EASTERN Center for Arts and Technology
Practical Nursing
MED MATH PACKET

Ratio and Proportion

A. **Ratio**: in medications, ratio is the weight (strength) of the drug in a tablet or capsule.

50 mg = 1 tablet

OR

The weight of the drug in a certain volume

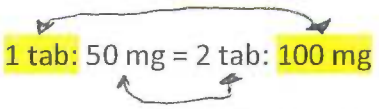
1 mL = 50 mg

B. **Proportion**: we use a proportion equation to show that 2 ratios are equal

1 tab: 50 mg = 2 tab = 100 mg

1 mL = 50 mg = 2 ml: 100 mg

To solve, multiply the 2 outer and then the 2 inner numbers
(extremes) (means)



1 x 100 = 50 x 2
100 = 100

Always write the "Known" on the left, and the "Want to know–Unknown" on the right.

The units must be the same order/place on both sides of the equation.

For example: g : mg = g : mg

NOT

mg : g = g : mg

Now, substitute numeric values for the "Known" ratio on the left, and "Want-to-know-Unknown" ratio on the right. Use (x) for the "want to know" quantity.

For example, the Doctor's order reads: Give "drug a" 10 mg to the patient.

You have a bottle of "drug a" in which the label reads: 8 mg/1 ml. (This is KNOWN).

You need to find out the UNKNOWN, or how much of what is in the bottle will be equal to what the doctor ordered.

Set up a ratio and proportion equation:

_____ : _____ = _____ : _____

(Known Side) (Unknown Side)

Known Side				**What you want to know – Unknown Side**		
8 mg	:	1 ml	=	mg	:	ml
8 mg	:	1 ml	=	10 mg	:	X ml

$8x = 10$

Divide both sides of the equation by the same number – the number in front of the X

$$\frac{8x}{8} = \frac{10}{8}$$

$X = 1.25$

Label your answer with the what you wanted to know, in this case "ml"

1.25 ml

You will give 1.25 ml of "Drug a" to give the patient 10 mg.

You can check your answer by substituting it for x and solving the equation.

8 mg: 1 mL = 10 mg: 1.25 mL

8 x 1.25 = 1 x 10

10 = 10

The Metric System

The metric system of weights and measures is the system of **choice** when calculating drug dosages.

The basic metric units of measurement are the:

1) gram (weight) 2) liter (volume) 3) meter (length)

You will use weight and volume measurements frequently when calculating drug dosages.

These units of measurement are usually abbreviated.

g = gram L = liter m = meter

Note: "L" is capitalized. You might see a capital "G" or "gm" for gram- the preferred use is a lower case "g".

Prefixes combined with the basic unit names indicate larger or smaller quantities of the base units.

You will need to memorize these!

Only one prefix is larger than the basic unit:

kilo -	"k"	1000

1 kg = 1000 g

Only use "g" for drug calculations (not km or kL)

Three prefixes denote units smaller than the basic unit:

centi-	"c"	0.01 (one-hundredth)
milli-	"m"	0.001 (one-thousandth)
micro-	"mc" or u	0.000001 (one-millionth)

In drug administration, you will most often use:

milligram (mg)

microgram (mcg)

} weights

milliliter (mL) → volume

One cubic centimeter (cc) = one mL. The abbreviation "cc" is NO LONGER used anymore. Use only the abbreviation "ml" or "mL"

There are rules to follow when writing quantities in the metric system:

1) write numbers in Arabic (1,2,3, etc.) 5 g

2) write the numbers before the abbreviation 5 g (NOT g5)

3) express fractions as decimals 1.5 g (NOT 1 ½ g)

4) place a zero in front of a decimal point when it is not preceded by a whole number

0.5 g (NOT .5g)

5) omit unnecessary zeros 0.5 g (NOT .50 g)
5 g (NOT 5.0 g)

Now you try it. Write these, using correct notation rules and abbreviations:

Four kilograms _____

Fifty milliliters _____

Two-thirds microgram _____

One and one-fourth liters _____

Three hundred milliliters _____

Five and eight-tenths grams _____

Eight hundred milligrams _____

Answers:
4 kg 50 ml 0.67 mcg 1.25 L 300 ml 5.8 g 800 mg

Converting Between Metric Units of Measurement

When calculating drug dosages prescribed in the metric system, it may be necessary to convert between measurements within a unit, i.e. g to mg, mg to mcg.

