

Acceleration: **any** change in velocity.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{change in time}}$$

$$a = \frac{\Delta v}{t} = \frac{v_f - v_i}{t}$$

1. A car moving at 30 ft/s accelerates uniformly to 40 ft/s in 8 seconds. Calculate the acceleration of the car.

1 B. A car starts at rest and accelerates at 2 m/sec^2 for 4 seconds. How fast will it be moving at the end of that time?



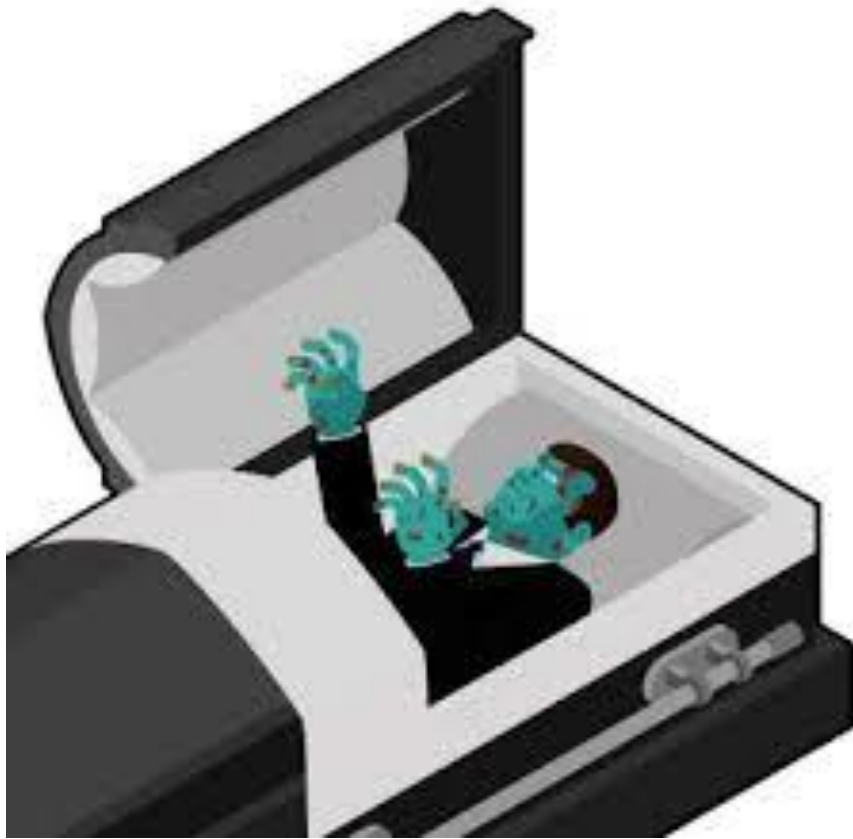
Text Page 76: A chameleon extends its tongue to capture a tasty insect. The tongue accelerates at 33 m/s^2 for .12 seconds. What is the speed of the tongue when it grabs the insect?

2. A student enters the parking lot at 30 miles/hr (which is 44 ft/s). He sees Mr. Mahoney and slows down to 1 ft/s in 2 seconds. Find his acceleration (in ft/s²).

3. A Porsche turbo can go from rest to 60 mi/hr in 4 seconds. Find the acceleration of the car in ft/s^2 .

4. An object is dropped from rest and accelerates downward at 9.81 m/s^2
How fast will it be moving after falling for 8 seconds?

5. Igor was driving his hearse Northward at 42 m/s when he remembered that he had forgotten his shovel. He hit the brakes, bringing the hearse to a dead stop. If he accelerated at -16 m/s^2 , how long did it take him to stop?



6. A skateboarder is moving at a constant velocity of 1.75 m/s when he starts up an incline that causes him to slow down at a constant acceleration of -0.20 m/s^2 . How much time passes from when he begins to slow down until he begins to move back down the incline?

7. A car which is moving at 30 ft/s begins to accelerate at 8 ft/s². How long will it take the car to reach a speed of 55 ft/s?

8. A car is traveling at 10 m/s and accelerates at a constant rate until it reaches 30 m/s. What is the average speed of the car?

If the car was accelerating for 8 seconds, what was the magnitude of the acceleration?

What distance did it cover while accelerating?

An object starts at rest and accelerates at 3m/sec^2 for 15 seconds. How far does it move in the 15 seconds?

