PHYS 211 College Physics I
Final A

December 11, 2017

Name J.C. Daly

1. A game begins with a coin toss. The referee tosses the coin with an initial vertical velocity of 7.50 m/s.

   a. How high does the coin go? 2.87 m

   b. How long is it in the air? 1.53 s

Grades

100 | 100,100,100,100,100
99
94,94
93
90 | 90
88
80 | 79
73
70 |
66
65
62
60 | 57
50 | 48
40 | 41
39

$0 = v^2 = v_0^2 - 2gy$

$y = \frac{v_0^2}{2g} = \frac{(7.5)^2}{2*9.8} = 2.869\,m$

$y = v_0 t - \frac{1}{2}gt^2 = t(v_0 - \frac{g}{2}t) = 0$

$v_0 - \frac{gt}{2} = 0$

$t = \frac{2v_0}{g} = \frac{7.5*2}{9.8} = 1.53\,s$

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2. A 65.0 kg skater is traveling due east at a speed of 6.50 m/s. A 83 kg skater is moving north at a speed of 4.25 m/s. They collide and hold on to each other after the collision, managing to move off at an angle θ north of east, with a speed v_f.

   Find

   a. the angle θ 39.9° and

   b. the speed v_f 3.72 m/s.

$$m_1\vec{v}_1 + m_2\vec{v}_2 = (m_1+m_2)\vec{v}$$

$$m_1 v_1 = 65 * 6.5\,\hat{x} = 422.5\,\hat{x}$$

$$m_2 v_2 = 83 * 4.25\,\hat{y} = 352.75\,\hat{y}$$

$$m_1 + m_2 = 65 + 83 = 148$$

$$\vec{v} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2}{m_1+m_2} = \frac{422.5}{148}\hat{x} + \frac{352.75}{148}\hat{y}$$

$$\vec{v} = 2.85\,\hat{x} + 2.38\,\hat{y}$$

$$= \sqrt{(2.85)^2 + (2.38)^2}\ \angle \tan^{-1}\left(\frac{2.38}{2.85}\right)$$

$$= 3.715\ \angle 39.9^\circ$$

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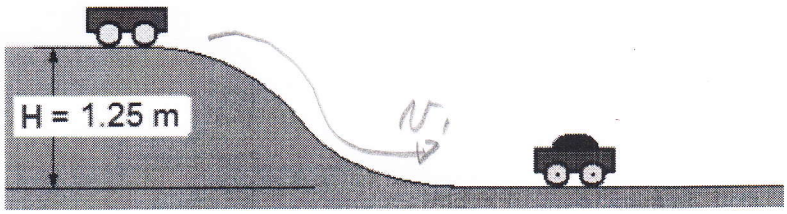

Figure 3

3. A railroad car with a mass of 1050 kg starts from rest at the top of the 1.25 m hill shown in Figure 3. The car rolls down the hill and crashes into a stationary car of mass 1520 kg. After the collision the cars are coupled and move together. Assume friction can be ignored.

   a. What is the speed of the cars after the collision? 2.02 m/s

   b. How much energy is lost in the collision? 7610 J

$mgh = \frac{1}{2} m v_1^2$

$v_1 = \sqrt{2gh} = \sqrt{2 \times 9.8 \times 1.25} = 4.95 \text{ m/s}$

$v_1 m_1 = v_f (m_1 + m_2)$

$m_1 + m_2 = 1050 + 1520 = 2570$

$v_f = \left(\frac{m_1}{m_1 + m_2}\right) v_1 = \frac{1050}{2570} * 4.95$

$v_f = 2.022 \text{ m/s}$

Energy Lost $E_0 = \frac{1}{2} m_1 v_1^2 = \frac{1050}{2} \times (4.95)^2$

$E_0 = 12,864 \text{ J}$

$E_f = \frac{1}{2}(m_1 + m_2) v_f^2$

$= \frac{1}{2} * 2570 * (2.022)^2$

$E_f = 5,254 \text{ J}$

$E_0 - E_f = 12,864 - 5,254 = 7610 \text{ J}$

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4. A 0.85 kg hockey puck is sliding on ice. The coefficent of kinetic friction is 0.250.

   a. What is the friction force acting on the puck? 2.08 N

   b. What is the acceleration of the puck? 2.45 m/s²

$F_f = \mu_k F_N = \mu_k mg = 0.25 \times 9.8 * 0.85$

$F_f = 2.08\ N$

$F = ma$

$a = \frac{F}{m} = \frac{2.08}{0.85} = 2.45\ m/s^2$

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5. A suitcase is pulled 55 m along a horizontal surface as shown in Figure 5 The person pulls the suitcase with a force of 25 N at an angle of 35° from the horizontal. Find the work done by the force in pulling the suitcase the distance of 55 m.

Figure 5

$W = F d \cos\theta = 25 * 55 * \cos 35^\circ$

$W = 1,126\ J$

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6. If electricity costs 15 cents per kilowatt hour, how much does it cost to run a 1.5 kilowatt hair dryer for 10 minutes? 3.75 ¢

$$1.5\ \text{kW} * 10\ \text{min} * \frac{1\ \text{hr}}{60\ \text{min}} = \frac{1.5 * 10}{60} = \frac{1.5}{6}\ \text{kW·hr}$$

$$\frac{1.5}{6}\ \text{kW·hr} * 0.15\ \frac{\$}{\text{kW·hr}} = \$0.0375$$

$$\boxed{3.75\ ¢}$$