Physics 10154 - Exam #1b

Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct units and significant figures.

1. (20 pts) A ball is thrown vertically upwards from an altitude of 25 meters above ground level. The ball is in the air for 3.4 seconds before hitting the ground.

a) What is the initial velocity of the ball?
b) To what maximum height does the ball reach above ground level?

$\Delta y = -25$

$v_{oy} = ?$

$v_y = ?$

$a_y = -9.8$

$t = 3.4$

$\Delta y = v_{oy} t + \frac{1}{2} a t^2$

$-25 = v_{oy}(3.4) - 4.9(3.4)^2$

$31.6 = v_{oy}(3.4)$

$\boxed{v_{oy} = 9.3 \text{ m/s}}$

Max ht

$\Delta y = ?$

$v_{oy} = 9.3 \text{ m/s}$

$v_y = 0$

$a_y = -9.8 \text{ m/s}^2$

$0^2 = 9.3^2 + 2(-9.8)\Delta y$

$\Delta y = 4.4$ above initial location

so $\boxed{\Delta y = 29 \text{ m above ground}}$

2. (30 pts) A driver travels North with a constant speed of 63 miles/hour except for a 17 minute break where the car is stopped. The car's average speed for the entire trip is 52 miles/hour, then what is the total distance travelled by the car during the trip?

Part 1	Part 2	Tot
$\Delta x_1 = ?$	$\Delta x_2 = 0$	$\Delta x_{Tot} = ?$
$t_1 = ?$	$t_2 = .283\ hr$	$t_{Tot} = ?$
$V_1 = 63\ mi/hr$	$V_2 = 0$	$V_{Tot} = 52\ mi/hr$

$$V_{Tot} = \frac{\Delta x_1 + \Delta x_2}{t_1 + t_2}$$

$$52 = \frac{\Delta x_1 + 0}{t_1 + .283}$$

Also $63 = \frac{\Delta x_1}{t_1}$

$\Delta x_1 = 63 t_1$

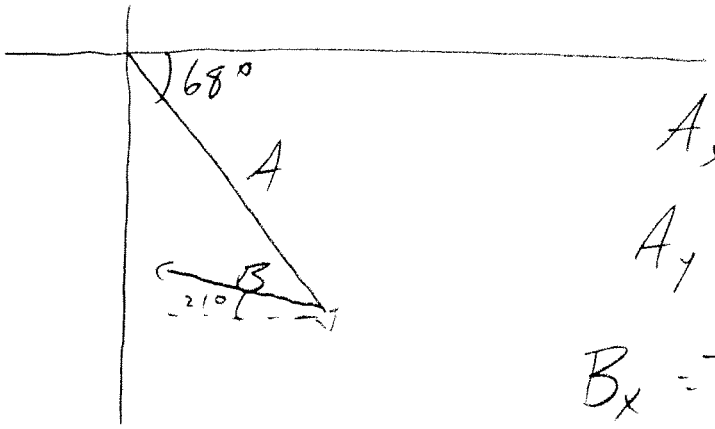
$$52 = \frac{63 t_1}{t_1 + .283}$$

$$63 t_1 = 52 t_1 + 14.7$$

$$11 t_1 = 14.7 \qquad t_1 = 1.34\ hr$$

$$\Delta x_{Tot} = (63)(1.34) = \boxed{84\ miles}$$

3. (20 pts) A person walks 220 meters in a direction 68° South of East, then 85 meters in a direction 21° North of West. What is the magnitude and direction of the person's total displacement?



$A_x = 220 \cos 68 = 82.4$

$A_y = 220 \sin 68 = -204.0$

$B_x = -85 \cos 21 = -79.4$

$B_y = 85 \sin 21 = 30.5$

$R_x = 82.4 - 79.4 = 3.0$

$R_y = -204.0 + 30.5 = -173.5$

$|\vec{R}| = \sqrt{3^2 + 173.5^2} = \boxed{170 \text{ m}}$

$\theta = \tan^{-1}\left(\frac{173.5}{3}\right) = \boxed{89° \text{ S of E}}$

4. (30 pts) A 3.0 meter long ramp with a 15° incline is placed on a ledge 1.5 meters above ground level. A puck starts from rest and slides down the ramp with a constant acceleration of 2.6 m/s². The instant after it leaves the ramp, it is moving at an angle of 15° below the horizontal, but it then enters into free fall until striking the ground.

What is the horizontal distance from the ledge that the puck strikes the ground?

On ramp

$\Delta s = 3.0$

$v_0 = 0$

$v = ?$

$a = 2.6\ m/s^2$

$t = ?$

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

$v^2 = 0 + 2(2.6)(3.0)$

$v = 3.95\ m/s$

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x

$\Delta x = ?$

$v_{0x} = 3.95\cos 15^\circ$

$= 3.82$

$v_x = 3.82$

$a_x = 0$

$t = ?$

y

$\Delta y = -1.5$

$v_{0y} = -3.95\sin 15^\circ$

$= -1.02$

$v_y = ?$

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

$t = ?$

$\Delta y = v_{0y}t + \frac{1}{2}at^2$

$-1.5 = -1.02t - 4.9t^2$

$4.9t^2 + 1.02t - 1.5 = 0$

use t sol'n

$t = \frac{-1.02 \pm \sqrt{1.05 + 29.4}}{9.8}$

$= \frac{4.49}{9.8} = .459$

$\Delta x = v_{0x}t$

$= (3.82)(.459) = \boxed{1.8\ m}$