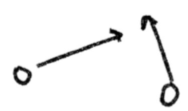
M-GP General Physics Week 30 5/15

## Elastic Collision

Kinetic energy + momentum is conserved



$$m_1 v_1 + m_2 v_2 = m_1 v_{f_1} + m_2 v_{f_2}$$

## Inelastic Collision

Only momentum is conserved, and masses combined

$$m_1 v_1 + m_2 v_2 = (m_1 + m_2) v_f$$

A 2000 (mass) kg Felix the Cat balloon (object) traveling 58 m/s

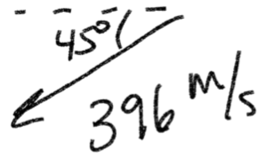
31° (degrees) above (above/below) horizontal collides with

A 4,990 (mass) kg Frankie D' Koolaid (object) traveling 396 m/s

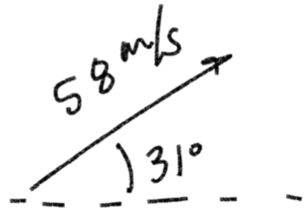
45° (degrees) below (above/below) horizontal. If inelastic,

find the velocity of the mass/mess.

① Felix 2000kg




② FDK
4,990 kg




resulting momentum X:

resulting momentum y:

① X $\rho = mv$

$mv\cos\theta$

$(2000kg)(58\,m/s)(\cos 31°)$

$99{,}431.4\ kg\,m/s$

② X $\rho = mv$

$mv\cos\theta$

$-(4990kg)(396\,m/s)(\cos 45)$

$-1{,}397{,}271.3\ kg\,m/s$

$99{,}431.4 + (-1{,}397{,}271.3)$

sum of X $-1{,}297{,}840\ kg\,m/s$

y ① $\rho = mv$

$mv\sin\theta$

$(2000kg)(58\,m/s)(\sin 31°)$

$59{,}744.4\ kg\,m/s$

② $\rho = mv$

$mv\sin\theta$

$-(4990kg)(396\,m/s)(\sin 45)$

$-1{,}397{,}271.3\ kg\,m/s$

sum of y $-1{,}337{,}526.9\ kg\,m/s$

$r = \sqrt{x^2 + y^2} = \sqrt{(-1{,}297{,}840)^2 + (-1{,}337{,}526.9)^2} = \boxed{1{,}863{,}697.0\ kg\,m/s}$

$\theta = \tan^{-1}\frac{y}{x} = \tan^{-1}\left(\frac{-1{,}337{,}526.9}{-1{,}297{,}840}\right) = 45.86° + 180° \quad 225.86° \quad 226°$

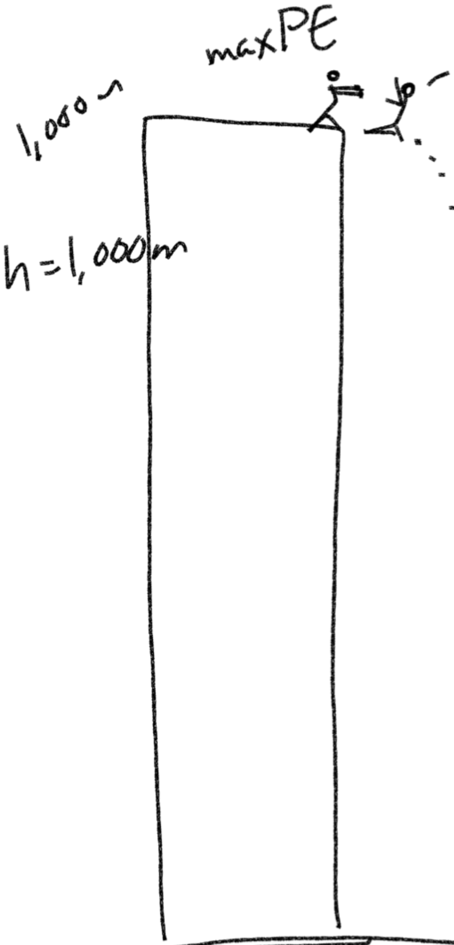
mass is felix + 

final momentum 1,863,697 kg m/s @ 226°

$$\text{final velocity} = \frac{\text{tot momentum}}{\text{total mass}}$$

$$= \frac{1{,}863{,}697 \text{ kg m/s}}{(2000 + 4990)\text{ kg}}$$

$$= \boxed{266.6 \text{ m/s}} \text{ @ } 226°$$




-Nooo....

Evelyn

## Potential Energy

Find velocity of impact

is energy based on position.

$m = 63\text{ kg}$

$PE = KE$

$\cancel{m}gh = \frac{1}{2}\cancel{m}v^2$

$2(gh) = (\frac{1}{2}v^2)2$

$\sqrt{2gh} = \sqrt{v^2}$

$PE = mgh$

(mass)(acc gravity)(hight)

## Kinetic Energy

is energy of motion

$KE = \frac{1}{2}mv^2$

max KE

Law of conservation of energy — energy cannot be created or destroyed

$v = \sqrt{2gh} = \sqrt{2(9.8\text{ m/s}^2)(1{,}000\text{ m})}$

$= \boxed{140 \text{ m/s}}$

$PE = mgh \quad (63\,kg)(-9.8\,m/s^2)(1{,}000\,m)$

$KE = \frac{1}{2} m v^2 \qquad v = \sqrt{2gh}$

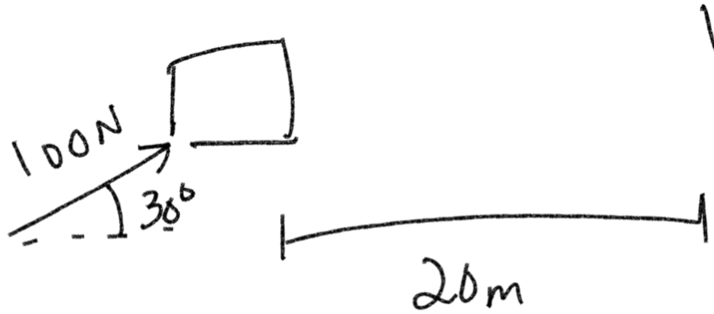
work = force * displacement


Work?

$W = F \cdot d \cdot \cos\theta$

$(100\,N)(20\,m)(\cos 30°)$

$\boxed{1732\,J}$




$W = F(\cos\theta)d$

$W = (F_x)(d_x) + (F_y)(d_y)$

$W = F \cdot d$

$$\begin{array}{lcc} & x & y \\ \text{Displacement:} & (8.0\hat{i} & + \; 3.0\hat{j}) \\ \text{Applied Force:} & (2.0\hat{i} & + \; 5.0\hat{j}) \end{array}$$

$F \cdot d = (8 * 2) + (3 * 5)$

$16 + 15 = \boxed{31\,J}$ magnitude

$$\cos\theta = \frac{F\cdot d}{|F||d|} = \frac{31}{\sqrt{29}\sqrt{73}}$$

$$|F| = r = \sqrt{x^2+y^2} = \sqrt{2^2+5^2} = \sqrt{4+25} = \sqrt{29}$$

$$|d| = r = \sqrt{x^2+y^2} = \sqrt{8^2+3^2} = \sqrt{64+9} = \sqrt{73}$$

$$\theta = \cos^{-1}\left(\frac{31}{\sqrt{29}\sqrt{73}}\right) = 49.6^\circ$$

$$\boxed{31\ J,\ 49.6^\circ}$$