Metric Conversions

Here are some metric weights arranged in size order, starting with the biggest:-

Kg (kilogram) **g** (gram) **mg** (milligram) **mcg** (microgram)

Each one is a thousand (1000) times smaller than the one before.
The same rule applies for the metric volumes below

L (Litre) **ml** (millilitre)

If you want to convert from big to **small** you multiply by 1000 by moving the decimal point 3 places to the right.

If you want to convert from **small** to big you divide by 1000 by moving the decimal point 3 places to the left.

Example 1: Convert 7.5 kg to g **Answer 1:** 7500 g

Example 2: Convert 7280 mcg to mg **Answer 2:** 7.28 mg

Example 3: Convert 1.5 Litres to ml **Answer 3:** 1500 ml

Example 4: Convert 55 ml to Litres **Answer 4:** 0.055 litres

Try the following questions

1) Convert 4.56 g to mg

2) Change 75 mcg to mg

3) Convert 0.78 mg to mcg

4) Change 950 mg to g

5) Convert 0.5 Litres to ml

6) Change 452 ml to Litres

Metric Conversions

ANSWERS

1) 4560 mg

2) 0.075 mg

3) 780 mcg

4) 0.95 g

5) 500 ml

6) 0.452 Litres

Giving the Correct Amount of Tablets

You can use the following formula to calculate how many tablets to give

$$\frac{prescription\ for\ the\ patient}{stock\ strength\ available} = tablets\ given$$

Example:
Your patient has been prescribed 400mg ibuprofen. The tablets available are 200mg. How many tablets do you give the patient?

Answer:

$$\frac{400\ mg}{200\ mg} = 2\ tablets$$

Notice that the prescription and stock units (mg) must be the same.

Try the following questions

1) A patient has been prescribed 40 mg. The stock tablets you have are 20 mg. How many tablets do you give the patient?

2) A patient has been prescribed 0.06 mg. The stock tablets you have are 30 mcg. How many tablets do you give the patient?

3) The stock tablets you have are 600 mcg. A patient has been prescribed 1.2 mg. How many tablets do you give the patient?

4) A patient has been prescribed 750 mg TDD (total daily dose). The stock tablets you have are 250 mg. How many tablets do you give the patient in a day?

5) A patient has been prescribed 750 mg TDD in 3 divided doses. The stock tablets you have are 250 mg. How many tablets do you give the patient for a single dose?

6) A patient has been prescribed 200 mg every 4 hours. The stock tablets you have are 100 mg. How many tablets do you give the patient in a day?

Giving the Correct Amount of Tablets

ANSWERS

1) $\frac{40}{20} = 2\ tablets$

2) 0.06 mg = 60 mcg $\frac{60}{30} = 2\ tablets$

3) 1.2 mg = 1200 mcg $\frac{1200}{600} = 2\ tablets$

4) $\frac{750}{250} = 3\ tablets$

5) $\frac{750}{3} = 250\ for\ a\ single\ dose$

$\frac{250}{250} = 1\ tablet$

6) $\frac{24}{4} = 6\ times\ a\ day$

200 x 6 = 1200 mg per day

$\frac{1200}{100} = 12\ tablets\ per\ day$

Giving the Correct Amount for Injection

You can use the following formula to calculate volumes for injection

$$\frac{prescription\ for\ the\ patient\ x\ stock\ volume\ (ml)}{stock\ strength\ available} = volume\ given\ (ml)$$

Example:
Your patient has been prescribed 50mg of pethidine as injection. The stock strength available is 100mg in 1ml. How many ml do you give the patient?
Answer:

$$\frac{50\ mg\ x\ 1\ ml}{100\ mg} = \frac{5}{10} = 0.5\ \text{ml}$$

Notice that prescription and stock units (mg) must be the same.

Try the following questions

1) A patient has been prescribed 2mg of Pethidine. The stock strength you have is 10mg/ml. How many ml do you give the patient?

2) 40 units of Insulin have been prescribed. It is dispensed as 100 units in 1ml. How much do you give?

