LEC 1

CH1 MEASUREMENTS

PHYSICAL QUANTITIES

→ Measurable
→ Express Physical laws.

PHYSICAL QUANTITIES

BASE QUANTITIES

- Length (m)
- Mass (Kg)
- Time (s)

DERIVED QUANTITIES

- Velocity (m/s)
- Force ($kg\,m/s^2$)
- Acceleration (m/s^2)

SCIENTIFIC NOTATION

→ Expresses a # in power of ten (10^x).
→ A non-zero digit to left of decimal.

- Kilo 10^3 K
- Giga 10^9 G
- Pico 10^{-12} p
- Nano 10^{-9} n
- Femto 10^{-15} f

ERROR

→ STANDARD VALUE − EXPERIMENTAL VALUE.

ERRORS

ASSIGNABLE

→ Cause
→ Same trend of Variations

Cure:
→ Control Experimentally

UNASSIGNABLE

→ Unknown Cause
→ No trend

Cure:
→ Compute Average.

SIGNIFICANT FIGURES

→ Due to uncertainity
→ Standard of writing a numerical value of a measurement.
→ All accurately known digits
→ First doubtful digit
→ Accurate measurements have higher SF.

RULES OF SIGNIFICANT FIGURES.

1) All non-zero digits are significant figs.
   eg: 3.456 → 4SF
   12.3456 → 6SF
2) Zeros b/w non-zeros are significant
   eg: 2306 → 4SF
   200894 → 6 SF
3) Zeros locating position of decimal in #s < 1 not significant.
   eg: 0.000458
4) Final zeros to the right of decimal point are significant.
   eg: 3.0000
5) Zeros that locate decimal point in #s > 1 are not significant.
   eg: 30000 1SF
   1400 2SF.

ALGEBRA WITH SIGNIFICANT FIGURES.

DIVISION & MULTIPLICATION.

$$\frac{4.54 \times 2.324}{1.3365} = 7.89447063 = 7.89$$

Note: A factor having smallest # S.Fs is least accurate.

ADDITION & SUBTRACTION

→ least # of decimal places.
→ Counting SFs not required.

eg: $4.345 + 23.51 = 27.855 = 27.86$.

ROUNDING DATA

RULES:

1) Digit to drop >5, +1 to last digit i.e. to stay and drop the rest to right
   eg: 3.677 → 3.68

2) Digit to drop <5, drop it right away.
   eg: 6.632 → 6.63

3) Digit to drop = 5

- retain **Even**
  - Drop 5
  - eg 6.65 ↓ 6.6
- retain **Odd**
  - +1
  - eg: 6.35 ↓ 6.4

PRECISION & ACCURACY

PRECISION

→ Least count of instrument.
→ Precise means small least count.

ACCURACY

→ Fractional uncertainity in measurement
→ Accurate means smaller % error.

TIP: Count more readings to reduce errors.

DIMENSIONAL ANALYSIS

→ Symbol for physical quantity is dimension.
→ Derive formulae
→ To check homogeneity of formula.

Q The energy of a photon of light of freq f is given by hf; h is plancks constant. What are base units of h?

$$E = hf$$

$$f = 1/t \Rightarrow 1/s$$

$$E \rightarrow J$$

$$E = F \cdot d \Rightarrow Kg\frac{m}{s^2} \cdot m \rightarrow Kg\frac{m^2}{s^2}$$

$$\frac{E}{f} = h$$

$$Kg\frac{m^2}{s^2} \times s \Rightarrow \boxed{Kg\frac{m^2}{s} \rightarrow h}$$