University of Essex

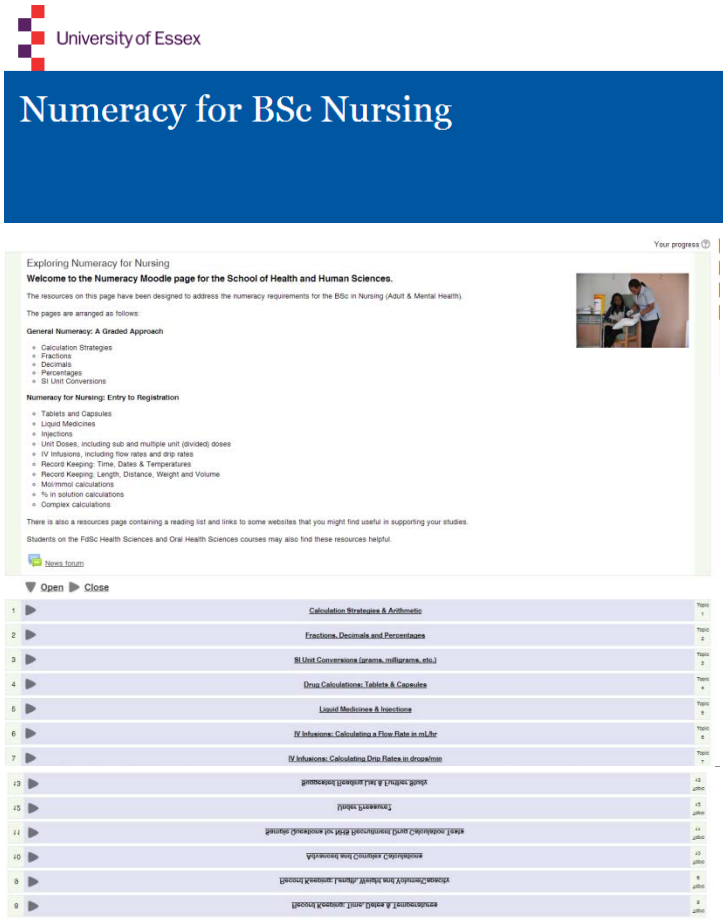
Numeracy for Nursing

Y2 Numeracy in Context – Drip Rates

Student Revision Booklet – June 2014

You <u>must</u> be secure with the following before beginning work on drug calculations:

- Fractions are converted into whole or decimal numbers by dividing the top number (numerator) by the bottom number (denominator). For example, $\frac{3}{4}$ = 3 ÷ 4 = 0.75
- A whole or decimal number can be converted to a fraction by dividing it by 1. For example, 3 can be represented by the fraction $\frac{3}{1}$
- To multiply fractions, first multiply the top numbers (numerators) and write this number at the top of your new fraction. Then multiply the bottom numbers (denominators) and write this answer at the bottom of your new fraction. Then cancel down.
- It may be easier to cancel down **before** you start to multiply.
- To multiply a fraction by a whole number, put that whole number over 1 to create a fraction - e.g. a 5ml stock solution is written as $\frac{5}{1}$.



Numeracy for BSc Nursing - Moodle

A **Numeracy for BSc Nursing** Moodle page contains tutorials and support resources for all aspects of numeracy and drug calculations.

You can use it to support and reinforce the areas we have covered today.

https://moodle.essex.ac.uk/course/view.php?id=3257

Converting Hours to Minutes

Hours	Minutes
1	60
2	120
3	180
4	240
5	300
6	360
7	420
8	480
9	540
10	600
11	660
12	720
13	780
14	840
15	900
16	960
17	1,020
18	1,080
19	1,140
20	1,200
21	1,260
22	1,320
23	1,380
24	1,440

There are 3 straightforward formulae for calculating drug and IV medication doses:

1. **Tablets, Liquids and Injections – NHS1**

$$\frac{\text{What you Need}}{\text{What you Have}} \times \frac{\text{Stock amount}}{1}$$

$$\frac{N}{H} \times \frac{S}{1}$$

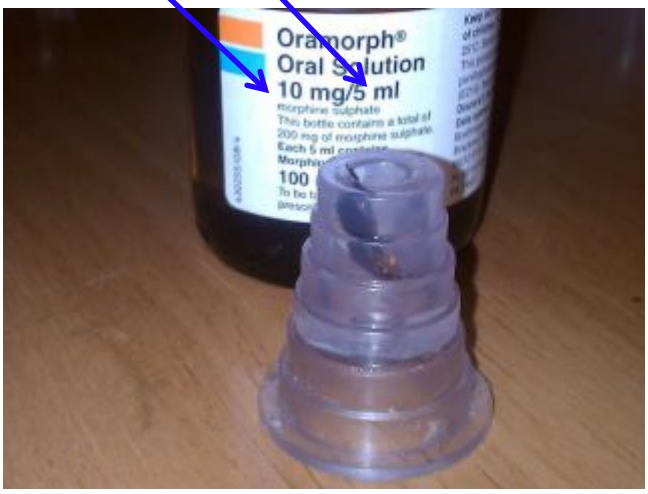
NHS1

Need

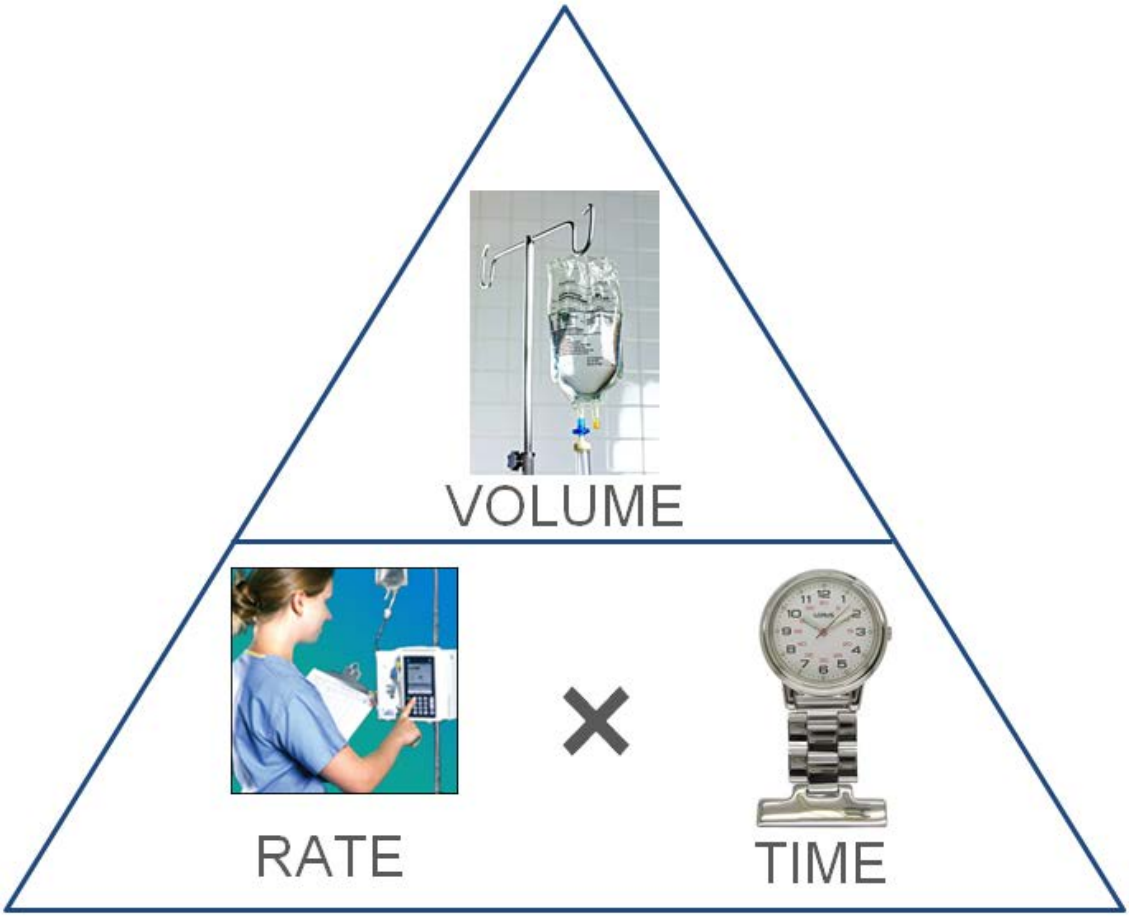
Have

Stock
1

ROUTINELY SCHEDULED MEDICINES		DATE
MEDICINE (Approved Name): Gentamicin	START DATE: 5/11/2013	ADMINISTRATION TIMES: 0600
DOSE: 80mg	ROUTE: I.V.	SPECIAL INSTRUCTIONS: -
DOCTOR'S SIGNATURE: Dr. Jones		-



2. IV Flow Rates in ml/hr – VRT



There are 3 elements to a flow rate calculation:

Volume – the amount of fluid to be delivered
Rate – the flow rate in ml/hr
Time – the amount of time taken

Use the triangle to cover up the element that you are trying to work out – you will be left with the correct formula.

Rate (ml/hr) = Volume (ml) ÷ Time (hrs)

Time (hrs) = Volume (ml) ÷ Rate (ml/hr)

Volume (ml) = Rate (ml/hr) × Time (hrs)

Remember – the fluid bag is high up, so the volume goes at the top!

The mnemonic **V**ery **R**arely **T**roubled may also help you to remember the formula.

3. Drip Rate Calculations in Drops/min (V/T*DF)

This is our basic formula for calculating a drip rate in drops/min. It is a **V**ery **T**idy **D**rip **F**ormula!

$$\text{Drip rate } (drops/min) = \frac{\text{Volume } (ml)}{\text{Time } (mins)} \times \frac{\text{Drop Factor } (drops/ml)}{1}$$

Like VRT, this formula can be manipulated to calculate the other elements. The variations are given below.

$$\text{Time (mins)} = \frac{\text{Volume (mls)}}{\text{Drip Rate (drops/min)}} \times \frac{\text{Drop Factor (drops/ml)}}{1}$$

$$\text{Volume (mls)} = \frac{\text{Drip Rate (drops/min)} \times \text{Time (mins)}}{\text{Drop Factor (drops/ml)}}$$

