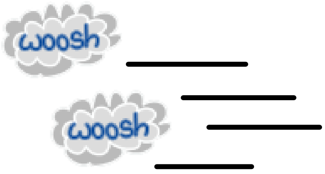
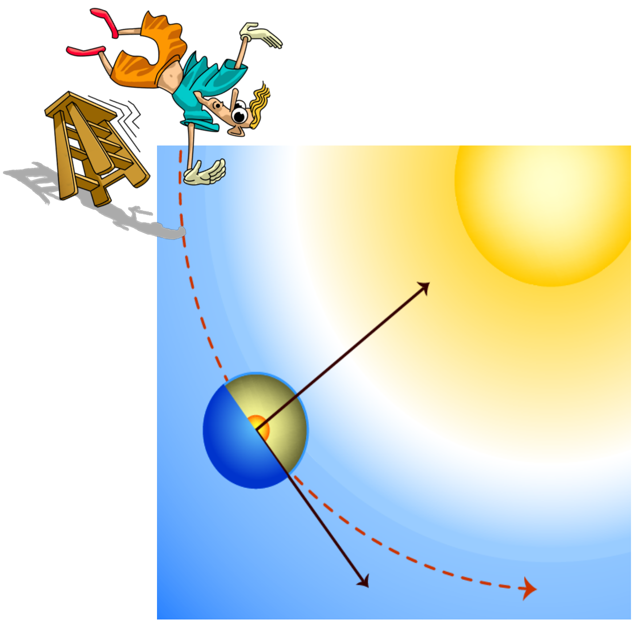
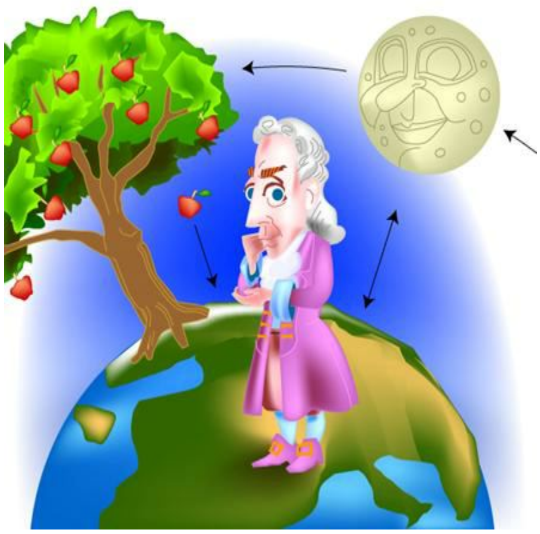
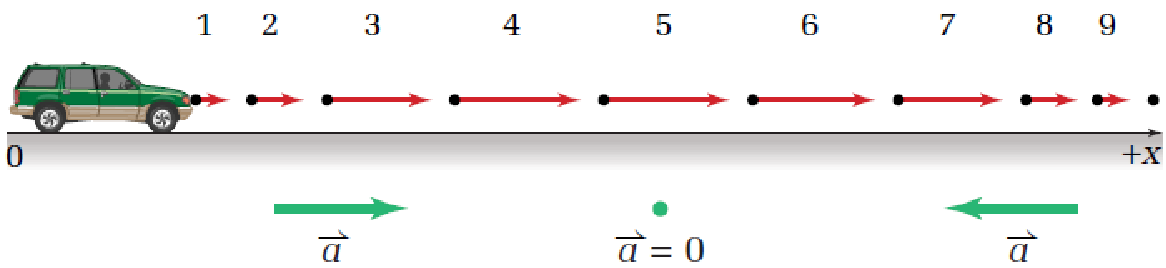


ACCELERATION







Close Reading: Acceleration

MHR Pg. 61-63 (first paragraph), 64, conceptual problems on 66.

*It is very important that you are able to learn concepts on your own through reading a science textbook, that said however, we will always review our readings.

Close Reading: Acceleration

Grade: 11

Subject: Physics 112

Date: 2014

1 Acceleration is a vector.

True

False

2 Which statement best describe what the units of acceleration mean.

m/s^2

A Time must be squared to give acceleration

B An object's velocity in m/s changes each second.

C To obtain acceleration one must divide meters by time twice.

3 A car is heading east at 50 km/h. After 3 seconds the car is traveling at 20 km/h [E]. The direction of the car's velocity after the three seconds is ______.

A East

B West

4 A car is heading east at 50 km/h. After 3 seconds the car is traveling at 20 km/h [E]. The direction of the car's acceleration during the three seconds is ______.

A East

B West

5 If an object's instantaneous velocity is zero then its acceleration must also be zero.

True

False

6 An object can keep a constant speed and experience a non-zero acceleration.

True

False

7 An object can experience a non-zero acceleration and keep a constant velocity.

True

False

8 In which of the following situations is it possible to experience an acceleration and have an instantaneous velocity of zero? (select all that apply)

A A car traveling around a circular race track.

B A book sitting on a table.

C A ball thrown up in the air and caught on the way down.

D A woman on a roller coaster ride going through a loop.

E A mass bouncing up and down on a spring.

F A child on a merry-go-round.

