

CHAPTER 22

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.









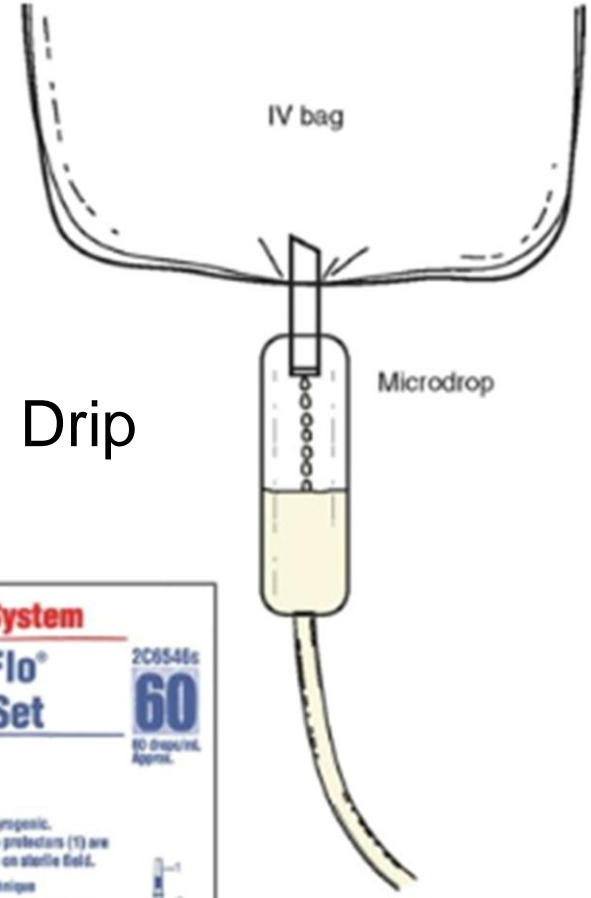
Pump Tubing Admin Set

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



InterLink® System

Continu-Flo® Solution Set

2C6519s
10
13 drops/mL
Approx.

90" (2.3 m)
2 Injection Sites
Luer Lock Adapter

Fluid path is sterile, nonpyrogenic.

Caution: 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. Insert 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 Luer lock adapter (5) to InterLink® cannula or vascular access device.
To properly set flow, always close regulating clamp (7) until roller meets bottom frame, then repeat to establish flow rate. Repeat procedure if adjustment

InterLink® System

Continu-Flo® Solution Set

2C6546s
60
60 drops/mL
Approx.

3 Injection Sites
Luer Lock Adapter
105" long (2.7 m)

Fluid path is sterile, nonpyrogenic.

Caution: 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). Insert and tap check valve (4) to purge air during priming. If flow does not start squeeze plastic container. Prime set, purge air. Close regulating clamp (7) until roller meets bottom of frame. Attach Luer lock adapter (5) to InterLink® cannula or vascular access device.
To properly set flow, always close regulating clamp (7) until roller meets bottom frame, then repeat to establish flow rate. Repeat procedure if adjustment

INTERLINK System

CONTINU-FLO Solution Set

110" (2.8 m), 3 Injection Sites
Male Luer Lock Adaptor with Retractable Collar
Fluid path is sterile, nonpyrogenic.
Cautions: Do not use if top protectors (1) are not in place.
Do not place on sterile field.

Indications for Use: For the administration of fluids from a container to the patient through a vascular access device.

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. Insert 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 INTERLINK cannula or vascular access device using a firm push and twist motion and then engage the Luer lock collar to prevent accidental disconnection. Swab section of injection site (5) with antiseptic prior to access. Access INTERLINK injection site (5) (identified by a colored ring) with INTERLINK cannula. See cannula directions.

To properly air 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. If needle must be used, insert small gauge needle into perimeter of septum (5). Do not disconnect administration set, syringe or other component from cannula while cannula is still connected to INTERLINK injection site. *Rx Only*. Single use only. Do not reinsert.

Notes: This product is not made with natural rubber latex. This product contains DEHP. To stop flow without disturbing regulating device (7), close side clamp (8). For secondary medication administration, use upper Y-injection site only. See directions for use with secondary medication set. When used in gravity mode, replace per CDC guidelines. When used with Baxter pumps or SIGMA Spectrum infusion system, replace/adjust per directions in respective pump labeling. When used with FLO-GARD pumps, replace after 24 hours. Lengths are approximate. For Product Information 1-800-533-0300.

Baxter

Manufactured by an affiliate of
Baxter Healthcare Corporation
Oxnard, IL 60055 USA
Made in the Dominican Republic
07-38-76-674
Rev 2016-02-01

Baxter, Conturo-Flo, Flo-Gard, Interlink, and SIGMA Spectrum are trademarks of Baxter International Inc.

ZC6537 S

10
10 drops/mL
Approx.



Drip Factor

Macro drip



Microdrip





More
Precise
Dosage

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

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Manufactured by an affiliate of
Baxter Healthcare Corporation
Lisle, IL 60115 USA
Made in Costa Rica
07-36-45-950

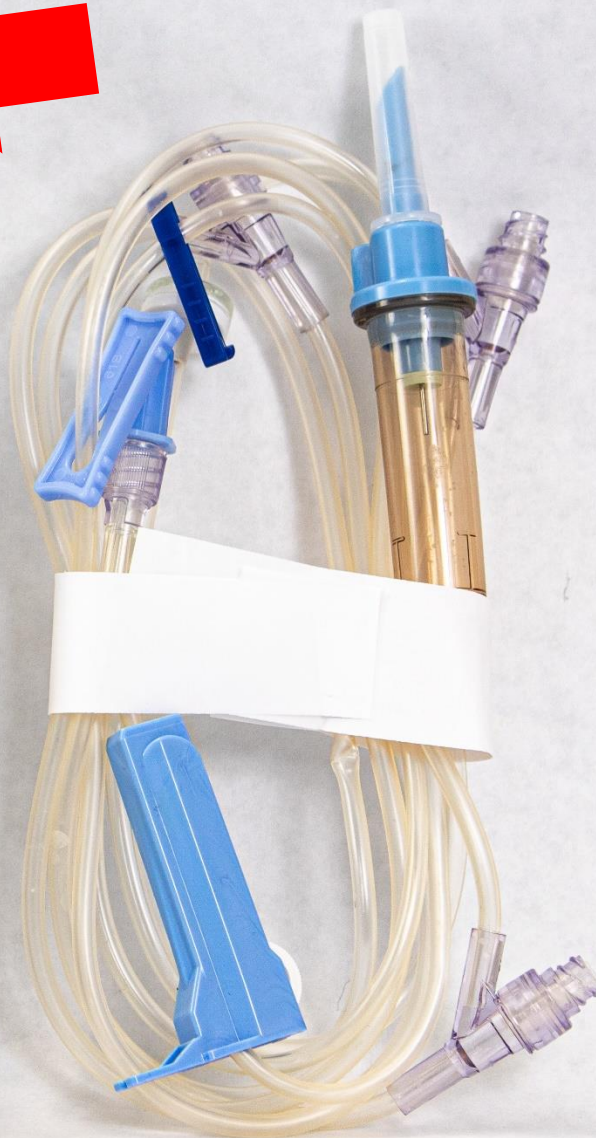
2



2C8540s

60

60 drops/mL
Approx.



