Phys 131 2024

Review I

Thurs: Seminar 12:30
WS 203

Fri: Exam I

Mon: Warm Up 6
Group Exercise

Exam: *Covers Ch 1→4
Lectures 1→11
HW 1→4
Discussion 1→4.

* Bring: - Calculator — no communicating devices.
- Single 3"x5" card one side.

* Study - 2022, 2023 Class Exam I - all questions
- HW, Discussion Problems
- Quizzes
- In Class quizzes

10AM Class - Stay in Room until 10:50am.

Ch 1→2 Know — meanings of: displacement, velocity acceleration
- graphical representations of motion

Equations: $v_{avg} = \frac{\Delta x}{\Delta t}$

v = slope x vs t

Δx = area under v vs t

$a_{avg} = \frac{\Delta v}{\Delta t}$

a = slope v vs t

$v_f = v_i + a\Delta t$

$y_f = y_i + v_i\Delta t + \frac{1}{2}a\Delta t^2$

$v_f^2 = v_i^2 + 2a\Delta(x_f - x_i)$

Free fall

$a_y = -g$

Quiz 1 80% - 100% // 80% - 106% Quiz 2 30% - 30% // 30% - 60%

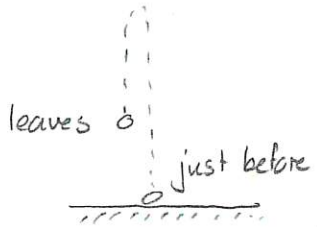
50 Ball thrown from above the ground ✓

A ball is thrown vertically upwards, leaving the hand at a height of 1.2 m above the ground. It hits the ground 2.5 s after leaving the hand. *(131Sp2023)*

a) Determine the speed with which the ball left the hand.

b) Determine the maximum height above the ground reached by the ball!

Answer: a)



$t_0 = 0s \quad t = 2.5s$

$y_0 = 1.2m \quad y = 0m$

$V_{0y} = ?? \quad V_y =$

$a_y = -g = -9.8 m/s^2$

credit!

$y = y_0 + V_{0y} t + \frac{1}{2} a_y t^2$ credit!

$\Rightarrow 0m = 1.2m + V_{0y}(2.5s) + \frac{1}{2}(-9.8 m/s^2)(2.5s)^2$

$\Rightarrow -1.2m = 2.5s\, V_{0y} - 30.6m$

$\Rightarrow 29.4m = 2.5s\, V_{0y}$

$\Rightarrow V_{0y} = \frac{29.4\ m}{2.5\ s} = 11.8 m/s$

b) At max height $V_y = 0 \quad y = ??$

$V_y^2 = V_{0y}^2 + 2 a_y (y - y_0)$ credit!

$\Rightarrow (0 m/s)^2 = (11.8 m/s)^2 + 2(-9.8 m/s^2)(y - 1.2m)$

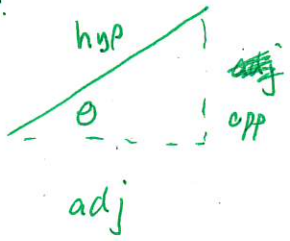
$\Rightarrow 0 m^2/s^2 = 139 m^2/s^2 - 19.6 m/s^2 (y - 1.2m)$

$\Rightarrow \frac{-139 m^2/s^2}{-19.6 m/s^2} = y - 1.2m \Rightarrow y = 7.07m + 1.2m$

$\Rightarrow y = 8.3m$

Ch 3: know - vector algebra
- unit vectors, components

Equations:



$\sin\theta = \frac{opp}{hyp}$

$\cos\theta = \frac{adj}{hyp}$

$\tan\theta = opp/adj$

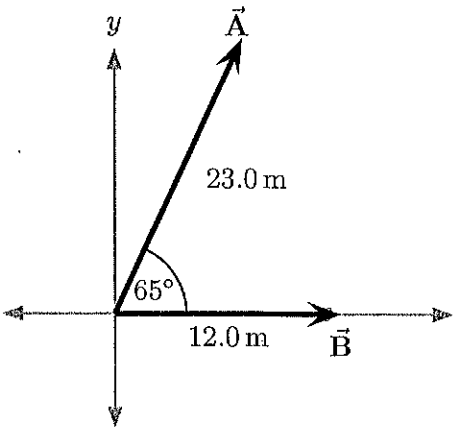
$\vec{A} = A_x\hat{i} + A_y\hat{j}$

$A = \sqrt{A_x^2 + A_y^2}$

Quiz 3 90% $\leq$ 70% - 90%

134 Vector subtraction, 1

Two displacement vectors, $\vec{A}$ and $\vec{B}$ are illustrated. *(131F2024)*



a) Determine the components of $\vec{C} = \vec{A} - \vec{B}$.

b) Determine the magnitude of $\vec{C}$.

