بسم الله الرحمن الرحيم

King Saud University
College of Science
Physics & Astronomy Dept.

PHYS 103 (GENERAL PHYSICS)

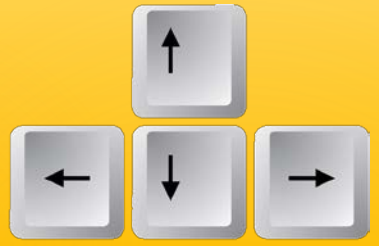
CHAPTER 1: DIMENSIONAL ANALYSIS

LECTURE NO. 1

THIS PRESENTATION HAS BEEN PREPARED BY: *DR. NASSR S. ALZAYED*

How to run this presentation?

Please use your mouse (just click on any place)



Or use keyboard arrows …….

Or use Pageup and Pagedown …..

Welcome to 103 Physics

- Importance of the course
- Directions on how to get maximum benefit of the course
- Talk about attendance, participation and office hours
- Short information about the LMS and how to make it effective and useful.
- Little about the textbook and online resources.
- Solving Problems Tips.

1.1 Standards of Length, Mass, and Time

- In mechanics, there are three basic quantities: *length*, *mass*, and *time*
- All other quantities in mechanics can be expressed in terms of these three.
- In 1960, an international committee established a set of standards for the fundamental quantities of science. It is called the SI (Système International)
- *In the SI: Units of length*: ***meter***

  Units of mass : ***kilogram***

  Units of time : ***second***

1.1 Standards of Length, Mass, and Time

- ***Length***: *SI Unit of length is: meter (m).*
- ***Mass:*** *SI Unit of mass is: kilogram (kg)*
- ***Time:*** *SI Unit of time is: second (s)*

- In many situations, you may have to derive or check a specific equation. A useful and powerful procedure called *dimensional analysis* can be used to assist in the derivation or to check your final expression.
- As a simple method: Left Hand Side must = Right Hand Side

1.1 Standards of Length, Mass, and Time: Movie

Please Click by mouse on the movie to play Then Wait .....

1.4 Dimensional Analysis

- ***Dimension:*** *it denotes the physical nature of a quantity*
- ***Example:*** *distance: could be in meters, yards, or micrometers. But overall it is: a* ***length***
- ***Symbols we are going to use are:***
  - *dimension of length:* **[L]**
  - *dimension of mass:* **[M]**
  - *dimension of time:* **[T]**

Units of Area, Volume, Velocity, Speed, and Acceleration

System	Area (L^2)	Volume (L^3)	Speed (L/T)	Acceleration (L/T^2)
SI	m^2	m^3	m/s	m/s^2
U.S. customary	ft^2	ft^3	ft/s	ft/s^2

1.4 Dimensional Analysis

- ***Example:*** *Use dimensional analysis to check the equation:* $x = \frac{1}{2}at^2$

Solution:

$$L = \frac{L}{\cancel{T}^2} \cdot \cancel{T}^2 = L$$

- ***Example:*** *Show that v=at is dimensionally correct.*
- ***Solution:***

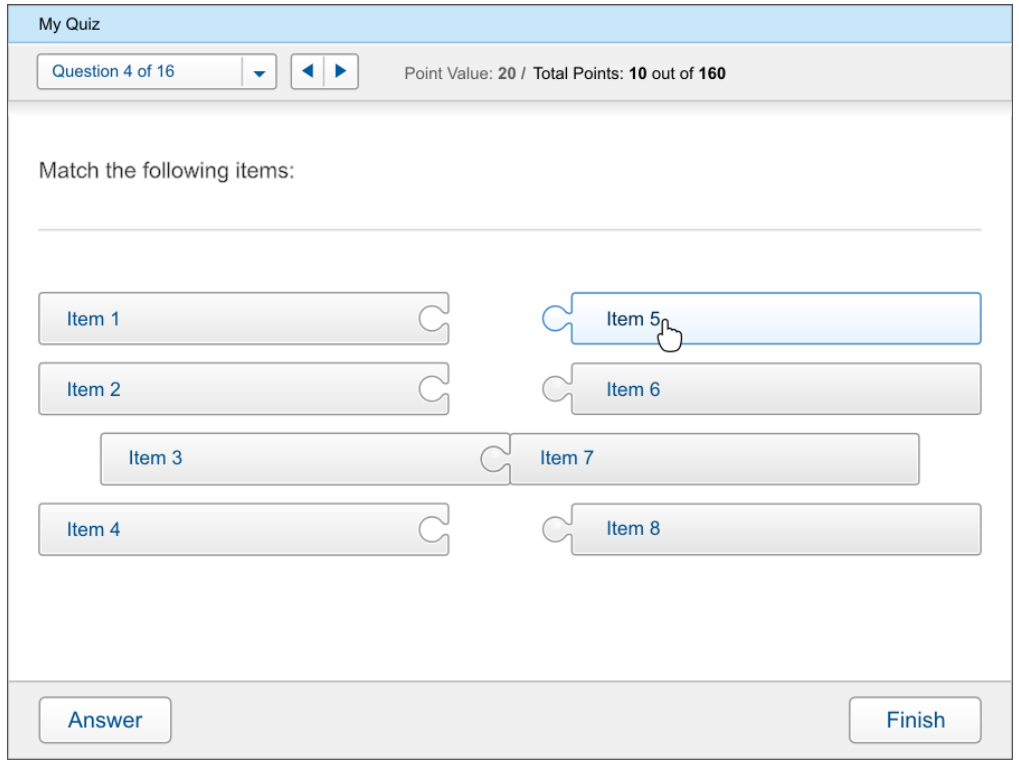
$$\text{L.H.S.: } [v] = \frac{L}{T}$$

$$\text{R.H.S.: } [at] = \frac{L}{T^{\cancel{2}}} \cancel{T} = \frac{L}{T}$$

$$\therefore \text{ L.H.S} = \text{R.H.S}$$

- *Hence the equation is dimensionally correct*

1.4 Dimensional Analysis (Quiz)

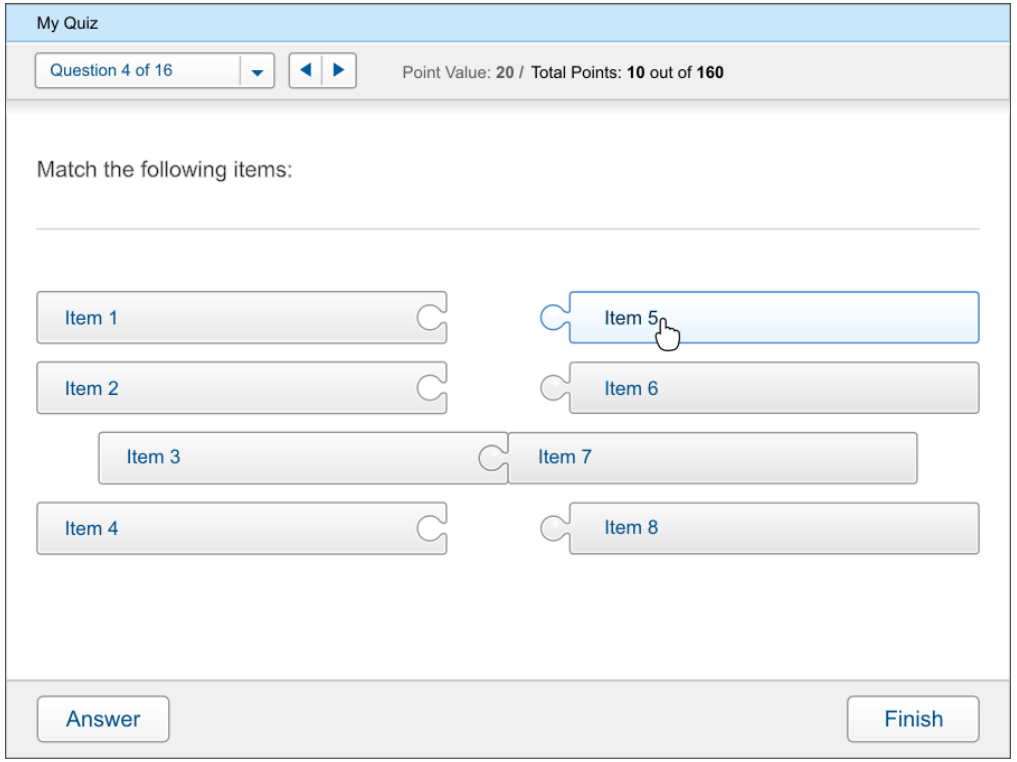


Click the **Quiz** button on iSpring Pro toolbar to edit your

1.5 Conversion of Units

- Sometimes it is necessary to convert units from one *measurement* system to *another*, or to convert *within* a system, for example, from kilometers to meters.
- Please visit this page for comprehensive list
- Examples:
  - 1 mile = 1 609 m = 1.609 km
  - 1 ft = 0.304 8 m = 30.48 cm
  - 1 m = 39.37 in. = 3.281 ft
  - 1 in. = 0.025 4 m = 2.54 cm (exactly)

1.5 Conversion of Units (Quiz)



Click the **Quiz** button on
iSpring Pro toolbar to edit your

Lecture Summary

- The three fundamental physical quantities of mechanics are length, mass, and time, which in the SI system have the units meters (m), kilograms (kg), and seconds (s), respectively.
- The method of dimensional analysis is very powerful in solving physics problems.
- Dimensions can be treated as algebraic quantities. By making estimates and performing order-of-magnitude calculations, you should be able to approximate the answer to a problem when there is not enough information available to completely specify an exact solution.

Please read the attachment ….