I.V. SET- 24 HRS. - ONLY

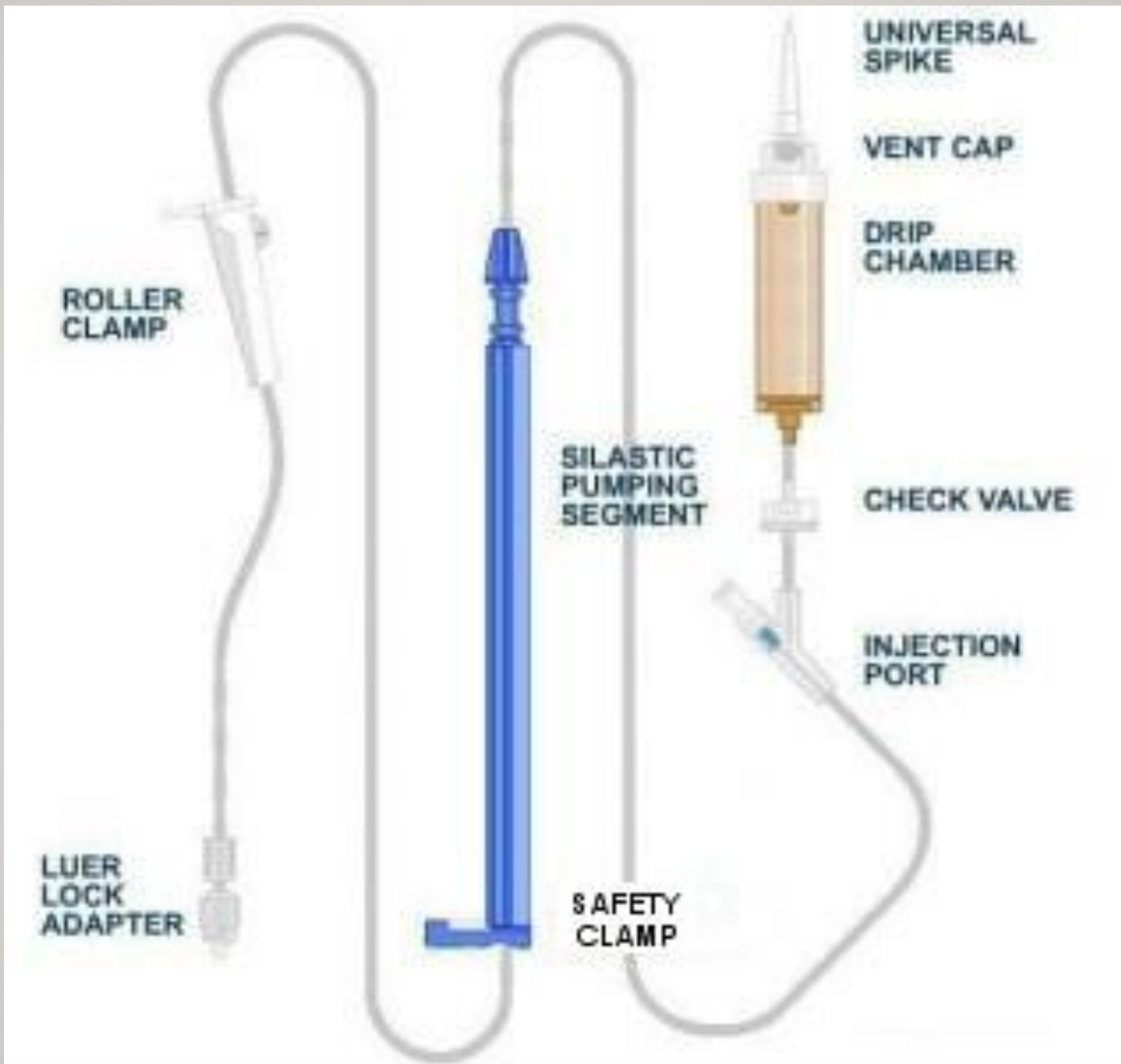
START DATE _____ HR. _____

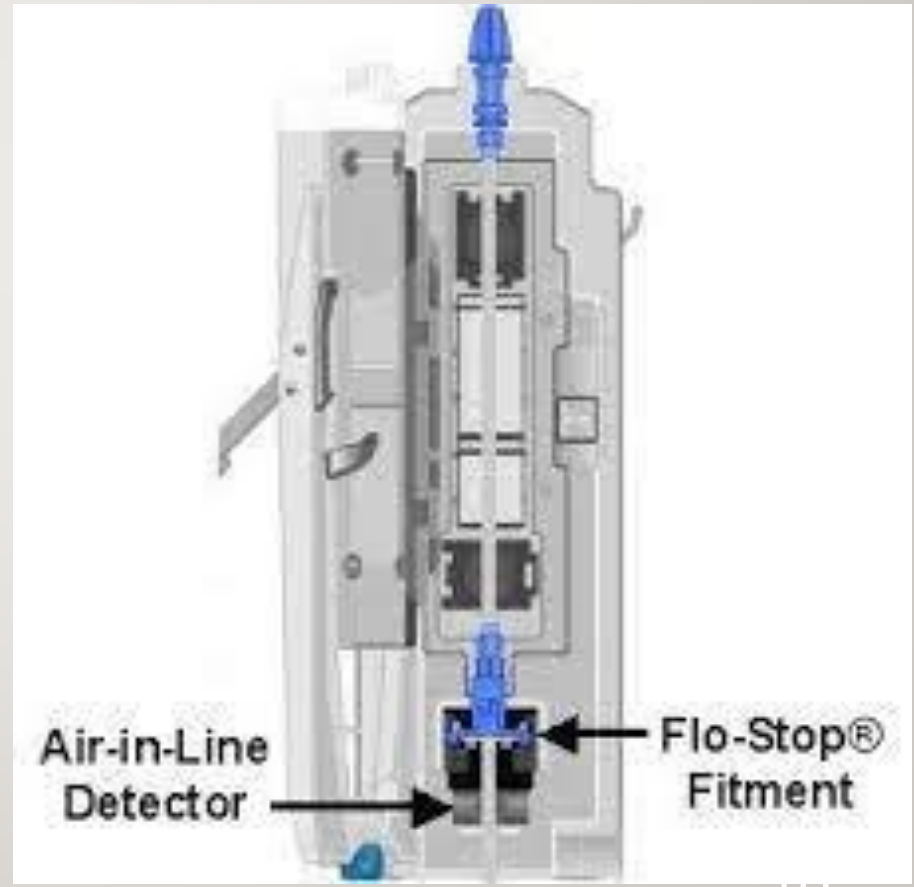
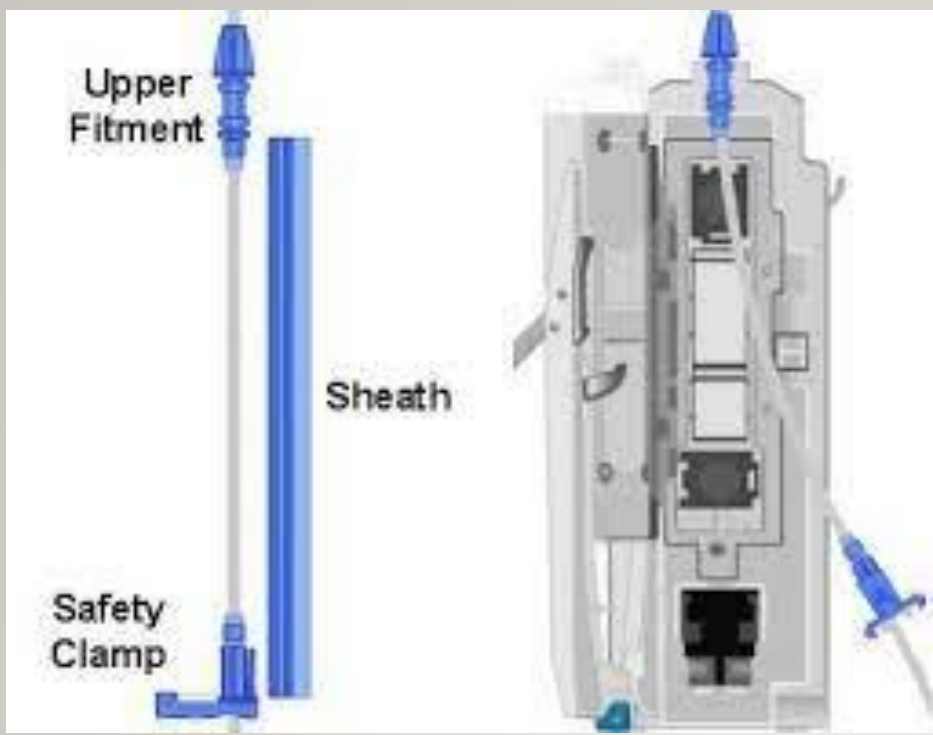
DISCARD DATE _____ HR. _____