Note the similarities with the VRT set up; this will help you to memorise the variations. All you need to remember is where to embed the Drop Factor element.

Also, note the structural similarity with the NHS1 formula. **Cancelling down the 'fractions', then multiplying across top and bottom works here too!**

You would not be expected to calculate a Drop Factor.

Some advanced/complex examples have been worked for you on the next few pages:

Remember: You MUST apply consistency with your time units. When calculating ml/hr, your time unit is HOURS. When calculating drops/min, your time unit is MINUTES.

Worked example 1:

A patient is to receive an IV infusion of 500ml of 5% glucose. The flow rate is 25 drops/min. If the drop factor is 20 drops/ml, how long will it take?

There are at least 2 ways to solve this problem. We will deal with the formula method first.

Method 1: Formula Method

$$\text{Time (mins)} = \frac{\text{Volume (mls)}}{\text{Drip Rate (drops/min)}} \times \frac{\text{Drop Factor (drops/ml)}}{1}$$

1. Set up the formula:

$$\frac{500\ (mls)}{25\ (drops/min)} \times \frac{20\ (drops/min)}{1}$$

2. Cancel down and solve:

$$\frac{(500 \div 25)=20}{(25 \div 25)=1} \qquad \frac{20}{1} \times \frac{20}{1} = \frac{400}{1} = 400 \text{ mins}$$

3. **Finally, convert your minutes to hours and minutes**. Remember that there are 60 minutes in an hour – converting from decimals can be tricky for this reason. Another good reason to learn your equivalent fractions/decimals thoroughly!

$$\frac{400}{60} = \frac{20}{3} \qquad \frac{20}{3} = 6\frac{2}{3} \text{ hrs } \left(\underbrace{\frac{3}{3}+\frac{3}{3}+\frac{3}{3}+\frac{3}{3}+\frac{3}{3}+\frac{3}{3}}_{\text{6 hours}} + \underbrace{\frac{2}{3}}_{\frac{2}{3}}\right)$$

$\frac{1}{3}$ of an hour = 20 minutes

$\frac{2}{3}$ of an hour must therefore be 40 minutes.

