JEE Main April 2025

Question Paper With Text Solution

04 April | Shift-1

PHYSICS

MATRIX

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

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JEE MAIN APRIL 2025 | 04 APRIL SHIFT-1

SECTION – A

Question ID : 347577183

26. Consider the sound wave travelling in ideal gases of He, CH_4 and CO_2. All the gases have the same ratio $\frac{P}{\rho}$, where P is the pressure and ρ is the density. The ratio of the speed of sound through the gases $V_{He} : V_{CH_4} : V_{CO_2}$ is given by

(1) $\sqrt{\frac{7}{5}} : \sqrt{\frac{5}{3}} : \sqrt{\frac{4}{3}}$ (2) $\sqrt{\frac{5}{3}} : \sqrt{\frac{4}{3}} : \sqrt{\frac{4}{3}}$ (3) $\sqrt{\frac{5}{3}} : \sqrt{\frac{4}{3}} : \sqrt{\frac{7}{5}}$ (4) $\sqrt{\frac{4}{3}} : \sqrt{\frac{5}{3}} : \sqrt{\frac{7}{5}}$

Ans. Official answer NTA (2)

Sol.

Question ID : 347577181

27. If $\vec{L}$ and $\vec{P}$ represent the angular momentum and linear momentum respectively of a particle of mass 'm' having position vector as $\vec{r} = a(\hat{i}\cos\omega t + \hat{j}\sin\omega t)$. The direction of force is

(1) Opposite to the direction of $\vec{r}$

(2) Opposite to the direction of $\vec{L}$

(3) Opposite to the direction of $\vec{P}$

(4) Opposite to the direction of $\vec{L} \times \vec{P}$

Ans. Official answer NTA (1)

Sol.

Question ID : 347577179

28. A body of mass m is suspended by two strings making angles θ_1 and θ_2 with the horizontal ceiling with tensions T_1 and T_2 simultaneously. T_1 and T_2 are related by $T_1 = \sqrt{3}T_2$, the angles θ_1 and θ_2 are

(1) $\theta_1 = 30^\circ\ \theta_2 = 60^\circ$ with $T_2 = \frac{3mg}{4}$

(2) $\theta_1 = 60^\circ\ \theta_2 = 30^\circ$ with $T_2 = \frac{mg}{2}$

(3) $\theta_1 = 45^\circ\ \theta_2 = 45^\circ$ with $T_2 = \frac{3mg}{4}$

(4) $\theta_1 = 30^\circ\ \theta_2 = 60^\circ$ with $T_2 = \frac{4mg}{5}$

Ans. Official answer NTA (2)

Sol.

Question ID : 347577186

29. An alternating current is represented by the equation, $i = 100\sqrt{2}\sin(100\pi t)$ ampere. The RMS value of current and the frequency of the given alternating current are

(1) $\frac{100}{\sqrt{2}}$ A, 100 Hz (2) $50\sqrt{2}$ A, 50 Hz (3) 100 A, 50 Hz (4) $100\sqrt{2}$ A, 100 Hz

Ans. Official answer NTA (3)

Sol.

Question ID : 347577192

30. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: In photoelectric effect, on increasing the intensity of incident light the stopping potential increases.

Reason R: Increase in intensity of light increases the rate of photoelectrons emitted, provided the frequency of incident light is greater than threshold frequency.

In the light of the above statements, choose the correct answer from the options given below

(1) **A** is false but **R** is true

(2) **A** is false but **R** is false

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

(4) Both **A** and **R** are true and **R** is **NOT** the correct explanation of **A**

Ans. Official answer NTA (1)

Sol.

Question ID : 347577191

31. When an object is placed 40 cm away from a spherical mirror an image of magnification $\frac{1}{2}$ is produced. To obtain an image with magnification of $\frac{1}{3}$, the object is to be moved :

(1) 20 cm away from the mirror.

(2) 20 cm towards the mirror.

(3) 80 cm away from the mirror.

(4) 40 cm away from the mirror.

Ans. Official answer NTA (4)

Sol.

Question ID : 347577177

32. In an electromagnetic system, the quantity representing the ratio of electric flux and magnetic flux has dimension of $M^P L^Q T^R A^S$, where value of ' Q ' and ' R ' are

(1) (–2, 1) (2) (3, –5) (3) (1,–1) (4) (–2, 2)

Ans. Official answer NTA (3)

Sol.

Question ID : 347577193

33. Considering the Bohr model of hydrogen like atoms, the ratio of the radius of 5th orbit of the electron in Li^{2+} and He^{+}

(1) $\frac{4}{9}$ (2) $\frac{3}{2}$ (3) $\frac{9}{4}$ (4) $\frac{2}{3}$

Ans. Official answer NTA (4)

Sol.

