



QUESTION WORKBOOK

Projectile motion

Mechanics · Year 12

AQA 3.4.1.4 · CIE 2.1 · OCR A 3.1.3

9 questions · 31 marks

PRINT EDITION

SECTION A · Warm-up

- A1** A projectile is launched horizontally. Explain why its horizontal and vertical motions can be treated separately. [2]

- A2** A ball rolls off a table 1.2 m high with a horizontal velocity of 3.0 m s^{-1} . Taking $g = 9.81 \text{ m s}^{-2}$, calculate the time to reach the floor and the horizontal distance travelled. [3]

- A3** State what happens to the horizontal and vertical components of a projectile's velocity during its flight (ignore air resistance). [2]

SECTION B · Standard

- B1** A stone is thrown horizontally at 20 m s^{-1} from the top of a cliff 45 m high. Taking $g = 9.81 \text{ m s}^{-2}$, calculate (a) the time of flight, (b) the horizontal distance travelled, and (c) the vertical component of velocity just before impact. [4]

- B2** A ball is launched at 25 m s^{-1} at 30° above the horizontal over level ground. Taking $g = 9.81 \text{ m s}^{-2}$, calculate (a) the horizontal and vertical components of the initial velocity, (b) the time of flight, and (c) the horizontal range. [5]

- B3** For the launch in the previous question, calculate the maximum height reached above the launch point. [3]

SECTION C · Stretch

- C1** A projectile is launched over level ground at 30 m s^{-1} at 40° to the horizontal. Using $R = \frac{u^2 \sin 2\theta}{g}$ with $g = 9.81 \text{ m s}^{-2}$, calculate its range and state the launch angle that would give the maximum range. [4]

- C2** A ball is launched at 15 m s^{-1} at 25° above the horizontal from a point 2.0 m above the ground. Taking $g = 9.81 \text{ m s}^{-2}$, calculate the time of flight until it lands and the horizontal distance travelled. (You will need to solve a quadratic in t .) [5]

- C3** Describe qualitatively how air resistance changes the trajectory and range of a projectile compared with the idealised case. [3]