUDIO ADJUST
SYSTEM ON
OPTIONS
1 2 3
4 5 6
8 9 ENTER
0 . CANCEL
alamy



RATE of infusion – mL/h



VTBI – Volume to be Infused


24
20
5
0.5

PICU


125
96
B
C
D

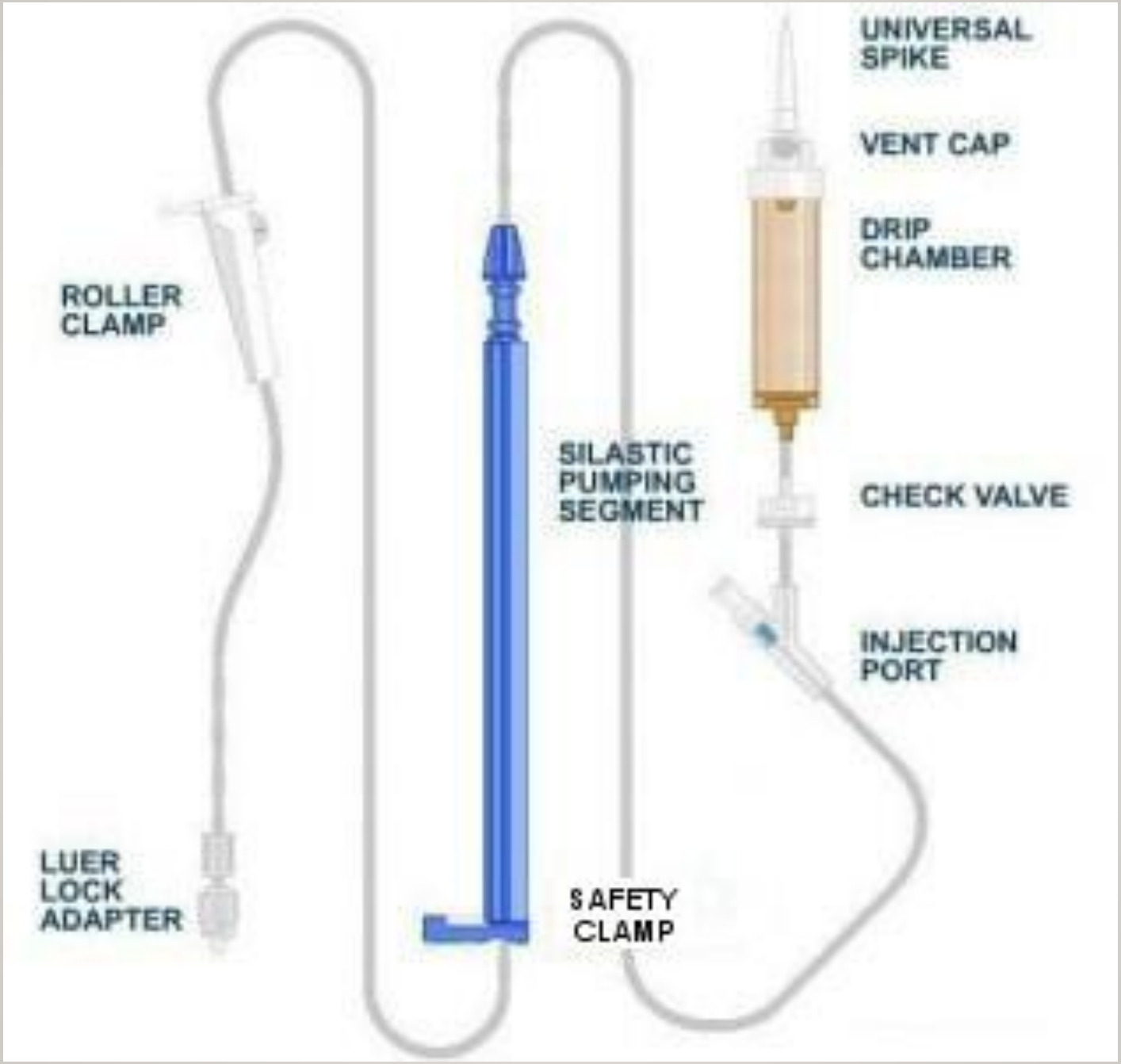
Patient Controlled Anesthesia

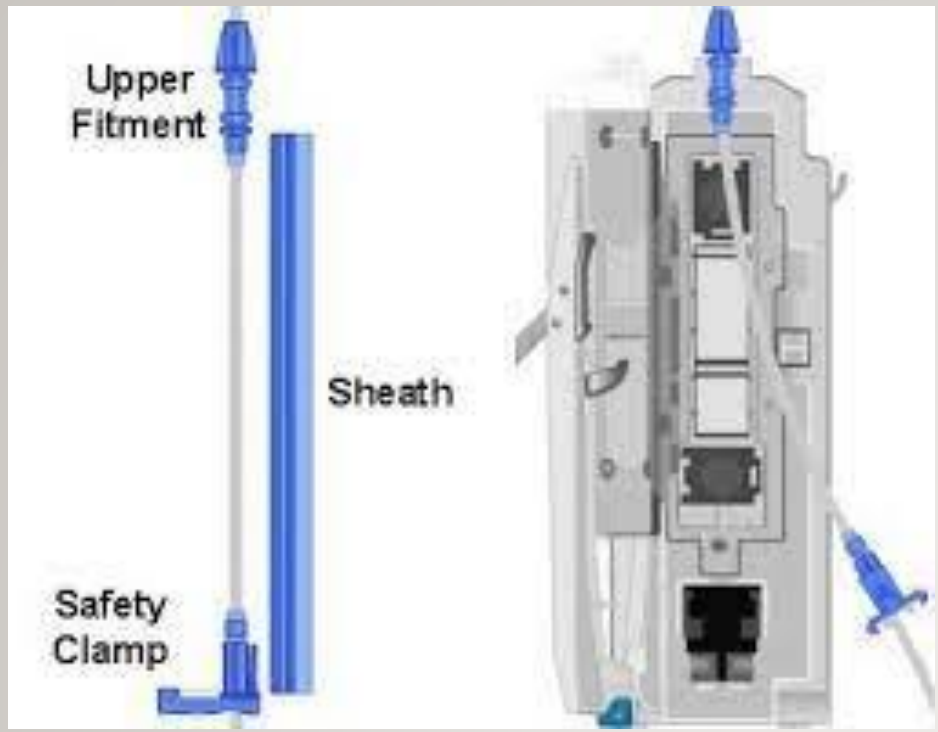
$2432.95 (refurbished PCA module

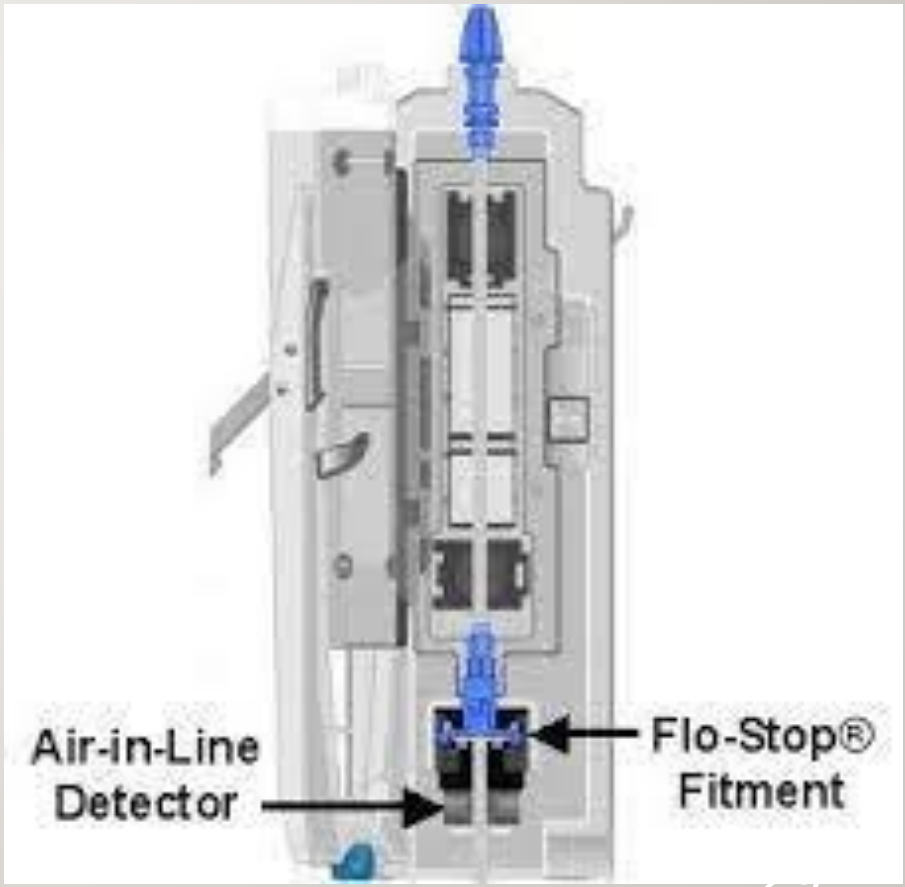
Pump Tubing Admin Set

Pump Admin Set

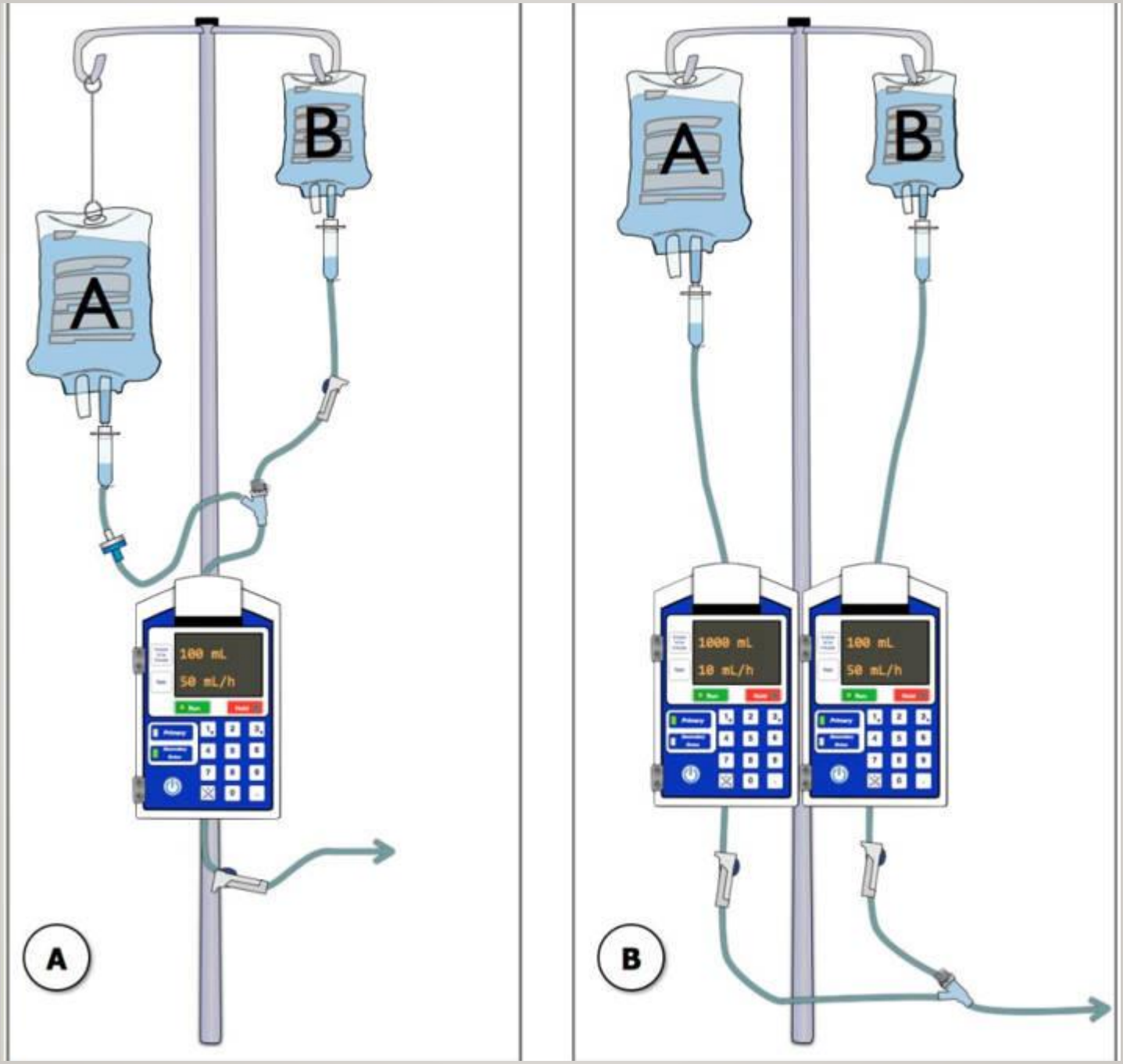

OPTIONS


UNIVERSAL SPIKE
VENT CAP
DRIP CHAMBER
ROLLER CLAMP
SILASTIC PUMPING SEGMENT
CHECK VALVE
INJECTION PORT
LUER LOCK ADAPTER
SAFETY CLAMP


Upper
Fitment
Sheath
Safety
Clamp


Air-in-Line
Detector
Flo-Stop®
Fitment

Picture is representative of product/component type


A
B
100 mL
50 mL/h
A
A
B
1000 mL
10 mL/h
100 mL
50 mL/h
B

GRAVITY FEED IV

(Drips per minute)
(gtt/min)

(no electricity needed)
(infusion rate can change)
(silent – no alarm)

Pump Admin Set

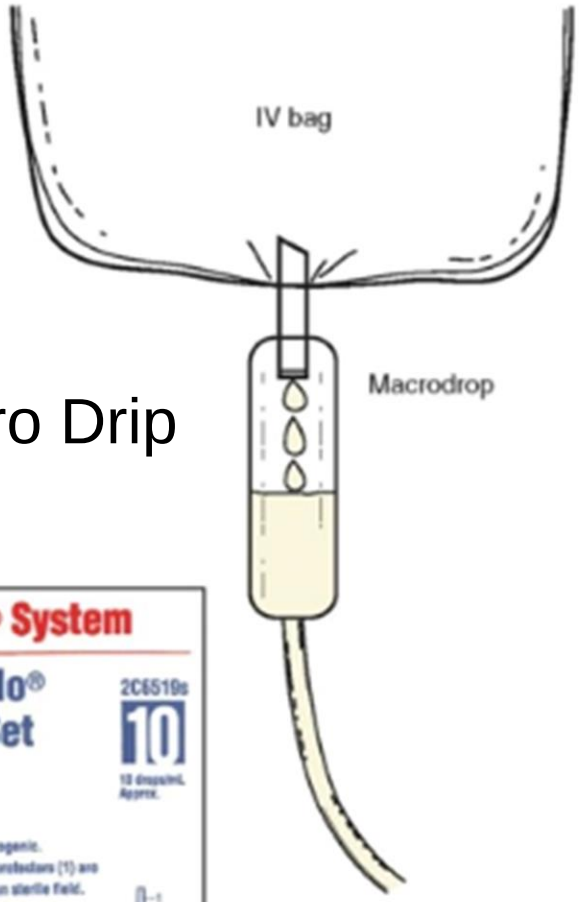
Gravity Feed Admin Set


CLEARLINK System
CONTINU-FLO Solution Set
105" (2.7 m)
3 Luer Activated Valves
Male Luer Lock Adapter with Retractable Collar
Fluid path is sterile, nonpyrogenic.
Cautions: Do not use if tip protectors (1) are not in place. Do not place on sterile field.
Directions: Use aseptic technique
Close regulating clamp (7). Insert spike (2) into solution container. Fill drip chamber (3) to fill line. Open regulating clamp (7). If flow does not start, squeeze plastic container. Invert and tap check valve (4) to purge air during priming. Prime set, purge air. Close regulating clamp (7) until roller meets bottom of frame. Attach male Luer adapter (8) to vascular access device using a firm push and twist motion and then engage the Luer lock collar to prevent accidental disconnection. Ensure downstream clamp is open. Swab Luer activated surface with preferred antiseptic prior to first use and before every subsequent connection. Access Luer activated valve (5) by firmly pushing male Luer of connecting device directly against Luer activated surface and rotate until connection is secure. To properly set flow, always close regulating clamp (7) until roller meets bottom of frame, then reopen to establish flow rate. Repeat procedure if adjusting clamp from fully open position.
