



DRUG CALCULATIONS



HOW TO SOLVE DRUG CALCULATIONS

- Identify what type of drug calculation and as a first step, use common sense to estimate a rough answer. In many cases, drawing a picture that visually represents the problem is often a helpful strategy.

- Remember that a formula often used for working out how many tablets to take or for a drug taken orally or injected is:

$$\text{VOLUME REQUIRED} = \frac{\text{STRENGTH REQUIRED (SR)}}{\text{STOCK STRENGTH (SS)}} \times \frac{\text{VOLUME OF STOCK}}{1}$$

TIP: An easy way to remember this formula is **SUNRISE (SR) / SUNSET (SS)**

- Remember that a formula often used to work out the number of drops per minute delivered by an intravenous infusion is:

$$\text{DRIP RATE (DPM)} = \frac{\text{VOLUME (mL)} \times \text{DROPS/mL}}{\text{TIME (h)} \times 60}$$

NOTE: DPM stands for **drops per minute**

- Remember that for intravenous infusion, sometimes you are asked to calculate volume, time, or rate, and the following formulae can be useful:

$$\text{VOLUME (mL)} = \text{RATE (mL/h)} \times \text{TIME (h)}$$

$$\text{RATE} = \frac{\text{VOLUME (mL)}}{\text{TIME (h)}}$$

$$\text{TIME} = \frac{\text{VOLUME (mL)}}{\text{RATE (mL/h)}}$$

- After applying the formula (if relevant), or calculating an exact answer using common sense, go back and check: is your final answer close to your initial estimate? If not, why not?

EXAMPLE 1: DRUG MADE UP FROM STOCK SOLUTION

This example illustrates how to work out injections or orally taken drugs made up from stock solution – for example, working out how many mLs to inject when the drug is in a stock solution.

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

TO SOLVE: We'll be using this formula:

$$\text{VOLUME REQUIRED} = \frac{\text{STRENGTH REQUIRED (SR)}}{\text{STOCK STRENGTH (SS)}} \times \frac{\text{VOLUME OF STOCK}}{1}$$

- Note down the strength of medication the patient needs and the stock strength:

Strength Required is 70 mg, **Stock Strength** is 10g in 200 mL

At this point our rough answer is – More than 1 mL and a lot less than 200mL.

- Since you need units to be the same, convert 10 g to mg by multiplying by 1000. e.g. $1000\text{mg} \times 10 = 10,000\text{mg}$ ($10,000\text{mg} = 10\text{g}$)

- Now put the values into the above for.

Note that 70mg (what the patient needs) is a very small part of 10,000mg – so expect your answer in mL to be much less than 200mL

$$\text{VOLUME REQUIRED} = \frac{70}{10000} \times \frac{200}{1} \text{ mL} = \frac{14000}{10000} = \frac{14}{10} \text{ mL} = 1.4\text{mL}$$

VISUAL REPRESENTATION

10,000mg PETHIDINE in 200mL solution

CONVERSION TIP:

g $\xrightarrow{\times 1,000}$ mg $\xrightarrow{\div 1,000}$ g

ANSWER: Based on the above, your answer = **1.4mL**



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EXAMPLE 2: INTRAVENOUS INFUSION

This example indicates how many mLs to give in a certain time, and how many drops per minute a patient will receive.

QUESTION: A teenager who is badly dehydrated is to receive 1.5 L over 10 hours of rehydration fluid by IV infusion. The giving set delivers 20 drops/mL. Calculate the drip rate.

