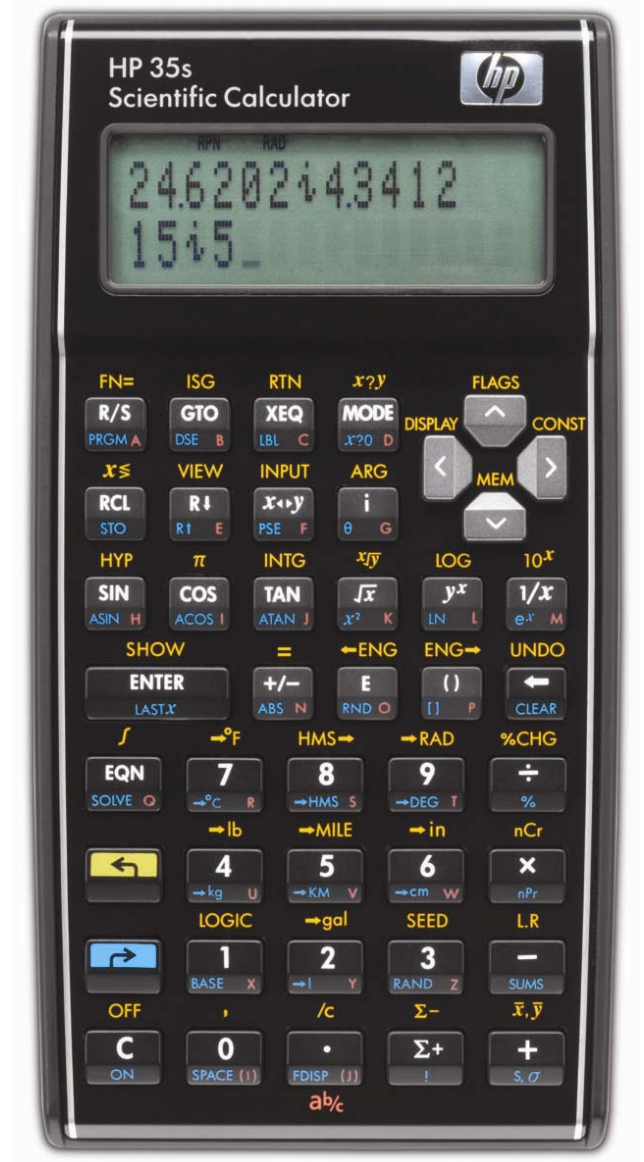# hp calculators

HP 35s Unit Conversions

Metric units and Imperial units

Conversion keys

Practice working problems involving conversions

Performing conversions that are not built in

Special considerations for temperature conversions

Metric units and Imperial units

Measurements of quantities such as length, mass or temperature use units. Metric units include centimeters and meters, grams and kilograms, or Celsius and Kelvin degrees. Imperial units include feet and yards, ounces and pounds, or Fahrenheit and Rankine degrees. The HP 35s provides eight functions for converting to and from Metric units. These conversions are useful for many problems in engineering, mathematics, and physical and biological sciences. They can also be used to create additional conversions, through HP 35s equations and programs.

Two training aids describe unit conversions on the HP 35s. This aid describes mass, length and volume conversions. Temperature conversions are more complicated; a simple example is given in this training aid and a second training aid describes conversion of temperature units in detail. For coordinate, angle and time conversions see the separate training aids, for example angle conversions are covered in the training aid on angle conversions and angle arithmetic.

Conversion keys

The unit conversion functions are on the right and left shifted [2] [4] [5] [6] and [7] keys. The available conversions are as follows:

> [⇄] [→kg] for pounds to kilograms
> [◁] [→lb] for kilograms to pounds
> [⇄] [→KM] for miles to kilometers
> [◁] [→MILE] for kilometers to miles
> [⇄] [→°C] for Fahrenheit to Centigrade
> [◁] [→°F] for Centigrade to Fahrenheit
> [⇄] [→cm] for inches to centimeters
> [◁] [→in] for centimeters to inches
> [⇄] [→l] for gallons to liters, and
> [◁] [→gal] for liters to gallons.

The right and left shifted functions on each key are the inverse of each other. Ways to build up other conversions from them are shown below.

Note that conversions *to* Metric units are always on the right-shifted leys, and conversions *from* Metric units are on the corresponding left-shifted keys.

Conversions of lb/kg, of in/cm, mile/km and of gal/l involve only multiplication by a conversion factor. Conversions of °F/°C require addition or subtraction of an offset constant as well as multiplication; they are described in more detail in the separate training aid on temperature conversions.

Practice working problems involving conversions

Example 1:   Convert 10 inches to centimeters

Solution: In RPN mode, type the number 10 and then press the right-shifted [5] key.

> [1] [0] [⇄] [→cm]

In algebraic mode, do the same. Pressing ENTER completes the calculation, but this is not necessary unless the conversion is part of a longer calculation.

