Content of Drug Calculation

Introduction

An important part of nurse's role is to ensure that drug dose is calculated and administered appropriately. This includes administering oral medications and intravenous infusions.

Metric System: It is the international system of weights and measures based on meter and gram. It was introduced by Talleyrand. Later it was modified to include meter, kilogram, second (time) and ampere (electricity). Units of metric system are related and rationally derived. It is simpler easier and more accurate to use. Therefore metric system is the most commonly used and widely accepted system of weights and measures. In metric system, the standard unit of measuring weight or mass is kilogram (kg).

When it is needed to use the decimal, it is necessary to be careful so that no mistake is made. Therefore smaller units may be used to avoid decimal. Example: 200mg instead of 0.2 gm.

Units of Capacity (Volume): The standard unit of measuring volume is liter.

Domestic measure: These measures are used to measure the doses of liquids at home. Common domestic measures and their accepted equivalents are teaspoonful, tablespoon, drops and ml.

Imperial system: Imperial system is an old system and is based on units which are not related. It is divided into 2 systems:

1. Avoirdupois system: the standard unit of this system is pound
2. Apothecaries system: also known as troy system is grain.

Percentage solutions and calculations: Percentage solution is the solution in which specific quantity of solute is dissolved in a definite volume of solvent to obtain a solution of definite strength and percentage.

Percentage solutions are of three types:

1. Weight in volume solution (W/V)
2. Weight in weight solution (W/W)
3. Volume by volume solution (V/V)

Weight in volume solution (W/V): In pharmacy, percentage solutions of solids and liquids are generally dispensed as W/V solutions.

Formula: 1% W/V solution means **solid** 1 part by weight is dissolved in **solvent** enough to produce 100 parts by volume of solution.

Here 1 part is not dissolved in full 100 parts because the total would be 101 parts instead of 100 parts. Therefore, the right procedure is to dissolve the solid in part of the solvent and then adjust the volume to 100 ml.

Weight in weight solution (W/W): In W/W percentage solutions, both solute and solvent are taken by weight.

1% W/W solution means **solid** 1 part by weight. **Solvent** by weight to produce 100 parts of W/W solution.

Solutions of liquids in solids and solids in solids are usually made W/W solutions.

Volume by volume (V/V) solutions: In V/V percentage solution, both the solute and solvent are taken by volume.

Formula: 1% V/V solution is **solute** 1 part by volume. **Solvent** to produce 100 parts by volume. This means 1 ml of solute is dissolved in sufficient amount of solvent to produce 100 ml of solution.

Converting metric units:
- 1 gram = 1000 milligram
- 1 milligram = 1000 micrograms
- 1 litre = 1000 millilitres
- 1 mega unit = 1,000,000 units
- 2.2 Ibs = 1 kg
- 30 ml = 1 oz
- 1 tsp = 5 ml
- 1 tbsp = 15 ml   2 tbsp = 1 oz

Dilution and strengths of solutions:

A drug when dissolved in a solution and the strength of the solution may be expressed as:

> ➢ grams per liter

> ➢ mg/ml
> ➢ ratio strength

> ➢ percentage

Drug dose calculation formula:

a) Volume or number of tablets to be given.

$$\frac{\text{Dose required}}{\text{Available dose}} \times \quad \begin{array}{l}\text{volume of stock solution or} \\ \text{number of tablets/capsules}\end{array}$$

b) Calculating drops per minute

$$\frac{\text{Volume to be given (mls)} \times \text{drip factor}}{\text{Time (hours)} \quad \times \quad 60 \text{ min}}$$

c) Calculating time required to complete an infusion

$$\frac{\text{Volume to be given (mls)} \times \text{drip factor}}{\text{rate (drops/min)} \quad \times \quad 60 \text{ min}}$$

d) Calculating millilitres per hour

$$\frac{\text{Total volume (ml)}}{\text{Total time (hours)}} = \text{ml/hour}$$

e) Calculating ml/hour

$$\frac{\text{Total volume to be infused (ml)} \times \text{dose (mg)} \times 60}{\text{Total amount of drug (mg)}} = \text{ml/hour}$$

f) Drug calculation by weight

$$\frac{\text{Patient weight (kg)} \times \text{mcg/kg/min} \times 60 \text{ mins} \times \text{vol of diluent (mls)}}{\text{Total micrograms in bag}} = \text{ml/hour}$$

