Combining Mastering Physics with Mastering Chemistry

Suppose you have already registered with Mastering Chemistry

Go to Mastering Physics website as a returning user and log in with username and password from Mastering Chemistry

Click on Knight/Jones/Field "College Physics"

Enter the Mastering Physics access code

Use student number as student ID

If you've used something other than student number for Mastering Physics, please change it to student number

GENERAL PHYSICS I: PHYS 1020

Schedule - Fall 2007
(lecture schedule is approximate)

Week	Date		Lecture	Cutnell & Johnson	Topic	Labs/Tests (Tuesdays, Wednesdays, Thursdays)
1	F	Sept 7	1	Chapter 1	Introduction	No lab or tutorial
2	M	10	2			No lab or tutorial
	W	12	3	Chapter 2	Kinematics in one dimension	
	F	14	4			
3	M	17	5			Errors Lecture
	W	19	6	Chapter 3	Kinematics in two dimensions	
	F	21	7			
4	M	24	8			Experiment 1: Measurement of Length and Mass
	W	26	9			
	F	28	10	Chapter 4	Forces and Newton's laws	

The first lab period is next week

It is the errors lecture (in the lab)

You should attend so you know how to combine errors of measurement

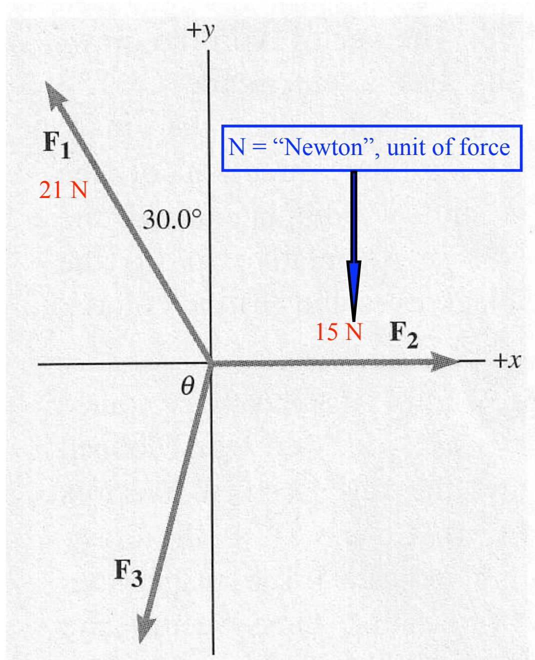
Prob. 1.46/46:
Three forces are applied to an object.

What must be the magnitude and direction of $\mathbf{F}_3$ if the sum of the forces is zero?

Need $\vec{F}_1 + \vec{F}_2 + \vec{F}_3 = 0$

So, $\vec{F}_3 = -\vec{F}_1 - \vec{F}_2$

Components:



Summary of Chapter 1

Vectors have a magnitude **and** a direction
Scalars have just a magnitude

Vectors add nose to tail
Simplify by breaking vectors into x, y components

Vectors are subtracted by reversing the direction of the vector to be subtracted and then adding:

A - B = A + (-B)

or, $\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$

Alternative notation for vectors

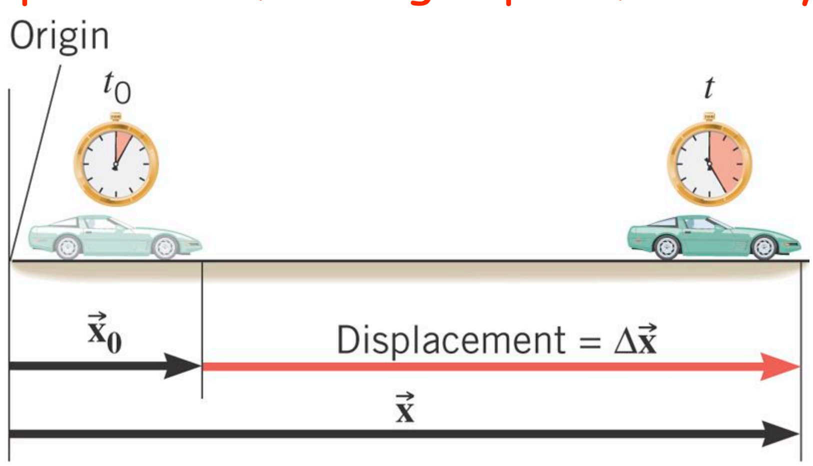
Dimensions must be the consistent in all terms of an equation
The basic dimensions are mass, length and time
[M], [L] and [T], (kg, m, s)

