UNIT 2
BASIC PHARMACY MATH

What does basic pharmacy math consist of?

Before you start calculating dosages of antineoplastic infusions based on a patient's body surface area, you need to learn some basics. We need to be able to convert between various measurement systems, learn a little bit of terminology and how to manipulate data to find some simple dosages for oral medications, days' supply, and IV drip rates. That is what most would consider basic pharmacy math, and this unit is designed to provide a guide to learning this information.

What are the specific learning objectives in this unit?

- temperature conversions
- household measurements
- metric system
- apothecary system
- medication abbreviations
- calculating dosages when giving medications in tablet or capsule form
- calculating dosages when giving medications in liquid form
- preparing solutions
- diluting stock solutions
- determining the rate of intravenous medications
- dosages based on body weight
- dosages based on body surface area
- pediatric dosing

It doesn't make a difference what temperature a room is, it's always room temperature.
--Steven Wright

The temperature for storing medication is extremely important for the stability—and therefore the effectiveness—of the medication. The two common temperature scales used in pharmacy are Celsius and Fahrenheit. Usually, storage requirements (including storage temperature) are listed in small print on the package label. The necessary temperature is usually given in both Celsius and Fahrenheit degrees, although not always. Furthermore, the Pharmacy Technician Certification Exam (a certification required by some of the higher paying technician jobs) always ask several questions involving temperatures. Hence, you need to be able to convert between Celsius and Fahrenheit.

Fahrenheit and Celsius are both linear scales, so let's gather some basic information on them and create a formula to compare them.
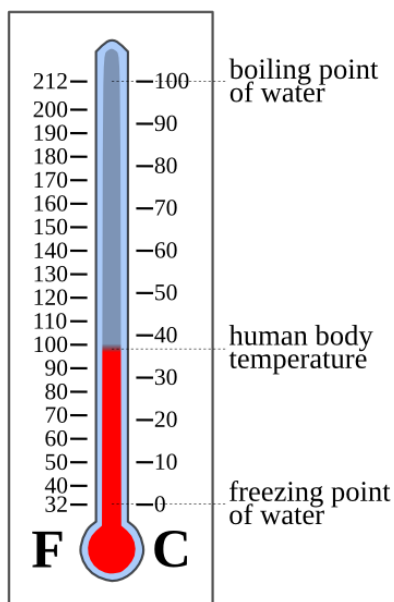
What is the temperature when water freezes in degrees Fahrenheit?

32° F

What is the temperature when water boils in degrees Fahrenheit?

212° F

What is the temperature when water freezes in degrees Celsius?

0° C

What is the temperature when water boils in degrees Celsius?

100° C

How many degrees does it take to get from the freezing point of water to the boiling point of water on the Fahrenheit scale?

180° F

How many degrees does it take to get from the freezing point of water to the boiling point of water on the Celsius scale?

100° C

Now lets create a ratio comparing the two ranges.

180° F : 100° C

That ratio can be reduced to....

9° F : 5° C

Now that we've established all that information, there is one other thing we need to look at before we can come up with a formula.

What is the difference between the freezing point of water in Fahrenheit and the freezing point of water in Celsius?

32º F

So, based on this information I can create the following formula to convert from a Celsius temperature to a Fahrenheit temperature:

$$T^o C \times \frac{9^o F}{5^o C} + 32^o F = your\ equivalent\ degrees\ F$$

Often, you'll see this formula simplified to:

$$C \times \frac{9}{5} + 32 = F$$

From this point we can use some basic algebra to create a formula to convert from Fahrenheit temperature to Celsius temperature:

$$(F - 32) \times \frac{5}{9} = C$$

Practice Problem

Let's test our new formulas. You may already know that the ideal body temperature for a homo sapien is 98.6º F or 37º C.

Change 98.6º F to Celsius using the following equation:

$$(F - 32) \times \frac{5}{9} = C$$

Change 37º C to Fahrenheit using the following equation:

$$C \times \frac{9}{5} + 32 = F$$

Name:

Date:

Convert the following temperatures. Round all your answers to the tenths position.

1) 50º C = _____º F	16) 5º C = _____º F	31) 60º F = _____º C
2) 47º C = _____º F	17) 2º C = _____º F	32) 58º F = _____º C
3) 45º C = _____º F	18) 0º C = _____º F	33) 55º F = _____º C
4) 40º C = _____º F	19) -5º C = _____º F	34) 45º F = _____º C
5) 37º C = _____º F	20) -10º C = _____º F	35) 37º F = _____º C
6) 32º C = _____º F	21) -40º C = _____º F	36) 32º F = _____º C
7) 30º C = _____º F	22) 100º F = _____º C	37) 25º F = _____º C
8) 25º C = _____º F	23) 90º F = _____º C	38) 22º F = _____º C
9) 22º C = _____º F	24) 89º F = _____º C	39) 15º F = _____º C
10) 20º C = _____º F	25) 82º F = _____º C	40) 12º F = _____º C
11) 18º C = _____º F	26) 80º F = _____º C	41) 5º F = _____º C
12) 15º C = _____º F	27) 79º F = _____º C	42) 0º F = _____º C
13) 12º C = _____º F	28) 75º F = _____º C	43) -5º F = _____º C
14) 10º C = _____º F	29) 70º F = _____º C	44) -14º F = _____º C
15) 7º C = _____º F	30) 63º F = _____º C	45) -20º F = _____º C