Question ID : 347577176

34. In an experiment with a closed organ pipe, it is filled with water by $\left(\frac{1}{5}\right)$ th of its volume. The frequency of the fundamental note will change by

(1) 20% (2) –20% (3) 25% (4) –25%

Ans. Official answer NTA (3)

Sol.

Question ID : 347577195

35. In a Young's double slit experiment, the slits are separated by 0.2 mm . If the slits separation is increased to 0.4 mm , the percentage change of the fringe width is :

(1) 0% (2) 25% (3) 50% (4) 100%

Ans.

Ans. Official answer NTA (3)

Question ID : 347577184

36. Two simple pendulums having lengths l_1 and l_2 with negligible string mass undergo angular displacements θ_1 and θ_2, from their mean positions, respectively. If the angular accelerations of both pendulums are same, then which expression is correct?

(1) $\theta_1 l_1^2 = \theta_2 l_2^2$ (2) $\theta_1 l_2 = \theta_2 l_1$ (3) $\theta_1 l_2^2 = \theta_2 l_1^2$ (4) $\theta_1 l_1 = \theta_2 l_2$

Ans. Official answer NTA (2)

Sol.

Question ID : 347577180

37. Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: The kinetic energy needed to project a body of mass m from earth surface to infinity is $\frac{1}{2}$mgR , where R is the radius of earth.

Reason R: The maximum potential energy of a body is zero when it is projected to infinity from earth surface.

In the light of the above statements, choose the correct answer from the options given below

(1) **A** is false but **R** is true

(2) **A** is false but **R** is false

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

(4) Both **A** and **R** are true and **R** is **NOT** the correct explanation of **A**

Ans. Official answer NTA (2)

Sol.

Question ID : 347577189

38. Current passing through a wire as function of time is given as $I(t) = 0.02t + 0.01\,A$. The charge that will flow through the wire from t= 1 s to t = 2 is

(1) 0.07 C (2) 0.04 C (3) 0.02 C (4) 0.06 C

Ans. Official answer NTA (2)

Sol.

Question ID : 347577194

39. The Boolean expression $Y = A\bar{B}C + \bar{A}\bar{C}$ can be realised with which of the following gate configurations.

A. One 3-input AND gate, 3 NOT gates and one 2-input OR gate, One 2-input AND gate,

B. One 3 -input AND gate, 1 NOT gate, One 2 -input NOR gate and one 2 -input OR gate

C. 3-input OR gate, 3 NOT gates and one 2-input AND gate

Choose the correct answer from the options given below:

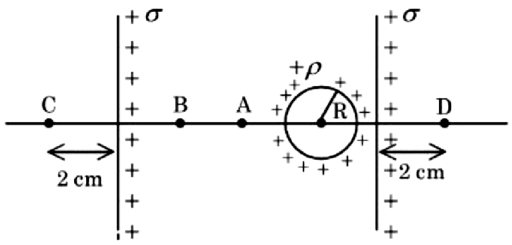
(1) B, C Only (2) A, C Only (3) A, B, C Only (4) A, B Only

Ans. Official answer NTA (4)

Sol.

Question ID : 347577187

40. Two infinite identical charged sheets and a charged spherical body of charge density 'ρ' are arranged as shown in figure. Then the correct relation between the electrical fields at A,B,C and D points is:



(1) $\vec{E}_A > \vec{E}_B; \vec{E}_C = \vec{E}_D$

(2) $\vec{E}_C \neq \vec{E}_D; \vec{E}_A > \vec{E}_B$

(3) $\left|\vec{E}_A\right| = \left|\vec{E}_B\right|; \vec{E}_C > \vec{E}_D$

(4) $\vec{E}_A = \vec{E}_B; \vec{E}_C = \vec{E}_D$

Ans. Official answer NTA (2)

Sol.

Question ID : 347577190

41. A small mirror of mass m is suspended by a massless thread of length l. Then the small angle through which the thread will be deflected when a short pulse of laser of energy E falls normal on the mirror

(c = speed of light in vacuum and g= acceleration due to gravity)

(1) $\theta = \frac{E}{mc\sqrt{gl}}$ (2) $\theta = \frac{3E}{4mc\sqrt{gl}}$ (3) $\theta = \frac{E}{2mc\sqrt{gl}}$ (4) $\theta = \frac{2E}{mc\sqrt{gl}}$

Ans. Official answer NTA (4)

Sol.

Question ID : 347577182

42. Two liquids A and B have θ_A and θ_B as contact angles in a capillary tube. If $K = \cos\theta_A / \cos\theta_B$, then identify the correct statement:

(1) K is negative, then liquid A and liquid B have convex meniscus.

(2) K is negative, then liquid A and liquid B have concave meniscus.

