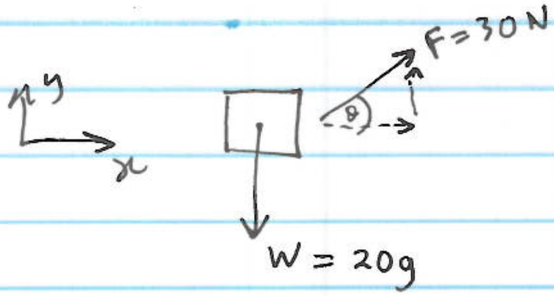
F 14 − 7



actual motion only in x plane

$$\Sigma F_x = m a_x$$

$$30 \cos\theta = 20 a_x$$

$$a_x = \frac{30}{20}\left(\frac{4}{5}\right) = 1.2 \ m/s^2$$

[illegible]

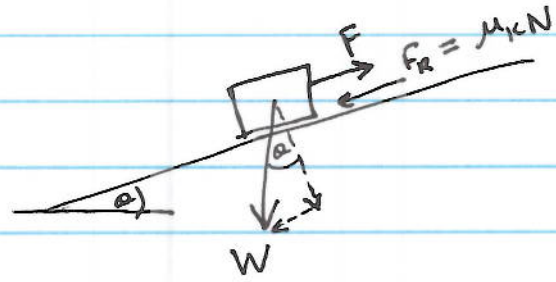
$$V_x = u_x + a_x t$$

$$V_x = 0 + 1.2(4) = 4.8 \ m/s$$

[illegible]

$$P = F\cos\theta . V = 30\left(\frac{4}{5}\right) . 4.8 = 115 \ W$$

F14 – 10



by Newton's 2nd Law (along the plane)

$$\Sigma F = ma \quad , \quad a = 0$$

$$F - F_R - W \sin\theta = 0$$

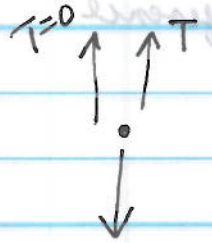
$$F - 0.2\,(20)\,(9.81)\cos 30 - 20(9.81)\sin 30 = 0$$

$$F = 132.08 \text{ N}$$

$$\text{Power} = FV = 132.08\,(5)$$

$$= 660.4 \text{ Watts}$$

F 14 – 11



$$T = 50(9.81) = 490.5 \text{ N}$$

$$P = Fv = 490(1.5) = 735.7 \text{ W}$$

but $\varepsilon = \dfrac{\text{power output}}{\text{power input}}$

$$\text{input} = \frac{\text{output}}{\varepsilon} = \frac{735.7}{0.8} = 920 \text{ W}$$

F 14 – 12

Using the high pulley as our Datum

$L = 2S_A + S_m$

differentiating

$0 = 2V_A + V_m$

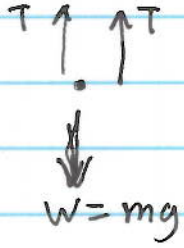
$V_m = -2V_A$

and

$a_m = -2a_A$

so $V_A = -6$ m/s

$a_A = -3$ m/s^2



$\Sigma F = 2T - mg = ma$

$2T - 50(9.81) = 50(3)$

$T = \frac{150 + 490.5}{2} = 320.25$

Power output (using bucket) $= TV$

$= 2(320.25)(6) = 3843$ W

$\text{input} = \frac{3843}{0.8} = 4803.75$ W

F 14 - 51

Use bottom of elevator as Datum ↑+

$$l_1 = -s_c + s_m + (s_m - s_B)$$

$$l_1 = -s_c + 2s_m - s_B$$

$$s_c + s_B = 2s_m$$

$$v_c + v_B = 2v_m$$

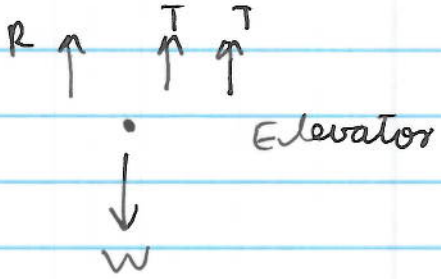
$$a_c + a_B = 2a_m$$

$$l_2 = 2(s_m - s_A)$$

$$v_m = v_A$$

$$a_m = a_A$$

$\Sigma F = ma$



for hoist $a_m = 1.5\ m/s^2$

$\Rightarrow a_A = 1.5\ m/s^2$

14 – 63

$P = Fv$

$\Sigma F = ma.$

$\Rightarrow \quad a = \dfrac{20 \times 1000}{100{,}000} N = 20 \ m/s^2$

$v = u + at$

$v = 0 + 20t = 20t$

$P = 20\,000\,(20t)$

$P = 400\,000\,t \quad W.$