

Work done, energy conservation and power

Physics grades 11-12 (A Level · IB · Class 11-12) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test lasts 45 minutes and is worth 20 marks. Calculators are allowed. Use $g = 9.81 \text{ N/kg}$, show every step of each calculation and give final answers with sensible significant figures and units.

Level: Physics grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** IB A.3

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Definitions (2 marks)

- Define work done by a force. (1 mark)
- State the work-energy theorem. (1 mark)

Question 2 Rope on a sack (3 marks)

Tendai in Harare drags a sack along level ground with a rope at 25° above the horizontal. The rope force is 90 N and the sack moves 8.0 m. Friction is a constant 40 N.

- Calculate the work done by the rope. (2 marks)
- Calculate the net work done on the sack. (1 mark)

Question 3 Carrying a box (2 marks)

A porter carries a box at constant speed along a level corridor. Explain why the work done on the box by the porter's lifting force is zero.

Question 4 Smooth and rough ramp (3 marks)

A trolley of mass 2.0 kg is released from rest at a vertical height of 0.45 m on a ramp. Use $g = 9.81 \text{ N/kg}$.

- Calculate its speed at the bottom if the ramp is smooth. (2 marks)
- Friction does 1.5 J of work on the way down. Calculate the new speed. (1 mark)

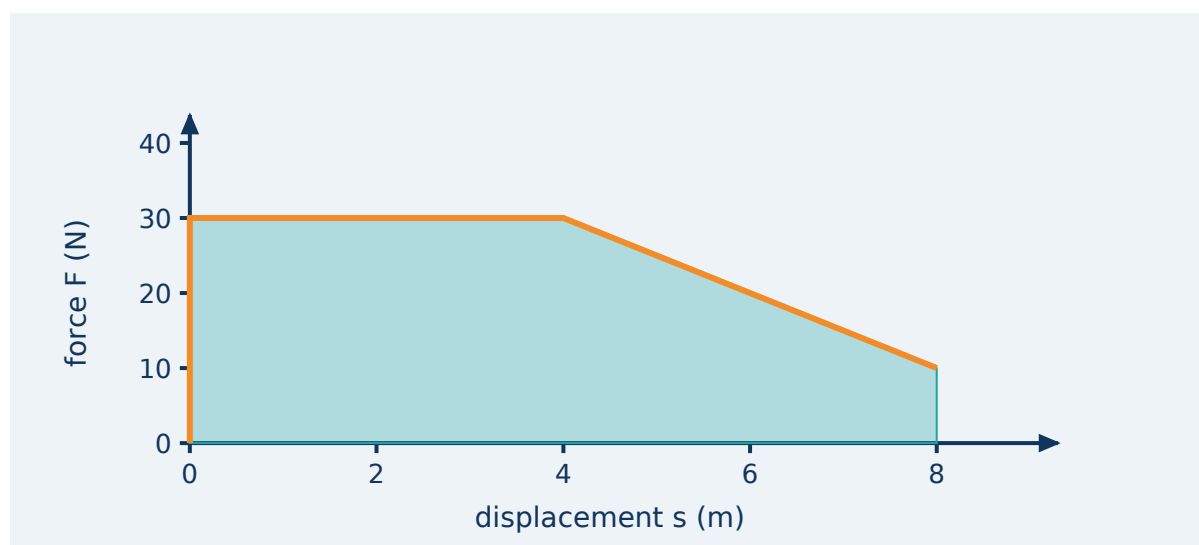
Question 5 Hoist efficiency (3 marks)

A hoist motor takes 900 W of electrical power and raises a 120 kg load at a constant 0.50 m/s.

- Calculate the useful power output. (2 marks)
- Calculate the efficiency. (1 mark)

Question 6 Force-displacement graph (3 marks)

The graph shows the force on a 5.0 kg trolley that starts from rest on a smooth track.



Force acting on a 5.0 kg trolley.

- Calculate the work done from 0 to 4 m. (1 mark)
- Calculate the work done from 4 m to 8 m. (1 mark)
- Calculate the speed at 8 m. (1 mark)

Question 7 Doubling the speed (2 marks)

A lorry brakes with a constant force. Explain why the stopping distance becomes four times as large when the starting speed doubles.

Question 8 Heavy and light balls (2 marks)

A student claims that, ignoring air resistance, a heavy ball dropped from 4.0 m reaches the ground faster than a light ball. Use energy to evaluate the claim.