AP Physics B 1D and 2D Kinematics & Vectors I (75-86min) Name_____ Per__

1500 cm/s 1. Convert 54000 m/hr into cm/s.

Part 1 44pts
FR 40pts
84pts

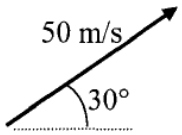
Questions 2-4) How may significant figures do this numbers have?

3 2. 0.00450 m

4 3. $12050

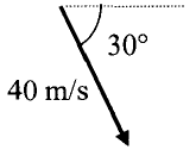
3 4. 7.54 x 10^6 m/s^2

Questions 5-8) Give the x and y component of these two vectors



43.3 m/s x-component

25 m/s y-component



34.6 m/s x-component

-20 m/s y-component

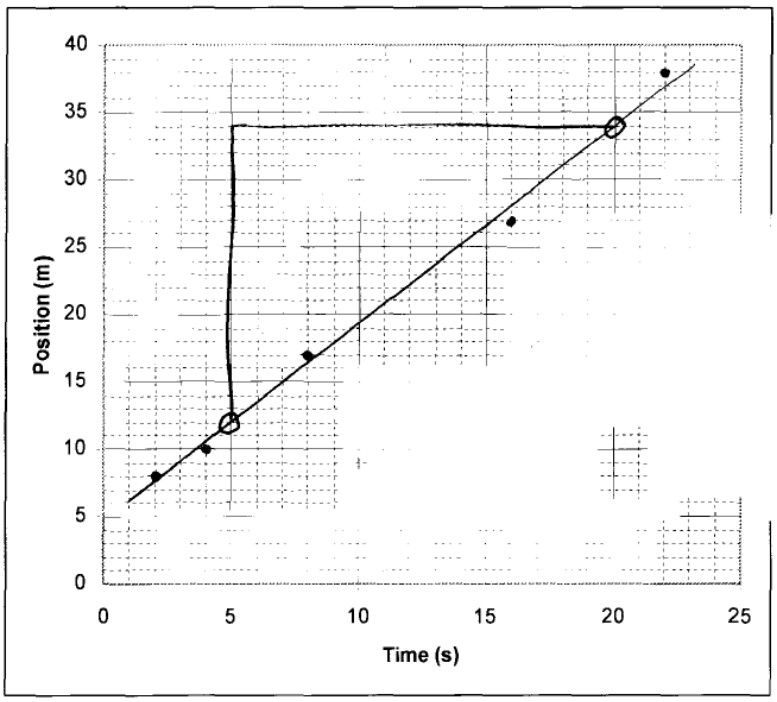
Questions 9-10) Add the two vectors from above and give the resultant magnitude and direction.

78.1 m/s magnitude

3.7° direction

11) Graph this data on the provided grid

Time (s)	Position (m)
2	8
4	10
8	17
16	27
22	38



1.4 -1.6 m/s 12) Calculate the slope of the line.

Rise/Run = 22 m / 15 s = 1.47 m/s

13) What does the slope of the line represent?

Velocity

C 14) A diver initially moving horizontally with speed v dives off the edge of a vertical cliff and lands in the water a distance d from the base of the cliff. How far from the base of the cliff would the diver have landed if the diver initially had been moving horizontally with speed 2v ?

(A) d
(B) $\sqrt{2d}$ Same time & 2x velocity
(C) 2d
(D) 4d
(E) It cannot be determined unless the height of the cliff is known.

C 15)

A stuntman drives a brand new 800kg sports car off a high cliff at 200 km/hour. At the exact moment that the car is driven off the cliff, an 800kg rock is dislodged and falls straight down toward the ground. Which of the following is a correct statement about the event?