Chapter 2: Kinematics in One Dimension

Will cover motion in a straight line with constant acceleration:

- Displacement – not always the same as distance travelled
- Speed, velocity, acceleration
- Equations of motion in one dimension
- Free fall under gravity - which way is up?
- Graphical representation

Displacement, average speed, velocity



Car starts at x_o at time t_o, reaches x at time t

Distance travelled = x - x_o

Displacement, $\Delta\vec{x} = \vec{x} - \vec{x}_0$

$$\text{Average speed} = \frac{\text{Distance}}{\text{Elapsed time}} = \frac{x - x_0}{t - t_0}$$

$$\text{Average velocity} = \frac{\text{Displacement}}{\text{Elapsed time}} = \frac{\Delta\vec{x}}{t - t_0}$$

Displacement and distance not necessarily the same

Example: Car travels 50 km to east, then 20 km to west in 1 hour.

Distance travelled = 50 + 20 = 70 km

Average speed = 70 km/h

Displacement $= \vec{x}_{final} - \vec{x}_{initial} = 30$ km to east

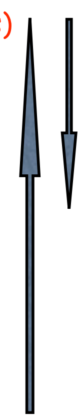
Average velocity = 30 km/h to east

Example: A car makes a trip due north for 3/4 of the time and due south for 1/4 of the time. The average northward velocity has a magnitude of 27 m/s. The average southward velocity has a magnitude of 17 m/s.

What is the average velocity for the entire trip?

Put T = time for the entire trip.

$x_1 = (3T/4) \times (27\ \text{m/s})$



$x_2 = (T/4) \times (17\ \text{m/s})$

Average velocity = Displacement/Time

$= (x_1 - x_2)/T$, to the north

$= 3 \times 27/4 - 17/4$ m/s

$= 16$ m/s, to the north

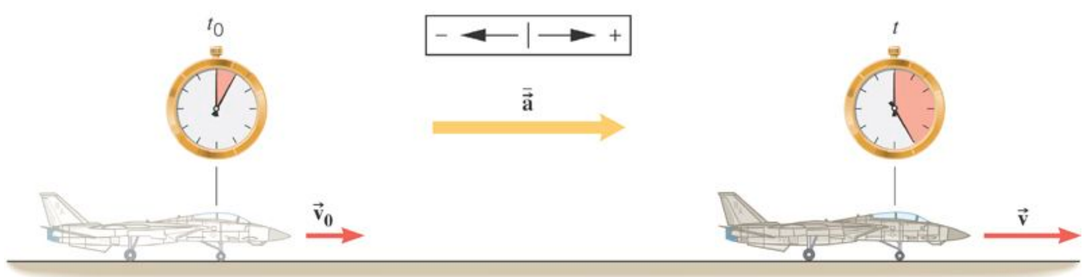
Instantaneous Velocity

The velocity measured during a vanishingly small time interval. That is, the velocity at a particular instant in time.

$$\vec{v} = \lim_{\Delta t \to 0} \frac{\Delta \vec{x}}{\Delta t}$$

This differs from the average velocity because the average is measured over an extended time during which the object may be accelerating.