Cautions:
Do not allow air to be trapped in set.
Puncturing set components may cause air embolism. Close secondary set clamp when flow rate exceeds 350 mL per hour to prevent air from being drawn into set. Do not swab Luer activated surface (5) when downstream clamp is closed or valve is recessed. Ineffective swabbing may result. Replace set if valve remains recessed. Do not access Luer activated valve with needles or cannula. Attempting such access will render the product damaged, replace immediately. Use of Luer lock connection is recommended. If Luer slip connection is used, insert into valve using a firm push and twist motion. Do not leave Luer slip unattended. Trace lines before connection. Do not connect any compressed gas device to intravenous injection sites.
Rx Only. Single use only. Do not resterilize.
Notes:
This product does not contain natural rubber latex. This product contains DEHP. To stop flow without disturbing regulating device (7), close lowest slide clamp (6). Flush Luer activated valve (5) after injection to prevent inadvertent mixing of incompatible medications/fluids. Flush Luer activated valve after blood infusion. If valve cannot be cleared of blood, replace immediately. For secondary medication administration, use upper Luer activated valve (5) only. See directions for use with secondary medication set. If intermittently disconnecting set from Luer activated valve, immediately cover male Luer of connecting device with a sterile replacement protector. Replace per CDC guidelines. Lengths are approximate. For Product Information 1-800-933-0303
Baxter
Manufactured by an affiliate of Baxter Healthcare Corporation
Deerfield, IL 60015 USA
Made in Costa Rica
07-36-45-950
Baxter, CLEARLINK and CONTINU-FLO are trademarks of Baxter International Inc. U.S. Pat. Nos. 4,662,599; 5,290,239; 5,300,044; 6,039,302
2C8546s
60
60 drops/mL Approx.
4 LDPE

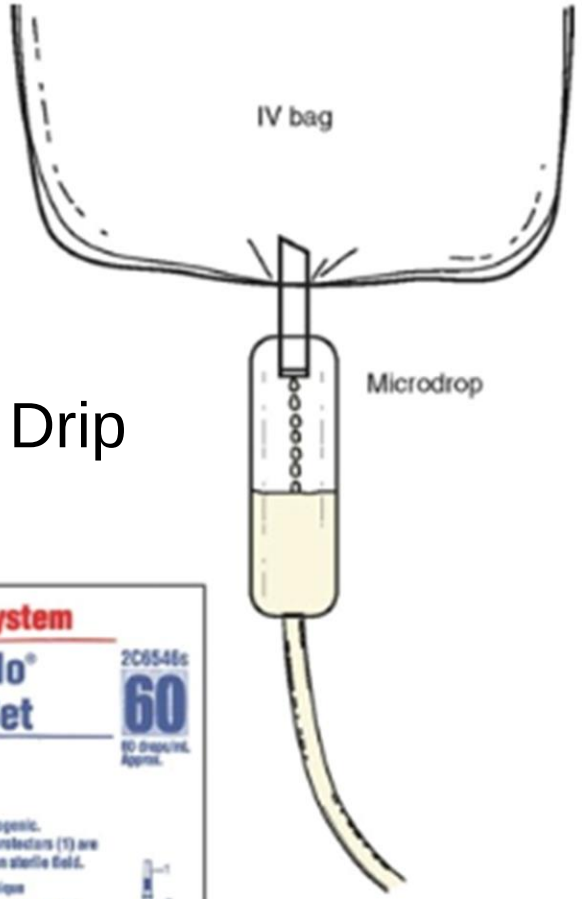

INTERLINK System
CONTINU-FLO Solution Set
2C6537 s
10
10 drops/mL
Approx.
Baxter

Drip Factor

Figure 22-1 Administration sets. A, Set with drop factor of 10 (10 gtt = 1 mL). B, Set with drop factor of 60 (60 gtt = 1 mL).



