JEE Main January 2026

Question Paper With Text Solution

23 January | Shift-2

PHYSICS

MATRIX

JEE Main & Advanced | XI-XII Foundation| VI-X Pre-Foundation

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JEE MAIN JANUARY 2026 | 23 JANUARY SHIFT-2

SECTION – A

Question ID : 444792487

26. The current passing through a conducting loop in the form of equilateral triangle of side $4\sqrt{3}$ cm is 2 A. The magnetic field at its centroid is $\alpha \times 10^{-5}$ T. The value of α is _____.

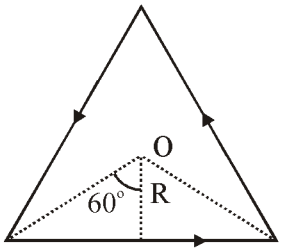
(Given : $\mu_0 = 4\pi \times 10^{-7}$ SI units)

क

(1) $3\sqrt{3}$ (2) $\frac{\sqrt{3}}{2}$ (3) $2\sqrt{3}$ (4) $\sqrt{3}$

Ans. Official answer NTA (1)

Sol.



$$R = 4\sqrt{3} \times \frac{\sqrt{3}}{2} \times \frac{1}{3} = 2\,cm$$

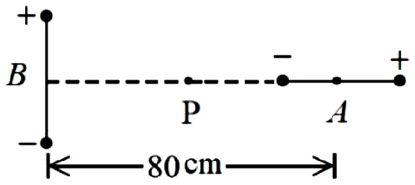
$$B = \frac{\mu_0 I}{4\pi R}\left(\sin 60^\circ + \sin 60^\circ\right) \times 3$$

$$= \frac{10^{-7} \times 2}{2 \times 10^{-2}}\left(\frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2}\right) \times 3$$

$$= 3\sqrt{3} \times 10^{-5} = \alpha \times 10^{-5} \Rightarrow \alpha = 3\sqrt{3}$$

Question ID : 444792488

27. Two short dipoles (A, B), A having charges ± 2 μC and length 1 cm and B having charges ± 4 μC and length 1 cm are placed with their centres 80 cm apart as shown in the figure. The electric field at a point P, equi-distant from the centres of both dipoles is _____ N/C.

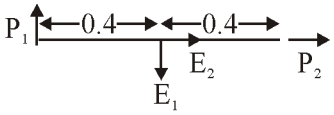


क

(1) $\frac{9}{16}\sqrt{2}\times10^4$ (2) $\frac{9}{16}\sqrt{2}\times10^5$ (3) $9\sqrt{2}\times10^4$ (4) $4.5\sqrt{2}\times10^4$

Ans. Official answer NTA (1)

Sol.



$P_1 = 4\times10^{-6}\times10^{-2}$ $P_2 = 2\times10^{-6}\times10^{-2}$

$E_1 = \frac{kP_1}{r^3}$ $E_2 = \frac{2kP_2}{r^3}$

$E = \sqrt{E_1^2 + E_2^2} = \frac{9\sqrt{2}}{16}\times10^4$

Question ID : 444792486

28. Suppose a long solenoid of 100 cm length, radius 2 cm having 500 turns per unit length, carries a current I = 10 sin (ωt) A, where ω = 1000 rad/s. A circular conducting loop (B) of radius 1 cm is coaxially slided through the solenoid at a speed v = 1 cm/s. The r.m.s. current through the loop when the coil B is inserted 10 cm inside the solenoid is $\frac{\alpha}{\sqrt{2}}$ μA. The value of α is _____.

[Resistance of the loop = 10 Ω]

क

(1) 100 (2) 80 (3) 197 (4) 280

Ans. Official answer NTA (3)

Sol. $n = 500, I = 10\sin(1000t);$

Assuming the solenoid to be infinitely long :

$\phi = BA = \mu_0 nI\cdot\pi r^2 \Rightarrow e = -\frac{d\phi}{dt} = -\mu_0 n\pi r^2.\frac{dI}{dt}$

$\text{induced current} = i = \frac{e}{R} = \frac{\mu_0 n\pi r^2}{R}\cdot10\times1000\times\cos(1000t)$

$i_{rms} = \frac{i_0}{\sqrt{2}} = 197.4 \simeq 197$

Question ID : 444792493

29. A prism of angle 75° and refractive index $\sqrt{3}$ is coated with thin film of refractive index 1.5 only at the back exit surface. To have total internal reflection at the back exit surface the incident angle must be_____.

