Nursing Maths

Pukamahi Whā (Workbook 4)

Ngā Ōwehenga, Ngā Tātaitanga Pūroi, me Ngā Pāpātanga

(Ratios, Drug calculations and Rates,- Infusions)

Student Name: _____

My Tutor: ……

Office: ……

Phone: ……

Email: ……..@unitec.ac.nz

My Class times:

Day			
Room or online?			
Time			

Assessment Dates

The Weekly Assessment Schedule can be found on the Nursing Maths Moodle page, (in the Assessments section). This is where you can find any updates. As every cohort has a different timetable, ask your lecturer for the exact day of your assessment in the week given.

Maths help is available from the **Academic Support Lecturers:** Lance Laulala (llaulala@unitec.ac.nz) & Margaret Evans. To make an appointment phone student support 0800 10 7510 or drop in ask at the ASKMe desk (check opening hours) or email mevans@unitec.ac.nz to make a time. Alternatively, book online at https://guides.unitec.ac.nz/labookings/numeracys

Another source of maths help is the web based on-line maths resources. Links to a selection of these are found at the UNITEC library webpage under "DIY Maths" found under "library guides" of the UNITEC library site. Visit http://libguides.unitec.ac.nz/DIYmaths

A very good website to practice metric conversions, infusions and drug calculations is http://www.testandcalc.com/quiz/index.asp
You can practice some nursing calculations by doing the assessment at http://www.nursingnumeracy.info/page11/page5/page5.html (will not work on Apple devices)

Nursing Calculations Textbook
Resource Link: Nursing Calculations by JD Gatford and N.M. Phillips can be accessed online at the Unitec Library at https://www-clinicalkey-com-au.libproxy.unitec.ac.nz/nursing/#!/browse/book/3-s2.0-C20130194937 (This link is also on Moodle)

Contents

MEASUREMENT REVIEW

Measurement Conversions

Remember:

1. What is the conversion factor? How many _____ in a _____

2. Do I need more or less? Do I multiply or divide?
   The bigger the unit the less you need (to divide, move the decimal point to the left)
   The smaller the unit the more you need (to multiply, move the decimal point right)

3. Move the decimal point the number of places corresponding to the number of zeros in the conversion factor.

4. **Hints**
   - Remember the prefixes: milli = 1/1000; centi = 1/100; kilo = 1000
   - Remember this sequence, we get 1000 times smaller each step:
     kilogram→ gram → milligram → microgram → nanogram)

Example: 230mcg = _____ mg?

1. How many mcg in a mg? There are 1000 mcg in one mg

2. mg is a bigger unit than mcg so I need less, i.e. I divide.

3. 230 ÷ 1000 = 0.23 This means that 230mcg = 0.23mg

Exercise 1

1. Write in grams:

	A	B	C
1	2.8kg	6.7kg	8.2kg
2	0.06kg	0.17kg	0.004kg
3	6500mg	4320mg	6740mg
4	325mg	563mg	745mg
5	20mg	5mg	67mg
6	23000mcg	460000mcg	2600mcg

MEASUREMENT REVIEW

2. Write in milligrams

	A	B	C
1	6g	3g	14g
2	4.5g	3.24g	7.53g
3	0.62g	0.57g	0.98g
4	0.006g	0.02g	0.074g
5	935mcg	254mcg	9823mcg
6	3500mcg	23mcg	57mcg
7	2mcg	3.4mcg	6.42mcg

3. Write in micrograms

	A	B	C
1	0.354mg	35mg	0.098mg
2	23ng	687ng	35.6ng
3	2.3g	0.08g	0.642g

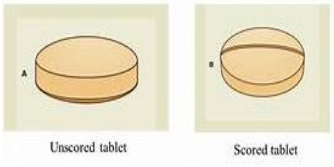
Look again at Nursing Calculations Pages 15 and 17, 1C and 1D
Look again at the exercises in Workbook 2.
Use the drills at the end of this workbook.

A good website to practice metric conversions is
http://www.testandcalc.com/quiz

TABLET CALCULATIONS

Oral Medication, Tablet Form

A Calculating how many single strength tablets are required.
(Scored tablets can be broken in half.).



Example: A patient is ordered **0.75 g** medication. Tablets are **500mg**.
How many tablets does the patient need?

Answer: Step 1: Tablets and prescription will need to be in the same measurement units.

Convert to the smaller unit (mg)
0.75g = 0.75 × 1000 = 750mg So the patient has been ordered 750mg.

Step 2: How many 500mg tablets to make 750mg?

Half of 500mg = 250mg.
500mg + 250mg = 750mg.

So 1½ tablets are required.

The maths formula for this is: **prescription ÷ tablet strength**

$\frac{750}{500} = \frac{75}{50} = \frac{3}{2} = 1\frac{1}{2}$ tablets.

Do Nursing Calculations Page 49 ex 2A

Exercise 2

1. A tablet contains 500mg of Lasix. The daily dose is 1g. How many tablets would you prescribe?

2. A tablet contains 0.25mg of digoxin. The daily dose is 125mcg. How many tablets would you prescribe?

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

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

TABLET CALCULATIONS

5. How many Lanoxin tablets containing 62.5mcg of digoxin will be required for a dose of 0.125mg digoxin?

6. A patient required Digoxin. Each tablet contains 0.125mg of Digoxin. How many tablets are given to a patient who requires

   a) 0.25mg of Digoxin

   b) 2mg of Digoxin

   c) 62.5mcg of Digoxin

7. A patient swallows 2½ Digoxin tablets (as in question 6). How many **micrograms** of Digoxin has been taken?

B Combinations of different strength tablets
The number of tablets should be as few as possible.

Only whole tablets may be used.

8. Complete this table:

Prescribed amount	Stock tablets on hand	Best combination of tablets
a) 50mg	2mg, 5mg, 20mg, 40mg	
b) 13mg	1mg, 5mg, 8mg, 10mg	
c) 18 mg	4mg, 10mg, 20mg	

Do Nursing Calculations Page 51 ex 2B

TABLET CALCULATIONS (Extension Work)

Sometimes a dosage is dependent on the weight of the patient.

Example: A 40kg dog needs a course of antibiotics. The recommended daily dose is 10mg/kg of body weight. Tablets are 100mg. How many tablets does the dog need per day?

Answer: For 40kg, the dog needs $10 \times 40 = 400$mg. Each tablet is 100mg so he needs 4 tablets.

Example: A Chihuahua weighs 2kg and requires a drug at a dose of 4mg/kg/day. Tablets contain 8mg. How many tablets are required per dose if they are administered b.i.d. (twice daily)?

Answer: For 2kg, the dog needs $4 \times 2 = 8$mg.
If this is needed b.i.d. each dose will be $8 \div 2 = 4$mg.

A tablet contains 8mg so the dog needs ½ tablet per dose.

Exercise 3

1. A drug is available in tablets which should be administered at a dose rate of 3mg/kg.
   Tablets are 30mg.
   How many tablets are needed for an animal weighing:
   a) 20kg? b) 60kg?

2. A 20kg animal requires a drug at the rate of 5mg/kg/day.
   The drug is supplied as a 50mg tablet.
   How many tablets are required for 7 days of treatment?

3. A 1kg kitten requires 60mg/kg/day of a drug.
   The total course of treatment requires an intake of 0.3g.
   Each tablet contains 30mg.
   a) How many tablets are needed per day?

   b) How many days of treatment are needed?

4. An 18kg animal is prescribed 5mg/kg/day to be administered t.i.d. (3x daily)
   Tablets contain 15mg.
   How many tablets should be given per dose?

5. A dog weighs 35kg and requires medication at a dose rate of 40mg/kg. Tablets contain 280mg.
   How many tablets are needed?

RATIOS

A ratio is a comparison of two (or more) quantities in fixed proportion to each other.
A ratio takes the form of whole numbers separated by a colon.
The numbers are expressed in the same units.

Example 1:
The ratio of red blood cells to white blood cells is
350,000 : 500
ie. There are 350,000 red blood cells to every 500 white blood cells.

Note that the wording is important, the ratio must be written the right way round.

The terms of a ratio can all be multiplied or divided by any number (except zero) to make an equivalent ratio, just as we did with fractions. Generally, we give ratios in their simplest form with whole numbers.

i.e. 350,000 : 500 (divide by 100)
= 3,500 : 5 (divide by 5)
= 700 : 1
So for every 700 red blood cells there is 1 white blood cell

Example 2:
A test tube contains 6 mL serum and 9 mL saline.
a) What is the serum to saline ratio?
b) What fraction of the solution is serum?

Answer
a) serum : saline = 6 : 9 (Simplify by ÷ 3)
= 2 : 3
b) There is 15mL (6mL + 9mL) in the test tube altogether. So the fraction of serum is
$\frac{6}{15} = \frac{2}{5}$

Example 3:
A recipe for strawberry cooler is 4 cups strawberries, 1 cup orange juice, ½ cup sugar, 1 Tbs lemon juice, 1 cup butter milk, 1½ Tbsp cornflour.

(a) What is the ratio of sugar to strawberries?
(b) If there were only 2 cups of strawberries, what would be the amount of the rest of the ingredients?

Answer
(a) Sugar : strawberries = $\frac{1}{2}$: 4
= **1:8 (always express ratios as whole numbers)**

(b) ½ cup orange juice, ¼ cup sugar, ½ Tbsp lemon juice, ½ cup buttermilk, ¾ Tbsp cornflour

RATIOS

Exercise 4

In each of the following, which is the strongest solution? Choose a, b or c for each question.

1.	a) 1:5	b) 1:50	c) 1:500
2.	a) 1:1000	b) 1:500	c) 1:300
3.	a) 1:10	b) 1:20	c) 1:100
4.	a) 1:3	b) 1:2	c) 1:5
5.	a) 1:1000	b) 1:100	c) 1:10
6.	a) 1:50	b) 1:10	c) 1:60
7.	a) 1:250	b) 1:10,000	c) 1:100
8.	a) 1:40	b) 1:3	c) 1:80
9.	a) 1:1	b) 1:20	c) 1:100
10.	a) 1:12	b) 1:120	c) 1:6

Exercise 5

Write the ratios below in their simplest form:

	A	B	C
1	5 : 15	2 : 38	25 : 50
2	6 : 90	12 : 50	35 : 77
3	85 : 20	140 : 36	12 : 4
4	2 : 4 : 12	15 : 5 : 20	24 : 40 : 16

RATIOS

Exercise 6

Write the ratios below in their simplest form:

	A	B	C
1	1cm: 1mm	5cm : 2m	1500mm : 2m
2	2kg : 500g	1kg : 450g	6kg : 2400g
3	5mg : 100mcg	10g : 250mg	780mcg : 1mg
4	15g : 1500mg	600mg : 1.2g	300mcg : 1mg
5	1 minute : 1 second	1 hour : 3 minutes	15 seconds : ½ minute

Exercise 7

(1) A breeder of budgerigars notes the ratio of colours of birds born yellow : blue : other colours = 5 : 3 : 2.

(a) What colour is most common?

(b) What fraction of the birds is yellow?

(c) What fraction of the birds is blue?

(2) A class contains 14 boys and 16 girls.

(a) What is the ratio of boys to girls?

(b) What is the ratio of boys to the total number of students?

(c) What fraction of the class is boys?

(3) The paint "sunset" is a mix of red and yellow paint. It is $3/5$ red.

(a) What fraction is yellow?

(b) What is the ratio of red : yellow paint?

(4) A woman sells a pot for $50 making a profit of $15. What is the ratio of:

(a) Profit : cost price?

(b) Selling price : cost price?

(c) Profit : selling price?

RATIOS: Finding a Missing Value

Example 1:
In a group of 6-week old babies, the ratio of those exclusively breast fed to those not was 7:3. If there were 12 babies not being exclusively breast-fed, how many were there that were exclusively breast-fed?

Answer:
1. Write the numbers in a table, lining up the columns:

Breast Fed		Not
7	:	3
?	:	12

2. Look for a pattern, vertically or horizontally. Remember we are multiplying or dividing.

Breast Fed		Not
7	:	3
?	:	12

× 4 ↓

3. Follow the pattern to find the missing number

× 4 ↓

7	:	3
?	:	12

↓ × 4

? = 28; There are 28 babies exclusively breast-fed.

NOTE : If you can't find the pattern, you can always multiply the diagonals and divide by the other number, ie. 7 × 12 ÷ 3 will also give you the answer.

Example 2:
In a high school, of the students cycling to school there was a ratio boys to girls of 12:7. If 60 boys cycled to school, how many girls cycled?

Answer:

× 5 ↓

Boys		Girls
12	:	7
60	:	?

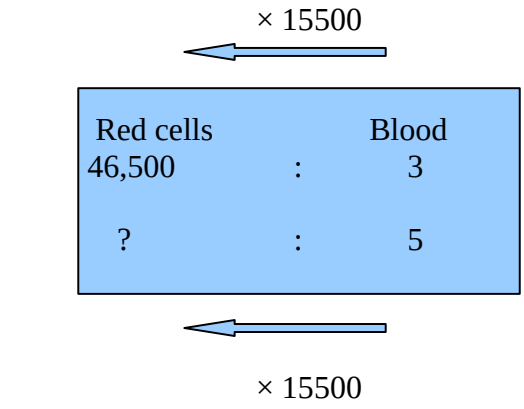
↓ × 5

? = 35; There were 35 girls that cycled to school.

