

**School of Nursing & Midwifery  
Pre-registration Nursing**



**CALCULATIONS FOR MEDICINE  
DOSAGES WORKBOOK**

**RGU and Practice Partners Numeracy Strategy Group**

Updated November 2019

## **Remit of Numeracy and Administration of Medicines Group**

To provide strategies and guidance for the School of Nursing and Midwifery, Robert Gordon University (RGU) and all partners in practice in relation to the development and assessment of numeracy and administration of medicine skills for nursing and midwifery students.

The group membership will include; RGU nursing and midwifery lecturers, practice education staff across NHS Grampian, NHS Orkney, NHS Shetland, care homes and clinical practice staff.

The group will meet a minimum of three times a year with an action plan noted at each meeting. Group actions to be reported at relevant RGU governance groups and the Education Forum.

### **Group Membership**

| <b>Name</b>      | <b>Role</b>                                                               |
|------------------|---------------------------------------------------------------------------|
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| Claire Begg      | Care Home Education Facilitator                                           |
| Emily Bochel     | Nurse Educator, RACH                                                      |
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| Jane Ewen        | Chief Nurse Practice Education & Development, NHS Grampian                |
| Lisa Forbes      | Nurse Manager, NHS Grampian                                               |
| Fiona Gibb       | Lead Midwife for Education/Senior Lecturer, RGU                           |
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## **Aim**

The aim of this workbook is to prepare you, the student, for your supervised practice and assessment for ESC 33 and ensure parity between practice learning environments.

## **Introduction**

The NMC Standards for Medicine Management (2007) were withdrawn in January 2019. However, you may wish to access the following link where signposting to a range of professional guidance on medicines management is provided:

<https://www.nmc.org.uk/standards/standards-for-post-registration/standards-for-medicines-management/> [Accessed 5 July 2019].

There are two important points to remember:

The first is that it is good practice to get another person to check a complex calculation (or one we are unsure of). This should be carried out independently of each other.

The second is that we should not rely on the use of a calculator (although a calculator may be used to check a calculation in practice).

The standards you are expected to achieve as a nursing student are set out in the Essential Skills Clusters (ESCs) that you will find in your "Ongoing Achievement Record (OAR)".

## **Summary of Content**

In this workbook we have defined what is meant by the terms: *unit dose*, *sub* and *multiple unit dose* and *SI unit conversion*. We have provided a framework for basic to complex calculations mapped to each stage of the nursing programme and we have also given you some examples of the kind of calculation you will be expected to undertake to meet ESC 33 so you can be prepared for your supervised practice.

## **NMC Essential Skills Cluster (ESC)**

Medicines management, with regard to calculations, is covered by ESC 33:

**People can trust the newly registered nurse to correctly and safely undertake medicines calculations.**

In stage one, ESC 33.1:

Is competent in basic medicines calculations relating to:

- Tablets and capsules
- Liquid medicines
- Injections including:
  - Unit dose
  - Sub and multiple unit dose
  - SI unit conversion

In stage three, ESC 33.2:

Is competent in the process of medication-related calculation in nursing field involving:

- Tablets and capsules
- Liquid medicines
- Injections
- IV infusions including:
  - Unit dose
  - Sub and multiple unit dose
  - Complex calculations
  - SI unit conversion

These should all be met by supervised practice, usually with your mentor or their delegated deputy.

## Preparation

In order to help meet the requirements for ESC 33 (33.1 and 33.2), we are providing two resources: Safe Medicate® and this workbook.

1. "Safe Medicate"® is an online resource that we provide for you. You will have received log in details and instructions on how to use this resource during your programme. It will teach you how to perform medicine calculations and it will allow you to practice in your own time and at your own pace.

You will have been assessed formatively by the Safe Medicate® Foundation Numeracy Assessment at the start of stage one which will guide you to the areas you need to develop.

There are 5 key areas of numeracy you will need to be proficient in:

- Division
- Long multiplication
- Decimals
- Fractions
- Metric (SI) conversions.

If you are struggling with any of these five areas, you can find help from the resources identified below in "hints and tips" and from Study Support here at RGU.

### Study Support Contact Details

Student Help Point

Level 3

Ishbel Gordon Building

Tel: 01224 263089

email: [studyskills@rgu.ac.uk](mailto:studyskills@rgu.ac.uk)

Also, see the Medicine Dosage Calculations section on the Study Skills and Access Unit study area on CampusMoodle:

<http://campusmoodle.rgu.ac.uk/course/view.php?id=76947>

We will use Safe Medicate® to test you formatively in each stage of your programme. In stage one the test will be on solids, liquid and injections. In stage two it will be intravenous infusions. In stage three it will be a combination of these areas at field level rather than foundation level.

2. The second resource is this workbook itself, which will help prepare you for the supervised practice you will be required to undertake to meet ESC 33.1 and 33.2.

## Definitions

### Unit dose

A dose of medicine prepared in an individual form, e.g. tablet or capsule or packet for convenience, safety, or monitoring.

