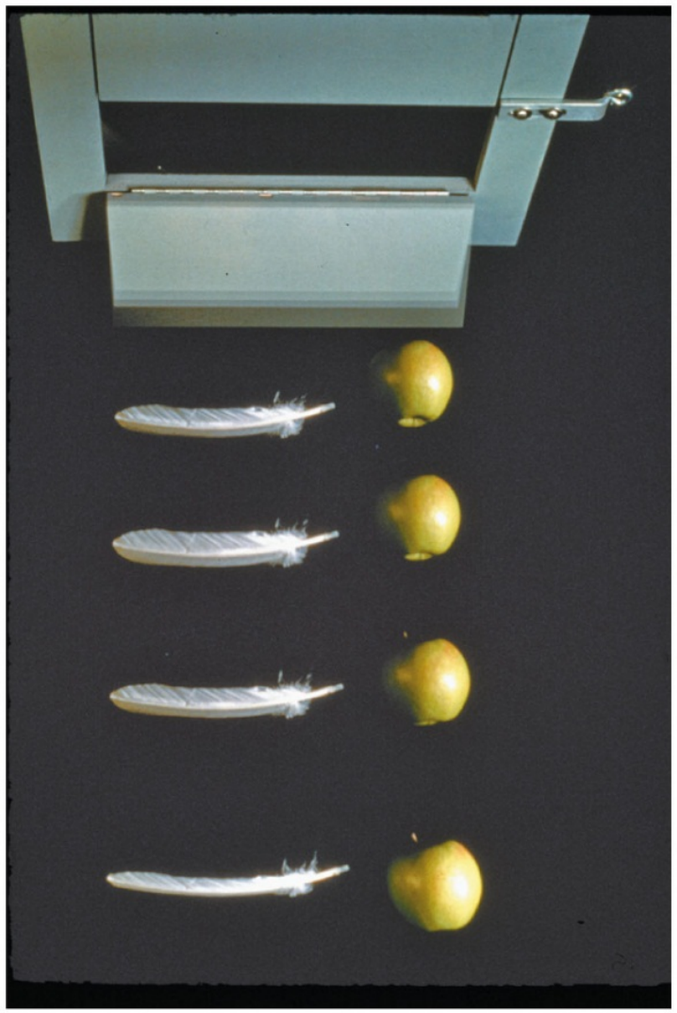
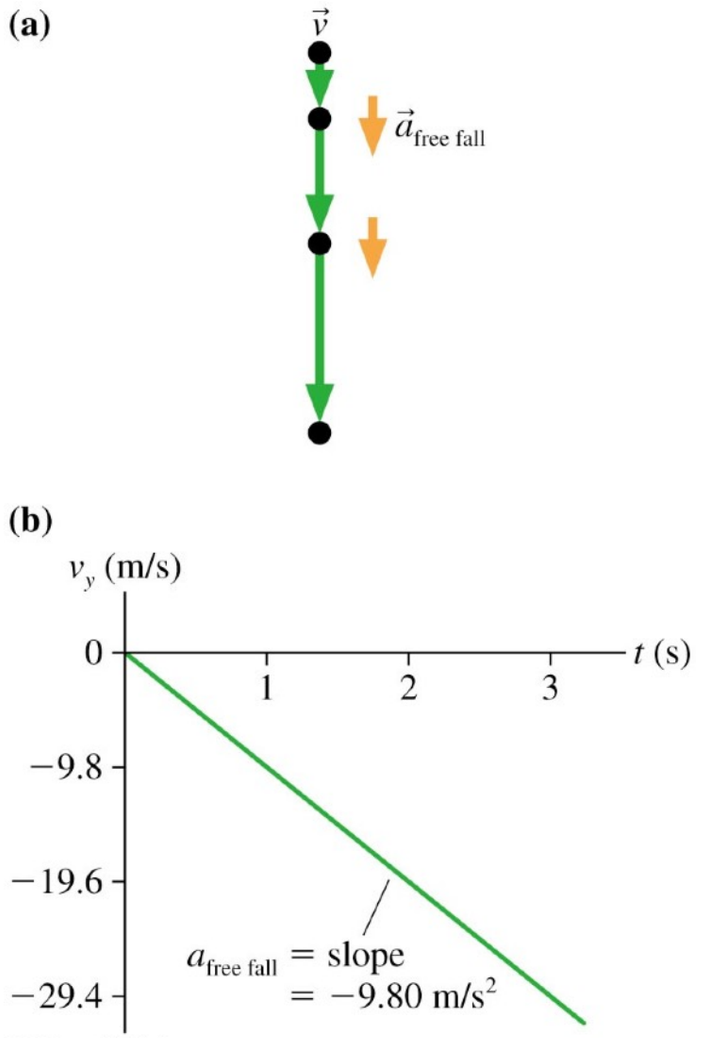
Free fall (acceleration due to gravity)





$$\vec{a}_{\text{free fall}} = (9.80\ \text{m/s}^2, \text{vertically downward})$$

Galileo was right

Question #21

A ball is tossed straight up in the air. At its very highest point, the ball's acceleration vector $\vec{a}$

a. Points up.

b. Is zero.

c. Points to the left.

d. Points down.