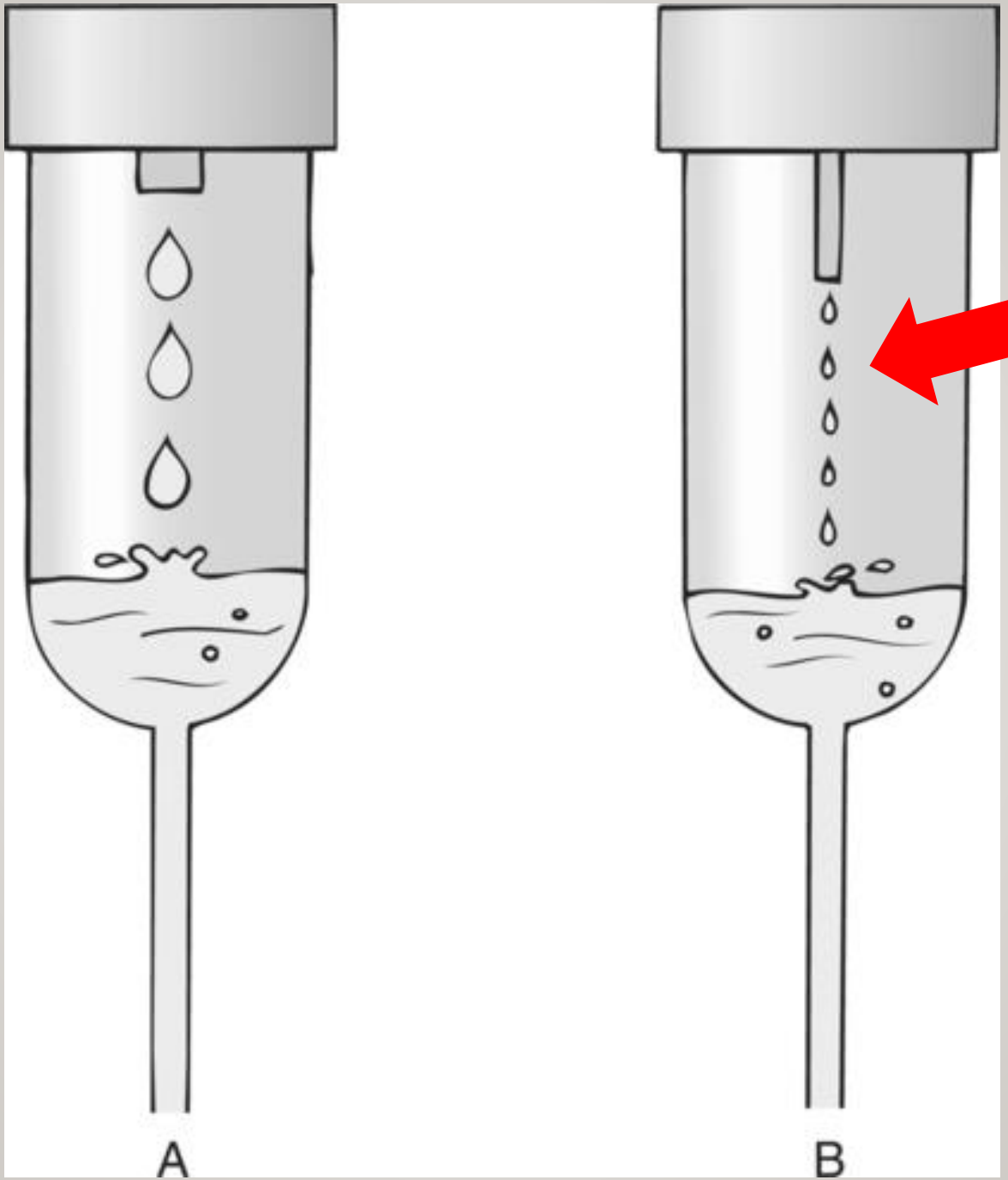
Macro Drip



Micro Drip

Macrodrip

Microdrip

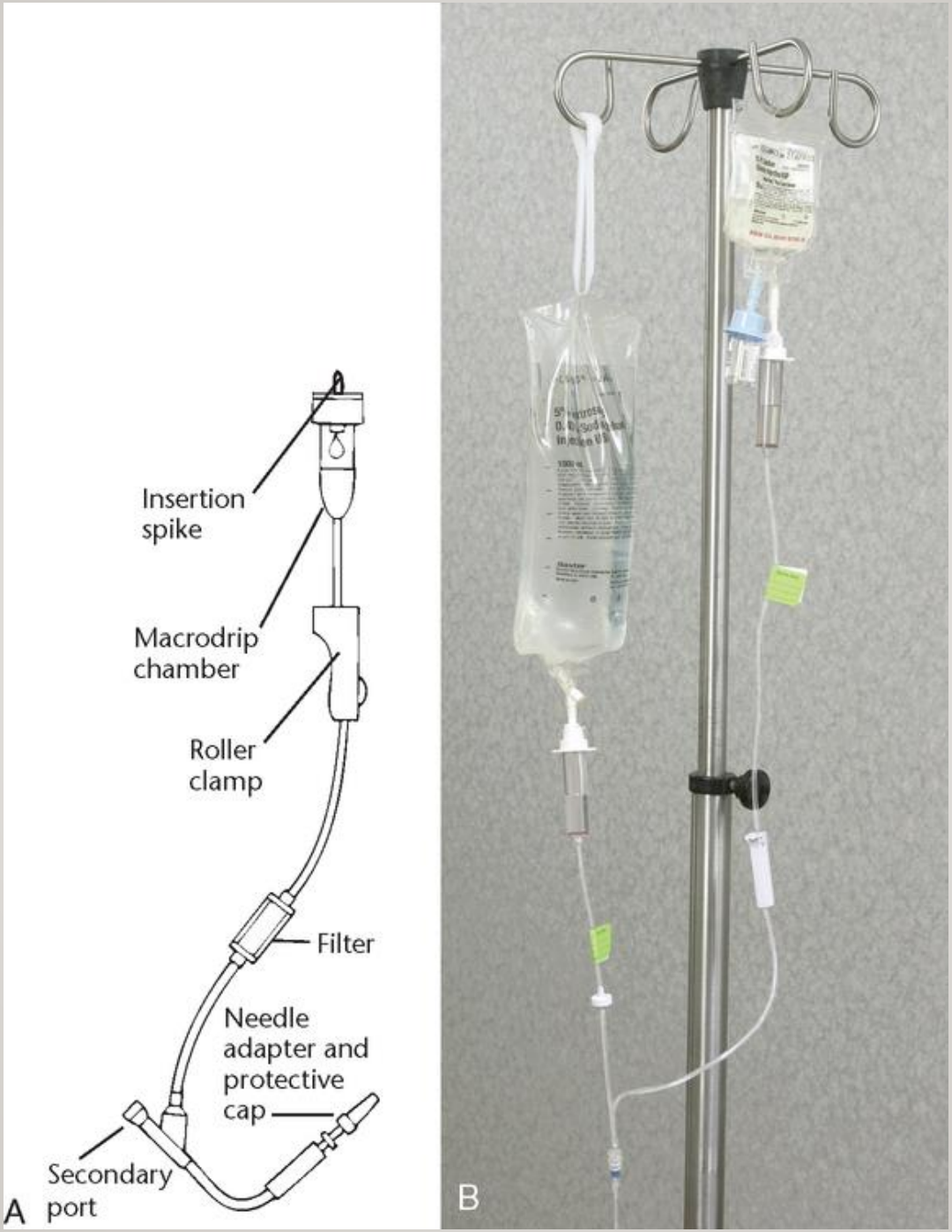


More Precise Dosage

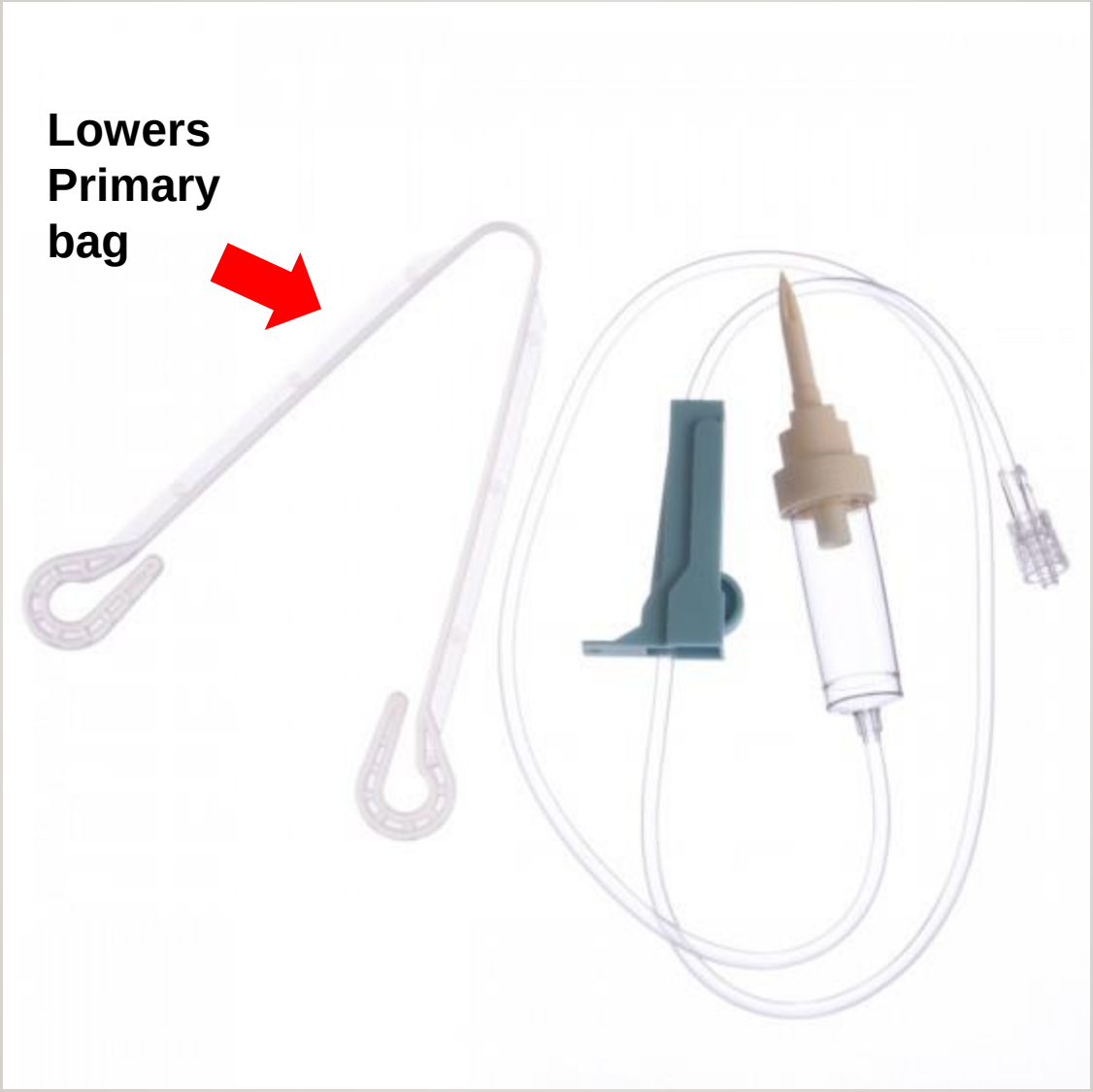

I.V. SET– 24 HRS. – ONLY
START DATE _____ HR. _____
DISCARD DATE_____ HR. _____
SIGNATURE_____

Gravity Feed IV

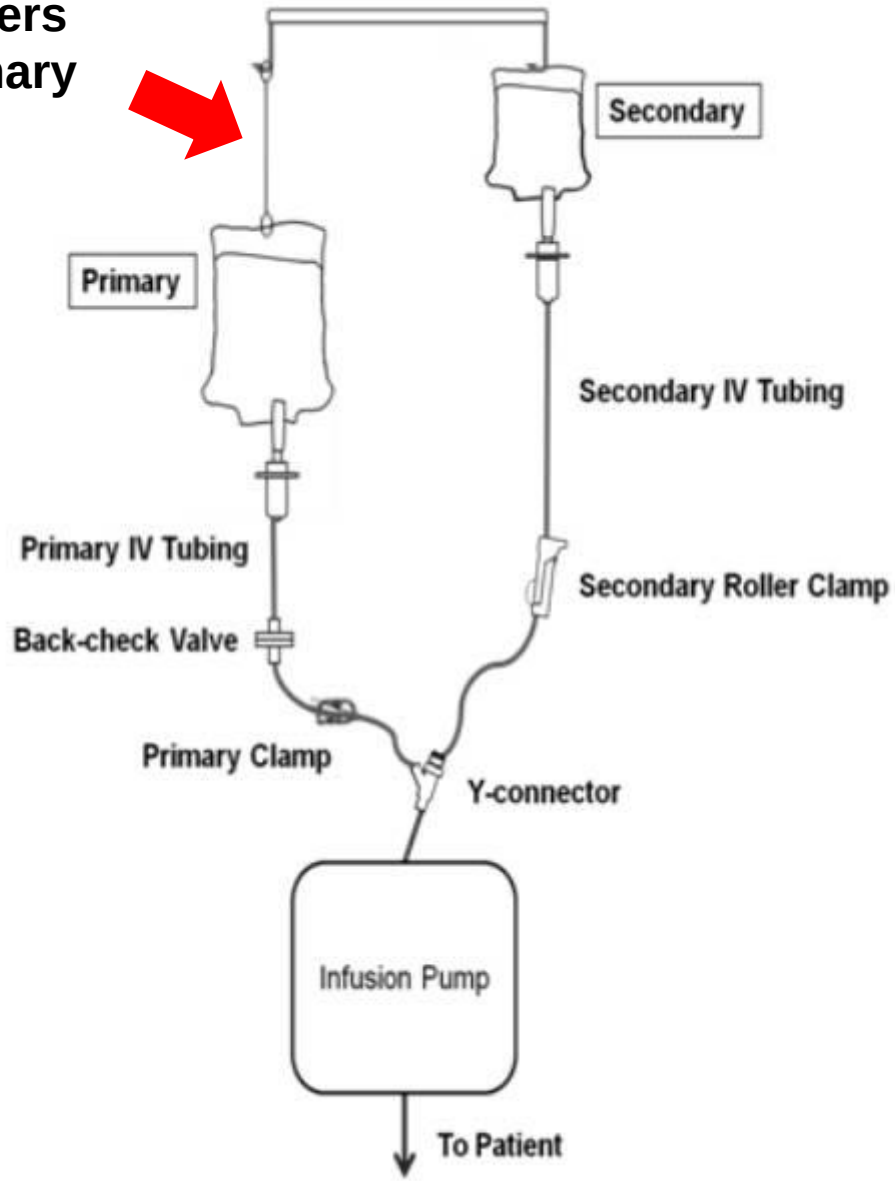
Gravity Feed Admin Set


Insertion spike
Macrodrip chamber
Roller clamp
Filter
Needle adapter and protective cap
Secondary port
A
B

Lowers Primary bag



Lowers Primary bag



Essentials of Medication Administration

Dimensional Analysis - ORAL & PARENTERAL CALCULATIONS
STUDENT HELP SHEET

A. CONVERTING (See Chapter 8 & 9)

Convert to / Given

unit X = _____ X _____

Example: *Convert 38 lb to kg*

38 lb = _____ kg

$kg(x) = \frac{1\ kg}{2.2\ \cancel{lb}} \times \frac{38\ \cancel{lb}}{1}$

$x = 17.3\ kg$

B. DOSAGE CALCULATIONS (See Chapter 16)

1. No conversion needed:

Available / Order

unit x = _____ X _____

Example:

Order: Vistaril 15 mg IM q4h

Available: Vistaril 30 mg/2mL

$mL(x) = \frac{2\ mL}{30\ \cancel{mg}} \times \frac{15\ \cancel{mg}}{1}$

$x = 1\ mL$

2. Conversion needed:

Available / Conversion / Order

unit x = _____ X _____ X _____

Example:

Order: Ampicillin 0.5 g IM q6h

Available: Ampicillin 250 mg per mL

$mL(x) = \frac{1\ mL}{250\ \cancel{mg}} \times \frac{1{,}000\ \cancel{mg}}{1\ \cancel{g}} \times \frac{0.5\ \cancel{g}}{1}$

$x = 2\ mL$

C. CALCULATE SAFE DOSAGES BY WEIGHT (See Chapter 25)

First – Check - Are the units the same in the Medication ORDER and Medication AVAILABLE?
(If they are the same start at Step #2. – If they are not the same, conversion is needed - start at Step #1)

Step #1: (convert lb to kg) (use format A above & see example)

Step #2: Calculate to see if the ordered dose is safe:
(If the recommend is a range, the calculation below must be performed twice to get the safe range)

Recommend / Weight (in kg)

mg(x) = _____ X _____

Example: *Order: Vistaril 15 mg IM q4h*
Recommend: 0.5 to 1 mg/kg/dose q 4 h
Available: 30 mg/2mL

Weight: ~~38 lb~~ 17.3 kg (see conversion example in format A above)

$mg(x) = \frac{0.5\ mg}{\cancel{kg}/dose} \times \frac{17.3\ \cancel{kg}}{1}$

$x = 8.65\ mg/dose$

$mg(x) = \frac{1\ mg}{\cancel{kg}/dose} \times \frac{17.3\ \cancel{kg}}{1}$

$x = 17.3\ mg/dose$

Safe dose range = 8.65 – 17.3 mg/dose

Step #3: Compare answer in Step #2 to the Order to see if the order is Safe.
If it is not safe – STOP - and call the MD.

Step #4: If it is safe, perform the dosage calculation (use format B above) and administer the medication.
(See dosage calculation in B1 example)

Revised Fall 2018

Essentials of Medication Administration

IV CALCULATION HELP SHEET

DIMENSIONAL ANALYSIS

PUMP

mL/hr

1) Set up: $\frac{xmL}{hr} = \frac{\text{Total mL ordered (Volume)}}{\text{Ordered Time to infuse (Hours)}}$

Order: *Administer 3,000 mL of D_5W over 24 hr.*

Example: $\frac{xmL}{hr} = \frac{3{,}000\ mL}{24\ hr}$

$X = 125mL/hr$

2) Set up: $\frac{xmL}{hr} = \frac{\text{Order } mL}{min} \times \frac{\text{Conversion } min}{hr}$

Order: *Administer 50 mL of D_5W Over 30 min.*

Example: $\frac{xmL}{hr} = \frac{50\ mL}{30\ \cancel{min}} \times \frac{60\ \cancel{min}}{1\ hr}$

$x = 100\ mL/hr$

GRAVITY

gtt/min (with time) pg 544

Set up: $\frac{xgtt}{min} = \frac{\text{Drop Factor } gtt}{mL} \times \frac{mL}{min}$

Order: *Infuse 50 mL D_5W over 20 minutes with a drop Factor of 60 gtt/mL. What is the rate in gtt/min?*

Example: $\frac{xgtt}{min} = \frac{60\ gtt}{1\ \cancel{mL}} \times \frac{50\ \cancel{mL}}{20\ min}$

$x = 150\ gtt/min$

GRAVITY

gtt/min (from mL/hr)

Set up: $\frac{xgtt}{min} = \frac{\text{Drop Factor } gtt}{mL} \times \frac{\text{Rate } mL}{hr} \times \frac{\text{Conversion } 1\ hr}{60\ min}$

