

PH 101: Mechanics

Quiz 2 — Kinematics & Momentum — ANSWER KEY

Duration: 30 minutes Maximum marks: 12

SET A

Instructions

- Write your name and roll number before starting.
- This paper has 6 questions in 3 parts, for a total of 12 marks.
- Take $g = 10\text{m/s}^2$ unless stated otherwise.

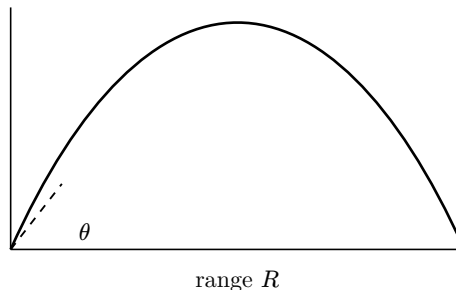
MCQ Answer Grid

Q	1	2	3
Ans	B	C	C

Part A — Multiple Choice

6 marks

- Q1. A projectile is launched over level ground with fixed speed and launch angle θ (air resistance neglected). [2 marks]



Which θ maximizes the range R ?

- (A) 90°
(B) 45° ✓
(C) 30°
(D) 60°

Explanation. $R = (v^2 \sin 2\theta)/g$ is maximal when $\sin 2\theta = 1$.

- Q2. A ball is dropped from rest from a height of 20 m. How long does it take to reach the ground? [2 marks]

- (A) $\sqrt{2}$ s
(B) 1 s
(C) 2 s ✓
(D) 4 s

Explanation. $t = \sqrt{2h/g} = \sqrt{4} = 2$ s.

- Q3.** In a perfectly **inelastic** collision, which quantity is generally *not* conserved? [2 marks]
- (A) Linear momentum
 - (B) Total energy
 - (C) **Kinetic energy** ✓
 - (D) Mass

Part B — Fill in the Blanks

2 marks

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- Q4.** “For every action there is an equal and opposite reaction” is Newton’s third law. [1 mark]
- Q5.** The SI unit of power is the watt, equal to one joule per second. [1 mark]

Part C — Short Answer

4 marks

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- Q6.** Starting from $v = u + at$ and $s = ut + \frac{1}{2}at^2$, derive $v^2 = u^2 + 2as$. [4 marks]

Model answer. From the first equation $t = (v - u)/a$. Substituting, $s = u(v - u)/a + \frac{1}{2}a((v - u)/a)^2 = (v^2 - u^2)/(2a)$, hence $v^2 = u^2 + 2as$.

Rubric. +1 solve first equation for t ; +2 substitution; +1 algebra to the final form.

— End of paper —