



Medication Calculations - part 1

Learning Skills

Introduction:

Common calculations required in nursing include finding volumes needed for oral or injected doses and working out IV infusion flow and drip rates. All these calculations require the application of the various maths skills looked at in previous worksheets.

This sheet will teach you to:

- Calculate volume required for an injected dose and oral dose
- Work with paediatric doses

1. When medication is injected.

The formula to calculate the volume required for an injection is:

$$\text{volume required} = \frac{\text{strength required}}{\text{stock strength}} \times \frac{\text{volume of stock}}{1}$$

The volumes are measured in millilitres (mL)

The strength required and stock strength are measured in grams (g), milligrams (mg) or micrograms (mcg)

You must make sure that the unit of measurement for the stock strength and strength required match – if they don't convert them both to the **smaller** of the two units.

Example

Calculate the volume to be drawn up if a patient requires 1mg of bumetanide, and each stock ampoule contains 2mg/4mL.

Strength required is 1mg,

The stock strength is 2mg in 4 mL,

The units match so the formula becomes:

$$\text{volume} = \frac{\text{required}}{\text{stock}} \times \frac{\text{stock volume}}{1} = \frac{1}{2} \times \frac{4}{1} \text{ mL} = \frac{4}{2} \text{ mL} = 2\text{mL}$$

The volume to be drawn up is 2mL

Note

After you have calculated your answer always look again at the strength required and stock strength and consider if your required volume **looks reasonable**.

Example

An infant requires 2000 units of Calciparine. If stock ampoules contain 20000 units in 1mL, how much should you draw up?

Strength required is 2000 units,

Stock strength is 20000units in 1mL

So the formula becomes:

$$\begin{aligned} \text{volume} &= \frac{\text{required}}{\text{stock}} \times \frac{\text{stock volume}}{1} = \frac{2000}{20000} \times \frac{1}{1} \text{mL} = \frac{2000}{20000} \text{mL} = \frac{2}{20} \text{mL} = \frac{1}{10} \text{mL} \\ &= 10 \overline{)0.1} = 0.1 \text{mL} \end{aligned}$$

The volume required is 0.1mL.

Example

If an adult patient was ordered 85mg of cortisone, and each stock ampoule was 5mL and contained 100mg of cortisone, find the volume required?

Strength required is 85mg,

Stock strength is 100mg in 5mL

$$\begin{aligned} \text{volume} &= \frac{\text{required}}{\text{stock}} \times \frac{\text{stock volume}}{1} = \frac{85}{100} \times \frac{5}{1} \text{mL} = \frac{425}{100} \text{mL} = \frac{85}{20} \text{mL} \\ &= 20 \overline{)04.25} = 4.25 \text{mL} \end{aligned}$$

Volume required is 4.25 mL.

Example

A patient is ordered 70mg of pethidine, find the volume required if the stock solution contains 10g of pethidine per 200mL.

Strength required is 70mg,

Stock strength is 10g in 200mL

First change the g to mg to make the units the same:

$$10\text{g} \times 1000 = 10000\text{mg}$$

So stock strength is 10000mg in 200mL

$$\begin{aligned} \text{volume} &= \frac{\text{required}}{\text{stock}} \times \frac{\text{stock volume}}{1} = \frac{70}{10000} \times \frac{200}{1} \text{mL} = \frac{14000}{10000} \text{mL} = \frac{14}{10} \text{mL} \\ &= 10 \overline{)01.4} = 1.4 \text{mL} \end{aligned}$$

Volume required is 1.4mL of stock solution.

2. Mixtures

When administering a dose of medication in a suspension form the formula is the same as for injections:

$$\text{volume required} = \frac{\text{strength required}}{\text{stock strength}} \times \frac{\text{volume of stock}}{1}$$

Example

A patient who has a sore head from an accidental fall is prescribed 1000mg of a mild painkiller to be taken orally. The stock contains 100mg in 5mL. How much medication should be given to the patient?

Strength required is 1000mg

Stock strength is 100mg in 5mL

$$\text{volume} = \frac{\text{required}}{\text{stock}} \times \frac{\text{stock volume}}{1} = \frac{1000}{100} \times \frac{5}{1} \text{ mL} = \frac{5000}{100} \text{ mL} = \frac{50}{1} \text{ mL} = 50 \text{ mL}$$

So we would measure out 50mL of painkiller to give to the patient.

Example

Bill is prescribed 800mg of erythromycin, stock on hand contains 500mg/10mL in suspension. Find the amount of suspension required?

Strength required is 800mg

Stock strength is 500mg in 10mL

$$\begin{aligned} \text{volume} &= \frac{\text{required}}{\text{stock}} \times \frac{\text{stock volume}}{1} = \frac{800}{500} \times \frac{10}{1} \text{ mL} = \frac{8000}{500} \text{ mL} = \frac{80}{5} \text{ mL} \\ &= 5 \overline{) 160} = 16 \text{ mL} \end{aligned}$$

Bill would receive 16mL of erythromycin.

