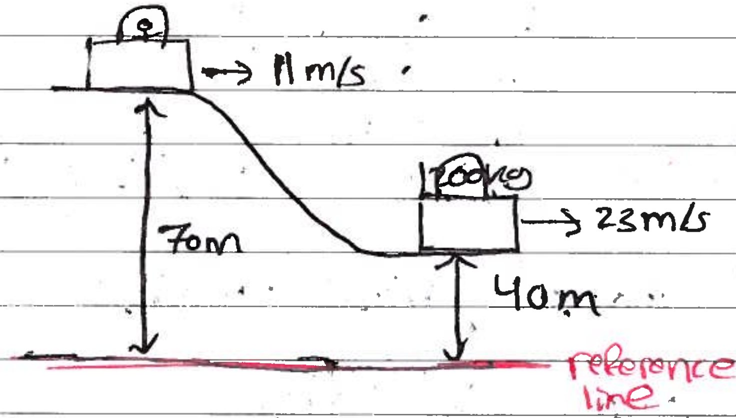
Cons of Energy Solutions #1

1.)



m=1200kg

a.) $\Delta E_g = mgh_2 - mgh_1$

$= (1200)(9.8)(70) - (1200)(9.8)(70)$

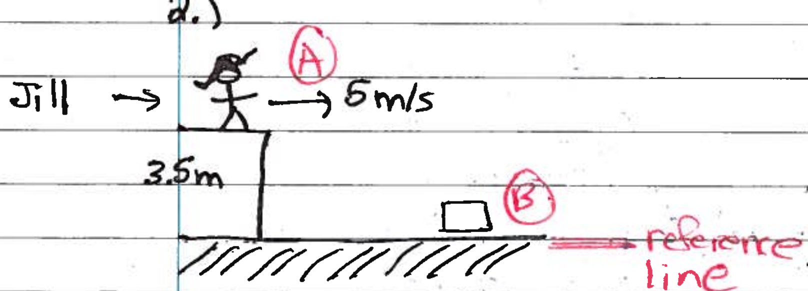
$= \boxed{352\ 800\ J}$

b.) $\Delta E_k = \frac{1}{2}mv_1^2 - \frac{1}{2}mv_2^2 = \frac{1}{2}(1200)(23)^2 - \frac{1}{2}(1200)(11)^2$

$\boxed{= 244\ 800\ J}$

c.) some energy is probabbly lost due to friction. It's given off as heat (unusuable energy)

2.)



$V_A = 5 m/s$ $\quad h_B = 0$

$h_A = 3.5m$ $\quad V_B = ?$

$E_{tot}Ⓐ = E_{tot}Ⓑ$

$\frac{1}{2}\cancel{m}V_A^2 + \cancel{m}gh_A = \frac{1}{2}\cancel{m}V_B^2 + \cancel{m}gh_B$

$\frac{1}{2}V_a^2 + gh_a = \frac{1}{2}V_B^2 + gh_B$

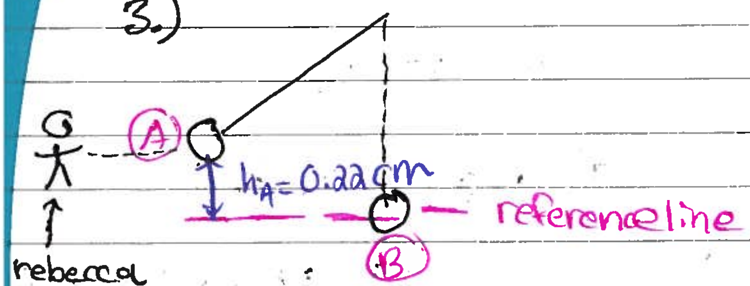
$\frac{1}{2}(5)^2 + (9.8)(3.5) = \frac{1}{2}V_B^2 + \cancel{(9.8)(0)}$

$\frac{1}{2}V_B^2 = 12.5 + 34.3$

$V_B^2 = 93.6$

$\boxed{V_B = 9.67 m/s}$

3.)



