

Dosage Calculation using Dimensional Analysis

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Methods in Dosage Calculation

- › Formula method

$$\frac{D}{H} \times Q = X$$

- › Ratio and Proportion

$$50 \text{ mg}:1\text{ml} \quad \text{or} \quad \frac{50\text{mg}}{1\text{ml}}$$

- › Dimensional Analysis (Units Conversion)

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Why Dimensional Analysis?



Decreases number of steps to calculate.

Units of measure can be mixed, they will cancel each other out.

May be a safer method of calculation.

Can use as a second method to see if another method calculated correctly.

DECIMALS



- › Think of decimals like money or pizza slices:

Tenths place (0.1): Like dimes in a dollar or cutting a pizza into 10 big slices.

- › Example: $3.4 \rightarrow$ 3 wholes and 4 tenths (4 dimes = \$0.40).

Hundredths place (0.01): Like pennies in a dollar or cutting each pizza slice into 10 smaller pieces.

- › Example: $3.46 \rightarrow$ 3 wholes, 4 tenths, and 6 hundredths (46 cents).

*Rule of thumb: Tenths = bigger chunks,
Hundredths = finer detail.*

MEDICATION AND IV ROUNDING RULES



› Adults:

- Oral meds <1 mL $\rightarrow$ round to hundredths (0.01 mL)
- Oral meds >1 mL $\rightarrow$ round to tenths (0.1 mL)
- Tablets $\rightarrow$ whole or half if scored
- IV fluids $\rightarrow$ whole mL/hr

Pediatrics (Children):

- Oral meds $\rightarrow$ round to hundredths (0.01 mL)
- Prefer liquids, avoid rounding tablets
- IV fluids $\rightarrow$ round to whole mL/hr

Neonates / NICU:

- Oral/IV meds $\rightarrow$ round to hundredths (0.01 mL)
- Critical meds (insulin, heparin, vasoactive) $\rightarrow$ never round
- IV fluids $\rightarrow$ round to tenths (0.1 mL/hr) if pump allows

Rounding 5-4 Rules

- › The Rule
- › If the digit after your rounding place is 5 or more (5,6,7,8,9) → round up.
- › If the digit after your rounding place is 4 or less (0,1,2,3,4) → round down (keep the number the same).

Rounding to the tenth place: Examples

- › Example:
- › Example 1: 3.46 → round to tenths
- › Tenths place = 4.
- › Look at hundredths = 6 (≥ 5 , strong wind).
- › Tree gets pushed up → 4 → 5.
- › "The Tree and the Wind"
- › Think of the **tenths digit** as a tree, and the **hundredths digit** as the wind:
- › If the wind is **weak (0–4)**, the tree stays **still** → number doesn't change.
- › If the wind is **strong (5–9)**, the tree gets pushed up to the **next branch** → number increases.



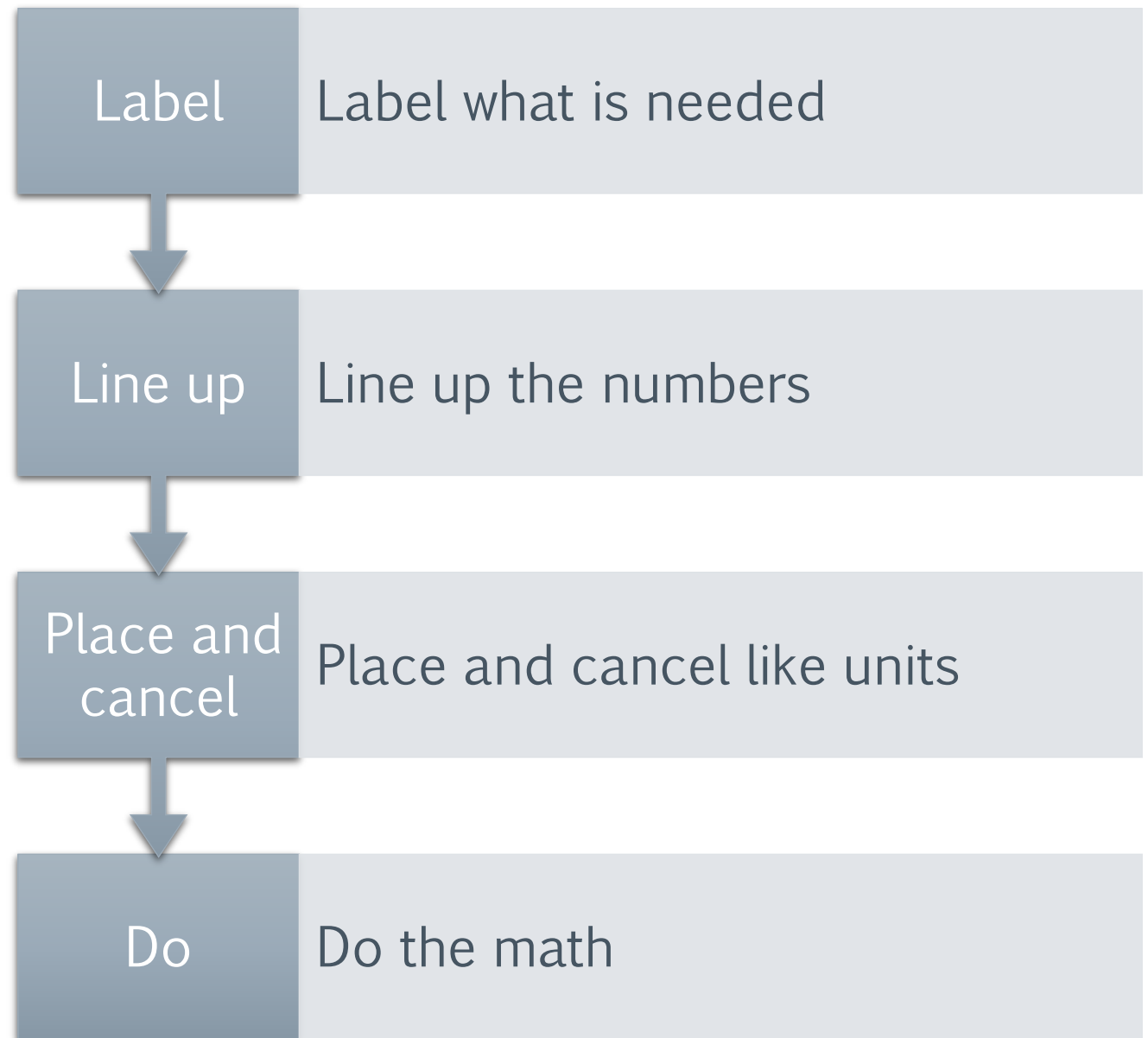
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FOUR STEPS IN DIMENSIONAL ANALYSIS