Quiz Module 1

Metric conversion:

1) 9 oz constitute how many millilitres?

   a) 100 ml

   b) 150 ml

   c) 270 ml

   d) 200 ml

2) 30 mg constitute how many micrograms?

   a) 1000 mcg

   b) 1500 mcg

   c) 30,000 mcg

   d) 15,000 mcg

3) 10 teaspoon constitute how many millilitres?

   a) 150 ml

   b) 100 ml

   c) 50 ml

   d) 70 ml

4) 0.5 grams constitutes how many mcg?

   a) 500,000

   b) 50,000

   c) 25,000

   d) 250,000

5) 170 pounds constitute how many kilograms?

   a) 70.2 kg

   b) 77.3 kg

   c) 50 kg

   d) 50.4 kg

Quiz Module 2

Oral liquid medication:

1) The doctor writes an order for medication that is in an oral suspension. The order reads to administer 50 mg per oral every 4 hours as needed for pain. You have a bottle which contains 25mg/2ml. How many teaspoon will you administer?

   a) 0.5 teaspoon

   b) 0.8 teaspoon

   c) 1 teaspoon

   d) 1.2 teaspoon

2) The doctors writes an order for a medication. The order reads: "Administer 0.5 mg by mouth daily." You are dispensed with a bottle that contains 100 mcg/ tablet. How many tablets will you administer?

   a) 5 tablets

   b) 2 tablets

   c) 3 tablets

   d) 2.5 tablets

Quiz Module 3

Percentage calculations:

1) Calculate the quantity of sodium chloride required for 500 ml of a 5% solution.

   a) 50 grams

   b) 25 grams

   c) 75 grams

   d) 10 grams

2) Calculate the quantity of glucose needed to prepare 750 ml of 25% glucose solution.

   a) 180 grams

   b) 185 grams

   c) 187.5 grams

   d) 186.5 grams

12.3 Data collection tool

Section A

Demographic Data:

1. Age:
   a) 21-30 years
   b) 31-40 years
   c) 41-50 years 2. Gender:
   a) Male
   b) Female
3. Years of experience:
   a) 1-3 years
   b) 4-6 years
   c) 7-9 years
   d) >10 years 4. Qualification:
   a) GNM
   b) BSc
   c) MSc
   d) NPcc
5. Designation:
   a) Staff nurse
   b) Senior staff nurse
   c) Team leader
6. When calculating drug doses, is it necessary to double-check your own calculations?

   a)   Yes   b)   No

Section B

Conversion of metric unit

1. How much mcg constitute 5mg:
   a) 2000 mcg
   b) 500 mcg
   c) 5000 mcg
   d) 5500 mcg
2. How many microliters constitute 8 mL of drug solution?
   a) 8 microlitre
   b) 80 microlitre
   c) 800 microlitre
   d) 8000 microlitre

3. How much ml is 1 teaspoon??
    a) 10 ml
    b) 15 ml
    c) 5 ml
    d) 30 ml
4. How much ml is 1 oz?
    a) 10 ml
    b) 15 ml
    c) 5 ml
    d) 30 ml
5. How much ml are there in 1 tablespoon?
    a) 10 ml
    b) 15 ml
    c) 5 ml
    d) 30 ml
6. How much gram constitute 7500 mg?
    a) 75 gram
    b) 7.5 gram
    c) 750 gram
    d) 0.75 gram
7. How much gram does 4000 mcg constitute?
    a) 0.04 gram
    b) 0.004 gram
    c) 0.4 gram
    d) 0.0004 gram

Section C

Dilution and strengths of solutions.

