Dosage calculation

Equivalents, rounding, dimensional analysis, weight-based doses, IV rates, titration and NCSBN's calculation rules

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1 AT A GLANCE

Most dosage math comes down to a few equivalents and one reliable method. Calculation errors are medication errors, so double-check every one.

Equivalents to memorize

This	Equals
1 teaspoon	5 mL
1 tablespoon	3 teaspoons, or 15 mL
★ **1 ounce**	30 mL
1 cup	8 ounces, or 240 mL
★ **1 kg**	1000 g, and **2.2 lb**
1 g	1000 mg
1 mg	1000 mcg
1 L	1000 mL

Moving the decimal: Metric units step by tens: to a smaller unit, the decimal moves right; to a larger unit, left. 0.1 mg is 100 mcg; 500 mg is 0.5 g.

Units, percent, ratios and time

- Insulin and heparin are measured in **units**; insulin syringes are marked in units.
- A percent is grams per 100 mL: 5% dextrose has 5 g in every 100 mL. 0.9% saline has 9 g of salt in 1000 mL.
- A 1 to 1000 ratio, like some epinephrine: 1 g in 1000 mL, or 1 mg per mL.
- 24-hour clock: from 1 AM to noon, drop the colon (6:30 AM is 0630); from 1 PM, add 1200 (2:45 PM is 1445). 12:30 AM is 0030; 12:30 PM is 1230.
- Oral syringes are more precise than cups for small doses, especially for children.

Dimensional analysis

- 1. Write the goal unit, like mL or tablets.
- 2. Start with a fraction that has the goal unit on top, like 5 mL per 125 mg.
- 3. Add fractions so each unwanted unit appears once on top and once on the bottom, and cancels.
- 4. Multiply across the tops, multiply across the bottoms, then divide.
- ★ **Units left aren't the goal unit? The setup is wrong**: fix it before you calculate.

Rounding, leading and trailing zeros

- ★ **Round only at the end.** Rounding early adds error.
- A common convention: adult liquid doses over 1 mL to the tenth (2.36 mL is 2.4); doses under 1 mL, and children's doses, to the hundredth (0.276 is 0.28). Drops: whole numbers. Follow your agency's policy.
- Look one place past the one you keep: 5 or more rounds up, under 5 rounds down.
- ★ A **leading zero** (0.6 mg), but **never a trailing zero**: 6.0 can be misread as 60.

Oral and weight-based doses: worked examples

Problem	Work	Answer
Order 50 mg; tablets are 25 mg	50 ÷ 25	2 tablets
★ **Order 0.1 mg; tablets are 50 mcg**	**Convert first**: 0.1 mg is 100 mcg. 100 ÷ 50	2 tablets
Order 250 mg; liquid is 125 mg per 5 mL	250 ÷ 125 is 2; 2 × 5 mL	10 mL
Powder: after mixing, 200 mg per mL; order 300 mg	Use the concentration after mixing, not the diluent volume	1.5 mL
★ **Child 33 lb; order 10 mg per kg; liquid 100 mg per 5 mL**	**Kilograms first**: 33 ÷ 2.2 is 15 kg. 10 × 15 is 150 mg. 150 ÷ 100 × 5	7.5 mL
Infant 3.6 kg; order 0.5 mg per kg; supply 10 mg per mL	0.5 × 3.6 is 1.8 mg. 1.8 ÷ 10	0.18 mL, in a small syringe

Safe dosage range

- Before giving a weight-based dose, check the safe range in a drug reference. Multiply the weight by the low limit and by the high limit: the order must fall between them.
- ★ Example: an infant weighs 8 kg; the safe range is 10 to 15 mg per kg per dose, so 80 to 120 mg. The order is 150 mg: too high. **Hold it and clarify the order.**
- Does it make sense? 20 tablets for one dose means stop and recheck.

Titration

- The order sets the limits: the starting dose, how much to change it, how often, the target, and the maximum.
- Before each change, assess against the target; after it, reassess, and document both.
- ★ **Never go beyond the maximum**, change it faster than ordered, or titrate without assessing. Target not reached at the maximum, or the client worsens: call the provider.

Educational use only. Not a substitute for clinical judgment, your facility's policy or the provider's orders. Where practice varies, follow facility policy and state law. No patient information.