Acceleration

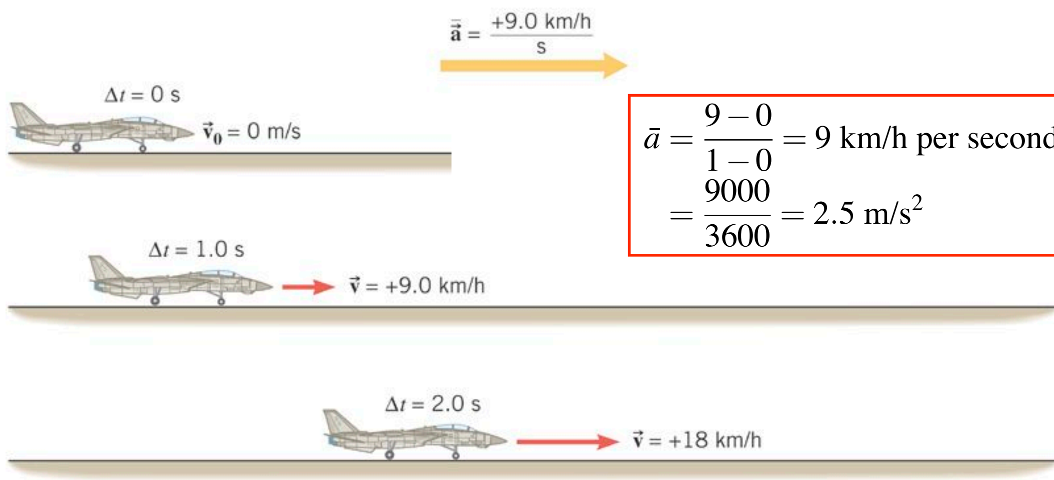


$$\text{Average acceleration} = \frac{\text{Change in velocity}}{\text{Elapsed time}} = \frac{\vec{v} - \vec{v}_0}{t - t_0}$$

$$\text{Instantaneous acceleration} = \lim_{\Delta t \to 0} \frac{\Delta \vec{v}}{\Delta t}$$

Any change of velocity, including slowing down, is an "acceleration".

Average acceleration



$$\boxed{\begin{aligned}\bar{a} &= \frac{9-0}{1-0} = 9 \text{ km/h per second} \\ &= \frac{9000}{3600} = 2.5 \text{ m/s}^2\end{aligned}}$$

$$\boxed{\bar{a} = \frac{18-9}{2-1} = 9 \text{ km/h per second}}$$

Two cars are moving in a straight section of a highway. The acceleration of the first car is greater than the acceleration of the second car and both accelerations have the same direction.

Clicker Question

Which one of the following is true?

a) The velocity of the first car is always greater than the velocity of the second car.

b) The velocity of the second car is always greater than the velocity of the first car.

c) In the same time interval, the velocity of the first car changes by a greater amount than the velocity of the second car.

d) In the same time interval, the velocity of the second car changes by a greater amount than the velocity of the first car.

Equations of Motion

Consider an object that has speed v_o at time $t = 0$.
It is accelerated in a straight line at a constant rate to speed v at time t.

Acceleration:

$$a = \frac{v - v_0}{t}, \text{ so } v = v_0 + at \qquad (1)$$

Average speed:

$$\bar{v} = \frac{x - x_0}{t} = \frac{v + v_0}{2} = \frac{v_0 + at + v_0}{2}$$

$$x - x_0 = v_0 t + \frac{1}{2} a t^2 \qquad (2)$$

From previous page:

$$\bar{v} = \frac{x - x_0}{t} = \frac{v + v_0}{2}$$

$$x - x_0 = \frac{1}{2}(v + v_0)t \qquad (3)$$

And:

(1) $v - v_0 = at$

(3) $\dfrac{v + v_0}{2} = \dfrac{x - x_0}{t}$

Multiply –

$$(v - v_0) \times \frac{(v + v_0)}{2} = a\cancel{t} \times \frac{(x - x_0)}{\cancel{t}}$$

$$v^2 - v_0^2 = 2a(x - x_0) \qquad (4)$$

The famous four formulae

$$v = v_0 + at \quad (1)$$

$$x - x_0 = v_0 t + \frac{1}{2} a t^2 \quad (2)$$

$$x - x_0 = \frac{1}{2}(v + v_0) t \quad (3)$$

$$v^2 - v_0^2 = 2a(x - x_0) \quad (4)$$

You will definitely need to know these!

Example: A runner accelerates to a velocity of 5.36 m/s due west in 3 seconds. His average acceleration is 0.640 m/s^2, also directed due west. What was his velocity when he began accelerating?

Take quantities pointing to the east (right) as positive.

$$v_0 = ?$$
$$v = -5.36 \text{ m/s}$$
$$a = -0.640 \text{ m/s}^2$$
$$t = 3 \text{ s}$$

$$v - v_0 = at \quad (1)$$

So:

$$v_0 = v - at = -5.36 - (-0.640) \times 3 = -3.44 \text{ m/s}$$

Answer: 3.44 m/s due west.