3) Ampoules of Morphine contain 10mg in 2ml. What volume must be drawn up to give 8mg?

4) The patient needs 250 mcg of Drug X. You have 1 mg in 1 ml. How many ml do you give?

5) 0.6mg of drug X is required. Stock is 0.4 mg in 2 ml. What volume do you give?

6) 0.25g of drug is ordered. Available stock on the ward is 500mg/5ml. Calculate the volume to be drawn up for injection.

7) 0.1 ml is given; it should have been 0.01ml. How many times too much is this?

Giving the Correct Amount for Injection

ANSWERS

1) $\frac{2\ x\ 1}{10} = 0.2\ ml$

2) $\frac{40\ x\ 1}{100} = 0.4\ ml$

3) $\frac{8\ x\ 2}{10} = 1.6\ ml$

4) $\frac{250\ x\ 1}{1000} = \frac{25}{100} = 0.25\ ml$

5) $\frac{0.6\ x\ 2}{0.4} = \frac{6\ x\ 2}{4} = \frac{12}{4} = 3\ ml$

6) $\frac{250\ x\ 5}{500} = \frac{1250}{500} = \frac{250}{100} = 2.5\ ml$

7)10 times too much. Every time the decimal point moves 1 place this is a factor of 10.

Body Weight Calculations (single dose)

To work out the dosage based on the weight of the patient use the following formula

Dosage required = prescription x body weight

Example:
Mrs B has been prescribed Ibuprofen 5mg/kg/dose. She weighs 60 kg. Calculate how much Ibuprofen you will give her.

Answer:

5 mg x 60 = 300 mg

Note, the answer is **never** in kg (this only refers to the body weight)

Try the following questions

1) A patient has been prescribed Erythromycin, 40 mg/kg/dose. He weighs 74 kg. What is the dosage in mg?

2) A male patient weighs 90 kg and has been prescribed, 1.5 mg/kg/dose of drug X. How many mg will he need for a single dose?

3) Cloxacillin, 50 mg/kg/dose has been prescribed to a patient, whose weight is 45 kg.
   a) How many mg are required for a single dose?
   b) How many grams is this?

4) A female patient has been prescribed Chloramphenicol, 40 mg/kg/dose. She weighs 78 kg. How many grams of the drug does she require for each dose?

5) A patient weighs 60kg and requires 40 mcg/ kg of a drug.
   a) How many mcg are required?
   b) How many mg is this?

6) A patient who is 5 years old and weighs 20 kg has been prescribed 5 mcg per kilogram body weight of Digoxin elixir. The Digoxin elixir is available as 50 mcg per ml.
   a) How many mcg does the patient require per single dose?
   b) What volume will you give the patient at each dose?

Body Weight Calculations (single dose)

ANSWERS

1) 40 x 74 = 2960 mg

2) 90 x 1.5 = 90 + 45 = 135mg

3a) 50 x 45 = 2250mg

3b) 2.25 g

4) 78 x 40 = 3120mg = 3.12 g

5a) 60 x 40 = 2400mcg

5b) = 2.4 mg

6a) 20 x 5 = 100mcg

6b) $\frac{100}{50}$ x 1 = 2 ml

Body weight calculations (TDD and divided doses)

Sometimes the dose of a drug is written as a **T**otal **D**aily **D**ose (**TDD**) usually given in 3 or 4 **divided doses**.
It is very important that you notice the difference between a **TDD** and a single dose otherwise you could give 3 or 4 times too much!
Also you need to know that **bd** means twice a day, **tds** means 3 times a day and **qds** means 4 times a day.
Sometimes medicines are given every 4 hours (6 times a day).

Example: Mrs B has been prescribed Ibuprofen 5mg/kg/day in 3 divided doses. She weighs 60 kg.
a) Calculate her daily dose.
b) Calculate a single dose
Answer:
a) TDD = dose x body weight = 5 mg x 60 = 300 mg/day

b) Single dose = $\frac{TDD}{3} = \frac{300}{3}$ = 100mg/single dose

Try the following questions

1) Mrs K has been prescribed Amoxicillin, 45 mg/kg/day and she weighs 50 kg. How many mg of Amoxicillin will you give her for the whole day?