Question #21

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a. Points up.

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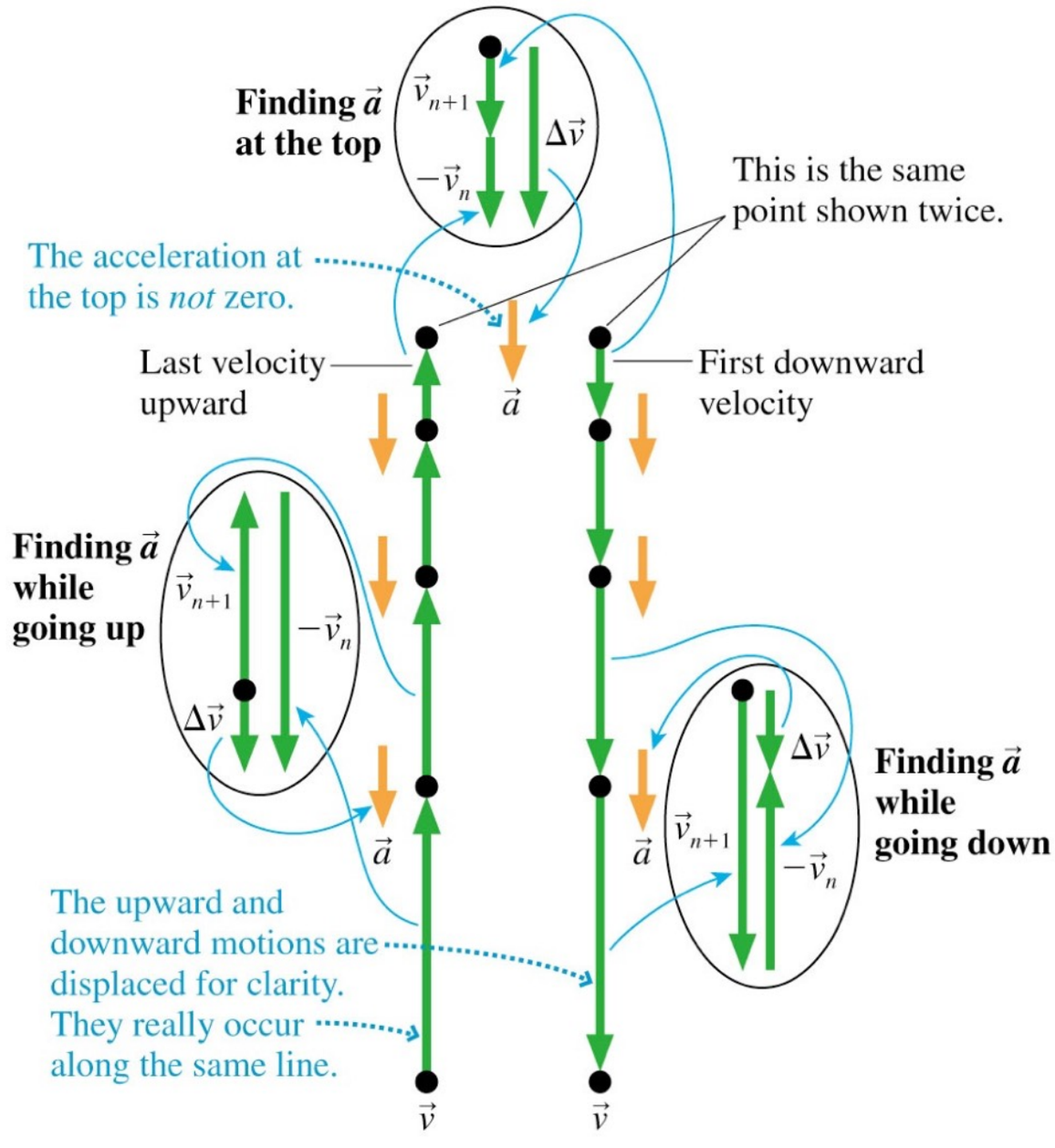
c. Points to the left

d. Points down.

In fact, the acceleration vector points down as the ball rises, at the highest point, and as it falls.