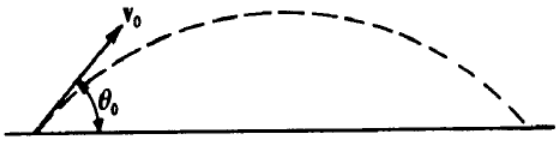
(A) The ~~car hits the ground first.~~
(B) The ~~rock hits the ground first.~~
(C) The car and the rock hit the ground at the same time.
(D) The x velocities of the car and the rock equalize over a period of time.
(E) The x accelerations of the car and the rock are different

$t = \sqrt{\frac{2h}{g}}$

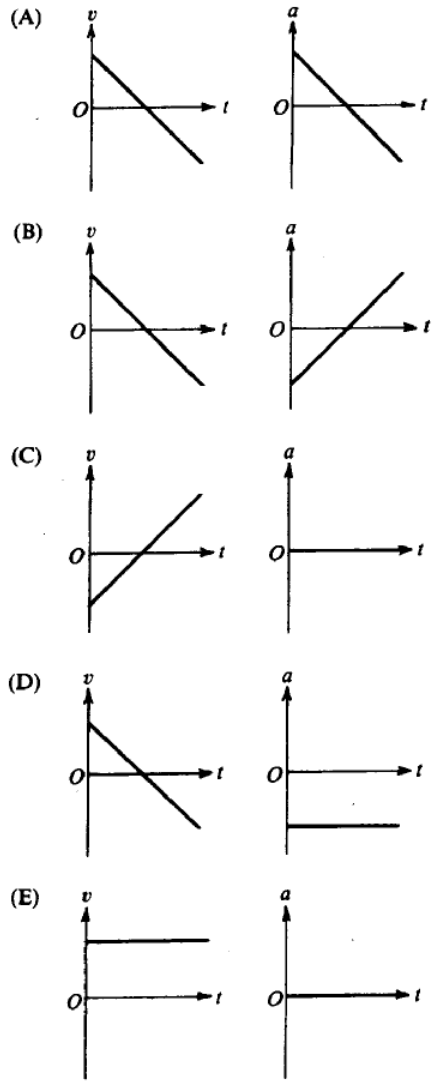
C 16)

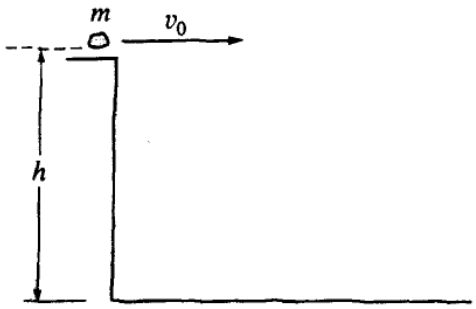
A girl standing on a high bridge over a creek throws a rock straight down at leaves floating in the creek. Just as she throws the rock she accidentally drops another rock. Neglecting air resistance, which statement best describes the situation just as the rocks reach the water?

(A) The acceleration of the thrown rock is greater.
(B) The acceleration of the dropped rock is greater.
(C) The acceleration of both rocks is the same.
(D) The average velocity of both rocks is the same.
(E) The final velocity of both rocks is the same.



D 17) A projectile is fired with initial velocity v_0 at an angle θ with the horizontal and follows the trajectory shown above. Which of the following pairs of graphs best represents the vertical components of the velocity and acceleration, v and a, respectively, of the projectile as functions of time t ?





E 18) A rock of mass m is thrown horizontally off a building from a height h, as shown above. The speed of the rock as it leaves the thrower's hand at the edge of the building is v_0. How much time does it take the rock to travel from the edge of the building to the ground?

(A) $\sqrt{hv_0}$

(B) h/v_0

(C) hv_0/g

(D) $2h/g$

(E) $\sqrt{2h/g}$

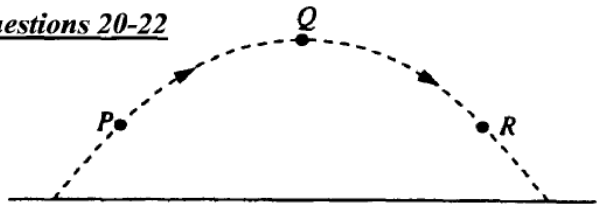
$-3.15\ m/s^2$ 19) A jetliner is landing with a speed of 69 m/s. Once the jet touches down, it has 750 m of runway in which to reduce its speed to 6.1 m/s. Compute the average acceleration of the plane during landing.

$v^2 = v_0^2 + 2a(x - x_0)$

$6.1^2 = 69^2 + 2a$

$a = -3.15\ m/s^2$

Questions 20-22



A ball is thrown and follows the parabolic path shown above. Air friction is negligible. Point Q is the highest point on the path. Points P and R are the same height above the ground.

D 20. How do the speeds of the ball at the three points compare?

