Physics

Daily Practice Paper #1 · JEE Advanced 2026 · Class 12

SolveFlow · Demo Paper

Field	Value
Subject	Physics
Total Questions	10
Total Marks	40
Negative Marking	-1 per wrong answer
Time Suggested	30 minutes
Syllabus	Class 12 — Electrostatics, Current Electricity,
	EMI, Optics, Modern Physics, Semiconductors

CO & Bloom's Level Mapping

Q No.	Topic	CO	Bloom's Level
1	Electrostatics — Point Charges	CO1	L3 — Apply
2	Current Electricity — Wheatstone Bridge	CO1	L3 — Apply
3	Magnetic Effects of Current	CO2	L4 — Analyse
4	Electromagnetic Induction	CO2	L3 — Apply
5	Alternating Current — Resonance	CO2	L3 — Apply
6	Ray Optics — Lens Formula	CO3	L3 — Apply
7	Wave Optics — YDSE	CO3	L3 — Apply
8	Dual Nature — de Broglie	CO4	L2 — Understand
9	Atoms & Nuclei — Hydrogen Spectrum	CO4	L3 — Apply
10	Semiconductors — p-n Junction	CO5	L2 — Understand

Instructions

- Each question carries **4 marks** for a correct answer.
- -1 **mark** is deducted for each incorrect answer.
- No marks are deducted for unattempted questions.
- Use of calculator is **not** permitted.
- Write answers clearly in the response sheet.

Q1 | *Electrostatics*Marks: 4 | CO/BL: CO1 / L3

Two conducting spheres of radii r_1 and r_2 are charged to the **same surface charge density** σ. The ratio of their electric potentials $\dfrac{V_1}{V_2}$ is:

(A) $\dfrac{r_2}{r_1}$

(B) $\dfrac{r_1}{r_2}$

(C) $\left(\dfrac{r_1}{r_2}\right)^2$

(D) 1

Solution — Correct Answer: (B)

The charge on a sphere of radius r with surface charge density σ:

$$Q = \sigma \cdot 4\pi r^2$$

Electric potential at the surface:

$$V = \frac{kQ}{r} = \frac{k \cdot \sigma \cdot 4\pi r^2}{r} = 4\pi k\,\sigma\,r \tag{1}$$

Therefore $V \propto r$, so:

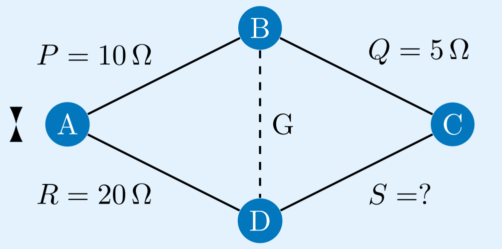
$$\boxed{\frac{V_1}{V_2} = \frac{r_1}{r_2}}$$

Key Point

For same surface charge density, the potential scales *linearly* with radius. Compare with same charge: $V \propto 1/r$ — the opposite scaling.

Q2 | *Current Electricity — Wheatstone Bridge*Marks: 4 | CO/BL: CO1 / L3

In a balanced Wheatstone bridge $P/Q = R/S$, with $P = 10\,\Omega$, $Q = 5\,\Omega$. The value of S at balance when $R = 20\,\Omega$ is:



Battery between A and C

(A) $8\,\Omega$

(B) $10\,\Omega$

(C) $12\,\Omega$

(D) $6\,\Omega$

Solution — Correct Answer: (B)

At balance condition:

$$\frac{P}{Q} = \frac{R}{S} \tag{2}$$

$$\frac{10}{5} = \frac{20}{S} \tag{3}$$

$$2 = \frac{20}{S} \tag{4}$$

$$S = \frac{20}{2} = \boxed{10\,\Omega} \tag{5}$$

Key Point

The Wheatstone bridge is balanced (galvanometer reads zero) when $\frac{P}{Q} = \frac{R}{S}$. No current flows through the galvanometer arm at balance.