RATIOS

Example 3:
If there are 46,500 red blood cells in 3mL of blood, how many red blood cells in 5mL?

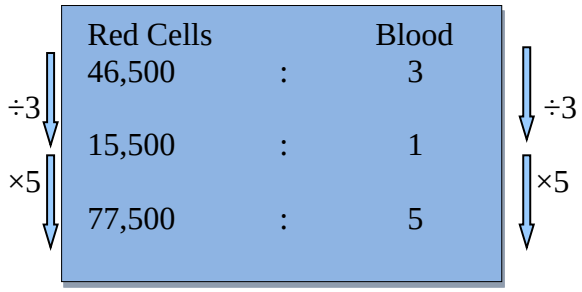
Answer (Method 1):



As 3 won't go into 5, try for a horizontal pattern. To work it out, divide 46,500 by 3. This gives 15,500.
5 × 15500 = 77,500. So there are 77,500 red blood cells in 5mL of blood.

Answer (Method 2)

First find how many blood cells in 1 mL, then go for 5mL:



Exercise 8
Find the missing letter

(1) 1 : 3
a : 6

(2) 3 : 4
b : 12

(3) 3 : 2
c : 8

(4) 1 : 3
3 : d

(5) 12 : 9
4 : e

(6) 5 : 9
20 : f

RATIOS

Exercise 9

(1) The weights of two boys are in the ratio 3:5. If the lighter boy weighs 36kg, find the weight of the other boy.

(2) The heights of two friends are in the the ratio 7:9. The shorter of the friends is 154 cm tall. What is the height of the taller friend?

(3) The ratio of adults to children diagnosed with diabetes is 25:1. If there are 30 children diagnosed with diabetes, how many adults are there?

(4) The ratio of men getting a gallbladder disease to women getting the same disease is 1:4. If 2805 men get the disease, how many women will?

(5) The ratio of left handers to right handers is 2:9. If there are 130 left handers, how many right handers are there?

(6) The ratio of kilometres to miles is 8:5. If Nelson is 432 kilometres from Christchurch, how many miles is this?

SPLITTING AN AMOUNT IN A GIVEN RATIO

Example:
Two brothers are to divide $1890 between them in the ratio 5:4. How much does each receive?

Answer by proportion

1. **Add:** Total shares = 5 + 4 = 9

2. **Divide:**

Share 1890÷ 9 = 210

3. **Multiply each side:**

5 : 4
= 5 × 210 : 4 × 210
= $1050 : $ 840

4. **Check by adding:** $1050 + $840 = $1890 which is the amount we started with.

So one brother receives $1050 and the other $840

Exercise 10

(1) a) Share 12 in the ratio 2:1

b) Share 20 in the ratio 3:1

c) Share 35 in the ratio 1:4

d) Share 100 in the ratio 9:1

e) Share 100 in the ratio 3:2

SPLITTING AN AMOUNT IN A GIVEN RATIO

(2) The profits of a raffle are split between two clubs in the ratio 11:8.
If the total profit was $5700, how much does each club get?

(3) At the start of a game of marbles, Jenny and Tim have 40 counters each. At the end of the game, the number of counters that Jenny and Tim each have is in the ratio 5:3.
How many counters do they each have?

(4) A patient has to take 90mL of medication in three doses in a ratio of 3:2:1.
How much must he take in each dose?

(5) Two partners divide their profits from a business venture in the ratio of their investments.
If Jim invested $9000 and Harry $5000, how would they divide a profit of $84,000?

SPLITTING AN AMOUNT IN A GIVEN RATIO

(6) To make concrete a builder mixes gravel, sand and cement in the ratio 4: 2: 1. The builder wants 350kg of concrete. How much gravel does he need?

(7) Children at an intermediate school were asked whether or not they had breakfast at home every day that week before coming to school. The ratio for girls of those that had breakfast to those that didn't was 3:1. The ratio for boys was 4:1. If there were 220 girls and 240 boys at the school, how many children didn't have breakfast every day that week?

(8) A survey is done on how children at a primary school get to school. The ratio of children going by car, walking, catching a bus, and riding a bike was 5: 4: 2: 1. If there were 252 children at the school, how many came by bus?

DRUG CALCULATIONS

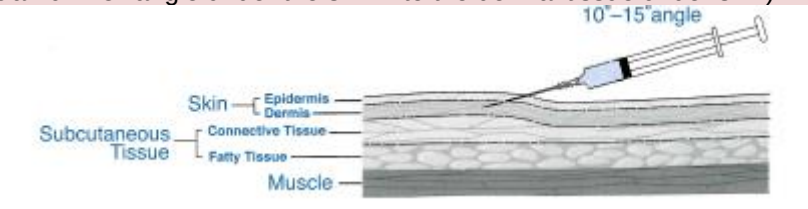
ORAL MEDICATIONS AND INJECTIONS

The following notes, provided on the sticky note, are for your interest and reference and will not be tested in this course. Students learn these in the Bachelor of Nursing and in Vet Nursing courses.

Some Useful Abbreviations

Routes of administration

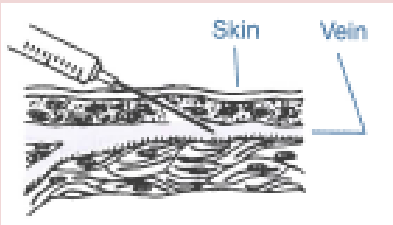
PO = orally; GI = gastrointestinal; SL = sublingual (ie under tongue)
NG = nasogastric (ie through the nose into the stomach)
OD = right eye; OS = left eye; OU = both eyes
AD = right ear; AS = left ear;
Subcut or s.c. or s.q. = subcutaneously
(ie inject at a 10 - 15° angle under the skin into the dermal tissue under skin)



Images from Daniels,J.M. & Smith, L.M. (2005).Clinical Calculations:A Unified Approach, 5th Edition.USA:Thomson Delmar Learning

IM = intramuscularly
(into the muscle ie inject at a 90° angle.)

IV – intravenous (ie into the vein)



Note also
WFI = water for injection
BSA = body surface area
PCA = patient controlled analgesia

Times of administration

ac = before meals; bid = twice a day; tid = three times a day;
pc = after meals; prn = as the patient needs medication;
qid = four times a day; q4h = every 4 hours (ie four hourly); stat = immediately
min = minute; h or hr = hour; hrly = hourly

Amounts & Preparations

cap = capsule; elix = elixir; EC = enteric coated;
sol = solution; supp = suppository; syr = syrup;
tab = tablet; tr = tincture; ung = ointment;
gtt = drop mcg/mL = micrograms in a millilitre = mcg per mL = µg/mL
mg/kg/day = milligrams per kilogram of body weight per day

DRUG CALCULATIONS

All drug calculation problems can be solved in the same way as the ratio proportion problems.
Follow these same steps:

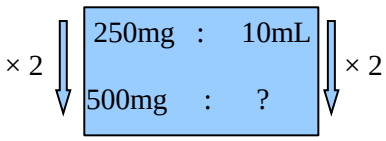
Step 1. Write the numbers in a box, lining up the columns
You always have three pieces of information and are trying to find the fourth. Make sure you line up like with like.

Step 2. Look for a pattern, vertically or horizontally. Remember we are multiplying or dividing.

Step 3. Follow the pattern to find the missing number

NOTE : If you can't find the pattern, multiply the diagonals and divide by the other number to calculate your unknown quantity

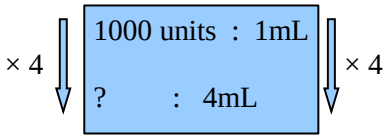
Example 1: Aminophyline comes as 250mg/10mL. A patient is prescribed 500mg.
How much must he be given?



? = 20mL. The patient is prescribed 20mL.

Alternatively to multiply the diagonals and then divide by the other number this becomes
500 × 10 divided by 250
$= \frac{500 \times 10}{250} =$ 20mL dose

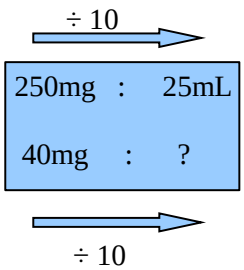
Example 2: Heparin has 1000 units/mL.
How much Heparin in 4mL?



? = 4000units.
There are 4000 units in 4mL solution.

Alternatively to multiply the diagonals and then divide by the other number this becomes
1000 × 4 divided by 1
$= \frac{1000 \times 4}{1} =$ 4000 units

Example 3: Lasix contains 250mg/25mL. A patient is prescribed 40mg. How much should they be given?



? = 4mL. The patient is prescribed 4mL.

Alternatively to multiply the diagonals and then divide by the other number this becomes
40 × 25 divided by 250
$= \frac{40 \times 25}{250} =$ 4 mL

DRUG CALCULATIONS

Example 4: A drug comes as 50mg/mL. How much do you give someone prescribed 65mg?
Method 1:

	50mg	: 1mL	
÷10 ↓	5mg	: 0.1mL	↓ ÷10
× 13 ↓	65mg	: 1.3mL	↓ × 13

Answer: 1.3mL

Method 2:

50mg	:	1 mL
65mg	:	?

Multiply diagonals and divide by the other number:

$$\frac{65 \times 1}{50} = \frac{65}{50} = \frac{13}{10} = 1.3\text{mL}$$

Exercises from Nursing Calculations (tick the box as you have completed these exercises)

Online access at Unitec Library:
https://www-clinicalkey-com-au.libproxy.unitec.ac.nz/nursing/#!/browse/book/3-s2.0-C20130194937

Think about the size required:

- ☐ **Ex 3A**

Continue with

- ☐ **Ex 2C**. (These are fairly straight forward.)

Then work on

- ☐ **Ex 2D,**
- ☐ **Ex 2E,**
- ☐ **Ex 3G and**
- ☐ **Chapter 2 Revision.**

This is all there is to it! The methods are the same for preparing medications for injection.

DRUG CALCULATIONS

Online access at Unitec Library:
https://www-clinicalkey-com-au.libproxy.unitec.ac.nz/nursing/#!/browse/book/3-s2.0-C20130194937
For more of a challenge, practice any of these:

- ☐ **Ex 3C**
- ☐ **Ex 3D**
- ☐ **Ex 3E**
- ☐ **Ex 3F**
- ☐ **Chapter 3 Revision.**

Paediatric doses are no different:

- ☐ **Ex 5B** and
- ☐ **Ex 5C**

Sometimes you have to calculate the dose depending on the weight of the child:

- ☐ **Ex 5A**

Medication measured in Units

Insulin is given to diabetic patients to replace their own lack of natural insulin.
Insulin is measured in International Units (IU) which relate to the amount of activity of the drug rather than relating to the weight of the drug. Insulin U-100 has 100 units of insulin per mL of medication; administer U-100 using only a U-100 syringe.
Insulin U-40 has 40 units of insulin per mL and is administered in a U-40 syringe.

Other drugs measured in units are hormones, vitamins, antibiotics, antitoxins and biologically prepared drugs. The value of the unit of drug depends on the drug itself because a unit of measure is a measure of drug potency rather than being a set volume. There can be a few units per mL up to several millions of units per mL

Exercise 11

1. Complete the following table:

Strength Required	Stock	Volume Required
a) 1000U	1000U/2mL	
b) 1.25mcg	2.5mcg/1mL	
c) 20mg	100mg/50mL	
d) 1 megaunit	1 megaunit/10mL	
e) 4g	1g/5mL	

DRUG CALCULATIONS

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

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

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

5. Calculate how much lasix you would administer to a client if the dose of lasix is 0.01g and the vial contains 20 mg/2ml.

6. A dose of 0.5mg neocytamen is ordered. How many ml would you give a client if it is available in a strength of 250 mcg/ml?

7. What volume of lanoxin syrup would you give a client for a dose of 250 mcg, when it comes as 0.05 mg/ml?

8. Calculate how much ampicillin you would give a client if the dose of ampicillin is 0.5g and the vial contains 250 mg/2ml.

9. Erythromycin has a strength of 700mg/10mL. What volume of syrup is to be given to a patient who needs:
a) 420mg of Erythromycin

b) 350mg of Erythromycin

c) 210mg of Erythromycin

10. A patient is given 15 mL of syrup (as in question 11). How much Erythromycin does it contain?

11. How much Morphine is needed if 20mg is required if it is available in a strength of 25mg/mL?

DRUG CALCULATIONS

Exercise 12

1. Calculate how much of a drug you would administer to a client if the dose of pethidine was 75 mg and the vial contains 100 mg/2ml.