### Sub unit dose

If the requirement is LESS than the dose of prepared medicine, e.g. ½ tablet

### Multiple unit dose

If the requirement is MORE than the dose of prepared medicine, e.g. 2 tablets

### SI unit conversion

The International System of Units (SI) – is an adaptation of the metric system. In healthcare, and in our case, we use it for measuring weights and volumes. We may have to undertake metric conversions to convert prescription doses to what is available as stock, e.g. 0.5mg to 500 micrograms

## Hints and Tips

A useful tool is the times table calculator:

| X  | 0 | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9   | 10  | 11  | 12  |
|----|---|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| 0  | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0   | 0   |
| 1  | 0 | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9   | 10  | 11  | 12  |
| 2  | 0 | 2  | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 18  | 20  | 22  | 24  |
| 3  | 0 | 3  | 6  | 9  | 12 | 15 | 18 | 21 | 24 | 27  | 30  | 33  | 36  |
| 4  | 0 | 4  | 8  | 12 | 16 | 20 | 24 | 28 | 32 | 36  | 40  | 44  | 48  |
| 5  | 0 | 5  | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45  | 50  | 55  | 60  |
| 6  | 0 | 6  | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54  | 60  | 66  | 72  |
| 7  | 0 | 7  | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63  | 70  | 77  | 84  |
| 8  | 0 | 8  | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72  | 80  | 88  | 96  |
| 9  | 0 | 9  | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81  | 90  | 99  | 108 |
| 10 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90  | 100 | 110 | 120 |
| 11 | 0 | 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99  | 110 | 121 | 132 |
| 12 | 0 | 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

## Other Resources

### Books

DOWNIE, G., MACKENZIE, J., and WILLIAMS, A., 2010. *Calculating drug doses safely: a handbook for nurses and midwives*. 2nd ed. Edinburgh: Churchill Livingstone Elsevier. Please see Chapter 2, pp. 14-27.

GATFORD, J.D. and PHILLIPS, N., 2002. *Nursing calculations*. 6th ed. Edinburgh: Churchill Livingstone Elsevier. Please see Chapter 1.

HUTTON, M., 2008. *Essential calculation skills for nurses and midwives*. Maidenhead: Open University Press. Please see Chapters 1- 3.

ROGERS, K.M.A. and SCOTT W.N., 2011. *Nurses! Test yourself in essential calculation skills*. Glasgow: Open University Press. Please see Section 1.

### Web pages

BRITISH BROADCASTING CORPORATION (BBC), 2015. *Skillswise English & maths for adults*. [online]. London: BBC. Available from: <http://www.bbc.co.uk/skillswise/maths> [Accessed 14 June 2019].

BRITISH BROADCASTING CORPORATION (BBC), 2014. *GCSE Bitesize: maths*. [online]. London: BBC. Available from: <http://www.bbc.co.uk/schools/gcsebitesize/maths/number/> [Accessed 14 June 2019].

### Online videos

CHALKBOARD LEARNING, 2011. *Long multiplication*. [online video]. 5 April. Available from: <http://www.youtube.com/watch?v=0jhf1ldvP-o> [Accessed 14 June 2019].

VIMONT, D., 2012. *Long division with two digit divisor*. [online video]. 13 June. Available from: <http://www.youtube.com/watch?v=1j5eWFQfLYc> [Accessed 19 June 2019].

KHAN ACADEMY, 2010. *Adding decimals*. [online video]. 9 August. Available from: <http://www.youtube.com/watch?v=w616LEmrHVE> [Accessed 14 June 2019].

KHAN ACADEMY, 2010. *Subtracting decimals*. [online video]. 10 August. Available from: <http://www.youtube.com/watch?v=Eq4mVCd-yyo> [Accessed 14 June 2019].

KHAN ACADEMY, 2010. *Multiplying decimals*. [online video]. 10 August. Available from: <http://www.youtube.com/watch?v=JEHejQphIYc> [Accessed 14 June 2019].

MIDDLESEX UNIVERSITY, 2010. *Metric unit conversion 2 - exercises*. [online video]. 31 March. Available from: <http://www.youtube.com/watch?v=ClxIsX9JV-M> [Accessed 14 June 2019].

## Using a Formula, Common Sense and the BNF

### Formula for SOLIDS:

$$\frac{\text{Want (what the patient has been prescribed)}}{\text{Got (what is available in stock)}}$$

### Formula for LIQUIDS:

$$\frac{\text{Want} \times \text{Volume (what it is in)}}{\text{Got}}$$

We can also use our common sense and knowledge of correct drug doses to do a mental check. If the answer we arrive at is 20 tablets it may be reasonable to question either the prescription or our calculation. 20 is a lot of tablets to swallow! We know we would only give 2-3ml of fluid subcutaneously and 5ml intramuscularly so amounts over that are likely to be an error. Also, always check the BNF to see if the dose is within the correct therapeutic range.

### Tip for rounding up:

As a general rule of thumb, round under 1ml to 2 decimal places (hundredths) and over 1ml to one decimal place (tenths). Remember 5 or over goes to the one above, under 5 the number below.

For example:

$$0.336 = 0.34\text{ml}$$

$$0.332 = 0.33\text{ml}$$

$$1.33\text{ml} = 1.3\text{ml}$$

$$1.56\text{ml} = 1.6\text{ml}$$

## Examples of Medicine Dose Calculations for Adult/Mental Health/Children and Young People

*It is essential to have a British National Formulary (BNF) to refer to whilst you complete these medication related calculations so you become familiar with the medicines.*

We have provided a mixture of examples for you to have a go at. Don't worry if the examples are not particularly used in your field of practice; they are all useful to prepare you for your summative assessment in the OAR.