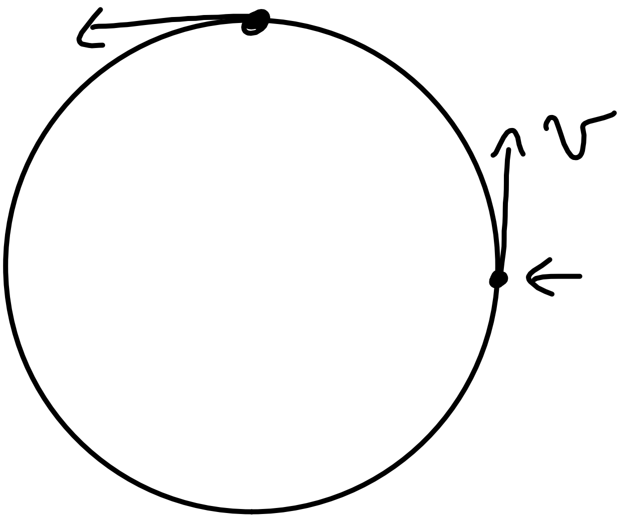
G A child on a swing.

Speed, Velocity & Acceleration

Suppose an object is moving in a circle.
Consider a starting point, discuss:

instantaneous speed, velocity and acceleration.

Average speed, velocity and acceleration.



$$a_{avg} = \frac{\vec{v}_f - \vec{v}_0}{t}$$

4.7 Acceleration (Calculating)

*Use Hot Wheels!

- Define acceleration.
- Give examples of acceleration.
- Describe how it feels to accelerate.

Defining Acceleration

Acceleration is a measure of the change in velocity of a moving object. It measures the rate at which velocity changes. Velocity, in turn, is a measure of the speed and direction of motion, so a change in velocity may reflect a change in speed, a change in direction, or both. Both velocity and acceleration are vectors. A vector is any measurement that has both size and direction. People commonly think of acceleration as in increase in speed, but a decrease in speed is also acceleration. In this case, acceleration is negative and called deceleration. A change in direction without a change in speed is acceleration as well.

4.8 Calculating Acceleration from Velocity and Time

- Explain how to calculate average acceleration when direction is constant.
- Identify the SI unit for acceleration.
- Solve simple acceleration problems.

Calculating Average Acceleration in One Direction

Calculating acceleration is complicated if both speed and direction are changing or if you want to know acceleration at any given instant in time. However, it's relatively easy to calculate average acceleration over a period of time when only speed is changing. Then acceleration is the change in velocity (represented by Δv) divided by the change in time (represented by Δt):

$$acceleration = \frac{\Delta v}{\Delta t} \quad => \vec{a} = \frac{\vec{v}_f - \vec{v}_o}{t}$$

Guidance

- Acceleration is the rate of change of velocity. So in other words, acceleration tells you how quickly the velocity is increasing or decreasing. An acceleration of 5 m/s^2 indicates that the velocity is increasing by $5m/s$ in the positive direction every second.
- Gravity near the Earth pulls an object downwards toward the surface of the Earth with an acceleration of 9.8 $m/s^2 (\approx 10\ m/s^2)$. In the absence of air resistance, all objects will fall with the same acceleration. The letter $g$is used as the symbol for the acceleration of gravity.
  - When talking about an object's acceleration, whether it is due to gravity or not, the acceleration of gravity is sometimes used as a unit of measurement where $1g = 9.8m/s^2$. So an object accelerating at 2g's is accelerating at $2*9.8m/s^2$ or $19.6m/s^2$
- *Deceleration* is the term used when an object's *speed* (i.e. magnitude of its velocity) is decreasing due to acceleration in the opposite direction of its velocity.

Calculating Acceleration

Focus on reading and finding the quatities given and asked from the problem

Guided Practice (no direction changes)

A car is initially traveling 20 m/s [E]. It then accelerates to 32 m/s [E] in 3.5 seconds.

Calculate the acceleration of the car.

Reread question and set up the frame of reference and coordinate system

W,- ⟷ E,+

Frame of reference is relative to the road or a stationary observer outside of the car - this will most often be the case.

Reread question and list known/wanted quantities - make quantities relative to positive direction if necessary

Note: If given no position information then assume that $\vec{d}_o$ = zero

$\vec{v}_o = 20\,m/s$ [E] $t = 3.5\,s$

$\vec{v}_f = 32\,m/s$ [E] ← Instaneous Vel after a specific time.

Check for a formula using only the known and wanted quantities

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_o}{t}$$

Substitute values and solve for the unknown

← change in velocity

$$\vec{a} = \frac{32 - 20}{3.5} = \frac{12}{3.5} = \boxed{3.4\,m/s^2} \text{ [E]}$$

Check answer conceptually - does its value and direction make sense?

Calculating Acceleration

Guided Practice (no direction changes)

Solving for final velocity - Pair Up

A car is initially moving 15 m/s [E] and accelerates at 3.5 m/s² [E] for 9.2 seconds. Calculate the car's final velocity.

Reread question and list known/wanted quantities

W ← → E
− +

$v_f = ?$

$v_0 = 15\,m/s\,[E]$

$a = 3.5\,m/s^2\,[E]$

$t = 9.2\,s$

$$a = \frac{v_f - v_0}{t}$$

$$3.5 \times 9.2 = \frac{v_f - 15}{9.2} \times 9.2$$

$$32.2 + 15 = v_f - 15 + 15$$

$$47.2\,m/s = v_f$$

Attachments

moving-man_all.jar