We will use ratio and proportion to do this:

You will have to **memorize** only 4 units of weight and 2 units of volume in order to do this:

Weight

1 kg = 1000 g

1 g = 1000 mg

1 mg = 1000 mcg

Volume

1 L = 1000 mL

Example: Suppose you want to convert 425 mg into grams.

Known: 1 g = 1000 mg (You memorized this)

Known Side				**What you want to know – Unknown Side**		
1 g	:	1000 mg	=	g	:	mg
1 g	:	1000 mg	=	X g	:	425 mg

To solve: Multiply the means and extremes.

$$1000x = 425$$

Then divide each side by the number in front of the X

$$\frac{1000x}{1000} = \frac{425}{1000}$$

$$x = 0.425$$

Label the answer with what you wanted to know, in this case "g"

0.425 g

So, 425 mg is equal to 0.425 g

Try this: Convert 2.3 g to milligrams

2.3 g = _____ mg

_____ : _____ = _____ : _____

What do you know? 1 g = 1000 mg

Write this on the left side of the ratio.

(1 g : 1000)

What do you want to know?

(How many milligrams (x) in 2.3 g)

Write this on the right side of the ratio.

1 g : 1000 mg = 2.3 g : x mg

Did you remember the correct order for g + mg?

(Must be in the same order as on the left side!)

Now solve the problem.

1 : 1000 = 2.3 : x

1 x = 2300 mg

2.3 g = 2300 mg

There is a shortcut to convert between <u>metric</u> units of measurement. Each numeric value for kilogram, gram, milligram, and microgram, and for liter and milliliter differ by 1000 between each increment. You will only calculate drug dosages by one increment at a time.

a) to convert a <u>larger</u> unit to the next smaller unit, move the decimal point 3 places to the <u>right</u>.

8 kg = _____ g

8.000 = 8000
→→→
8 kg = 8000 g

Try this: 0.25 g = _____ mg

Answer: 250- same as multiplying by 1000)

b) to convert a smaller unit to the next larger unit, move the decimal point 3 places to the left.

600 mg = _____ g

600. = 0.6 g
←←←

Try this:

5500 mcg = _____ mg

Answer: 5.5 mg

Hint:
5500 mcg = _____ mg, Label which is "b"igger and which is "s"maller.(mcg is a smaller unit than mg).

5500 mcg = _____ mg So, in this case, you want to find the "b"igger

Now, think about how the alphabet is laid out,
A thru Z, (abcdefghijk lm nopqrstuvwxyz). Which side is the "b" on? It is on the left side of the alphabet. So in this case you want to move the decimal 3 places to the left, towards the "b", the left side of the alphabet.

5500 mcg = 5500. mg

5500 mcg is equal to 5.5 mg

Now let's try

1.25 mg = _____ mcg

1.25 mg = 1,250. mcg

We want to find the "S"maller. So we move 3 places to the right, because the "s" Is on the right side of the alphabet.

1.25 mg = 1250 mcg

Household Measurements

Not routinely used for calculating drug dosages. You will use to calculate a patients Intake and Output (I & O) of fluids and possibly when calculating liquid medications, especially in Pediatrics.

