

Independent horizontal and vertical motion of projectiles

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

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

This test covers independent horizontal and vertical motion, launch components, range and air resistance. Use a calculator, show your working and give units with every final answer. Take $g = 9.81 \text{ m/s}^2$. The test is worth 20 marks.

Level: Physics grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** A Level 3.4

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

Question 1 Horizontal launch (2 marks)

A ball is projected horizontally from a table. State its horizontal acceleration and its vertical acceleration, ignoring air resistance. (2 marks)

Question 2 Rolling off a platform (3 marks)

A ball rolls off a platform 1.8 m high at 4.0 m/s horizontally.

- Calculate the time to reach the ground. (2 marks)
- Calculate the horizontal distance travelled. (1 mark)

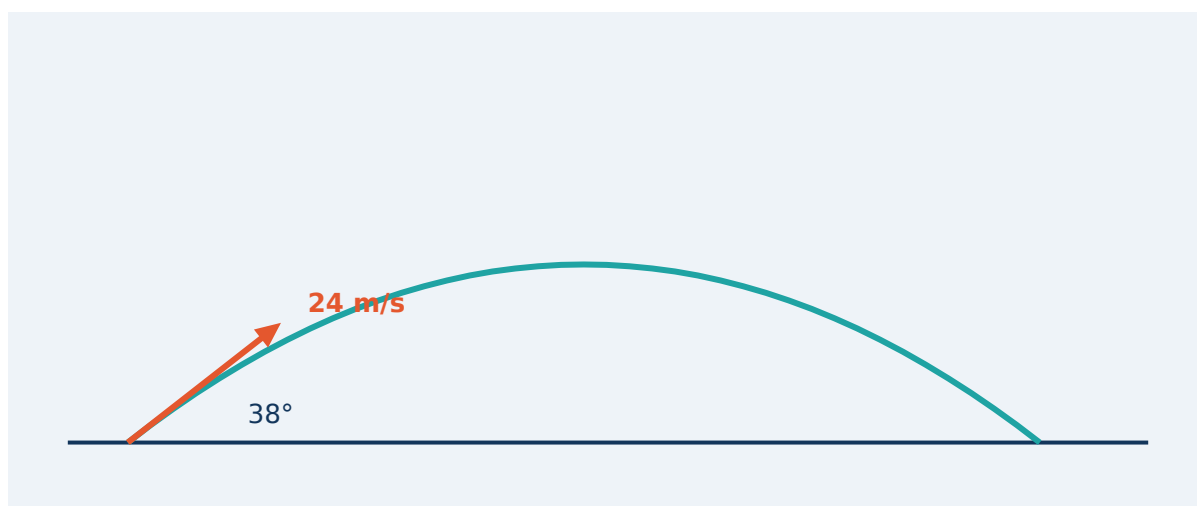
Question 3 Components (2 marks)

A javelin leaves the thrower's hand at 30 m/s at 42° above the horizontal. Calculate the horizontal and vertical components of the velocity. (2 marks)

Question 4 Full trajectory (4 marks)

A ball is kicked at 24 m/s at 38° above the horizontal on level ground, as shown.

- Calculate the time of flight. (2 marks)
- Calculate the range. (1 mark)
- Calculate the maximum height. (1 mark)



Path of the ball.

Question 5 Equal ranges (3 marks)

A ball is thrown at 18 m/s. Show that launch angles of 30° and 60° give the same range on level ground, and calculate it. (3 marks)

Question 6 Air resistance (3 marks)

Describe three ways in which air resistance changes the motion of a football compared with the ideal parabola. (3 marks)

Question 7 Velocity at the top (2 marks)

Explain why the speed of a projectile is smallest at the top of its path, but not zero. (2 marks)

Question 8 Best angle (1 mark)

State the launch angle for maximum range on level ground without air resistance. (1 mark)