Physics 4A
Fall 2025

ave. = 6.5
σ = 2.4

Name Answer Key

Lab: 8:00 am 11:20 am 2:40 pm (circle one)

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

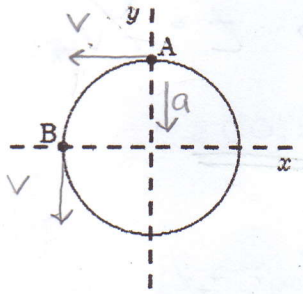
Problem 1 (1.5 points)
A baseball is hit at an angle θ and travels along a parabolic arc before it strikes the ground. Which one of the following statements is true?

$v_y = 0$ m/s
$v_x = v_{ox}$

E

a) The acceleration of the ball decreases as the ball moves upward.
b) The velocity of the ball is 0 when the ball is at the highest point in the arc.
c) The acceleration of the ball is 0 when the ball is at the highest point in the arc.
d) The velocity of the ball is a maximum when the ball is at the highest point in the arc.
e) None of the above.

Problem 3 (1.5 points)
A toy racing car moves with constant speed around the circle shown below. When it is at point B, its coordinates are x = -2 m, y = 0 m and its velocity is (-4 m/s)*j*. When it is at point A, its velocity and acceleration are:



r = 2.0m
v = 4m/s
$a = v^2/r = 8.0\ m/s^2$

direction is towards center

D

a) (4 m/s)*i* and (8 m/s^2)*j*, respectively
b) (4 m/s)*i* and (-8 m/s^2)*j*, respectively
c) (-4 m/s)*i* and (8 m/s^2)*j*, respectively
d) (-4 m/s)*i* and (-8 m/s^2)*j*, respectively
e) (-4 m/s)*i* and 0, respectively

$a = F/m = 8.0\ m/s^2$

Problem 3 (3 points)
An object experiencing a constant force accelerates at 8.0 m/s^2. What will the acceleration of the object be (in m/s^2) if:

a) The force is the same and the mass is cut in half?

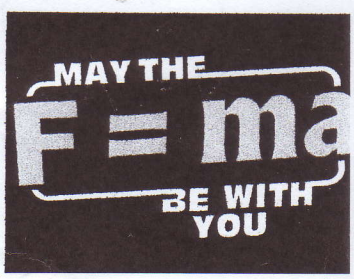
$a_{new} = F/(m/2) = 2(F/m) = 16\ m/s^2$

b) The force is quadrupled and the mass is doubled?

$a_{new} = (4F)/(2m) = 2(F/m) = 16\ m/s^2$

c) The force is cut in half and the mass is tripled?

$a_{new} = (F/2)/(3m) = 1/6(F/m) = 1.3\ m/s^2$



Problem 4 (4 points)
A baseball is thrown with an initial speed of 23.5 m/s at a 42.0° angle in the absence of air resistance..

a) What is baseball's speed and direction of the travel at t = 3.00 s?

$V_{ox} = (23.5\,m/s)\cos 42.0° = 17.5\,m/s$

$V_{oy} = (23.5\,m/s)\sin 42.0° = 15.7\,m/s$

y_o	y	V_{oy}	V_y	a_y	t
		15.7 m/s	?	$-9.80\,m/s^2$	3.00 s

$V_y = V_{oy} + a_y t$

$= 15.7\,m/s + (-9.80\,m/s^2)(3.00\,s) = -13.7\,m/s$

$V = \sqrt{V_x^2 + V_y^2}$

$V = \sqrt{(17.5\,m/s)^2 + (-13.7\,m/s)^2}$

$\boxed{V = 22.2\,m/s}$

$\theta = \tan^{-1}\left(\frac{V_y}{V_x}\right) = \tan^{-1}\left(\frac{-13.7\,m/s}{17.5\,m/s}\right)$

$\boxed{\theta = -38.1°}$

b) What is the ball's height when it has traveled a horizontal distance of 35.0 m?

x_o	x	V_{ox}	t
0	35.0 m	17.5 m/s	?

$x = x_o^{=0} + V_{ox}t \rightarrow t = x/V_{ox}$

$t = \frac{35.0\,m}{17.5\,m/s} = 2.00\,s$

y_o	y	V_{oy}	V_y	a_y	t
0 m	?	15.7 m/s		$-9.80\,m/s^2$	2.00 s

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

$y = (15.7\,m/s)(2.00\,s) + \frac{1}{2}(-9.80\,m/s^2)(2.00\,s)^2$

$\boxed{y = 11.8\,m}$

c) What is the maximum height reached by the baseball?

y_o	y	V_{oy}	V_y	a_y	t
0 m	?	15.7 m/s	0 m/s	$-9.80\,m/s^2$	?

$V_y^{=0} = V_{oy} + a_y t \rightarrow t = -\frac{V_{oy}}{a_y} = \frac{-15.7\,m/s}{-9.80\,m/s^2} \rightarrow t = 1.60\,s$

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

$y = \frac{1}{2}V_{oy}t = \frac{1}{2}(15.7\,m/s)(1.60\,s) \rightarrow \boxed{y = 12.6\,m}$