3B.1 Level 2 #1

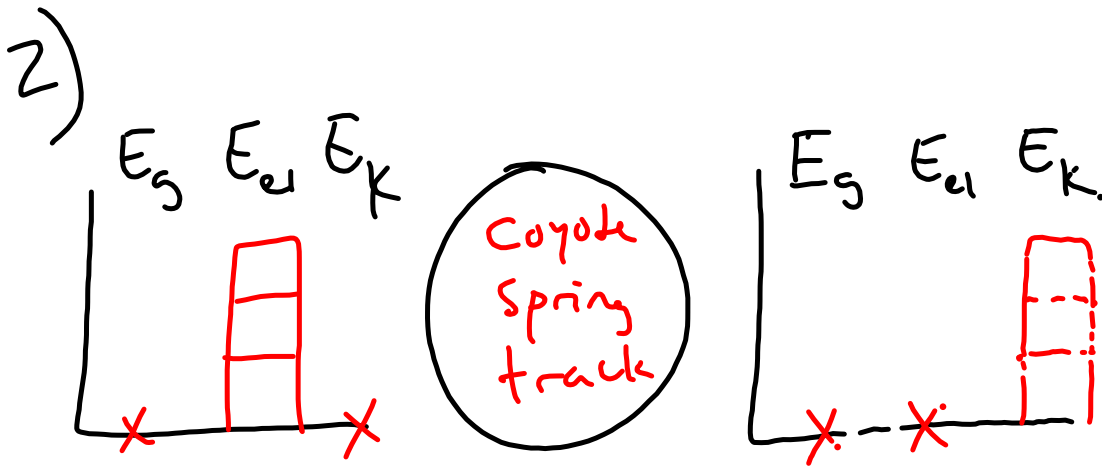1) E_g E_{el} E_k Slide child Earth E_g E_{el} E_k

$$E_{gi} = E_{kf}$$

$$\cancel{m}gh_i = \frac{1}{2}\cancel{m}v_f^2$$

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

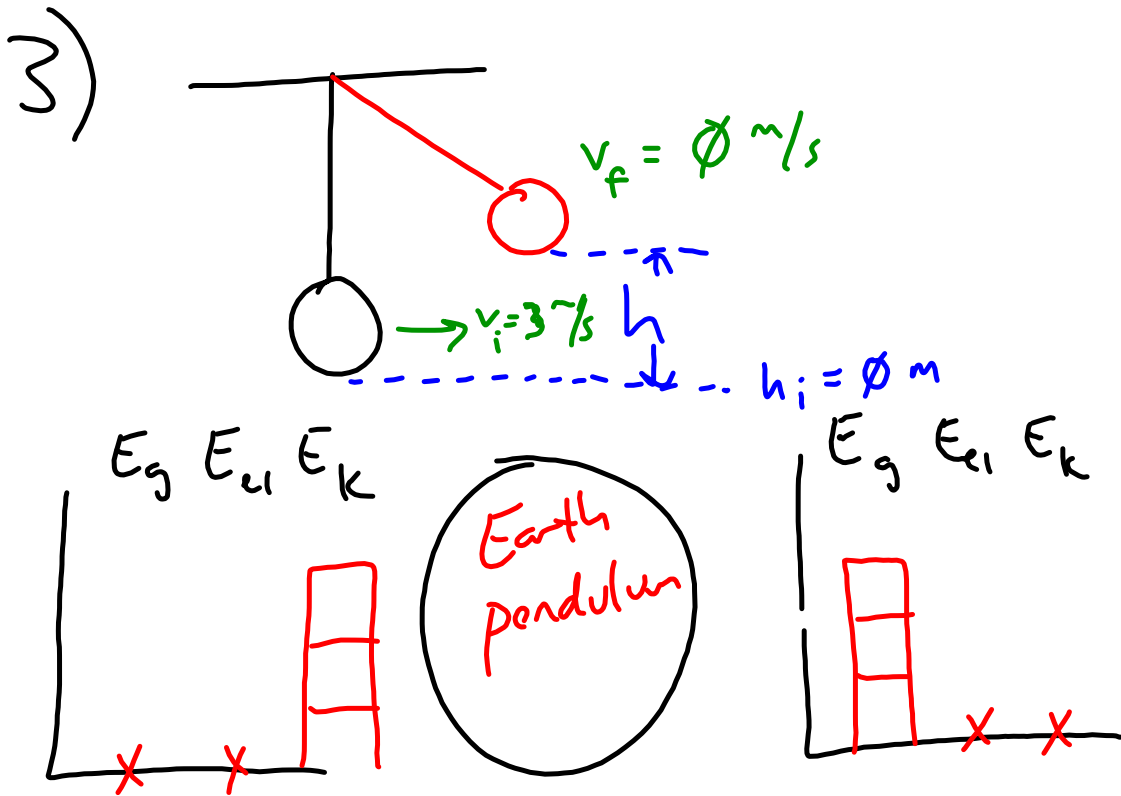$$= \pm\sqrt{2(9.8 \text{ m/s}^2)(4 \text{ m})}$$