Worksheet 6-2 (part I)

Name:

Date:

Specific storage conditions are required to be printed in product literature and on drug packaging and drug labels to ensure proper storage and product integrity. The conditions are defined by the following terms[1]:

Cold: any temperature not exceeding 8° C

        Freezer: -25° to -10° C

        Refrigerator: 2° to 8° C

Cool: 8° to 15° C

Room temperature: the temperature prevailing in a working area

        Controlled room temperature: 15° to 30° C

Warm: 30° to 40° C

Excessive heat: any temperature above 40° C

Calculate all the above temperatures in Fahrenheit, round to the nearest whole number degree.

Cold: any temperature not exceeding _____ F

        Freezer: _____ to _____ F

        Refrigerator: _____ to _____ F

Cool: _____ to _____ F

Room temperature: the temperature prevailing in a working area

        Controlled room temperature: _____ to _____ F

Warm: _____ to _____ F

Excessive heat: any temperature above _____ F

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1   These important standards are contained in a combined publication that is recognized as the official compendium, the United States Pharmacopeia (USP) and the National Formulary (NF)

Name:

Date:

Specific storage conditions are required to be printed in product literature and on drug packaging and drug labels to ensure proper storage and product integrity. The conditions are defined by the following terms[2]:

Cold: any temperature not exceeding 46° F

     Freezer: -13° to 14° F

     Refrigerator: 36° to 46° F

Cool: 46° to 59° F

Room temperature: the temperature prevailing in a working area

     Controlled room temperature: 59° to 86° F

Warm: 86° to 104° F

Excessive heat: any temperature above 104° F

Calculate all the above temperatures in Celsius, round to the nearest whole number degree.

Cold: any temperature not exceeding _____ C

     Freezer: _____ to _____ C

     Refrigerator: _____ to _____ C

Cool: _____ to _____ C

Room temperature: the temperature prevailing in a working area

     Controlled room temperature: _____ to _____ C

Warm: _____ to _____ C

Excessive heat: any temperature above _____ C

2   These important standards are contained in a combined publication that is recognized as the official compendium, the United States Pharmacopeia (USP) and the National Formulary (NF)

Worksheet 6-3

Name:

Date:

_____

Solve the following temperature conversion problems.

1) When making a mixture, you are instructed to heat the mixture to 130° C. You have only a Fahrenheit thermometer. What is the equivalent temperature on the Fahrenheit scale?

2) Most of the drugs in a pharmacy need to be stored at controlled room temperature, which is defined by the USP/NF as 15° C to 30° C. The air conditioning at Bidwell Community Pharmacy breaks down on a warm day in August. The weather forecast says that it is supposed to get up to 90° F. Is that within the acceptable range?

3) The following sterile compounding request is sent to the hospital pharmacy:

> **Alteplase in a Syringe**
>
> **Rx** alteplase, 2mg/ml   50 mg
>   sterile water for injection   25 mL
>
>   1. Reconstitute the alteplase with SWFI.
>   2. Draw up 5 mL in 10 mL syringes.
>   3. Label syringes with contents, concentration, and date of preparation.
>   4. Place syringes in freezer. They should be frozen with premix piggybacks.
>
> The syringes are stable for 45 days, at -25° C to -10° C

a)   What is the Fahrenheit at which you should store this product?

b)   What expiration should you put on this product if you made it today?

4) A prescription is sent to the pharmacy requesting a substance to be heated in a 300° F oven for 12-18 hours. At what Celsius temperature does the oven need to be set?

5) An autoclave is usually set to 250° F to sterilize medical instruments. What is the equivalent temperature in degrees Celsius?

6) Convert the following refrigerator temperatures and record them in the appropriate spaces on the log below. Note any temperatures out of the safe range (2° to 8° C).

Date	Degrees F	Degrees C
1/25	36.1	a.
1/26	37.7	b.
1/27	39.0	c.
1/28	34.5	d.
1/29	36.9	e.
1/30	36.7	f.
1/31	38.8	g.
2/1	43.8	h.
2/2	48.8	i.

Which days, if any, fell outside the safe range?

7) Convert the following freezer temperatures and record them in the appropriate spaces on the log below. Note any temperatures out of the safe range (-13° F to 14° F).

Date	Degrees C	Degrees F
1/25	-15.1	a.
1/26	-12.9	b.
1/27	-13.2	c.
1/28	-9.4	d.
1/29	-10.5	e.
1/30	-13.5	f.
1/31	-15.7	g.
2/1	-18.9	h.
2/2	-21.0	i.

Which days, if any, fell outside the safe range?