Name Key

Ch. 2 Kinematics in 1-D Assessment

Essex High School
Physics 200

Formulas and info:

$$\Delta x = v_0 t + \frac{1}{2} a t^2$$

$$v = v_0 + at$$

$$v^2 = v_0^2 + 2a\Delta x$$

1 mile = 5280 feet

1 ft = 0.305 m

Part I:

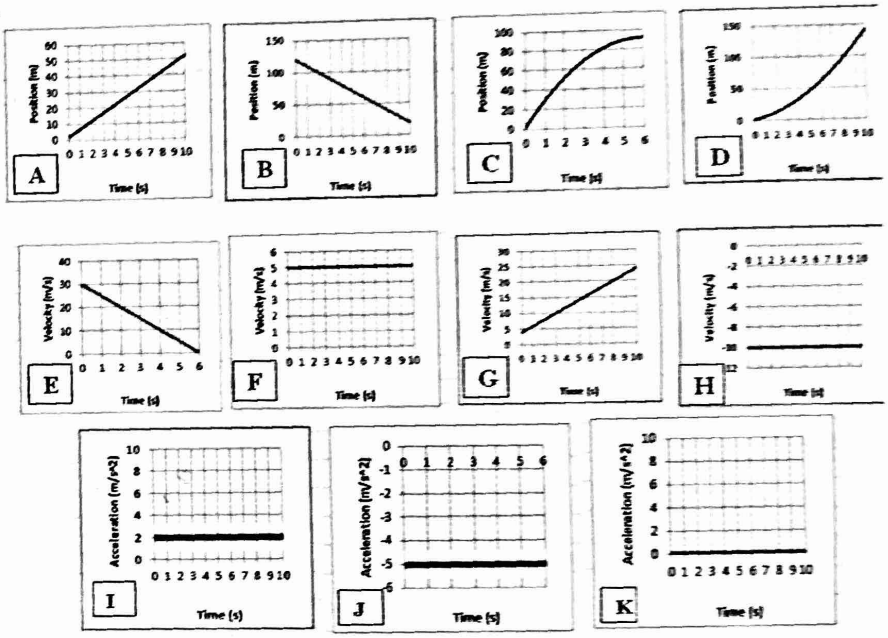
1) Describe an example of motion that has negative velocity and positive acceleration.

Someone is walking to the left and slowing down.

2) Describe an example of motion that has zero velocity and negative acceleration.

A motionless object is just beginning to move leftward (or downward)

3) Three parts:

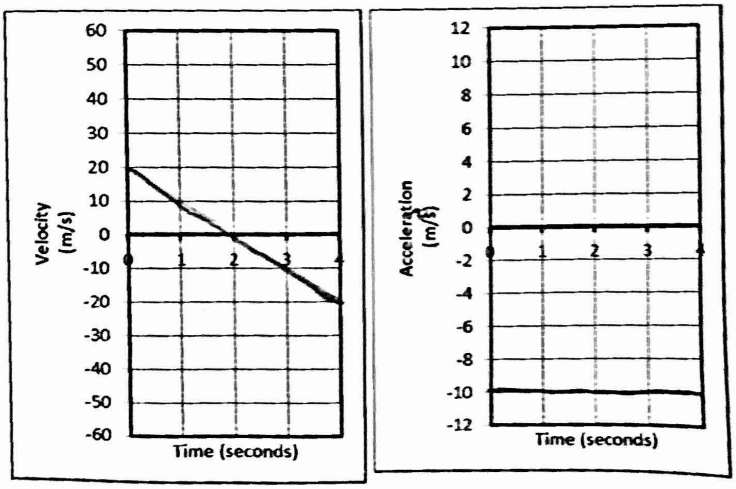


E i. Which **velocity** graph shows the same motion depicted in **position** graph **C**?

D ii. Which **position** graph shows the same motion depicted in **acceleration** graph **I**?

B iii. Which **position** graph shows the same motion depicted in **velocity** graph **H**?