2. What volume of phenergon would you give a client for a dose of 6.25 mg when it comes as 25 mg/ml?

3. Atropine is available in a strength of 0.6 mg/ml. How many ml would you give a client for a dose of 0.4mg?

4. Calculate how much lanoxin you would give a client if the dose of lanoxin is 0.2mg and the vial contains 0.5 mg/2ml.

5. A volume of 0.5% flagyl has a dose of 0.5 g per 100mL. How much would you give a client if the prescribed dose is 0.75g?

6. A 1:40 solution (1g/40mL) of aminophylline is available. What volume would you give a client if the dose is 400mg?

7. Heparin comes as 1000 units/ml. What volume would you administer for a 600 unit dose?

8. Heparin comes as 25000 units/ml. What volume would you administer for a 20000 unit dose?

DRUG CALCULATIONS

9. 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?

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

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

12. Atropine ampoules are 0.4mg/mL. How much must be given to a patient requiring 0.3mg?

13. A patient needs 0.8mg of Atropine. Available are 0.6mg/mL ampoules.
How much needs to be drawn up?

Ampoule of atropine

DRUG CALCULATIONS - BODY WEIGHT AND BODY SURFACE AREA

Drug calculations for body weight
Prescribing particular medications can have adverse effects such as drowsiness, be life threatening, or cause weight loss. The cytotoxic drugs used to treat cancer are one example of drugs that are prescribed as mg/kg body weight.

Drug Calculations for Body Surface Area
The skin is the largest organ of our body and can stretch to accommodate the body mass of a growing child or adult as surface area increases with increases in body weight and height. **Nomogram** charts provide an easy way to work out body surface area based on a patient's height and weight. Body Surface area is measured in m^2 (square metres)

Example 1: Body weight (Exercises 14 & 15)
Calculate the dose of the drug to be given if a patient weighing 60kg is prescribed a dose of 6mg/kg

Body weight x amount of drug per kilogram
60 x 6 =360 mg

Example 2: Body surface area (BSA) (Exercise 16)

Calculate the dose of a drug to be given if a patient with a body surface area of $1.55m^2$ is prescribed a dose of $500mg/m^2$.
Body surface area x amount of drug per m^2
1.75 x 500 = 875mg

Example 3: Single dose

Calculate the size of a single dose for a child who weighs 12kg and is prescribed Erythromycin, 40mg/kg/day, 6 hourly.

Total volume of the drug administered in 1 day is
body weight x amount of drug per kilogram
12 x 40 = 480mg/day

Amount for a single dose?

$$\frac{24 \text{ hours}}{6 \text{ hours}} = 4 \text{ doses}$$

$$\frac{480 \text{ mg}}{4 \text{ doses}} = 120 \text{ mg for each dose}$$

Exercise 13

1. Calculate the dose of the drug to be given:

   a) A patient weighing 73 kg is prescribed a dose of 3mg/kg

   b) A patient weighing 66kg is prescribed a dose of 15mg/kg

   c) A patient with a BSA of 1.55m^2 is prescribed 250mg/m^2

   d) A patient with a BSA of 1.88m^2 is prescribed 250mg/m^2

2. A patient weighs 12kg and is ordered 15mg/kg of medication. If the stock strength is 200mg in 5mL. Calculate the volume required.

3. Calculate the size of a single dose:

a) A patient is prescribed 20mg/kg body weight. The patient weighs is 70kg, Doses to be administered in equal doses every 6 hours.

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

c) A patient with a BSA of 1.74m^2 prescribed a dose of 150mg/m^2 to be given 3 times a day.

DRUG CALCULATIONS : APPLICATIONS

Exercise 14:
For each question below:

- Firstly calculate the number of mL of medication you will draw up to deliver the drug dose required.
- Then choose the best syringe to deliver each dose. The best syringe is the smallest possible syringe to deliver the dose required.
- Mark in the dose you will draw up and deliver.
- If your answer is a dosage which is between the syringe calibrations, mark the syring to the lower calibration line.

1. Order: Streptomycin 600 mg IM daily

DRUG CALCULATIONS : APPLICATIONS

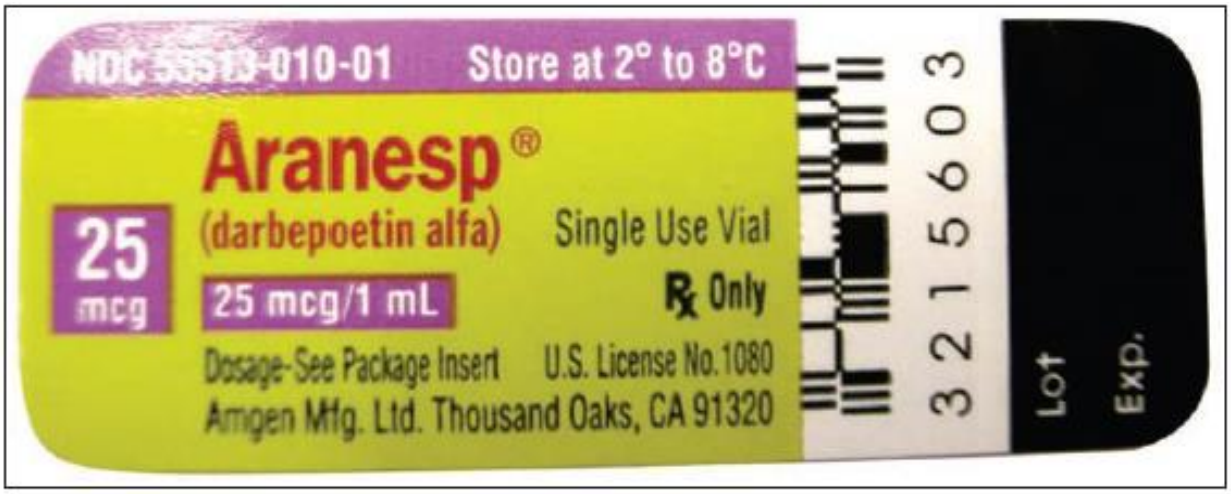
2. Order: Oxytetracycline 100 mg IM q8h

DRUG CALCULATIONS : APPLICATIONS

3. Order : 0.76 g quinidine gluconate

DRUG CALCULATIONS : APPLICATIONS

4. Order is 0.015mg



DRUG CALCULATIONS : Calculations using Body Weight

Example:

a) Amoxicillin/clavulanate K is prescribed at 20mg per kg/24 hours in 3 divided doses. The patient's weight is 5kg. How many millilitres will you administer in a single dose? (Round down to 1d.p.)

Answer:

20mg per kg for 5kg = 20 × 5 = 100mg needed in 24 hours.
Split this into 3 doses: 100 ÷ 3 = 33.3mg per dose.

Medication is 125mg/5mL

÷ 25

125mg	:	5mL
33mg	:	?

÷ 25

? = 1.32 mL. The patient is prescribed 1.3 mL (1d.p.)

Alternatively, to multiply the diagonals and then divide by the other number this becomes

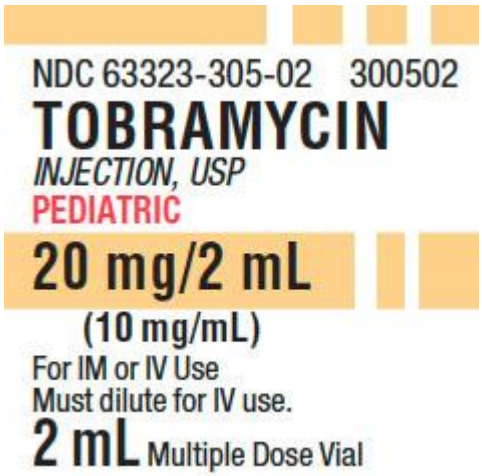
33 × 5 divided by 125

$= \frac{33 \times 5}{125} = 1.32$ mL

DRUG CALCULATIONS : Calculations using Body Weight

Exercise 15

1. Tobramycin sulphate is prescribed at 6.5 mg per kg / 24 hours in 3 divided doses.
   The patient's weight is 24 kg.
   How many millilitres will you administer in a single dose? (round down to 1 dp)



Mark the required dose on the most appropriate (i.e. smallest possible) syringe.

DRUG CALCULATIONS : Calculations using Body Weight

2. Cefazolin is prescribed at 40 mg per kg / 24 hours in 4 divided doses. The patient's weight is 33 kg.
On hand you have 500 mg in 5 mL IV
How many millilitres will you administer in a single dose? (Round down to 1 dp)

3. Amoxicillin is prescribed at 25 mg / kg per 24 hours in 3 divided doses.
The patient's weight is 10 kg.

Calculate the dose required, choose the most appropriate syringe to deliver this dose and mark the dose you will draw up. (To avoid potential overdose, especially in very small babies, always rounds doses down to nearest syringe marking.)

DRUG CALCULATIONS : Calculations using Body Weight

4. Amoxicillin / clavulanate potassium is prescribed at 25 mg / kg per 24 hours in 3 divided doses. The patient's weight is 6 kg.
   Using the drug at hand shown below calculate the required number of mL per dose.
   Choose the most appropriate syringe and mark on the required dose to be drawn up. (round down to 1 dp)

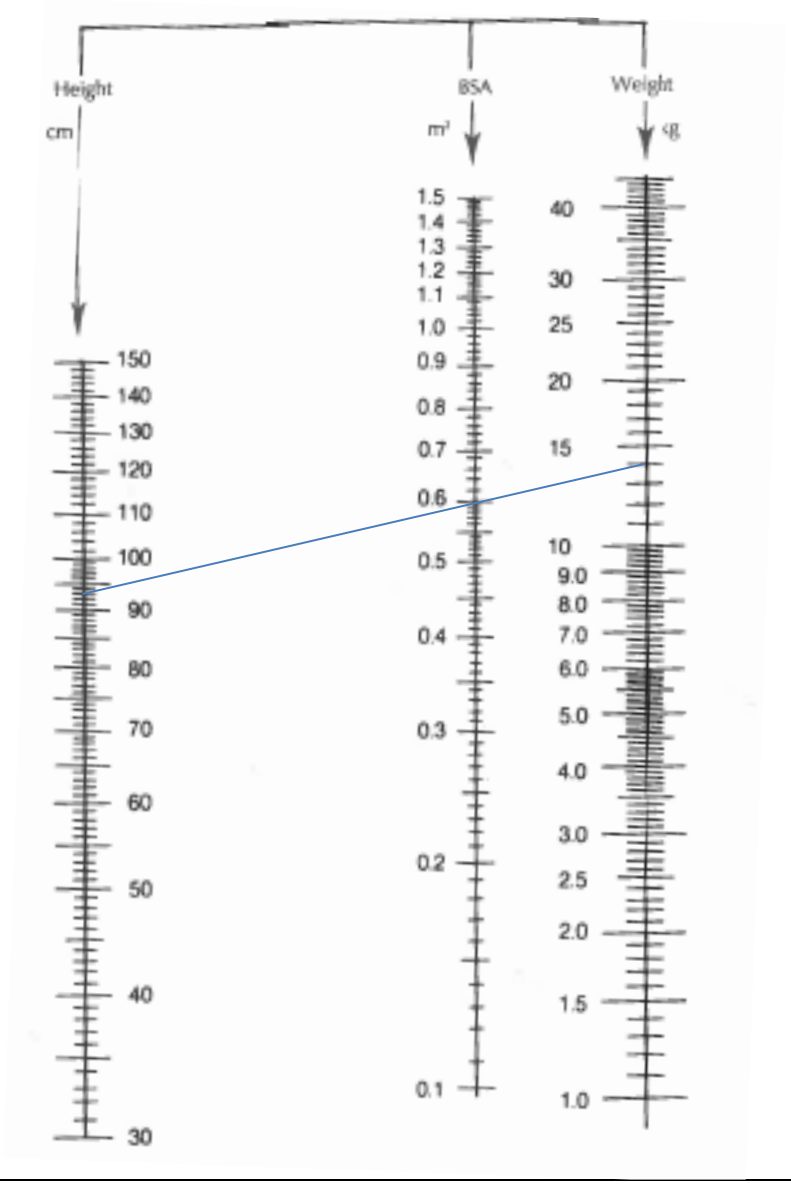
DRUG CALCULATIONS : Calculations using Body Weight

5. Amoxicillin is prescribed at 35 mg / kg / 24 hours divided into 3 equal doses.
The patient weighs 16 kg.
How many mL will you administer in a single dose? (round to 1 dp)

DRUG CALCULATIONS : Calculations using Body Weight

6. Atrophine sulphate has been prescribed at 0.01 mg/kg in a single dose. The patient weighs 20kg. How many mL will you administer in a single dose? (round to 1 dp). Show this dose on the most appropriate syringe

DRUG CALCULATIONS : Calculations using Body Surface Area



Paediatric Nomogram for calculating Body Surface Area (BSA) from a person's height and weight.

Use a ruler to draw a straight line between a person's height and their weight. Read the central scale to find an estimate of their body surface area (in square metres).

Image from Gatford, J.D., & Philips, N.M. (2011). Nursing Calculations, Eighth Edition,Elsvier Ltd

Example:
A boy of height 94cm and weight 14kg is prescribed bleomycin 10 units per m^2. How many units does he need to be given?

