

## Work and Energy and Power 1

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Use the ideas of work and energy to solve the following problems.

1. An object of mass 4kg is thrown vertically upwards with a speed of  $6\text{ms}^{-1}$ . Assuming no air resistance, find the maximum height it reaches.
2. (a) An object of mass 5kg is dropped from the top of a tower of height 100m. Assuming no air resistance, find the speed with which it hits the ground.  
(b) An object of mass 3kg is thrown vertically downwards with an initial speed of  $20\text{ms}^{-1}$  from the top of a tower of height 150 m. Calculate the speed with which the object hits the ground. Ignore air resistance.
3. A particle of mass 6kg is initially stationary at a point A on a horizontal smooth surface. A person pushes the particle with a force of 15N along a straight line from point A to point B on the smooth surface. The distance AB is 20m. The force of 15N is applied continuously along the 20m distance. Assume there is no air resistance.
  - (a) Calculate the work done by the person pushing the particle.
  - (b) Calculate the kinetic energy of the particle when it reaches point B.
  - (c) Calculate the speed of the particle when it reaches B.
4. A cyclist starts from rest and cycles along a straight line. From the start he continuously pedals the bicycle to produce a constant driving force of 150N. The total mass of the cyclist and the bicycle is 80kg.  
  
Calculate the speed of the cyclist when he is 100m away from his starting point.
5. Repeat each of Question 1 to Question 4 assuming that there is a constant force of magnitude 10N resisting the motion.

6.



A car moving at a constant speed of 15 m/s starts accelerating due to a driving force of 500 N.

The car travels with this driving force over a distance of 20 m.

Assume that there are no forces opposing the motion of the car.

The total mass of the car and the passengers inside is 800 kg.

- (a) Calculate the initial kinetic energy of the car and the passengers.
- (b) Calculate the work done by the driving force.

- (c) What speed does the car reach after travelling the 20 m distance?
7. An object of mass 10kg thrown vertically upwards reaches a maximum height of 12m.
- (a) Assuming no air resistance, calculate the initial speed of projection of the object.
- (b) In fact the object experiences a constant air resistance of 5N during its motion. Use this information to work out the initial speed of projection of the object. Calculate the speed with which the object hits the ground on its return journey, assuming the same size of air resistance.
8. A motor is used to lift a 100 kg load through a vertical height of 30 m. Given that the output power of the motor is 1.25 kW, calculate the time it took to lift the load through the 30 m vertical height.