Question #22

A rock is tossed straight up from the ground level with an initial speed of 20 m/s. When it returns it falls into a 10-m deep hole

1 - What is the velocity of the rock as it hits the bottom of the hole

a) 24 m/s
b) 14 m/s
c) 32 m/s
d) 48 m/s
e) 10 m/s

Vertical Kinematics

A 200 kg weather rocket is loaded with 100 kg of fuel and fired straight up. It accelerates upward at 30 m/s^2 for 30 s, then runs out of fuel.

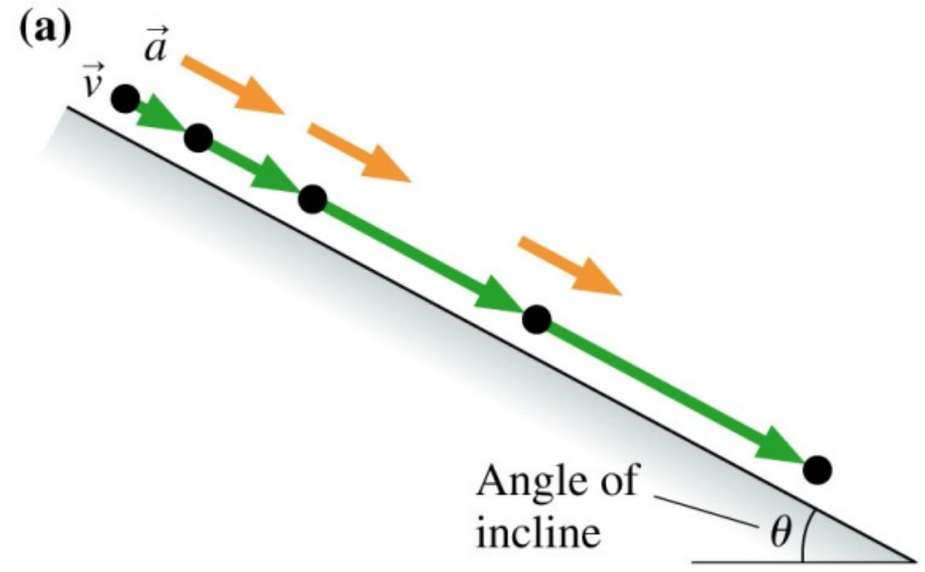
a)What is the rocket's max altitude
b) How long is the rocket in the air before hitting the ground.

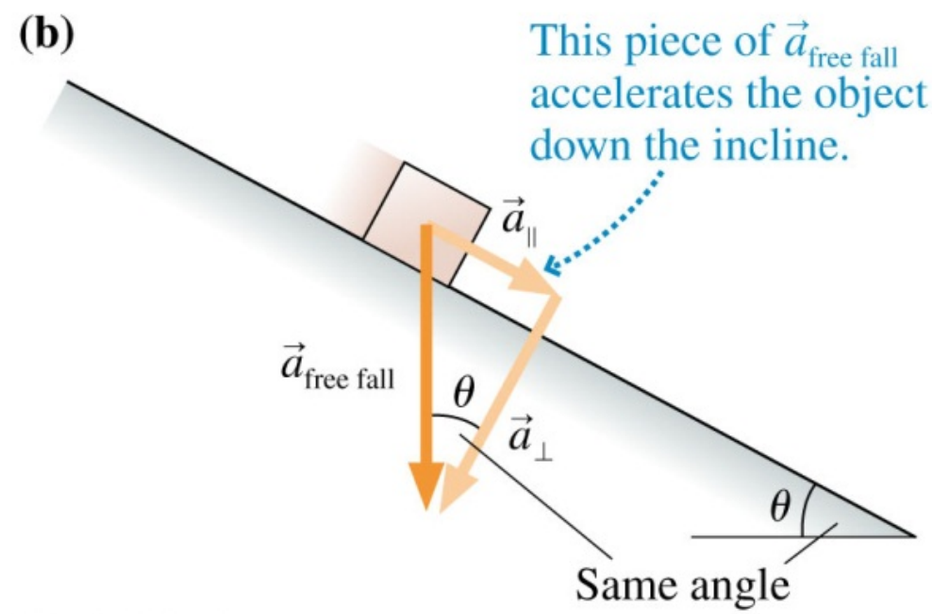
Vertical Kinematics

A weather rocket is launched up. The rocket motor provides a constant acceleration for 16 seconds, then the motor stops. The rocket altitude 20 seconds after launch is 5100 meters. What is the rocket's acceleration during the first 16 seconds?