Important Formulae

$$\bar{v} = \frac{d}{t} \quad \rightarrow \quad d = \bar{v} t$$

$$\bar{a} = \frac{v_f - v_i}{t} \quad \rightarrow \quad v_f = v_i + a t$$

$$\bar{v} = \frac{v_f + v_i}{2}$$

Important Formulae:

$$v_{av} = d/t$$

$$a = \Delta v / \Delta t = (v_f - v_i) / t$$

solved for v_f

$$v_f = v_i + at$$

If acceleration is constant

$$v_{av} = (v_f + v_i) / 2$$

When they are all put together:

$$d = v_i t + (1/2)at^2$$

That last equation may be referred to as the equation of motion!

d equals vt plus half a t squared.

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d equals vt plus half a t squared;

and don't leave out units, you'll incur the wrath!

Time is the only scalar here. A , V , and D are vectors.

Solo:

Distance and time, your secrets we've shared.

D equals vt plus half a t squared.

Yes, d is vt plus half a t squared,

and I never make the left out units gaffe!

Time is the only scalar here.

A , V , and d are vectors.

All:

d equals vt plus half a t squared,

and please don't forget to check the math!

<http://ionaphysics.org/movies/NormaDruids.mp4> (Starts at about 4:30)

<http://www.ionaphysics.org/library/physics%20songs/midi/DISTANCE.MID>

Now let us solve some problems:

Problem 1: An object starts at rest and accelerates at 2 m/s^2 . How far will it move in 8 s ?

Problem 2: How far will a freely falling object move in 4.2 seconds ?
(Take the acceleration of gravity to be 9.81 m/s^2)

Problem 3: An astronaut drops a feather from 1.2 m above the surface of the moon. If the acceleration due to gravity on the moon is 1.62 m/s^2 downward, how long does it take the feather to hit the moon's surface?

Now here is a challenge!

Problem 4: A police motorcycle at rest is passed by a driver moving at a constant 88 ft/s (which is 60 mi/hr). At the instant the car passes the motorcycle, the officer begins to accelerate at 10 ft/s^2 . How long will it take for the motorcycle to overtake the car?



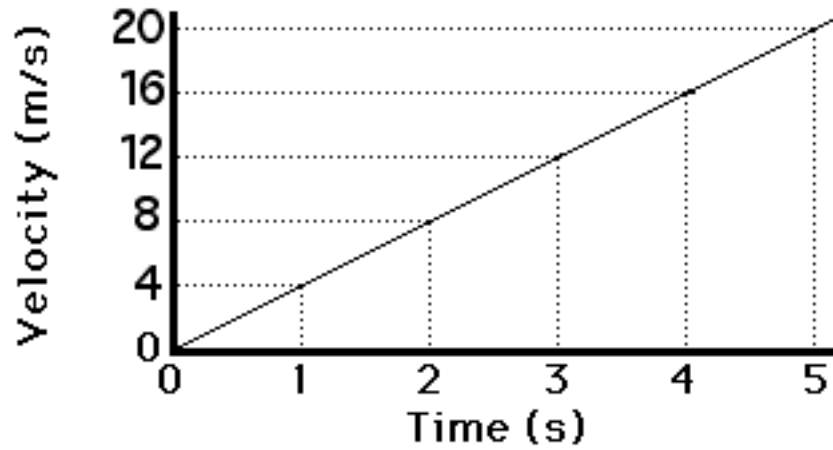
Graphs:

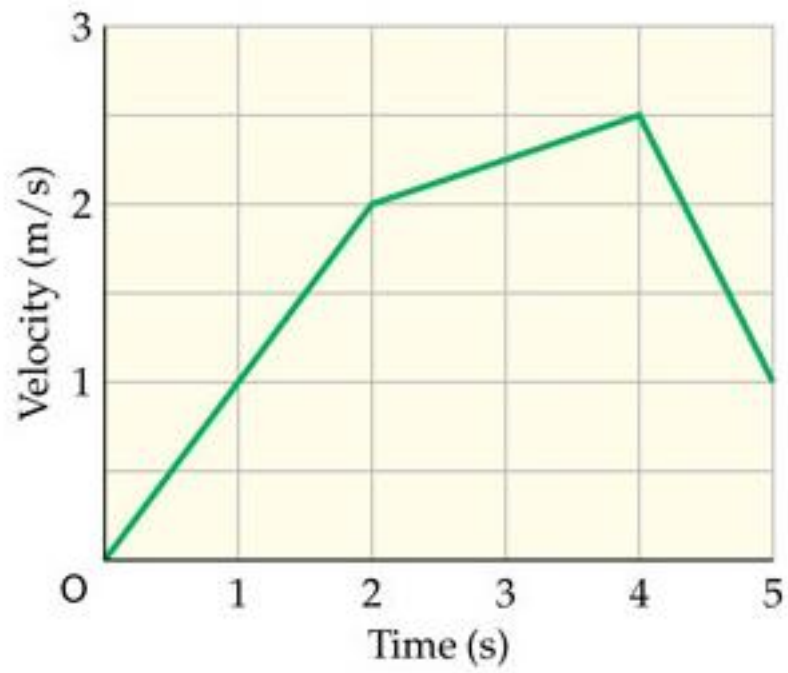
Velocity - time graph

SLOPE of V-t graph

$$= \Delta v / \Delta t$$

=acceleration (!)