## BASIC CALCULATIONS

### Tablets and Capsules

#### Example 1 – same unit of measurement/multiple unit

Dexamethasone 16mg is prescribed. The available stock is Dexamethasone 2mg tablets.

Q. How many tablets should be administered?

$$A. \frac{WANT}{GOT} = \frac{16mg}{2mg} = 8 \text{ tablets}$$

WANT refers to the prescription that has been written for the patient. GOT refers to the stock that is available to you.

#### Example 2 – different unit of measurement

Captopril 12500 micrograms has been prescribed. Stock available is 12.5mg.

Q. How many tablets should be administered?

$$A. \frac{WANT}{GOT} = \frac{12500 \text{ micrograms}}{12.5mg} = \frac{12500 \text{ divided by } 1000}{12.5mg} = \frac{12.5}{12.5} = 1 \text{ tablet}$$

#### Example 3 – multiple unit doses

Oxycodone 15mg has been prescribed. The available stock is as follows:

Oxycodone 5mg tablets

Oxycodone 10mg tablets

Oxycodone 20 mg tablets

Q. How many of each and in what combination of tablets should be given to ensure that the patient is administered as few tablets as possible?

A. 1 x 5mg Oxycodone and 1 x 10mg Oxycodone

#### Example 4 – multiple unit doses

Omeprazole 40mg has been prescribed. Stock available is 20mg capsules.

Q. How many capsules are required?

$$A. \frac{Want \ 40mg}{Got \ 20mg} = 2 \text{ tablets}$$

#### Example 5 – metric conversion

Tamsulosin 0.4mg has been prescribed. Tamsulosin 400 microgram tablets are available.

Q. How many tablets are to be administered?

$$A. \frac{Want \ 0.4mg}{Got \ 400micrograms} = \frac{400 \ micrograms}{400micrograms} = 1 \text{ tablet}$$

#### Example 6 – sub units

Digoxin 62.5 micrograms has been prescribed. Stock available is 125 micrograms.

Q. How many tablets are to be administered?

$$A. \frac{62.5 \ micrograms}{125 \ micrograms} = \frac{1}{2} \text{ tablet}$$

(continued)

Please note that it is not good practice to halve tablets as it is difficult to get an exact dose. Capsules and enteric coated tablets should never be halved. If there is no other solution, sometimes a scored tablet can be halved but check with the pharmacist first to ensure there is no other way and this is an acceptable solution.

Q. From which professional would you need approval before you gave this dose?

A. Pharmacist

Practice Questions: Solid Medicine (tablets and capsules)

1. Nitrazepam 10mg has been prescribed orally. Stock available is 5mg tablets. How many tablets are required to be administered?

2. Diazepam 15mg has been prescribed orally. Stock available is 2mg, 5mg and 10mg. How many of which tablet strength are required to be administered to allow the patient to take the least number of whole tablets?

3. Haloperidol 0.5mg has been prescribed orally. Stock available is 500 micrograms. How many tablets should be administered?

4. Clozapine 12.5mg has been prescribed orally. Stock available is 25mg scored tablets. How many tablets would be required? *Whose permission do you need to seek before administering the required dose?*

5. Amitriptyline 75mg has been prescribed orally. Stock available is 10mg 25mg 50 mg. How many of which tablet strength are required to be administered to allow the patient to take the least number of tablets?

6. Carbamazepine 200mg has been prescribed orally for a 10-year-old boy. Stock available is 100mg tablets, 200mg and 400mg. How many of which tablet strength are required to be administered to allow the patient to take the least number of tablets?

7. Prednisolone 7.5mg has been prescribed orally. Stock available is 2.5mg. How many tablets should be administered?

8. Paracetamol 500mg has been prescribed for a 12-year-old girl. Stock available is 500mg. How many tablets should be administered? What is essential you find out before administering the dose?

9. Ibuprofen 200mg is prescribed orally for a 10-year-old boy. Stock available is 200mg tablets. How many tablets should be administered?

10. Fludrocortisone 200 micrograms have been prescribed. Stock tablets are 0.1mg. How many tablets should be administered?

11. Glibenclamide 2.5mg has been prescribed orally. Stock available is 2.5mg and 5mg tablets. How many of which tablet strength are required to be administered to allow the patient to take the least number of tablets?

12. Digoxin 0.5mg has been prescribed. Stock available is 250 micrograms. How many tablets should be administered? What do you need to be aware of before administering this drug?

13. Cimetidine 800mg has been prescribed orally. Stock available is 200mg. How many tablets should be administered?

14. Ranitidine 300mg has been prescribed. Stock available is 150mg. How many tablets should be administered?

15. Furosemide 60mg has been prescribed. Stock available is 20mg and 40mg tablets. How many of which tablet strength are required to be administered to allow the patient to take the least number of tablets?

### Liquid Medicines

#### Example 1 – same unit of measurement

Flucloxacillin 500mg in oral solution has been prescribed. Stock available is 250mg.in 5ml.