(sin 15° = 0.25 and sin 25° = 0.43)

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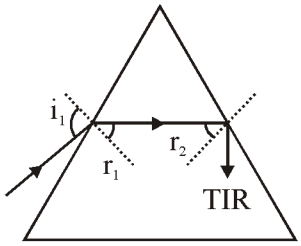
(1) < 15° (2) between 15° and 20°

(3) > 25° (4) 15°

Ans. Official answer NTA (4447921684, 4447921686, 4447921687)

Sol.



$$r_2 = \theta_c = \sin^{-1}\left(\frac{3/2}{\sqrt{3}}\right)$$

$$= 60^\circ$$

$$r_1 + r_2 = A = 75^\circ \Rightarrow r_1 = 15^\circ$$

$$1.\sin i_1 = \sqrt{3}\sin 15^\circ = \sqrt{3} \times 0.25 = 0.43 \Rightarrow i_1 = 25^\circ$$

$$0^\circ \leqslant i < 25^\circ \Rightarrow (1),(2),(4) \text{ are correct options.}$$

Question ID : 444792476

30. To compare EMF of two cells using potentiometer the balancing lengths obtained are 200 cm and 150 cm. The least count of scale is 1 cm. The percentage error in the ratio of EMFs is _____.

क

(1) 1.55 (2) 1.75 (3) 1.65 (4) 1.45

Ans. Official answer NTA (1)

Matrix Answer – Bonus

Sol. $$\text{ratio} = r = \frac{E_1}{E_2} = \frac{\ell_1}{\ell_2}$$

$$\Rightarrow \frac{dr}{r} = \frac{d\ell_1}{\ell_1} + \frac{d\ell_2}{\ell_2} = \frac{1}{200} + \frac{1}{150}$$

$$\Rightarrow \frac{dr}{r} \times 100 = 1.167\%$$

Question ID : 444792490

31. A circular loop of radius 7 cm is placed in uniform magnetic field of 0.2 T directed perpendicular to plane of loop. The loop is converted into a square loop in 0.5 s. The EMF induced in the loop is _____ mV.

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(1) 6.6 (2) 1.32 (3) 13.2 (4) 8.25

Ans. Official answer NTA (2)

Sol. $e = \frac{B\Delta A}{\Delta t}; 2\pi r = 4\ell \Rightarrow \ell = \pi r / 2$

$A_i = \pi r^2, \quad A_f = \ell^2 = \pi^2 r^2 / 4$

$$e = \frac{B\left(\pi r^2 - \pi^2 r^2 / 4\right)}{0.5} = -1.32 mV$$

Question ID : 444792491

32. The ratio of speeds of electromagnetic waves in vacuum and a medium, having dielectric constant k = 3 and permeability of $\mu = 2\mu_0$, is

(μ_0 = permeability of vacuum)

क

(1) 36 : 1 (2) $\sqrt{6}:1$ (3) 6 : 1 (4) 3 : 2

Ans. Official answer NTA (2)

Sol. $\mu = \frac{c}{v} = \sqrt{\mu_r \varepsilon_r} = \sqrt{2 \times 3} = \sqrt{6}:1$

Question ID : 444792481

33. A small metallic sphere of diameter 2 mm and density 10.5 g/cm^3 is dropped in glycerine having viscosity 10 Poise and density 1.5 g/cm^3 respectively. The terminal velocity attained by the sphere is ____ cm/s.

