READ 8.1 - 8.3

Exam III Next Monday at
7:30 A.m chp 6, 7

H.W #9 available
Due next Friday

Thursday discussion sections
Q & A! (optional)

Ballistic pendulum

How can you measure velocity of ball?

m = ball mass
M = pendulum mass

① conserve momentum

$$m v_i = (m+M) v_f$$

② conserve Energy

$$\frac{1}{2}(m+M) v_f^2 = (m+M) g h \left(\frac{m+M}{m+M}\right)$$

$$\frac{1}{2}\frac{(m+M)^2 v_f^2}{(m+M)} = (m+M) g h$$

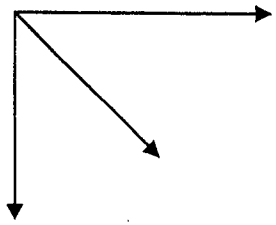
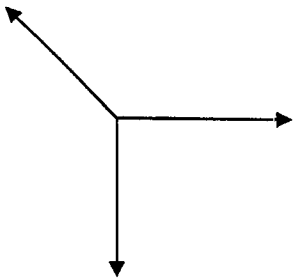
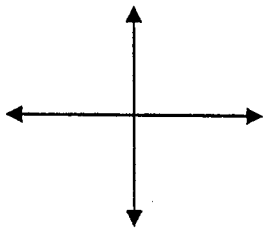
$$\frac{1}{2}\frac{m^2 v_i^2}{(m+M)} = (m+M) g h$$

$$v_i^2 = 2gh\frac{(m+M)^2}{m^2}$$

$$\boxed{v_i = \sqrt{2gh}\,\frac{m+M}{m}}$$

know h can determine v_i

A firecracker is thrown into the air and explodes into many pieces of approximately equal mass. Which of the following diagrams show the possible velocities the pieces have?

- A) 
B) 
C) 

A) A
B) B
C) C
D) More than one of the above
E) All of the above

ex) A 0.1 g fly is stationary and encounters a windshield of a 1000 kg automobile traveling at 100 km/h

a) Find change in momentum of car

b) " " fly

c) How many flies does it take to reduce car's speed by 1 km/h

$$m_f \cancel{v_{fi}}^{0} + m_c v_{ci} = (m_f + m_c) v$$

$$v = \frac{m_c v_{ci}}{m_f + m_c} \Rightarrow \underline{v \approx v_{ci}} = 100 \text{ km/h}$$

$$\Delta p_{car} = -\Delta p_{fly}$$

$$-m_{fly} (v_{fly_f} - \cancel{v_{fly_i}}^{0})$$

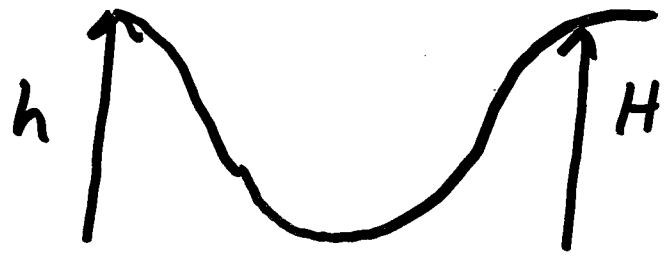
$$= -m_{fly} (100 \text{ km/h}) = \underline{-.01 \text{ kg km/h}} \quad b)$$

a) car : $\underline{.01 \text{ kg-km/h}}$

c) $N \Delta p_{fly} = -m_{car} \Delta v_{car}$

$$N = \frac{-(1000 \text{ kg})(-1 \text{ km/h})}{.01 \text{ kg-km/h}} = \underline{10^5 \text{ flies}}$$

ex) A skier starts from a height h. She skis down and up another hill to a height H.



is $H > h$
$H = h$
$H < h$

a) Frictionless

b) Friction

c) she picks up a box along way

d) she drops a box at bottom

Ex) A car moving at 30 mi/h is stopped by braking and locks wheels. Car slides 50 ft before coming to rest. How far would car skid if it were moving at 60 mi/h?

work

$$W = F_f d \cos 180^\circ = -F_f d$$

$$W = \Delta K = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

$$-F_f d = -\frac{1}{2} m v_i^2$$

$$F_f d_1 = \frac{1}{2} m v_i^2 \qquad v_i = 30 \text{ mi/h}$$

$$F_f d_2 = \frac{1}{2} m v_{i2}^2 \qquad v_{i2} = 60 \text{ mi/h}$$

ratios

$$\frac{F_f d_1}{F_f d_2} = \frac{\frac{1}{2} m v_i^2}{\frac{1}{2} m v_{i2}^2} \qquad \frac{d_1}{d_2} = \frac{v_i^2}{v_{i2}^2}$$

$$d_2 = d_1 \frac{v_{i2}^2}{v_i^2} = d_1 \left(\frac{60 \text{ mi/h}}{30 \text{ mi/h}} \right)^2$$

$$d_2 = 4 d_1$$

$$d_2 = 50 \text{ ft} \cdot 4 = \boxed{200 \text{ ft}}$$

A box slides down an inclined plane with friction and compresses a spring with spring constant K. The box then goes back up the incline to a height h. I then replace the spring with a new spring with spring constant 4K.
How far will new spring compress compared to original spring?

- A) Same
- B) ½ as much
- C) twice as much
- D) ¼ as much
- E) 4 times as much

$$U = \frac{1}{2} k x_1^2$$

$$U = \frac{1}{2} 4k x_2^2$$

$$\frac{1}{2} k x_1^2 = \frac{1}{2} 4k x_2^2$$

$$x_1^2 = 4 x_2^2$$

$$x_1 = 2 x_2$$

$$x_2 = \frac{x_1}{2}$$