Q. How much solution should be administered?

A.  $\frac{WANT \times volume}{GOT} = \frac{500mg \times 5ml}{250mg} = \frac{2 \times 5}{1} = \frac{10}{1} = 10ml$  **OR**

$\frac{WANT}{GOT} \times volume = \frac{500mg}{250mg} \times 5ml = \frac{2}{1} \times 5 = 10ml$

#### Example 2 – measurement in millilitres

N.B. For some liquid medicines, the dose is prescribed in millilitres.

Lactulose 15ml has been prescribed. Stock is a 500ml bottle.

Q. How much lactulose should be administered?

A. 15ml

### Practice Questions: Liquid Medicines

1. Paracetamol suspension 1g has been prescribed. The available stock is paracetamol 250mg in 1ml. How much suspension should be administered?

2. Oramorph oral solution 20mg has been prescribed. Stock available is Oramorph oral solution 10mg in 5ml. How much oral solution should be administered?

3. Morphine solution 7.5mg has been prescribed. The available stock is Morphine 10mg in 5ml. How much solution should be administered?

4. Phenytoin suspension 150mg has been prescribed. Stock available is phenytoin suspension 30mg in 5ml. How much should be administered?

5. Promazine hydrochloride oral solution 200mg has been prescribed. The stock available is 25mg in 5ml OR 50mg in 5ml. How much should be administered from which stock to give the smallest volume?

6. Codeine Linctus BP 15mg is prescribed in an oral solution. The stock available is 15mg in 5ml. How much oral solution do you administer?

7. Erythromycin oral suspension 125mg is prescribed for a 2-year-old child. The only available stock at the moment is 250mg in 5ml. How much oral solution is required to be administered?

8. Diazepam oral solution 1mg is prescribed for a 7-year-old child. The stock available is 2mg in 5ml. How much oral solution do you administer?

9. Hemineverin syrup 500 mg is prescribed. Stock available is 250mg in 5ml. How much solution will be administered?

10. Galantamine oral solution - Reminyl 4mg has been prescribed. Stock available is 4mg/ml. How much solution will be administered?

11. Ibuprofen 50mg oral suspension has been prescribed for a 5-month-old baby who weighs over 5kg. The available stock is 100mg in 5ml. How much oral suspension should be administered?

12. Salbutamol oral solution 1mg has been prescribed for a 5-year-old child. The stock available is 2mg in 5ml. How much solution should be administered?

13. Seroxat liquid 20mg has been prescribed. The stock available is 10mg/5ml. How much solution should be administered?

14. Citalopram 48mg has been prescribed as oral drops. The stock available is 40mg/ml. How much solution should be administered?

## Injections

### Example

Haloperidol 1.5mg via subcutaneous injection is prescribed. Stock available is injection solution of 5mg/ml.

Q. What volume of solution should be drawn up and administered?

A. 
$$\frac{\text{WANT} \times \text{volume}}{\text{GOT}} = \frac{1.5\text{mg} \times 1\text{ml}}{5\text{mg}} = 0.3\text{ml}$$

### Practice Questions – Liquids for Injections

1. Morphine 5mg via subcutaneous injection has been prescribed. The available solution is Morphine 10mg/ml. What volume of solution should be drawn up and administered?

2. Prochlorperazine 12.5mg has been prescribed to be given by intramuscular injection. Available stock is 12.5mg in 1ml. How much solution should be drawn up and administered?

3. Midazolam 10mg has been prescribed by intramuscular injection. Stock available is 5mg/1ml. How much volume of solution is required to be drawn up and administered?

4. Furosomide 40mg is prescribed by intramuscular injection. The available stock is 10mg/1ml. How much solution volume is required to be drawn up and administered?

5. Heparin 5000 units is prescribed intravenously. Available stock is 2500 units/1ml. How much volume of the solution will be required to be drawn up and administered?

6. Actrapid Insulin 10 units has been prescribed subcutaneously. The stock available is 100 units/ml. What volume needs to be drawn up and administered?

7. Adenosine 12mg has been prescribed by rapid intravenous injection. Stock available is 3mg in 1ml. How much solution will need to be administered?

8. Amiodarone 300mg is prescribed by intravenous injection. Stock available is 30mg in 1ml. How much solution will need to be administered?

9. Clonazepam 500 micrograms has been prescribed for an 8-year-old boy. Stock available is 1mg in 1ml of diluent (water). How much solution should be administered?

10. Digoxin 40 micrograms is prescribed for an infant as an intramuscular maintenance dose. Stock available is 50 micrograms in 2ml. How much solution should be administered?

11. Pethidine 35mg as an intramuscular injection is prescribed for a boy. Stock available is 50mg in 1ml. How much solution should be administered?

12. Haloperidol 1.5mg has been prescribed. Stock available is a solution of 5mg/1ml. What volume of solution is required to be administered?

13. Zuclopenthixol Decanoate 100mg has been prescribed intramuscularly. Stock available is 200mg/ml. How much solution should be administered?

14. Risperidone 37.5mg has been prescribed by intramuscular injection. Stock available is vials of 25mg, 37.5mg and 50mg with diluent. Which vial would you use?

15. Lorazepam 1.5mg has been prescribed by intramuscular injection. Stock available is 4mg/ml. How much solution should be administered?

### Body Weight Calculations

The **first step** is to convert the patient's body weight into kg OR weigh the patient in kg.