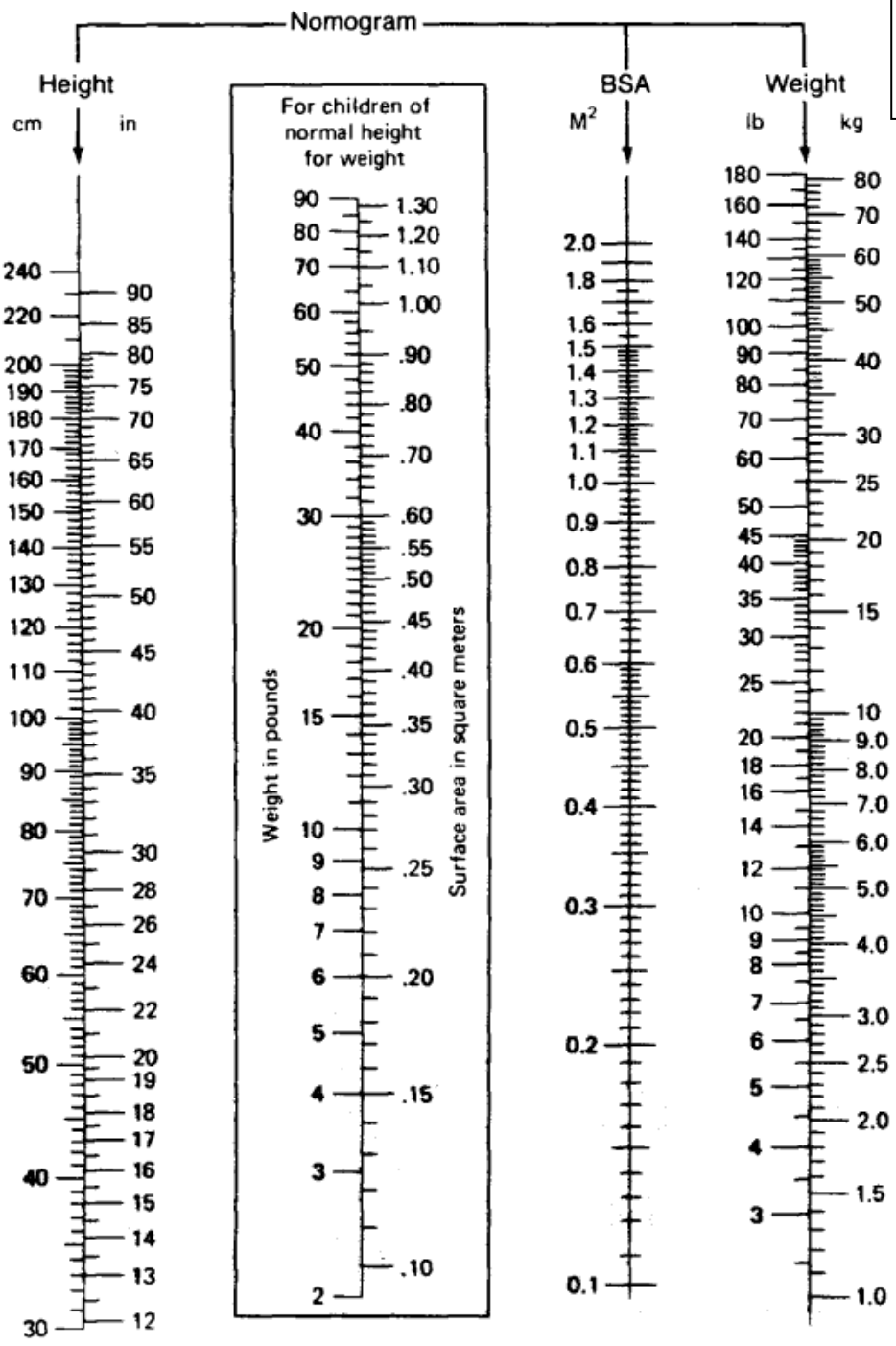
Answer: From the line on the nomogram above we estimate his BSA as $0.6m^2$.
$10 \times 0.6 = 6$ units needed.

Exercises from Nursing Calculations (tick the box as you have completed these exercises)

☐ **Ex 5E** **and** ☐ **Ex 5F** **and** ☐ **Chapter 5 Revision.**

DRUG CALCULATIONS : Calculations using Body Surface Area

Nomogram for Paediatric Body Surface Area (BSA)



Exercise 16

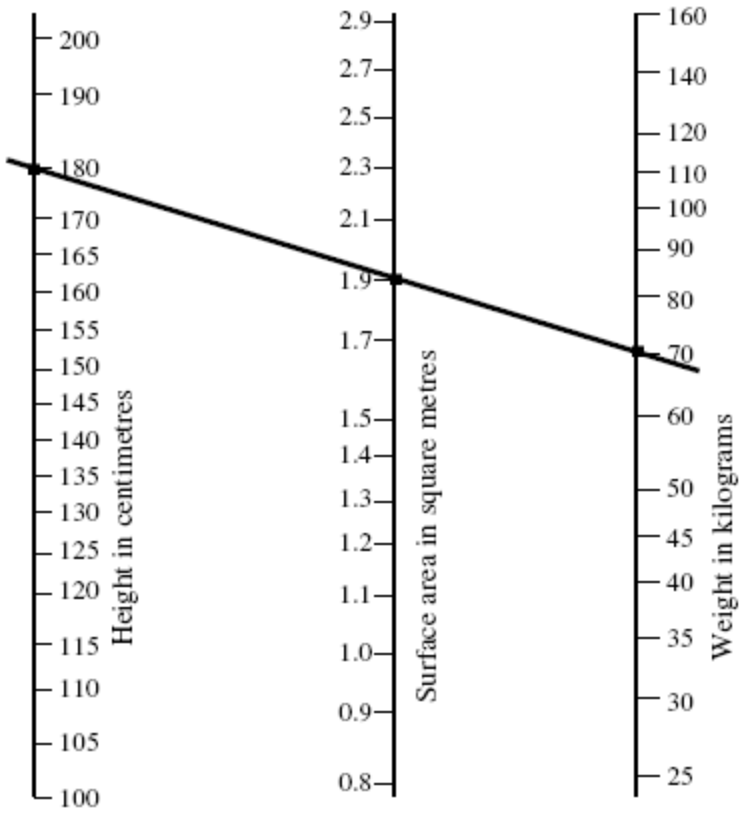
Draw **and label** the appropriate lines on the nomogram to estimate each BSA:

1. What is the BSA of Joe who is 30cm long and weighs 6.8kg.

2. What is the BSA of Cindy who weighs 22 kg and is 86 cm high.

DRUG CALCULATIONS : Calculations using Body Surface Area

3. Compare the first nomogram, on the previous page, with the second one shown below. What information is shown by the line drawn on the following nomogram?



4. When would you use this second nomogram instead of the first nomogram?

5. On each nomogram draw and label the line to find the estimate of the BSA for a person 100cm high who weighs 25kg. How do these two BSA values compare?

DRUG CALCULATIONS : Calculations using Body Surface Area

6. A boy needs the chemotherapy drug cyclophosphamide.
The recommended dose is 1000mg/m^2 BSA. He weighs 35kg and is 145 cm tall.

Find his BSA,and use this to calculate the dose required.

7. Calculate the volume of vincristine medication required for a person with a BSA of 0.54m^2 given the recommended dosage of 1.5 mg / m^2 when the stock solution on hand has the concentration of 1g / 500 mL.

The correct dose to be given is 0.405mL.
Clearly show how this dose is calculated, stating what you are calculating at each step.

DRUG CALCULATIONS : Calculations using Body Surface Area

8. A young girl is to be given cytarabine IV. She weighs 40kg and is 150cm in height.

Find her BSA correct to the nearest $0.1m^2$. BSA = ……

The recommended dosage is 150 mg/m^2.
Stock at hand has the strength of 500 mg/5mL.

Calculate the dose required.
Then calculate the volume to be drawn up for injection.

The most appropriate syringe to use is the smallest possible one which delivers the full volume required. Round down to nearest syringe mark if needed.

Choose the best syringe from these shown below and colour in the volume you would draw up for this girl's IV injection of cytarabine.

RATE CONVERSIONS **(Extension Work)**

Changes to rates, and metric conversions

Concentrations of drugs or substances in a solution might be expressed as follows:

mg/mL	milligrams per millilitre
g/mL	grams per millilitre
mg/dL	milligrams per decilitre (**decilitre being 100 mL**)
g/dL	grams per decilitre
mg/L	milligrams per litre
g/L	grams per litre
g/g	grams per gram

Example 1. Using the ratio method to increase or decrease both sides of the ratio.
You have 5g of sugar dissolved in 250mL of water. Express this as :

i) g/dL
ii) g/L

Answer:

i) g/dL decilitre = 100 mL, so you need to find out the concentration per 100 mL

5g : 250mL
÷ 5 ÷ 5
1g : 50mL
× 2 × 2
2g : 100mL

Write this as 2g/dL

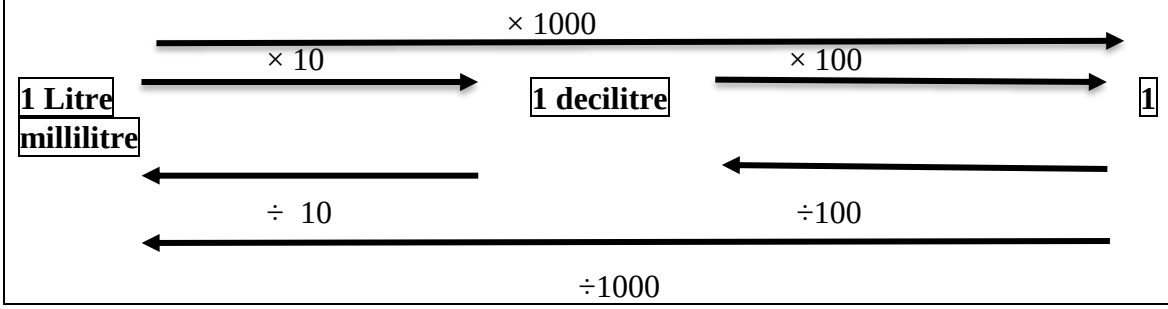
ii) g/L You need to find the concentration per 1000 mL

5g : 250 mL
x 4 x4
20g : 1000 mL

Write this as 20g/L

Reminder: CONVERTING BETWEEN LITRES, DECILITRES AND MILLILITRES

If you are used to using the King Henry system, unit to deci: one jump right; deci to milli, 2 jumps right etc.



RATE CONVERSIONS **(Extension Work)**

Example 2. If a liquid has a salt concentration of 865 mg/L, how many grams per decilitre (g/dL) is this? Remember a decilitre means 100mL.

Answer: Step 1: Convert 865 mg to g. This will not change the other side of the ratio, as you still have exactly the same amount of salt per Litre. You are just renaming mg as g.
865 ÷ 1000 = 0.865 g 865 mg/L = 0.865 g/L

Step 2: Now to find out how many grams per decilitre, divide both sides by 10 (because a decilitre is 100 mL so is one tenth of a Litre. You have the same concentration but one tenth of the amount.)

0.865 g : 1 L (1000mL)
÷ 10 ⇓ ⇓ ÷ 10
0.0865 g : 100mL (1 dL)

So the answer is 865mg/L = 0.0865 g/dL

Example 3. Change 17.92 g/dL into the equivalent:
i) mg/dL
ii) mg/mL
iii) g/L

Answers:
i) (Find mg/dL)
This is a straight conversion 17.92 g = 17,920 mg, so the answer is 17,920 mg/dL

ii) (Find mg/mL)
We need to reducing from dL to mL, so divide by 100.

17 920 mg : 1 dL (100mL)
÷100 ⇓ ⇓ ÷100
179.2 mg : 1 mL so the answer is 179.2mg/mL

iii) (Find g/L)
The g/L rate is always the same as the mg/mL rate.
(This is because they have the same conversion factor: 1 gram = 1000 mg just as 1L = 1000 mL.)
So the answer must be 179.2 g/L

Alternatively, we need to multiply our original quantity by 10 to get up to a litre:

17.92 g : 1 dL (100mL)
×10 ⇓ ⇓ ×10
179.2 g : 1000 mL (1L) so the answer is 179.2g/L

RATE CONVERSIONS (Extension Work)

Exercise 17

1. (a) A patient is losing blood at the rate of 90mL/hour.
   How many mL of blood are lost per minute. (ie convert 90mL/hour into mL/min)

   (b) Calculate the volume of blood lost in 40 minutes, if the patient continued to bleed at this rate?

   (c) How long would it take for this patient to lose 0.36L of blood at this rate?

