Pakistan School
Kingdom of Bahrain

Rules of the Class:

- 1) Be on time for all your classes
- 2)Respect all the participants of the class.
- 3)Do not create any disturbance.
- 4)Raise hand if you have a question or you wish to answer any question.
- 5)Pay attention to your teacher.
- 6)Enter into the class with your actual name and CPR number.
- 7)Follow the Time Table.

Engaging Starter

- Define Error.

Welcome to the new session of Grade 11th " Physics "

Unit: 1

"Measurements"

Topic:1.4 "Errors and Uncertainties"

Learning Objectives: By the end of the session, students will be able to:

1) **Classify different types of errors in measurements.**

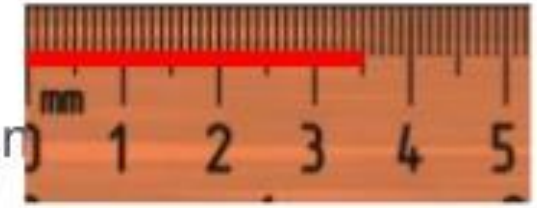
2) **Describe different rules for rounding off measured values.**

Errors and Uncertainties

in measurements and in calculations

What Is An Uncertainty?

- No measuring instrument (be it a plastic ruler or the world's most accurate thermometer) is perfectly accurate
- When you make any measurement, there always is some uncertainty as to the exact value.
- For example:
  - The ruler says this red line is 3.5 cm lon
  - Due to imperfections in the design and manufacturing of the ruler, I can't be sure that it is exactly 3.500 cm, just something close to that, perhaps 3.492. or 3.521



Uncertainty and Measurements

There are **errors** associated with any measurement.

Random error | Systematic error | Human error

Random error – These errors can be caused by a variety of sources:

1. Inability to read a measurement beyond the smallest division
2. Limited accuracy of measuring instruments
3. Fluctuations in temperature/pressure

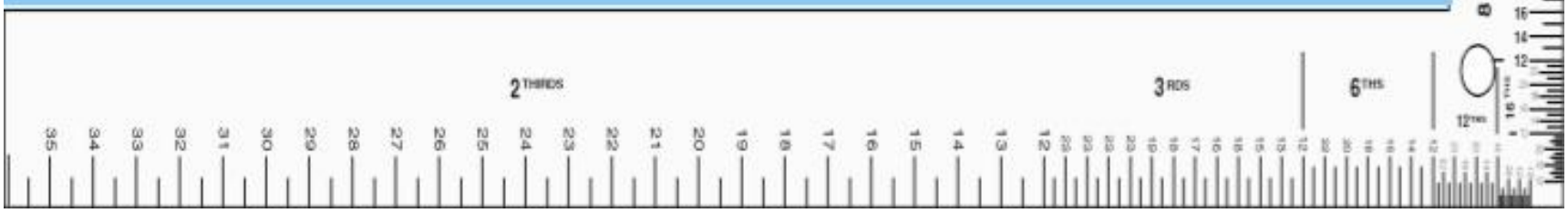
Measurement Errors

Random errors can be reduced by repeating readings.

As the error is random, some measurements will be high, others low but on average they should be more precise.

Systematic errors can be reduced by calibrating equipment.

By checking zero readings and scale calibration, systematic errors can be calculated and compensated for.



RANDOM ERROR:

- The error produced due to sudden change in experimental conditions is called "RANDOM ERROR".
- For example:
  During sudden change in temperature, change in humidity, fluctuation in potential difference (voltage).
- It is an accidental error and is beyond the control of the person making measurement.

PERSONAL ERROR:

- An error comes into play because of faulty procedure adopted by by the observer is called "PERSONAL ERROR".
- Personal error comes into existence due to making an error in reading a scale.
- it is due to faulty procedure adopted by the person making measurement.

Rounding Off
Significant Figures

Rounding Off

means to
find a round number
that is closest
to the real answer.

Rules Rounding Significant Digits Rule #1

If the digit to the immediate right of the last significant digit is less than 5, do not round up the last significant digit.

- For example, let's say you have the number 43.82 and you want to round off to the nearest tenths

Answer: ?

Round 3.945 to the Nearest Tenth

=

3.9

Rules Rounding Significant Digits Rule #2

- If the digit to the immediate right of the last significant digit is greater than 5, you round up the last significant figure
- Let's say you have the number 234.87 and you want to round off again to the nearest tenths

Answer: ?

Round to the nearest tenth.

Tens	Units	.	Tenths	Hundredths	Thousandths
	4	.	5	6	9

→ 4.6

Rules Rounding Significant Digits Rule #3

- If the number to the immediate right of the last significant is a 5, and that 5 is followed by a non zero digit, round up
- Example: 78.657 (you want 3 significant digits)
- Answer: 78.7

Rules Rounding Significant Digits Rule #4

- If the number to the immediate right of the last significant is a 5, and that 5 is followed by a zero, you look at the last significant digit and make it an even number.
- If the digit after 5 is already even, then retain.

Example 1: 2.5350 = 2.54

Example 2: 2.6450 = 2.64

ASSESSMENT:

ROUNDING OFF

- the process of deleting nonsignificant digits from a calculated number.

Rules for Rounding Off Numbers

If the first digit to be dropped is:	Then the last significant digit should:	Examples (Rounded off to 3 sig. figs.)
Greater than 5	Be increased by 1	42.68 → 42.7 5.3999 → 5.40
Less than 5	Stay the same	17.326 → 17.3 0.9994 → 0.999
5, followed by nonzero digit(s)	Be increased by 1	2.7852 → 2.79 15.555 → 15.6

ROUNDING OFF

Rules for Rounding Off Numbers

For numbers ending in the digit 5 or 0 and the first digit to be dropped is 5, always round up to the nearest even number. This strategy prevents compounding round off errors in the final answer.

Examples (Rounded off to 3 sig. figs.)

4.635	→	4.64
0.2775	→	0.278
78.65	→	78.6
100.50	→	100.

ROUNDING OFF

- Rounding off must be carried out in a single step

  example: 14.348 (to 3 SF) should not be first rounded to 14.35 and then to 14.4.

- Round off only at the final stage of the calculation and to carry all digits in the memory of the calculator until the final stage, or
- Add an extra SF for each intermediate stage until the final stage of the calculation.

Closure

a) Define Error .

b) Differentiate between Random and Systematic error.

c) What do we mean by personal error?.

d) Rounding off means?

Home Work

Assignment is given in uploaded notes.

Thank you…..