The formula is  $2.2\text{lb} = 1\text{kg}$ .

The **second step** is to calculate the medication dose.

Calculate the daily dose.

Divide the daily dose by the number of doses to be administered.

Use either the ratio-proportion or formula method to calculate the number of tablets/capsules or volume to be administered with each.

For some drugs the dosage required is calculated on a body weight basis. Body weight is measured in kilograms (kg) and so this dose is usually quoted as mg per **kg**.

Therefore, for an individual patient, dosage required is obtained by multiplying the number of milligrams by that patient's weight or surface area.

**Example:**

Dosage required = prescription x body weight 70kg man is to have gentamicin 2mg per kg. Dose required:  $70 \times 2 = 140\text{mg}$

Practice Questions – Body Weight Calculations

1. An initial dose of Digoxin 25 micrograms/kg/day has been prescribed for a 5-year-old girl weighing 25kg. Stock available is 50 micrograms per ml. The daily dose of Digoxin should be given in 3 divided doses. How many mls are required for one dose?

2. Midazolam is prescribed for a 14kg child by mouth for sedation. The recommended dose is 500micrograms/kg. How many mg should be prescribed?

3. Paracetamol by intravenous infusion 1g is prescribed for a 48 kilogram child. (Max. 4g daily). Is this an acceptable dose? Provide a rationale for your answer.

4. Erythromycin 40mg/kg/dose has been prescribed. The patient weighs 74kg  
How many grams are required for one dose?

5. Chloramphenicol 40mg/kg/dose has been prescribed. The patient weighs 78kg. How many grams are required for one dose?

6. Gentamicin is prescribed at a rate of 2.5ml/kg/hour. The patient weighs 45kg. How many ml will the patient require in 1 hour?

7. Gentamicin is prescribed at a rate of 2.5ml/kg/hour. The patient weighs 45kg. The Gentamicin is 40mg/ml. How many mg is the patient receiving:  
a. Each hour?  
b. Convert this to grams.

8. Lorazepam 25 microgram/kg is prescribed for a patient who weighs 85kg. Stock available is 4mg/ml. What is the dose required?

9. Sodium Bicarbonate is prescribed 10ml/kg over 5 hours. The patient weighs 65kg.
- How many ml will she receive in total?
  - How many ml per hour?

10. Digoxin 3 microgrammes /kg are prescribed for a 3-year-old child who weighs 18kg. Stock available is 50 micrograms per ml. How many millilitres for a single dose?

### Infusion Rates – ml/hour

$$\text{Rate ml/hour} = \frac{\text{Volume required for patient in ml}}{\text{Time (hours)}} \quad \text{OR} \quad \frac{\text{Volume required in ml}}{\text{Minutes}} \times 60$$

#### Example

A patient is to receive 2 litres of normal saline over the next 12 hours.

Q. What is the infusion rate in ml/hour?

A. Step 1 – convert litres to millilitres

$$2 \text{ litres} = 2000 \text{ millilitres}$$

Step 2 – use the formulae

$$\frac{2000}{12} = 166.7 \text{ ml/hour}$$

#### Example

Normal Saline 0.9% 1500ml is prescribed to be given over 45 minutes.

Q. What is the infusion rate in ml/hour?

$$\text{A. } \frac{\text{Volume required for patient in ml} \times 60}{\text{Time (minutes)}} = \frac{1500 \text{ ml} \times 60}{45} = 2000 \text{ ml/hr}$$

Practice Questions – Infusion Rates

1. Normal Saline 0.9% 500ml is prescribed to be given over 20 minutes. What is the infusion rate in ml/hour?

2. Normal Saline 0.9% 1000ml is prescribed to be given over 20 minutes. What is the infusion rate in ml/hour?

3. Normal saline 0.9% 750ml is prescribed to be given over 8 hours. What is the infusion rate in ml/hour?

4. Normal Saline 0.9% 500ml is prescribed to be given over 30 minutes. What is the infusion rate in ml/hour?

5. Dextrose 5% 750ml is prescribed to be given over 4 hours. What is the infusion rate in ml/hour?

6. Normal saline 0.9% 0.75litres is prescribed to be given over 6 hours. What is the infusion rate in ml/hour?

7. Dextrose 5% 250ml is prescribed to be given over 30 minutes. What is the infusion rate in ml/hour?

8. Normal Saline 0.9% 500ml is prescribed to be given over 15 minutes. What is the infusion rate in ml/hour?

9. Normal Saline 0.9% 1000ml is prescribed to be given over 30 minutes. What is the infusion rate in ml/hour?

10. Dextrose 5% 500ml is prescribed to be given over 8 hours. What is the infusion rate in ml/hour?

11. Normal Saline 0.9% 250ml is prescribed to be given over 10 minutes. What is the infusion rate in ml/hour?

12. Hartmann's solution 0.5 litres are prescribed to be given over 4 hours. What is the infusion rate in ml/hour?

13. Normal Saline 0.9% 500ml is prescribed to be given over 15 minutes. What is the infusion rate in ml/hour?

14. Normal Saline 0.9% 250ml is prescribed to be given over 15 minutes. What is the infusion rate in ml/hour?

15. Dextrose saline 1 litre is prescribed to be given over 4 hours. What is the infusion rate in ml/hour?

16. Normal Saline 0.9% 750ml is prescribed to be given over 45 minutes. What is the infusion rate in ml/hour?

17. Normal Saline 0.9% 500ml is prescribed to be given over 10 minutes. What is the infusion rate in ml/hour?

18. Dextrose 5% 2 litres are prescribed to be given over 24 hours. What is the infusion rate in ml/hour?

19. Normal Saline 0.9% 1500ml is prescribed to be given over 30 minutes. What is the infusion rate in ml/hour?

### Infusion Rates – drops per minute

$$\text{Drop/minute} = \frac{\text{ml}}{\text{hour}} \times \frac{\text{Drop factor}}{60}$$