Order: *Administer D_5RL at 75 mL/hr with a Drop Factor of 10 gtt/mL. What is the rate in gtt/min?*

Example: $\frac{xgtt}{min} = \frac{10\ gtt}{\cancel{mL}} \times \frac{75\ \cancel{mL}}{1\ \cancel{hr}} \times \frac{1\ \cancel{hr}}{60\ min}$

$x = 12.5$

$x = 13\ gtt/min$

TOTAL INFUSION TIME

Set up: $xhr = \frac{\text{Rate } hr}{mL} \times \frac{\text{Volume } mL}{1}$

Order: *Calculate the infusion time for an IV of 1,000 mL D_5W infusing at a rate of 125 mL/hr*

Example: $xhr = \frac{1\ hr}{125\ \cancel{mL}} \times \frac{1000\ \cancel{mL}}{1}$

$x = 8\ hr$

IV CALCULATIONS: INFUSION TIME & DRIP RATE

D.

1. First calculate the hourly volume by dividing the total volume of the IV bag by the numbers of hours over which the IV is to be infused, according to the health care provider's orders:

$$\text{mL/hr} = \frac{\text{Total infusion in mL}}{\text{Hours of infusion (time)}}$$ *cannot be in minutes

2. Determine whether the infusion administration set is microdrip (60 gtt/ml) or macrodrip (10 to 20 gtt/ml).

3. Multiply the hourly volume by the drop factor of the infusion set and divide that number by 60 (60 minutes in an hour).

***Drip rates are rounded up or down to the nearest whole number*:**

$$\text{gtt/min} = \frac{\text{Hourly volume} \times \text{gtt factor}}{60}$$

IV CALCULATIONS: INFUSION TIME & DRIP RATE

D.

1. First calculate the hourly volume by dividing the total volume of the IV bag by the numbers of hours over which the IV is to be infused, according to the health care provider's orders:

$$\text{mL/hr} = \frac{\text{Total infusion in mL}}{\text{Hours of infusion (time)}}$$ *must convert minutes to hours

2. Determine whether the infusion administration set is microdrip (60 gtt/ml) or macrodrip (10 to 20 gtt/ml).

3. Multiply the hourly volume by the drop factor of the infusion set and divide that number by 60 (60 minutes in an hour).

Drip rates are rounded up or down to the nearest whole number:

$$\text{gtt/min} = \frac{\text{Hourly volume} \times \text{gtt factor}}{60}$$

CALCULATING FLOW RATES FOR INFUSION PUMPS

- Identify the following:
  - Volume
  - Time in hours
  - Round flow rate to the nearest whole number or tenths depending on the equipment

$$\frac{X\,\text{mL}}{\text{hr}} = \frac{\textit{solution}\,(\text{mL})}{\textit{time}\,(\text{hr})}$$

PRACTICE PROBLEM

Flow Rate Problem: Infuse 3,000 mL over 24 hr

$$x \text{ mL/hr (whole number)} = \frac{\text{Amount of solution}}{\text{Time in hours}}$$

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

$$x = 125 \text{ mL/hr}$$

FINDING TIME OF INFUSION

$$\frac{\text{Amount of Solution}}{\text{Infusion rate in mL/hr}} = \text{Length of Infusion}$$

INFUSION TIME PRACTICE PROBLEM

What is the infusion time for an IV of 3,000 mL D5W infusing at a rate of 125 mL per hour?

INFUSION TIME PRACTICE PROBLEM

What is the infusion time for an IV of 3,000 mL D5W infusing at a rate of 125 mL per hour?

$$\frac{3000\ \text{mL}}{125\ \text{mL/hr}} = 24\ \text{hours}$$

CALCULATING FLOW RATES FOR INFUSION PUMPS (LESS THAN AN HOUR)

When medication may infuse in less than an hour extend dimensional analysis formula.

$$\frac{X\,\text{mL}}{\text{hr}} = \frac{\textit{solution}\,(\text{mL})}{\textit{time}\,(\cancel{\text{minutes}})} \times \frac{60\,\cancel{\text{minutes}}}{1\,\text{hr}}$$

Conversion Factor (minutes to hours)

PRACTICE PROBLEM

Order:

4.5 g Zosyn in 100 mL NS IVPB in 30 min BID

What is the rate in mL/hr?

CONVERT MINUTES TO A DECIMAL

Example:

$$\frac{100\ \text{mL}}{30\ \cancel{\text{min}}} \times \frac{60\ \cancel{\text{min}}}{1\ \text{hr}} = 200\ \text{mL/hr}$$

or

$$\frac{100\ \text{mL}}{0.5\ \text{hr}} = 200\ \text{mL/hr}$$

PRACTICE PROBLEM

Order:

4.5 g Zosyn in 100 mL NS IVPB in 30 min

BID

What is the rate in mL/hr?

