Lecture 20

Happy St. Pat's !!

(We've learned a lot!)

→ Assignment 5, still, again ...
it never ends.

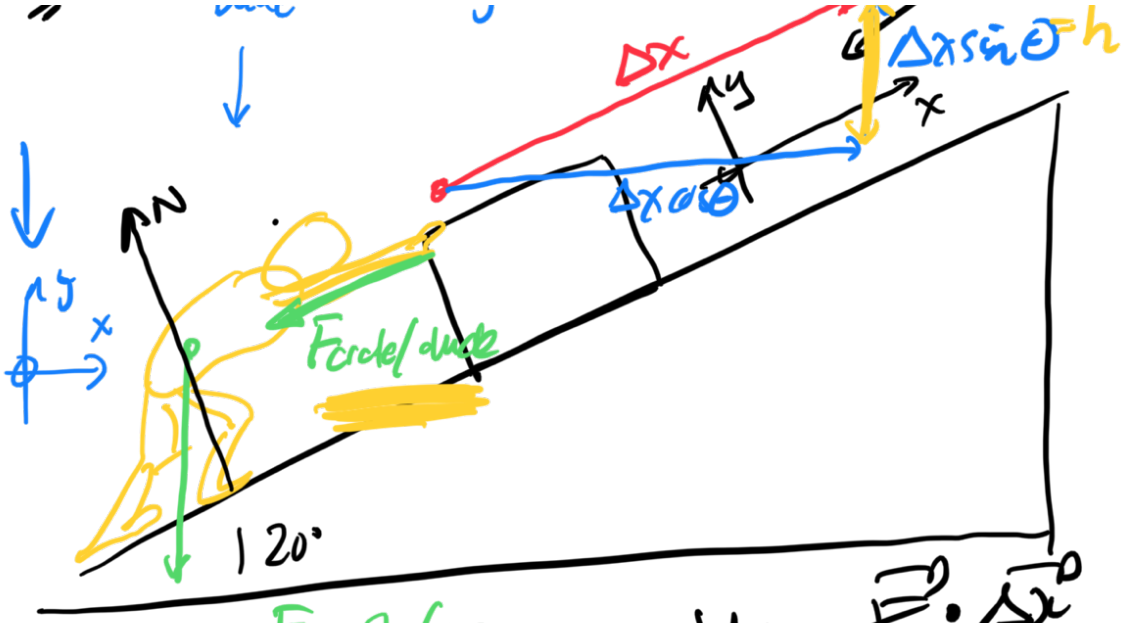
→ Due on Wednesday at 11:59 pm.

→ Spring break starts thursday ...
So no class on Friday.

→ No test next week !!

#9.

Dido is the object of intent!



$W = \vec{F} \cdot \Delta\vec{x}$

$W_{F_{crate}} = -F_{crate} \cdot \Delta x = -(450)(3.95)$

$= -1778\ J$

(<0)

$W_{gravity} = (-mg\hat{j}) \cdot (\Delta x \cos\theta\, \hat{i} + \Delta x \sin\theta\, \hat{j})$

$(=0)$

$a(b+c) = ab + ac$

$\therefore = -mg\,\Delta x \sin\theta$

h!