#### Example

The doctor prescribes an IV infusion of 5% Dextrose in Water one litre to infuse over the next eight hours. The IV tubing that you are using has a drop factor of 15.

Q. What is the correct rate of flow?

A.  $\frac{1000}{8} \times \frac{15}{60} = \frac{1000}{8} \times \frac{1}{4} = \frac{1000}{32} = 31.25 = 31$  as you round the number down.

### Practice Questions – Infusion Rates – drops per minute

1. The doctor prescribes 1.5 litres of Hartman's solution to be administered intravenously to your patient over the next 12 hours. Calculate the rate of flow if the IV tubing has a drop factor of 20.

2. One and a half litres of IV Fluids is prescribed over 8 hours. The drop factor is 15. How many drops per minute are required to start the flow off at the correct rate?

3. One litre of Normal Saline is prescribed over 9 hours. The drop factor is 15. Calculate the number of drops per minute.

4. The doctor prescribes 1.5 litres of Hartman's solution to be administered intravenously to your patient over the next 12 hours. Calculate the rate of flow if the IV tubing has a drop factor of 15.

5. The medications scheduled for your patient include Cephalexin 1.5 grams in 50ml of a 5% Dextrose solution. According to the pharmacy, this preparation should be administered in 30 minutes. The IV tubing on your unit has a drop factor of 15. What is the correct rate of flow in drops per minute?

6. The doctor prescribes 1.5 litres of Hartman's solution to be administered intravenously to your patient over the next 12 hours. Calculate the rate of flow if the IV tubing has a drop factor of 20.

7. Your patient has a prescription to infuse 100ml of 5% Dextrose in 4.5% Normal Saline with 40mg of Potassium Chloride over the next 60 minutes. The set has a drop factor of 15 drops per millilitre. What is the correct rate of flow for this patient?

8. In checking your patient's 10:00am medications, you notice that you have prescriptions to infuse 50mg of Chloramphenicol in 100ml of 5% Dextrose in Water over 30 minutes. The IV tubing has a drop factor of 15. What is the correct rate of flow?

### Infusion Times

To calculate the duration of an infusion, use the following formula:

$$\frac{\text{Volume to be infused}}{\text{Rate (ml per hour)}} = \text{duration of infusion}$$

#### Example 1

A patient receives 200ml of fluid at a rate of 400ml per hour.

Q. What will be the duration of the infusion?

A.  $\frac{200}{400} = \frac{1}{2} = \frac{1}{2}$  hour

**Example 2**

500ml of Dextrose 5% is started at 1:00am.

Q. When will the infusion finish if it is running at a rate of 50ml per hour?

A.  $\frac{500}{50} = \frac{10}{1} = 10 \text{ hours} = 11:00$

**Example 3**

500ml of solution is running at a rate of 80ml per hour.

Q. How long will the infusion last? Give your answer in hours and minutes.

A.  $\frac{500}{80} = 6.25 \text{ hrs}$

Now change the decimal places into minutes by multiplying them by 60.

So,  $0.25 \times 60 = 15 \text{ minutes} = \text{therefore total infusion time} = 6 \text{ hrs } 15 \text{ mins}$

**Example 4**

2 litres of Hartmann's solution is running at a rate of 200ml per hour. After 5 hours the rate is changed to 100ml/hr.

Q. How long will the infusion run at the new rate?

A.  $5 \text{ hours} \times 200\text{ml} = 1000\text{ml}$

$2000 - 1000 = 1000$

$\frac{1000}{100} = 10 \text{ hours remaining}$

Q. What will the total running time be for the infusion?

A.  $5 \text{ hours} + 10 \text{ hours} = 15 \text{ hours}$

Practice Questions – Infusion Times

- 500ml of blood is to be given at the rate of 125ml per hour. How long will the infusion last?

- One litre of crystalloid is to be given at the rate of 125ml per hour. How long will the infusion last?

- 1500ml of 5% Dextrose solution is running at a rate of 90ml per hour. How long will the infusion last? Give your answer in hours and minutes.

4. A patient receives 125ml of fluid at a rate of 250ml per hour. What will be the duration of the infusion?

5. A patient is to receive 750ml of fluid at a rate of 250ml per hour. What will be the duration of the infusion?

6. A patient is prescribed 900mg Clindamycin (in 100ml solution) to be given at 150ml/hr. What will be the duration of the infusion?

7. 1000ml of Hartmann's solution is started at 6:00am. When will the infusion finish if it is running at a rate of 125ml per hour?