$m = 200g = 0.2kg$

$h_A = 0.22cm$

$V_A = 0\,m/s$

$h_B = 0cm$

$V_B = ?$

$E_{tot}^{(A)} = E_{tot}^{(B)}$

assuming 100% →

$$\frac{1}{2}\cancel{m}V_A^2 + \cancel{m}gh_A = \frac{1}{2}\cancel{m}V_B^2 + \cancel{m}gh_B$$

$$\cancel{\frac{1}{2}V_A^2}^{\,0} + gh_A = \frac{1}{2}V_B^2 + \cancel{gh_B}^{\,0}$$

$$\frac{1}{2}V_B^2 = gh_A$$

$$V_B = \sqrt{2gh_A} = \sqrt{2(9.8)(0.22)}$$

$$\boxed{= 2.08\ m/s}$$

∴ the speed of the pendulum is 2.08 m/s

this is really cool! The speed of the pendulum does not depend on the mass! who would have guessed?

$$93\% = \frac{E^{(B)}}{E^{(A)}} \times 100\%$$

→ if ~~80~~ 93% efficient

$$\frac{93\%}{100\%}E^{(A)} = E^{(B)}$$

$$0.93\left[\cancel{\frac{1}{2}mV_A^2}^{\,0} + \cancel{m}gh_A\right] = \frac{1}{2}\cancel{m}V_B^2 + \cancel{mgh_B}^{\,0}$$

$$0.93[gh_A] = \frac{1}{2}V_B^2$$

$$\frac{1}{2}V_B^2 = 0.93(9.8)(0.22)$$

$$\boxed{V_B = 2.00\ m/s}$$

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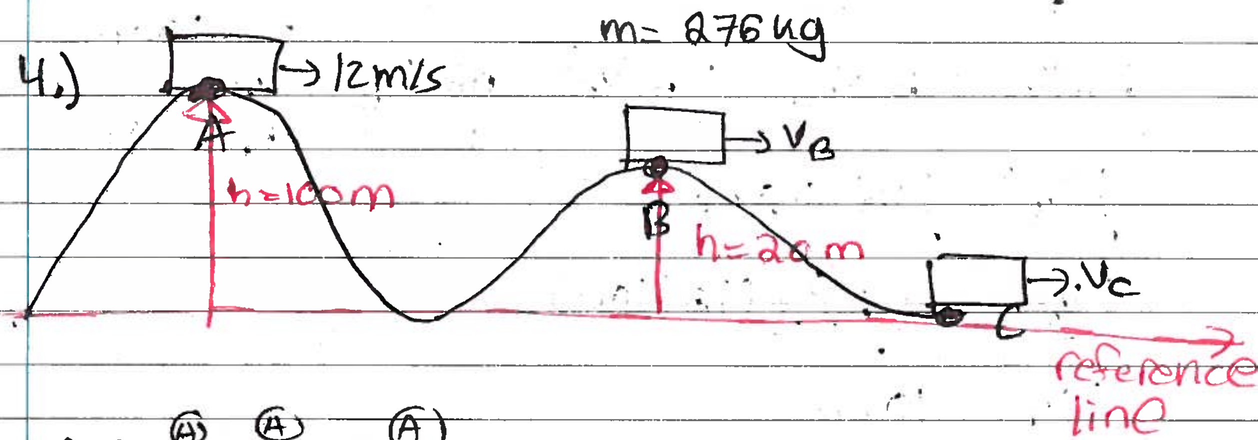
4.)



a.) $E_m^{(A)} = E_K^{(A)} + E_g^{(A)}$

$= \frac{1}{2} m V_a^2 + m g h_a = \frac{1}{2}(275)(12)^2 + (9.8)(276)(100)$

$\boxed{= 289\ 300\ J}$

b.) $E_m^{(A)} = E_m^{(B)}$ [mechanical energy is the same provided no friction]

$\boxed{E_m^{(B)} = 289{,}300\ J}$

d.) $E_m^{(B)} = 289\ 300 = m g h_B + \frac{1}{2} m V_B^2$

$289300 = (275)(9.8)(20) + \frac{1}{2}(275) V_B^2$

did these out of order

$236\ 400 = \frac{1}{2}(275)\ V_B^2$

$V_B^2 = 1712$, $\boxed{V_B = 41.4\ m/s}$

c.) $E_m^{(B)} = 289\ 300 = E_g^{(B)} + E_K^{(B)}$, $E_K^{(B)} = 289\ 300 - E_g^{(B)}$

$E_K^{(B)} = 289300 - m g h_B$

$= 289\ 300 - (275)(9.8)(20)$

$= \boxed{235\ 400\ J}$

e.) $E_m^{A} = E_m^{C}$

$V_A = 12\ m/s$
$h_A = 100\ m$
$V_B = ?$
$h_B = 0\ m$

$\frac{1}{2}\cancel{m}V_A^2 + \cancel{m}gh_A = \frac{1}{2}\cancel{m}V_B^2 + \cancel{mgh_B}$

$h_B = 0$

$\frac{1}{2}V_B^2 = \frac{1}{2}V_A^2 + gh_A$

$\frac{1}{2}V_B^2 = \frac{1}{2}(12)^2 + (9.8)(100)$

$\frac{1}{2}V_B^2 = 1062$

$V_B^2 = 2104$

$\boxed{V_B = 45.9\ m/s}$