

Angular motion, torque and balance

AP Physics 1 (algebra-based) · Test

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

This test lasts 45 minutes and is worth 20 points. Take $g = 9.81 \text{ N/kg}$. Show every substitution, include units, and state the direction of each torque. The last question asks for a short written argument.

Level: AP Physics 1 (algebra-based) · **Curriculum:** AP P1 Unit 5

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

Question 1 Definitions (2 marks)

- Define torque and give its SI unit. (1 mark)
- State the two conditions for static equilibrium. (1 mark)

Question 2 Unit conversions (2 marks)

- Convert 120 rpm to rad/s. (1 mark)
- Convert 0.75 rev to radians. (1 mark)

Question 3 Wheel speeding up (3 marks)

A wheel starts from rest and reaches 18 rad/s in 6.0 s with constant acceleration.

- Calculate the angular acceleration. (1 mark)
- Calculate the angle turned in revolutions. (2 marks)

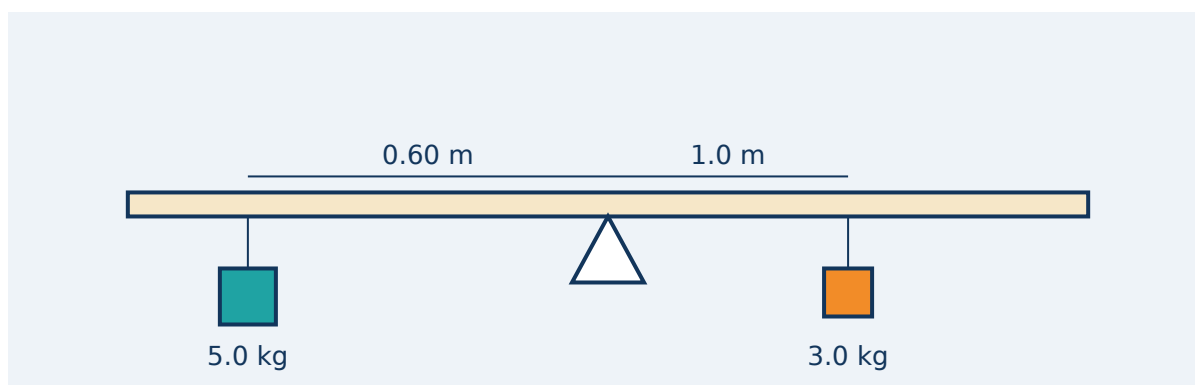
Question 4 Spanner torque (3 marks)

A force of 45 N acts 0.35 m from a nut at 30° to the spanner.

- Calculate the torque about the nut. (2 marks)
- Calculate the perpendicular force at the same point that gives the same torque. (1 mark)

Question 5 Is the plank balanced? (3 marks)

The plank is light and pivoted at its middle.



Two masses hang on the plank.

- Show that the plank is balanced. (1 mark)
- A further 1.0 kg is added to the right-hand mass. Calculate the net torque and its direction. (2 marks)

Question 6 Long handle (2 marks)

Explain why a long-handled spanner loosens a tight nut more easily than a short one.

Question 7 Beam and cable (3 marks)

A uniform 1.6 m beam of mass 6.0 kg is hinged to a wall and held horizontal by a vertical cable at the free end.

- Calculate the tension in the cable by taking torques about the hinge. (2 marks)
- Calculate the vertical force exerted by the hinge. (1 mark)

Question 8 Paragraph argument (2 marks)

A student says an object with zero net force must be in equilibrium. Write a short argument to evaluate this.