JEE Mains 2026 21 Jan Shift 2 Question Paper(Memory Based)

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1. 1 g of an organic compound produces 1.49 g of $Mg_2P_2O_7$. Determine the percentage of phosphorus (P).

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2. In phosphorus estimation, 0.5 g of an organic compound gives 0.75 g of $Mg_2P_2O_7$. The percentage of phosphorus (P) in the compound is (nearest integer):

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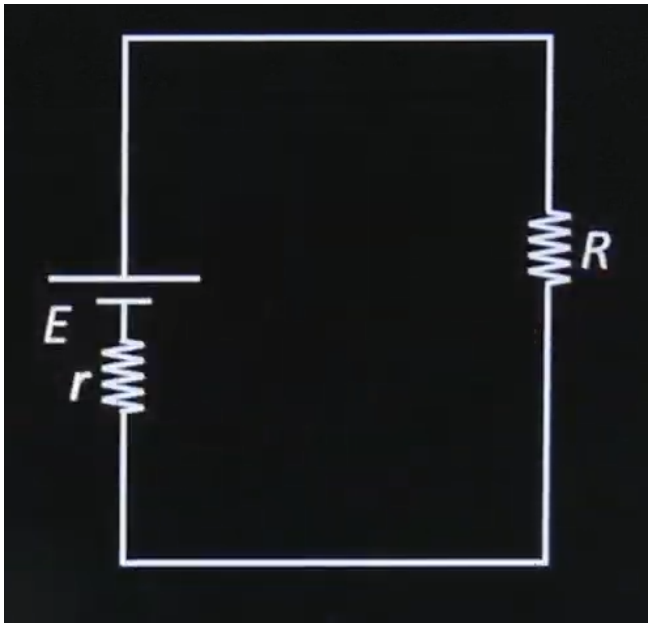
3. In a circuit, there is a battery of emf E and internal resistance r, connected to an external load resistance R as shown. Find the value of R so that maximum power is dissipated across R.



(A) $R = r$
(B) $R = \frac{r}{2}$
(C) $R = \sqrt{2}\,r$
(D) $R = 2r$

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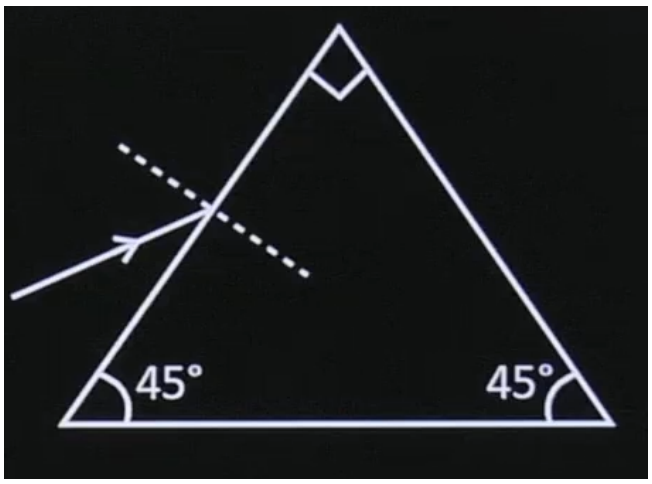
4. The refractive index of a prism is $\sqrt{2}$. What should be the angle of incidence for a light ray such that the emerging ray grazes out of the surface?



(A) 90°
(B) 60°
(C) 30°
(D) 45°

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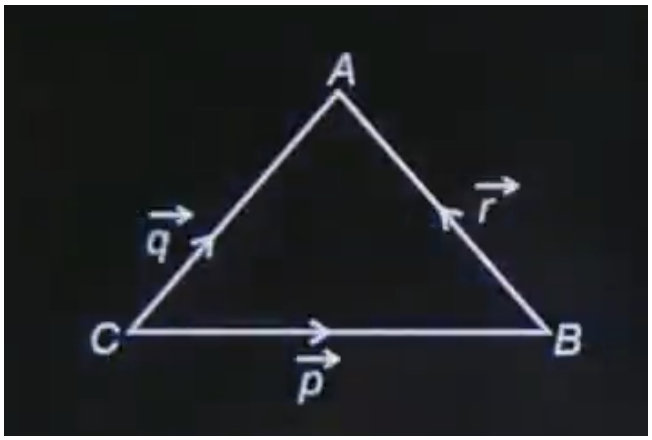
5. If three vectors are given as shown. If the angle between vectors $\vec{p}$ and $\vec{q}$ is θ, where

$$\cos\theta = \frac{1}{\sqrt{3}}, \quad |\vec{p}| = 2\sqrt{3}, \quad |\vec{q}| = 2,$$

then find the value of

$$|\vec{p} \times (\vec{q} - 3\vec{r})|^2 - 3|\vec{r}|^2.$$



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8. What will be the number of significant figures in the summation of 0.153, 153.2 and 153.2?

(1) 3
(2) 4
(3) 5
(4) 6

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9. The largest value of $n \in \mathbb{N}$ such that 7^n divides $(101)!$ is _____.

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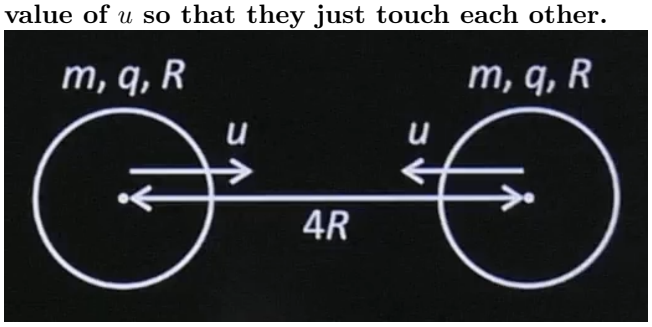
10. Two spheres having equal mass m, charge q, and radius R are moving towards each other. Both have speed u at an instant when the distance between their centres is $4R$. Find the minimum value of u so that they just touch each other.