4) (2pts) Suppose an object is launched directly upward in the absence of air resistance (i.e. freefall). The object goes up and comes down, remaining in the air for 4 seconds. On the graphs to the right, sketch the object's velocity, and acceleration at each point in the 4 second trip. ~~For simplicity, assume use $g = -10 m/s^2$.~~



or useful diagram

Problems [4 points Each = Useful Equation (1/2 point) + Givens with symbols and units (1/2 point) + Work – Givens substituted into equations and solved (1/2 point) + Correct units for answer (1/2 point) + Correct answer (1 point).]

1. Video analysis of a car shows that it is able to start from rest and reach a speed of 6.00 m/s over a distance of 6m meters. Calculate the car's acceleration.

$V_0 = 0 m/s \quad V = 6.00 m/s \quad \Delta x = 6m$

$V^2 = V_0^2 + 2a\Delta x$

$(6 m/s)^2 = 0 + 2a(6m)$

$a = 3 m/s^2$

2. A car is traveling at a constant rate of ~~20m/s~~ 60m/s. At some point, the car begins to undergo constant acceleration of $4 m/s^2$. If this acceleration lasts for 5 seconds, what distance does the car travel during the acceleration period?

$V_0 = 60 m/s$

$a = 4 m/s^2$

$\Delta t = 5s$

$\Delta x = V_0 t + \frac{1}{2} a t^2$

$\Delta x = 60 m/s (5s) + \frac{1}{2} (4 m/s^2)(5s)^2$

$\Delta x = 300m + 50m$

$\Delta x = 350m$

3. A pumpkin is dropped from the top of a tall building. If the pumpkin freefalls to ground level in a time of 2.5 seconds, what is its ~~speed in miles per hour~~ velocity when it hits the ground?

$V_0 = 0 m/s$

$\Delta t = 2.5s$

$a = -9.8 m/s^2$

$V = V_0 + at$

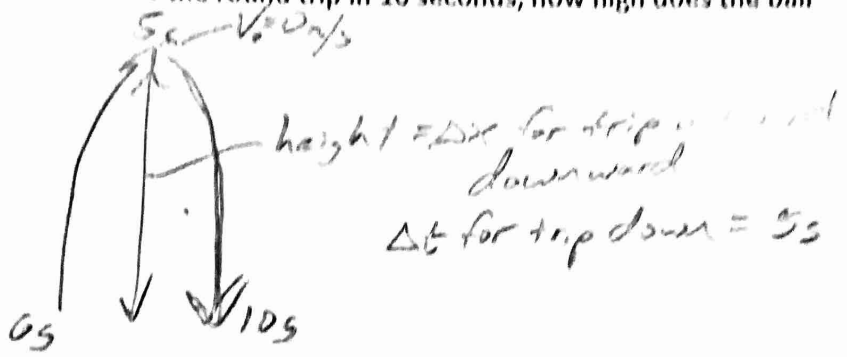
$V = 0 m/s + (-9.8 m/s^2)(2.5s)$

$V = -24.5 m/s$

4. In the absence of air resistance (freefall), a soccer ball is kicked straight up in the air and then returns directly to Earth. If the soccer ball makes the round trip in 10 seconds, how high does the ball go?

$\Delta t_{total} = 10s$

$a = -9.8 m/s^2$



Consider the fall...

$\Delta x = V_0 t + \frac{1}{2} a t^2$

$\Delta x = 0 + \frac{1}{2}(-9.8 m/s^2)(5s)^2$

$\Delta x = -123 m$ — ball goes up 123m

5. Starting from rest, a bear accelerates at a constant rate of $3m/s^2$ until it reaches its top speed of 15m/s.

a. How far does the bear travel while it is accelerating?

$a = 3 m/s^2$

$V = 15 m/s$

$V_0 = 0 m/s$

b. How long does it take the bear to reach its top speed?

5. convert 60mph to m/s.