($\pi = \frac{22}{7}$ and g = 10 m/s^2)

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(1) 3.0 (2) 1.5 (3) 2.0 (4) 1.0

Ans. Official answer NTA (3)

Sol. $$v_T = \frac{2}{9}\cdot\frac{r^2(\rho-\sigma)g}{\eta} = \frac{2}{9}\cdot\frac{\left(10^{-3}\right)^2(10.5-1.5)\times10^3\times10}{10\times\frac{1}{10}}$$

$$= 0.02\,m/s = 2\,cm/s$$

Question ID : 444792483

34. One mole of an ideal diatomic gas expands from volume V to 2V isothermally at a temperature 27° C and does W joule of work. If the gas undergoes same magnitude of expansion adiabatically from 27° C doing the same amount of work W, then its final temperature will be (close to) _____ °C.

$(\log_e 2 = 0.693)$

क

(1) –189 (2) –117 (3) –30 (4) –56

Ans. Official answer NTA (4)

Sol. $$W = nRT\ell n\frac{V_2}{V_1}$$

$$= 1\times R\times 300\ell n\left(\frac{2V}{V}\right)$$

$$\text{For adiabatic process : } \Delta Q = 0 = \Delta U + \Delta W$$

$$\Rightarrow \Delta U = -W = -R\times300\ell n\,2$$

$$nC_v\Delta T = -R\times300\times\ell n\,2$$

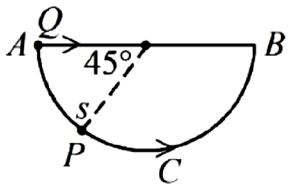
$$\Rightarrow 1\times\frac{5R}{2}\times\Delta T = -R\times300\times\ell n\,2$$

$$\Rightarrow \Delta T = -83.16^\circ C$$

$$\text{final temperature} = 27-83 = -56^\circ C$$

Question ID : 444792478

35. A bead P sliding on a frictionless semi-circular string (ACB) and it is at point S at t = 0 and at this instant the horizontal component of its velocity is v. Another bead Q of the same mass as P is ejected from point A at t = 0 along the horizontal string AB, with the speed v, friction between the beads and the respective strings may be neglected in both cases. Let t_P and t_Q be the respective times taken by beads P and Q to reach the point B, then the relation between t_P and t_Q is :



क

(1) $t_P > t_Q$ (2) $t_P = t_Q$ (3) $t_P < t_Q$ (4) $t_P > 1.25t_Q$

Ans. Official answer NTA (3)

Matrix Answer : Bonus

Sol. It is not mentioned in the question, whether the frame is in vertical plane or horizontal plane. If the frame is in vertical plane, the time for P cannot be calculated. Also, it cannot be checked qualitatively if it is greater than or less than the time for Q. If the frame is assumed to be in horizontal plane, the phrase 'horizontal component' for P will not be justifiable. So it should be a bonus.

Question ID : 444792489

36. Two charges 7 μC and –2 μC are placed at (–9, 0, 0) cm and (9, 0, 0) cm respectively in an external field $E = \frac{A}{r^2}\hat{r}$, where $A = 9 \times 10^5$ N/C.m^2. Considering the potential at infinity is 0, the electrostatic energy of the configuration is _____J.

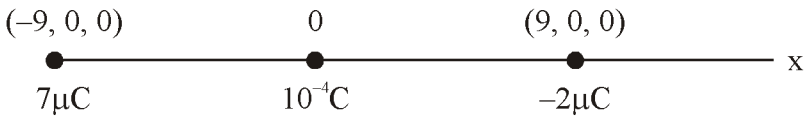
क

(1) 24.3 (2) 49.3 (3) –90.7 (4) 1.4

Ans. Official answer NTA (2)

Sol. The given electric field is produced by a point charge placed at origin :

$$\vec{E} = \frac{kq}{r^2}\hat{r} = \frac{A}{r^2}\cdot\hat{r} \Rightarrow q = 10^{-4}c$$



$$U = \frac{k\times 7\times 10^{-6}\times 10^{-4}}{0.09} - \frac{k\times 2\times 10^{-6}\times 10^{-4}}{0.09} - \frac{k\times 7\times 2\times 10^{-12}}{2\times 0.09}$$

$$= 49.3\,J$$

Question ID : 444792479

37. A block is sliding down on an inclined plane of slope θ and at an instant t = 0 this block is given an upward momentum so that it starts moving up on the inclined surface with velocity u. The distance (S) travelled by the block before its velocity become zero, is _____.

