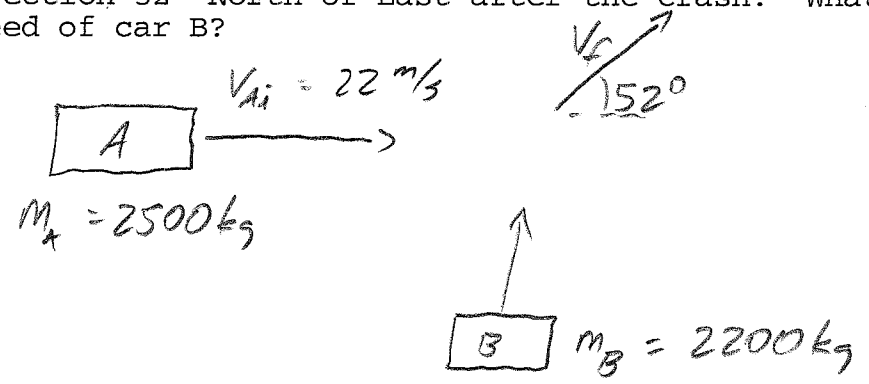
Physics 10154 - Exam #6D

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 (2500 kg) is moving East at 22 m/s, and it has a perfectly inelastic collision (meaning they stick together after the crash) with car B (2200 kg), moving initially North with an unknown speed. Forensics shows that the combined wreck moved in a direction 52° North of East after the crash. What was the initial speed of car B?



$$x: \; m_A v_{Ax,i} + m_B v_{Bx,i} = (m_A + m_B) v_{f,x}$$

$$(2500)(22) + 0 = (4700) v_f \cos 52°$$

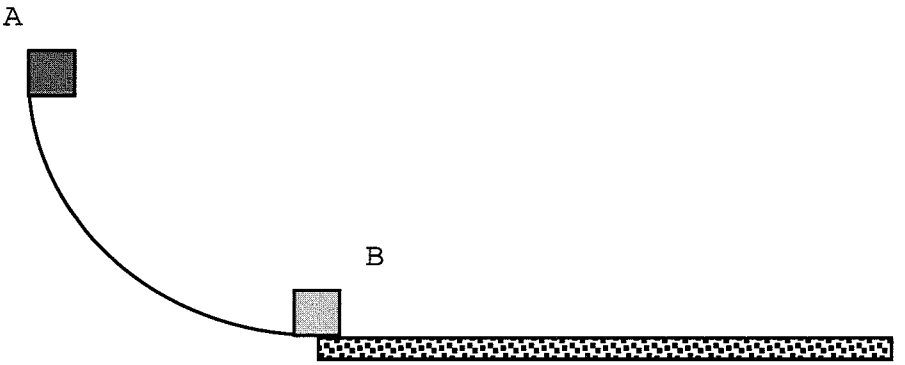
$$v_f = \frac{(2500)(22)}{4700 \cos 52°} = \boxed{19 \text{ m/s}}$$

$$y: \; m_A v_{Ay,i} + m_B v_{By,i} = (m_A + m_2) v_{f,y}$$

$$0 + 2200 v_{B,i} = 4700(19) \sin 52$$

$$v_{B,i} = \frac{4700(19) \sin 52}{2200} = \boxed{32 \text{ m/s}}$$

2. Mass A (1.5 kg) starts at rest 85 cm above ground and slides down a curved ramp to collide elastically with mass B (2.2 kg), initially at rest. Mass B then slides 1.2 meters across a rough surface before coming to rest. What is the coefficient of kinetic friction between the surface and mass B?



Mass A sliding down:

$W_{grav} = \Delta K$

$mgh = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{2gh} = 4.08\ m/s$

Collision: $V_{Ai} = 4.08\ m/s$ $V_{Bi} = 0$

$$V_{Bf} = \frac{2m_A}{m_A+m_B}V_{Ai} + \frac{m_B-m_A}{m_A+m_B}V_{Bi}$$

$$= \frac{2(1.5)}{(1.5+2.2)}(4.08) + 0 = 3.31\ m/s$$

B sliding: $V_0 = 3.31\ m/s$

$W_{KF} = \Delta K$

$-\mu_K mg\Delta s = 0 - \frac{1}{2}mV_0^2$

$$\mu_K = \frac{V_0^2}{2g\Delta s} = \frac{(3.31)^2}{2(9.8)(1.2)} = \boxed{0.47}$$