ANSWER: 200 mL/hr

CALCULATING FLOW RATES

SAFETY ALERT!

The usual rate ranges from 50–200 mL/hr. If the rate exceeds this amount, double check the order and your calculations.

IV CALCULATIONS: INFUSION TIME & DRIP RATE

1. First calculate the hourly volume by dividing the total volume of the IV bag by the numbers of hours over which the IV is to be infused, according to the health care provider's orders:

$$\text{mL/hr} = \frac{\text{Total infusion in mL}}{\text{Hours of infusion (time)}}$$

2. Determine whether the infusion administration set is microdrip (60 gtt/ml) or macrodrip (10 to 20 gtt/ml).

3. Multiply the hourly volume by the drop factor of the infusion set and divide that number by 60 (60 minutes in an hour).

***Drip rates are rounded up or down to the nearest whole number*:**

$$\text{gtt/min} = \frac{\text{Hourly volume} \times \text{gtt factor}}{60}$$

IV CALCULATIONS: **DRIP RATE**

Multiply the hourly volume by the drop factor of the infusion set and divide that number by 60 (60 minutes in an hour).

Drip rates are rounded up or down to the nearest whole number:

$$\text{gtt/min} = \frac{\text{Hourly volume} \times \text{gtt factor}}{60}$$

CALCULATING IV FLOW RATES IN DROPS (GTT) PER MINUTE

- If pumps are not available, the rate is manually regulated with flow regulator in tubing.
- Drops per minute is determined by the drop factor (gtt/mL) of the drip chamber below IV bag.
- Adjust gtt/min by placing a watch that has a second hand close to the drip chamber and counting the drops.
- ***Drop factor is printed on package; NEVER assume.***

IV TUBING

- Macrodrop
  - Standard type for general infusions
  - Delivers 10, 15, or 20 gtt/mL for each mL
  - Used to deliver large volumes
- Microdrop
  - Delivers tiny drops—60 gtt/mL
  - Used to deliver small amounts with precision
  - Because drop factor is 60 gtt/mL, drops per minute equals mL per hour (e.g., 25 mL per hr = 25 gtt/min).

Figure 22-1 Administration sets. A, Set with drop factor of 10 (10 gtt = 1 mL). B, Set with drop factor of 60 (60 gtt = 1 mL).

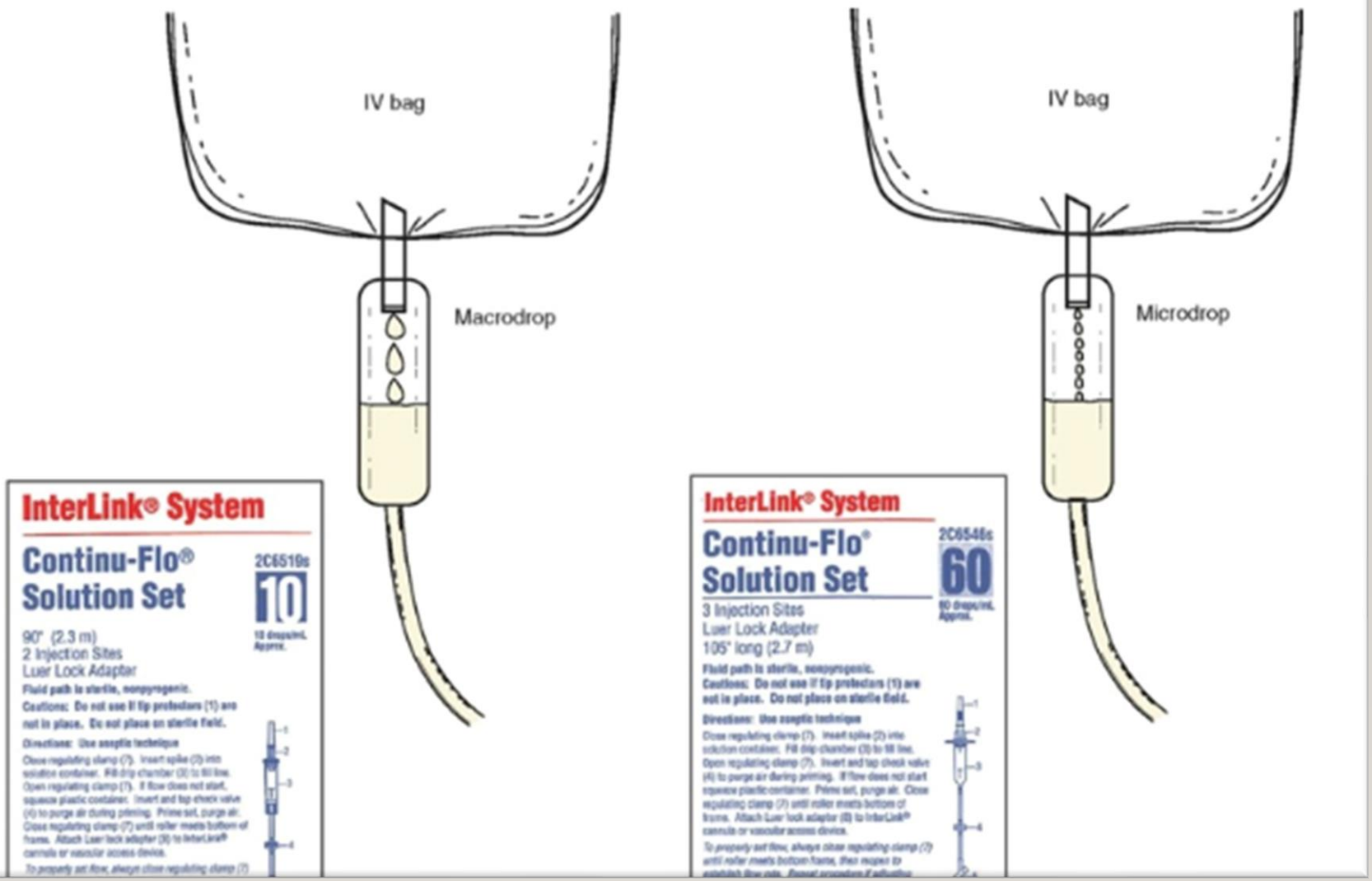
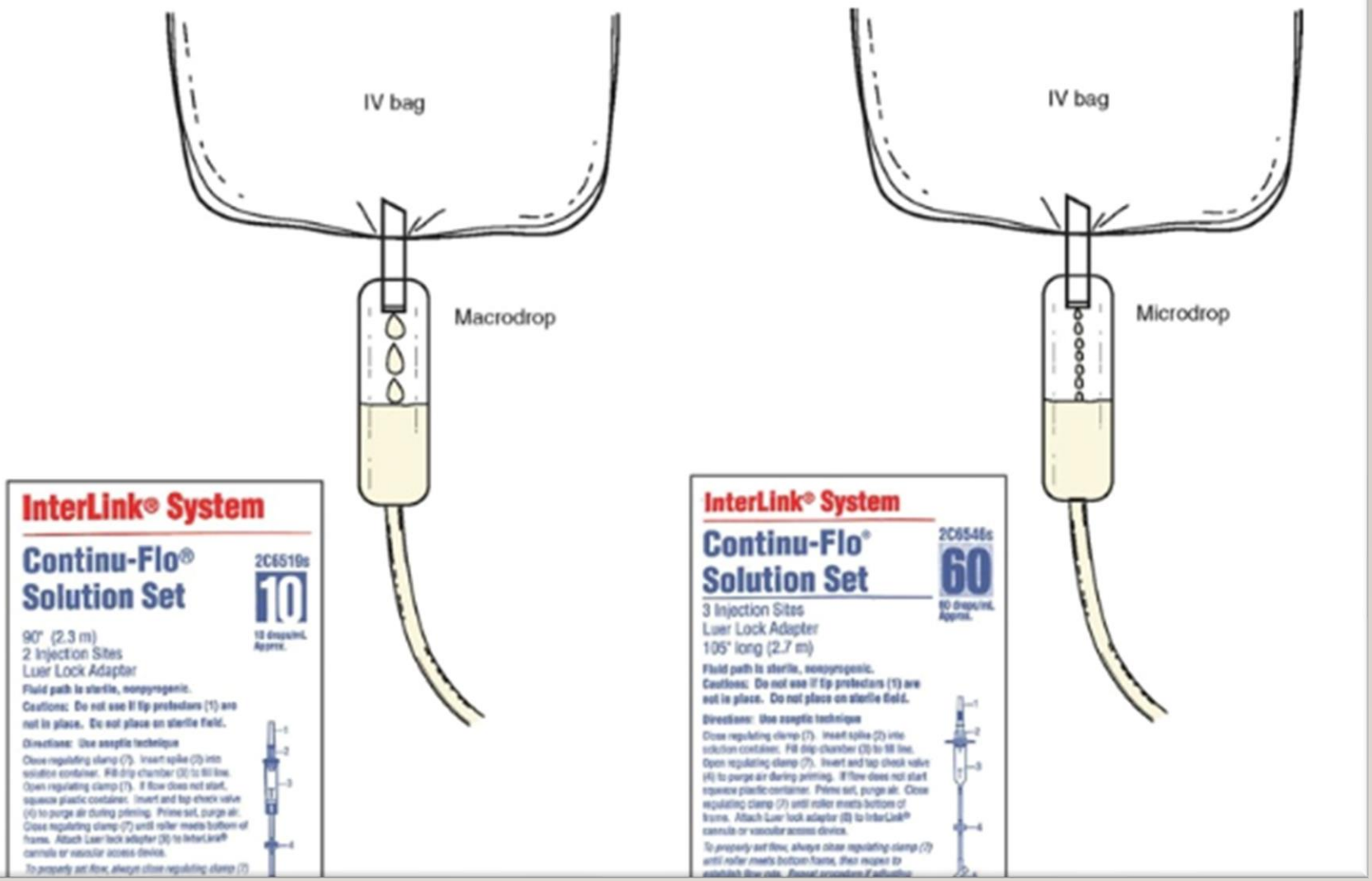
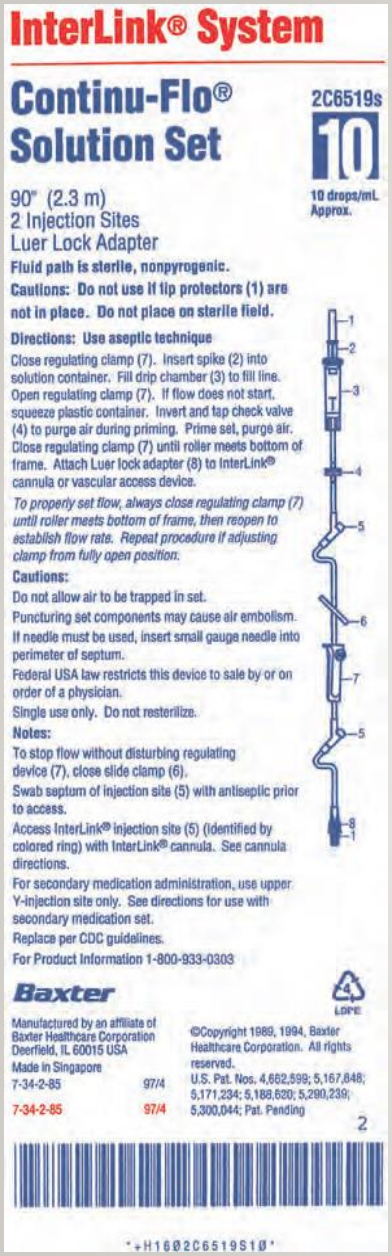
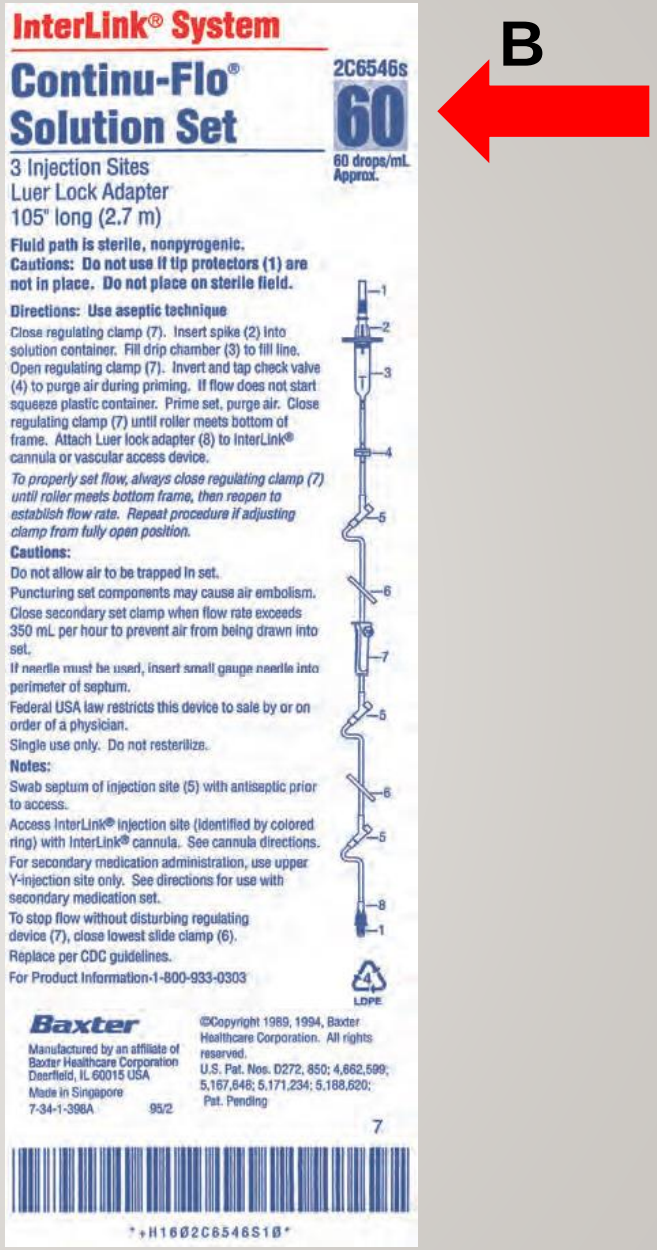