$$= 8.85 \text{ m/s}$$

2)

$E_g \quad E_{el} \quad E_k$ Coyote Spring track $E_g \quad E_{el} \quad E_k$

$$E_{el} = E_k$$

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

$$V = \pm\sqrt{\frac{kx^2}{m}}$$

$$= \sqrt{\frac{(650 \, N/m)(0.6m)^2}{(55 kg)}}$$

$$= 2.06 \, m/s$$

3)

$v_f = \emptyset \, \text{m/s}$

$\rightarrow v_i = 3 \, \text{m/s}$ h

$h_i = \emptyset \, \text{m}$

$E_g \quad E_{el} \quad E_k$ $E_g \quad E_{el} \quad E_k$

Earth
Pendulum

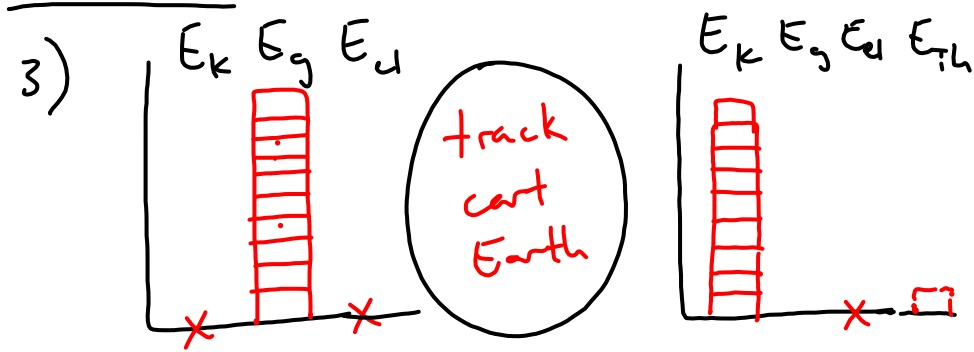$$E_{ki} = E_{gf}$$

$$\frac{1}{2} \cancel{m} v_i^2 = \cancel{m} a_g h_f$$

$$h_f = \frac{v_i^2}{2 a_g}$$

$$= \frac{(3 \, \text{m/s})^2}{2(9.8 \, \text{m/s}^2)}$$

$$= 0.45 \, \text{m}$$

WS 4:

3)

