JEE Main April 2025

Question Paper With Text Solution

07 April | Shift-2

PHYSICS

MATRIX

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

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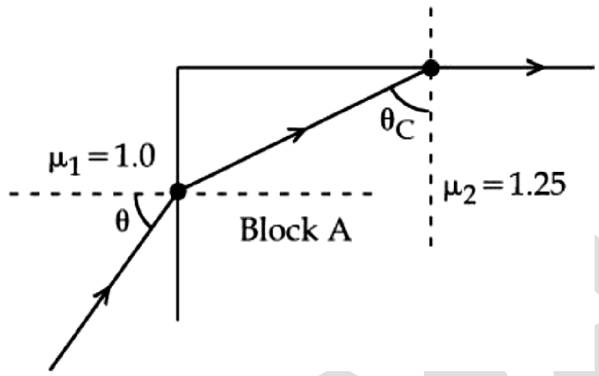
JEE MAIN APRIL 2025 | 07TH APRIL SHIFT-2

SECTION – A

Question ID : 6034212250

26. A transparent block A having refractive index $\mu = 1.25$ is surrounded by another medium of refractive index $\mu = 1.0$ as shown in figure. A light ray is incident on the flat face of the block with incident angle θ as shown in figure. What is the maximum value of θ for which light suffers total internal reflection at the top surface of the block :



(1) $\tan^{-1}(4/3)$ (2) $\cos^{-1}(3/4)$ (3) $\tan^{-1}(3/4)$ (4) $\sin^{-1}(3/4)$

Ans. Official answer NTA (4)

Sol.

Question ID : 6034212239

27. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : The radius vector from the Sun to a planet sweeps out equal areas in equal intervals of time and thus areal velocity of planet is constant.

Reason (R) : For a central force field the angular momentum is a constant.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(2) (A) is not correct but (R) is correct

(3) Both (A) and (R) are correct and (R) is the correct explanation of (A)

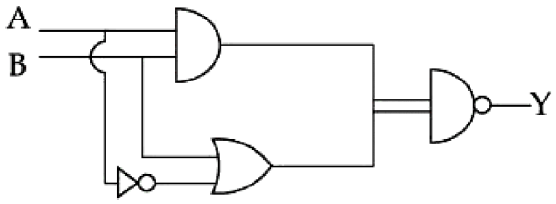
(4) (A) is correct but (R) is not correct

Ans. Official answer NTA (3)

Sol.

Question ID : 6034212253

28. Consider the following logic circuit.



The output is Y = 0 when :

(1) A = 1 and B = 0 (2) A = 1 and B = 1 (3) A = 0 and B = 1 (4) A = 0 and B = 0

Ans. Official answer NTA (2)

Sol.

Question ID : 6034212242

29. Match List-I with List-II.

List - I	**List-II**
(A) Isothermal	(I) ΔW (work done) = 0
(B) Adiabatic	(II) ΔQ (supplied heat) = 0
(C) Isobaric	(III) ΔU (change in internal energy) $\neq 0$
(D) Isochoric	(IV) $\Delta U = 0$

Choose the correct answer from the options given below :

(1) (A)-(IV), (B)-(I), (C)-(III), (D)-(II) (2) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)

(3) (A)-(III), (B)-(II), (C)-(I), (D)-(IV) (4) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

Ans. Official answer NTA (4)

Sol.

Question ID : 6034212245

30. A dipole with two electric charges of 2 μC magnitude each, with separation distance 0.5 μm, is placed between

the plates of a capacitor such that its axis is parallel to an electric field established between the plates when a potential difference of 5V is applied. Separation between the plates is 0.5 mm. If the dipole is rotated by 30° from the axis, it tends to realign in the direction due to a torque. The value of torque is :

(1) 2.5×10^{-9} Nm (2) 5×10^{-3} Nm (3) 2.5×10^{-12} Nm (4) 5×10^{-9} Nm

Ans. Official answer NTA (4)

Sol.