Figure 22-1 Administration sets. A, Set with drop factor of 10 (10 gtt = 1 mL). B, Set with drop factor of 60 (60 gtt = 1 mL).





A

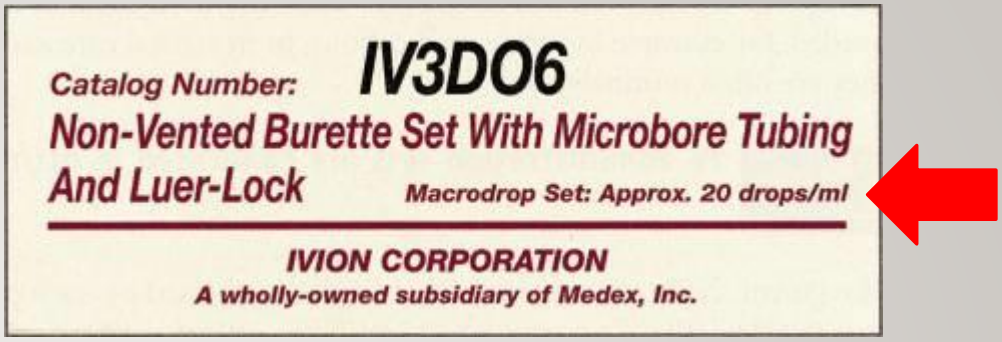


B

Figure 22-2
Administration sets (package).
A, Macrodrip set with drop factor of 10 (10 gtt 5 1 mL).
B, Microdrip set with drop factor of 60 (60 gtt 5 1 mL).

Identify the drop factor

a.



b.

c.

d.

CALCULATING FLOW RATES IN DROPS PER MINUTE

- Can be used for primary solutions and intermittent solutions of large and small volumes (e.g., IVPB and boluses)

Remember: Identifying the drop factor on the IV tubing package is the *FIRST* step in accurate administration of IV fluids, in gtt/min.

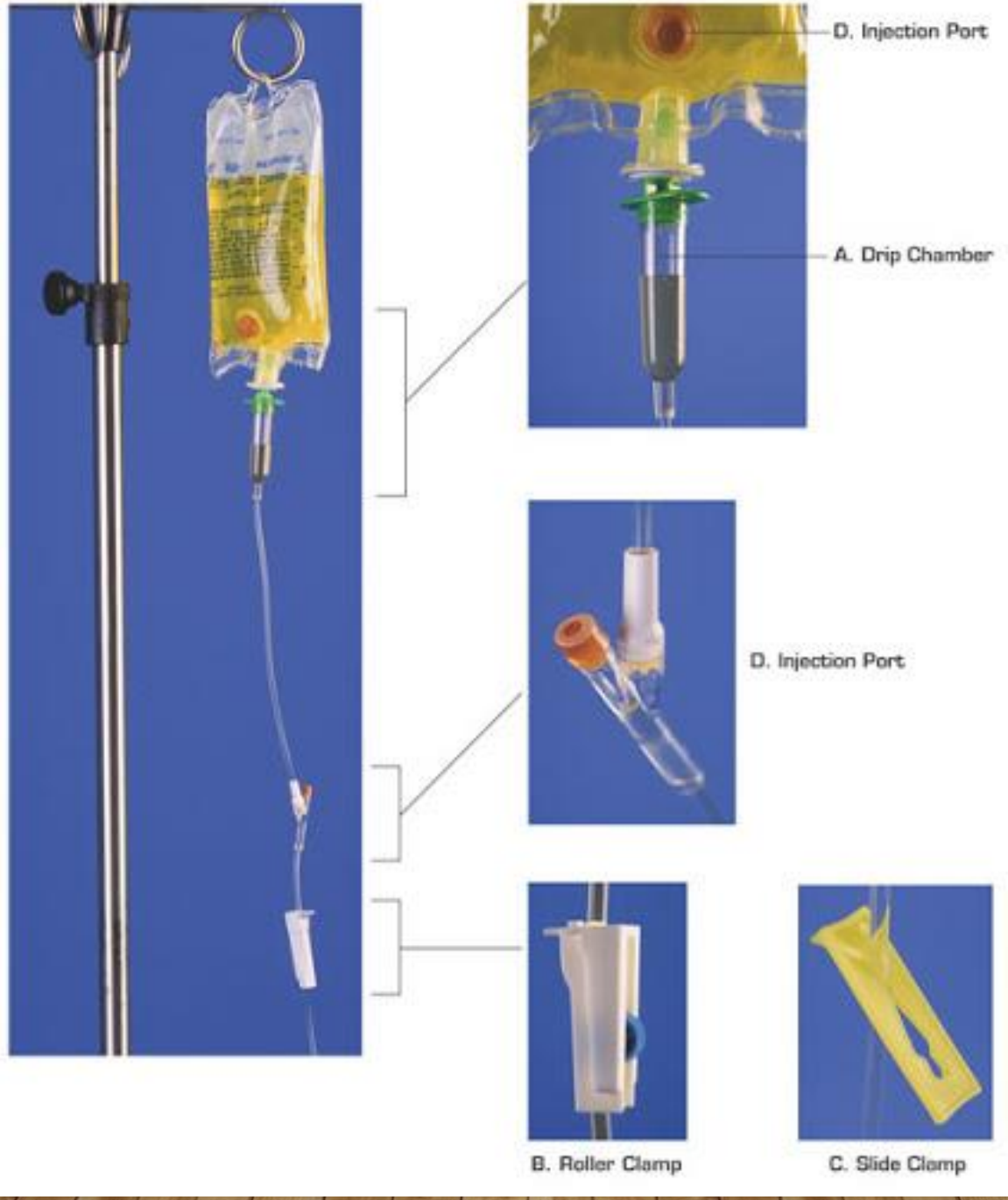
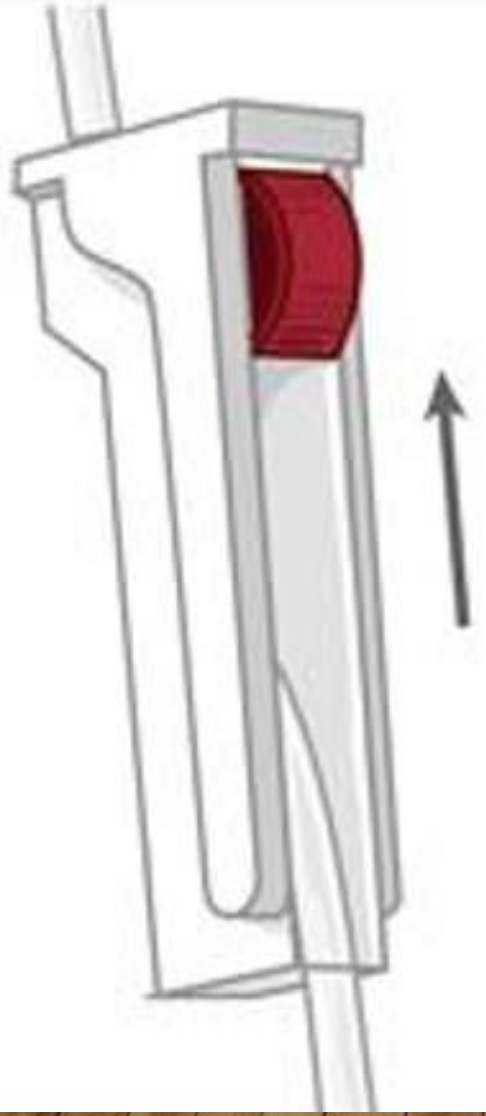

D. Injection Port
A. Drip Chamber
D. Injection Port
B. Roller Clamp
C. Slide Clamp

Figure 22-1 Observing the drop chamber to count drops per minute. (From Potter PA, Perry AG, Stockert P, Hall A: *Fundamentals of nursing,* ed 9, St Louis, 2016, Mosby.)