What is the distance covered in each interval?

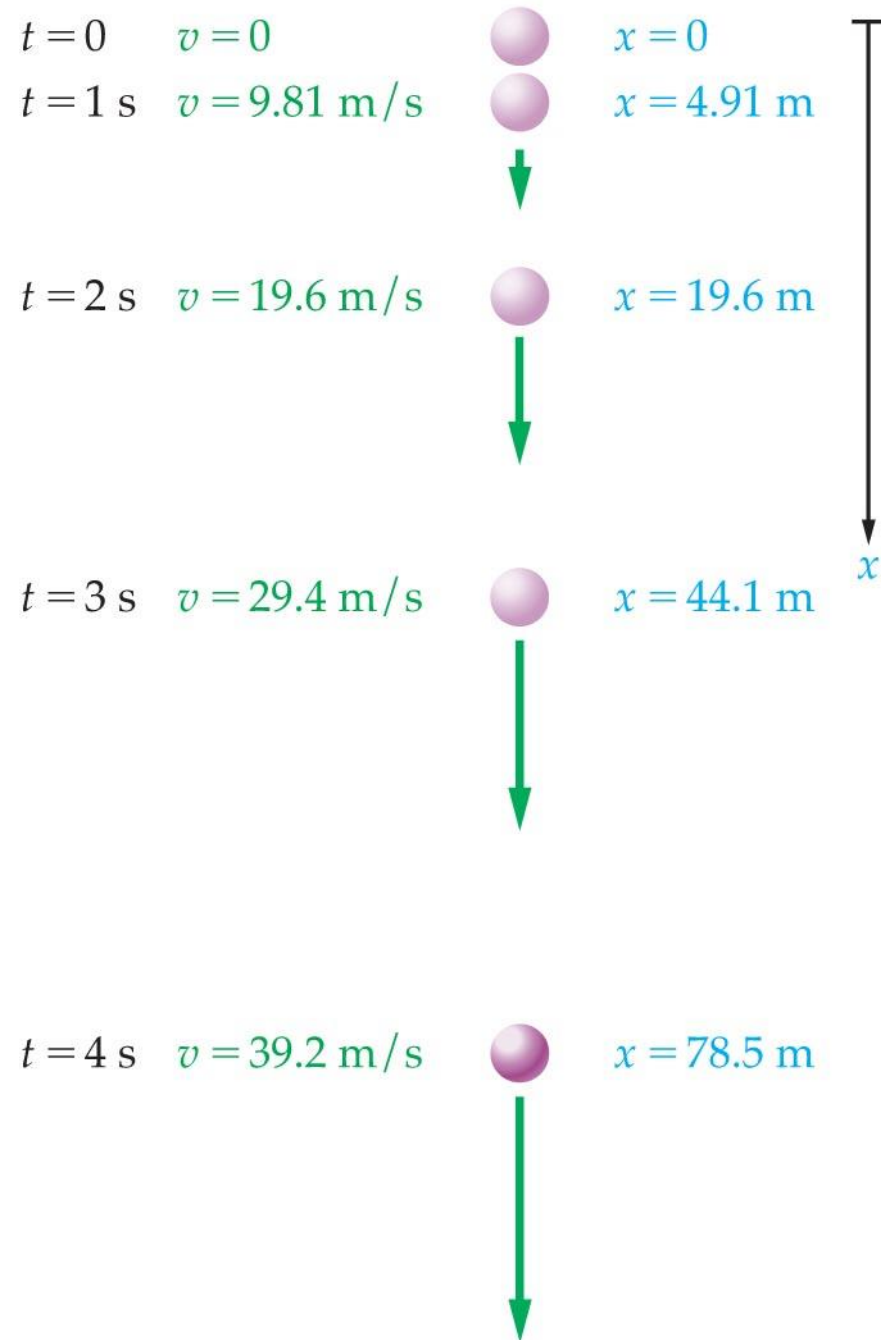
0-2 sec

2-4 sec

4-5 sec

Distance covered = area under SEP the graph
 $d = v t$

Free Fall = constant vertical acceleration



Free Fall:

Acceleration of gravity = 9.81 m/s^2

= 32 ft/s^2

1. An object falls freely from rest.
 - a. How fast will it be moving after falling for 2.3 seconds?
 - b. What is its average speed?
 - c. How far did it fall?