Physics 10154 – Exam #6D

Answer the following two questions. Be sure to clearly indicate your answer with a circle or box. <u>Show all work</u>. If I cannot see how you arrived at an answer, I will deduct points!

1. Two cars of equal mass collide at an intersection and move as one after the collision. Car A is moving North at 24 m/s. Car B is moving 33° North of East at an unknown speed. Immediately after the collision, the two cars move off at an angle of 67° North of East. What was the speed of car B prior to the collision?

$$x: \quad m(0) + mV_B \cos 33° = 2mV_f \cos 67°$$

$$y: \quad m(24) + mV_B \sin 33° = 2mV_f \sin 67°$$

$$V_B = \frac{2V_f \cos 67°}{\cos 33°} = 0.932 V_f$$

$$24 + .932 V_f \sin 33° = 2 V_f \sin 67°$$

$$24 = V_f (2 \sin 67° - .932 \sin 33°)$$

$$24 = V_f (1.84 - .508)$$

$$V_f = 18 \, m/s$$

$$V_B = (.932)(18) = \boxed{17 \, m/s}$$

2. A 22-gram bullet collides with a 650-gram pendulum bob initially at rest. After the collision, the bullet passes through the bob and goes on at a speed of 180 m/s. The 1.2-meter pendulum rises to a maximum angle of 22° after the collision. What is the initial speed of the bullet prior to the collision?

Collision

$$(.022)V_{1i} + (.650)(0) = (.022)(180) + .650\, V_{2f}$$

$$.022\, V_{1i} = 3.96 + .650\, V_f$$

Pendulum

$$h = 1.2(1 - \cos 22°) = .0874\, m$$

$$\Sigma W_F = W_{grav} = 0 - \tfrac{1}{2}mv_0^2$$

$$-mgh = -\tfrac{1}{2}mv_0^2$$

$$V_0 = \sqrt{2gh} = \sqrt{2(9.8)(.0874)}$$

$$= 1.31\ m/s$$

$$.022\, V_{1i} = 3.96 + (.650)(1.31)$$

$$V_{1i} = \frac{4.81}{.022} = \boxed{220\ m/s}$$