TO SOLVE: We'll be using this formula – remember that DPR stands for 'drops per minute'

$$\text{DRIP RATE (DPM)} = \frac{\text{VOLUME (mL)} \times \text{DROPS/mL}}{\text{TIME (h)} \times 60}$$

- Note down the key figures in the above scenario

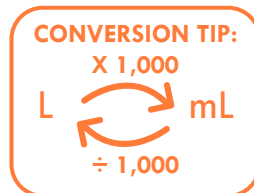
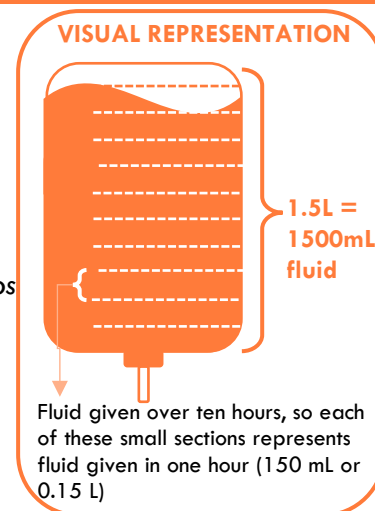
Volume is 1.5 L, **Drops/mL** is 20 and **Time (h)** is 10

Rough answer? Since the drops per mL is 20, and there are 60 minutes in an hour, you'll calculate an answer in drops per mL by multiplying the fluid per hour by $20/60 = 1/3$. So one-third of your mL per hour (150 mL) should be your answer – i.e. 50 mL.

- Notice units of rehydration fluid (L) different from giving set (mL), so convert 1.5L to mL by multiplying by 1000: e.g. $1.5 \times 1000 = 1500$ ($1,500\text{mL} = 1.5\text{L}$)

- Put the values into the above formula:

$$\text{DRIP RATE (DPM)} = \frac{1500\text{mL} \times 20}{10 \times 60} = \frac{150 \times 2^{+2}}{1 \times 6^{+2}} = \frac{150 \times 1}{1 \times 3} = \frac{150}{3} = 50 \text{ dpm}$$



ANSWER: Based on the above, your answer = 50 dpm (which matches the initial estimate)

EXAMPLE 3: TABLETS TAKEN ORALLY

This example illustrates how to calculate how many tablets to give for a certain dose.

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

TO SOLVE: We'll be using this formula:

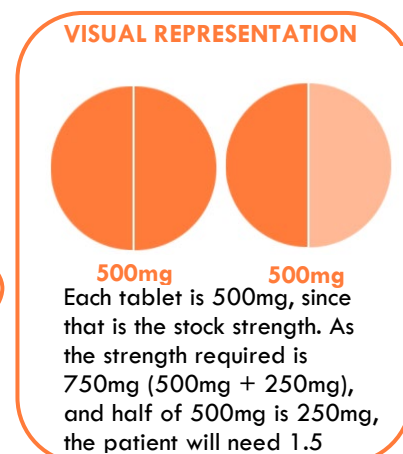
$$\text{VOLUME REQUIRED} = \frac{\text{STRENGTH REQUIRED (SR)}}{\text{STOCK STRENGTH (SS)}} \times \frac{\text{VOLUME OF STOCK}}{1}$$

- Note down the key figures in the above scenario – the units are the same so we won't need to convert
Strength Required is 750 mg, **Stock Strength** is 500mg

Rough answer? Tablets are 500mg so we'll need more than one tablet but less than two.

- Put the values into the above formula
Note – when administering tablets, the volume of stock is always 1, since the tablets are not supplied in a solution.

$$\text{VOLUME REQUIRED} = \frac{750}{500} \times \frac{1}{1} = \frac{750}{500} = \frac{3}{2} = 1.5 \text{ tablets}$$



ANSWER: Based on the above, your answer = 1.5 tablets



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EXAMPLE 5: INTRAVENOUS INFUSION

This example illustrates how to calculate how much fluid a patient receives.

QUESTION: A patient is receiving 100 mL/h of a solution for 1.5 hours. How much fluid are they receiving?