8. 500ml of Normal Saline is started at 14:00. When will the infusion finish if it is running at 100ml per hour?

9. 1 litre of 5% Dextrose solution is running at a rate of 100ml per hour. After 8 hours the rate is changed to 50ml/hr.:

- a. How long will the infusion run at the new rate?
- b. What will the total running time be for the infusion?

10. 500ml of 0.9% Sodium Chloride solution is running at a rate of 75ml per hour. After 3 hours the rate is changed to 50ml/hr.

- a. How long will the infusion run at the new rate?
- b. What will the total running time be for the infusion?

## Infusion Volumes

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

***Volume = rate per hour X time infusion running***

### Example

A patient is to receive dextrose saline for 24 hours at a rate of 125ml/hour.

Q. How many litres of dextrose saline will the patient receive?

A. Volume = 125ml x 24 = 3000ml = 3 litres

### Practice Questions – Infusion Volumes

1. Normal saline is given for 48 hours at a rate of 125ml/hour. How many litres will the patient receive?

2. Dextrose 5% solution is given at a rate of 125ml/hour. The infusion is for 8 hours. How much dextrose will be infused?

3. Blood is given to a patient at a rate of 160ml/hour for 6 hours. How much blood will be given?

4. Crystalloid is given at rate of 80ml/hour for 10½ hours. How many litres of fluid have been infused?

5. Normal Saline 0.9% is given at a rate of 500ml/hour for 4 hours, then 125ml/hour for 8 hours. How much Normal Saline will have been infused?

6. A patient receives a fluid challenge of 500ml of Normal Saline 0.9% over 15 minutes, followed by Normal Saline 0.9% 500ml over 4 hours. How much Normal Saline will have been infused?

7. A patient receives 2 fluid challenges of 500ml of Normal Saline 0.9% over 30 minutes, followed by Normal Saline 0.9% over 4 hours at 125ml/hr. How much Saline will have been infused?

8. A patient receives 3 x fluid challenges of 500ml Normal Saline 0.9% over 60 minutes, followed by Normal Saline 0.9% over 8 hours at 125ml/hour. How much Normal Saline will have been infused?

9. A patient receives a fluid challenge of 250ml Normal Saline 0.9% over 10 minutes, followed by Normal Saline 0.9% over 4 hours at 125ml/hour. How much Normal Saline will have been infused?

10. A patient receives 2 fluid challenges of 250ml Normal Saline 0.9% over 20 minutes, followed by Normal Saline 0.9% over 4 hours at 125ml/hour. How much Normal Saline will have been infused?

11. A patient receives 3 fluid challenges of 250ml Normal Saline 0.9% over 60 minutes, followed by Normal Saline 0.9% over 4 hours at 125ml/hour. How much Normal Saline will have been infused?

12. Crystalloid is given at a rate of 80ml/hour for 8 hours. How much crystalloid will have been infused?

13. Blood is given over 12 hours at a rate of 80ml/hour. How much blood will have been infused?

14. Normal Saline 0.9% is given at 500ml/hour for 2 hours, then 200ml/hr for 8 hours. How much Normal Saline will have been infused?

15. Normal Saline 0.9% is given at 250ml/hour for 4 hours, then 125ml for 8 hours. How much Normal Saline will have been infused?

16. Normal Saline 0.9% is given at 250ml/hour for 2 hours, then 125ml for 4 hours. How much Normal Saline will have been infused?

17. Normal Saline 0.9% is given at 500ml/hour for 1 hour, then 125ml for 8 hours. How much Normal Saline will have been infused?

18. Normal Saline 0.9% is given at 500ml/hour for 4 hours, then 250ml for 8 hours. How much Normal Saline will have been infused?

19. Normal Saline 0.9% is given at 500ml/hour for 3 hours. Then 125ml for 7 hours. How much Normal Saline will have been infused?

20. Normal Saline 0.9% is given at 250ml/hour for 6 hours, then 125ml for 8 hours. How much Normal Saline will have been infused?

## COMPLEX CALCULATIONS - ESSENTIAL

### Solution Strengths (mg/ml)

$$\text{Concentration of stock (mg / ml)} = \frac{\text{Stock strength (mg)}}{\text{Volume of stock solution (ml)}}$$

#### Example 1

500mg of amoxicillin powder is dissolved in 20ml of water.

Q. What is the concentration in mg/ml?

$$\text{A. } \frac{500\text{mg}}{20\text{ml}} = 25\text{mg/ml}$$

#### Example 2

Epinephrine is available for injection as either a 1:1000 or a 1:10000 solution.

Q. What does 1:1000 mean?

A. 1g in 1000ml = 1000mg in 1000ml

Q. What does 1:10000 mean?

A. 1g in 10000ml = 1000mg in 10000ml

#### Example 3

A patient requires 3mg of Epinephrine.

Q. How many ml would be required if you used a 1:1000 solution?

$$\text{A. } \frac{1000\text{mg}}{1000\text{ml}} = 1\text{mg/ml} \quad \text{Therefore } 3\text{mg} = \mathbf{3\text{ml of 1:1000}}$$

#### Example 4

Carbocistine syrup is available in 250mg in 5ml solution.