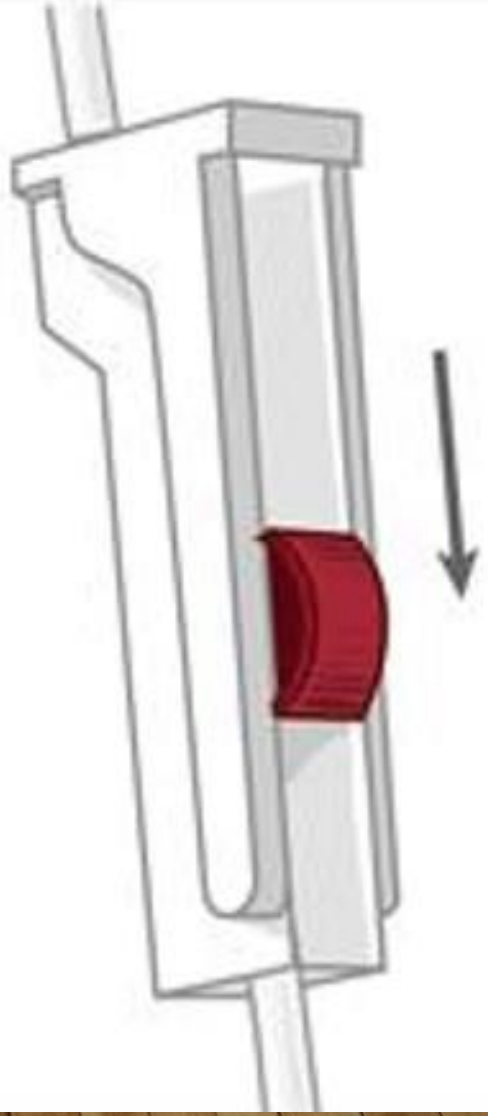
A Roller Clamp is Volume Control Device

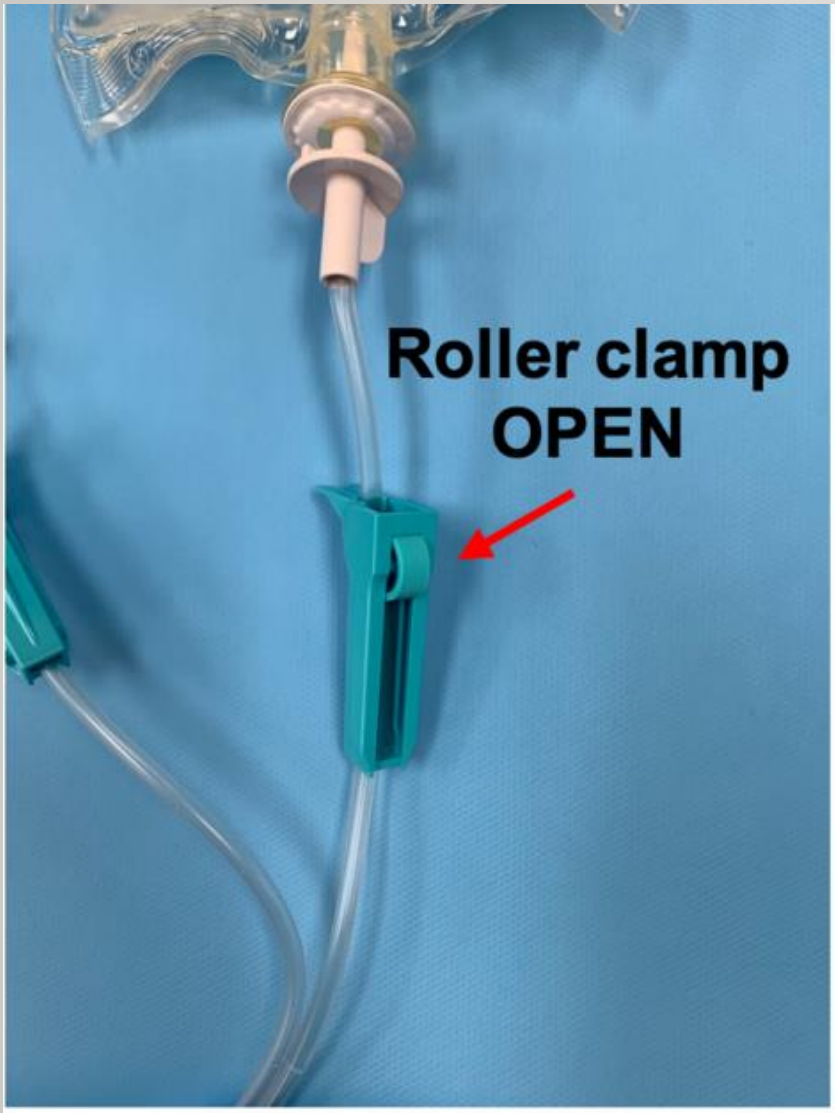
Used to administer small volumes of fluid and medications

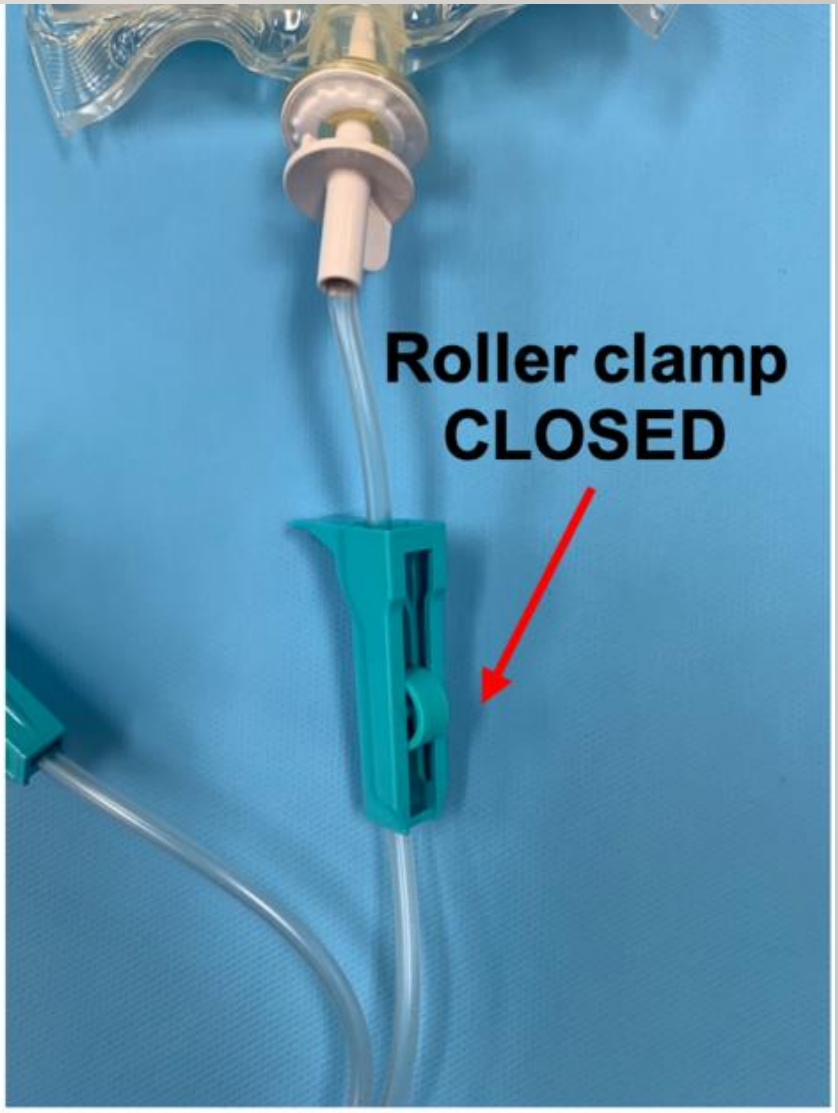
Open



Close




Roller clamp
OPEN

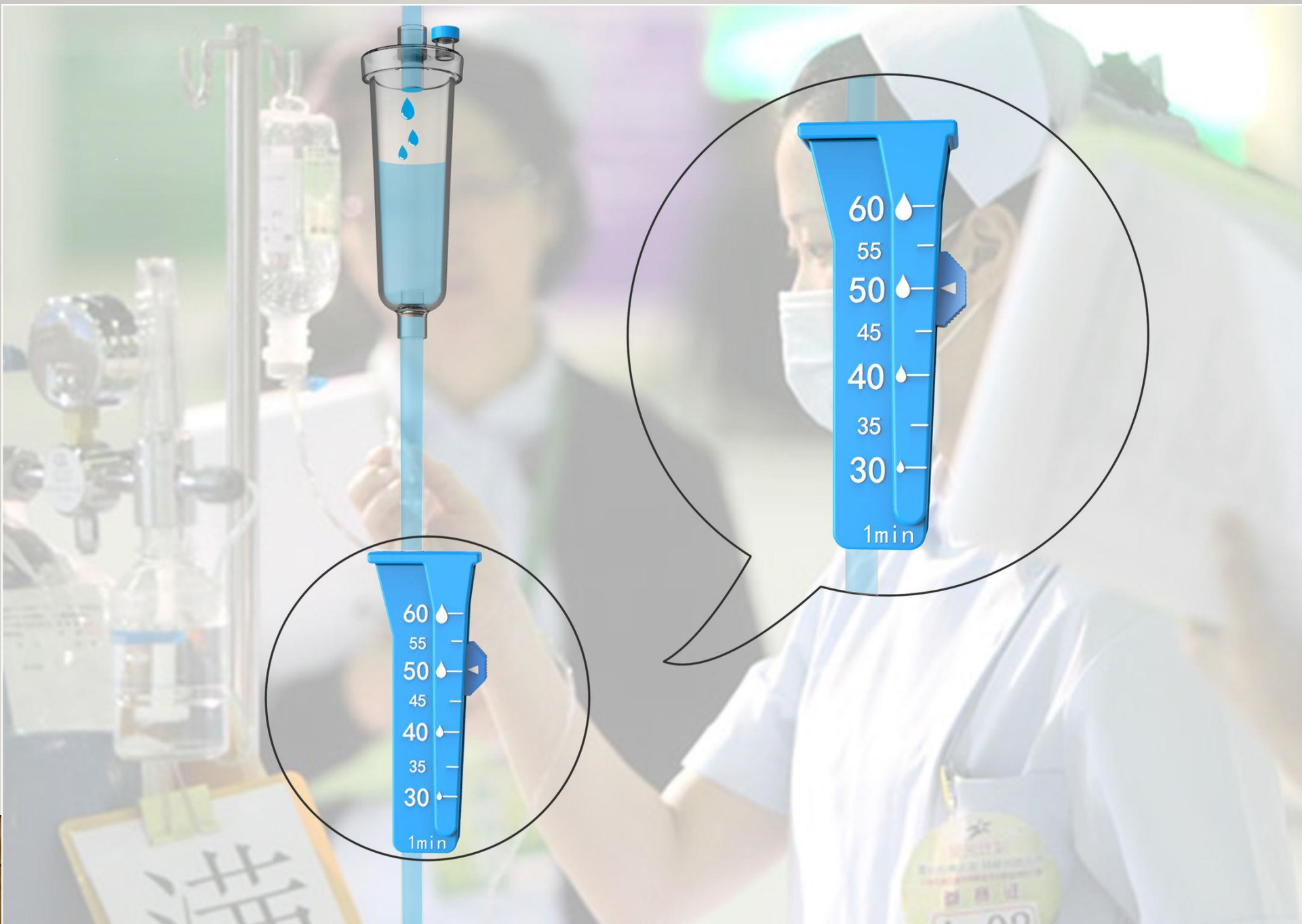

Roller clamp
CLOSED

IV CLAMPS

- Roller clamps allow adjustment of flow
- Auxiliary clamps can stop flow temporarily without changing the rate set by the roller clamp



