PHSC 1011

Look over Chapters 2 and 3

Good Things to get to Known

- Instantaneous speed
- Vectors
- Scalars
- Acceleration
- Speed
- Meter
- Second

Kilogram

Velocity

Δ delta (change in)

Parabola

Air Resistance

Acceleration due to Gravity

Speed

Speed is the rate at which an object covers distance.

\[ \text{Speed} = \frac{\text{Distance}}{\text{Time}} \]

or in symbols

\[ v = \frac{d}{t} \]

Speed has units of length divide by units of time.

Examples:

- miles/hour (mph)
- meters/second (m/s)
- km/hour (km/hr)
Example 1

1) How many seconds are needed by a car whose speed is 40 km/hr to cover a distance of 800 m?

Instantaneous Speed

*Instantaneous speed* is how fast something is going at any moment in time.

Vectors

A *Vector* is any quantity that needs two things (a size and a direction) to completely describe it.

A *Scalar* is a number that only has a Magnitude associated with it.
Velocity

To complete describe the motion of an object we need to know its speed and which direction it is going. Both of these pieces of information are referred to as the Velocity of an object.

To represent any vector quantity we sometimes draw an arrow to show the direction and magnitude of the vector.

Acceleration

Acceleration is the rate at which velocity changes with time.

\[ a = \frac{\Delta v}{t} \]

Units of Acceleration

Acceleration has units of speed divided by time.

The units of acceleration we will use are:

\[ \frac{\text{length}}{(\text{time})^2} \Rightarrow \frac{m}{s^2} \] (meters per seconds squared)
Example 2

2) Modern oil tankers weigh over a half-million tons and have lengths of up to a quarter of a mile. Such massive ships require a distance of 5.0 km (about 3.0 miles) and a time of 20 min to come to a stop from a top speed of 30 km/hr. What is the ship's average acceleration?

**g, What a Special Acceleration**

Near the surface of the earth objects are accelerated downwards due to the force of Gravity.

The value of the Acceleration due to Gravity (g) on Earth is:

\[ g = 32 \, \text{ft/s}^2 \text{ or } 9.8 \, \text{m/s}^2 \approx 10 \, \text{m/s}^2 \]

**Some Data**

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<thead>
<tr>
<th>Time (s)</th>
<th>Speed (m/s)</th>
<th>Distance (m)</th>
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<td>4</td>
<td>39.2</td>
<td>78.4</td>
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<tr>
<td>5</td>
<td>49</td>
<td>122.5</td>
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</tbody>
</table>
The Speed and Distance

If an object is accelerating the speed at each second is given by:

\[ v = at \]

The distance the object travels each second is given by:

\[ d = \frac{1}{2} at^2 \]

Example 3

3) A climber near the summit of a vertical cliff accidentally knocks loose a large rock. She sees it shatter at the bottom of a cliff 8 s later.

a) What was the speed of impact?
b) How far did the rock fall?

Throw an Object Straight Up Into The Air

The speed at the object's highest height will be zero.

The object will return with the same speed that you throw it up with, but it will be moving in the downward direction.
If you throw an object horizontally

The horizontal velocity will stay the same but the vertical velocity changes due to the acceleration of gravity.

If you throw at an angle

The path that the object will take is a Parabola.

Air Resistance

All things do not fall with the same rate due to gravity.

It is Air Resistance the slow down objects as they fall.

Air Resistance is due to the air that objects have to push out of the way to fall.
Air Resistance depends on three things

1) The shape of the object.

2) The mass of the object.

3) The speed with which the object is moving.

Terminal Speed

At some point the object can not be slowed down anymore due to the air resistance.

At this point the speed of the object will be constant. This speed is referred to as the Terminal Speed.