Equivalents: **Must memorize!**

1 tbs = 5 ml

1 ounce – 30 ml

2.2 lbs = 1 kg or 1000 g

Conversions 1

1. 500 ml = _____ L

2. 0.015 g = _____ mg

3. 8 mg = _____ g

4. 10 mg = _____g

5. 60 mg = _____g

6. 300 mg =_____g

7. 0.2 mg = _____ g

8. 1.2 g =_____mg

9. 0.0025 kg = _____g

10. 0.065 g = _____mg

11. 0.005 L = _____ mL

12. 1.5 L =_____ml

13. 450 ml = _____L

14. 250 ml = _____ L

15. 2 kg = _____g

16. 79,200 mL = _____ L

17. 1 L = _____mL

18. 1 g = _____ mg

19. 1 mL = _____ L

20. 0.23 mcg = _____ mg

21. 1.05 g = _____ kg

22. 0.01 mcg = _____ mg

23. 0.4 mg = _____mcg

24. 25 g =_____kg

25. 10 L = _____mL

26. 5 mL = _____ L

27. 30 mg = _____ mcg

Conversions 2

1. 1 g = _____ mg
2. 2 g = _____ mg
3. 1.5 g = _____ mg
4. 0.5 g = _____ mg
5. 0.25 g = _____ mg
6. 0.05 g = _____ mg
7. 0.1 g = _____ mg
8. 1.1 g = _____ mg
9. 0.3 g = _____ mg
10. 25 mg = _____ g
11. 5 mg = _____ g
12. 3000 mg = _____ g
13. 1500 mg = _____ g
14. 15,000 mg = _____ g
15. 10 mg = _____ g
16. 100 mg = _____ g
17. 0.5 mg = _____ g
18. 7.5 mg = _____ g
19. 20.15 mg = _____ g

Conversions 3 **Show all work and label all answers.**

Remember: 1 mg = 1000 mcg 1 kg = 1000 g
1 g = 1000 mg 1 L = 1000 ml

Use ratio and proportion:

1. 25 mg = _____ g

2. 0.064 g = _____ mg

3. 4 mg = _____ g

4. 4.6 g = _____ mg

5. 375 ml = _____ L

6. 89 kg = _____ g

7. 45 mg = _____ mcg

8. 0.6 g = _____ mg

9. 50 kg = _____ lb

10. 2500 g = _____ lb

Practice Problems: SHOW all work and LABEL all answers.

Use ratio and proportion.

1. 500 mg = _____g

2. 25 mg = _____g

3. 5 mg = _____ mcg

4. 0.2 g = _____ mg

5. 4 g = _____ mg

6. A patient drank 8 ounces of milk. How many mL is this?

7. A patient weighs 70 kg. How many pounds is this?

8. The patient drank 4 ounces of juice, 6 ounces of milk, and 8 ounces of water. How many ml of fluid did the patient drink?

9. The physician orders "force fluids to 2000 mLs." How many liters is this?

10. Ordered: 60 mg. On hand you have 20 mg tablets. How many tablets will you give? (Is this a one-step or a two-step problem?)

11. Ordered: 0.75 g. On hand you have 250 mg tablets. How many tablets will you give? (Is this a one-step or a two-step problem?)

12. Ordered: 10 mg of diazepam (Valium). On hand you have 0.02 g in each scored tablet. How many tablets will you give? (Is this a one-step or two-step problem?)

One-Step Metric Problems: Show all work. Use ratio and proportion, and label all work.

1. Ordered: diazepam (Valium) 5 mg. You have 10 mg tablets. How many tablets will you give?

2. Ordered: 0.1 g of secobarbital. On hand are 0.05 g capsules. How many capsules will you give?

3. Ordered: 500 mg of achromycin. On hand are 250 mg capsules. How many capsules will you give?

4. Ordered: 0.25 g of erythromycin. On hand you have 1 g per 10 ml. How many ml will you give?

5. Ordered: 15 mg of codeine. On hand you have 30 mg tablets. Will you give more or less of what you have on hand? How many tablets will you give?

Two-Step Metric Problems: Show all work. Use ratio and proportion, label all work.

1. Ordered: 2 g of staphcillin. The vial reads: "Add 8.6 ml of diluent to contents of vial. Each ml will contain 500 mg of staphcillin." How many ml will you administer?

2. Ordered: 500 mg of gantrisin. Available are gantrisin 0.25 g tablets. How many tablets will you give?

3. You are to give 0.125 g of keflin. On hand you have keflin 50 mg/5ml. How many ml will you give? The keflin will be administered in an IV solution.