SIGNATURE _____

Pump Admin Set









Picture is representative of product/component type



A Infusion Setup

PRIMARY INFUSION

RATE 100 mL/h

VTBI 500 mL

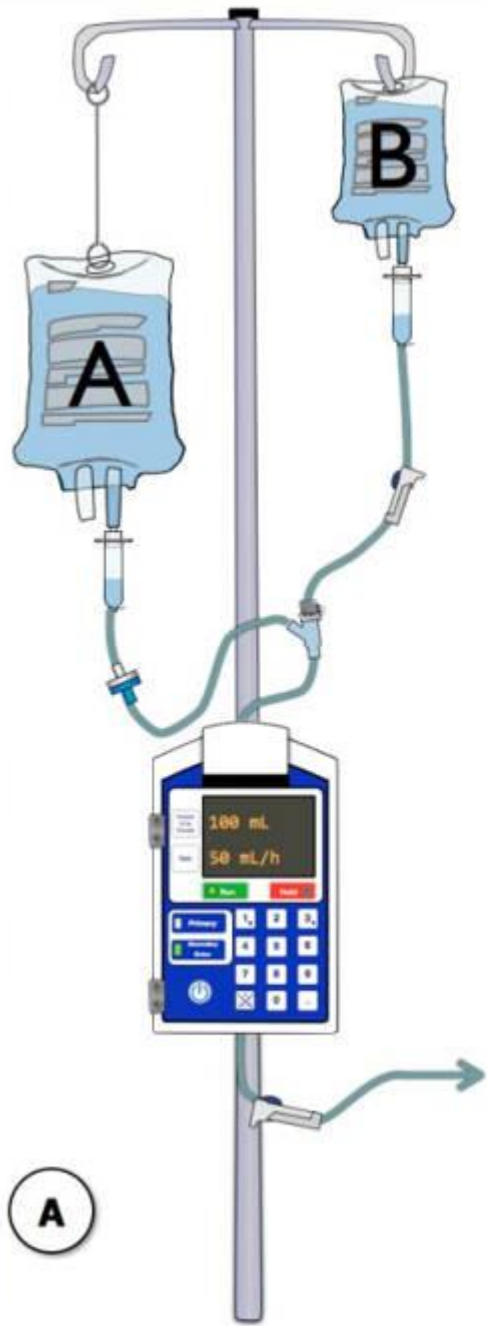
>Press START

DELAY
OPTIONS

VOLUME
DURATION

SECOND-
ARY

START

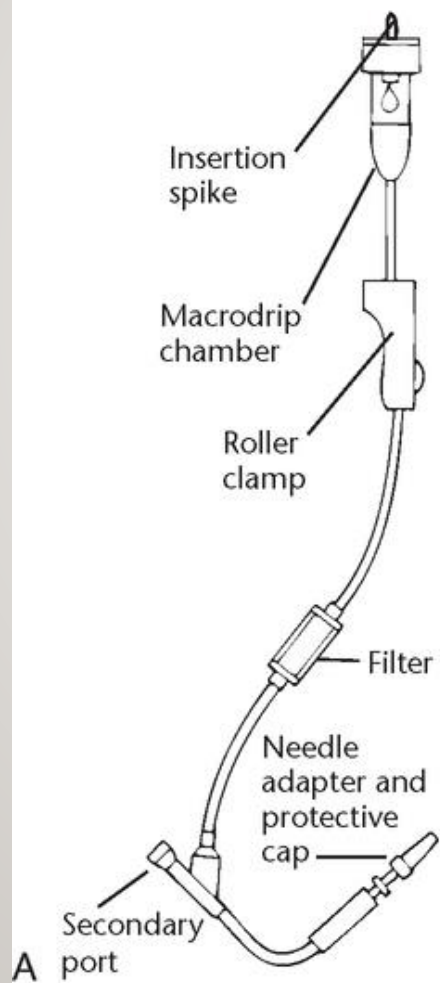




Gravity Feed IV

Gravity Feed Admin Set

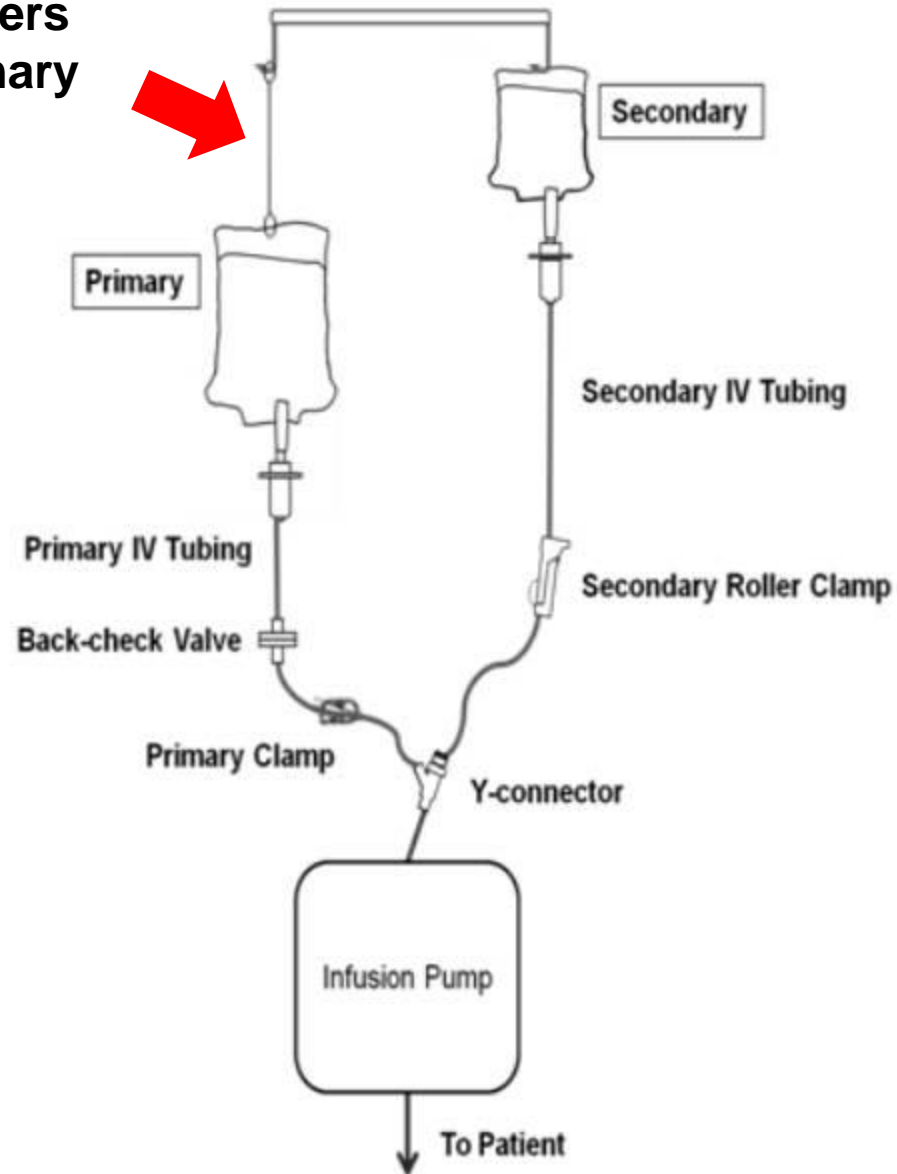




**Lowers
Primary
bag**



**Lowers
Primary
bag**



Essentials of Medication Administration
Dimensional Analysis - ORAL & PARENTERAL CALCULATIONS
STUDENT HELP SHEET