2. A saline solution has 32.5g salt added to 100mL of water.
   (a) Write this concentration as g/dL

   (b) Convert this to the equivalent concnetration expressed as mg/dL

   (c) Express this concentration as mg/mL

3. My lamb stew has 1.4g of fat per 20g of lamb stew.
   (a) Convert this ratio of fat per lamb stew into mg/g

   (b) Convert this ratio into g/kg

RATE CONVERSIONS (Extension Work)

4. Change 23.85g/dL into the equivalent:
   (a) mg/dL

   (b) mg/mL

   (c) g/L

5. Change 6.78mg/dL into the equivalent:
   (a) mg/L

   (b) g/100mL

   (c) mg/mL

6. A solution has 38.5 mL of sudol in 100mL of solution.
   Express this concentration of sudol to solution, 38.5 mL/100mL as the equivalent in:
   (a) mL/dL

   (b) mL/mL

   (c) L/L

   (d) mL/L

RATE CONVERSIONS (Extension Work)

7. A patient's haemoglobin level is 12.97 g/dL

   Convert this to the following rates:
   (a) mg/dL

   (b) mg/L

   (c) mg/mL

   (d) g/L

8. A patient's bilirubin level is 0.985 mg/dL
   Convert this to the following rates:
   (a) mg/L

   (b) g/100mL

   (c) mg/mL

INTRAVENOUS (IV) INFUSION RATES

Intravenous medication is administered directly *into a vein*. In adults 3mL can be safely given as a subcutaneous or an intramuscular injection. Larger volumes cause tissue damage so are given via IV infusion. Doctors determine the safe daily volume a patient is able to receive in IV infusion.
IV administered drugs go directly into the blood stream so are useful to give rapid drug action.

Basic IV Setup

Let's take a look at a the most basic possible setup for an IV:

D. Injection Port

This injection port provides a place to insert additional medication to mix with the fluid in the IV bag

A. Drip Chamber

The drip chamber is where you can count the number of drops per minute being infused. It must always be half full to prevent air getting into the patient's vein (air blocks in the vein cause blood flow problems).

D. Injection Port

This injection port provides a place to insert additional medication without it mixing with the fluid in the IV bag.

B. Roller Clamp

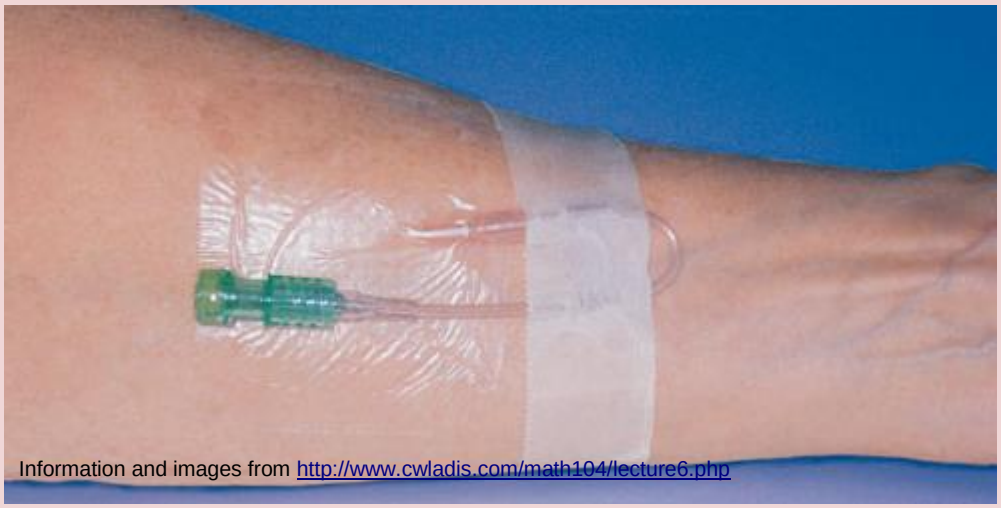
Rolling the clamp changes the pressure on the tubing which then changes the number of drops per minute being infused.

C. Slide Clamp

The slide clamp pinches the tubing shut completely to stop the IV infusion flow.

All IV bags are hung above the patient's heart to provide enough gravitational pressure for the fluid to be infused.
Hourly checking of IVs ensure the flow rate is being maintained despite any changes in the patient's body position.

INTRAVENOUS (IV) INFUSION RATES



A cannula is a hollow needle, or more often a length of flexible plastic tubing, which has been inserted into the vein using a needle. IV lines inserted into veins in arms and legs stay in for about 3 days. Larger veins in the body's torso can hold IV lines for longer periods but carry greater risks of bleeding and of any site infection spreading to many other parts of the body.

MEASURING INFUSION RATES

Infusion Rates can be measured in one of two ways:

millilitres per hour (mL/h)
or drops per minute (drops/min)

Remember the 'per' is a division; the units tell us what division to do:

Rate given as millilitres per hour = mL/h = millilitres divided by hours
or Rate given as drops per minute = gtt/min = drops divided by minutes

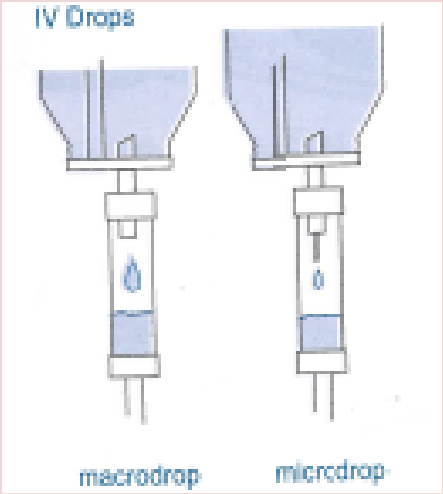
If you have amounts in units other than these (eg in litres) then they must first be converted.

The size of the opening into the drip chamber determines the size of the drop delivered by the infusion set. This determines the number of drops making up one millilitre of fluid, ie drops per mL.

The drop size is the drop factor and is expressed as drops per mL (gtt/mL).

A macrodrip set delivers 10, 15 or 20 drops per mL.

The drop factor of a microdrip set is 60 or even 100 drops per mL as these drops are very small.



INFUSION RATES (millilitres per hour)

Example 1: A patient needs to receive 1L of fluid over a period of 4 hours. What flow rate in mL/h must the infusion pump be set to?

Rate = millilitres ÷ hours = 1000 ÷ 4 = 250mL/h

Example 2: A patient is receiving fluid at a rate of 50ml/h. How much will she have received after 6 hours?

Every hour she receives 50mL so after 6 hours she has received 50 × 6 = 300mL
or (remember 50mL/h means 50mL in 1 hour)

	fluid		time	
× 6 ⇓	50mL	:	1 hour	⇓ × 6
	?	:	6 hours	

? = 300mL. The patient receives 300mL in 6 hours.

Example 3: A patient is receiving fluid at a rate of 200mL/h. How long will it take for him to receive 50mL?

	fluid		time	
÷ 4 ⇓	200mL	:	1 hour	⇓ ÷ 4
	50mL	:	?	

? = ¼ hour or 15 minutes. It will take 15 minutes for him to receive 50mL.

"Intravenous medications are pharmaceutical preparations having the highest risk of possible medication errors. These drugs are typically associated with complicated preparation, administration, and monitoring. Errors in their use can have serious consequences for both the patient and health care providers. Inappropriate speed of administration of the drug was found to be the most common type of medication error in intravenous drugs." https://www.omicsonline.org/open-access/medication-errors-in-intravenous-drug-preparation-and-administration-a-brief-review-2167-1168-1000285.php?aid=60999 13/09/18

This highlights the need for nurses to be vigilant and to get infusion rates calculated correctly.

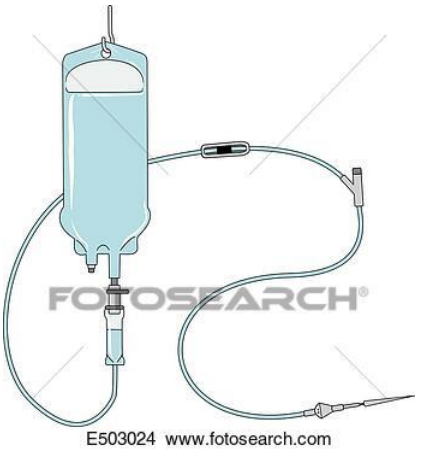
Exercises from Nursing Calculations

- ☐ **Exercise 4A**
- ☐ **Exercise 4B**

Extension:

- ☐ **Exercise 4C**

INFUSION RATES (millilitres per hour)



Exercise 18

1) 500mL is to be infused over a 5 hour period. Find the flow rate in mL/h.

2) An infusion is to run for 30 minutes and is to deliver 200mL.
What is the rate of the infusion in mL/h?

3) Calculate the flow rate in mL/h if 1.2L is to be infused over 24 hours.

4) An order states that 500mL albumin 5% is to be given in 4 hours. What is the flow rate that should be set?

Exercise 19 **(Extension work)**

1) Mr Smith is to receive 800mL of an antibiotic via an IV infusion over 15 hours. Calculate the flow rate in mL/h (round to the nearest whole number).

2) A patient is receiving 260mL/h of a solution for 1.3 hours (1 hour and 18 minutes). How much have they received?

3) A patient is prescribed 1L of a saline solution. The rate is set at 150mL/h. How long will the infusion take? Give your answer in hours and in hours and minutes.

INFUSION RATES
Infusion time taken & finishing times

Example

At 0430 hours, an infusion pump is set to deliver 1.5 litres of fluid at a rate of 90mL/hr.
After 10 hours the pump is reset to 75mL/h. Calculate the finishing time.

Infusion 1:

Find how many millilitres are used in the first 10 hours, and the remaining volume.

X 10 ↓ 90mL : 1 hour
? mL : 10 hours ↓ X 10

? mL = 900 mL

Volume remaining?
1500mL – 900mL = 600mL

Infusion 2:

Find how long infusion 2 takes.

÷ 3 ↓ 75mL : 60 mins
25 mL : 20 mins
600mL : ? mins ↓ ÷ 3
x 24 x 24

? mins = 480mins = 8 hours

or $\frac{600 \div 25}{75 \div 25} = \frac{24}{3} = 8$ hours

Total time taken for both infusions:
10 + 8 = 18 hours

Find finish time:

0430 hours + 18 hours = 2230 hours

Exercise 20 (from Exercise 4F in the Nursing Calculations book by JD Gatford and N.M. Phillips)

1. One litre of Hartman's solution is to be given IV. For the first 6 hours the solution is delivered at 85mL/hr, then the rate is prescribed to be reduced to 70mL/hr. Find the total time taken to give the full volume.

2. A patient is to receive half a litre of dextrose5%IV. A flask is set up at 0800 hours running at 60mL/hr. After 5 hours the rate is prescribed to be increased to 80mL/hr. At what time will the infusion be completed?

INFUSION RATES IN DROPS PER MINUTE (Drip Rate)

For this we have the extra information of how many drops/mL the microdrip is releasing.

Remember we want **Drops per minute**

So we: 1. Find the number of drops to be given
2. Find the minutes for infusion
3. Calculate drops divided by minutes to get infusion rate in gtt/mL

Example 1:
A patient is to receive 1.5L of fluid over 6 hours. The I.V. set is delivering 20 drops/mL. What drip rate is needed in drops per minute? Give your answer to the nearest drop.

1. Find the drops: We want 1.5L ie 1500mL. The microdrip delivers 20 drops/mL (the drop factor).

× 1500 ↓	20 drops : 1 mL	↓ × 1500
	? : 1500mL	

? = 30,000 drops. (Be very careful of the zeros!)

2. Find the minutes: 6 hours = 6 × 60 minutes = 360 minutes

3. Find the drops per minute: Divide the total drops by the total minutes, 30,000 ÷ 360. This is easiest done by expressing as a fraction and simplifying as far as possible before dividing.

$$\frac{30000 \div 10}{360 \div 10} = \frac{3000 \div 3}{36 \div 3} = \frac{1000 \div 4}{12 \div 4} = \frac{250}{3}$$

$$3\overline{)25^{1}0.^{1}0} = 83.3$$

Remember: Divide to one more decimal place than required and then round to the required place.

Answer: The required drip rate is 83 drops per minute.

Example 2 (Extension method for Example 1)

Treat the problem as a fraction: $\frac{\text{total drops}}{\text{minutes}} = \frac{(\text{total mL required x drops/mL})}{\text{hours x } 60}$

Simplify your fraction and calculate as needed.

$$\frac{1500 \times \overset{1}{\cancel{20}}}{6 \times \underset{3}{\cancel{60}}} = \frac{\overset{500}{\cancel{1500}} \times 1}{6 \times \underset{1}{\cancel{3}}} = \frac{500}{6} = \frac{250}{3}$$

Now divide as in example 1. (Nursing Calculations gives this method)

Exercises from Nursing Calculations

- ☐ **Exercise 4D**
- ☐ **Exercise 4E**

INFUSION RATES IN DROPS PER MINUTE (Drip Rate)

Exercise 21 How many drops per minute? Where necessary, round answers to the nearest whole number)

1) Calculate the drip rate (drops per minute) if 330 ml is prescribed to take 5 hours. The microset has a Drop factor of 60 drops /ml

2) What drip rate is required to administer 600ml of drug for 6 hours at 30 drops per ml?

3) A young adult has been prescribed 1000mL of 5% Dextrose to be administered over a period of 10 hours, through a set delivering 20 drops/mL. What drip rate in drops/min should be established?