2) A patient, whose weight is 67.5 kg, has been prescribed Drug X, 10 mg/kg/day in 3 divided doses.
   a) Calculate his **TDD**.
   b) Calculate the single dose.

3) A patient has been prescribed Capreomycin sulphate, 5 mg/kg **qds**. He weighs 94 kg. What is his total daily dose?

4) A patient has been prescribed Cephalothin, 20 mg/kg **tds**. She weighs 67 kg, what will be her total daily dose in grams?

5) A patient has been prescribed Chloramphenicol, 45 mg/kg/day in 4 divided doses. She weighs 70 kg.
   a) What is her **TDD**?
   b) What is the single dose?

Body weight calculations (TDD and divided doses)

ANSWERS

1) 45 x 50 = 2250 mg

2a) 67.5 x 10 = 675 mg per day

2b) $\frac{675}{3} = 225$ mg per single dose

3) 5 x 94 x 4 = 94 x 20 = 1880 mg

4) 20 x 67 x 3 = 67 x 60 = 4020 mg = 4.02 g

5a) 45 x 70 = 3150 mg TDD

5b) 3150 ÷ 4 = 787.5 mg

Infusion Rate Calculations (ml/hour)

$$\frac{Volume\ required\ for\ the\ patient\ (ml)}{Time\ (hours)}$$

Example: A patient is to receive 4 Litres of normal saline over the next 8 hours. What is the infusion rate in millilitres per hour (ml/hour)?

Answer: First convert the 4Litres to ml, which is 4000 ml then substitute it into the formula:

$$\frac{4000}{8} = \frac{2000}{4} = \frac{1000}{2} = \frac{500}{1} = 500 \text{ ml/hour}$$

Try the following questions

1) 800 ml of fluid in a burette is to be infused over 2 hours? What is the infusion rate in millilitres per hour?

2) 500 ml of Hartmann's solution is to be given to a teenager over 8 hours. What is the infusion rate in ml/hour?

3) Over a period of 16 hours, a patient is to receive 2.4 Litres of dextrose 4%. What is the infusion rate in ml per hour?

4) A doctor requests 0.75L of Crystalloid X to be infused over 6 hours using a pump. At what rate in ml/hr should the infusion be administered?

5) Half a litre of Dextrose to be given over 4 hours. What is the rate in ml/hour?

6) The doctor prescribes 1000 ml of 5% Dextrose in normal saline to be infused over 6 hours. How many ml per hour is this?

7) A patient receives 50ml of saline in half an hour. What is the rate in ml/hour?

8) What is the rate in ml/hour for 20 ml of fluid to be given over a quarter of an hour?

Infusion Rate Calculations (ml/hour)

ANSWERS

1) $\frac{800}{2} = 400$ ml/hour. Remember you must include the unit, ml/hour for a full and correct answer.

2) $\frac{500}{8} = \frac{250}{4} = \frac{125}{2} = \frac{62.5}{1}$ = 62.5 Now round your answer to a whole number = 63 ml/hour

3) 2.4 Litres = 2400 ml, $\frac{2400}{16} = \frac{1200}{8} = \frac{600}{4} = \frac{300}{2}$ = 150 ml per hour. Notice how the 4% is irrelevant to this question so you do not need it in your calculation.

4) 0.75 L = 750 ml. $\frac{750}{6} = \frac{375}{3}$ = 125 ml/hour

5) $\frac{500}{4} = \frac{250}{2}$ = 125 ml/hour

6) $\frac{1000}{6} = \frac{500}{3}$ = 166.666...round up to 167 ml/hour

7) 50 ml in HALF an hour = 100 ml in 1 hour. So the rate is 100ml/hour

8) 20 ml x 4 (as there are 4 quarters in an hour) = 80 ml /hour

Infusion Rate Calculations (drops/minute)

$$\frac{volume\ required\ (ml)}{hours}\ x\ \frac{drop\ factor}{60}$$

Example: A patient is to receive 1 Litre normal saline over the next 4 hours. What is the infusion rate in drops per minute if the drop rate is 15?