4. Ordered: robinul 0.002 g. Available are 1 mg tablets. How many tablets will you give?

5. Ordered: 0.75 g of erythromycin. On hand you have 250 mg tablets. How many tablets will you give?

6. Ordered: diazepam (Valium) 10 mg. On hand you have diazepam (Valium) 0.005 g tablets. How many tablets will you give?

7. Ordered: 4 mg of codeine. On hand you have 0.002 g tablets of codeine. How many tablets will you give?

8. Ordered: 75 mg of demerol IM. On hand you have a vial of 0.05 g per ml. How many ml will you give?

9. Ordered: chlorpromazine 0.075 g. On hand you have chlorpromazine 25 mg/ml. How many ml will you give?

Medication Orders:

Name of Drug: generic name (Brand Name)
Dosage of Drug
Route of Drug (po, IM, IV, SQ)
Frequency given: every day, every 4 hours, etc....

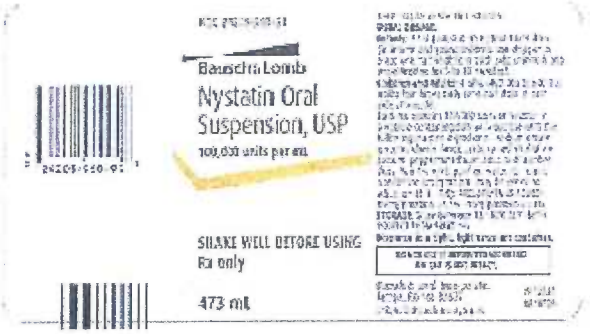
LABEL all answers and SHOW all work.

1. Order: Give digoxin (Lanoxin) 0.125 mg. You have: digoxin (Lanoxin) 0.25 mg per tablet. How many tablets will you give?

2. Order: Give furosemide (Lasix) 80 mg. You have: furosemide (Lasix) 40 mg tablets How many tablets will you give?

3. Order: Give erythromycin (EryPed) 160 mg You have: erythromycin (EryPed) 200 mg/5 ml. How much erythromycin will you give?

4. Order: nystatin 250,000 units. You have: nystatin 100,000 units per mL How much will you give?



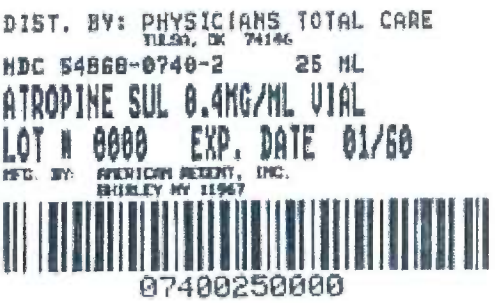
5. Order: Give sucralfate (Carafate) 500 mg. You have: sucralfate (Carafate) 1 g per tablet. How many tablets will you give?

6. Order: methylprednisolone (Medrol) 8 mg. You have: methylprednisolone (Medrol) 2 mg per tablet. How many tablets will you give?

7. Order: Give promethazine (Chlorpromazine) 25 mg
You have: promethazine (Chlorpromazine) 10 mg/5 mL. How much will you give?

8. Order: Give atropine 0.3 mg

You have: atropine 0.4 mg/mL



9. Order: Give midazolam (Versed) 3 mg po. You have: Versed 5 mg/mL. How much will you give?

10. Order: Give Cefadyl 750 mg. You have: Cefadyl 500 mg/ 2 mL
How much will you give?

11. Order: Give penicillin G 1,200,000 units.
You have: penicillin G 6,000,000 units/10 mL. How much will you give?

12. Order: Give digoxin (Lanoxin) 0.125 mg.
You have: digoxin (Lanoxin) 250 mcg/ml.
How much will you give?

13. Order: Give levothyroxine (Synthroid) 0.225 mg
You have: levothyroxine (Synthroid) 75 mcg/tab.
How many tablets will you give?