4) a) A young child has been prescribed 800mL of Hartman's solution to be administered over twenty hours, using a set delivering at 20 drops/mL. What should the drip rate be?

b) If the medication is to be delivered over 10 hours what would the drip rate be?

5) A patient is ordered 100mL to be infused over 45 minutes via a 20 drops/mL set. What drip rate should be set?

6) A patient is ordered 20 mL to be infused over 30 minutes via a microdrop set at 60 drops/mL. What drip rate should be established?

7) What drip rate is required to administer 500mL of whole blood via a blood giving set (15 drips/mL) over a period of 4 hours?

INFUSION RATES

Exercise 22 **(Extension work)**

1) A patient is receiving an IV infusion at the rate of 80mL/h.
Calculate the drip rate as delivered via a 20 drops/mL macrodrop set

2) Find the drip rate if a patient is receiving fluid at the flow rate of 120mL/h through a 20 drops/mL giving set?

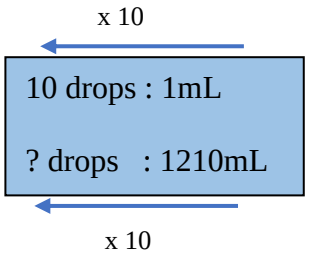
3) How much drug is given if it takes 3 hours at a drop factor of 60 drops/ml and a drip rate of 45 drops per min? *(Hint: Find total number of drops, divide by drop factor to find how many mL.)*

4) You are monitoring an IV infusion of 5% dextrose that has been running for 6 hours at a rate of 40 drops/min via a microdrip set at 15 drops/mL. What volume of fluid has been administered in this time? *(Hint: This is similar to question 3)*

INFUSION RATES - How long remains for the infusion to be completed?

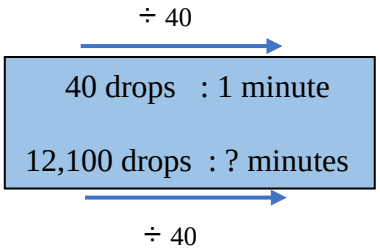
Example: 1210 mL of Lactated Ringer's solution remains, and is being infused at 40 drops/minute. The drop factor is 10 drops per mL. How long will the infusion take to complete at this rate? Give your answer in hours and minutes.
Find the total number of drops: (1210 mL x 10 drops per mL = 12100 drops in total)
Find the total n umber of minutes: Divide the total drops by the drops/minute rate to = 12100 ÷ 40 = 1210÷4 = 302.5 min
Find the total time for the infusion in hours and minutes: Divide minutes by 60 to find hours 302.5 ÷ 60 = 5 hours, 2.5 min

Find the total number of drops:



? drops = 12100 total drops

Find the total number of minutes:



? minutes = 12,100 drops ÷ 40 = 302.5mins

Find the number of hours and minutes the infusion will take: Divide the total minutes by 60 to find hours 302.5 = ÷ 60 = 5 hours, 2.5 minutes

Exercise 23

1. 1020 mL of 5% dextrose in water remains and is infused at 60 drops/minute.
   The drop factor is 15 drops per mL.
   How long will the infusion take to complete at this rate? Answer in hours and minutes.

2. 120 mL of 0.5 normal saline is being infused at 30 drops/minute.
   The drop factor is 60 drops per mL.
   How long will the infusion take to complete at this rate?

3. 1040 mL of 0.9% sodium chloride remains and is being infused at 50 drops per minute.
   The drop factor is 20.
   How long will the infusion take to complete?

INFUSION RATES

4. 40 mL of 0.9% sodium chloride remains and is being infused at 25 drops/minute.
   The drop factor is 20.
   How long will it take to complete the infusion?

5. 290 mL of 5% dextrose in 0.9% sodium chloride remains and is being infused at 60 drops/minute.
   The drop factor is 20.
   How long will the infusion take to complete?

6. 1000mL of 5% dextrose in water remains and is being infused at 50 drops/minute.
   The drop factor is 20.
   How long remains before the infusion is complete?

7. 70 mL of 0.5 normal saline solution remains and is being infused at 25 drops/minute.
   The drop factor is 20.
   How long will the infusion take to complete at this rate?

8. 550 mL of 0.45% sodium chloride remains and is being infused at 55 drops/minute.
   The drop factor is 20.
   How long will the infusion take to complete?

REVISION 1 : Ratios

1. Write in the simplest form
   (a) 12:16 (b) 8:24 (c) 20:150

2. Paste is made using flour and water in the ratio 4:3
   (a) If 8 cups of flour are used, how much water will be needed?

   (b) How much flour will be needed to mix with 15 cups of water?

3. $30 is divided between 3 people in the ratio of 5:2:3.
   How much will each person get?

4. The ratio on ward X of male patients to female patients is 2:5.
   a) If there are 6 male patients, how many female patients are there?

   b) If there are 20 female patients, how many male patients are there?

5. Medication Q is made up of solutions A, B and C. To make 50ml of the medication you need: 10ml of A ; 20ml of B; 5ml of C
   a) What is the ratio of i) A to B ii) B to C iii) C to A

   b) If you needed to produce 100ml of Q how many ml of A, B and C would you need?

   c) There are 40ml of A left.
      i) What is the maximum dosage of Q that you can produce?

      ii) What quantities of B and C are needed to produce this dose?

REVISION 2 : Tablets

1. How many 30mg tablets of drug B are required to produce a dosage of:
a) 60mg b) 120mg c) 15mg d) 75mg

2. Medicine D comes in 20mg tablets. How many tablets are required in each dose for the following situations:

a) total dosage 120mg , 3 doses b) total dosage 60mg, 2 doses

c) total dosage 100mg, 5 doses d) total dosage 30mg, 3 doses

3. A patient is ordered penicillin 500mg orally. In the ward are 50mg capsules. What number should be given?

4. 12.5mg of captopril is prescribed for hypertension. On hand are tablets of strength 25mg. How many tablets should be given?

5. How many 30mg tablets of codeine should be given for a dose of codeine 45mg?

6. Choose the best combination of 1mg, 2mg, 5mg and 10mg tablets of warfarin for each of these dosages?
a) 3mg b) 7mg c) 13mg d) 16mg

7. A tablet contains 500mg of lasix . The daily dose is 1g. How many tablets would you prescribe?

8. A tablet contains 0.25mg of digoxin. The daily dose is 125mcg. How many tablets would you prescribe?

REVISION 3 : Drug Calculations

1. Medicine A is available in a solution of 10mg per 50ml. How many mls are needed to produce a dose of:
   a) 30mg b) 5mg c) 200mg d) 85mg

2. Medicine C is available in a solution of 15micrograms per 100ml. How many mls are needed to produce a dose of:
   a)150mcg b) 45mcg c)30mcg d) 75mcg

3. A solution contains furosemide 10mg/mL. How many milligrams of frusemide are in
   a) 5mL b) 10mL c) 25mL of the solution?

4. A suspension contains erythromycin 250mg/5mL. How many milligrams of erythromycin are in
   a) 15mL b) 25mL c) 35mL of the suspension?

5. A patient is ordered 750mg of erythromycin orally. Calculate the volume required if the suspension on hand has a strength of 250mg/5mL.

6. Paracetamol 750mg is to be given as a syrup. Stock on hand contains 150mg in 5mL. Calculate the volume of syrup to be given.

7. A patient is prescribed penicillin 400mg orally. Stock syrup has a strength of 125mg/5mL. What volume should be given?

8. Flucloxacillin 375mg is ordered. Stock syrup contains 125mg/5mL. What volume of syrup should the patient be given?

9. Furosemide (frusemide) 125mg is ordered. Stock solution is 50mg/mL. What volume of solution should be given?

10. Calculate how much of a drug you would administer to a client if the dose of pethidine was 75 mg and the vial contains 100 mg/2ml.

11. What volume of phenergon would you give a client for a dose of 6.25 mg when it comes as 25 mg/ml?

12. Atropine is available in a strength of 0.6 mg/ml. How many ml would you give a client for a dose of 0.4mg?

13. Calculate how much lasix you would administer to a client if the dose of lasix is 1g and the vial contains 20 mg/2ml.

14. Calculate how much lanoxin you would give a client if the dose of lanoxin is 0.2mg and the vial contains 0.5 mg/2ml.

15. A 0.5mg dose of neocytamen is ordered. How many ml would you give a client if it is available in a strength of 250 mcg/ml?

16. What volume of lanoxin syrup would you give a client for a dose of 250 mcg, when it comes as 0.05 mg/ml?

17. Calculate how much ampicillin you would give a client if the dose of ampicillin is 0.5g and the vial contains 250 mg/2ml.

18. Heparin comes as 1000 units/ml. What volume would you administer for a 600 unit dose?

19. Heparin comes as 25000 units/ml. What volume would you administer for a 20000 unit dose?

REVISION 4 : Drug Calculations Applications

1. A young girl with pneumonia is to receive antibiotic treatment with amoxicillin.
   The doctor's orders state 20 mg/kg/day divided t.i.d 8 hourly. This patient weighs 18 kg.

   a) Calculate the **daily** dose required.

   b) How many mg of amoxicillin this patient will receive for **each** dose?

   c) If the first dose is given at 0600, state times for the following two doses.

The amoxicillin label shows this information.

   d) Calculate the correct volume of reconstituted solution needed for each dose of amoxicillin for this girl.

   e) State the route of administration for this amoxicillin

   f) Choose the best syringe from the ones on the next page and mark in the volume you would draw up for this girl's dose of amoxicillin. Round down to avoid an overdose.

REVISION 4 : Drug Calculations Applications

2. A teenager is prescribed 900 mg paracetamol PO t.i.d. The stock elixir contains 250 mg/5mL.

   a) Calculate the volume to be given, clearly showing your calculation steps.

   b) What is the total volume the teenager would have each day?

   c) On the ward is a bottle containing 300 mL Paracetamol. Will this be enough for a week of treatment for this teenager?

3. A child is prescribed cloxacillin. The dosage is 50 mg/kg/day, in 4equal doses.

   a) Calculate the size of a single dose if the child weighs 45 kg. Show your working clearly.

   b) Calculate the amount of oral suspension to be given per dose.

REVISION 5 : Infusion Rates

Drip Rate = The number of drops delivered each minute (drop/minute)

Drop Factor = The number of drops for each millilitre (drops/ml)
(determined by length and diameter of needle)

1. Calculate the drip rate if 330 ml is prescribed to take 5 hours. Drop factor of 60 drops /ml

2. What drip rate is required to administer 600ml of drug for 6 hours at 30 drops per ml?

3. How much drug is given if it takes 3 hours at a drop factor of 60 drops/ml and a drip rate of 45 drops per min?

4. How long will it take to administer 450ml of drug at a rate of 60 drops/ min and a drop factor of 30 drops

5. Nazeem has had a car accident and requires blood plasma transfusion.
The registrar has ordered 750mL of plasma to be delivered over a 3 hour period using a 15 drop/mL macrodrip set. Calculate the infusion rate in drops/minute required for this infusion.

6. At 0300 hours, 2 L of normal saline is set up to be delivered through an infusion pump at 85mL/hr. After 8 hours the prescribed rate is increased to 120mL/hr. Calculate the finishing time.

7. Ari is getting an infusion of 2.5 litres at the rate of 450mL/h. There is 1.25 litres of infusion left to run. The consultant treating Ari would like to schedule some further tests for him and has asked you how much longer this infusion will take to complete.
   The correct answer is 2 hours 46 minutes 40 seconds. Show how this answer is calculated, clearly stating what you are calculating at each stage of the calculation process. (Hint: Consider how many minutes make one third of an hour. Using fractions will be easier than decimals.)

8. A patient is to receive two litres of dextrose 4% in $\frac{1}{5}$ normal saline solution.
   For the first $3\frac{1}{2}$ hours the fluid is delivered at 160 mL/h.
   A specialist then prescribes that the rate be slowed so that the remaining fluid will run over the next 16 hours.

   a) Calculate the amount of fluid delivered in the first $3\frac{1}{2}$ hours.

   b) Now calculate the remaining volume to be delivered, and then the required flow rate for the next 16 hours. Give your answer in mL/h.