Motion on an incline

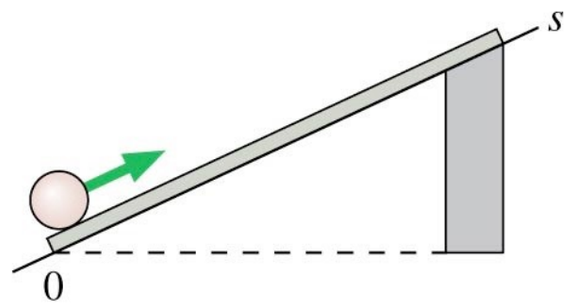
$$a_s = \pm g \sin\theta$$

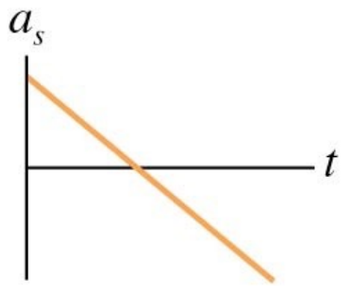




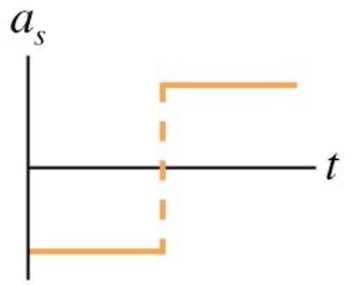
Question #23

A ball rolls up the ramp, and then rolls back down. Which is the correct acceleration graph?

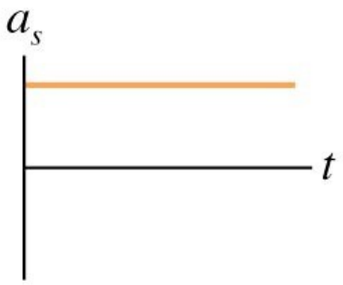




B

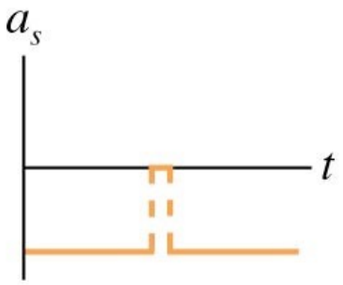


D



C

A



E

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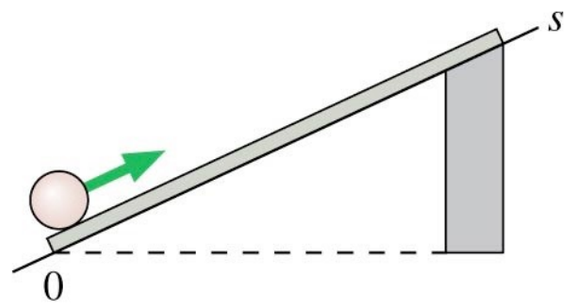
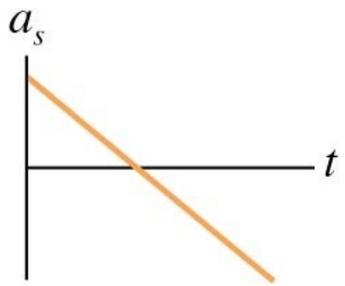
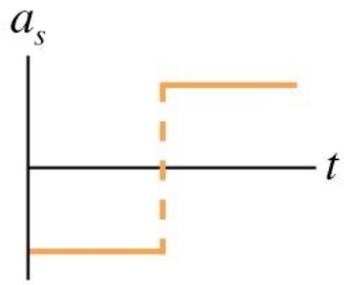
A ball rolls up the ramp, and then rolls back down. Which is the correct acceleration graph?

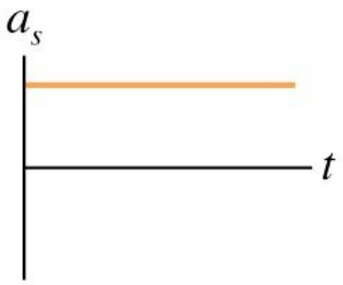




B



D



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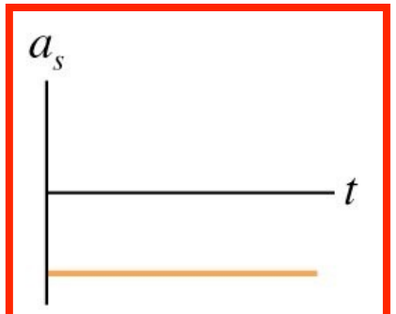

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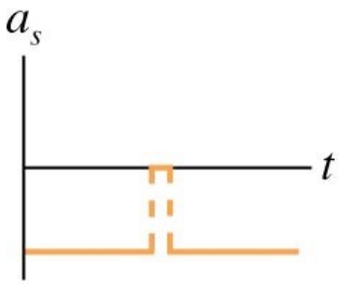


E

Question #24

A car traveling 30 m/s runs out of gas on a 10 degree incline. How far up the hill will it coast before starting to roll back down?

