

Work, kinetic energy and the net-work theorem

AP Physics 1 (algebra-based) · Test

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

This test covers work, kinetic energy and the work-energy theorem at AP Physics 1 level. Use $g = 9.81 \text{ m/s}^2$. Show all working for calculations, include units and use full sentences in the written parts. Calculators are allowed.

Level: AP Physics 1 (algebra-based) · **Curriculum:** AP P1 Unit 3

Time: 40 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Definition and theorem (2 marks)

State the work-energy theorem and give the SI base-unit form of the joule.

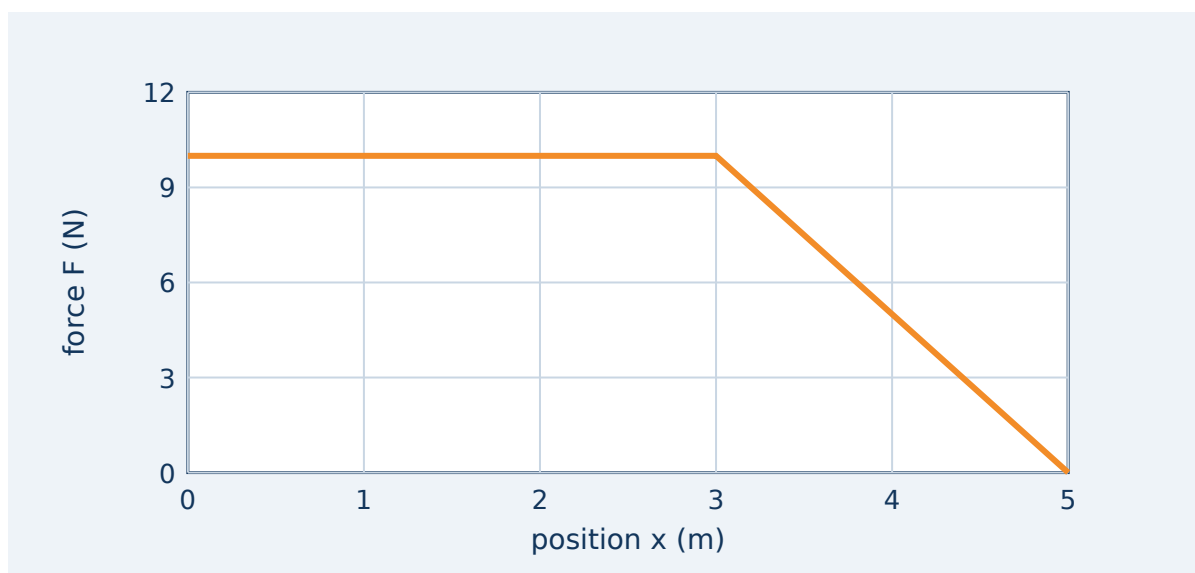
Question 2 Arrow in a target (3 marks)

A 0.040 kg arrow travelling at 55 m/s embeds 0.12 m deep in a straw target.

- Calculate the arrow's kinetic energy. (1 mark)
- Calculate the average force stopping the arrow. (1 mark)
- Calculate the depth if the same arrow arrived at 110 m/s with the same force. (1 mark)

Question 3 Variable force on a block (4 marks)

A 4.0 kg block starts from rest at $x = 0$ on a smooth surface. The force on it is shown.



Force on a 4.0 kg block against position.

- Calculate the work done between 0 and 5.0 m. (2 marks)
- Calculate the speed at $x = 5.0$ m. (2 marks)

Question 4 Hauling firewood (4 marks)

Chiamaka in Lagos pulls a 40 kg load of firewood 25 m with a rope force of 90 N at 30° above the horizontal. Friction on the load is 55 N. The load starts at rest.

- Calculate the work done by the rope. (1 mark)
- Calculate the work done by friction. (1 mark)
- Calculate the final speed. (2 marks)

Question 5 Satellite in orbit (3 marks)

A satellite moves at constant speed on a circular orbit around the Earth. Write a short paragraph explaining, using work, why its kinetic energy does not change although gravity acts on it all the time.

Question 6 Lifting two ways (2 marks)

A box is raised 1.5 m, first by lifting it straight up and then by pushing it slowly up a frictionless ramp to the same height. Compare the work done by gravity in the two cases and justify the answer.

Question 7 Speed scaling (1 mark)

A cyclist triples her speed. By what factor does her kinetic energy change?

Question 8 Gradient meaning (1 mark)

A graph of kinetic energy against distance for a cart is a straight line through the origin.
State what its gradient represents.