



THE VOLUME DEFENCE AND EDUCATION ACADEMY

"Your Success, Our Commitment"

JEE ADVANCED — PHYSICS PRACTICE PAPER

High-Difficulty Problem Set | Time: 60 min | Total Marks: 34

Instructions:

All questions are compulsory. Use of calculator not permitted.

SECTION 1 — Single Correct Answer

Each question has exactly ONE correct option.

+3 for correct | -1 for wrong | 0 if unattempted

Q.1 A particle of mass m is executing simple harmonic motion along the x-axis with amplitude A . When the displacement of the particle is $x = A/2$, the ratio of its kinetic energy to its potential energy is:

- A) 1 : 3
- B) 3 : 1
- C) 1 : 2
- D) 2 : 1

Q.2 A conducting sphere of radius R carries a charge Q . A point charge q is placed at a distance $3R$ from its centre. The force on q due to the sphere is most accurately described as:

- A) $kQq/(3R)^2$, independent of induced charges
- B) Slightly greater than $kQq/(3R)^2$ due to image charges
- C) Slightly less than $kQq/(3R)^2$ due to image charges
- D) Zero, because the sphere redistributes charge uniformly

Q.3 Two identical thin lenses, each of focal length f , are kept coaxially in contact. A luminous object is placed at a distance $2f$ from this combination. The image is formed at a distance:

- A) $f/2$
- B) $2f/3$
- C) f
- D) $2f/3$ on same side as object

Q.4 A radioactive nucleus X decays with half-life T_1 to nucleus Y , which in turn decays with half-life T_2 to a stable nucleus Z . Starting with N atoms of X and none of Y or Z , the number of atoms of Y is maximum when:

- A) $t = (T_1 T_2 / (T_2 - T_1)) \ln(T_2/T_1)$
- B) $t = (\ln 2 \cdot T_1 T_2) / (T_2 - T_1)$
- C) $t = (T_1 + T_2)/2$
- D) $t = (T_1 T_2 \ln(T_2/T_1)) / ((T_2 - T_1) \ln 2)$



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SECTION 2 — One or More Correct Answers

One or more options may be correct.

Full marks (+4): Only if ALL correct options selected

Partial: +1 per correct option (no wrong option)

-2: If any wrong option is chosen

Q.5 A uniform solid cylinder rolls without slipping on a rough inclined plane of angle θ . Which of the following statements are correct?

- A) Friction force acts up the incline
- B) The acceleration of the centre of mass is $(2/3)g \sin \theta$
- C) The angular momentum about the contact point is NOT conserved
- D) The kinetic energy is entirely translational

Q.6 In Young's double-slit experiment, if the slit separation is doubled while keeping the screen distance and wavelength fixed, which of the following changes?

- A) Fringe width decreases by a factor of 2
- B) Angular fringe width decreases by a factor of 2
- C) The intensity at central maximum remains the same
- D) The number of fringes visible on a fixed screen increases

SECTION 3 — Integer Answer Type

Answer is a non-negative integer (0–9)

+3 for correct | 0 otherwise (no negative marking)

Q.7 A particle is projected from the ground with speed $u = 20 \text{ m/s}$ at an angle $\theta = 30^\circ$ to the horizontal. The speed of the particle (in m/s) when its velocity makes an angle of 60° with the horizontal is closest to:

Integer answer: _____

Q.8 In a Wheatstone bridge, the resistances are:

$P = 10 \Omega$, $Q = 10 \Omega$, $R = 10 \Omega$, $S = 10 \Omega$

A cell of EMF 6 V and internal resistance 2Ω is connected across AC.

The current through the galvanometer (if bridge is balanced) is:

Integer answer: _____ mA