Question ID : 6034212243

31. The equation of a wave travelling on a string is $y = \sin [20\pi x + 10\pi t]$, where *x* and t are distance and time in SI units. The minimum distance between two points having the same oscillating speed is :

(1) 10 cm (2) 2.5 cm (3) 20 cm (4) 5.0 cm

Ans. Official answer NTA (4)

Sol.

Question ID : 6034212236

32. An object with mass 500 g moves along x-axis with speed $v = 4\sqrt{x}$ m / s . The force acting on the object is :

(1) 6 N (2) 8 N (3) 4 N (4) 5 N

Ans. Official answer NTA (3)

Sol.

Question ID : 6034212251

33. A photoemissive substance is illuminated with a radiation of wavelength λ_i so that it releases electrons with de-Broglie wavelength λ_e. The longest wavelength of radiation that can emit photoelectron is λ_o. Expression for de-Broglie wavelength is given by :

(m : mass of the electron, h : Planck's constant and c : speed of light) :

(1) $\lambda_e = \sqrt{\dfrac{h}{2mc\left(\dfrac{1}{\lambda_i} - \dfrac{1}{\lambda_o}\right)}}$ (2) $\lambda_e = \sqrt{\dfrac{h\lambda_0}{2mc}}$

(3) $\lambda_e = \dfrac{h}{\sqrt{2mc\left(\dfrac{1}{\lambda_i} - \dfrac{1}{\lambda_o}\right)}}$ (4) $\lambda_e = \sqrt{\dfrac{h\lambda_i}{2mc}}$

Ans. Official answer NTA (1)

Sol.

Question ID : 6034212244

34. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : Magnetic monopoles do not exist.

Reason (R) : Magnetic field lines are continuous and form closed loops.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(2) (A) is correct but (R) is not correct

(3) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(4) (A) is not correct but (R) is correct

Ans. Official answer NTA (1)

Sol.

Question ID : 6034212249

35. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : Refractive index of glass is higher than that of air.

Reason (R) : Optical density of a medium is directly proportionate to its mass density which results in a proportionate refractive index.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) (A) is not correct but (R) is correct

(2) (A) is correct but (R) is not correct

(3) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Ans. Official answer NTA (2)

Sol.

Question ID : 6034212246

36. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : The outer body of an air craft is made of metal which protects persons sitting inside from lightning-strikes.

Reason (R) : The electric field inside the cavity enclosed by a conductor is zero.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(2) (A) is not correct but (R) is correct

(3) (A) is correct but (R) is not correct

(4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Ans. Official answer NTA (4)

Sol.

Question ID : 6034212238

37. Which one of the following forces cannot be expressed in terms of potential energy :

(1) Coulomb's force (2) Restoring force (3) Frictional force (4) Gravitational force

Ans. Official answer NTA (3)

Sol.

Question ID : 6034212237

38. A helicopter flying horizontally with a speed of 360 km / h at an altitude of 2 km, drops an object at an instant. The object hits the ground at a point O, 20 s after it is dropped. Displacement of 'O' from the position of helicopter where the object was released is :

(use acceleration due to gravity $g = 10\ m/s^2$ and neglect air resistance) :

(1) 7.2 km (2) $2\sqrt{2}$ km (3) $2\sqrt{5}$ km (4) 4 km

Ans. Official answer NTA (2)

Sol.

Question ID : 6034212241

39. The helium and argon are put in the flask at the same room temperature (300 K). The ratio of average kinetic energies (per molecule) of helium and argon is :

(Give : Molar mass of helium = 4 g / mol, Molar mass of argon = 40 g / mol) :

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

Ans. Official answer NTA (1)

Sol.

Question ID : 6034212240

40. A capillary tube of radius 0.1 mm is partly dipped in water (surface tension 70 dyn / cm and glass water contact angle $\approx 0°$) with 30° inclined with the vertical. The length of water risen in the capillary is _____ cm .

(Take g = 9.8 m / s^2) :

(1) $\frac{71}{5}$ (2) $\frac{68}{5}$ (3) $\frac{82}{5}$ (4) $\frac{57}{2}$

Ans. Official answer NTA (3)

Sol.