3. Tablets

For tablets use a similar formula as for oral and injected doses to calculate the number of tablets required, however as the stock volume will always be 1 tablet the formula is modified to:

$$volume = \frac{strength\ required}{stock\ strength}$$

Note

The rules for tablets are that you always try to use a whole tablet, and never use less than half a tablet. Always try to give as few tablets as is possible.

Example

750mg of ciprofloxacin is prescribed. On hand are 500mg tablets. How many tablets should be given?

Strength required is 750mg

Stock strength is 500mg

$$volume = \frac{strength\ required}{stock\ strength} = \frac{750}{500} tabs = \frac{75}{50} = \frac{3}{2} = 1.5 tabs$$

1 tablet and a half tablet are required

Example

How many 20mg tablets of codeine are required for a dose of 0.05g?

Strength required is 0.05g

Stock strength is 20mg

First step is to convert 0.05g to mg

$$0.05g \times 1000 = 0.050 \times 1000 = 50mg$$

Strength required is 50mg

$$volume = \frac{strength\ required}{stock\ strength} = \frac{50}{20} tabs = \frac{5}{2} = 2.5 tabs$$

2 tablets and a half tablet are required

4. Paediatric doses

When medicating infants or children the dose required may be expressed in terms of body weight. Further calculations can therefore be necessary.

Example

A child weighing 16kg is ordered 40mg/kg/day, 4 doses a day, of erythromycin. Find the strength required for a single dose.

Daily dose = 40mg for each kg = $40 \times 16 = 640\text{mg/day}$

$$\text{Single dose} = 640\text{mg} \div 4\text{doses} = 4 \overline{)6^2 40} = 160\text{mg}$$

Example

A 5 year old girl is ordered paracetamol stat. The pharmacy guidelines recommend 15mg/kg. The child weighs 18kg. Stock strength is 125mg/5mL. How many ml will the child receive?

Strength required = 15mg for each kg = $15 \times 18 = 270\text{mg}$

Stock strength = 125mg in 5mL

$$\text{volume} = \frac{\text{required}}{\text{stock}} \times \frac{\text{stock volume}}{1} = \frac{270}{125} \times \frac{5}{1} \text{mL} = \frac{1350}{125} \text{mL} = \frac{270}{25} \text{mL}$$

$$\frac{54}{5} = 5 \overline{)54.0} = 10.8\text{mL}$$

The child requires a dose of 10.8mL

5. Some exercises to try

- 1) A patient is ordered an injection of 80mg of pethidine. Each stock ampoule contains 100mg per 1mL. How much will you draw up for the injection?
- 2) A child requires 50 milligrams of Phenobarbitone. If stock ampoules contain 200 milligrams in 2mL, how much will you draw up?
- 3) What volume is required for the injection if a patient is ordered 500mg of capreomycin sulphate, and each stock ampoules contains 300mg/mL,?
- 4) A patient needs 5000mg of medication. Stock solution contains 1g per 1mL. What volume is required?
- 5) A teenager is prescribed 1000mg of chloramphenicol, stock on hand contains 250mg/10mL in suspension. Calculate the volume required.
- 6) A patient is prescribes 3g of sulphadiazine, the stock contains 600mg/5mL. How much sulphadiazine should be given to the patient?
- 7) How many 300mg tablets should be administered for a prescribed dose of 450mg?
- 8) How many 25mg tablets are required for a prescribed dose of 0.05g?
- 9) Calculate the size of a single dose if a child weighing 20kg is ordered flucloxacillin 100mg/kg/day, 4 doses per day.
- 10) A doctor orders penicillin V potassium oral suspension 56mg/kg/day in four doses per day for a child who weighs 25kg. The suspension available is 125mg/5mL. What volume should be administered at each dose?

6. Solutions

- 1) 0.8 mL
- 2) 0.5 mL
- 3) 1.7 mL
- 4) 5 mL
- 5) 40 mL
- 6) 25 mL
- 7) 1.5 tabs
- 8) 2 tabs
- 9) strength required per day = 20kg x 100mg each kg = 2000mg
- 10) Strength required per dose = 2000mg ÷ 4 = 500mg
strength required per day = 25kg x 56mg each kg = 1400mg
- 11) Strength required each dose = 1400mg ÷ 4 = 350mg

$$\text{volume} = \frac{\text{required}}{\text{stock}} \times \frac{\text{stock volume}}{1} = \frac{350}{125} \times \frac{5}{1} \text{ mL} = \frac{1750}{125} \text{ mL} = \frac{350}{25} \text{ mL} = \frac{14}{1} \text{ mL} = 14 \text{ mL}$$

7. For more information

Visit our Learning Skills website at <http://www.csu.edu.au/division/studserv/maths/index.htm>

8. References

The following resources will provide you with further useful information on this topic:

Gatford, J.D and Phillips, N. (2006). *Nursing Calculations*. UK: Churchill Livingstone.

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