A. CONVERTING (See Chapter 8 & 9)

$$\text{unit X} = \frac{\text{Convert to}}{\text{Given}} \times \text{X}$$

Example: Convert 38 lb to kg

$$38 \text{ lb} = \text{_____ kg}$$

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

$$x = 17.3 \text{ kg}$$

B. DOSAGE CALCULATIONS (See Chapter 16)

1. No conversion needed:

$$\text{unit x} = \frac{\text{Available}}{\text{Order}} \times \text{X}$$

Example:

Order: Vistaril 15 mg IM q4h
 Available: Vistaril 30 mg/2mL

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

$$x = 1 \text{ mL}$$

2. Conversion needed:

$$\text{unit x} = \frac{\text{Available}}{\text{Conversion}} \times \text{X} \times \text{Order}$$

Example:

Order: Ampicillin 0.5 g IM q6h
 Available: Ampicillin 250 mg per mL

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

$$x = 2 \text{ mL}$$

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)

$$\text{mg}(x) = \frac{\text{Recommend}}{\text{Weight (in kg)}} \times \text{X}$$

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)

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

$$x = 8.65 \text{ mg/dose}$$

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

$$x = 17.3 \text{ mg/dose}$$

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)



IV CALCULATION HELP SHEET

DIMENSIONAL ANALYSIS



PUMP

mL/hr

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

Order: Administer 3,000 mL of D₅W over 24 hr.

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

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

Order: Administer 50 mL of D₅W Over 30 min.

Example: $\frac{x \text{ mL}}{\text{hr}} = \frac{50 \text{ mL}}{30 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}}$
 $x = 100 \text{ mL/hr}$

GRAVITY

gtt/min (with time) pg 544

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

Order: Infuse 50 mL D₅W over 20 minutes with a drop Factor of 60 gtt/mL. What is the rate in gtt/min?

Example: $\frac{x \text{ gtt}}{\text{min}} = \frac{60 \text{ gtt}}{1 \text{ mL}} \times \frac{50 \text{ mL}}{20 \text{ min}}$
 $x = 150 \text{ gtt/min}$

GRAVITY

gtt/min (from mL/hr)

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

Order: Administer D₅RL at 75 mL/hr with a Drop Factor of 10 gtt/mL. What is the rate in gtt/min?

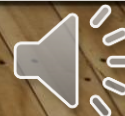
Example: $\frac{x \text{ gtt}}{\text{min}} = \frac{10 \text{ gtt}}{1 \text{ mL}} \times \frac{75 \text{ mL}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}}$
 $x = 12.5$
 $x = 13 \text{ gtt/min}$

TOTAL INFUSION TIME

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

Order: Calculate the infusion time for an IV of 1,000 mL D₅W infusing at a rate of 125 mL/hr

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



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:

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

2. Determine whether the infusion administration set is **microdrip (60 gtt/ml)** or **macro drip (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 **macro drip (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:

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

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

$$\frac{x \text{ mL}}{\text{hr}} = \frac{\text{solution (mL)}}{\text{time (hr)}}$$

PRACTICE PROBLEM

34

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

$$\begin{aligned}x \text{ mL/hr (whole number)} &= \frac{\text{Amount of solution}}{\text{Time in hours}} \\x \text{ mL/hr} &= \frac{3,000 \text{ mL}}{24 \text{ hr}} \\x &= 125 \text{ mL/hr}\end{aligned}$$

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.

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



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:

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

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

42 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:

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

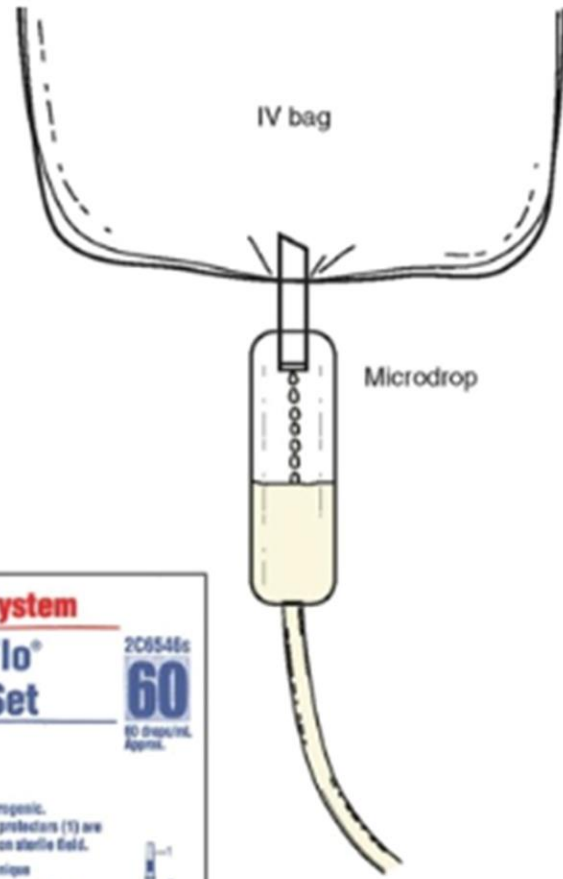
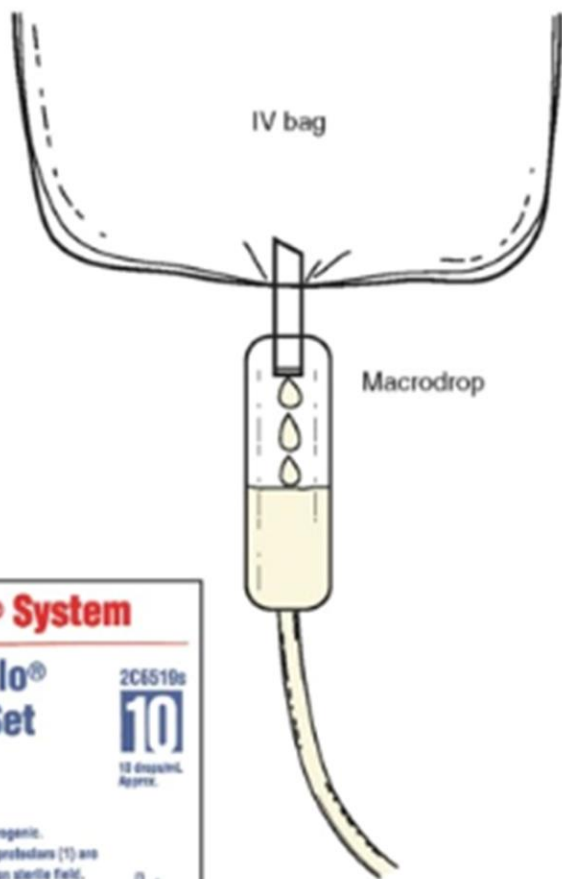
CALCULATING IV FLOW RATES IN DROPS (GTT) PER MINUTE

- 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).



InterLink® System

**Continu-Flo®
Solution Set**

2C6519s
10
10 drops/mL
Approx.

90" (2.3 m)
2 Injection Sites
Luer Lock Adapter

Fluid path is sterile, nonpyrogenic.

Caution: 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. Insert 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 Luer lock adapter (8) to InterLink® cannula or vascular access device.

To properly set flow, always close regulating clamp (7) until roller meets bottom frame, then reopen to establish flow rate. Repeat procedure if adjustment

InterLink® System

**Continu-Flo®
Solution Set**

2C6546s
60
60 drops/mL
Approx.