TO SOLVE: Note, you're asked for the **volume** of fluid (how many mL the patient gets in total), rather than the drip rate, so we'll be using the below formula:

$$\text{VOLUME (mL)} = \text{RATE (mL/h)} \times \text{TIME (h)}$$

- Note down the key figures in the above scenario

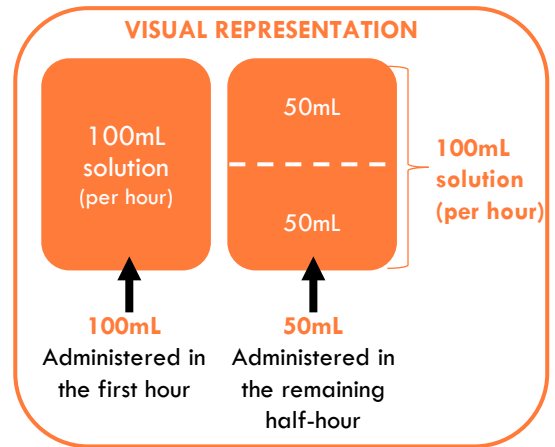
Rate is 100 mL/h, **Time** is 1.5h

Rough answer? If the patient gets 100 mL in an hour they would get half of that (50 mL) in half an hour so expected answer is 150 mL.

- Put the values into the above formula:

$$\text{VOLUME (mL)} = 100\text{mL} \times 1.5 = 150\text{mL}$$

ANSWER: Based on the above, your answer = **150mL** (which matches the initial estimate)



EXAMPLE 5: INTRAVENOUS INFUSION

This example illustrates how to work out how long an infusion will take.

QUESTION: A patient is prescribed 2 L of a dextrose saline solution. The flow rate is set at 160 mL/h. How long will the infusion take?

TO SOLVE: We'll be using this formula:

$$\text{TIME} = \frac{\text{VOLUME (mL)}}{\text{RATE (mL/h)}}$$

- Note down the key figures in the above scenario

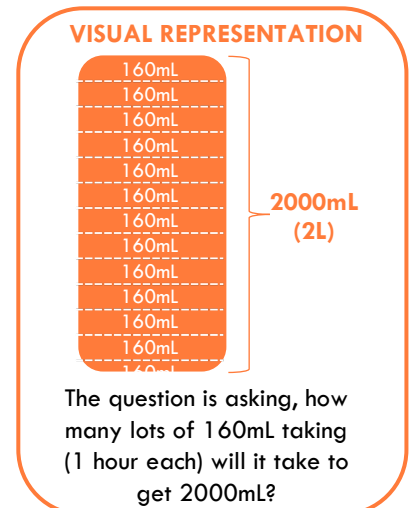
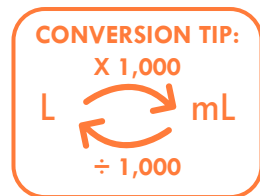
Volume is 2 L, **Rate** is 160mL/h

- Notice units of saline (L) different from mL used in flow rate, so convert 2 L to mL by multiplying by 1000. e.g. $2 \times 1000 = 2000$ ($2,000\text{mL} = 2\text{ L}$)

Rough answer? Since $2\text{ L} = 2000\text{ mL}$ and the flow rate is 160 mL per hour, you need to work out how many lots of 160 mL add up to 2000 to get your answer. A rough guess could be between 10 and 15 hours.

- Put the values into the above formula

$$\text{TIME} = \frac{2000}{160} = \frac{200 \div 4}{16 \div 4} = \frac{50 \div 2}{4 \div 2} = \frac{25}{2} = 12.5 \text{ hours}$$





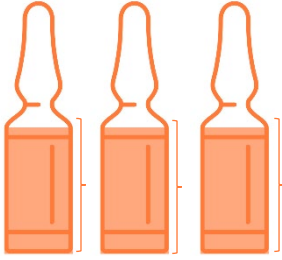
EXAMPLE 6: DILUTION

This example illustrates how to dilute a drug to the required concentration.

QUESTION: Prepare a morphine infusion 30 mg to be made up to a final volume of 30 mLs. Stock ampoules of morphine contain 10 mg/mL. A strength of 1mg/mL is required. How much normal saline would need to be added to the syringe?