$W_N = 0 = -(75)(9.8)(3.95)(\sin 20°)$

$= -993\ J$

"constant speed" → $\Delta K = 0$ ∴

$$W_{\text{all forces}} = \Delta K = 0$$

∴ $W_{F_{crate}} + W_g + W_{guy} = 0$

$W_{F_{crate}}$: −ve, W_g: −ve, W_{guy}: +ve

$$-1778 - 993 + W_{guy} = 0$$

$$\therefore W_{guy} = 1778 + 993$$

$$= 2771 \text{ J}$$

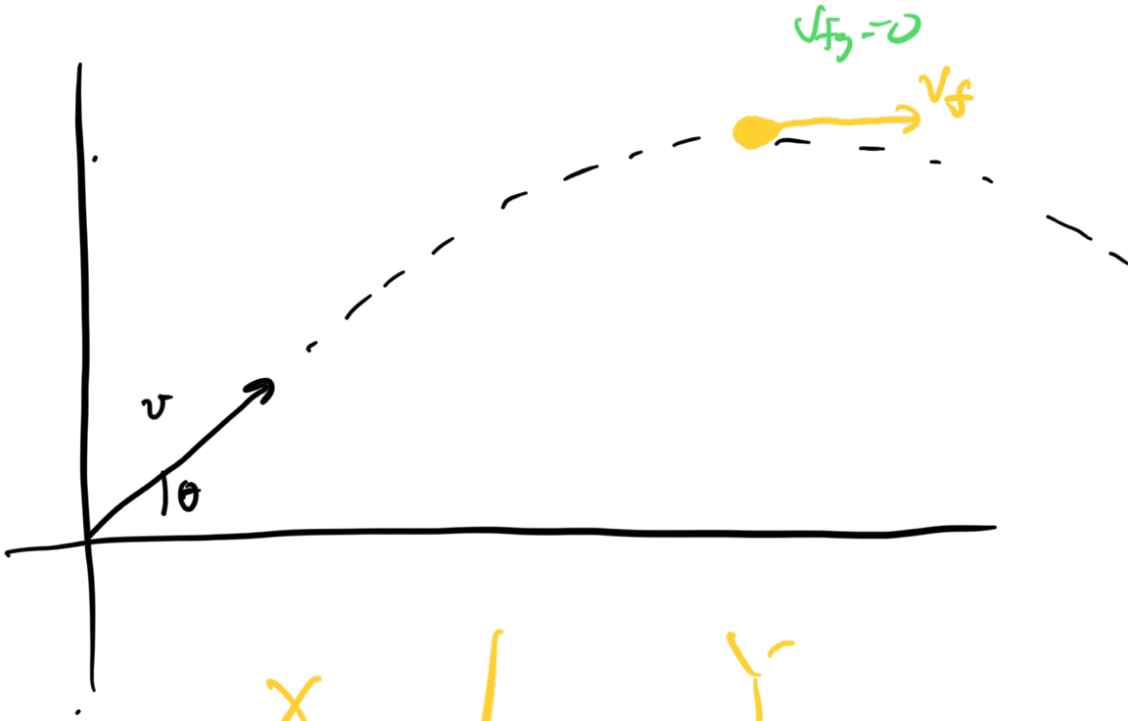
10: $K = \frac{1}{2} m v^2$

a) $120 \frac{\text{km}}{\text{hr}} \times \frac{1000 \text{ m}}{\text{km}} \times \frac{1 \text{ hr}}{3600 \text{ s}}$

hr

11.

$m = 0.150$ kg $\quad K = \frac{1}{2}mv_f^2$



X	Y
$a_x = 0$	$a_y = -g$
$v_{ix} = v\cos\theta$	$v_{iy} = v\sin\theta$
$= (22.6)(\cos 40^\circ)$	$v_{fy} = 0$
$= 17.31$ m/s	

$v_{fx} = v_{ix} + a_x t$ ($a_x t = 0$)

