

Energy conservation, bar charts and power

AP Physics 1 (algebra-based) · Test

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

This test covers potential energy, conservation of energy with and without friction, and power. Show all working and give units. A calculator is allowed.

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

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

Question 1 Power and energy (2 marks)

- State what is meant by power. (1 mark)
- A 60 W lamp is left on for 2.0 hours. Calculate the energy it transfers, in joules. (1 mark)

Question 2 Book on a shelf (2 marks)

Emma lifts a 2.4 kg book from the floor to a shelf 1.6 m high.

- Calculate the gain in gravitational potential energy. (1 mark)
- The book falls off the shelf. Calculate its speed just before it hits the floor, ignoring air resistance. (1 mark)

Question 3 Playground swing (3 marks)

A 40 kg child on a swing is released from rest at a point 0.80 m above the lowest point of the swing.

- Calculate the child's speed at the lowest point. (2 marks)
- Calculate the kinetic energy there. (1 mark)

Question 4 Dart gun (2 marks)

A spring ($k = 300 \text{ N/m}$) in a toy gun is compressed by 0.040 m and launches a 0.015 kg dart horizontally.

- Calculate the energy stored in the spring. (1 mark)
- Calculate the launch speed of the dart. (1 mark)

Question 5 Sliding crate (3 marks)

An 8.0 kg crate slides from rest down a rough ramp, dropping a vertical height of 1.5 m, and reaches 3.0 m/s at the bottom.

- Calculate the loss of gravitational potential energy. (1 mark)
- Calculate the gain in kinetic energy. (1 mark)
- Calculate the thermal energy produced. (1 mark)

Question 6 Pump power (2 marks)

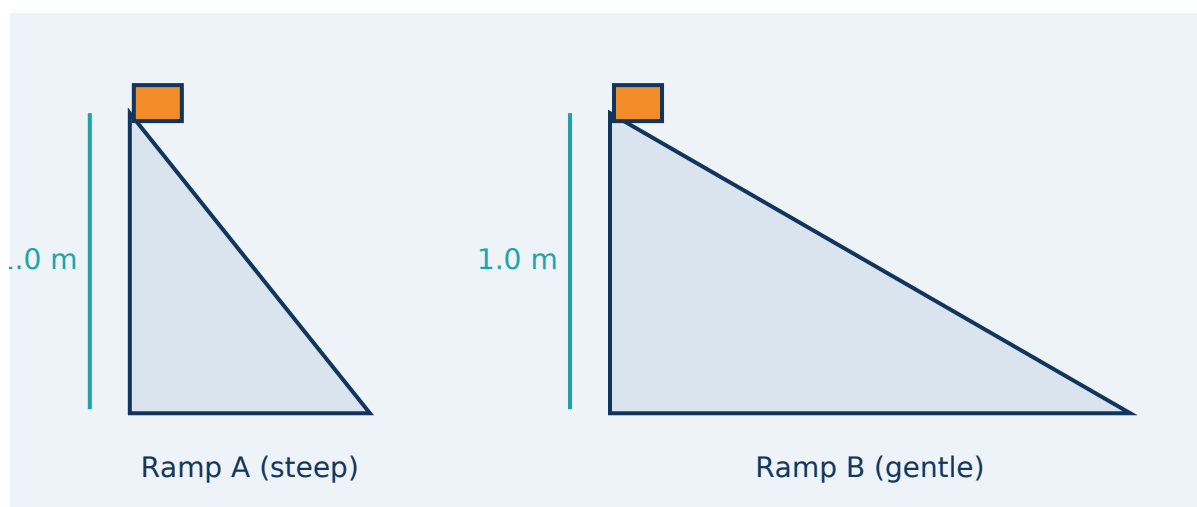
A pump raises 200 kg of water to a tank 15 m higher in 120 s.

- Calculate the gain in gravitational potential energy. (1 mark)
- Calculate the average useful power. (1 mark)

Question 7 Two ramps (3 marks)

Two identical blocks are released from rest at the tops of the smooth ramps shown.

- Compare their speeds at the bottom and justify your answer using energy. (2 marks)
- State which block takes longer to reach the bottom and explain why. (1 mark)



Two blocks of equal mass are released from rest at the tops of the ramps.

Question 8 Hoist with losses (3 marks)

A hoist lifts a 150 kg load at a constant 0.40 m/s. Its motor is 60 % efficient.

- Calculate the useful power delivered to the load. (2 marks)
- Calculate the electrical power the motor draws. (1 mark)