TO SOLVE:

1. Note that the stock ampoules of morphine each contain **10 mg** morphine, therefore you will need **3 stock ampoules** to get **30 mg** ($3 \times 10 = 30$).
2. Those three stock ampoules come in a total of **3 mL** of solution ($1 \text{ mL} + 1 \text{ mL} + 1 \text{ mL} = 3 \text{ mL}$). So, just from your stock, you have **30 mg** morphine in **3 mL** solution.
3. You need **30mg** morphine in **30mL** solution so to top this up, you add **27mL** of saline to the syringe. ($30 - 3 = 27$)



10mg morphine in 1mL solution

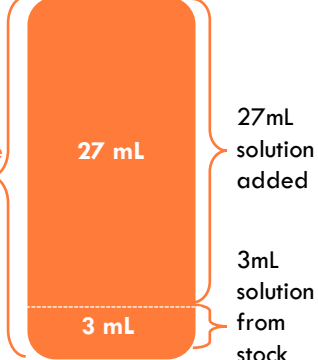
3x stock ampoules of morphine

VISUAL REPRESENTATION

There is 10 mg morphine in each stock ampoule, so you need 3 stock ampoules ($3 \times 10 \text{ mg} = 30 \text{ mg}$) to get the required 30 mg morphine.

These stock ampoules come in a total of 3 mL of solution ($1 \text{ mL} + 1 \text{ mL} + 1 \text{ mL} = 3 \text{ mL}$).

Since you need your 30 mg to be in 30 mL of solution, you need to add $30 - 3 = 27 \text{ mL}$ saline to the syringe



30mg morphine in 30mL solution

27 mL

27mL solution added

3 mL

3mL solution from stock



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EXERCISES



Complete the below exercises to test your skills and see what you've learnt!

EXERCISE SET 1

- How much is drawn from a patient ordered an injection of 80 mg of pethidine? Each stock ampoule contains 100 mg per 1 mL.
- A child requires 50 milligrams of Phenobarbitone. If stock ampoules contain 200 milligrams in 2 mL, how much will you draw up?
- What volume is required for the injection if a patient is ordered 500 mg of capreomycin sulphate, & each stock ampoules contains 300 mg/mL?
- A patient needs 5000 mg of medication. Stock solution contains 1 g per 1 mL. What volume is required?
- If 1000 mg of chloramphenicol is given & stock on hand contains 250 mg / 10 mL in suspension, calculate the volume required.
- A patient is prescribed 3 g of sulphadiazine, the stock contains 600 mg / 5 mL. How much stock should be given to the patient?
- Complete the following table:

	STRENGTH REQUIRED	STOCK	VOLUME REQUIRED
a)	1000 U	1000 U / 2 mL	
b)	1.25 micrograms	2.5 micrograms / 1 mL	
c)	20 mg	100 mg / 50 mL	
d)	1 megaunit	1 megaunit / 10 mL	
e)	4 g	1 g / 5 mL	

EXERCISE SET 2

- 500 ml is to infuse over a 5 hour period. Find the flow rate in mL/h.
- Mr Smith is to receive 800 mL of an antibiotic via an IV infusion over 15 hours. Calculate the flow rate to be set.
- An infusion is to run for 30 minutes and is to deliver 200 mL. What is the rate of the infusion in mL/h?
- Calculate the flow rate if 1.2 L is to be infused over 24 hours.
- An order states that 500 mL albumin 5% is to be given in 4 hours. What is the flow rate that should be set?

ANSWERS

SET 2	1) 100mL/h	2) 53mL/h	3) 400mL/h	4) 50mL/h	5) 125mL/h
SET 1:	1) 0.8mL	2) 0.5mL	3) 1.7 mL	4) 5mL	5) 40mL
	7) 2mL	b) 0.5mL	c) 10mL	d) 10mL	e) 20mL