Q3 | *Magnetic Effects of Current*Marks: 4 | CO/BL: CO2 / L4

A proton moves with speed v in a uniform magnetic field B. The angle between $\vec{v}$ and $\vec{B}$ is $30°$. The radius of the **circular component** of its helical path is:

(A) $\dfrac{mv}{2qB}$

(B) $\dfrac{mv \sin 30°}{qB}$

(C) $\dfrac{mv\cos 30^\circ}{qB}$

(D) $\dfrac{mv}{qB\sin 30^\circ}$

Solution — Correct Answer: (B)

When a charged particle moves at angle θ to $\vec{B}$, only the perpendicular component $v_\perp$ drives circular motion:

$$v_\perp = v\sin\theta = v\sin 30^\circ = \frac{v}{2}$$

Radius of circular component:

$$r = \frac{mv_\perp}{qB} = \frac{mv\sin 30^\circ}{qB} = \boxed{\frac{mv}{2qB}} \tag{6}$$

The parallel component $v_\parallel = v\cos 30^\circ$ gives the pitch of the helix.

Key Point

The path is a *helix*: radius $r = mv\sin\theta\,/\,qB$, pitch $p = 2\pi mv\cos\theta\,/\,qB$. Both B and the simplified form $mv/(2qB)$ are equivalent here.

Q4 | *Electromagnetic Induction*Marks: 4 | CO/BL: CO2 / L3

A square loop of side 10 cm is placed in a uniform magnetic field $B = 0.5\,\text{T}$ perpendicular to its plane. The loop is pulled completely out of the field in 0.1 s. The induced EMF is:

(A) 0.05 V

(B) 0.5 V

(C) 0.005 V

(D) 5 V

Solution — Correct Answer: (A)

$$\text{Area} = (0.10)^2 = 0.01\,\text{m}^2 \tag{7}$$

$$\Delta\Phi = B\cdot A = 0.5\times 0.01 = 0.005\,\text{Wb} \tag{8}$$

$$\mathcal{E} = \left|\frac{\Delta\Phi}{\Delta t}\right| = \frac{0.005}{0.1} = \boxed{0.05\,\text{V}} \tag{9}$$

Key Point

Faraday's Law: $\mathcal{E} = -\frac{d\Phi_B}{dt}$. The magnitude of the induced EMF equals the rate of change of magnetic flux.

Q5 | *Alternating Current — Resonance*Marks: 4 | CO/BL: CO2 / L3

A series RLC circuit has $R = 100\,\Omega$, $L = 1\,\text{H}$, $C = 100\,\mu\text{F}$. The resonant frequency f_0 is approximately:

(A) $15.9\,\text{Hz}$

(B) $50\,\text{Hz}$

(C) $100\,\text{Hz}$

(D) $31.8\,\text{Hz}$

Solution — Correct Answer: (A)

At resonance, $X_L = X_C$:

$$f_0 = \frac{1}{2\pi\sqrt{LC}} \tag{10}$$

$$= \frac{1}{2\pi\sqrt{1 \times 100 \times 10^{-6}}} \tag{11}$$

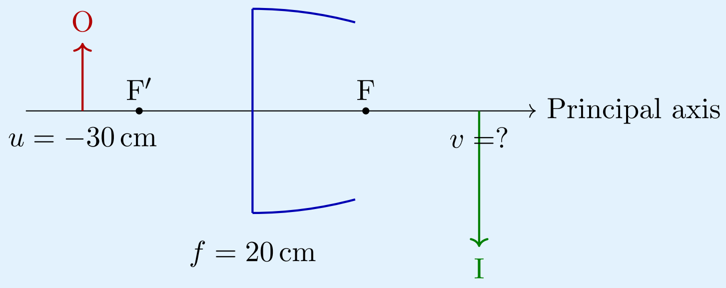
$$= \frac{1}{2\pi \times 0.01} = \frac{1}{0.0628} \approx \boxed{15.9\,\text{Hz}} \tag{12}$$

Key Point

At resonance: $Z = R$ (minimum impedance), current is maximum, and $V_L = V_C$ (they cancel). Quality factor $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$.

Q6 | *Ray Optics — Convex Lens*Marks: 4 | CO/BL: CO3 / L3

A convex lens of focal length $f = 20\,\text{cm}$ forms a real image of an object placed $30\,\text{cm}$ from the lens. The image distance v is:



(A) $60\,\text{cm}$

(B) $12\,\text{cm}$

(C) $-60\,\text{cm}$

(D) $-12\,\text{cm}$

Solution — Correct Answer: (A)

Using the thin lens formula with sign convention ($u = -30\,\text{cm}$, $f = +20\,\text{cm}$):

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \tag{13}$$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{20} + \frac{1}{-30} \tag{14}$$

$$= \frac{3}{60} - \frac{2}{60} = \frac{1}{60} \tag{15}$$

$$v = \boxed{60\,\text{cm}} \tag{16}$$

The positive value confirms a real, inverted image on the other side.