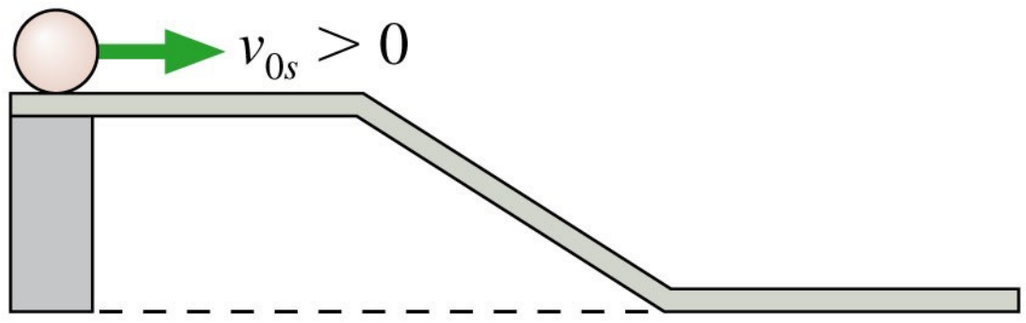
a) 264 m
b)170 m
c) 92 m
d) 18 m
e) 529 m

You try

A car is driving along at 25 m/s when it begins to go down a hill with a slope of 20 degrees. You immediately let off the gas and allow the slope of the hill to take you down without braking. If your speed is 60 m/s at the bottom of the hill, how far did you travel?

Group Exercise

Together with your neighbor, sketch out the position, velocity, and acceleration vs. time graphs for the situation below.



