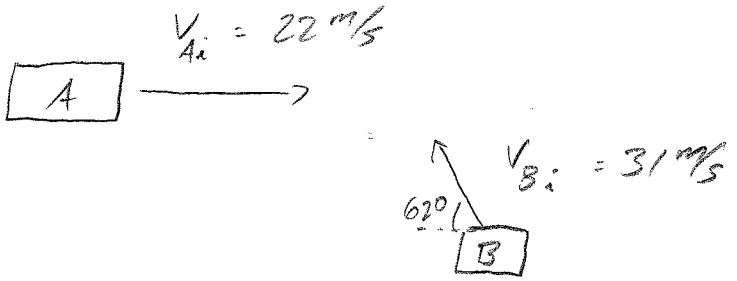
Physics 10154 - Exam #6B

Each problem is worth 50 points. 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. Car A is moving initially 22 m/s East, and car B is moving initially 31 m/s in a direction 62° North of West. The two cars have the same mass, and they stick together after the collision. What is the magnitude and direction of the final combined velocity of the cars?



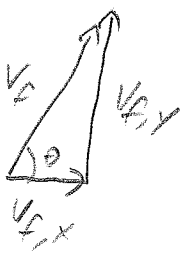
$$x: m_A V_{A_i,x} + m_B V_{B_i,x} = (m_A + m_B) V_{f,x}$$

$$m(22) + m(-31\cos 62°) = 2m\, V_{f,x}$$

$$V_{f,x} = \frac{22 - 14.55}{2} = 3.72\ m/s$$

$$y: m(0) + m(31\sin 62°) = 2m\, V_{f,y}$$

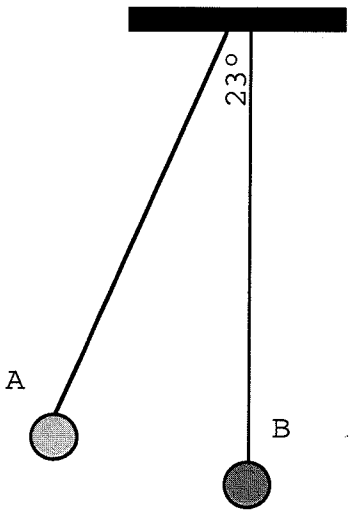
$$V_{f,y} = \frac{27.37}{2} = 13.69\ m/s$$



$$|\vec{V}_f| = \sqrt{3.72^2 + 13.69^2} = \boxed{14\ m/s}$$

$$\theta = \tan^{-1}\left(\frac{13.69}{3.72}\right) = \boxed{75°\ N\ of\ E}$$

2. Pendulum A is at rest at an angle of 23° with respect to the vertical, and it is released. Both pendulum bobs are supported by strings of length 2.2 meters. The 1.2 kg pendulum bob A collides elastically with the 3.6 kg pendulum bob B. To what vertical height does pendulum bob B rise to after the collision?



A falling:

$h = L - L\cos 23°$

$= 2.2(1 - \cos 23°)$

$= 0.175\ m$

$W_{grav} = \Delta K_A$

$mgh = \frac{1}{2}mv^2 - 0$

$v = \sqrt{2gh} = 1.85\ m/s$

Collision:

$$V_{BF} = \frac{2m_A}{m_A + m_B} V_{Ai} + \frac{m_B - m_A}{m_A + m_B}(0)$$

$$= \frac{2(1.2)}{1.2 + 3.6}(1.85) = 0.926\ m/s$$

B rising $W_{grav} = \Delta K_B$

$-mgh = 0 - \frac{1}{2}mv_0^2$

$h = \frac{v_0^2}{2g} = \boxed{.044\ m}$ or $4.4\ cm$