PHYSICS 11

MATH FOR PHYSICS II

SIGNIFICANT DIGITS (=SIGNIFICANT FIGURES):

- **Non-zero digits are always significant**

235 3 sd

1.5 2 sd

859 317 6 sd

5 1 sd

- **Zeros between non-zero digits are always significant**

2005 4 sd

1.08 3 sd

3105 4 sd

305.04 5 sd

- **Zeros at the beginning of a number are never significant**

0.05 1 sd

0.00041 2 sd

0.25 2 sd

* 0.000 exception "zero" accurate to the nearest thousandth

- **Zeros at the end of a number AND to the right of the decimal are significant**

1.0 2 sd

25.00 4 sd

3.480 4 sd

0.005800 4 sd

- **Zeros at the end of a number AND to the left of the decimal point <u>may or may not</u> be significant.** This depends on the precision of the measuring device used.

1000 1-4 sd

ROUNDING TO A REQUIRED NUMBER OF SIGINIFICANT DIGITS

- Round the following to 4 significant digits:

12.4065	12.41	2000.154	2000 ! 2.000×10^{3}
1.007853	1.008	0.00345689	0.003457 3.457×10^{-3}
0.0006	N/A only 1 sd	3.00000	3.000
0.00000	N/A	1 000 000	1.000×10^{6}

SCIENTIFIC NOTATION

- Express in scientific notation with 2 significant digits: _ . _ × 10^□

12 000 456 m	1.2×10^{7} m
300 km	3.0×10^{2} km
0.50 g	5.0×10^{-1} g
123 cm	1.2×10^{2} cm
105 V	1.1×10^{2} V
3 Ω	N/A only 1 sd
6038 L	6.0×10^{3} L
1984 m/s	2.0×10^{3} m/s

45 N	4.5×10^1 N
0.002345 dm	2.3×10^{-3} dm
89 560 N	9.0×10^4 N
3045 W	3.0×10^3 W

➢ **Significant digits = all digits that are certain + one estimated (uncertain) digit.**

CALCULATIONS WITH SGINIFICANT DIGITS

1. When multiplying and dividing measured quantities, the final answer can have only the number of significant digits that is the same as the number of significant digits in the quantity having the smallest number of significant digits.

$(3.5)(1.85) = 6.475 \doteq 6.5$

$15.4 \div 1.8 = 8.\overline{5} \doteq 8.6$

2. When adding and subtracting measured quantities, the final answer can have only as many decimal places as the quantity having the least number of decimal places

$14.5 + 12.38 = 26.88 \doteq 26.9$

$13.81 - 4.52 + 3.75 - 4.5 = 8.54 \doteq 8.5$

3. Carry more than just the significant digits through your calculations – do not round off intermediate results. Round at the end to give the final answer.

PRECISION indicates the reliability or reproducibility of a measurement.

ACCURACY indicates how close a measurement is to the known/accepted value.

CERTAINTY depends on the limitations of the measuring device, the skill of the person taking the measurement and the value of the measured quantity.

Example: If a sample of 2.0 Kg is weighed on a balance that gives values to ±0.5kg, its true mass can vary from 1.5kg to 2.5 kg. There is as much as 25% variation possible. If the same balance is used to weigh a sample of 10 kg, the true value can vary between 9.5kg and 10.5kg. This variation is only 5%, thus there is more certainty is the second measurement.

Ex1

100 % . . . . 2.00 kg

x % . . . . 0.5 kg

$$\frac{x}{100} = \frac{0.5}{2.0}$$

$x = 25\%$

Ex2

100% . . . 10 kg

x% . . . 0.5 kg

$$\frac{x}{100} = \frac{0.5}{10}$$

$x = 5\%$

SI units

Quantity	Symbol of the quantity	Unit	Symbol of the unit
length	l	metre	m
time	t	second	s
mass	m	(kilo) gram	(k) g
electric current	I	Ampere	A
Luminos intensity	I_v	candela	cd
amount	n	mole	mol
temperature	T	kelvin	K
* energy (derived)	E	Joule	J

➢ *Note: Unless you are instructed otherwise, use either the scientific notation or a "RULE OF A THOUSAND" that states that your final answer should be a value between 0.1 and 1000 which can be achieved by appropriate SI prefixes.*