(g = gravitational acceleration)

क

(1) $\frac{u^2}{4g\sin\theta}$ (2) $\frac{u^2}{\sqrt{2}g\cos\theta}$ (3) $\frac{2u^2}{g\cos\theta}$ (4) $\frac{u^2}{2g\cos\theta}$

Ans. Official answer NTA (1)
Matrix answer (Bonus)

Sol. Bonus

$v^2 = u^2 + 2as \Rightarrow 0^2 = u^2 + 2(-g\sin\theta)\cdot s$

$s = \frac{u^2}{2g\sin\theta}$

Question ID : 444792494

38. Which of the following pair of nuclei are isobars of the element ?

क

(1) $^{198}_{80}Hg$ and $^{197}_{79}Au$ (2) $^{3}_{1}H$ and $^{3}_{2}He$ (3) $^{236}_{92}U$ and $^{238}_{92}U$ (4) $^{2}_{1}H$ and $^{3}_{1}H$

Ans. Official answer NTA (2)

Sol. $_1H^3$ and $_2He^3$ are isobars

Question ID : 444792477

39. A paratrooper jumps from an aeroplane and opens a parachute after 2 s of free fall and starts deaccelerating with 3 m/s². At 10 m height from ground, while descending with the help of parachute, the speed of paratrooper is 5 m/s. The initial height of the airplane is _____m.

($g = 10$ m/s²)

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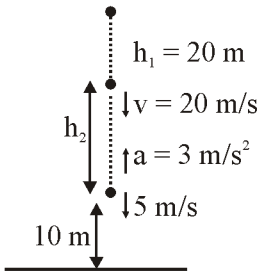
(1) 82.5 (2) 62.5 (3) 92.5 (4) 20

Ans. Official answer NTA (3)

Sol.



$h_1 = 0 + \frac{1}{2}(10)2^2 = 20\,m$

$5^2 = 20^2 + 2(-3)h_2$

$\Rightarrow h_2 = 62.5\,m$

$height = h_1 + h_2 + 10$

$= 20 + 62.5 + 10$

$= 92.5\,m$

Question ID : 444792480

40. A body of mass 14 kg initially at rest explodes and breaks into three fragments of masses in the ratio 2 : 2 : 3. The two pieces of equal masses fly off perpendicular to each other with a speed of 18 m/s each. The velocity of the heavier fragment is _____ m/s.

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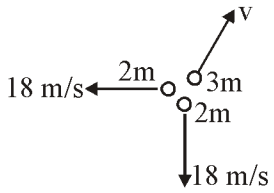
(1) 12 (2) $12\sqrt{2}$ (3) $24\sqrt{2}$ (4) $10\sqrt{2}$

Ans. Official answer NTA (2)

Sol.



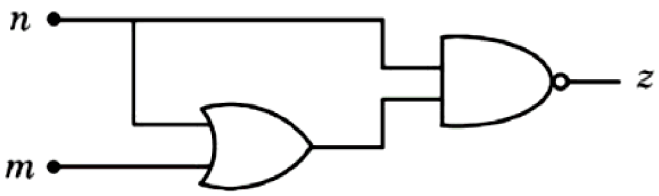
$2m + 2m + 3m = 14 \Rightarrow m = 2kg$

$6v = 4 \times 18 \times \sqrt{2}$

$\Rightarrow v = 12\sqrt{2}\,m/s$

Question ID : 444792495

41. For the given logic gate circuit, which of the following is the correct truth table ?



क

(1)

n	m	z
0	0	1
0	1	1
1	1	0
1	0	0

(2)

n	m	z
0	0	0
0	1	1
1	1	0
1	0	1

(3)

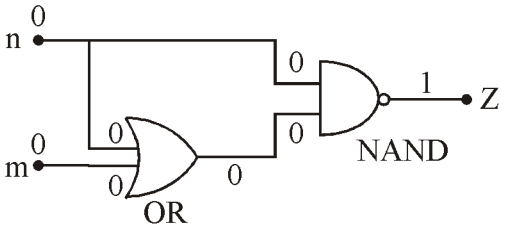
n	m	z
0	0	1
0	1	0
1	1	1
1	0	0

(4)

n	m	z
0	0	1
0	1	0
1	1	0
1	0	0

Ans. Official answer NTA (1)

Sol.