Key Point

Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$. Magnification: $m = \frac{v}{u} = \frac{60}{-30} = -2$ (inverted, magnified $\times 2$).

Q7 | *Wave Optics — Young's Double Slit*Marks: 4 | CO/BL: CO3 / L3

In YDSE, slit separation $d = 0.5\,\text{mm}$, screen distance $D = 1\,\text{m}$, wavelength $\lambda = 600\,\text{nm}$. The fringe width β is:

(A) $1.2\,\text{mm}$

(B) $0.6\,\text{mm}$

(C) 1.0 mm

(D) 2.4 mm

Solution — Correct Answer: (A)

$$\beta = \frac{\lambda D}{d} = \frac{600 \times 10^{-9} \times 1}{0.5 \times 10^{-3}} = \frac{6 \times 10^{-7}}{5 \times 10^{-4}} = 1.2 \times 10^{-3}\,\text{m} = \boxed{1.2\,\text{mm}} \tag{17}$$

Key Point

Fringe width $\beta = \dfrac{\lambda D}{d}$. All fringes (bright and dark) have the *same* width β in YDSE.

Q8 | *Dual Nature of Matter* Marks: 4 | CO/BL: CO4 / L2

The de Broglie wavelength of an electron accelerated through $V = 100\,\text{V}$ is:

(A) 1.23 Å

(B) 0.123 nm

(C) 12.3 Å

(D) Both (A) and (B) are correct

Solution — Correct Answer: (D)

The de Broglie wavelength formula for an electron through potential V:

$$\lambda = \frac{h}{\sqrt{2meV}} = \frac{1.227}{\sqrt{V}}\,\text{nm} = \frac{1.227}{\sqrt{100}}\,\text{nm} = \frac{1.227}{10}\,\text{nm} = 0.1227\,\text{nm} \tag{18}$$

Converting: $0.1227\,\text{nm} = 1.227\,\text{Å}$ (since $1\,\text{nm} = 10\,\text{Å}$).
$\therefore$ Both (A) and (B) express the same value. $\boxed{\text{Answer: (D)}}$

Key Point

Quick formula: $\lambda = \dfrac{1.227}{\sqrt{V}}\,\text{nm} = \dfrac{12.27}{\sqrt{V}}\,\text{Å}$ for an electron accelerated through V volts.

Q9 | *Atoms & Nuclei — Hydrogen Spectrum* Marks: 4 | CO/BL: CO4 / L3

An electron in a hydrogen atom transitions from $n = 3$ to $n = 2$ (Balmer series). The wavelength of the emitted radiation is approximately:

(A) 656 nm

(B) 121 nm

(C) 486 nm

(D) 365 nm

Solution — Correct Answer: (A)

Energy difference (using $E_n = -13.6/n^2$ eV):

$$\Delta E = 13.6\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) = 13.6\left(\frac{1}{4} - \frac{1}{9}\right) = 13.6 \times \frac{5}{36} = 1.889\,\text{eV} \tag{19}$$

Wavelength using $\lambda = hc/E$:

$$\lambda = \frac{1240\,\text{eV}\cdot\text{nm}}{1.889\,\text{eV}} \approx \boxed{656\,\text{nm}} \tag{20}$$

This is the **H-α line** — the red line of the Balmer series, visible to the eye.

Key Point

Balmer series: $n_1 = 2$, $n_2 = 3, 4, 5\ldots$, visible range. Lyman: $n_1 = 1$, UV. Paschen: $n_1 = 3$, IR.

Q10 | *Semiconductors — p-n Junction* Marks: 4 | CO/BL: CO5 / L2

In a p-n junction diode under **forward bias**, the width of the depletion layer:

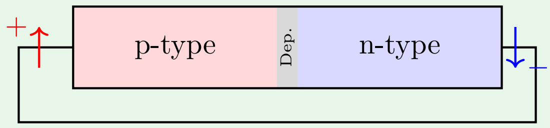
(A) Increases

(B) Decreases

(C) Remains unchanged

(D) First increases then decreases

Solution — Correct Answer: (B)



Forward Bias: + to p-side

Under forward bias the external voltage *opposes* the built-in potential, reducing the electric field across the depletion region. Majority carriers diffuse across, **narrowing** the depletion width. $\boxed{\text{Answer: (B) Decreases}}$

Key Point

Forward bias → depletion width **decreases**, barrier height **decreases**, current **increases**.
Reverse bias → depletion width **increases**, barrier height **increases**, tiny leakage current.