A1> Dan needs to give the rock KE such that it will have enough PE to reach the window. Mech E is conserved

A1>

$$E_B = E_T$$

$$\cancel{PE_B}^{0} + KE_B = PE_T + \cancel{KE_T}^{0}$$

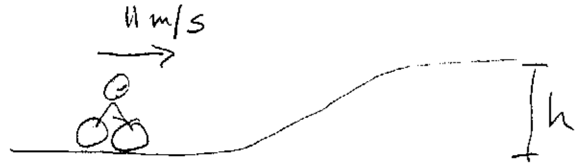
$$\tfrac{1}{2}\cancel{m}v^2 = \cancel{m}gh$$

$$v^2 = 2(9.8)(2.65)$$

$$\boxed{V = 7.21\ m/s}$$

A2> Since she does not have to pedal there must not be any non-conserved forces, so Mech E is conserved, the KE she has will be changed into PE

A2>



m= 50 kg

$$KE_B = PE_T$$

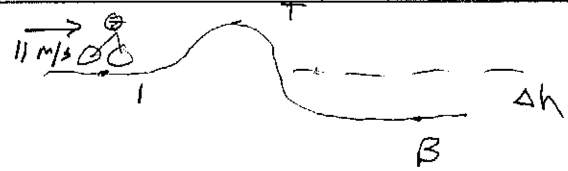
$$\tfrac{1}{2}\cancel{m}v^2 = \cancel{m}gh$$

$$\tfrac{1}{2}(11)^2 = (9.8)h$$

$$\boxed{h = 6.17m}$$

A3> As Amanda heads down the hill her Mech E is conserved and actually increased by the work she does on the pedals, which only convert a part of her work into Mech E

A3>



$$KE_1 + PE_{\Delta h} + W = KE_B$$

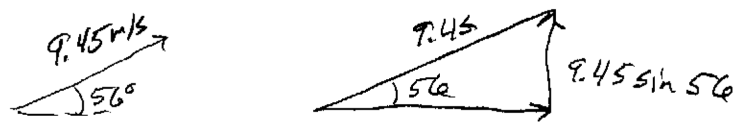
$$\tfrac{1}{2}mv_1^2 + mg\Delta h + (.85)W_A = \tfrac{1}{2}mv_B^2$$

$$\tfrac{1}{2}(50)(11)^2 + (50)(9.8)(5) + (.85)(830) = \tfrac{1}{2}(50)V_B^2$$

$$\boxed{V_B = 15.7\,m/s}$$

A4> The vertical velocity of the ball creates KE that will be converted by gravity to PE at the top of its flight.

A4>



$$KE_V = PE_T$$

$$\tfrac{1}{2}mv^2 = mgh$$

$$\tfrac{1}{2}(9.45\sin 56)^2 = (9.8)h$$

$$\boxed{h = 3.13\,m}$$

A5> The rate that the motor can do work, Power, determines the rate it can move against a resistive force.

A5>

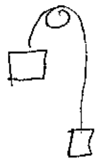
$$P = FV$$

$$75(746) = F(12.5)$$

$$\boxed{F = 4480\,N}$$

A6> When released the Larger mass falls, gravity does work to convert its PE to KE and PE and KE of the Smaller mass. Mech E is conserved

A6>



$$PE_{LT} = KE_{LB} + PE_{ST} + KE_{ST}$$

$$M_L gh = \tfrac{1}{2}M_L V^2 + M_s gh + \tfrac{1}{2}M_s V^2$$

$$(4)(9.8)(1.5) = \tfrac{1}{2}(4)V^2 + (2.5)(9.8)(1.5) + \tfrac{1}{2}(2.5)V^2$$

$$4(9.8)(1.5) - (2.5)(9.8)(1.5) = \left[\tfrac{1}{2}(4) + \tfrac{1}{2}(2.5)\right]V^2$$

$$\boxed{V = 2.60\ m/s \text{ downward}}$$

A7> when you pull the bow back you store elastic PE which does work on the arrow to give it KE that it uses to move through the air. Mech E is not conserved while moving through the air.

A7>

$$PE_{el} \to W \to KE_{ia} \to KE_{fa} + W_{NC}$$

$$PE_{el} = KE_{fa} + W_{NC}$$

$$\tfrac{1}{2}kx^2 = \tfrac{1}{2}mv_f^2 + F_R d$$

$$\tfrac{1}{2}(370)(.3)^2 = \tfrac{1}{2}(.035)(12)^2 + F_R(90)$$

$$\boxed{F_R = 0.157N}$$

A8> enough PE_{elast} must be stored in the spring to do the required work against the resistive force

A8>

$$PE_{elast} = W_{NC}$$

$$\tfrac{1}{2}kx^2 = Fd$$

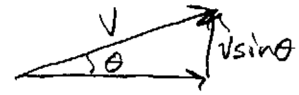
$$\tfrac{1}{2}k(.035)^2 = (2.4)(.78)$$

$$\boxed{k = 3060\ N/m}$$

B1> The gun stores PE_{elast} in the bands that is converted to KE when released the vert comp of the release velocity creates the part of the bands KE that is converted to PE at the top of its path.