The answer is **6 hours 40 minutes**.

Method 2: No Formula Required

1. Calculate the total number of **drops** to be delivered.
    - **Volume (ml) × Drop Factor (drops/ml) = Total Number of Drops**
    - 500ml x 20 drops/ml = 10,000 drops

2. Next, divide the total number of drops by the drip rate (drops/min) to calculate the total number of minutes.
    - **Total Number of Drops ÷ Drip Rate (drops/min) = Time (min)**
    - 10,000 drops ÷ 25 drops/ml = 400 min

3. Finally, convert your minute to hours and minutes. **Remember that there are 60 minutes in an hour –** converting from decimals can be tricky for this reason. Another good reason to learn your equivalent fractions/decimals thoroughly!

    - 400 ÷ 60 = 6.67 hours. This is equal to $6\frac{2}{3}$ hours

    - $\frac{2}{3} \times \frac{60}{1} = \frac{120}{3}$ = 40.

The answer is therefore **6 hours 40 minutes**.

Worked example 2:

A patient is receiving saline by infusion from an administration set which delivers 20 drops/ml. The set is adjusted to deliver at 50 drops/min. How much fluid will the patient receive in 3 hours?

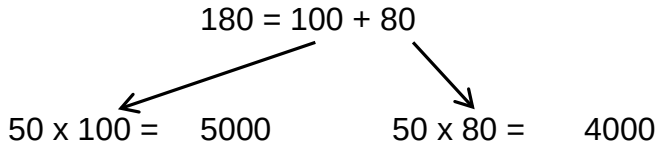
Method 1: Formula Method

$$\text{Volume (mls)} = \frac{\text{Drip Rate (drops/min)} \times \text{Time (mins)}}{\text{Drop Factor (drops/ml)}}$$

1. Set up the formula

$$\frac{50\ (\text{drops/min}) \times 180\ (\text{mins})}{20}$$

2. We can use **partitioning** to solve the multiplication problem 50 ×:180



5000 + 4000 = **9000**

$$\frac{9000\ (\text{drops})}{20\ (\text{drops per ml})}$$

3. This division is easily solved by dividing 9,000 by 10 and halving the answer:

$$\frac{9000\ (\text{drops})}{10\ (\text{drops per ml})} = 900 \qquad 900 \div 2 = 450$$

The answer is therefore **450ml**.

Worked Example 3:

A patient receives 4% glucose/0.18% NaCl to infuse at 21 drops per minute. If the drop factor is 20 drops/ml, how many mls/hr will the patient receive?

At first glance, this looks like a straightforward calculation. However, if you try to apply the basic formula, you will notice that this problem involves both drip rates **and** flow rates.

1. This time, we need to work out how many drops will be delivered over one hour.
    - 21 drops/min × 60 min = 1,260 drops/hr

2. Divide this number by the drop factor to calculate the flow rate
    - 1,260 drops/hr ÷ 20 drops/ml = **63 ml/hr**

At this level, we are no longer simply applying a standard formula, but using our existing knowledge to find new ways of tackling various problems. This is what advanced problem solving looks like!

Now try the following questions. Work without a calculator where possible. Feel free to work in a group, sharing strategies and discussing working methods. Don't forget to ask for help if you get stuck!

Drip Rate Calculations

$$\text{Drip rate } (drops/min) = \frac{\text{Volume } (ml)}{\text{Time } (mins)} \times \frac{\text{Drop Factor } (drops/ml)}{1}$$

1. Complete the table:

Volume/Time	Rate (mls/hr)	Drip Rate (20 drops/ml)	Drip Rate (15 drops/ml)
1000ml over 12 hours	83		
1000ml over 10 hours	100		
1000ml over 8 hours	125		
500ml over 8 hours	63		
500 ml over 6 hours	83		
500ml over 4 hours	25		

(Adapted from Wright, 2011)

2. A patient is prescribed normal saline (0.9% NaCl) 850 ml IV over 8 hours. The drop factor is 10 drops/ml. Calculate the drip rate.