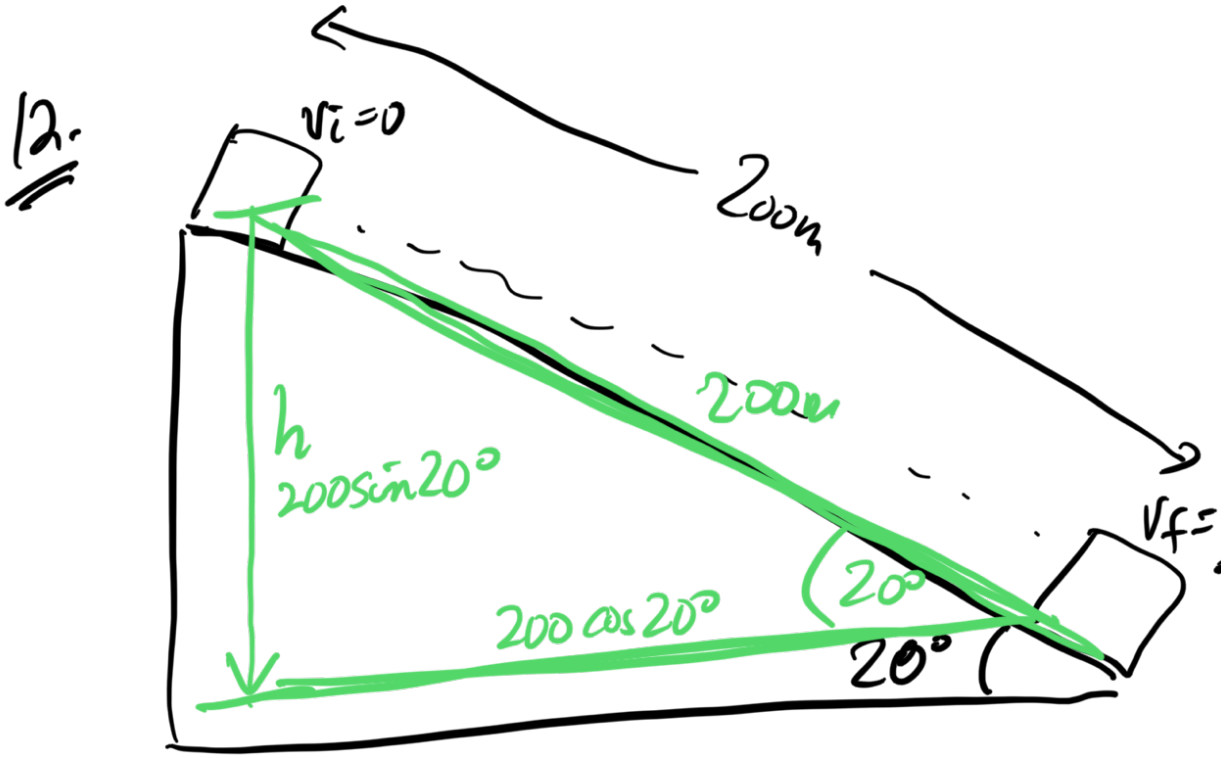
$= 17.31 \text{ m/s}$

$$K = \frac{1}{2} m v_f^2$$

$$= \frac{1}{2}(.15)(17.31)^2$$

$$= 22.5 \text{ J}$$

12.



$$W_g = mgh$$

$h = 200 \sin 20°$

$W_{all\ forces} = \Delta K$

$K_f - K_i$

$$mgh = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

$$v_f^2 = 2gh$$

$$v_f = \sqrt{2gh}$$

$$= \sqrt{2g(200 \sin 20°)}$$

$$= 36.6 \text{ m/s}$$

10 (c) $K = \frac{1}{2}(9.11 \times 10^{-31})(2.1 \times 10^{7}$ m

$= \boxed{2.01 \times 10^{-16} \text{ J}}$

Speed of light

$\boxed{C = 3.0 \times 10^{8} \text{ m/s}}$

nothing can travel faster than the speed of light.

Atoms

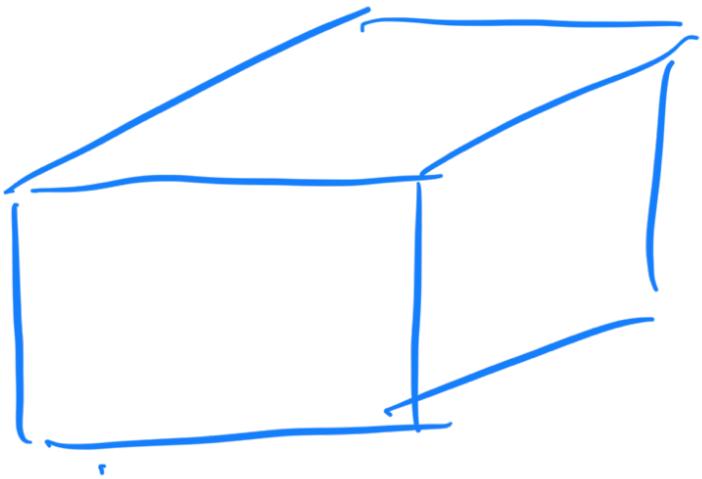
$f = \frac{2.1 \times 10^{7} \text{ m/s}}{}$

3.0×10^{0} m/s

$= 0.07$

7% of the speed of light

Iron → 1 kg



How many atoms?

Periodic Table & the Elements.

$^{56}_{=}Fe$ → $\frac{56}{=}$ g/mol

6.022×10^{23} atoms.

$0.056 \ \frac{kg}{mol}$

$$\frac{1 \text{ kg}}{0.056 \text{ kg}} \rightarrow \frac{N \text{ atoms}}{6.022 \times 10^{23}}$$

$$N_{atoms} = 6.022 \times 10^{23} \times \frac{1}{0.056}$$

$$= 1.07 \times 10^{25} \text{ atoms.}$$

How many electrons?

$^{56}Fe \rightarrow$ 28 protons

28 electrons.

$N_{electrons} \rightarrow 28 \times 1.07 \times 10$

$= 3.0 \times 10^{26}$ electrons

Total kinetic Energy of all of the electrons.

$E = K_{e^-} \times N_{electrons}$

$= (2.0 \times 10^{-16} J)(3.0 \times 10^{}$

$E = 6.02 \times 10^{10} J$

water.

60,000 cars

a) $K = 1.1 \times 10^6$ J

Atomic Energy is

HUGE!