Look at http://www.nursingnumeracy.info/page11/page5/page5.html for more revision practice

DRILL 1

Convert to grams:		Unit Conversions	
1kg	0.5kg	1000g	500g
12kg	120kg	12 000g	120 000g
7.2 kg	3000mg	7200g	3g
2000mg	750 000mcg	2g	0.75g
7600mg	400 000mg	7.6g	400g
645mg	0.008kg	0.645g	8g
1 000 000 mcg	187mg	1g	0.187g
5 000 000 mcg	600 000ng	5g	0.0006g
762 000 mcg	600 000mcg	0.762g	0.6g
40 000 mcg	6 500 000ng	0.04g	0.0065g
5000 mcg	700 000mcg	0.005g	0.7g
1 000 000 000 ng	700 000mg	1g	700g
750 ng	700 000ng	0.000 000 75g	0.0007g

DRILL 2

Convert to milligrams:

5g	0.5g
54g	5.4g
6000mcg	0.05kg
5 000 000ng	5 870 000ng
100mcg	5 000 000 mcg
6.2 kg	8 000 mcg
0.000 007kg	102 mcg
6.8 g	5000 mcg
425 000mcg	1 000 000 000 ng
42.5 mcg	640 000ng
1400mcg	0.000 001kg
750 000ng	32mcg
207g	3200ng

Unit Conversions

5000mg	500mg
54000mg	5400mg
6mg	50 000mg
5mg	5.87mg
0.1mg	5000mg
6200000mg	8mg
7mg	0.102mg
6800mg	5mg
425mg	1000g
0.0425gm	0.6mg
1.4mg	1mg
0.75mg	0.032mg
207000mg	0.0032mg

DRILL 3

Convert to micrograms:

1kg	0.000 005kg
12kg	0.012kg
7g	300mg
20g	0.75mg
6mg	46g
600mg	0.8ng
1 000ng	187mg
4000 000ng	600 000ng
7.62 mg	2.02mg
0.05 mg	6 50ng
0.006g	0.000 003g
0.0006g	0.725g
3 00 ng	700 000ng

Unit Conversions

100 000 000mcg	5000mcg
12000 000 000mcg	12 000 000mcg
7 000 000mcg	300 000mcg
20 000 000mcg	750mcg
6000mcg	46 000 000mcg
600 000mcg	0.0008mcg
1mcg	187 000mcg
4000mcg	600mcg
7620mcg	2020mcg
50mcg	0.65mcg
6000mcg	3mcg
600mcg	725 000mcg
0.3mcg	700mcg

DRILL 4 **2× – 9×**

8 × 8 =	6 × 3 =	7 × 7 =	64	18	49
5 × 6 =	8 × 9 =	8 × 4 =	30	72	32
6 × 6 =	5 × 4 =	3 × 7 =	36	20	21
3 × 4 =	1 × 9 =	3 × 5 =	12	9	15
2 × 4 =	8 × 8 =	9 × 6 =	8	64	54
5 × 7 =	9 × 5 =	8 × 5 =	35	45	40
4 × 9 =	9 × 9 =	7 × 4 =	36	81	28
7 × 7 =	5 × 6 =	8 × 6 =	49	30	48
9 × 3 =	8 × 5 =	6 × 6 =	27	40	36
7 × 8 =	7 × 6 =	2 × 6 =	56	42	12
9 × 7 =	6 × 8 =	3 × 2 =	63	48	6
8 × 9 =	8 × 2 =	4 × 4 =	72	16	16
7 × 8 =	9 × 3 =	6 × 4 =	56	27	24
10 × 7 =	5 × 5 =	3 × 8 =	70	25	24

DRILL 5

27 ÷ 9 =	25 ÷ 5 =	40 ÷ 8 =	3	5	5
24 ÷ 6 =	27 ÷ 3 =	45 ÷ 9 =	4	9	5
70 ÷7 =	14 ÷ 2 =	8 ÷ 8 =	10	7	1
54 ÷ 6 =	28 ÷ 4 =	28 ÷ 7 =	9	7	4
28 ÷ 4 =	49 ÷ 7 =	32 ÷ 4 =	7	7	8
35 ÷ 5 =	30 ÷ 5 =	21 ÷ 7 =	7	6	3
16 ÷ 8 =	18 ÷ 2 =	18 ÷ 6 =	2	9	3
36 ÷ 9 =	10 ÷ 5 =	40 ÷ 10 =	4	2	4
9 ÷ 9 =	30 ÷ 10 =	48 ÷ 6 =	1	3	8
35 ÷ 7=	40 ÷ 4 =	24 ÷ 3 =	5	10	8
12 ÷ 6 =	56 ÷ 8 =	18 ÷ 6 =	2	7	3
90 ÷ 9 =	12 ÷ 2 =	30 ÷ 6 =	10	6	5
63 ÷ 7 =	12 ÷ 3 =	81 ÷ 9 =	9	4	9
72 ÷ 8 =	24 ÷ 8 =	36 ÷ 6 =	9	3	6

DRILL 6 **25×÷**

25 × 4 =	25 × 20 =	25 × 25 =	100	500	625
25 × 7 =	100 ÷ 25 =	175 ÷ 25 =	175	4	7
25 × 6 =	25 × 19 =	25 × 8 =	150	475	200
25 × 2 =	300 ÷ 25	600 ÷ 25 =	50	12	24
25 × 12 =	25 × 11 =	375 ÷ 25 =	300	275	15
25 × 5 =	200 ÷ 25 =	400 ÷ 25 =	125	8	16
25 × 14 =	25 × 23 =	25 × 24 =	350	575	600
25 × 9 =	25 × 11 =	150 ÷ 25 =	225	275	6
25 × 22 =	75 ÷ 25 =	275 ÷ 25 =	550	3	11
25 × 17 =	25 × 15 =	550 ÷ 25 =	425	375	22
25 × 3 =	350 ÷ 25 =	325 ÷ 25 =	75	14	13
25 × 10 =	25 × 16 =	50 ÷ 25 =	250	400	2
25 × 21 =	25 × 13 =	500 ÷ 25 =	525	325	20

DRILL 7 **dividing with zeros**

210 ÷ 3 =	1500 ÷ 300 =	2700 ÷ 30 =	70	5	90
1500 ÷ 5 =	3200 ÷ 800 =	1400 ÷ 200 =	300	4	7
3600 ÷ 600 =	24000 ÷ 40 =	28000 ÷ 40 =	6	600	700
1800 ÷ 2 =	5600 ÷ 70 =	490 ÷ 70 =	900	80	7
1200 ÷ 300 =	800 ÷ 200 =	3000 ÷ 50 =	4	4	60
3200 ÷ 40 =	6300 ÷ 90 =	18000 ÷ 20 =	80	70	900
800 ÷ 40 =	4000 ÷ 20 =	1000 ÷ 50 =	20	200	20
360 ÷ 60 =	300 ÷ 60 =	300 ÷ 10 =	6	5	30
63 000 / 900	400 000 / 400	1 200 000 / 40 000	70	1000	30
40 000 / 800	56 000 / 80	1 500 000 / 3 000	50	700	500
60 000 / 3 000	120 000 / 2 000	36 000 / 600	20	60	60
160 000 / 40	45 000 / 900	240 000 / 4 000	4 000	50	60

DRILL 8 **multiplying with decimals**

2 × 0.6 =	0.5 × 0.07 =	0.2 × 6.5 =	1.2	0.035	1.3
3 × 0.3 =	0.7 × 0.08 =	2.5 × 0.6 =	0.9	0.056	1.5
5 × 0.8 =	0.03 × 0.05 =	0.08 × 0.04 =	4	0.0015	0.0032
4 × 0.7 =	0.7 × 8 =	0.1 × 58 =	2.8	5.6	5.8
3 × 0.9 =	0.06 × 0.7 =	0.7 × 0.3 =	2.7	0.042	0.21
2 × 0.08 =	0.02 × 8 =	0.6 × 0.8 =	0.16	0.16	0.48
3 × 0.06 =	0.6 × 0.1 =	0.01 × 0.01 =	0.18	0.06	0.0001
5 × 0.02 =	0.09 × 0.06 =	0.01 × 0.07 =	0.1	0.0054	0.0007
2 × 0.05 =	0.3 × 0.02 =	0.3 × 0.2 =	0.1	0.006	0.06
6 × 0.4 =	1.5 × 0.2 =	1.2 × 0.03 =	2.4	0.3	0.036
8 × 0.3 =	0.04 × 0.1 =	0.06 × 0.8 =	2.4	0.004	0.048
7 × 0.05 =	0.5 × 0.9 =	0.07 × 0.06 =	0.35	0.45	0.0042
5 × 0.08 =	0.4 × 0.3 =	9 × 0.08 =	0.4	0.12	0.72

DRILL 9 **dividing with decimals**

1.2 ÷ 3 =	0.35 ÷ 5 =	4.2 ÷ 7 =	0.4	0.07	0.6
2.5 ÷ 5 =	0.24 ÷ 4 =	0.035 ÷ 5 =	0.5	0.06	0.007
4.8 ÷ 6 =	0.36 ÷ 9 =	7.2 ÷ 8 =	0.8	0.04	0.9
0.6 ÷ 3 =	0.48 ÷ 8 =	2.4 ÷ 4 =	0.2	0.06	0.6
2.8 ÷ 4 =	0.45 ÷ 5 =	2 ÷ 5 =	0.7	0.09	0.4
1.5 ÷ 5 =	0.072 ÷ 8 =	3 ÷ 2 =	0.3	0.009	1.5
5.4 ÷ 6 =	0.018 ÷ 3 =	0.0025 ÷ 5 =	0.9	0.006	0.0005
1.8 ÷ 9 =	0.36 ÷ 6 =	5.6 ÷ 7 =	0.2	0.06	0.8
3.2 ÷ 4 =	4 ÷ 5 =	0.024 ÷ 3 =	0.8	0.8	0.008
4.2 ÷ 6 =	1.6 ÷ 4 =	3 ÷ 5 =	0.7	0.4	0.6
2.8 ÷ 7 =	2.5 ÷ 5 =	0.15 ÷ 5 =	0.4	0.5	0.03
4.5 ÷ 5 =	0.14 ÷ 7 =	2.1 ÷ 7 =	0.9	0.02	0.3
4.0 ÷ 8 =	4.2 ÷ 6 =	0.036 ÷ 6	0.5	0.7	0.006

DRILL 10 **dividing by a decimal**

1.2 ÷ 0.3 =	0.35 ÷ 0.05 =	4.2 ÷ 0.07 =	4	7	60
2.5 ÷ 0.5 =	0.24 ÷ 0.4 =	0.035 ÷ 0.5 =	5	0.6	0.07
4.8 ÷ 0.06 =	0.36 ÷ 0.9 =	7.2 ÷ 0.08 =	80	0.4	90
0.6 ÷ 0.003 =	0.48 ÷ 0.8 =	24 ÷ 0.04 =	200	0.6	600
2.8 ÷ 0.04 =	0.45 ÷ 0.5 =	2 ÷ 0.5 =	70	0.9	4
1.5 ÷ 0.05 =	0.072 ÷ 0.8 =	3 ÷ 0.2 =	30	0.09	15
5.4 ÷ 0.6 =	0.018 ÷ 0.3 =	0.0025 ÷ 0.05 =	9	0.06	0.05
1.8 ÷ 0.9 =	0.36 ÷ 0.06 =	5.6 ÷ 0.07 =	2	6	80
3.2 ÷ 0.04 =	4 ÷ 0.05 =	0.024 ÷ 0.3 =	80	80	0.08
4.2 ÷ 0.006 =	1.6 ÷ 0.04 =	3 ÷ 0.05 =	700	40	60
2.8 ÷ 0.7 =	2.5 ÷ 0.5 =	0.15 ÷ 0.0005 =	4	5	300
4.5 ÷ 0.05 =	14 ÷ 0.7 =	2.1 ÷ 0.007 =	90	20	300
4.0 ÷ 0.08 =	42 ÷ 0.6 =	36 ÷ 0.6	50	70	60

DRILL 11 **multiplying/dividing with zeros/decimals**

0.8 × 200 =	2000 × 0.6 =	350 ÷ 0.5 =	160	1200	700
0.06 × 60 =	300 × 0.3 =	240 ÷ 0.04 =	3.6	90	6000
0.7 × 5000 =	50 000 × 0.8 =	3.6 ÷ 0.9 =	3500	40000	4
30 × 0.004 =	4000 × 0.07 =	4800 ÷ 0.8 =	0.12	280	6000
0.9 × 20 =	300 × 0.9 =	0.45 ÷ 0.005 =	18	270	90
7000 × 0.5 =	2000 × 0.08 =	7200 ÷ 0.8 =	3500	160	9000
0.002 × 600 =	30 × 0.06 =	18000 ÷ 0.03 =	1.2	1.8	600 000
800 × 0.3 =	500 × 0.02 =	36 ÷ 0.06 =	240	10	600
0.9 × 700 =	20 × 0.05 =	40 ÷ 0.05 =	630	1	800
0.0003 × 40 =	60 × 0.04 =	1.6 ÷ 0.0004 =	0.012	2.4	4000
0.6 × 70 =	8000 × 0.3 =	25000 ÷ 0.5 =	42	2400	50 000
0.002 × 300 =	70 × 0.05 =	140 ÷ 0.7 =	0.6	3.5	200
4000 × 0.6 =	500 × 0.08 =	4200 ÷ 0.6 =	2400	40	7000

ANSWERS

Exercise 1

1.

	A	B	C
1	2,800g	6,700g	8,200g
2	60g	170g	4g
3	6.5g	4.32g	6.74g
4	0.325g	0.563g	0.745g
5	0.02g	0.005mg	0.067g
6	0.023g	0.46g	0.0026g

2.

