Work Done and Kinetic Energy

Specification: AQA 7367: MC1, MC3 · Edexcel 9FM0: FM1 Work, energy and power

INDEPENDENT

You do

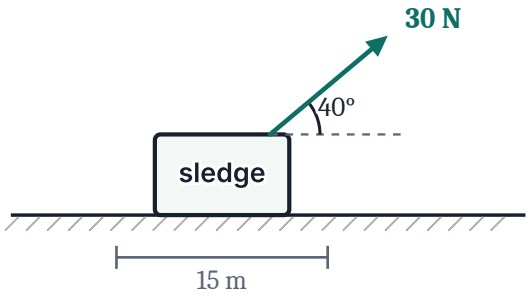
A · Work done Forces along the motion, then at an angle.

1 A horizontal force of 25 N pulls a box 8 m along a horizontal floor. Find the work done by the force.

2 A train travels 0.4 km against a constant resistance of 12 kN. Find the work done against the resistance.

3 A constant force does 630 J of work moving an object 14 m in the direction of the force. Find the force.

4 A rope with tension 30 N at 40° to the horizontal pulls a sledge 15 m across horizontal ground. Find the work done by the tension.



B · Kinetic energy Convert to kg and m s^{-1} first.

5 Find the kinetic energy of a ball of mass 3 kg moving at 4 m s^{-1}.

6 Find the kinetic energy of a car of mass 1.2 tonnes travelling at 90 km h^{-1}.

7 A ball of mass 0.2 kg has 14.4 J of kinetic energy. Find its speed.

8 A particle moving at 6 m s^{-1} has 54 J of kinetic energy. Find its mass.

C · Reasoning (no calculator) Explain in words as well as numbers.

9 The speed of a body doubles. What happens to its kinetic energy? Explain.

10 A box slides along a horizontal floor. Explain why the normal reaction does no work on the box.

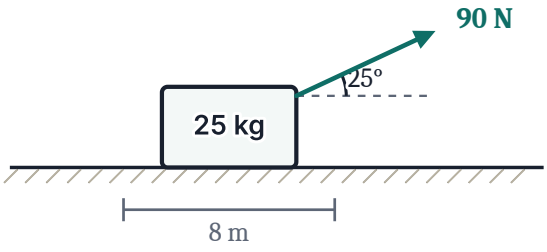
11 A force of 50 N pulls a box 10 m along a horizontal floor. The force does 250 J of work. Find the angle between the force and the floor.

D · Work–energy principle Total work done = change in kinetic energy. Take g = 9.8 m s^{-2}.

12 A particle of mass 4 kg is at rest on a smooth horizontal surface. A horizontal force of 18 N acts on it while it moves 9 m. Find its final speed.

13 A car of mass 1500 kg slows from 30 m s^{-1} to 12 m s^{-1} over 120 m on a horizontal road. Find the constant braking force.

14 A box of mass 25 kg is pulled from rest 8 m across a rough horizontal floor by a rope at 25° above the horizontal. The tension is 90 N and the coefficient of friction is 0.2. Take g = 9.8 m s^{-2}. Find the speed of the box.



15 A car travelling at speed u brakes on a horizontal road with its wheels locked. The coefficient of friction between the tyres and the road is μ.
(a) Show that the car stops in a distance $u^2/(2\mu g)$.
(b) Explain why this distance does not depend on the mass of the car.

E · Exam-style question Show your method: marks are for working.

16 A sled of mass 40 kg is pulled from rest across rough horizontal snow by a rope at $20°$ above the horizontal. The tension is 150 N and the coefficient of friction is 0.15. Take $g = 9.8$ m s^{-2}.
(a) Show that the normal reaction is 341 N to 3 s.f. [2]
(b) Find the work done against friction over 30 m. [2]
(c) Use the work–energy principle to find the speed after 30 m. [3]
(d) State one modelling assumption. [1]