(3) K is zero, then liquid A has convex meniscus and liquid B has concave meniscus.

(4) K is negative, then liquid A has concave meniscus and liquid B has convex meniscus.

Ans. Official answer NTA (4)

Sol.

Question ID : 347577185

43. The mean free path and the average speed of oxygen molecules at 300 K and 1 atm are 3×10^{-7} and 600 m/s, respectively. Find the frequency of its collisions.

(1) 2×10^{9} / s (2) 2×10^{10} / s (3) 5×10^{8} / s (4) 9×10^{5} / s

Ans. Official answer NTA (1)

Sol.

Question ID : 347577178

44. Which of the following are correct expression for torque acting on a body?

A. $\vec{\tau} = \vec{r} \times \vec{L}$

B. $\vec{\tau} = \frac{d}{dt}(\vec{r} \times \vec{p})$

C. $\vec{\tau} = \vec{r} \times \frac{d\vec{p}}{dt}$

E. $\vec{\tau} = \vec{r} \times \vec{F}$

($\vec{r}$ = position vector $\vec{p}$ = linear momentum; $\vec{L}$ = angular momentum $\vec{a}$ = angular acceleration I = moment of inertia; $\vec{F}$ = force; t = time)

Choose the correct answer from the options given below:

(1) B, C, D and E Only

(2) B, D and E Only

(3) C and D Only

(4) A, B, D and E Only

Ans. Official answer NTA (1)

Sol.

Question ID : 347577188

45. Two small spherical balls of mass 10 g each with charges -2μC and 2μC, are attached to two ends of very light rigid rod of length 20 cm . The arrangement is now placed near an infinite nonconducting charge sheet with uniform charge density of 100 μC /m^2 such that length of rod makes an angle of 30^0 with electric field generated by charge sheet. Net torque acting on the rod is:

(Take $\varepsilon_0 : 8.85\times10^{-12} C^2 / Nm^2$)

(1) 1.12 Nm

(2) 11.2 Nm

(3) 2.24 Nm

(4) 112 Nm

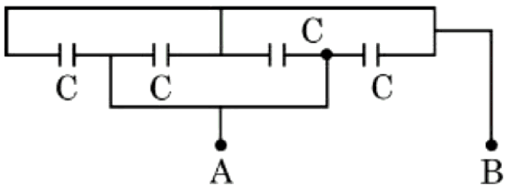
Ans. Official answer NTA (1)

Sol.

SECTION – B

Question ID : 347577198

46. Four capacitors each of capacitance 16μF are connected as shown in the figure. The capacitance between points A and B is : (in μF).



Ans. Official answer NTA (64)

Sol.

Question ID : 347577197

47. A circular ring and a solid sphere having same radius roll down on an inclined plane from rest without slipping.

The ratio of their velocities when reached at the bottom of the plane is $\sqrt{\frac{x}{5}}$ where $x =$ _____

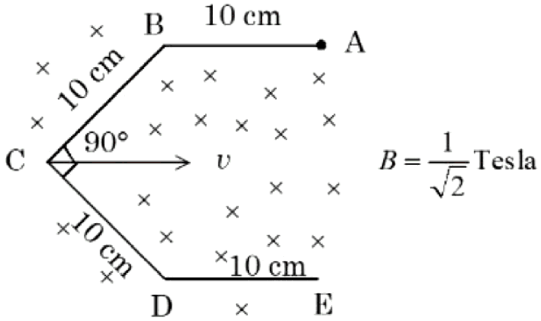
Ans. Official answer NTA (4)

Ans. Matrix answer (3.5)

Sol.

Question ID : 347577200

48. Conductor wire ABCDE with each arm 10 cm in length is placed in magnetic field of $\frac{1}{\sqrt{2}}$ Tesla, perpendicular to its plane. When conductor is pulled towards right with constant velocity of 10 cm/s, induced emf between points A and E is _____ mV .



Ans. Official answer NTA (10)

Sol.

Question ID : 347577199

49. Two slabs with square cross section of different materials (1, 2) with equal sides (l) and thickness d_1 and d_2 such that $d_2 = 2d_1$ and $l > d_2$. Considering lower edges of these slabs are fixed to the floor, we apply equal shearing force on the narrow faces. The angle of deformation is $\theta_2 = 2\theta_1$. If the shear moduli of material 1 is $4 \times 10^9\ N/m^2$, then shear moduli of material 2 is $x \times 10^9$, N/m^2, where value of x is _____.

Ans. Official answer NTA (1)

Sol.

Question ID : 347577196

50. Distance between object and its image (magnified by $-\frac{1}{3}$) is 30 cm. The focal length of the mirror used is , $\left(\frac{x}{4}\right)$ cm,

where magnitude of value of x is _____

Ans. Official answer NTA (45)

Sol.