Answer: First convert 1L to ml, which is 1000 ml, and then substitute into the formula:

$$\frac{1000}{4} x \frac{15}{60} = \frac{1000}{4} x \frac{1}{4} = \frac{1000}{16} = \frac{500}{8} = \frac{250}{4} = \frac{125}{2} = 62.5$$

Remember to round your answer to the nearest whole number = 63 drops per minute.

Try the following questions

1) Half a litre of fluid is to be given over 5 hours. What is the infusion rate in drops per minute if the drop factor is 15?

2) A young woman is to be given 480 ml of metronidazole 500 mg over 4 hours. What is the infusion rate in drop per minute if the drop factor is 20?

3) Over the next 15 hours a male patient is to receive $4\frac{1}{2}$ litres of dextrose 5%. What is the infusion rate in drop per minute if the drop factor is 20?

4) A patient is to receive 500 ml of dextrose 5% over 2 hours. What is the infusion rate in drops per minute if the drop factor is 20?

5) A female patient is to receive $2\frac{1}{2}$ litres of fluid over 10 hours. What is the infusion rate in drops per minute if the drop factor is 15?

6) One unit of blood (500 ml) is to infuse over 4 hours. What is the flow rate if the drop factor of the giving set is 15 drops/ml?

Infusion Rate Calculations (drops/minute)

ANSWERS

1) $\frac{1}{2}$ Litre = 500 ml. $\frac{500}{5} \times \frac{15}{60} = \frac{100}{1} \times \frac{1}{4} = \frac{100}{4} = 25$ drops/minute

2) $\frac{480}{4} \times \frac{20}{60} = \frac{120}{1} \times \frac{1}{3} = \frac{120}{3}$ = 40 drops/minute

Note: you are not being asked about the metronidazole so don't use the 500mg.

3) $\frac{4500}{15} \times \frac{20}{60} = \frac{4500}{15} \times \frac{1}{3} = \frac{4500}{45}$ = 100 drops per minute

Please note that you have not been asked about the strength of the dextrose solution so don't use the 5%.

4) $\frac{500}{2} \times \frac{20}{60} = \frac{250}{1} \times \frac{1}{3} = \frac{250}{3}$ = 83.333 = 83 drops/min.

5) $\frac{2500}{10} \times \frac{15}{60} = \frac{250}{1} \times \frac{1}{4} = \frac{250}{4}$ = 62.5 = 63 drops per minute

6) $\frac{500}{4} \times \frac{15}{60} = \frac{125}{1} \times \frac{1}{4} = \frac{125}{4}$ = 31.25 = 31 drops/min

Calculating Infusion Times

To calculate the time an infusion will run for, use the following formula:

$$\frac{Volume\ to\ be\ infused\ (ml)}{rate\ (ml\ per\ hour)}$$

Example:

A patient is given 2 litres of Saline at a rate of 125 ml/hour. How long (hours) will the infusion last for?

Answer:

$\frac{2000}{125} = \frac{400}{25} = \frac{80}{5}$ = 16 hours

Try the following questions

1) 800 ml of blood is to be given to a patient at the rate of 160 ml per hour. How long will the infusion last?

2) Half a Litre of solution is given at a rate of 125ml/hour. How long will the infusion last for?

3)1 Litre of solution is running at a rate of 80 ml/hour. How long will the infusion last for? Give your answer in hours and minutes

4) A patient receives 200 ml of fluid at a rate of 400 ml/hour. What is the duration of the infusion?

5) An infusion of 1200 ml Dextrose 5% is started at 10 am. When will the infusion finish if it is running at a rate of 100 ml/hour? Give your answer using the 24 hour clock.

6) 4 litres of 0.9% normal saline is administered at a rate of 400ml/hour. After 5 hours the rate is changed to 250 ml/hour.

a) How many hours will the infusion run for at the new rate?
b) What was the total running time for the infusion?