(A) ~~$v_P < v_Q < v_R$~~
(B) ~~$v_R < v_Q < v_P$~~
(C) ~~$v_Q < v_R < v_P$~~
(D) $v_Q < v_P = v_R$
(E) $v_P = v_R < v_Q$

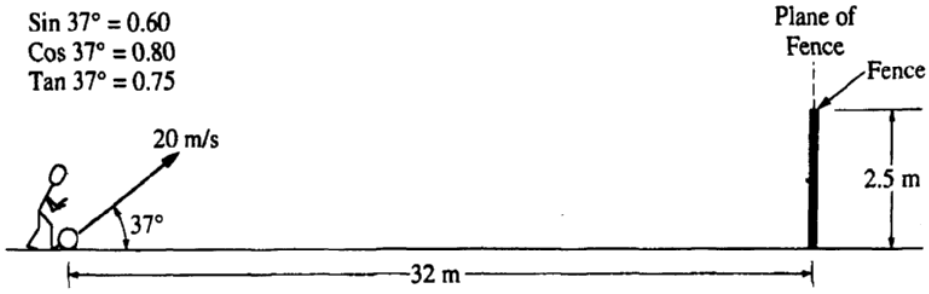
E 21. Which of the following diagrams best shows the direction of the acceleration of the ball at point P ?

(A) ↙
(B) ↗
(C) →
(D) ↘
(E) ↓

A 22. Which of the following best indicates the direction of the net force, if any, on the ball at point Q ?

(A) ↓
(B) ←
(C) →
(D) ↘
(E) There is no net force on the ball at point Q.

Sin 37° = 0.60
Cos 37° = 0.80
Tan 37° = 0.75



Note: Diagram not drawn to scale.

194B modified (12 points) A ball of mass 0.5 kilogram, initially at rest, is kicked directly toward a fence from a point 32 meters away, as shown above. The velocity of the ball as it leaves the kicker's foot is 20 meters per second at an angle of 37° above the horizontal. The top of the fence is 2.5 meters high. The kicker's foot is in contact with the ball for 0.05 second. The ball hits nothing while in flight and air resistance is negligible.

b. Determine the time it takes for the ball to reach the plane of the fence.

(4)

$V_x = 20 \cos 37° = 16\ m/s$

$x = V_x t$

$t = x/V_x = \frac{32\ m}{16\ m/s} = 2\ s$

c. Will the ball hit the fence? If so, how far below the top of the fence will it hit? If not, how far above the top of the fence will it pass?

(4)