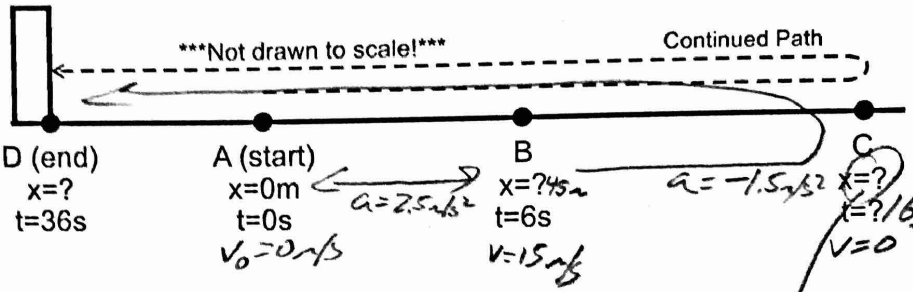
$$\left(\frac{60 \text{ miles}}{\text{hour}}\right)\left(\frac{5280 \text{ ft}}{1 \text{ mile}}\right)\left(\frac{0.305 \text{ m}}{1 \text{ ft}}\right)\left(\frac{1 \text{ hour}}{3600 \text{ s}}\right) = 26.8 m/s$$

Physics 200 **Extended Problem (12pts)** Name: _____

Chapter 2 Test (2 points each)

A student is stuck on a one-dimensional line in the X dimension. She can move left and right, but not up, down, back, or forth. Starting from rest at point A (x=0m, t=0s), she accelerates to the right at a rate of 2.5m/s² until she reaches point B a time of 6 seconds. At t=6s, (as she passes point B) her acceleration instantly changes to -1.5m/s² (leftward acceleration). She continues traveling with this same -1.5m/s² acceleration until she reaches point D 30 seconds later (at t=36s). After leaving point B, and before reaching point D, she reverses direction at point C. At point D she crashes into an immovable wall and stops.

Acceleration between **points A and B = 2.5m/s²**
Acceleration between **points B and D = -1.5m/s²**



(a) What is her **velocity** at point B?

$V = V_0 + at$
$= 0m/s + 2.5m/s(6s) = 15m/s$

(b) What is the **distance** of point B from the origin (Point A, x=0m)?

$\Delta x = V_0 t + \frac{1}{2} a t^2$
$= 0 + \frac{1}{2}(2.5m/s)(6s)^2$
$= 45m$

$x = 45m + 75m = 120m$

(c) How much ~~time elapses~~ as she travels from point B to point C?

$V_0 = 15m/s$
$V = 0m/s$
$a = -1.5m/s^2$

$V = V_0 + at$
$0m/s = 15m/s + (-1.5m/s^2)t$
$\Delta t = 10s$

(d) What is the **distance** between points B and C?

$\Delta t = 10s$ ← between B & C

$\Delta x = V_0 t + \frac{1}{2} a t^2$
$= 15m/s(10s) + \frac{1}{2}(-1.5m/s^2)(10s)^2$
$= 150m - 75m = 75m$

(e) What is her **velocity** when she reaches point D (before she stops, while she is still moving)?

Consider C to D ⇒ $V_0 = 0m/s$ $a = -1.5m/s^2$ $t_0 = 16s$ $t = 36s$ $\Delta t = 20s$

$V = V_0 + at \Rightarrow V = 0m/s + (-1.5m/s^2)(20s)$
$V = -30m/s$

(f) What is her total ***displacement*** (**not** distance traveled!) for the entire trip – through all points A-D?

$x_0 = 0m$ $x = ?$

$\Delta x_{A\to B} = 45$
$\Delta x_{B\to D} = -225$
$\Delta x_{total} = 45 - 225 = -180m$

Total Δx

Consider B → D: $x_0 = 45m$ $V_0 = 15m/s$ $t_0 = 6s$
$t = 36s$ $\Delta t = 30s$ $a = -1.5m/s^2$

$\Delta x = V_0 t + \frac{1}{2} a t^2$
$= 15m/s(30s) + \frac{1}{2}(-1.5m/s^2)(30s)^2 = -225m$