Q. How much of the drug is in 1ml?

$$\text{A. } \frac{250\text{mg}}{5\text{ml}} = \mathbf{50\text{mg/ml}}$$

### Practice Questions – Solution Strengths

1. 2g of Cefotaxime is dissolved in 100ml of water. What is the concentration in mg/ml?

2. 50mg of Amphotericin is dissolved in 500ml of 5% Dextrose. What is the concentration in mg/ml?

3. A syringe contains 40mg of morphine in 4ml. What is the concentration in mg/ml?

4. 20mg of IV Furosemide is in a syringe in 4ml. What is the concentration in mg/ml?

5. A patient requires 1mg of Epinephrine. How many ml would be required if you used a 1:10000 solution?

6. A patient requires 1.0mg of 1:1000 Adrenaline. How much do you give (in ml)?

7. 1.2g of Co-Amoxiclav is dissolved in 20ml of water. What is the concentration in mg/ml?

8. 1g of IV Erythromycin is prepared in 200ml of water. What is the concentration in mg/ml?

9. 1g of IV Paracetamol is available in a 100ml solution. What is the concentration in mg/ml?

10. 600mg of IV Benzyl Penicillin is made up in 100ml of 0.9 Sodium Chloride. What is the concentration in mg/ml?

11. Dihydrocodeine syrup is available in 10mg in 5ml solution. How much of the drug is in 2ml?

12. Atenolol syrup is available in 25mg in 5ml solution. How much of the drug is in 10ml?

13. Diazepam syrup is available in 2mg in 5ml solution. How much of the drug is in 25ml?

14. Levetiracetam syrup is available in 100mg in 1ml solution. How much of the drug is in 7.5ml?

15. Sodium Valproate syrup is available in 40mg in 1ml solution. How much of the drug is in 25ml?

## PERCENTAGE CONCENTRATION STRENGTHS – OPTIONAL

### Weight/Volume (W/V) or Volume/Volume (V/V)

#### Example 1

#### Volume / volume strength

How much pethidine is contained in 500ml of a 2% v/v concentration?

Remember: A percentage is a fraction with a base of 100.

$$\text{So } 2\% = \frac{2}{100}$$

Then multiply by the volume:

$$\frac{2}{100} \times 500 = 10\text{ml}$$

**Example 2****Weight /volume concentration strengths**

Q. How much pethidine is contained in 1.25 litres of a 0.5% weight volume concentration:

$$\frac{0.5}{100} \text{ A. } \times 1250\text{ml} = 25\text{g}$$

Q. Express 200g in 1 litre as a % solution.

$$\text{A. } \frac{200\text{g}}{1000\text{ml}} = \frac{1}{5} = 20\%$$

Q. Will the *solution* be a w/v or v/v solution?

A. Weight volume

**Example 3**

250ml of solution contains 1750mg of a drug.

Q. What is this in a % w/v solution?

A. 1750mg in 250ml 175mg in 25ml

$$700\text{mg in } 100\text{ml} \quad 0.7\text{g in } 100\text{ml} \quad = 0.7\%w/v$$

OR

$$\frac{1750}{1000} = 1.75\text{g} \quad \frac{175}{250} \times 100 = 0.7\% w/v$$

Practice Questions - Percentage Concentration Strengths

1. Express 75g in 500ml as a % solution.

2. Express a 45% w/v solution as g/l.

3. Dosage required is 100mg of a drug using a solution labeled 5% w/v. What volume would you administer?

4. Patient is prescribed 3ml of a drug. The only solution available is 75% v/v Calculate how much of this solution is needed to give the prescribed amount?

5. Lidocaine has to be infused at a rate of 300mg/min using a 5% w/v solution of Lidocaine in glucose 5% w/v. What will the rate be first in:
- a. ml per min, then in
  - b. ml per hour?

6. Lidocaine has to be infused at a rate of 150mg/min using a 10% w/v solution of lidocaine in glucose 5% w/v. What is the pump setting first in:
- a. ml/min, then in
  - b. ml/hr.?

7. Lidocaine is prescribed to be infused at a rate of 120mg/min. Using a 10% w/v solution of Lidocaine in Glucose 5% w/v, calculate the rate for:
- a. ml/min, and
  - b. ml/hr?

8. Lidocaine has to be infused at a rate of 400mg/min using a 5% w/v solution of Lidocaine in glucose 5% w/v. What will the rate be first in:
- a. ml per min, then in
  - b. ml per hour?

9. How much glucose would you need to add to make up a 500ml solution of 5% w/v Glucose?

10. How much sodium chloride would you need to add to 750ml to make up a 0.9% w/v solution?

11. Express 80g in 500ml as a % solution. Will the solution be a w/v or v/v solution?

12. Express a 55% w/v solution as g/l.

13. How much glucose would you need to add to make up a 1000ml solution of 10% w/v Glucose?

14. Patient is prescribed 5ml of a drug. The only solution available is 75% V/V. Calculate how much of this solution is needed to give the prescribed amount.

15. Express 600g in 1l as a % solution. Will the solution be a w/v or v/v solution?

## ANSWERS

The answer booklet can be obtained from your mentor. Good luck!

## FEEDBACK

Thank you for using this workbook - we hope it was useful? We will be collecting feedback about it so we can continually improve this as a resource - so we would be very grateful if you would please contribute when asked.

Please direct any queries to:  
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