3 Injection Sites
Luer Lock Adapter
105" long (2.7 m)

Fluid path is sterile, nonpyrogenic.

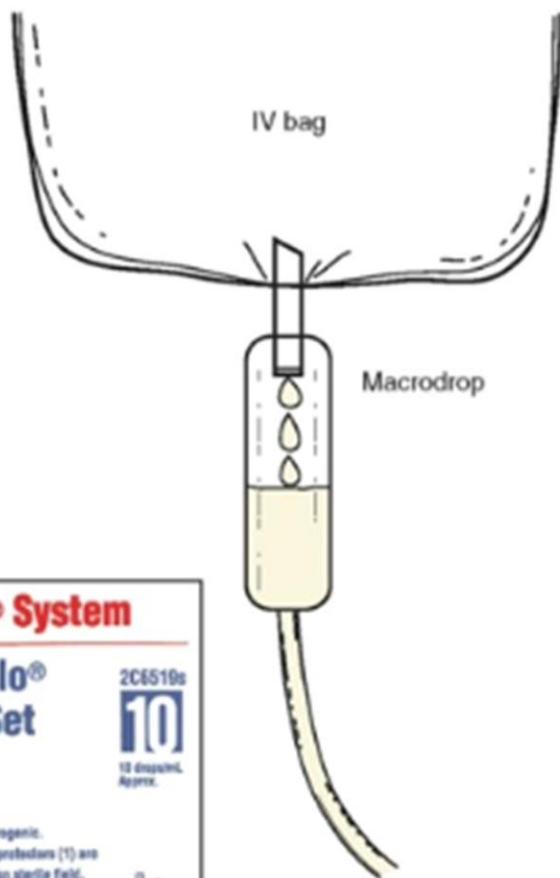
Caution: Do not use if tip protectors (1) are not in place. Do not place on sterile field.

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). Insert and tap check valve (4) to purge air during priming. If flow does not start, squeeze plastic container. Prime set, purge air. Close regulating clamp (7) until roller meets bottom of frame. Attach Luer lock adapter (8) to InterLink® cannula or vascular access device.

To properly set flow, always close regulating clamp (7) until roller meets bottom frame, then reopen to establish flow rate. Repeat procedure if adjustment

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).



InterLink® System

**Continu-Flo®
Solution Set**

2C6519s
10
10 drops/mL
Approx.

90" (2.3 m)
2 Injection Sites
Luer Lock Adapter

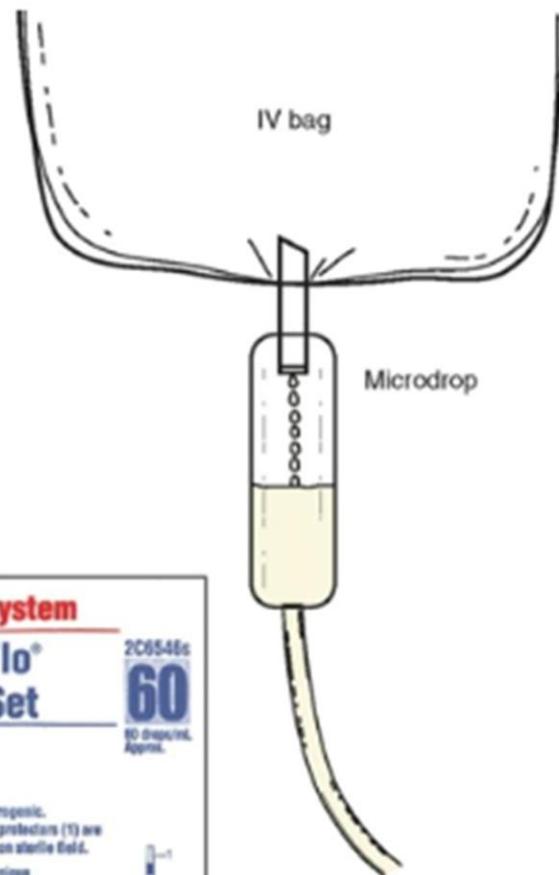
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InterLink® System

**Continu-Flo®
Solution Set**

2C6546s
60
60 drops/mL
Approx.

3 Injection Sites
Luer Lock Adapter
105" long (2.7 m)

Fluid path is sterile, nonpyrogenic.

Caution: 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). Insert and tap check valve (4) to purge air during priming. If flow does not start, squeeze plastic container. Prime set, purge air. Close regulating clamp (7) until roller meets bottom of frame. Attach Luer lock adapter (8) to InterLink® cannula or vascular access device.

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Continu-Flo® Solution Set

2C6519s
10
10 drops/mL
Approx.

90" (2.3 m)
2 Injection Sites
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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. If needle must be used, insert small gauge needle into perimeter of septum.

Federal USA law restricts this device to sale by or on order of a physician.

Single use only. Do not resterilize.

Notes:

To stop flow without disturbing regulating device (7), close slide clamp (6).

Swab septum of injection site (5) with antiseptic prior to access.

Access InterLink® injection site (5) (identified by colored ring) with InterLink® cannula. See cannula directions.

For secondary medication administration, use upper Y-injection site only. See directions for use with secondary medication set.

Replace per CDC guidelines.

For Product Information 1-800-933-0303

Baxter

Manufactured by an affiliate of
Baxter Healthcare Corporation
Deerfield, IL 60015 USA

Made in Singapore
7-34-2-85 97/4

7-34-2-85 97/4

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U.S. Pat. Nos. 4,662,599; 5,167,648;
5,171,234; 5,188,620; 5,290,239;
5,300,044; Pat. Pending



2



+H1602C6519S10

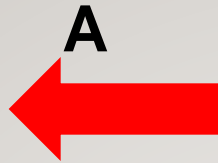


Figure 22-2

Administration sets
(package).

A, Macrodrop set with
drop factor of 10 (10
gtt 5 1 mL).

B, Microdrop set with
drop factor of 60 (60
gtt 5 1 mL).

InterLink® System

Continu-Flo® Solution Set

2C6546s
60
60 drops/mL
Approx.

3 Injection Sites
Luer Lock Adapter
105" long (2.7 m)

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). Invert and tap check valve (4) to purge air during priming. If flow does not start squeeze plastic container. Prime set, purge air. Close regulating clamp (7) until roller meets bottom of frame. Attach Luer lock adapter (8) to InterLink® cannula or vascular access device.

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.

If needle must be used, insert small gauge needle into perimeter of septum.

Federal USA law restricts this device to sale by or on order of a physician.

Single use only. Do not resterilize.

Notes:

Swab septum of injection site (5) with antiseptic prior to access.

Access InterLink® injection site (identified by colored ring) with InterLink® cannula. See cannula directions.

For secondary medication administration, use upper Y-injection site only. See directions for use with secondary medication set.

To stop flow without disturbing regulating device (7), close lowest slide clamp (6).

Replace per CDC guidelines.

For Product Information 1-800-933-0303

Baxter

Manufactured by an affiliate of
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Deerfield, IL 60015 USA

Made in Singapore
7-34-1-396A 95/2

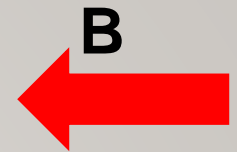
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reserved.
U.S. Pat. Nos. D272, 850; 4,662,599;
5,167,648; 5,171,234; 5,188,620;
Pat. Pending



7



+H1602C6546S10



Identify the drop factor

2C5419 s
Baxter-Travenol
Vented Basic Set
10 drops/mL

10

a.

Catalog Number: **IV3D06**
Non-Vented Burette Set With Microbore Tubing
And Luer-Lock *Macrodrop Set: Approx. 20 drops/ml*

IVION CORPORATION
A wholly-owned subsidiary of Medex, Inc.



b.

No. 4967

 **VENOSET® Piggyback**
Primary I.V. Set, Vented, 80 Inch

15
DROPS/mL

 ABBOTT LABORATORIES, NORTH CHICAGO, IL 60064, USA

c.