3. A patient receives glucose saline 1250 ml IV 12 hourly. The giving set is calibrated at 10 drops per ml. Calculate the drip rate.

4. A patient is prescribed half a litre of dextrose 5% over 4 hours via a giving set which delivers 20 drops/ml. Calculate the drip rate.

5. An anaemic patient is prescribed 1 unit of packed cells over 4 hours. The unit of packed cells holds 250ml. The IV set delivers 20 drops/ml. Calculate the drip rate.

Time Calculations

$$\text{Time (mins)} = \frac{\text{Volume (mls)}}{\text{Drip Rate (drops/min)}} \times \frac{\text{Drop Factor (drops/ml)}}{1}$$

1. A 500 ml infusion of 5% glucose is delivered at a rate of 20 drops per minute. If the drop factor is 10 drops/ml, how long will the infusion take?

2. An infusion of one litre of 0.9% NaCl is started at 8pm. The flow rate is 20 drops per min and the drop factor is is 10 drops/ml. At what time will the infusion finish?

3. A patient is to receive an IV infusion of 750ml of 5% glucose. The flow rate is 25 drops per minute. If the drop factor is 15 drops/ml, how many hours will it take for this infusion to finish?

4. Your patient has been receiving an IV infusion, and 90ml remains in the bag. The infusion is dripping at the rate of 45 drops per minute via a drop factor of 20 drops/ml. How many minutes remain before the infusion is completed?

Volume Calculations

$$\text{Volume (mls)} = \frac{\text{Drip Rate (drops/min)} \times \text{Time (mins)}}{\text{Drop Factor (drops/ml)}}$$

1. A patient is receiving dextrose 5% by infusion (15 drops/ml). The drip rate is set to deliver 40 drops per minute. How much fluid will the patient receive over 4 hours?

2. An administration set which delivers 20 drops/ml has been running at 50dpm for 2 hours. How much fluid should the patient have received?

3. Your colleague has set up a 1000ml infusion of saline (15 drops/ml) prescribed to run over 10 hours at 42 drops per minute. The infusion was commenced at 8am. What time is it due to finish? Did your colleague calculate the correct rate?

Case Study

A 74-year-old woman is transferred from a residential home and admitted to the hospital ward with a diagnosis of right-upper-lobe pneumonia. She has a past medical history of lung cancer, hypertension, depression and anxiety disorder. Her observations are: B/P 150/86 mmHg; P 90 bpm; R 30 resps/min; T 38.3°C. Her current medications include the following:

- IV fluids: glucose 5% sodium chloride 0.45% 1,000ml 8 hourly
- Azithromycin 500mg IV daily
- EnsurePlus ¾ strength 800 ml via PEG to run from 0100 to 0800 daily
- Alprazolam 0.5mg via PEG 3 times a day (t.i.d.)
- Sertraline 50mg by mouth (PO) at bedtime
- Losartan potassium 25mg via PEG daily
- Fluconazole 200mg oral suspension, via PEG immediately (stat.) then 100mg daily for 7 days
- Docusate sodium 100mg oral suspension via PEG twice daily (b.i.d.)
- Furosemide 40mg oral suspension via PEG twice daily (b.i.d.)
- Paracetamol 1g oral suspension, via PEG 4 hourly prn if temperature above 38°C

Read the labels below when necessary, to answer the following questions:

Questions – Case Study

1. What is the rate of flow for the IV solution in ml per hour?

2. What is the rate of flow for the IV in drops/min? The drop factor rate is 15 drops/ml.

3. The IV infusion was started at 1900h (7pm). When will it be completed?

4. What is the amount of glucose and sodium chloride in the IV solution?

5. The directions printed on the azithromycin IV bag label read ‘500mg in glucose 100ml, infused via pump over 60 minutes’. What is the pump setting in mls/hr?