Example:

Order: KCL 30 meq PO x 1.
The medication is supplied
in a solution of 40 meq/15
ml. How many ml will you
administer?

$$X_{ml} = \frac{30 \text{ meq}}{40 \text{ meq}} \times \frac{15 \text{ ml}}{1} = \frac{450}{40} = 11.25 \text{ ml}$$



Order: Give 650 mg of Tylenol P.O. Q 8 hrs.
Tylenol is supplied in 325 mg tablets. How many
tabs will you give?

$$X \text{ tabs} = \frac{650 \cancel{\text{mg}}}{.} \times \frac{1 \text{ tab}}{325 \cancel{\text{mg}}} = \frac{650}{325} = 2 \text{ tabs}$$

Parental Medications

A vial of Nafcillin is labeled 2 grams. The vial instructs to add 1.7 ml of sterile water for each 500 mg of the drug for reconstitution. The solution will equal 8 ml after reconstitution. How much of the solution should you draw up if the order is to administer 500 mg of Nafcillin per dose?

$$x\text{ml} = \frac{500\cancel{\text{mg}}}{.} \times \frac{8\text{ ml}}{2\cancel{\text{gram}}} \times \frac{2\cancel{\text{grams}}}{2000\text{mg}} = 2\text{ml}$$

Infuse 1 Liter
D5.2 NS over
10 hours.

Drop Factor 10

Calculate
gtt/min



Intravenous Fluids

$$\begin{aligned} x \frac{\text{gtts}}{\text{min}} &= \frac{1 \text{ L}}{10 \text{ hours}} \times \frac{10 \text{ gtts}}{1 \text{ ml}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1000 \text{ ml}}{1 \text{ L}} = \\ \frac{10,000}{600} &= 16.\overline{66} \end{aligned}$$

Round to the nearest whole number
Ans=17 gtt/min

Note: gtt/min is always rounded to the whole number.

INTRAVENOUS DRIPS

The patient is receiving 10 mg/min through an IVPB. The solution has the strength of 400mg in 100 ml. Calculate the IV flow rate in ml/h

$$x \frac{ml}{hr} = \frac{100ml}{400mg} \times \frac{10 \cancel{mg}}{\cancel{min}} \times \frac{60 \cancel{min}}{1 hr} = \frac{60,000}{400} =$$

150 ml/hr

A patient is to receive a loading dose of heparin which is ordered at 500 units and then a maintenance dose of 1300 units per hour.

The solution comes at 250 units/ml in a 250 ml bag.

1. How many ml will the patient receive as a loading dose?

2. Loading doses are typically given over 30 minutes. At what rate will you set the pump for the maintenance dose?

$$1. \ x\text{ml} = \frac{500 \text{ units}}{250 \text{ units}} \times \frac{1 \text{ ml}}{1} = \frac{500}{250} = 2 \text{ ml}$$

$$2. \ x \frac{\text{ml}}{\text{hr}} = \frac{2 \text{ ml}}{30 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} = \frac{120}{30} = 4 \text{ ml/hr}$$

Drug Calculations by Body Weight

› Order Reads: Gentamycin
20 mg IV Q 8 hr

› Recommended safe dose
range is 6-7.5 mg/kg/day

› Pt weighs 33 lbs

› Calculate the safe range

› Low Dose

$$xmg = \frac{6 \text{ mg}}{\text{kg}} \times \frac{33 \text{ lbs}}{2.2 \text{ lbs}} \times \frac{1 \text{ kg}}{2.2 \text{ lbs}} = \frac{198}{2.2} = 90 \text{ mg}$$

› High Dose

$$xmg = \frac{7.5 \text{ mg}}{\text{kg}} \times \frac{33 \text{ lbs}}{2.2 \text{ lbs}} \times \frac{1 \text{ kg}}{2.2 \text{ lbs}} = \frac{247.5}{2.2} = 112.5 \text{ mg}$$

References

Olsen, J., Giangrasso, A., Shrumpton, D. (2011). Medication Dosage Calculation: A dimensional Analysis Aproach. (10th ed). Prentice Hall. ISBN: 978-0-132-15-661-5.

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**"Education is not
the learning of
facts, but the
training of the mind
to think."
-Albert Einstein**