$y = y_0 + v_{y0}t + \frac{1}{2}at^2$

$V_{y0} = 12\ m/s$ 9.8

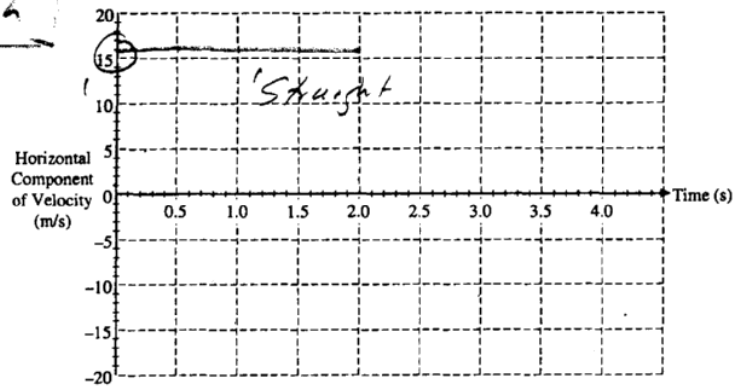
$y = 4.4\ m$

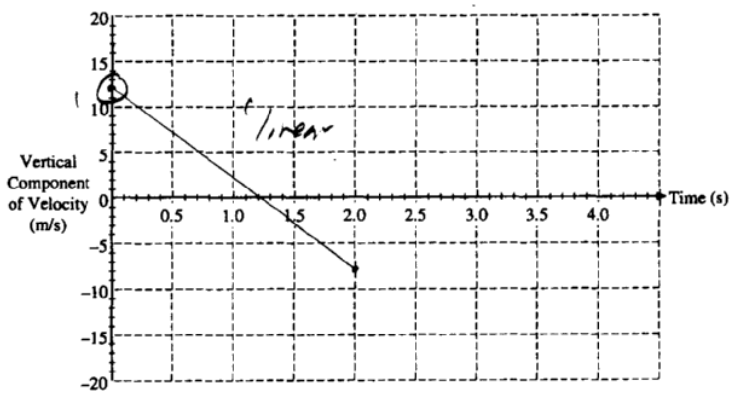
NO

$4.4 - 2.5 = 1.9$ too High

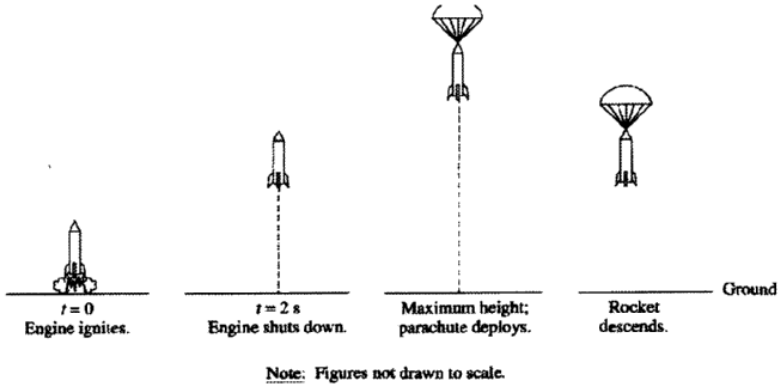
d. On the axes at the right, sketch the horizontal and vertical components of the velocity of the ball as functions of time until the ball reaches the plane of the fence.

(4)





2B1 modified (15 points). A model rocket of mass 0.250 kg is launched vertically with an engine that is ignited at time t = 0, as shown. The engine provides an acceleration of 30 m/s^2 by firing for 2.0 s. Upon reaching its maximum height, the rocket deploys a parachute, and then descends vertically to the ground.



Note: Figures not drawn to scale.

(1) (a) When does the rocket reach its maximum velocity?

$t = 2\,s$

(2) (b) Calculate the maximum velocity of the rocket.

$v_y = v_{y_0} + at$

$= (30\,m/s^2)(2) = 60\,m/s$

(4) (c) What maximum height will the rocket reach?

$y_2 = y_0 + v_{y_0}t + \frac{1}{2}at^2$

$y_2 = \frac{1}{2}(30)(2)^2$

$y_2 = 60\,m$

$v_y^2 = v_{y_2}^2 + 2a(y - y_2)$

$0 = (60\,m/s)^2 - 19.6(y - 60)$

$y = 244\,m$

(3) (d) At what time after t = 0 will the maximum height be reached?

