Introduction

• 10 lectures in Education LT 351
• Workshops in Teachers College Science Education Lab 431
• Books
  - EDUF 1017 Science Foundations 2 - Physical Phenomena
    - Lecture Notes - $7 - code no. R618000H
    - Workshop Book - $7.50 - code no. R618000F
    Both available from the Copy Centre or go to
• Web site - copies of notes and other information:
• Assessment
  - Final exam - lecture and workshop material

Outline

1. Introduction - Distance, Speed, Acceleration
2. Newton’s First Law, Force, Newton’s Second Law
3. Buoyancy, Density, Floating
4. Newton’s Third Law, Walking & Running, Jumping
5. Gravity
6. Kinetic & Gravitational Potential Energy
7. Waves, Sound, Hearing
8. Charge, Current, Voltage, Batteries
9. Resistance, Power
10. Electrical Networks & Safety

Units

• What are the units of the measurements?
• We use the SI (Système International) units - mks system - based mostly on
  - Length - metre (m)
  - Mass - kilogram (kg)
  - Time - second (s)
  - Electric Current - ampere (A)
  - Temperature - kelvin (K)
• There are also the cgs units, imperial units and ‘US customary’ units

Prefixes:

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>tera</td>
<td>T</td>
<td>10^12</td>
</tr>
<tr>
<td>giga</td>
<td>G</td>
<td>10^9</td>
</tr>
<tr>
<td>mega</td>
<td>M</td>
<td>10^6</td>
</tr>
<tr>
<td>kilo</td>
<td>k</td>
<td>10^3</td>
</tr>
<tr>
<td>deci</td>
<td>d</td>
<td>10^-1</td>
</tr>
<tr>
<td>centi</td>
<td>c</td>
<td>10^-2</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>10^-3</td>
</tr>
<tr>
<td>micro</td>
<td>µ</td>
<td>10^-6</td>
</tr>
<tr>
<td>nano</td>
<td>n</td>
<td>10^-9</td>
</tr>
<tr>
<td>pico</td>
<td>p</td>
<td>10^-12</td>
</tr>
</tbody>
</table>

Speed

• “The distance travelled in a given amount of time”
• Defined bit more carefully: Average speed is the distance travelled (along any path) divided by the time it took
  \[
  \text{average speed} = \frac{\text{distance travelled}}{\text{time elapsed}}
  \]
• Speed is a scalar and is always positive.
• Velocity is a more technical term when displacement and direction are important.
  - SI Units are length/time - e.g. m/s or ms^{-1}
Example

Example (Hecht Example 2.4)

A 600km cross-country car rally is won by a team of two drivers each of whom had the wheel for half the distance of the trip. If one averaged 60 km/h and the other 20 km/h, what was their overall average speed?

Converting between units

How fast do they go?
- Human walking
- Human running
- Car 30 m/s 110 km/hr
- Aircraft
- Sound
- Light

Example of conversion

\[ \frac{110 \text{ km}}{\text{hr}} \times \left( \frac{1 \text{ hr}}{3600 \text{ s}} \right) \times \left( \frac{1000 \text{ m}}{\text{km}} \right) = 30 \text{ m/s} \]

Constant Speed

- Constant or uniform speed - equal distances in equal times
- How to specify the speed at an instant? Narrow the time of the average

Acceleration

- How do we quantify changes in motion? - speed up (accelerate), slow down (decelerate), changes in direction.

**Acceleration** is the time rate of change of velocity.

\[ \text{average acceleration} = \frac{\text{change in velocity}}{\text{time elapsed}} \]

- Units are (m/s)/s - m/s² or m/s² - “metres per second squared”
- Acceleration may be positive or negative
- When \( v_f < v_i , \ a < 0 \), the runner has decelerated.
- When \( v_f > v_i , \ a > 0 \), the runner has accelerated.

Summary

- Correct use of units makes calculations easy - use the basic SI units
- Distance v. displacement
- Speed v. velocity
- acceleration

\[ \text{average velocity} = \frac{\text{displacement}}{\text{time elapsed}} \]

\[ \text{average acceleration} = \frac{\text{change in velocity}}{\text{time elapsed}} \]

- NEXT: ……How do we accelerate? Force

See on-line version for print that is too small