$E_k \quad E_g \quad E_{el}$ track cart Earth $E_k \quad E_g \quad E_{el} \quad E_{Th}$

$$E_{gi} = ma_g h$$

$$= (40 \, kg)(9.8 \, m/s^2)(5 \, m)$$

$$= 1960 \, J$$

$$E_{th} = 0.1 \left(E_{gi} \right) = 0.1 (1960 \, J)$$

$$= 196 \, J$$
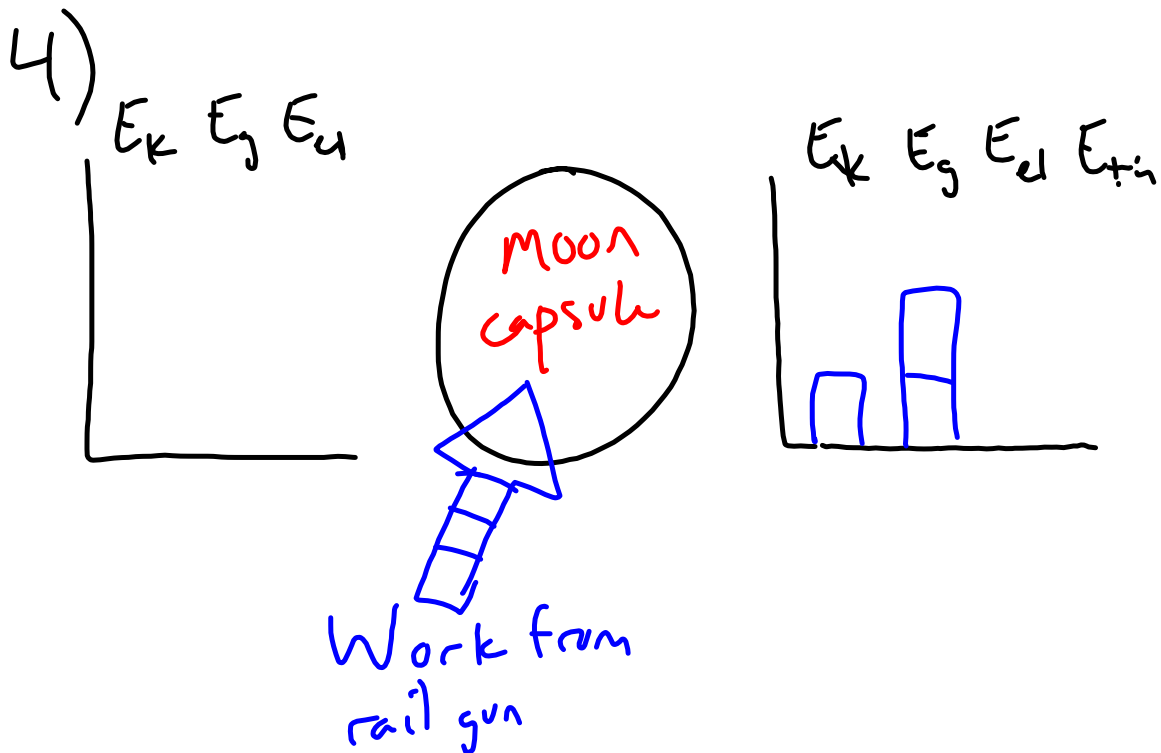
$$E_{gi} = E_{kf} + E_{th}$$

$$E_{gi} = \frac{1}{2} m v_f^2 + E_{Th}$$

$$\frac{1}{2} m v_f^2 = E_{gi} - E_{Th}$$

$$v_f = \sqrt{\frac{2(E_{gi} - E_{Th})}{m}}$$

$$= \sqrt{\frac{2(1960 \, J - 196 \, J)}{40 \, kg}}$$

$$= 9.39 \, m/s$$

4)

E_k E_g E_{el}

Moon capsule

E_k E_g E_{el} E_{th}

Work from rail gun

$$W = E_{kf} + E_{gf}$$

$$= \frac{1}{2} m v_f^2 + m a_g h_f$$

$$= \frac{1}{2}(10000 kg)(1700 \text{ m/s})^2 +$$

$$(10000 kg)(1.6 \text{ m/s}^2)(10000 \text{ m})$$

$$= 1.44 E10 J + 1.6 E9 J$$

$$= 1.6 E10 J$$