

Metric System Review Part 1:

The metric system, also known as “SI” (Système International d’Unités) is based on multiples of 10. This makes it easy to convert from one SI unit to the other. All you have to do is move the decimal point left or right by the correct number of places.

The three most common base units in SI are the *meter*, *kilogram* and *second*. They measure, respectively, distance, mass, and time. By adding a metric prefix, you change them to designate larger or smaller amounts.

We’ll use distance measurement for our examples. The SI base unit for distance measurement is the meter (m). You won’t see it on the chart, which only shows prefixes, but you can think of it as being at the $\times 10^0$ place.

EXAMPLE: 1 km = ? m

The prefix “k” is 3 powers of ten above the base unit (10^0), so we moved the decimal point 3 places to the right, e.g.,

$$1 \text{ km} \rightarrow 1.000 \text{ km} = 1000 \text{ m}$$

Notice that we added some zeros to do this. No problem, since $1 = 1.000\dots$. The extra zeros just give us room to move the decimal point. So the rule to remember is: **move down the chart** \rightarrow **move the decimal right**.

Conversely: **move up the chart** \rightarrow **move the decimal left**, e.g.,

EXAMPLE: 1.25 mm = ? m

This time we must move the decimal point 3 places left (also adding zeros) to get the answer:

$$1.25 \text{ mm} \rightarrow 001.25 \text{ mm} = 0.00125 \text{ m}$$

Now for a last tough one that does not involve the base unit; try:

EXAMPLE: 1.2 mm = ? cm

There are two prefixes to deal with, but the same rules apply. If you want to move one power of ten up the chart, the decimal shifts one place to the left:

$$1.2 \text{ mm} \rightarrow 01.2 \text{ mm} = 0.12 \text{ cm}$$

Finally, try this one on your own:

PUZZLE: 0.045 km = ? cm

ANSWER: 45000 cm (move the decimal five places to the right and get 45000)

Chart of the Metric Prefixes

FACTOR	PREFIX	SYMBOL
$\times 10^{24}$	yotta	Y
$\times 10^{21}$	zetta	Z
$\times 10^{18}$	exa	E
$\times 10^{15}$	peta	P
$\times 10^{12}$	tera	T
$\times 10^9$	giga	G
$\times 10^6$	mega	M
$\times 10^3$	kilo	k
$\times 10^2$	hecto	h
$\times 10^1$	deka	da
$\times 10^{-1}$	deci	d
$\times 10^{-2}$	centi	c
$\times 10^{-3}$	milli	m
$\times 10^{-6}$	micro	μ
$\times 10^{-9}$	nano	n
$\times 10^{-12}$	pico	p
$\times 10^{-15}$	femto	f
$\times 10^{-18}$	atto	a
$\times 10^{-21}$	zepto	z
$\times 10^{-24}$	yocto	y

NOTE FOR THE MATHEMATICALLY GIFTED: If writing extra zeros and counting decimal points seems too cumbersome, consider the following mathematically equivalent shortcut:

To convert from the X prefix to the Y prefix, multiply by 10^{X-Y} (where X and Y are the power factors).

Try this out on the above examples to see how easily it works.

Metric System Review Part 2:

You've already worked with the metric system in other science classes. This is a review to test how much you remember. The chart of metric prefixes below is provided for your reference.

Did you know that the metric system was created in France shortly after the French Revolution? The motivation for metrics was to reject the "made up" measurement standards endorsed by royalty, and replace it with a system of units based on logic and consistency. Instead of hard-to-remember ratios like "1 mile = 5280 feet" the metric system uses ratios like "1 kilometer = 1000 meters."

It's all based on "tens" so metric calculations can often be done without using a calculator. Fill in the blanks below and see just how easy it can be.

WARMUP:

- 1 meter = _____ centimeters
- 1 meter = _____ millimeters
- 1 kilometer = _____ meters
- 1 centimeter = _____ millimeters
- 1 kilometer = _____ centimeters

EASY:

- 20 kg = _____ g
- 0.5 km = _____ m
- 10 L = _____ mL
- 0.25 m = _____ cm
- 100 cm = _____ mm

DIFFICULT:

- 50 cm = _____ m
- 500 ms = _____ s
- 2000 mm = _____ cm
- 50 mg = _____ g
- 10 s = _____ ms

CHALLENGING:

- 1.2 km = _____ m
- 1 mg = _____ μ g
- 1 hm = _____ dm
- 23.7 g = _____ kg
- 12 inches = _____ cm

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$\times 10^{-1}$	deci	d
$\times 10^{-2}$	centi	c
$\times 10^{-3}$	milli	m
$\times 10^{-6}$	micro	μ
$\times 10^{-9}$	nano	n
$\times 10^{-12}$	pico	p
$\times 10^{-15}$	femto	f
$\times 10^{-18}$	atto	a
$\times 10^{-21}$	zepto	z
$\times 10^{-24}$	yocto	y

Metric System Review Part 2: Solutions

WARMUP:

1. 1 meter = 100 centimeters
2. 1 meter = 1000 millimeters
3. 1 kilometer = 1000 meters
4. 1 centimeter = 10 millimeters
5. 1 kilometer = 100,000 centimeters

EASY:

6. 20 kg = 20,000 g
7. 0.5 km = 500 m
8. 10 L = 10,000 mL
9. 0.25 m = 25 cm
10. 100 cm = 1000 mm

DIFFICULT:

11. 50 cm = 0.5 m
12. 500 ms = 0.5 s
13. 2000 mm = 200 cm
14. 50 mg = 0.05 g
15. 10 s = 10,000 ms

CHALLENGING:

16. 1.2 km = 1,200 m
17. 1 mg = 1000 μ g
18. 1 hm = 1000 dm
19. 23.7 g = 0.0237 kg
20. 12 inches = 30.48 cm