

Homework 5.6 – Movement means Energy II

1.

$$\begin{aligned} \text{(a)} \quad E_p &= mgh & m &= 300\text{kg} \\ &= 300 \times 10 \times 30 & g &= 10\text{N/kg} \\ &= 90,000\text{J} & h &= 30\text{m} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad E_p &= mgh & m &= 300\text{kg} \\ &= 300 \times 10 \times 2 & g &= 10\text{N/kg} \\ &= 6,000\text{J} & h &= 2\text{m} \end{aligned}$$

(c) Using the conservation of energy, the kinetic energy on the rollercoaster at 2m above the ground is equal to the initial potential energy less the potential energy 2m above the ground.

So

$$\begin{aligned} E_k &= 90,000\text{J} - 6,000\text{J} \\ &= 84,000\text{J} \end{aligned}$$

2. The kinetic energy of a vehicle is affected by

- i) the mass of the vehicle
- ii) the speed of the vehicle

3.

$$\begin{aligned} \text{(b)} \quad \text{Power} &= \frac{\text{work}}{\text{time}} = \frac{E_p}{\text{time}} = \frac{mgh}{t} & m &= 300\text{kg} \\ & & g &= 10\text{N/kg} \\ & & h &= 2\text{m} \end{aligned}$$

so

$$\text{Power} = \frac{mgh}{t} = \frac{100 \times 10 \times 4}{20} = 200\text{W}$$

4.
(b)

$$m = 800\text{kg}$$
$$v = 30\text{m/s}$$

$$E_k = \frac{1}{2}mv^2$$
$$= \frac{1}{2} \times 800 \times (30)^2$$
$$= \frac{1}{2} \times 800 \times 900$$
$$= 360000\text{J}$$