First row values are shown in the figure. Other values can be checked similarly.

n	m	z
0	0	1
0	1	1
1	1	0
1	0	0

Question ID : 444792482

42. An air bubble of volume 2.9 cm^3 rises from the bottom of a swimming pool of 5 m deep. At the bottom of the pool water temperature is 17 °C. The volume of the bubble when it reaches the surface, where the water temperature is 27 °C, is _____ cm^3.

($g = 10\ m/s^2$, density of water = $10^3\ kg/m^3$, and 1 atm pressure is 10^5 Pa)

क

(1) 4.5 (2) 3.0 (3) 4.2 (4) 2.0

Ans. Official answer NTA (1)

Sol. $\frac{P_2V_2}{T_2} = \frac{P_1V_1}{T_1}$

$$\Rightarrow \frac{10^5 \times V}{300} = \frac{\left(10^5 + 10^3 \times 10 \times 5\right) \times 2.9}{290}$$

$$\Rightarrow \quad V = 4.5\,cm^3$$

Question ID : 444792484

43. The internal energy of a monotomic gas is 3nRT. One mole of helium is kept in a cylinder having internal cross section area of 17 cm^2 and fitted with a light movable frictionless piston. The gas is heated slowly by suppling 126 J heat. If the temperature rises by 4 °C, then the piston will move _____ cm.

(atmospheric pressure = 10^5 Pa)

क

(1) 1.45 (2) 15.5 (3) 1.55 (4) 14.5

Ans. Official answer NTA (2)

Sol. $U = 3nRT \Rightarrow \Delta U = 3nR\Delta T \quad = 3\times1\times R\times4 = 12R$

$W = Q - \Delta U = 126 - 12\times8.314 = P\Delta V$

$$\Delta V = \frac{26.232}{10^5} = A\times h = 17\times10^{-4}\times h$$

$$\Rightarrow h = 0.1543m = 15.43cm$$

Question ID : 444792485

44. A parallel plate capacitor with plate separation 5 mm is charged by a battery. On introducing a mica sheet of 2 mm and maintaining the connections of the plates with the terminals of the battery, it is found that it draws 25% more charge from the battery. The dielectric constant of mica is _____.

क

(1) 2.0 (2) 1.0 (3) 1.5 (4) 2.5

Ans. Official answer NTA (1)

Sol.

$$C_0 = \frac{\varepsilon_0 A}{5} \qquad C = \frac{\varepsilon_0 A}{5-2+\frac{2}{K}}$$

$\Delta q = V\cdot\Delta C$

$0.25\times q_0 = V(C - C_0) \Rightarrow 0.25\times C_0\cdot V = V(C - C_0)$

$$\Rightarrow 1.25C_0 = C \Rightarrow 1.25\times\frac{\varepsilon_0 A}{5} = \frac{\varepsilon_0 A}{5-2+\frac{2}{K}}$$

$$\Rightarrow K = 2$$

Question ID : 444792492

45. When an unpolarized light falls at a particular angle on a glass plate (placed in air), it is observed that the reflected beam is linearly polarized. The angle of refracted beam with respect to the normal is _____.

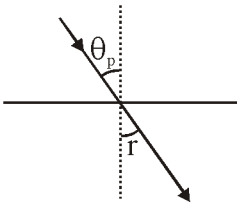
($\tan^{-1}(1.52) = 57.7°$, refractive indices of air and glass are 1.00 and 1.52, respectively.)

क

(1) 32.3° (2) 39.6° (3) 36.3° (4) 42.6°

Ans. Official answer NTA (1)

Sol.