Question ID : 6034212248

41. A mirror is used to produce an image with magnification of $\frac{1}{4}$. If the distance between object and its image is 40 cm , then the focal length of the mirror is_____ :

(1) 15 cm (2) 10.7 cm (3) 10 cm (4) 12.7 cm

Ans. Official answer NTA (2)

Sol.

Question ID : 6034212234

42. The dimension of $\sqrt{\frac{\mu_0}{\epsilon_0}}$ is equal to that of :

(μ_0 = Vacuum permeability and ε_0 = Vacuum permittivity) :

(1) Capacitance (2) Inductance (3) Voltage (4) Resistance

Ans. Official answer NTA (4)

Sol.

Question ID : 6034212235

43. Match List - I with List - II.

List-I	**List-II**
(A) Mass density	(I) $[ML^2T^{-3}]$
(B) Impulse	(II) $[MLT^{-1}]$
(C) Power	(III) $[ML^2T^0]$
(D) Moment of inertia	(IV) $[ML^{-3}T^0]$

Choose the correct answer from the options given below :

(1) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

(2) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)

(3) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

(4) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)

Ans. Official answer NTA (2)

Sol.

Question ID : 6034212247

44. The unit of $\sqrt{\frac{2I}{\epsilon_0 C}}$ is :

(I = intensity of an electromagnetic wave, c : speed of light)

(1) NC^{-1} (2) Nm (3) NC (4) Vm

Ans. Official answer NTA (1)

Sol.

Question ID : 6034212252

45. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : The density of the copper $\left({}^{64}_{29}\mathrm{Cu}\right)$ nucleus is greater than that of the carbon $\left({}^{12}_{6}\mathrm{C}\right)$ nucleus.

Reason (R) : The nucleus of mass number A has a radius proportional to $A^{1/3}$.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) (A) is not correct but (R) is correct

(2) (A) is correct but (R) is not correct

(3) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

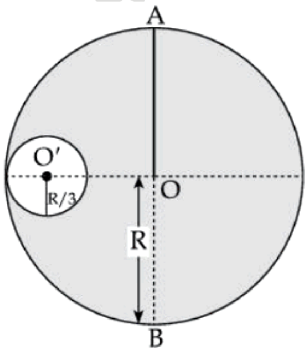
Ans. Official answer NTA (1)

Sol.

SECTION – B

Question ID : 6034212254

46. M and R be the mass and radius of a disc. A small disc of radius $\frac{R}{3}$ is removed from the bigger disc as shown in figure. The moment of inertia of remaining part of bigger disc about an axis AB passing through the centre O and perpendicular to the plane of disc is $\frac{4}{x}MR^2$. The value of x is _____.



Ans. Official answer NTA (9)

Sol.

Question ID : 6034212255

47. Two cylindrical rods A and B made of different materials, are joined in a straight line. The ratios of lengths, radii and thermal conductivites of these rods are : $\frac{L_A}{L_B}=\frac{1}{2}, \frac{r_A}{r_B}=2$ and $\frac{K_A}{K_B}=\frac{1}{2}$. The free ends of rods A and B are maintained at 400 K, 200 K, respectively. The temperature of rods interface is _____, when equilibrium is established.

Ans. Official answer NTA (360)

Sol.

Question ID :

48. A parallel plate capacitor has charge 5×10^{-6} C. A dielectric slab is inserted between the plates and almost fills the space between the plates. If the induced charge on one face of the slab is 4×10^{-6}C then the dielectric constant of the slab is _____ .

Ans. Official answer NTA (5)

Sol.

Question ID : 6034212258

49. The electric field in a region is given by $\vec{E}=(2\hat{i}+4\hat{j}+6\hat{k})\times10^3$ N / C. The flux of the field through a rectangular surface parallel to x-z plane is 60 Nm^2C^{-1}. The area of the surface is _____cm^2.

Ans. Official answer NTA (15)

Sol.

Question ID : 6034212256

50. An inductor of reactance 100 Ω, a capacitor of reactance 50 Ω, and a resistor of resistance 50 Ω are connected in series with an AC source of V, 50 Hz. Average power dissipated by the circuit is _____ W.

Ans. Official answer NTA (1)

Sol.