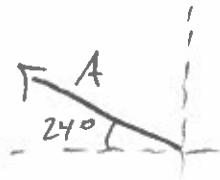


Physics 10154 - Exam #1B

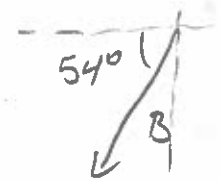
Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct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

1. (30 pts) Three people are attempting to push a heavy piece of furniture across a rough surface. Person A pushes with a force of 325 Newtons in a direction 24.0° North of West. Person B pushes with a force of 284 Newtons in a direction 54.0° South of West. What must be the magnitude and direction of the third force (from person C) so that the net force is 562 Newtons directly West?



$$A_x = -325 \cos 24^\circ = -296.90$$

$$A_y = +325 \sin 24^\circ = +132.19$$



$$B_x = -284 \cos 54^\circ = -166.93$$

$$B_y = -284 \sin 54^\circ = -229.76$$

$$\text{Want } A_x + B_x + C_x = -562$$

$$A_y + B_y + C_y = 0$$

$$\Rightarrow C_x = -562 + 296.90 + 166.93 = -98.17$$

$$C_y = 0 - 132.19 + 229.76 = +97.57$$

$$|C| = \sqrt{C_x^2 + C_y^2} = \boxed{138 \text{ N}}$$

$$\theta = \tan^{-1}\left(\frac{97.57}{98.17}\right) = \boxed{44.8^\circ \text{ N of W}}$$



2. (35 pts) A cyclist travels in a straight line due North in a trip consisting of three parts. In part 1, she rides with an average speed of 8.22 m/s. In part 2, she rests for 12.5 minutes. Her average velocity for the entire trip is 7.10 m/s. What is the total distance she travels?

<u>Part 1</u>	<u>Part 2</u>	<u>Total</u>
$\Delta x_1 = ?$	$\Delta x_2 = 0$	$\Delta x_{tot} = ?$
$t_1 = ?$	$t_2 = 750 \text{ s}$	$t_{tot} = ?$
$\bar{v}_1 = 8.22 \text{ m/s}$	$\bar{v}_2 = 0$	$\bar{v}_{tot} = 7.10 \text{ m/s}$

$$\bar{v}_{tot} = \frac{\Delta x_1 + \Delta x_2}{t_1 + t_2}$$

$$7.10 = \frac{8.22 t_1 + 0}{t_1 + 750}$$

$$7.10 t_1 + 5325 = 8.22 t_1$$

$$5325 = 1.12 t_1$$

$$t_1 = 4754.6 \text{ s}$$

$$\Delta x_{tot} = (8.22)(4754.6) + 0$$

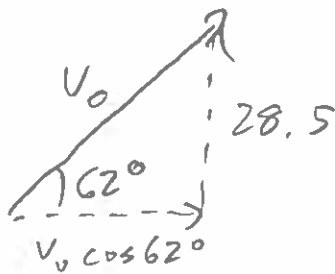
$$= \boxed{39,100 \text{ m}}$$

3. (35 pts) A stone is launched at angle of 62.0° above the horizontal, and it reaches a maximum height of 41.5 meters above the launch point.

- a) What is the magnitude of the initial velocity of the stone?
 b) How far does the stone travel horizontally from the launch point to its landing point, assuming both are at ground level?

a)

<u>x</u>	<u>y</u>	
$\Delta x = ?$	$\Delta y = 41.5 \text{ m}$	$v_y^2 = v_{oy}^2 + 2a_y \Delta y$
$v_{ox} = ?$	$v_{oy} = ?$	$0 = v_{oy}^2 + 2(-9.8)(41.5)$
$v_x = ?$	$v_y = 0$	$v_{oy} = \pm 28.5$
$a_x = 0$	$a_y = -9.8 \text{ m/s}^2$	use + 28.5
$t = ?$	$t = ?$	



$$\sin 62^\circ = \frac{v_{oy}}{v_0}$$

$$v_0 = \frac{28.5}{\sin 62^\circ} = \boxed{32.3 \text{ m/s}}$$

b)

<u>x</u>	<u>y</u>	
$\Delta x = ?$	$\Delta y = 0$	$\Delta y = v_{oy} t + \frac{1}{2} a_y t^2$
$v_{ox} = 15.16$	$v_{oy} = 28.5 \text{ m/s}$	$0 = 28.5t - 4.9t^2$
$v_x = 15.16$	$v_y = ?$	$0 = t(28.5 - 4.9t)$
$a_x = 0$	$a_y = -9.8$	$t = 0, 5.8165$
$t = ?$	$t = ?$	use this

$$\Delta x = v_{ox} t = (15.16)(5.816) = \boxed{88.2 \text{ m}}$$