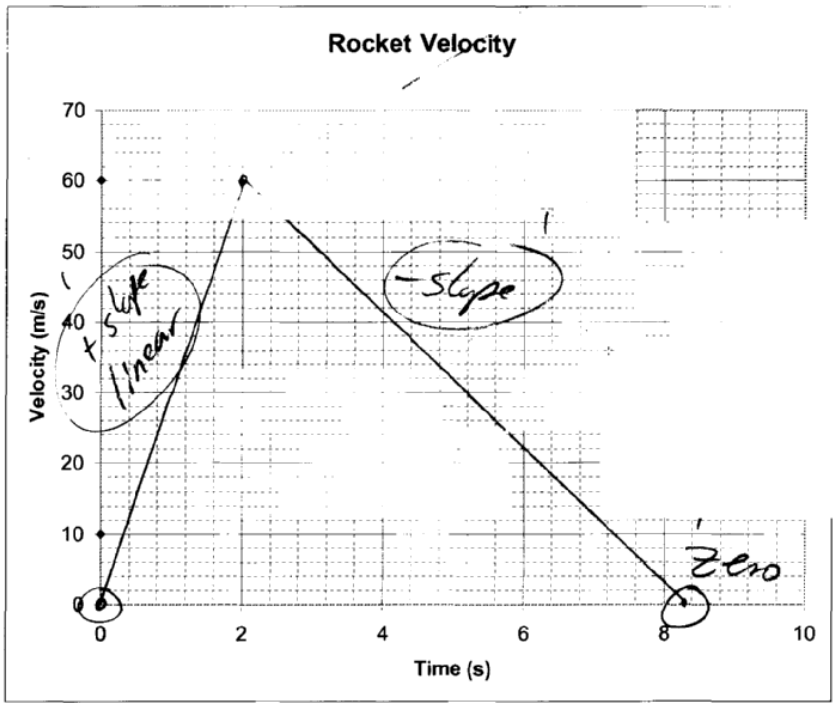
$v_y = v_2 + at$

$0 = 60 - 9.8t$

$t = 6.12\,s$

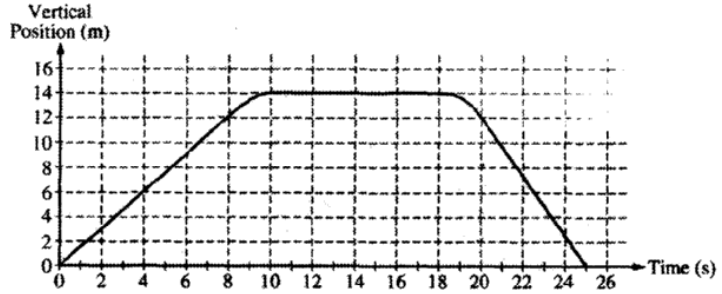
total time = $8.12\,s$

(5) (e) Sketch the velocity –vs- time graph from the time the rocket engine ignites to the time the rocket reached its maximum height.

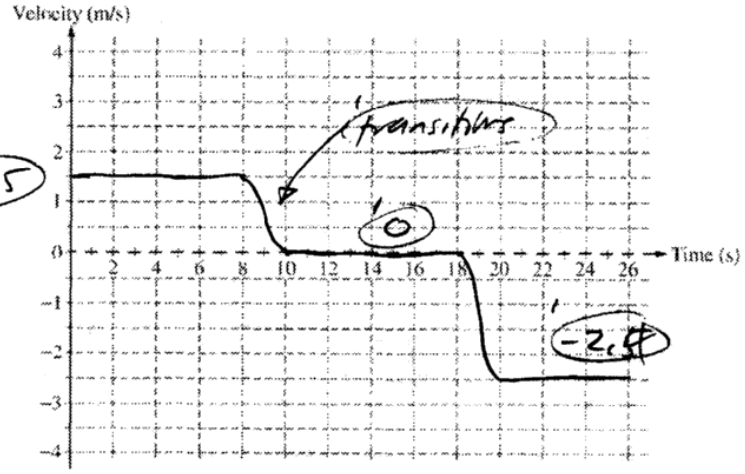


5B1 modified (8points)

The vertical position of an elevator as a function of time is shown at the right



(4) (a) On the grid at the right, graph the velocity of the elevator as a function of time.



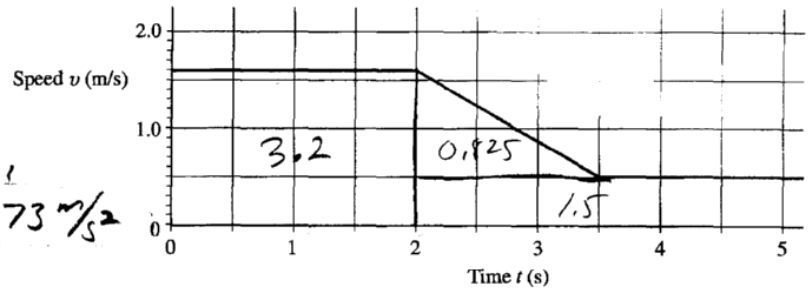
(3) (b) i Calculate the average acceleration for the time period $t = 8$ s to $t = 10$ s.

$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t} = \frac{0 - 1.5}{2} = -0.75\ m/s^2$$

(1) ii. On the box at the right that represents the elevator, draw a vector to represent the direction of this average acceleration.

2B1B modified (5 points)

The graph at the right shows the speed v of a cart as a function of time t for 5.0 s.



(3) (c) Calculate the acceleration of the cart at $t = 3.0$ s.

$$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{0.5 - 1.6}{1.5} = -0.73\ m/s^2$$

(2) (d) Calculate the distance traveled by the second cart during the 5.0 s interval after the collision (0 s < t < 5.0 s).

Area of Graph 5.525 m