

TEMPERATURE CONVERSION

Two Scales

There are two scales used to report temperature, the English scale of Fahrenheit and the metric scale of Celsius. There are two classic equations used to convert between these two scales. The formulas are:

$$^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32^{\circ})$$

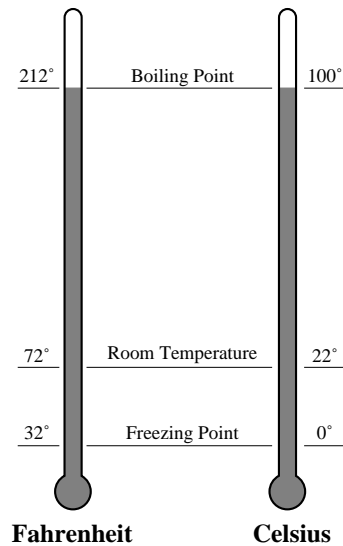
$$^{\circ}\text{F} = (9/5 X^{\circ}\text{C}) + 32$$

Confusion

Typically these two formulas provide more confusion than clarity. The following is our attempt at sharing a method that we find helpful in making these conversions.

The Scales

To understand how to make these conversions start with comparing the two scales. With the Fahrenheit scale, water freezes at 32° and boils at 212°. On the Celsius scale, water freezes at 0° and boils at 100°.

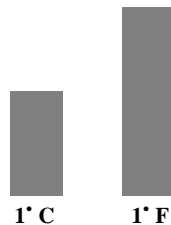


Difference of 32°

To start with then we can see that if we want to go from Fahrenheit to Celsius we must start by subtracting 32°. To go from Celsius to Fahrenheit we must add 32°.

Size of the Division

The difference between 32° and 212° is 180°. This is the difference between water freezing and boiling on the Fahrenheit scale. The difference between freezing and boiling on the Celsius scale is 100°. Therefore, we can see that each 1° change in the Celsius scale is the same as a 1.8° change in the Fahrenheit scale.



Changing Scales

As a result, to change from Celsius to Fahrenheit we must multiply the result by 1.8. To change from Fahrenheit to Celsius we must divide by 1.8

Final Confusion

The most confusing part is to determine if you should adjust for the 32° first or adjust for the size of the scale first. Here are the rules.

Rule 1 - to change °F to °C - subtract 32° then divide by 1.8

Rule 2 - to change °C to °F - multiply by 1.8 and add 32°

Conclusion

We now have two new formulas

$$^{\circ}\text{C} = \frac{^{\circ}\text{F} - 32^{\circ}}{1.8}$$

$$^{\circ}\text{F} = ^{\circ}\text{C} \times 1.8 + 32^{\circ}$$

A Third Choice

Several text books show a third method of making this conversion. This is a three step method:

Step 1 - add 40° to the existing value

Step 2 - Multiply by 1.8 if going to °F and divide by 1.8 if going to °C

Step 3 - Subtract 40°

Example

Change 212°F to °C

$$\text{Step 1} - 212^{\circ}\text{F} + 40^{\circ} = 252^{\circ}\text{F}$$

$$\text{Step 2} - 252^{\circ}\text{F} \div 1.8 = 140^{\circ}$$

$$\text{Step 3} - 140^{\circ} - 40^{\circ} = 100^{\circ}\text{C}$$

Your Choice

It makes little difference which technique you use. Select the one that fits your style and proceed.

TEMPERATURE CONVERSION - PRACTICE PROBLEMS

(Answers on page 90)

a. Change 212°F to °C

b. Change 70 °F to °C

c. Change 140 °F to °C

d. Change 20 °C to °F

e. Change 85 °C to °F

f. Change 4 °C to °F

TEMPERATURE CONVERSION - PRACTICE PROBLEMS

a. Change 212°F to °C

$$^{\circ}\text{F} = \frac{^{\circ}\text{C} - 32}{1.8} = \frac{212^{\circ}\text{F} - 32^{\circ}\text{F}}{1.8} = 100^{\circ}\text{C}$$

b. Change 70 °F to °C

$$^{\circ}\text{C} = \frac{70^{\circ}\text{F} - 32^{\circ}\text{F}}{1.8} = 21^{\circ}\text{C}$$

c. Change 140 °F to °C

$$^{\circ}\text{C} = \frac{140^{\circ}\text{F} - 32^{\circ}\text{F}}{1.8} = 60^{\circ}\text{C}$$

d. Change 20 °C to °F

$$^{\circ}\text{F} = ^{\circ}\text{C} \times 1.8 + 32^{\circ}$$

$$^{\circ}\text{F} = 20^{\circ}\text{C} \times 1.8 + 32^{\circ}\text{F}$$

$$^{\circ}\text{F} = 68^{\circ}\text{F}$$

e. Change 85 °C to °F

$$^{\circ}\text{F} = ^{\circ}\text{C} \times 1.8 + 32^{\circ}$$

$$^{\circ}\text{F} = 85^{\circ}\text{C} \times 1.8 + 32^{\circ}\text{F}$$

$$^{\circ}\text{F} = 185^{\circ}\text{F}$$

f. Change 4 °C to °F

$$^{\circ}\text{F} = ^{\circ}\text{C} \times 1.8 + 32^{\circ}$$

$$^{\circ}\text{F} = 4^{\circ}\text{C} \times 1.8 + 32^{\circ}\text{F}$$

$$^{\circ}\text{F} = 39^{\circ}\text{F}$$