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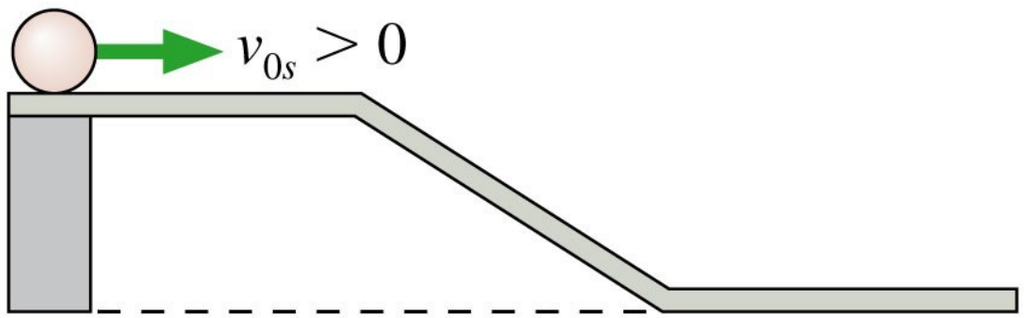
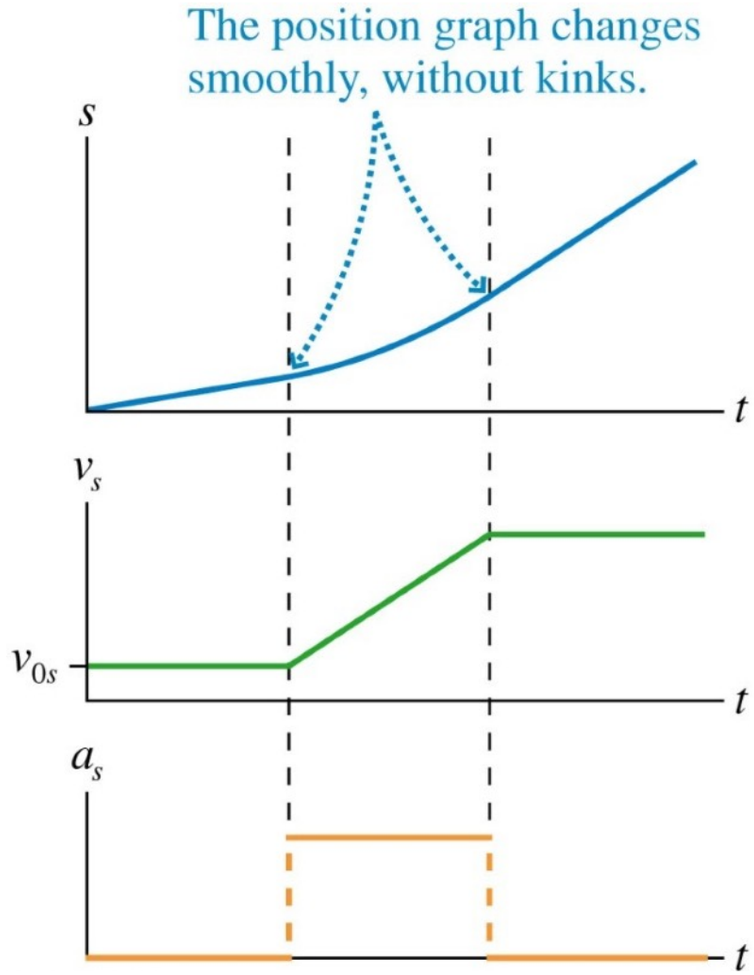
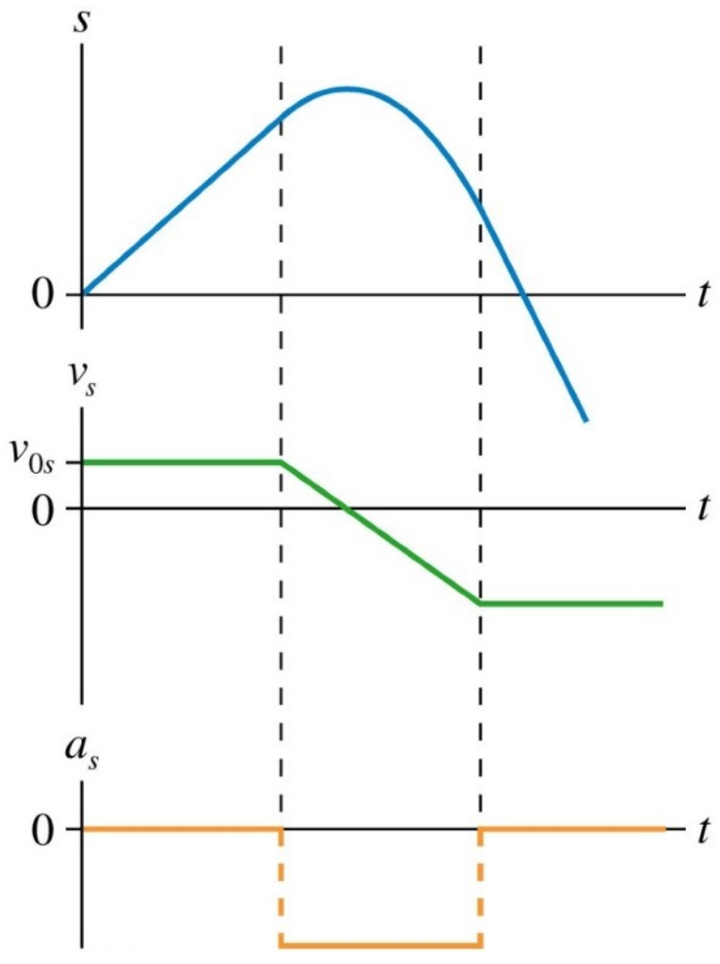




Group Exercise II

Below is a set of motion graphs for a ball moving on a track. Together with your other neighbor draw a picture of the track the ball is moving on and describe the ball's initial condition.