$\theta_p = \tan^{-1}(\mu)$

$= \tan^{-1}(1.52)$

$= 57.7°$

$r + 57.7° = 90°$

$\Rightarrow r = 32.3°$

Question ID : 444792498

46. The velocity of sound in air is doubled when the temperature is raised from 0 °C to α °C. The value of α is _____.

क

Ans. Official answer NTA (819)

Sol. $v \propto \sqrt{T} \Rightarrow \frac{2v}{v} = \sqrt{\frac{T'}{273}} \Rightarrow T' = 273 \times 4$

$t = 273 \times 4 - 273 = 819°C$

Question ID : 444792497

47. A ball of radius r and density ρ dropped through a viscous liquid of density σ and viscosity η attains its terminal velocity at time t, given by $t = A\rho^a r^b \eta^c \sigma^d$, where A is a constant and a, b, c and d are integers.

The value of $\frac{b+c}{a+d}$ is _____.

क

Ans. Official answer NTA (1)

Sol. $t = A \cdot \rho^a r^b \eta^c \sigma^d$

$\Rightarrow T = \left(ML^{-3}\right)^{a+d} \cdot L^b \cdot \left(ML^{-1}T^{-1}\right)^c$

$T = M^{a+d+c} \cdot L^{-3a-3d+b-c} \cdot T^{-c}$

$a + d + c = 0 \quad .....(1)$

$3a+3d-b+c=0$ .....(2)

$-c=1$ .....(3)

solving(1),(2) & (3) : $a+d=1, b=2, c=-1$

$$\frac{b+c}{a+d}=\frac{2-1}{1}=1$$

Question ID : 444792500

48. The average energy released per fission for the nucleus of $^{235}_{92}U$ is 190 MeV. When all the atoms of 47 g pure $^{235}_{92}U$ undergo fission process, the energy released is $\alpha \times 10^{23}$ MeV. The value of α is _____.

(Avogadro Number = 6×10^{23} per mole)

क

Ans. Official answer NTA (228)

Sol. Total energy released $=\frac{47}{235}\times 6\times 10^{23}\times 190\text{MeV}$

$=228\times 10^{23}\text{MeV}$

Ans. $\rightarrow 228$

Question ID : 444792499

49. The size of the images of an object, formed by a thin lens are equal when the object is placed at two different positions 8 cm and 24 cm from the lens. The focal length of the lens is _____ cm.

क

Ans. Official answer NTA (16)

Sol. $|m|=\frac{f}{|u-f|}$

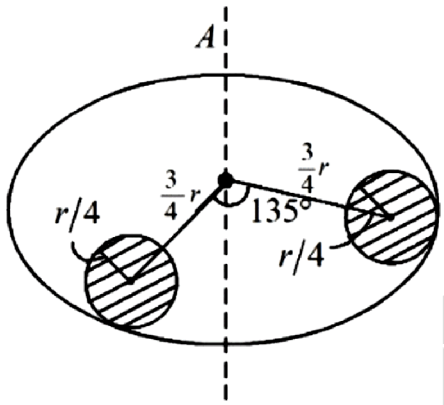
one case $\rightarrow u=8$, other case : $u=24$

in the two eases magnitude of magnification will be equal :

$$\frac{f}{f-8}=\frac{f}{24-f}\Rightarrow f=16\,\text{cm}$$

Question ID : 444792496

50. Suppose there is a uniform circular disc of mass M kg and radius r m shown in figure. The shaded regions are cut out from the disc. The moment of inertia of the remainder about the axis A of the disc is given by $\frac{x}{256}Mr^2$. The value of x is _____.



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Ans. Official answer NTA (109)

Sol. mass of removed disc $= m = \frac{M}{\pi r^2}\left(\pi\left(\frac{r}{4}\right)^2\right)$

$= M/16$

moment of inatia of removed disc

$= I_1 = I_{cm} + mx^2 = \frac{m(r/4)^2}{2} + m(3r/4)^2$

moment of inentia of original disc $= I = \frac{Mr^2}{2}$

$= I - 2I_1$

$= \frac{Mr^2}{2} - 2I_1 = \frac{109Mr^2}{256}$

Ans $\rightarrow 109$