

Friction, slopes, pulleys and springs

AP Physics 1 (algebra-based) · Test

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

This test lasts 45 minutes and is worth 20 points. Use $g = 9.81 \text{ m/s}^2$, show all working, include units and draw free-body diagrams whenever they help.

Level: AP Physics 1 (algebra-based) · **Curriculum:** AP P1 Unit 2

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

Question 1 Kinetic friction (1 mark)

State the equation for kinetic friction and define each symbol. (1 mark)

Question 2 Box on a floor (3 marks)

An 8.0 kg box rests on a floor with $\mu_s = 0.60$.

- Calculate the maximum static friction force. (2 marks)
- State the friction force when a horizontal push of 40 N is applied. (1 mark)

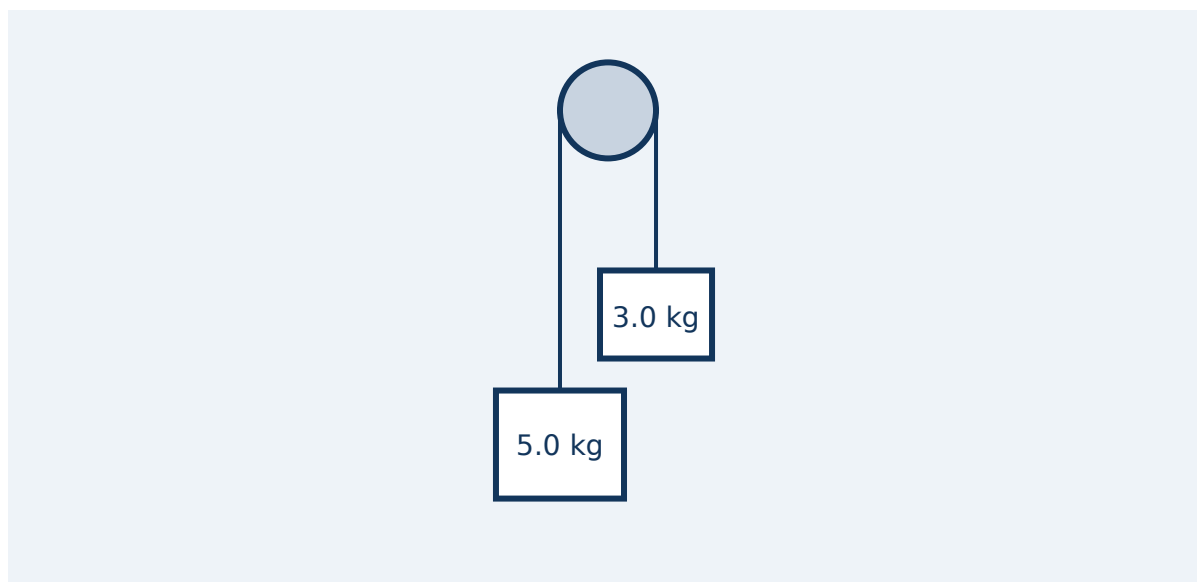
Question 3 Sliding on a slope (3 marks)

A 6.0 kg block slides down a 20° slope with $\mu_k = 0.10$. Calculate its acceleration. (3 marks)

Question 4 Atwood machine (4 marks)

The figure shows masses of 5.0 kg and 3.0 kg over a frictionless pulley.

- Calculate the acceleration of the masses. (2 marks)
- Calculate the tension in the string. (2 marks)



Light string, frictionless pulley.

Question 5 Spring (3 marks)

A spring with $k = 120 \text{ N/m}$ is stretched by 0.080 m .

- Calculate the force it exerts. (1 mark)
- Calculate the mass that would hang at rest at this stretch. (2 marks)

Question 6 Why μ is not constant (2 marks)

Explain why a larger force is needed to start a heavy crate sliding than to keep it sliding. (2 marks)

Question 7 Stopping on the road (3 marks)

A car travelling at 20 m/s brakes with locked wheels on a road with $\mu_k = 0.70$. Calculate the stopping distance. (3 marks)

Question 8 Sled pulled at an angle (1 mark)

Explain why friction on a sled decreases when the rope is raised above the horizontal. (1 mark)