Auxiliary Clamps


60
55
50
45
40
35
30
1min
60
55
50
45
40
35
30
1min

81 HOW TO SET UP A GRAVITY FEED IV

https://www.youtube.com/watch?v=aN78RVfe0Js

(1:23)

https://www.youtube.com/watch?v=9ykawWkLa4Y

(4:56)

Essentials of Medication Administration

IV CALCULATION HELP SHEET

DIMENSIONAL ANALYSIS

PUMP

mL/hr

1) Set up: $\frac{xmL}{hr} = \frac{\text{Total mL ordered (Volume)}}{\text{Ordered Time to infuse (Hours)}}$

Order: *Administer 3,000 mL of D_5W over 24 hr.*

Example: $\frac{xmL}{hr} = \frac{3{,}000\ mL}{24\ hr}$

$X = 125mL/hr$

2) Set up: $\frac{xmL}{hr} = \frac{\text{Order } mL}{min} \times \frac{\text{Conversion } min}{hr}$

Order: *Administer 50 mL of D_5W Over 30 min.*

Example: $\frac{xmL}{hr} = \frac{50\ mL}{30\ \cancel{min}} \times \frac{60\ \cancel{min}}{1\ hr}$

$x = 100\ mL/hr$

GRAVITY

gtt/min (with time)

Set up: $\frac{xgtt}{min} = \frac{\text{Drop Factor } gtt}{mL} \times \frac{\text{Order } mL}{min}$

Order: *Infuse 50 mL D_5W over 20 minutes with a drop Factor of 60 gtt/mL. What is the rate in gtt/min?*

Example: $\frac{xgtt}{min} = \frac{60\ gtt}{1\ \cancel{mL}} \times \frac{50\ \cancel{mL}}{20\ min}$

$x = 150\ gtt/min$

GRAVITY

gtt/min (from mL/hr)

Set up: $\frac{xgtt}{min} = \frac{\text{Drop Factor } gtt}{mL} \times \frac{\text{Rate } mL}{hr} \times \frac{\text{Conversion } 1\ hr}{60\ min}$

Order: *Administer D_5RL at 75 mL/hr with a Drop Factor of 10 gtt/mL. What is the rate in gtt/min?*

Example: $\frac{xgtt}{min} = \frac{10\ gtt}{\cancel{mL}} \times \frac{75\ \cancel{mL}}{1\ \cancel{hr}} \times \frac{1\cancel{hr}}{60\ min}$

$x = 12.5$

$x = 13\ gtt/min$

TOTAL INFUSION TIME

Set up: $\frac{xhr}{} = \frac{\text{Rate } hr}{mL} \times \frac{\text{Volume } mL}{1}$

Order: *Calculate the infusion time for an IV of 1,000 mL D_5W infusing at a rate of 125 mL/hr*

Example: $\frac{xhr}{} = \frac{1\ hr}{x} \times \frac{1000\ \cancel{mL}}{125\ \cancel{mL}\ \ 1}$

DIMENSIONAL ANALYSIS

Problem: Infuse D5W at 100 mL per hr

What is rate in gtt/min? DF = 10 gtt/mL

$$x\ \frac{\text{gtt}}{\text{min}} = \frac{10\ \text{gtt}}{1\ \cancel{\text{mL}}} \times \frac{100\ \cancel{\text{mL}}}{1\ \cancel{\text{hr}}} \times \frac{1\ \cancel{\text{hr}}}{60\ \text{min}}$$

$$x = \frac{10 \times 100}{60} = \frac{100}{6}$$

$$x = 16.6 = 17\ \text{gtt/min}$$

CALCULATING DROPS PER MINUTE WITH LARGE VOLUMES OF FLUID

- IV fluid can be ordered in large volumes over several hours (e.g., 1,000 mL over 8 hr).
- Preliminary step to determine the volume per hour:

$$x \text{ mL/hr} = \frac{\text{Amount of solution (mL)}}{\text{Time in hours}}$$

- Dimensional analysis incorporates this preliminary step in one equation.

DIMENSIONAL ANALYSIS

- Problem: IV of 1,000 mL NS to infuse in 8 hr
- IV tubing has drop factor of 20 gtt/mL

$$x\ \frac{\text{gtt}}{\text{min}} = \frac{20\ \text{gtt}}{1\ \cancel{\text{mL}}} \times \frac{1{,}000\ \cancel{\text{mL}}}{8\ \cancel{\text{hr}}} \times \frac{1\ \cancel{\text{hr}}}{60\ \text{min}}$$

$$x = \frac{20 \times 1{,}000}{60\ (8)}$$

$$x = \frac{20{,}000}{480} = \frac{1{,}000}{42}$$

$$x = 41.6 = 42\ \text{gtt/min}$$

SHORT CUT METHOD USING DROP FACTOR CONSTANT

88 SHORTCUT METHOD

- IV flow rate must be expressed in mL per hr
- Must obtain drop factor constant:
  - Divide 60 by the drop factor calibration

Drop Factor of Tubing	Drop Factor Constant
10 gtt/mL	$\frac{60}{10} = 6$
15 gtt/mL	$\frac{60}{15} = 4$
20 gtt/mL	$\frac{60}{20} = 3$
60 gtt/mL	$\frac{60}{60} = 1$

$$x \text{ gtt/min} = \frac{100 \text{ mL/hr}}{3} = 33.3 = 33 \text{ gtt/min}$$

PROBLEM: ADMINISTER 0.9% NS AT 100 ML/HR DROP FACTOR = 20 GTT/ML CONSTANT = 3

REMEMBER: DROP FACTOR CONSTANT IS OBTAINED BY DIVIDING 60 BY DROP FACTOR OF TUBING (20)

CASE STUDY

The IV pump you were using to infuse Mr. Flint's IVF is necessary for another patient and you must calculate the rate in gtt/min. You check the tubing package and find a drop factor of 20 gtt/ml. You recall the order:

1 L NS IV at 100 mL/hr now

What is the rate?

CASE STUDY (CONT.)

ANSWER:

Run the NS at 33 gtt/min. Remember to count the drops for a whole minute in order to accurately set the rate.

$$x \text{ gtt/min} = \frac{100 \text{ mL/hr}}{3} = 33.3 = 33 \text{ gtt/min}$$

PROBLEM: ADMINISTER 0.9% NS AT 100 ML/HR DROP FACTOR = 20 GTT/ML CONSTANT = 3

REMEMBER: DROP FACTOR CONSTANT IS OBTAINED BY DIVIDING 60 BY DROP FACTOR OF TUBING (20)

93 CASE STUDY

Mr. Flint's labwork is back and his K level is slightly decreased at 3.1 mEq/L. The physician changes the IV fluid to 1 L of D5 NS + 20 mEq KCl at a rate of 75 mL/hr.

Using the drop factor of 20 gtt/mL, what is the rate in gtt/min?

SHORTCUT METHOD

- IV flow rate must be expressed in mL per hr
- Must obtain drop factor constant:
  - Divide 60 by the drop factor calibration

Drop Factor of Tubing	Drop Factor Constant
10 gtt/mL	$\frac{60}{10} = 6$
15 gtt/mL	$\frac{60}{15} = 4$
20 gtt/mL	$\frac{60}{20} = 3$
60 gtt/mL	$\frac{60}{60} = 1$

DROP FACTOR CONSTANT

Example:

$$75\ \text{mL} \times \frac{20\ \text{gtt}}{60\ \text{min}} = 25\ \text{gtt/min}$$

or

$$\frac{75\ \text{mL}}{3} = 25\ \text{gtt/min}$$

drop factor constant

96 CASE STUDY

Mr. Flint's labwork is back and his K level is slightly decreased at 3.1 mEq/L. The physician changes the IV fluid to 1 L of D5 NS + 20 mEq KCl at a rate of 75 mL/hr.

Using the drop factor of 20 gtt/mL, what is the rate in gtt/min?

97 CASE STUDY

Mr. Flint's labwork is back and his K level is slightly decreased at 3.1 mEq/L. The physician changes the IV fluid to 1 L of D5 NS + 20 mEq KCl at a rate of 75 mL/hr.

Using the drop factor of 20 gtt/mL, what is the rate in gtt/min?

$$\frac{75 \times 20}{60} = 25 \text{ gtt/min}$$

Answer: 25 gtt/min

OR

$$\frac{75}{3} = 25 \text{ gtt/min}$$

Answer: 25 gtt/min

98 CASE STUDY

- The physician order IV fluid of 1 L of D5 NS at a rate of 100 mL/hr.
- What is the infusion time?

99 CASE STUDY

- The physician order IV fluid of 1 L of D5 NS at a rate of 100 mL/hr.
- What is the infusion time?

1 L stands for one liter
1 L = 1000ml

100 CASE STUDY

- The physician order IV fluid of 1 L of D5 NS at a rate of 100 mL/hr.
- What is the infusion time?

Answer:

1000ml / 100ml/hr = 10 hrs

CALCULATING IV FLOW RATES FOR SEVERAL SOLUTIONS

May have different amounts and types ordered over an extended period

Usually for 24-hr period

Usually divided by 3 shifts

Steps to calculate:

Add up the total amount of fluid

Proceed as with other IV calculations

CALCULATING TOTAL INFUSION TIMES

- IV rates often ordered in mL per hr
- Need to calculate total volume infused over time:

$$\frac{\text{Total number of mL to infuse}}{\text{mL/hr infusing at}} = \text{Total infusion time}$$

103

ORDER: ADMINISTER THE FOLLOWING IVS FOR 24 HR:

A. 1,000 ML D5W WITH 10 MEQ KCL (POTASSIUM CHLORIDE)
B. 500 ML D5NS WITH 1 AMP MVI (MULTIVITAMIN)
C. 500 ML D5W

- Steps:
- Calculate mL per hr
  of total volume.
- Calculate gtt per min.
- Reduce.

$$x \text{ mL per hr} = \frac{2{,}000 \text{ mL}}{24 \text{ hr}} = 83.33\ldots = 83 \text{ mL per hour}$$

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

$$x = \frac{83 \times \cancel{15}}{\cancel{60}} = \frac{83 \times 1}{4} = 20.7 = 21 \text{ gtt per min}$$

$$x = 21 \text{ gtt per min}$$

CHARTING IV THERAPY AND LABELING BAGS

- IV administration may be charted on special flow sheets and may include IV site assessment.
- IV bags must be labeled with contents, rate, and client identifiers.
- Rate tapes may be applied to visually cue hour and volume correlations.

105 REVUE – IV DRIP RATE CALCULATIONS

https://www.youtube.com/watch?v=a8Rvhg5_048

(19:53)