Dosage calculation

1 AT A GLANCE, CONTINUED

IV rates: formulas and worked examples

To find	Use	Example
mL per hour (pump)	Total volume ÷ hours. Minutes? ÷ minutes × 60	1,000 mL over 8 hours: 125 mL an hour. 50 mL over 30 minutes: 50 ÷ 30 × 60 = 100 mL an hour
★ **Drops per minute (gravity)**	Volume × drop factor ÷ minutes	1,000 mL over 8 hours, 15 drops per mL: 15,000 drops ÷ 480 minutes = 31.25, so **31 drops a minute**
Hours to finish	Volume ÷ rate. Decimal hour × 60 = minutes	1,000 mL at 80 mL per hour: 12.5 hours; 0.5 hour is 30 minutes. Started at 0700, it ends at 1930
★ **Units per hour to mL per hour**	Units per hour ÷ units per mL	Heparin 25,000 units in 500 mL is 50 units per mL; 1,200 units an hour ÷ 50 = **24 mL an hour**

Drop factors: Macrodrip: 10, 12, 15 or 20 drops per mL. Microdrip: 60, so drops per minute equal mL per hour. Round to a whole drop.

Micrograms per kilogram per minute

- Steps: concentration, dose per minute, per hour, then mL per hour.
- ★ 400 mg in 250 mL is 1,600 mcg per mL. 5 mcg per kg per minute × 80 kg is 400 mcg a minute; × 60 is 24,000 mcg an hour; ÷ 1,600 is **15 mL an hour**.
- Weight in pounds? Kilograms first: 176 lb ÷ 2.2 is 80 kg. Round the rate as your pump and agency policy allow.
- Check backwards: a pump at 18 mL an hour, at 50 units per mL, delivers 900 units an hour.

On the exam: NCSBN's calculation rules

Rule	What it means
Precision	The item asks for a whole number, or one or two decimal places. Whole number: type 2, not 2.0
Decimal point	When decimals are asked for, type the decimal point, with a leading zero
★ **Round only at the end**	Child 45 lb; 2.5 mg per kg; 20 mg per mL. Exact: 20.4545 kg, 51.136 mg, 2.5568 mL: enter **2.56**. Rounding to 20 kg first gives 2.5 mL: wrong, with no partial credit
Your tools	On-screen calculator and noteboard; no handheld calculators or conversion tables. Conversions are in your head

2 PRIORITY AND SAFETY CALLS

★ A dose outside the safe range: **don't give it. Hold it and clarify the order** with the prescriber.

Check the pump's programming against the order and the bag's concentration before you start.

Heparin and other high-alert drips are double-checked by a second nurse, under agency policy.

4 SELF-QUIZ

1. To convert pounds to kilograms, divide by _____.
2. 9:05 in the evening is _____.
3. Microdrip tubing gives _____ drops per mL.
4. 25 mL to run over 15 minutes: set the pump to _____ mL per hour.
5. Heparin 25,000 units in 500 mL, ordered at 1,200 units an hour, runs at _____ mL an hour.

ANSWER KEY 1. 2.2 · 2. 2105 · 3. 60 · 4. 100 · 5. 24

3 EXAM ANCHORS

1. Read each item for the unit it wants and how to round; type only the number, in that unit.
2. Dose traps: rounding early, forgetting to convert milligrams or pounds, and using the diluent volume.
3. IV traps: forgetting minutes to hours, the wrong drop factor, an unconverted decimal hour, skipping milligrams to micrograms.
4. Child 18 kg, 15 mg per kg, 160 mg per 5 mL: 270 mg, then 8.4375 mL. For a child, round to the hundredth: 8.44 mL.
5. 1,000 mL over 8 hours, 15 drops per mL: 31 drops a minute. 125 is the mL per hour, not the drops.

5 SOURCES

1. Open RN, Nursing Skills 2e, 5.4 Equivalencies. wtcs.pressbooks.pub/nursingskills/chapter/5-4-equivalen…
2. Open RN, Nursing Skills 2e, 5.12 Safe Dosage Range. wtcs.pressbooks.pub/nursingskills/chapter/5-12-safe-dos…
3. Open RN, Nursing Skills 2e, 5.17 Multi-Step Calculations. wtcs.pressbooks.pub/nursingskills/chapter/5-17-multi-st…
4. NCSBN, 2026 NCLEX Candidate Bulletin (on-screen calculator). nclex.com/files/2026_NCLEX_Candidate_Bulletin…

Built from RN PocketPal course lessons: Dosage calculation I: conversions and doses (c05-l05); Dosage calculation II: IV rates and titration (c05-l06); NCSBN's calculation rules (s09-l01). Every line on this sheet comes from those lesson scripts.

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