14. The physician orders heparin 10,000 Units SQ q 12 hours for your patient with a below-the-knee amputation. You have heparin 5000 Units per ml available. How many ml's will you administer? _____

15. Your patient with a gastric pull-up receives penicillin G 200,000 Units IM Q 6 hours. You have penicillin G 250,000 Units per ml available. How many ml's will you administer?_____

16. Your patient with a lumbar puncture receives heparin 7500 Units q 12 hours. Heparin 5000 Units per ml is available. How many ml's will you administer?

_____

17. Mr. Cook requires medication for nausea. prochlorperazine (Compazine) 10 mg PO every 4 hours prn, is ordered. You have 5mg tablets available. How many tablets will you administer? _____

18. Mr. Pace receives hydroxyzine (Atarax) 100 mg PO hs prn to relieve anxiety. You have 50 mg tablets available. How many tablets will you administer? _____

19. Mr. Day receives digoxin (Lanoxin) 0.25 mg PO daily for atrial fibrillation. How many tablets will the nurse administer? _____

20. Mr. Payne receives Keflex 500 mg PO qid before his dental extraction. How many capsules will the nurse give?

21. Mr. Tune is admitted with pancreatitis and receives diazepam (Valium) 5 mg PO q6 h prn for anxiety. You have 10mg tablets available. How many tablets will you administer?

22. Mr. Jones, admitted with irritable bowel syndrome, takes dicyclomine (Bentyl) 20 mg PO tid ac. The drug is available in 10mg capsules. How many capsules will the nurse administer?

23. Mrs. Tyth has pruritic dermatoses. The physician prescribes hydroxyzine (Atarax) 30 mg PO bid as part of her therapy. The drug supplied in syrup containing 10 mg per 5 mL. How many milliliters will the nurse administer?

24. Mrs. Gale, admitted for alcohol abuse, has an order for asorbic acid 0.75 g PO daily while hospitalized. You have 250-mg tablets available. How many tablets will you administer?

ANSWERS:

Conversion 1

1. 0.5
2. 15
3. 0.008
4. 0.01
5. 0.06
6. 0.3
7. 0.0002
8. 1200
9. 2.5
10. 65
11. 5
12. 1500
13. 0.45
14. 0.25
15. 2000
16. 79.2
17. 1000
18. 1000
19. 0.001
20. 0.00023
21. 0.00105
22. 0.00001
23. 400
24. 0.025
25. 10,000
26. 0.005
27. 30,000

Conversion 2

1. 1000
2. 2000
3. 1500
4. 500
5. 250
6. 50
7. 100
8. 1100
9. 300
10. 0.025
11. 0.005
12. 3.0
13. 1.5
14. 15
15. 0.01
16. 0.1
17. 0.0005
18. 0.0075
19. 0.02015

Conversion 3

1. 0.025
2. 64
3. 0.004
4. 4600
5. 0.375
6. 89,000
7. 45,000
8. 600
9. 110
10. 5.5

Practice Problems

1. 0.5
2. 0.025
3. 5,000
4. 200
5. 4,000
6. 240 ml
7. 154 lbs
8. 540 ml
9. 2 liters
10. 3 tablets
11. 3 tablets
12. 0.5 or ½ tablet

One-Step Metric Problems

1. 0.5 tablets
2. 2capsules
3. 2capsules
4. 2.5 ml
5. 0.5 or ½ tablet

Two-Step Metric Problems

1. 4 ml
2. 2 tablets
3. 12.5 ml
4. 2 tablets
5. 3 tablets
6. 2 tablets
7. 2 tablets
8. 1.5 ml
9. 3 ml

Medication Orders

1. 0.5 or ½ tablet
2. 2 tablets
3. 4 ml
4. 2.5 ml
5. 1/2 tablet
6. 4 tablets
7. 12.5 ml
8. 0.75 ml
9. 0.6 ml
10. 3 ml
11. 2 ml
12. 0.5 ml
13. 3 tablets
14. 2 ml
15. 0.8 ml
16. 1.5 ml
17. 2 tablets
18. 2 tablets
19. 2 tablets
20. 2 tablets
21. ½ tablet
22. 2 capsules
23. 15 ml
24. 3 tablets