No. 1883

 **VENOSET® MICRODRIP®**
Primary I.V. Set, Vented, 70 Inch

60
DROPS/mL

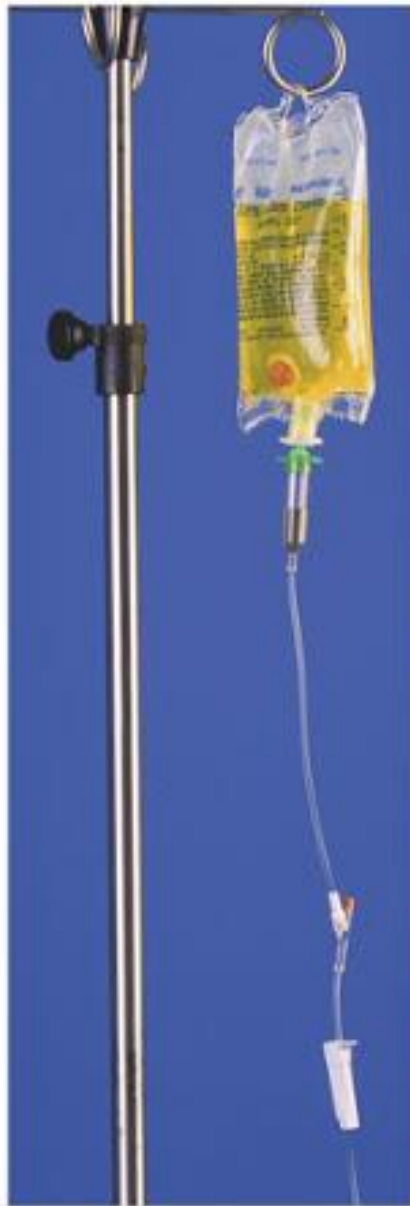
 ABBOTT LABORATORIES

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



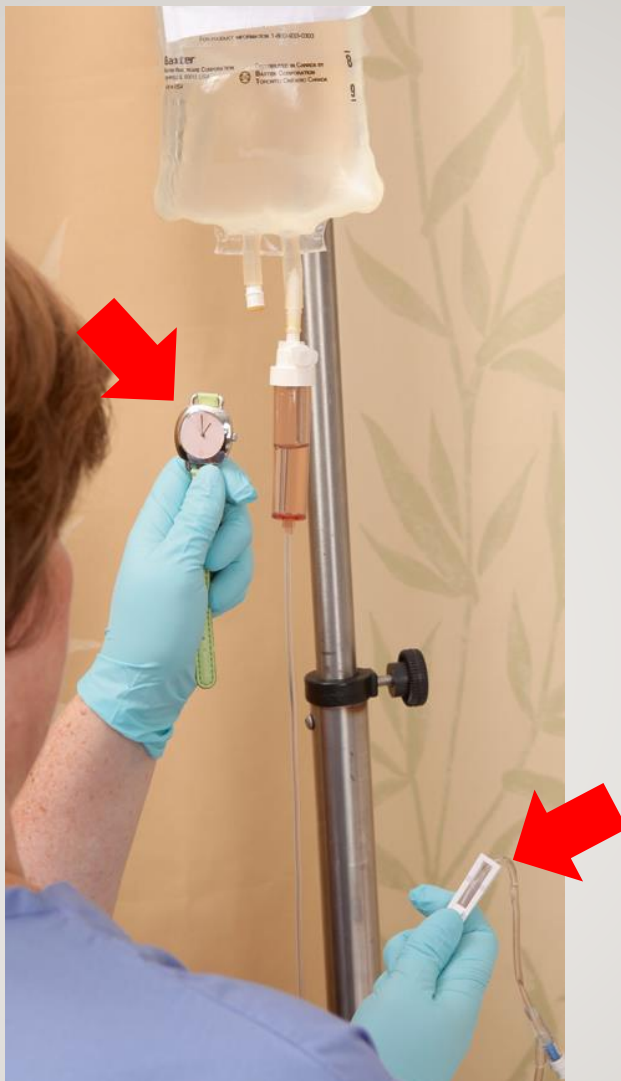


Figure 22-1 Observing the drop chamber to count drops per minute. (From Potter PA, Perry AG, Stockert P, Hall A: *Fundamentals of nursing*, ed 9, St Louis, 2016, Mosby.)

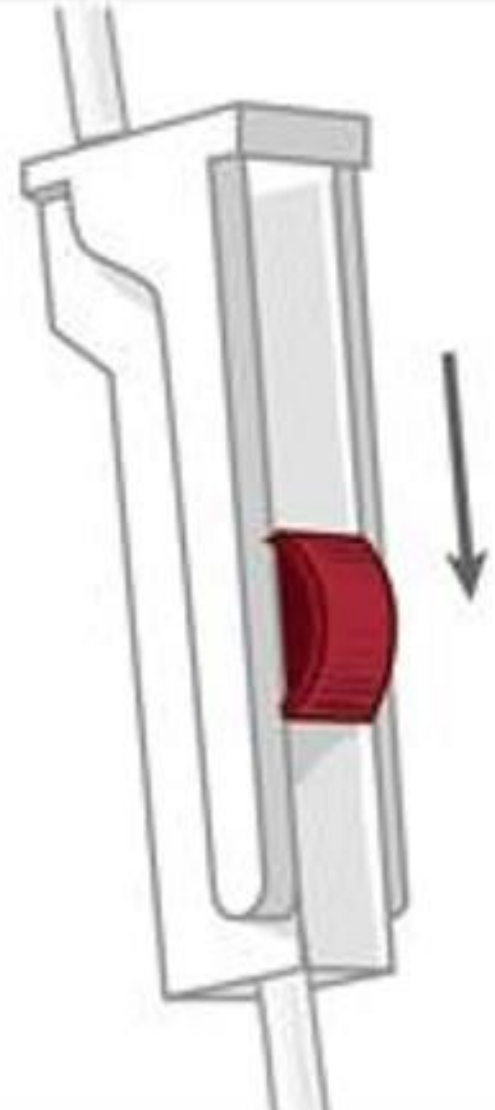
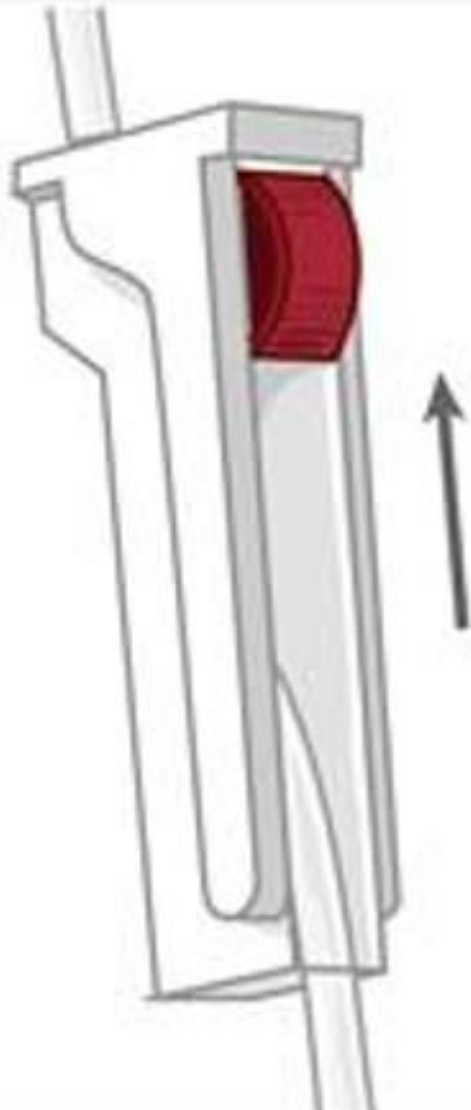
A Roller Clamp is Volume Control Device



