Nursing: Medication calculations 1

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 various maths skills looked at in previous worksheets.

This worksheet will teach you to calculate volume required for an injected dose and oral dose, as well as working with paediatric doses.

When medication is injected

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

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

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 do not match, then convert them both to the smaller of the two units.

Examples:

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

Strength required is 1mg.

The stock strength is 2mg in 4mL.

The units match so the formula becomes:

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

Answer: the volume to be drawn up in 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.

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

Strength required is 2 000 units.
Stock strength is 20 000 units in 1 mL
So the formula becomes:

$$volume = \frac{required}{stock} \times \frac{stock\ volume}{1} = \frac{2000}{20000} \times \frac{1}{1} mL = \frac{2\cancel{000}}{20\cancel{000}} mL = \frac{2}{20} mL = \frac{1}{10} mL = 10\overline{)1.0}^{\ 0.1} = 0.1mL$$

Answer: the volume required is 0.1mL.

c) An adult patient was ordered 85mg of cortisone. Each stock ampoule was 5mL and contained 100mg of cortisone. What volume is required?

Strength required is 85mg.

Stock strength is 100mg in 5mL.

So, the formula becomes:

$$volume = \frac{required}{stock} \times \frac{stock\ volume}{1} = \frac{85}{100} \times \frac{5}{1} mL = \frac{425}{100} mL = \frac{85}{20} mL = 20\overline{)85.^{5}0^{10}0} = 4.25mL$$

Answer: the volume required is 4.25mL.

d) 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:

10g × 1 000 = 10 000mg

So stock strength is 10 000mg in 200mL

$$volume = \frac{required}{stock} \times \frac{stock\ volume}{1} = \frac{70}{10000} \times \frac{200}{1} mL = \frac{14000}{10000} mL = \frac{14}{10} mL = 10\overline{)14.^{4}0} = 1.4mL$$

Answer: the volume required is 1.4mL of stock solution.

Mixtures

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

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

Examples:

a) A patient who has a sore head from an accidental fall is prescribed 1 000mg 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 1 000mg

Stock strength is 100mg in 5mL.

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

Answer: 50mL of painkiller should be given to the patient.

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

Strength required is 800mg.

Stock strength is 500mg in 10mL.

$$volume = \frac{stock}{required} \times \frac{stock\ volume}{1} = \frac{800}{500} \times \frac{10}{1} mL = \frac{8000}{500} mL = \frac{80}{5} mL \quad = 5\overline{)8^{3}0} = 16mL$$

Answer: Bill would receive 16mL of erythromycin.

Tablets

For tablets you may 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 less than half a tablet. Always try to give as few tablets as possible.

Examples:

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

Strength required is 750mg.

Stock strength is 500mg.

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

Answer: 1 tablet and a half tablet are required.

b) 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:

$$\mathbf{0.05g \times 1\,000 = 0.050 \times 1\,000 = 50mg}$$

Strength required is 50mg.

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

Answer: 2 tablets and a half tablet are required.

Paediatric dose

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

Examples:

a) 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 = $40 \times 16 = 640$ mg/day

Single dose = 640mg ÷ 4 doses = $4\overline{)6\ ^{2}4\ 0}\ \begin{matrix}1\ \ 6\ 0\end{matrix}$ = 160mg

Answer: a single dose is 160mg.

b) A five-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 x 18 = 270mg

Stock strength = 125mg in 5mL.

$$volume = \frac{required}{stock} \times \frac{stock\ volume}{1} = \frac{270}{125} \times \frac{5}{1} mL = \frac{1350}{125} mL = \frac{270}{25} mL = \frac{54}{5} = 5\overline{)54.0} = 10.8mL$$

Answer: the child requires a dose of 10.8mL.

Exercises

1. A patient is ordered an injection of 80 mg of pethidine. Each stock ampoule contains 100 mg per 1 mL. How much will you draw up for the injection?

2. A child requires 50 milligrams of Phenobarbitone. If stock ampoules contain 200 milligrams in 2 mL, How much will you draw up?

3. What volume is required for the injection if a patient is ordered 500 mg of capreomycin sulphate, and each stock ampoules contains 300 mg/mL?

4. A patient needs 5000 mg of medication. Stock solution contains 1 g per 1 mL. What volume is required?

5. A teenager is prescribed 1000 mg of chloramphenicol. Stock on hand contains 250 mg/10 mL in suspension. Calculate the volume required.

6. A patient is prescribed 3g of sulphadiazine, and the stock contains 600 mg/5 mL. How much sulphadiazine should be given to the patient?

7. How many 300 mg tablets should be administered for a prescribed dose of 450 mg?

8. How many 25 mg tablets are required for a prescribed dose of 0.05 g?

9. Calculate the size of a single dose if a child weighing 20 kg is ordered flucloxacillin 100 mg/kg/day, 4 doses per day.

10. A doctor orders penicillin V potassium oral suspension 56 mg/kg/day in four doses per day for a child who weighs 25 kg. The suspension available is 125 mg/5 mL. What volume should be administered at each dose?

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 = 20 kg x 100 mg each kg = 2000 mg

Strength required per dose = 2000 mg ÷ 4 = 500 mg

10. Strength required per day = 25 kg x 56 mg each kg = 1400 mg

Strength required each dose = 1400 mg ÷ 4 = 350 mg

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

For more information

Visit our intro to maths page on the Charles Sturt Student Portal where you can access more mathematics and numeracy resources, find and register for our Enhancing Numeracy workshops or make a 1:1 appointment with our numeracy advisers.

References

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

Gatford, J. D., & Phillips, N. (2011). *Nursing calculations* (8th ed.). Churchill.