(1) $\sqrt{\dfrac{q^2}{4\pi\varepsilon_0 mR}}$

(2) $\sqrt{\dfrac{q^2}{16\pi\varepsilon_0 mR}}$

(3) $\sqrt{\dfrac{q^2}{\pi\varepsilon_0 mR}}$

(4) $\sqrt{\dfrac{q^2}{8\pi\varepsilon_0 mR}}$

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11. Let O be the vertex of the parabola $y^2 = 16x$. The locus of the centroid of $\triangle OPA$, when point P lies on the parabola and point A lies on the x-axis such that $\angle OPA = 90^\circ$, is:

(A) $y^2 = 8(3x - 16)$
(B) $9y^2 = 8(3x - 16)$
(C) $y^2 = 8(3x + 16)$
(D) $9y^2 = 8(3x + 16)$

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13. Find the concentration of X^{2-} at equilibrium in $0.1\,\mathrm{M}$ H_2X. Given:

$$K_{a1} = 2.5 \times 10^{-7}, \qquad K_{a2} = 1 \times 10^{-13}$$

(1) 2.5×10^{-7}
(2) 1×10^{-13}
(3) 6×10^{-12}
(4) 5×10^{-10}

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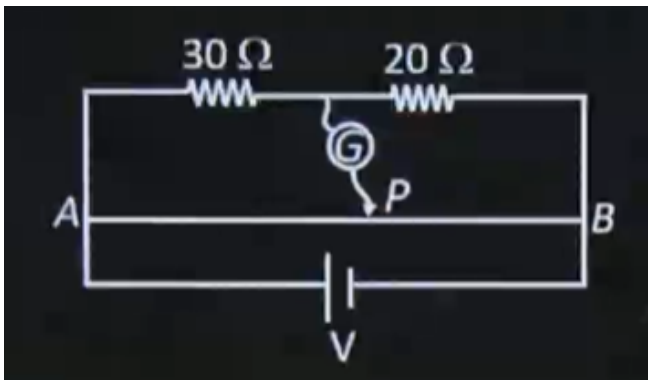
14. In a meter bridge, two balancing resistances are $30\,\Omega$ and $20\,\Omega$. If the galvanometer shows zero deflection for the jockey's contact point P, find the length AP.



(1) 40 cm
(2) 30 cm
(3) 60 cm
(4) 70 cm

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15. The RMS speeds of H_2 and O_2 gases are the same. If the temperature of O_2 gas is $23°C$, find the temperature of H_2 gas.

(1) 18.5 K
(2) 2.5°C
(3) 18°C
(4) 164 K

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16. An α-particle having kinetic energy 7.7 MeV is approaching a fixed gold nucleus (atomic number is 79). Find the distance of closest approach.
(1) 1.72 nm
(2) 6.2 nm
(3) 16.8 nm
(4) 0.2 nm

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17. If electric field of EM wave is given by $60[\sin(3 \times 10^{14}t) + \sin(12 \times 10^{14}t)]$ at $x = 0$, falls on a photosensitive material having work function 2.8 eV. Find the maximum energy (in eV) of ejected electrons.
(1) 2.52 eV
(2) 2.16 eV
(3) 2.00 eV
(4) 2.34 eV

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18. An ideal solenoid is kept with its axis vertical. Current I_0 is flowing in the solenoid. A charge Q is thrown downward inside the solenoid. The acceleration of the charged particle is then
(1) $a > g$
(2) $a = g$
(3) $a < g$
(4) $a = 0$

19. Find change in internal energy of gas if its temperature changes by 10 K. Number of moles of gas is 10. C_p (specific heat at constant pressure) of the gas is 7 cal/K-mol and R (gas constant) is 2 cal/K.
(1) 500 cal
(2) 1000 cal
(3) 250 cal
(4) 100 cal

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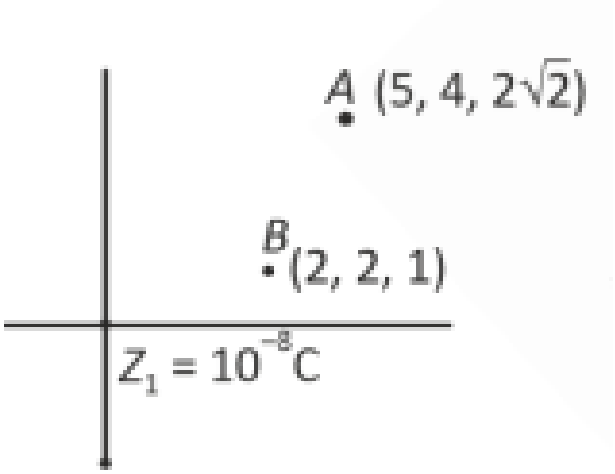
20. Find out work done in moving a $2\,\mu$C charge from point A to B.



(1) $6\,\mu$J
(2) 120 mJ
(3) $34.3\,\mu$J
(4) $24.2\,\mu$J

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21. If the product

$$\left(\frac{1}{{}^{15}C_0}+\frac{1}{{}^{15}C_1}\right)\left(\frac{1}{{}^{15}C_1}+\frac{1}{{}^{15}C_2}\right)\cdots\left(\frac{1}{{}^{15}C_{12}}+\frac{1}{{}^{15}C_{13}}\right)=\frac{\alpha^{13}}{{}^{14}C_0\cdot{}^{14}C_1\cdot{}^{14}C_2\cdots{}^{14}C_{12}},$$

then 30α is equal to:

(1) 16
(2) 32
(3) 15
(4) 28