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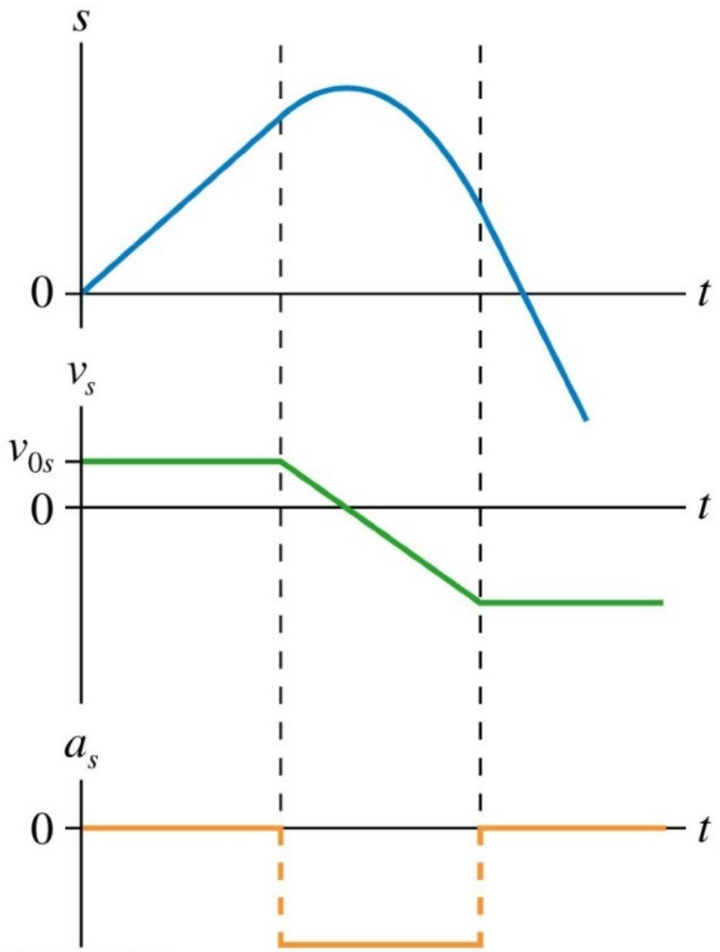
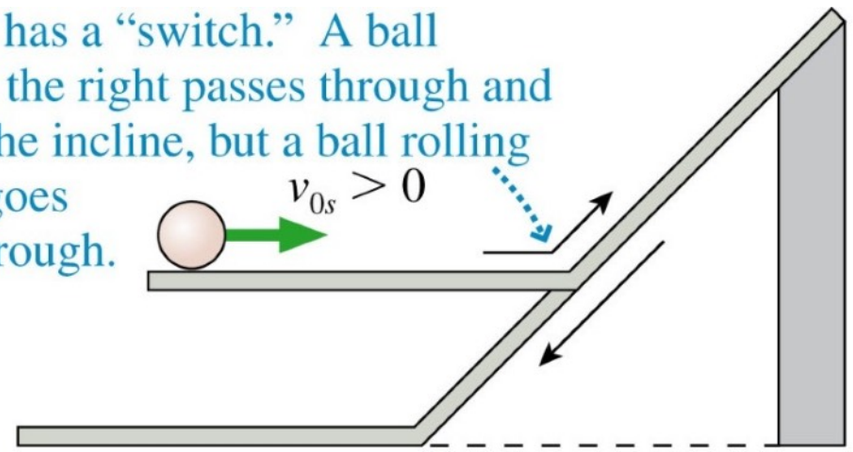


This track has a "switch." A ball moving to the right passes through and heads up the incline, but a ball rolling downhill goes straight through.