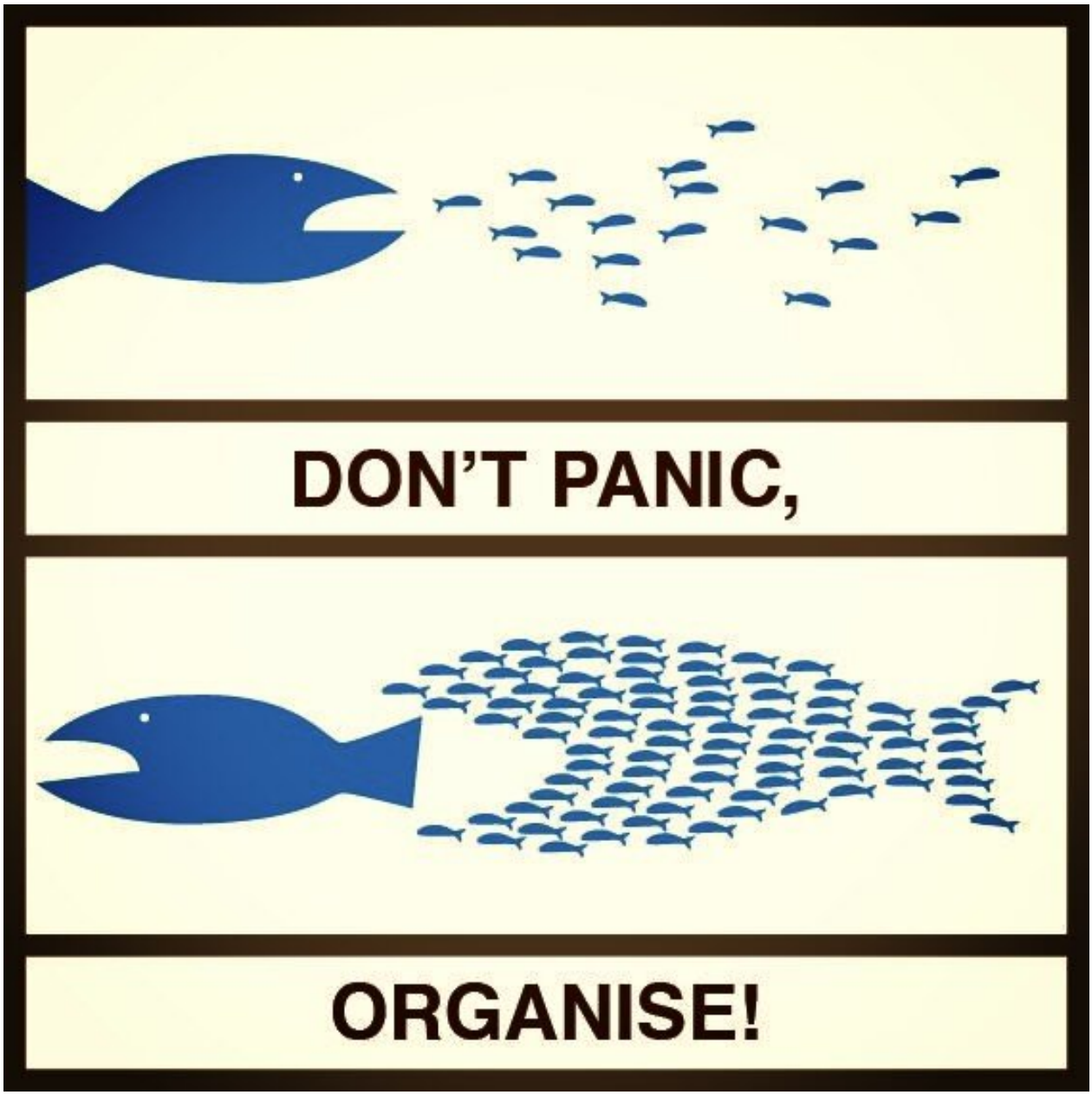
6. Sertraline is available as shown
   a. Which strength tablets will you use?

   b. How many tablets will you administer?

7. How many millilitres of alprazolam will you administer?

8. How many millilitres of fluconazole will you prepare for the stat dose?

9. The label on the docusate sodium reads 60mg/15ml. How many millilitres contain the prescribed dose?



Still worried? Contact me to ask about extra support and resources:

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