⊡ ⊡cm 1 0 ENTER


```
→CM(10)
            25.4000
```
Figure 1

Answer: 25.4 centimeters.

Example 2: How many gallons is 25 liters?

Solution: In RPN mode, type the number 25 and then press the left-shifted 2 key.

2 5 ⊡ ⊡gal

In algebraic mode, do the same. Again, pressing ENTER completes the calculation, but is not necessary unless the conversion is part of a longer calculation.

⊡ ⊡gal 2 5 ENTER


```
→GAL(25)
            6.6043
```
Figure 2

Answer: 6.6043 gallons.

Example 3: Convert 16 square inches to square centimeters

Solution: A square inch is an inch times an inch. After one ⊡ ⊡cm conversion, the units become centimeters times inches. After a second ⊡ ⊡cm conversion, the units become centimeters times centimeters, or square centimeters. So, in this case, conversion to centimeters is carried out twice, to give square centimeters.

In RPN mode, type the number 16 and then press the right-shifted 6 key twice.

1 6 ⊡ ⊡cm ⊡ ⊡cm

In algebraic mode, do the same. Again, pressing ENTER completes the calculation, but is not necessary unless the conversion is part of a longer calculation.

⊡ ⊡cm ⊡ ⊡cm 1 6 ENTER


```
→CM(→CM(16))
            103.2256
```
Figure 3

Another way to do this is to take the square root of 16 cm², giving 4 cm, then convert this to inches, then take the square. Figure 4 shows the result and confirms that the method used above is correct.

[◨] [x^2] [◨] [→cm] [$\sqrt{x}$] [1] [6] [ENTER]

SQ(→CM(SQRT(1…
103.2256   Figure 4

Answer: 103.2256 square centimeters.

Example 4:   Convert 5 yards to meters

Solution: The conversion keys use inches and centimeters, so it is necessary to go from yards to inches, then convert inches to centimeters, and finally go from centimeters to meters.

In RPN mode, type the number 5, multiply by 3 to go to feet, and multiply by 12 to go to inches. Now press the right-shifted [6] key to convert inches to centimeters. Finally divide by 100 to convert centimeters to meters.

[5] [ENTER] [3] [×] [1] [2] [×] [◨] [→cm] [1] [0] [0] [÷]

In algebraic mode, the order is different, and [ENTER] must be used at the end to complete the whole calculation

[◨] [→cm] [5] [×] [3] [×] [1] [2] [⟩] [÷] [1] [0] [0] [ENTER]
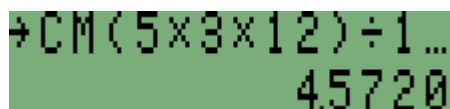
→CM(5×3×12)÷1…
4.5720   Figure 5

Answer: 4.572 meters.

Performing conversions that are not built in

Example 5:   As the density of water is 1 gm/cm³, what is it in lb/ft³ ?

Solution: This conversion is not built into the calculator. As in examples 3 and 4, it is therefore necessary to separate the calculation into the basic units, and then convert each unit. In this example, the steps required are:

- Convert gm to kg, by dividing by 1,000
- Convert kg to lb with [◁] [→lb]
- Convert 1/cm to 1/in three times, as the cm are cubed. A short cut for converting inverse units is to notice that this is the same as doing the opposite transformation. So, converting 1/cm to 1/in can be done with [◨] [→cm].
- Convert 1/in³ to 1/ft³ by multiplying by 12 cubed.

In RPN mode, the above should be done with these keys:

[1] [ENTER] [1] [0] [0] [0] [÷] [◁] [→lb] [◨] [→cm] [◨] [→cm] [◨] [→cm] [1] [2] [ENTER] [3] [y^x] [×]

In algebraic mode, the following keys are used instead; note that ENTER is needed to complete the calculation.

⊡ →cm ⊡ →cm ⊡ →cm ⊡ →lb 1 ÷ 1 0 0 0 > × 1 2 y^x 3 ENTER

```
→CM(→CM(→CM(→…
            62.4280
```
Figure 6

Answer: The density of water is close to 62.4 pounds per cubic foot.

Special considerations for temperature conversions

Special care must be taken with temperature conversions. The two commands ⊡ →°C and ⊡ →°F convert **temperatures** but not temperature differences. The following example shows a simple temperature conversion, for more details see the separate training aid on temperature conversions.

Example 8:   What is 20 degrees Celsius in Fahrenheit?

Solution: In RPN mode, type the number 20 and then press the left-shifted 7 key.

2 0 ⊡ →°F

In algebraic mode, do the same. As usual, pressing ENTER completes the calculation, but is not necessary unless the conversion is part of a longer calculation.

⊡ →°F 2 0 ENTER

```
→°F(20)
            68.0000
```
Figure 7

Answer: 68 degrees Fahrenheit.