B1>

$PE_{el} \rightarrow KE_{Band}$



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

$(33)(.14)^2 = mv^2$

$v = \sqrt{\frac{33(.14)^2}{m}}$

$KE_{vert} = PE_T$

$\frac{1}{2}m(v\sin\theta)^2 = mgh$

$\frac{1}{2}mv^2\sin^2\theta = mgh$

$\frac{1}{2}\cancel{m}\left[\frac{33(.14)^2}{\cancel{m}}\right]\sin^2\theta = mgh$

$\sin^2\theta = mgh \Big/ \frac{33(.14)^2}{2}$

$\sin^2\theta = \frac{m(9.8)(1.25)(2)}{33.(.14)^2}$

$\sin^2\theta = 37.9\,m$

$\boxed{\theta = \sin^{-1}\left[(37.9m)^{1/2}\right]}$

B2> The elastic PE of the spring is going to work against the resisting force

B2>

$PE_{el} = W_{NC}$

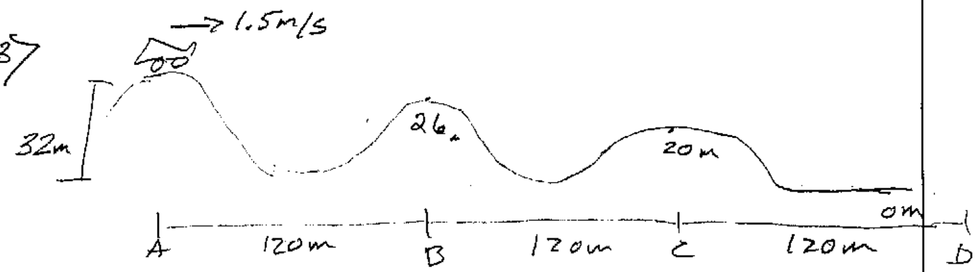
$\frac{1}{2}kx^2 = Fd$

$\frac{1}{2}(270)(.055)^2 = F(75)$

$\boxed{F = 5.44 \times 10^{-3} N}$

B3> The change of PE to KE allows the train to move through the coaster. Mech E is not conserved.

B3>



$mg = 500N$

$KE_A + PE_A \rightarrow W_{AB} + PE_B + KE_B \rightarrow W_{BC} + PE_C + KE_C$

$\rightarrow W_{CD} + KE_D$

$m = \frac{500}{9.8}$

K_B and KE_C and $KE_D \geq 0$

from A to C

$$PE_A + KE_A = W_{AC} + PE_C + \cancel{KE_C}^{\,0}$$

$$mgh_A + \tfrac{1}{2}mv_A^2 = Fd_{AC} + mgh_C$$

$$500(32) + \tfrac{1}{2}\left(\tfrac{500}{9.8}\right)(1.5)^2 = F(240) + 500(20)$$

$$\boxed{F = 25.2\ N}$$

check B $\quad KE_B > 0$

$$PE_A + KE_A = W_{AB} + PE_B + KE_B$$

$$mgh_A + \tfrac{1}{2}mv_A^2 = Fd_{AB} + mgh_B + \tfrac{1}{2}mv_B^2$$

$$500(32) + \tfrac{1}{2}\left(\tfrac{500}{9.8}\right)(1.5)^2 = (25.2)(120) + 500(26) + KE_B$$

$$KE_B = 28.7\ J \checkmark$$

B4) The KE shiv has while running will be transfered to PE as he swings opwards. He will have KE until he gets high enough he will only swing to height twice the length of the rope

B4)

$$KE_R = PE_T + KE_T$$

$$\tfrac{1}{2} m V_R^2 = mgh + \tfrac{1}{2} m V_T^2$$

$$\tfrac{1}{2}(8)^2 = (9.8)(5.5) + \tfrac{1}{2} V_T^2$$

$$V_T^2 = -43.8$$

so he never reachs the max height

$\boxed{\text{Zero}}$

B5) explain

B6)
a) Colleen uses a force to displace the rope a distance

b) Colleen puts in more work than comes out as mechanical work so the rest goes to Work Non-cons or heat.

B6) $n = 20$ $h = 4m$ $m = 35.0\ kg$

$d_p = 12m$ $F = 126.7N$

a) $W_T = Fdn$ $W_T = (126.7)(12)(20)$

$\boxed{W = 30400\ J}$

b) $W_{out} \to PE\,n = mgh(20) = 35(9.8)(4)(20)$

$W_{out} = 27440\ J$

$$W_T - W_{out} = W_{NC}$$

$$30408 - 27440 = W_{NC}$$

$\boxed{2970\ J}$