	A	B	C
1	6,000mg	3,000mg	14,000mg
2	4,500mg	3,240mg	7,530mg
3	620mg	570mg	980mg
4	6mg	20mg	74mg
5	0.935mg	0.254mg	9.823mg
6	3.5mg	0.023mg	0.057mg
7	0.002mg	0.0034mg	0.00642mg

3.

	A	B	C
1	354mcg	35,000mcg	98mcg
2	0.023mcg	0.687mcg	0.0356mcg
3	2,300,000mcg	80,000mcg	642,000mcg

Exercise 2

1) 2 tablets 2) ½ tablet 3) 1½ tablets 4) 2 tablets 5) 2 tablets
6) a) 2 tablets b) 16 tablets c) ½ tablet 7) 312.5mcg
8) a) 1 x 40mg + 2 x 5mg b) 1 x 5mg + 1 x 8mg c) 1 x 10mg + 2 x 4mg

Exercise 3

1) a) 2 tablets b) 6 tablets 2) 14 tablets 3) a) 2 tablets b) 5 days 4) 2 tablets
5) 5 tablets

Exercise 4

1) a 2) c 3) a 4) b 5) c 6) b 7) c 8) b 9) a 10) c

Exercise 5

	A	B	C
1	1 : 3	1: 19	1 : 2
2	1 : 15	6 : 25	5 : 11
3	17 : 4	35 : 9	3 : 1
4	1 : 2 : 6	3 : 1 : 4	3 : 5 : 2

Exercise 6

	A	B	C
1	10 : 1	5 : 200 = 1 : 40	1500 : 2000 = 3 : 4
2	2000 : 500 = 4 : 1	1000 : 450 = 20 : 9	6000 : 2400 = 5 : 2
3	5000 : 100 = 50 : 1	10,000 : 250 = 40 : 1	780 : 1000 = 39 : 50
4	15000 : 1500 = 10 : 1	600 : 1200 = 1 : 2	300 : 1000 = 3 : 10
5	60 : 1	60 : 3 = 20 : 1	15 : 30 = 1 : 2

Exercise 7

1. a) Yellow b) ½ c) $^3/_{10}$
2 a) 7 : 8 b) 7 : 15 c) $^7/_{15}$
3 a) $^2/_5$ b) 3 : 2 These answers are correct only if there are no other colours in the paint
4 a) 3 : 7 b) 10 : 7 c) 3 : 10

Exercise 8

(1) a is 2 (2) b is 9 (3) c is 12 (4) d is 9
(5) e is 3 (6) f is 36

Exercise 9

1) 60kg 2) 198cm 3) 750 adults 4) 11,220 women 5) 585 right handers
7) 270 miles

Exercise 10

1) a) 8 : 4 b) 15: 5 c) 7 : 28 d) 90 : 10 e) 60 : 40
2) $3300 ; $2400 3) Jenny has 50 and Tim has 30
4) 45mL ; 30mL ; 15 mL 5) Jim gets $54,000 and Harry gets $30,000
6) 200kg of gravel 7) 55 + 48 = 103 8) 42 children

Exercise 11

1) a) 2mL b) 0.5mL c) 10mL d) 10mL e) 20mL
2) 40mL 3)25mL 4)5mL
5) 1mL 6) 2mL 7) 5mL 8) 4mL 9) a) 6mL
b) 5 mL c) 3 mL 10) 1050mg 11) 0.8mL

Exercise 12

1) 1.5mL 2) 0.25mL 3) 0.67mL 4) 0.8mL 5) 15mL
6) 16mL 7) 0.6mL 8) 0.8mL 9) 0.8mL
10) 0.5mL 11) 1.7mL 12) 0.75mL 13) 1.33mL

Exercise 13

1. a) 219mg b) 990mg c) 387.5mg d) 470mg
2. 4.5 mL 3. a) 350 mg b) 500mg c) 87mg

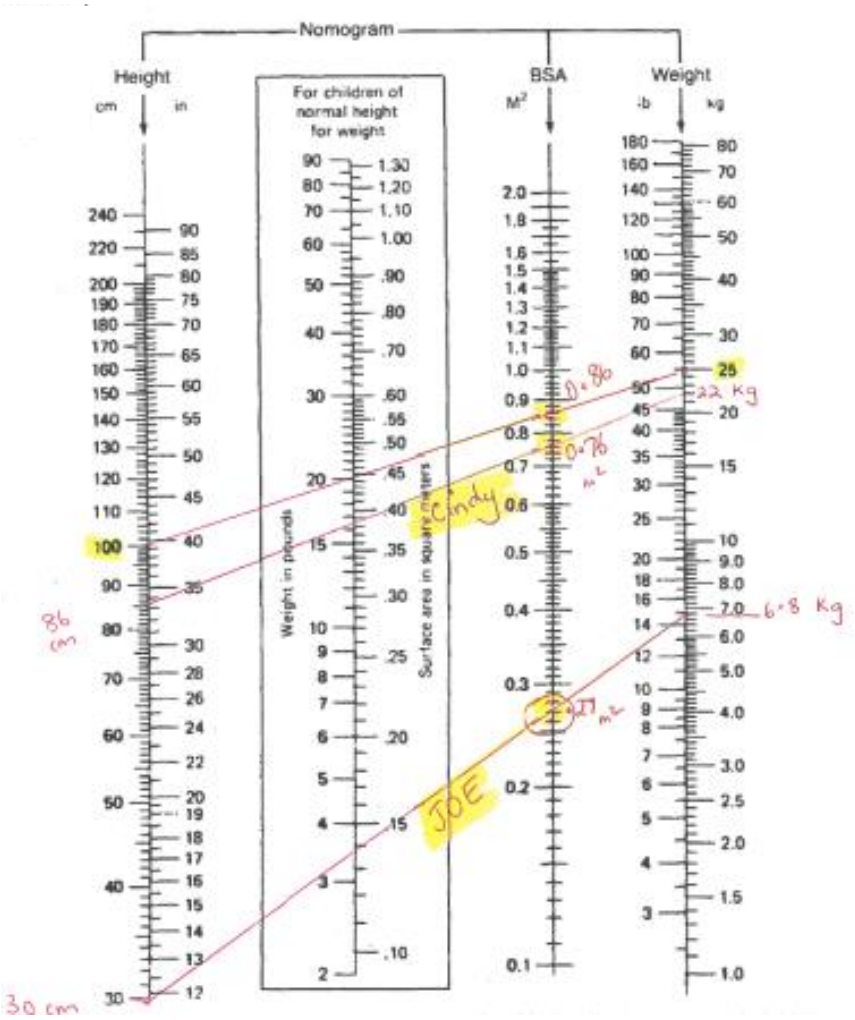
Exercise 14

1. 1.5 mL needed so use 3 mL syringe 2. 2 mL needed in a 3 mL syringe
3. 9.5 mL needed in a 12 mL syringe 4. 0.6 mL(cc) needed in 1cc syringe

Exercise 15

1. 5.2mL 2. 3.3mL
3. 1.66666 mL which rounds down to 1.66 mL (to avoid potential overdose, especially in very small babies, UNITEC Bachelor of Nursing always rounds doses down to nearest syringe marking. In contrast, some other nursing schools round to nearest value marked on syringe, which in this case would be 1.67 mL
4. 2mL 5. 7.5mL 6. 2mL

Exercise 16



1. $0.27m^2$
2. $0.73m^2$
3. A person 180cm tall and 70kg has BSA approx 1.9 m^2
4. Use the second one for older children or adults (over 25kg or 100cm)
5. 0.86 m^2 compared with 0.8 m^2 Both similar. The second is less accurate but it is just an estimate.
6. BSA = 1.2 m^2
   1200mg needed
7. 0.81mg needed=0.00081g
   0.00081 × 500 = 0.405mL
8. BSA = 1.3 m^2
   150 × 1.3 = 195mg needed.
   195 ÷ 100 = 1.95mL dose.

Exercise 17

1. (a) 1.5mL/min (b) 60mL (c) 4 hours
2. (a) 32.5g/dL (b) 32500 mg/dL (c) 325 mg/mL
3. (a) 70mg/g (b) 70g/kg
4. (a) 23850mg/dL (b) 238.5mg/mL (c) 238.5g/L
5. (a) 67.8 mg/L (b) 0.00678 g/100mL (c) 0.0678 mg/mL
6. (a) 38.5mL/dL (b) 0.385mL/mL (c) 0.385 L/L (d) 385 mL/L
7. (a) 12970mg/dL (b) 129700mg/L (c) 129.7mg/mL (d) 129.7g/L
8. (a) 9.85mg/L (b) 0.000985g/100mL (c) 0.00985mg/mL

Exercise 18

1) 100mL/h 2) 400mL/h 3) 50mL/h 4) 125mL/h

Exercise 19

1) 53mL/h 2) 338mL 3) 6.7 hours (or $6^2/_3$ hours) = 6 hours and 40 minutes

Exercise 20

1) 6 hours +7 hours = 13 hours
2) Total time = 5 hours + $7\frac{1}{2}$ hours = 5 hours + 7 hours 30 mins 12 hours 30 mins
   = 12 hours and 30 mins
   Finish time: 0800 + 12 hours and 30 mins = 1530 hours

Exercise 21

1) 66 drops/min 2) 50 drops/min 3) 33 drops/min 4) a) 13 dpm
b) 27dpm 5) 44dpm 6) 40dpm 7) 31 dpm

Exercise 22

1) 27 dpm 2) 40 dpm 3) 135mL
4) Volume = 40 × (6 × 60) = 14,400 drops = 14,400 ÷ 15 = 960mL

Exercise 23

1. 255 minutes which is 4 hours and 15 minutes.
2. 240 minutes which is 4 hours.
3. 416 minutes which is 6 hours and 56 minutes.
4. 32 minutes.
5. 97 minutes which is one hour and 37 minutes.
6. 400 minutes which is 6 hours and 40 minutes
7. 56 minutes 8. 200 minutes which is 3 hours and 20 minutes.

Revision 1: Ratios

1. (a) 3:4 (b) 1:3 (c) 2:15
2. (a) 6 cups (b) 20 cups
3. $15 : $6 : $9
4. (a) 15 (b) 8
5. (a) i) 10 : 20 = 1 : 2 ii) 20 : 5 = 4 : 1 iii) 5 : 10 = 1 : 2
   (b) 20ml of A; 40ml of B; 10ml of C (c) i) 200mL ii) 80ml of B; 20ml of C

Revision 2: Tablets

1. a) 2 tablets b) 4 tablets c) $\frac{1}{2}$ tablet d) $2\frac{1}{2}$ tablets
2. a) 2 tablets b) $1\frac{1}{2}$ tablets c) 1 tablet d) $\frac{1}{2}$ tablet
3. 10 tablets 4. ½ tablet 5. 1 ½ tablets
6. a) 2mg + 1mg b) 5mg + 2mg c) 10mg + 2mg + 1mg d) 10mg + 5mg + 1mg
7. 2 tablets 8. 0.5 tablets

Revision 3: Drug Calculations

1. a) 150ml b) 25ml c) 1000ml d) 425ml
2. a) 1000ml b) 300ml c) 200ml d) 500ml
3. a) 50mg b) 100mg c) 250mg 4. a)750mg b) 1250mg c) 1750mg
5. 15mL 6. 25mL 7. 16mL 8. 15mL 9. 2.5Ml 10. 1.5Ml
11. 0.25mL 12. 0.67mL 13. 100mL 14. 0.8mL 15. 2mL 16. 5mL
17. 4mL 18. 0.6mL 19. 0.8mL

Revision 4: Drug Calculations Applications

1. a) 360mg b) 120mg c) 1400 and 2200 (2pm and 10pm)
   d) 1.5mL e) Oral Suspension – given by mouth (P.O.)
   f) Draw up 1.5mL in a 3mL syringe
2. a) 18mL b) 54mL c) 378mL needed so no, not enough
3. a) 562.5mg b) 22.5mL

Revision 5: Infusion Rates

1. 66 drops/min 2. 50 drops/min 3. 135mL 4. 3 hours 45 mins
5. 63 drop/min 6. Total running time = 8 hr + 11 hr = 19 hr Finishing time = 0300 hr + 19 hr = 2200 hours 7. $1250 \div 450 = 2\frac{7}{9}$ hours = 2 hours $46\frac{2}{3}$ mins= 2 hours 46 mins 40 seconds
8. a) 480mL 560mL b) 1440mL remaining to deliver at 90mL/h

Nursing for Maths Glossary

Fill in the mathematical meaning of these words as you encounter them in the course.

Percentage Strength	
Ratio	
Ratio Strength	
Solute	
Solution	
Solvent	
Split into a given Ratio	

Acknowledgements

The following sources have been used and material has been adapted from them:

Nursing Calculations	Seventh Edition	J.D.Gatford, N.Phillips	Elsevier
Health: The Basics	8th Edition	Donatelle	2009
Dosage Calculations for Vetinary Nurses and Technicians		Terry Lake	Butterworth Heinemann
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Calculations for Veterinary Nurses		Margaret C. Moore and Norman G. Palmer	Blackwell Science
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