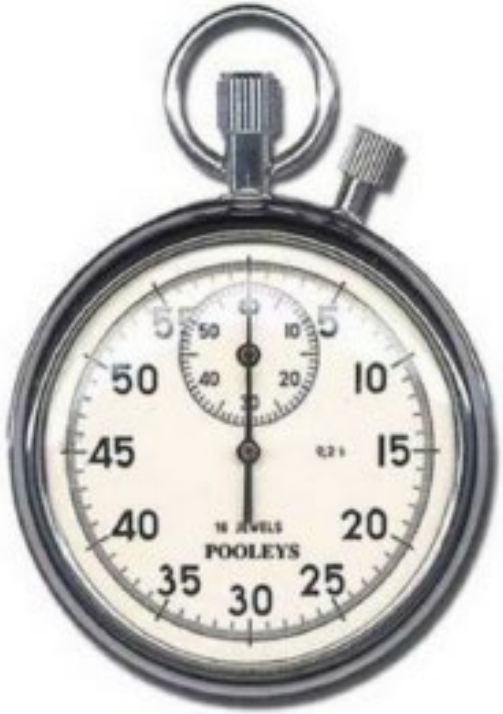
Physics 20 Unit 0 - Review

Measurement and Metric Prefixes / Scientific Notation, Sig. Digs



Measurement - The Metric System

The metric system was devised in the late 18th century by a group of french scientists lead by chemist Antoine Lavoissier.

Their hope was to create a standard set of units for scientific measurements.

The metric system spread to Canada in the mid 70's under Prime Minister Trudeau. It was a slow transition over from the British Imperial System and was more or less completed in 1984.

Most other countries also converted, with the exception of Liberia, Myanmar and the United States.

The metric system is comprised of 7 base units:

1. metre - (unit of length) Is the distance traveled by light in a vacuum during a time interval of 1/2997294858th of a second.

The original platinum-iridium alloy metre and kilogram.

2. kilogram - (unit of mass) A unit of mass equal to the mass of the international prototype kilogram in Sevres, France.

3. second - (unit of time) based on the decay of a cesium-133 atom.

4. Ampere - unit of electric current

5. Kelvin - unit of temperature

6. Candela - unit of luminous intensity

7. Mole - unit of amount of substance

For now, we will deal mostly with the metre, kilogram and second.

Prefixes

To express larger or smaller amounts of these base units, we use prefixes.

Prefixes Used With SI Units

Prefix	Symbol	Exponential Value	Prefix	Symbol	Exponential Value
pico	p	10^{-12}	tera	T	10^{12}
nano	n	10^{-9}	giga	G	10^{9}
micro	μ	10^{-6}	mega	M	10^{6}
milli	m	10^{-3}	kilo	k	10^{3}
centi	c	10^{-2}	hecto	h	10^{2}
deci	d	10^{-1}	deka	da	10^{1}

Working with prefixes:

ex) Convert.

1.4 cm = _____ m

Steps:

1. Look on your formula sheet.

centi ..... c ..... 10^{-2}

This -2 means "move the decimal twice to the left".

Recall... **so 1 cm is 0.01 m.**

$$10^{-2} = \frac{1}{10^2} = 0.01$$

2. Move the decimal the same number of spots as the exponent. Move left for negative exponents, right for positive exponents.

1.4 cm = 0.014 m

When moving from one prefix to another, subtract the exponents, and move the decimal this number of spaces.

centi ..... c ..... 10^{-2} **subtract**

milli ..... m ..... 10^{-3}

ex) Convert.

12 cm = _____ mm

(-2) - (-3) = +1

(move the decimal once to the right)

Practice: Convert.

1) 48 mm = _____ m

2) 10 cm = _____ hm

3) 1.2 GL = _____ L

4) 25 nm = _____ mm

5) 25000 mg = _____ kg

Derived Units

Derived units are made up from two or more base units.

ex) km/h → **velocity**

m/s^2 → **acceleration**

kg/L → **density**

We will encounter units like this later in this course.

Scientific Notation

In physics, we often study very large or very small numbers. For simplicity, these numbers are often converted to scientific notation using fewer digits and an exponent.

In this course (as well as Pure Math 20 & 30) we will use the form

$$L \times 10^{d}$$

where: $1 \leq L < 10$

d is a whole number integer (+ive or -ive)

ex) 125000 = 1.25×10^{5}

standard form — scientific notation

ex) 0.0000421 = 4.21×10^{-5}

standard form — scientific notation

Moving the decimal to the left gives a positive exponent, moving to the right gives a negative exponent.

ex) The speed of light is ~300 000 000 m/s. What is this value in scientific notation (expressed with one digit)?

ans:

ex) The radius of the Earth is 6.37×10^6 m . Express this value in standard notation (in metres).

ans:

ex) Express the answer from the previous example in kilometres using scientific notation.

ans:

Significant Digits

Before we start, let's get something straight...

...just what decimal place do we round to around here?

To determine this, let me enlighten you in the lost and ancient art of Sig Digs!

Rule 1: Determining Sig-Digs

Rule:	Example:
i) All nonzero integers are significant.	421.1 — 4 SD
ii) Leading zeros are never significant.	0.0034 2 — 3 SD
iii) Captive zeros are always significant.	2.05 — 3 SD
iv) Trailing zeros in a decimal number are significant.	25.0 — 3 SD

ex) Determine the number of Sig-Digs.

a) 0.002541

b) 45.204

c) 1.02501

d) 1.00

e) 1.25×10^5

Rule 2: Adding/Subtracting

When adding or subtracting, your answer must have the same number of sig-digs after the decimal as the lowest number of sig-digs after the decimal in the question.

ex) 1.25 + 2.0 = 3.25

2 SD 1 SD should be 1 SD

we must round this to 3.3

ex) 5.502 - 5.25 =

ex) 150.0 + 0.05 =

Rule 3: Multiplying/Dividing

When multiplying or dividing, the total number of sig-digs in the final answer must be the same as the smallest total sig-digs in the question.

ex) 1.5 x 6.35 = 9.525 round to 9.5

2 SD 3 SD should be 2 SD

ex) 7.89 / 2.75

ex) 0.0005 x 1258.5