1. How much sodium (in grams) is there in 500 ml of solution of sodium chloride 0.9% of solution:
    a)   2.5 gram
    b)   9 gram
    c)   4.5 gram
    d)   1.5 gram
2. 10 ml ampoule of adrenaline 1 in 1000, how much adrenaline in milligrams does the ampoule contains:
    a) 10 mg
    b) 30 mg
    c) 40 mg
    d) 50 mg

3. A 80kg patient is planned for suture. Maximum dose of lignocaine administered is 3mg/kg what is the maximum safe volume in ml of 2% lignocaine solution that can be given:
   a) 14 ml
   b) 12 ml
   c) 10 ml
   d) 8 ml
4. Sodium hypochlorite solution is available as 10% solution in 1 litre. How much water can be added to make its concentration 2%:
   a) 4000 ml
   b) 3000 ml
   c) 2000 ml
   d) 1000 ml
5. Atropine is available as 1mg in 10ml. How much mg/ml it forms?
   a) 0.01 mg/ml
   b) 0.1 mg/ml
   c) 1 mg/ml
   d) 10 mg/ml
6. 1% of dopexamine is available in 5ml ampoule. How many milligrams of dopexamine does that ampoule contains?
   a) 20 mg
   b) 30 mg
   c) 40 mg
   d) 50 mg
7. Injection epinephrine 1:1000 is the ampoule strength, how much mg of epinephrine is in 1 ml?
   a) 10 mg
   b) 100 mg
   c) 1 mg
   d) 15 mg

Section D

Drug dose calculation for measuring oral and intravenous medication.

1. A 45 kg female client arrives in emergency department with symptomatic bradycardia. Drug of choice is Atropine 20 microgram/kg which is given intravenously. How much atropine is required if 10ml contains 1 mg?
   a)   3 ml
   b)   6 ml
   c)   9 ml
   d)   12 ml
2. 375 mg of cefuroxime is prescribed however the drug is available in 750 mg dose. If diluted in 10 ml sterile water how much can be administered? a) 5 ml
   b) 7 ml
   c) 6 ml
   d) 8 ml

3. 130 mg of Paracetamol syrup is to be administered to a paediatric patient. The available dose is 250 mg per 5 ml. How much ml will you administer?
   a)   1.6 ml
   b)   2.6 ml
   c)   3.6 ml
   d)   4.6 ml
4. 125 microgram digoxin is prescribed orally. Available is digoxin elixir 50 microgram/ml with a pipette dropper. How many ml is required for this patient? a) 1 ml
   b)   1.5 ml
   c)   2 ml
   d)   2.5 ml
5. 1 gram of erythromycin orally is ordered. Available suspension is 250 mg in 5 ml. How many ml will you administer?
   a)   20 ml
   b)   30 ml
   c)   40 ml
   d)   50 ml
6. Gentamycin injection is available in 40mg/ml in 2ml ampoule. Prescribed dose is 4mg/kg for 60 kg patient. How many ampoules will be required?
   a)   6 ampoules
   b)   8 ampoules
   c)   10 ampoules
   d)   12 ampoules

Answer Key

<u>**Section B**</u>

Q.1: C

Q.2: D

Q.3: C

Q.4: D

Q.5: B

Q.6: B

Q.7: B

<u>**Section C**</u>

Q.1: C

Q.2: A

Q.3: B
Q.4: A

Q.5: B

Q.6: D

Q.7: C

Section D

Q.1: C

Q.2: A

Q.3: B

Q.4: D

Q.5: A

Q.6: A

Scoring Criteria

Based on UGC criteria the scoring is divided into good, moderate and poor knowledge.

Level of knowledge	Score
Excellent knowledge:	>75%
Good knowledge:	60-75%
Moderate knowledge:	50-60%
Poor knowledge:	<50%

Feedback Form

Your feedback will be greatly appreciated.

Kindly answer all the statements on the scale of 1 to 5.

1= Disagree (D)

2= Strongly Disagree (SD)

3= Uncertain (U)

4= Agree (A)

5= Strongly Agree (SA)

Select among 1 to 5 to indicate your response in accordance to your experience.

Sr. No.	Content	D	SD	U	A	SA
1.	The content was appropriate					
2.	The content was relevant					
3.	The content was easy to understand					
4.	Introduction was clear to the subject					
5.	The aims and objectives were clearly stated					
6.	The material was well organised					
7.	Modules were easy to understand					
8.	Web page was easily accessible					
9.	It helped to improve your knowledge					
10.	Quiz aided in stimulating practice of problems					
11.	It was convenient to save pdf for further use					
12.	There was a clear summary and conclusion					