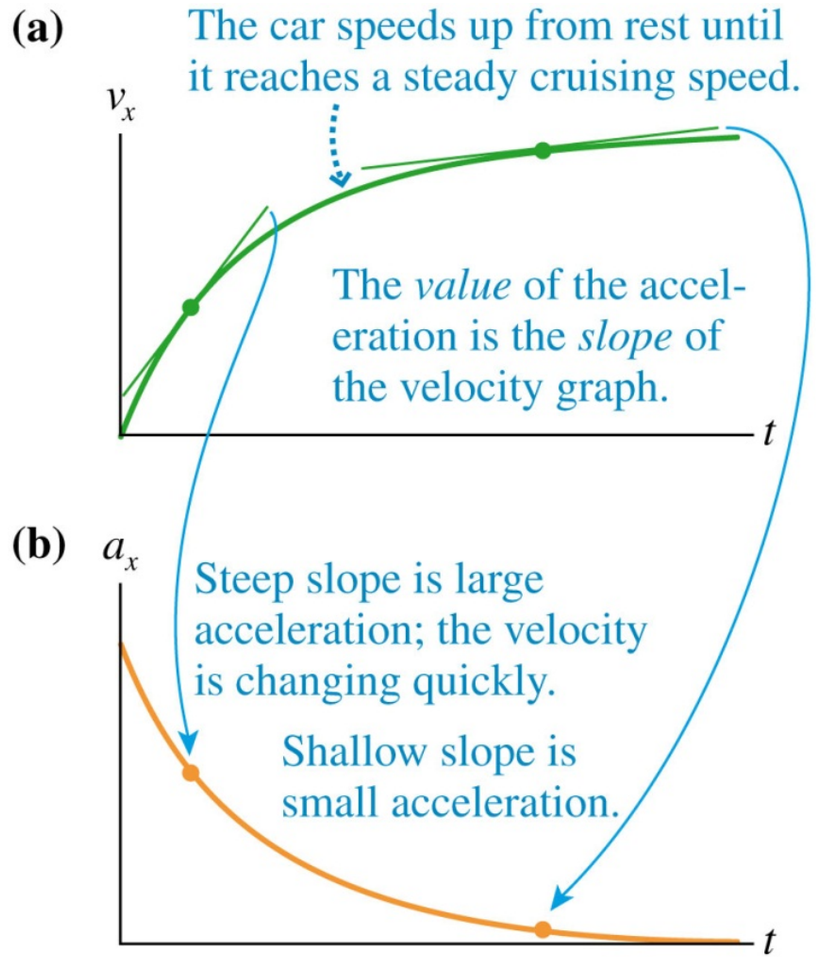


Instantaneous acceleration

$$v_f = v_i + a\Delta t$$

$$x_f = x_i + v_i\Delta t + \frac{1}{2}a(\Delta t)^2$$

$$v_f^2 = v_i^2 + 2a\Delta x$$



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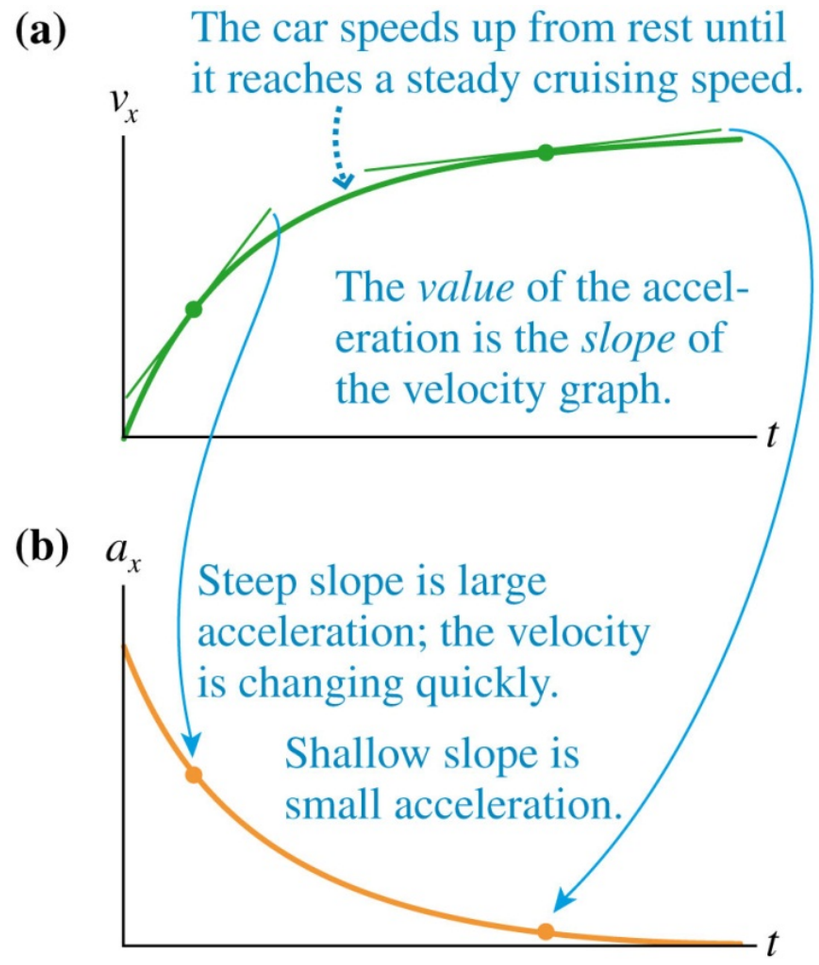
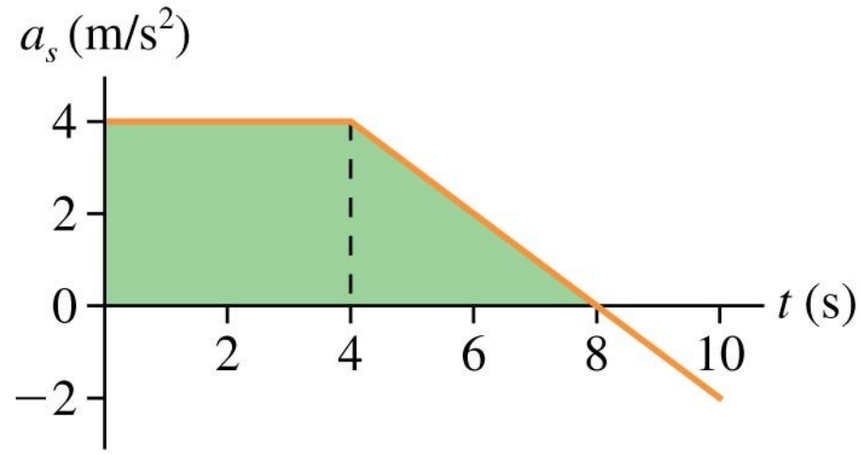


$$v_f = v_i + \int a\ dt$$

Question #25

The figure below shows the acceleration graph for a particle with an initial velocity of 10 m/s. What is the particle's velocity at t = 8 s?

a. 24 m/s
b. 32 m/s
c. 16 m/s
d. 26 m/s
e. 34 m/s



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