

Work and Power

- ◆ Work is done when a force moves an object or changes its direction. It is measured in _____.

- ◆ Rule for Work

$$\begin{array}{l} \text{Work} \\ \text{(in Joules)} \end{array} = \begin{array}{l} \text{Force} \\ \text{(in Newtons)} \end{array} \times \begin{array}{l} \text{Displacement} \\ \text{(in metres)} \end{array}$$
$$W = F \times s$$

- ◆ Power is the rate at which _____ is done. Power is measured in _____.

- ◆ Rule for Power

$$\begin{array}{l} \text{Power} \\ \text{(in Watts)} \end{array} = \begin{array}{l} \text{Work} \\ \text{(in Joules)} \end{array} / \begin{array}{l} \text{Time} \\ \text{(in seconds)} \end{array}$$
$$P = W / T$$

Questions

1. Why are both energy and work measured in Joules?
2. A ball with a weight of 30 Newtons is kicked 2 metres into the air. What work has been done?
3. A weightlifter lifts 2 weights of 200 Newtons each up to a height of 1 metre. What work has he done?
4. A furniture removalist lifts a box weighing 500 N into the back of a truck which is 1.5 metres above the ground. How much work has he done?
5. A 60 kilogram athlete runs up a 3 metre flight of stairs. What work has she done? (Assume $g = 9.8\text{m/s}^2$)
6. How much work does it take to push a 1 tonne truck a distance of 10 metres? (Assume $g = 9.8\text{m/s}^2$)
7. If a person does 6000 Joules of work in one minute, what power has he?
8. A bulldozer does work at a rate of 12 000 000 N every minute. How powerful is it?
9. A car with a forward force of 6000 N drives a distance of 1 kilometre in 1 minute. How much power does it have?
10. If the athlete in Q5 ran up the stairs in 3.5 seconds. How powerful is she?

Answers

1. It takes energy to do work 2.60J 3.400J 4.750J 5.1764J
6.98000J 7.100W 8.200000W 9.100000W 10.504W