Calculating Infusion Times

ANSWERS

1) $\frac{800}{160} = \frac{80}{16} = \frac{40}{8} = \frac{20}{4}$ = 5 hours

2) $\frac{500}{125} = \frac{100}{25}$ = 4 hours

3) $\frac{1000}{80} = \frac{100}{8} = \frac{50}{4} = \frac{25}{2}$ = 12.5 hours = 12 hours and 30 minutes

Remember that 0.5 of an hour is 0.5 x 60 = 30 minutes.

4) $\frac{200}{400} = \frac{1}{2}$ = half an hour

5) $\frac{1200}{100}$ = 12 hours.

The infusion starts at 10:00 so add 12 hours = 22:00 (10 pm)

6a) 400ml/hour x 5 hours = 2000ml

This means that after 5 hours 2000ml has been infused.

This leaves another 2000ml to run at the new rate of 250 ml/hour.

$\frac{2000}{250} = \frac{200}{25} = \frac{40}{5}$ = 8 hours

6b) So the total time for the infusion is 5 + 8 = 13 hours

Calculating Infusion Volumes

To calculate the volume given in an infusion, use the following formula:

Volume = Rate (ml/hour) x running time (hours)

Example:
A patient is given Saline for 16 hours at a rate of 125 ml/hour. How many Litres of saline will the patient receive?
Answer:

16 x 125 = 2000ml = 2 Litres

Try the following questions

1) Blood is given to a patient at the rate of 160 ml per hour for 5 hours. How much blood will the patient receive? Give your answer in ml.

2) Dextrose 5% solution is given at a rate of 125ml/hour. The infusion lasts for 4 hours. How much Dextrose solution will be infused?

3) Fluid is given at a rate of 80 ml/hour for 12 hours and 30 minutes. How many Litres of fluid will have been infused at the end of the running time?

4) How much fluid is given in half an hour if it is running at a rate of 400 ml/hour?

5) An infusion of Dextrose 5% started at 10:00 and finished at 22:00. How many Litres will have been given if it is running at a rate of 100 ml/hour?

6) 0.9% normal saline is administered at a rate of 400ml/hour for 5 hours after this the rate is changed to 250 ml/hour for the next 8 hours. How many Litres will have been given when the infusion finishes?

Calculating Infusion Volumes

ANSWERS

1) 160 x 5 = 800 ml

2) 125 x 4 = 500 ml

3) 12 hours and 30 minutes = 12.5 hours
12.5 x 80 = 1000ml = 1 Litre

4) 400 x $\frac{1}{2}$ = 200 ml

5) The infusion runs for 12 hours (22:00 - 10:00)
100 x 12 = 1200ml = 1.2 Litres

6) 400 x 5 = 2000ml
and then
250 x 8 = 2000ml
Total amount is 2000 + 2000 = 4000ml = 4 Litres

Working with Percentage Strength

You need to know that 5 % means $\frac{5}{100}$

this means 5 g in 100 ml

Example 1: How many grams of Dextrose will a patient receive from 2 litres of 5% Dextrose solution? (This is an example of a w/v, weight per volume question).

Answer 1:

$$\frac{2000\ x\ 5}{100} = 100\ g\ of\ dextrose$$

Example 2: You have a cream that is 8% zinc oxide. How many grams of zinc oxide are there in a 30g tube of cream? (This is an example of a w/w, weight per weight question).

Answer 2:

$$\frac{30\ x\ 8}{100} = 2.4\ g\ of\ zinc\ oxide$$

Try the following questions

1) A patient is given 1 litre of 5% dextrose. How many grams of dextrose do they receive?

2) A patient is given half a litre of 0.9% normal saline solution over 6 hours, how much sodium will they get?

3) A patient is given 2 litres of 0.45% saline. How many grams of sodium will the patient receive?

4) Which is stronger 0.9% Normal saline or 0.45% Normal saline?

5) How many grams of dextrose are needed to make up 2 Litres of 5% solution?