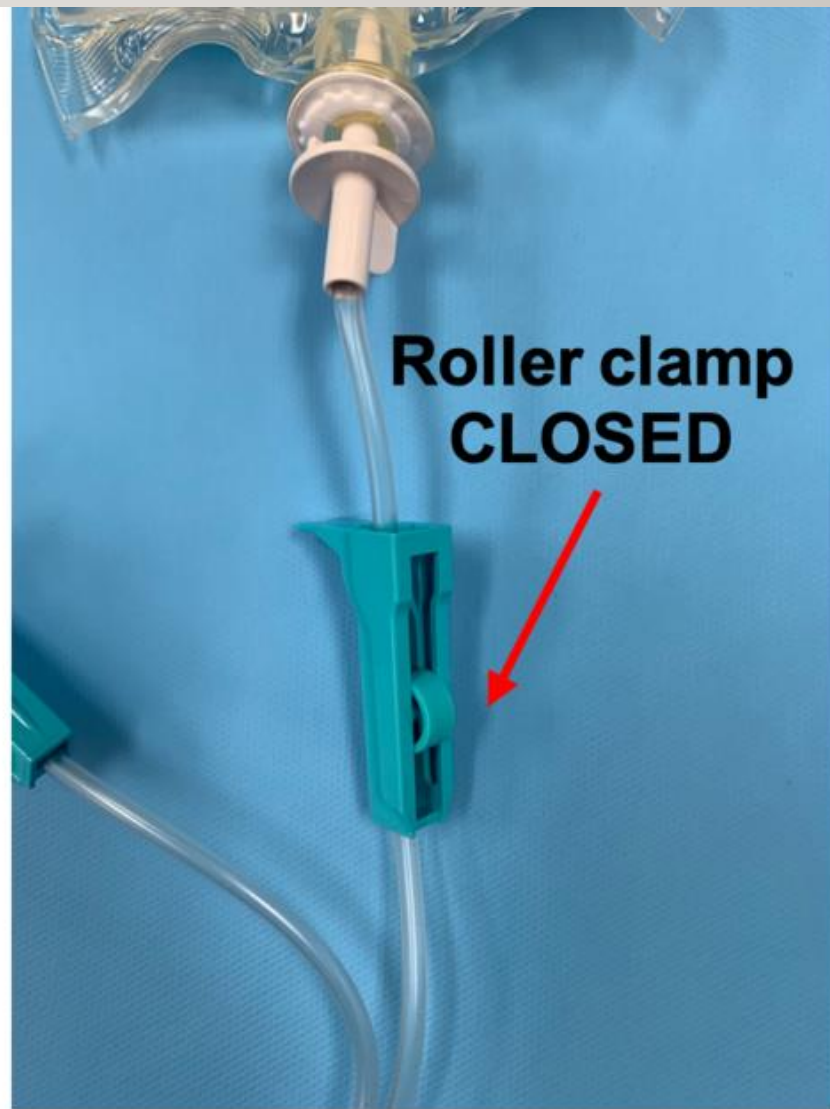
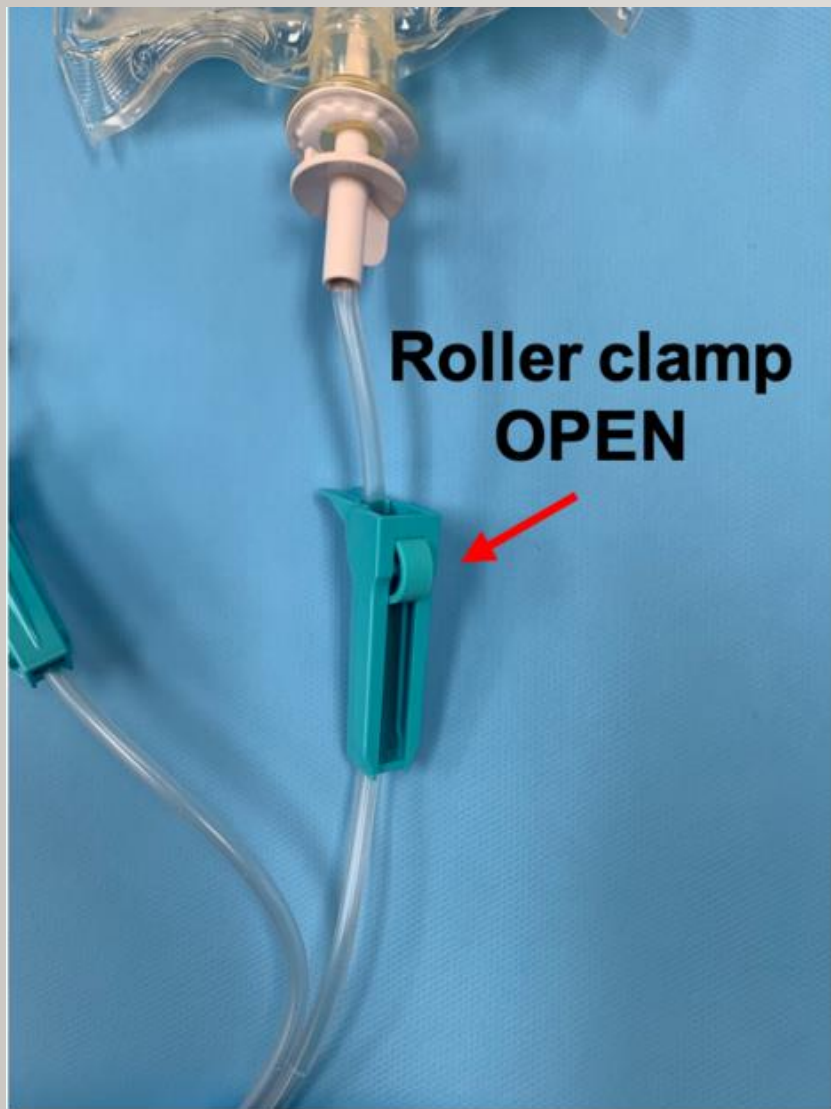
Used to administer small volumes of fluid and medications

