ave. = 7.0
σ = 2.4

Physics 4A
Spring 2025

Name Answer Key

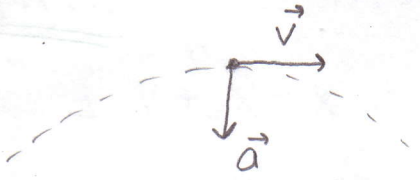
Lab: 8:00 am 11:10 am 2:30 pm

Quiz #4: Kinematics in Two Dimensions and Force and Motion

Problem 1 (1.25 points)
For projectile motion, when the projectile is at the highest point of its trajectory,

D

a) its acceleration is zero.
b) its velocity is zero.
c) its velocity and acceleration are both zero.
(d) its velocity is perpendicular to the acceleration.
e) none of the above

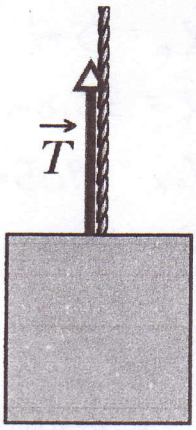


Problem 2 (1.25 points)
A block is suspended from a rope as shown in the figure to the right. Of the following, the tension in the rope will be greatest when the block:

B

a) moves downward with increasing speed
(b) moves downward with decreasing speed
c) remains stationary
d) moves upward with decreasing speed
e) moves upward at constant speed

$\vec{T}$ will be greatest when block is accelerating upwards.



Problem 3 (1.25 points)
A fireman is sliding down a fire pole. As he speeds up, he tightens his grip on the pole, thus increasing the frictional force the pole exerts on the fireman. When the frictional force equals the weight of the fireman, what happens?

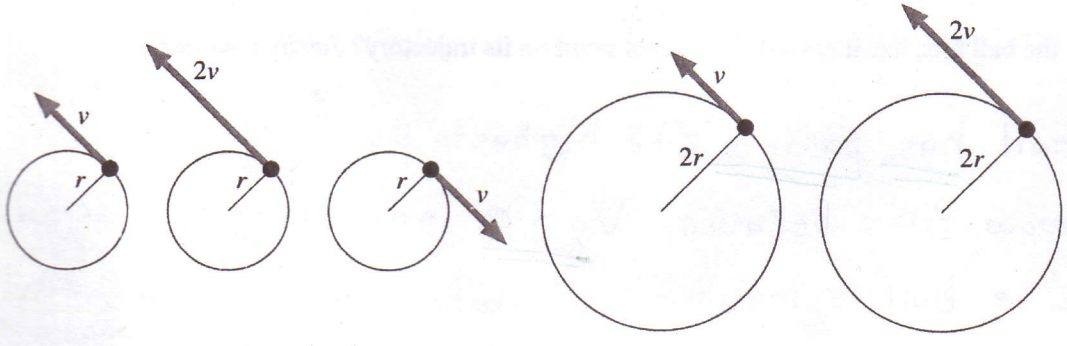
B

a) The fireman comes to a stop.
(b) The fireman continues to descend, but with constant speed.
c) The fireman descends with slower and slower speed.

Once $\sum \vec{F} = 0$, $\vec{a} = 0$ so velocity doesn't change.

Problem 4 (1.25 points)
Which of the particles below has the greatest centripetal acceleration?

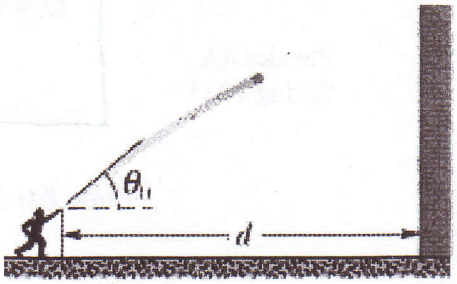
B



(a) (b) (c) (d) (e)

$a = v^2/r$ $a = \frac{(2v)^2}{r} = 4v^2/r$ $a = v^2/r$ $a = \frac{v^2}{(2r)}$ $a = \frac{(2v)^2}{2r} = 2v^2/r$

Problem 5 (5 points)
You throw a ball toward a wall at speed of 25.0 m/s and at an angle $\theta_0 = 40.0°$ above the horizontal. The wall is distance d = 35.0 m from the release point of the ball.



a) How far above the release point does the ball hit the wall?

$V_{ox} = (25.0 m/s)\cos 40.0° = 19.15 m/s$

$V_{oy} = (25.0 m/s)\sin 40.0° = 16.07 m/s$

$X_o = 0 m$

$X = 35.0 m$

$V_{ox} = 19.15 m/s$

$t = ?$

$X = X_o + V_{ox} t$ ($X_o = 0$)

$t = \frac{X}{V_{ox}}$

$t = \frac{35.0 m}{(19.15 m/s)} = 1.83 s$

$y_o = 0 m$

$y = ?$

$V_{oy} = 16.07 m/s$

$a_y = -9.80 m/s^2$

$t = 1.83 s$

$y = y_o + V_{oy} t + \frac{1}{2} a_y t^2$ ($y_o = 0$)

$y = (16.07 m/s)(1.83 s) + \frac{1}{2}(-9.80 m/s^2)(1.83 s)^2$

$y = 13.0 m$

b) What is the velocity of the ball (in unit vector notation) as it hits the wall?

$V_x = V_{ox} = 19.15 m/s$

$V_{oy} = 16.07 m/s$

$V_y = ?$

$a_y = -9.80 m/s^2$

$t = 1.83 s$

$V_y = V_{oy} + a_y t = 16.07 m/s + (-9.80 m/s^2)(1.83 s)$

$V_y = -1.86 m/s$

$\vec{V} = (19.15 m/s)\hat{i} - (1.86 m/s)\hat{j}$

c) When the ball hits, has it passed the highest point on its trajectory? *Justify your answer.*

The ball has passed the highest point.
We know this because $V_y < 0$ indicating that the ball is moving downward.