Answer:

a) $C_x = A_x - B_x$

$C_y = A_y - B_y$

Requires components

$A_x = A\cos 65^\circ$

$= 23\,m \cos 65^\circ = 9.7\,m$

$A_y = A \sin 65^\circ$

$= 23\,m \sin 65^\circ = 20.8\,m$

	x	y
$\vec{A}$	9.7 m	20.8 m
$\vec{B}$	12.0 m	0 m

$C_x = 9.7\,m - 12.0\,m = -2.3\,m$

$C_y = 20.8\,m - 0\,m = 20.8\,m$

b) $C = \sqrt{C_x^2 + C_y^2} = \sqrt{(-2.3)^2 + (20.8)^2}\ m$

$= 21.0\,m$

Ch 4: know - vector vector nature of displacement, velocity, acceleration

Equations: $\vec{v} = v_x \hat{i} + v_y \hat{j}$ $\quad \vec{a}_{avg} = \frac{\Delta \vec{v}}{\Delta t}$

$v_x \to \frac{\Delta x}{\Delta t}$ $\quad v_y \to \frac{\Delta y}{\Delta t}$

- kinematics eqns (two dimensions)
- projectile $a_x = 0$ $\quad a_y = -g$
- centripetal accel (direction and $a_c = v^2/r$)

Quiz 4 30% - 80% } 30% - 90%

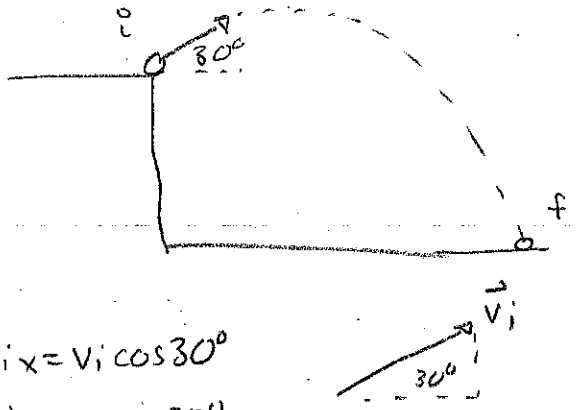
135 Ball launched from a cliff

A person hits a ball from the top of a cliff. The ball leaves at height of 12 m above the surface of the water at angle 30° above the horizontal. It hits the water 2.5 s later. *(131F2024)*

a) Determine speed with which the ball is launched.

b) Determine the horizontal distance traveled by the ball.

a)



$t_i = 0 \quad t_f = 2.5s$

$x_i = 0m \quad x_f =$

$y_i = 12m \quad y_f = 0m$

$v_{ix} = v_i \cos 30^\circ$

$v_{iy} = v_i \sin 30^\circ$

$a_x = 0 m/s^2 \quad a_y = -g = -9.8 m/s^2$

$v_{ix} = v_i \cos 30^\circ$

$v_{iy} = v_i \sin 30^\circ$

Then $y_f = y_i + v_{iy}\Delta t + \frac{1}{2} a_y \Delta t^2$

$0 = y_i + v_i \sin 30^\circ \Delta t - \frac{1}{2} g \Delta t^2$

$\Rightarrow v_i \sin 30^\circ \Delta t = \frac{g}{2}\Delta t^2 - y_i$

$\Rightarrow v_i \sin 30^\circ = \frac{g}{2}\Delta t - \frac{y_i}{\Delta t} = \frac{9.8 m/s^2}{2} \times 2.5s - \frac{12m}{2.5s}$

$= 12.25 m/s - 4.8 m/s$

$v_i \sin 30^\circ = 7.45 m/s$

$\Rightarrow v_i = \frac{7.45 m/s}{\sin 30^\circ} \Rightarrow v_i = 15 m/s$

b) $x_f = \cancel{x_i} + v_{ix}\Delta t + \cancel{\frac{1}{2}a_x \Delta t^2}$

$x_f = v_i \cos 30^\circ \Delta t$

$= 15 m/s \cos 30^\circ \times 2.5 s$

$= 32 m$