Open

Close







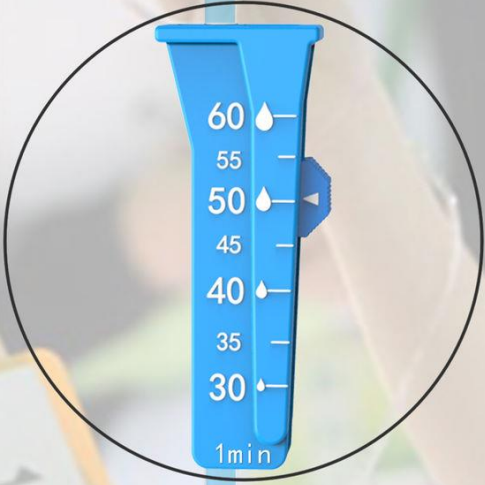
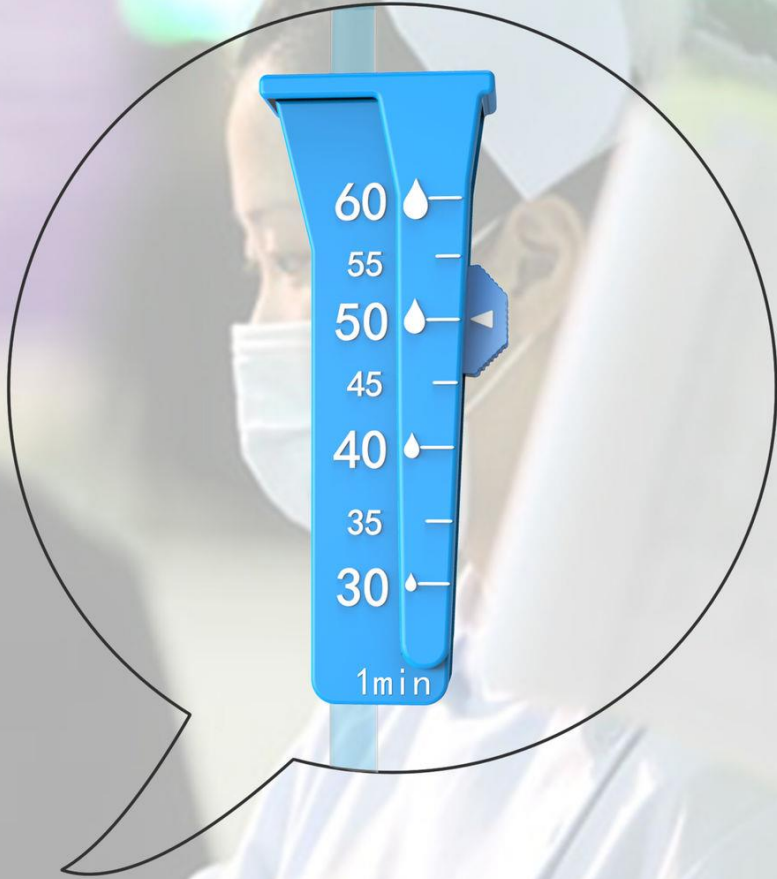
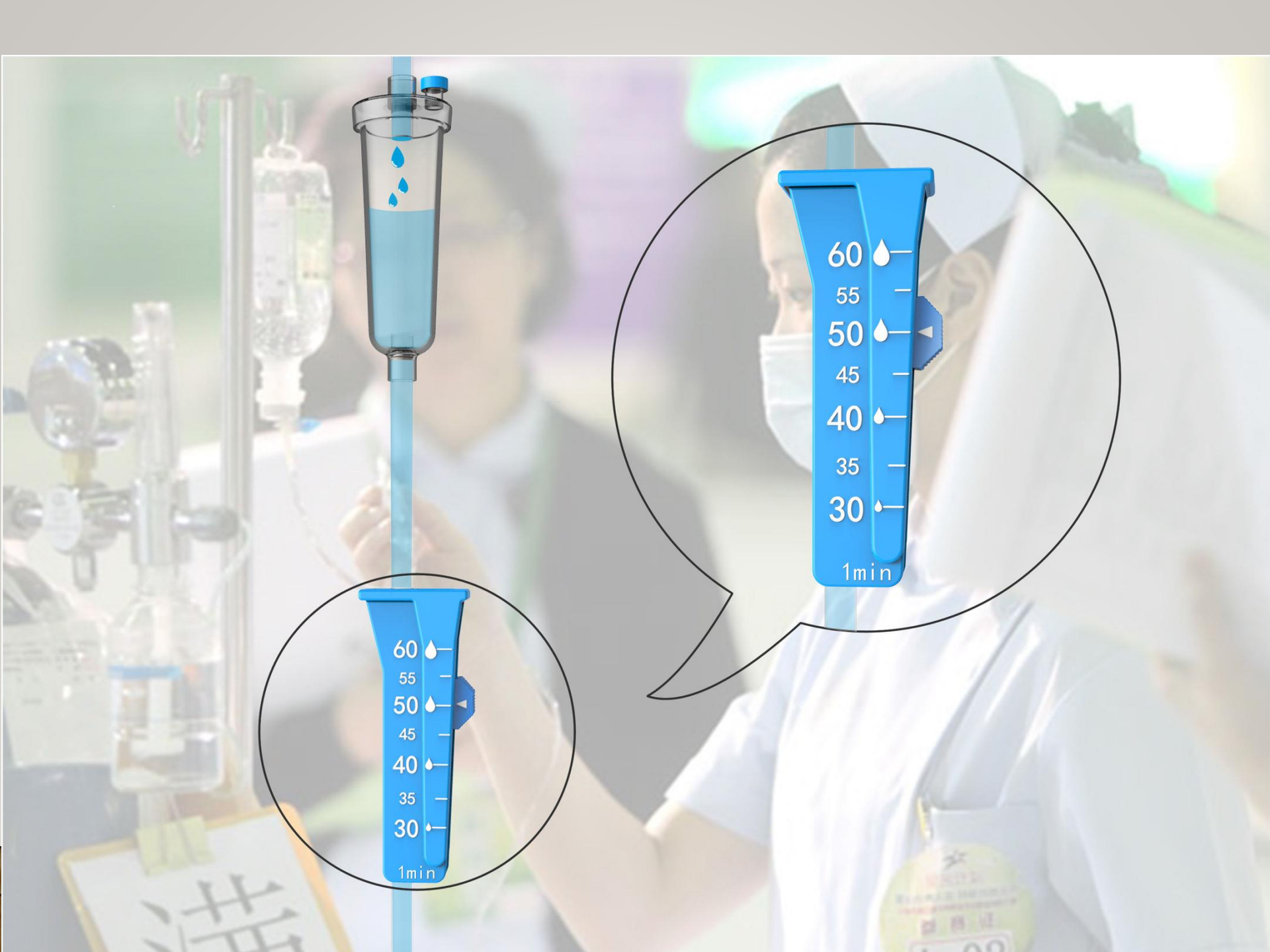
IV CLAMPS

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





Auxiliary Clamps



62 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: $\frac{x \text{ mL}}{\text{hr}} = \frac{\text{Total mL ordered (Volume)}}{\text{Ordered Time to infuse (Hours)}}$

Order: Administer 3,000 mL of D₅W over 24 hr.

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

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

Order: Administer 50 mL of D₅W Over 30 min.

Example: $\frac{x \text{ mL}}{\text{hr}} = \frac{50 \text{ mL}}{30 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}}$
 $x = 100 \text{ mL/hr}$

GRAVITY

gtt/min (with time)

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

Order: Infuse 50 mL D₅W over 20 minutes with a drop Factor of 60 gtt/mL. What is the rate in gtt/min?

Example: $\frac{x \text{ gtt}}{\text{min}} = \frac{60 \text{ gtt}}{1 \text{ mL}} \times \frac{50 \text{ mL}}{20 \text{ min}}$
 $x = 150 \text{ gtt/min}$

GRAVITY

gtt/min (from mL/hr)

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

Order: Administer D₅RL at 75 mL/hr with a Drop Factor of 10 gtt/mL. What is the rate in gtt/min?

Example: $\frac{x \text{ gtt}}{\text{min}} = \frac{10 \text{ gtt}}{1 \text{ mL}} \times \frac{75 \text{ mL}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}}$
 $x = 12.5$
 $x = 13 \text{ gtt/min}$

TOTAL INFUSION TIME

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

Order: Calculate the infusion time for an IV of 1,000 mL D₅W infusing at a rate of 125 mL/hr

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



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.

66 DIMENSIONAL ANALYSIS

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

$$\begin{aligned}x \frac{\text{gtt}}{\text{min}} &= \frac{20 \text{ gtt}}{1 \text{ mL}} \times \frac{1,000 \text{ mL}}{8 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \\x &= \frac{20 \times 1,000}{60 (8)} \\x &= \frac{20,000}{480} = \frac{1,000}{42} \\x &= 41.6 = 42 \text{ gtt/min}\end{aligned}$$

SHORT CUT METHOD USING DROP FACTOR CONSTANT



69 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	$\frac{60}{60} = 1$

70

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

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:

I 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.

73

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

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)

74 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?

75 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:

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

or

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

3



drop factor constant

77 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?

78 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?

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

OR

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

Answer: 25 gtt/min

Answer: 25 gtt/min

79 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?

80 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

81 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:

$$1000\text{ml} / 100\text{ml/hr} = 10 \text{ hrs}$$

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:

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

84

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.

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

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

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

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

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.

86 REVUE – IV DRIP RATE CALCULATIONS

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

(19:53)