6) How many grams of medication do you have in 20g of 12% w/w ointment?

Working with Percentage Strength

ANSWERS

1) $\frac{1000\ x\ 5}{100} = 50g$

2) $\frac{500\ x\ 0.9}{100} = \frac{5\ x\ 0.9}{1} = 4.5\ g$

Note that you do not use the 6 hours in this calculation.

3) $\frac{2000\ x\ 0.45}{100} = 20\ x\ 0.45 = 2\ x\ 4.5 = 9g$

4) 0.90 is bigger than 0.45 so 0.9% is stronger

5) $\frac{2000\ x\ 5}{100} = 100g$

6) $\frac{20\ x\ 12}{100} = 2.4\ g$

Solution Strength (mg/ml)

You need to know;

1 in 1000 = 1g in 1000ml
1 in 10 000 = 1 g in 10 000ml

Example 1: You have 2 solutions of Adrenaline: 1 in 1000 and 1 in 10 000
a) What is the concentration in mg/ml?
b) Which solution is the weakest?

Answer 1:

a) 1 g in 1000 ml = 1000 mg in 1000ml: $\frac{1000\ mg}{1000\ ml} = 1mg/ml$

1 g in 10 000 ml = 1000mg in 10 000 ml: $\frac{1000\ mg}{10\ 000\ ml} = 0.1\ mg/ml\ or\ 1mg\ in\ 10\ ml$

b) The 1 in 10 000 solution is the weakest

Example 2: You have 20 mg of drug in 8 ml. What is the concentration in mg/ml?

Answer 2:

$$\frac{20\ mg}{8\ ml} = 2.5\ mg/ml$$

Try the following questions

1) 500 mg of amoxicillin powder is dissolved in 25 ml of water. What is the concentration in mg/ml?

2) A syringe contains 20 mg of morphine in 4 ml. What is the concentration in mg/ml?

3) You have 1 gram of drug in 20 ml of fluid. What is the strength in mg/ml?

4) A patient requires 3 mg of Epinephrine by IM. You have the choice of a 1:1000 or a 1:10 000 solution.
a) Calculate how many ml is required for each solution.
b) Which solution is more suitable for injection?

5) Patient X requires 0.2 mg of 1 in 1000 Adrenaline. How many ml do you give?

Solution Strength (mg/ml)

ANSWERS

1) $\frac{500}{25} = 20\ mg/ml$

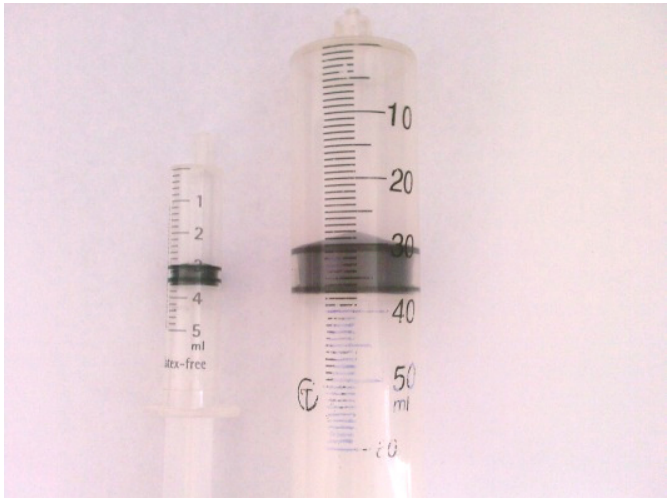
2) $\frac{20}{4} = 5\ mg/ml$

3) 1g = 1000mg $\frac{1000}{20} = 50\ mg/ml$

4a) $\frac{3\ x\ 1000}{1000} = 3\ ml$ for the 1 in 1000

4a) $\frac{3\ x\ 10000}{1000} = 30\ ml$ for the 1 in 10000

4b) The 1 in 1000 is more suitable for injection (much less fluid) as you can see from the picture below.



5) $\frac{0.2\ x\ 1000}{1000} = 0.2\ ml$