JEE Main April 2024

Question Paper With Text Solution

08 April | Shift-2
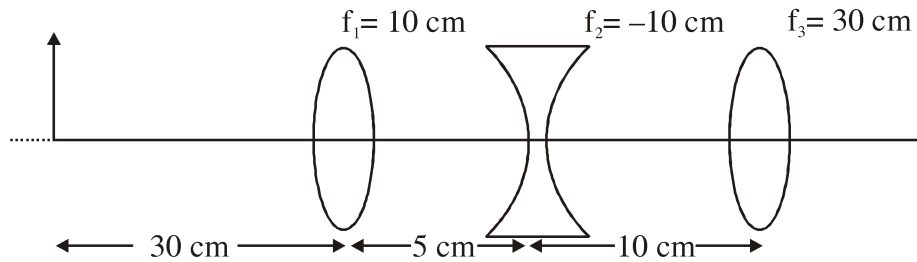
PHYSICS

31. The position of the image formed by the combination of lenses is:

(1) 30 cm (right of third lens)   (2) 30 cm (left of third lens)

(3) 15 cm (left of second lens)   (4) 15 cm (right of second lens)

Question ID : 87827056102

Ans.   Official Answer NTA (1)

Sol.

32. If ε_0 is the permittivity of free space and E is the electric field, then $\in_0 E^2$ has the dimensions:

(1) $[M\,L^{-1}\,T^{-2}]$ (2) $[M\,L^2\,T^{-2}]$ (3) $[M^{-1}\,L^{-3}\,T^4\,A^2]$ (4) $[M^0\,L^{-2}\,T\,A]$

Question ID : 87827056088

Ans.   Official Answer NTA (1)

Sol.

33. A given object takes n times the time to slide down 45° rough inclined plane as it takes the time to slide down an identical perfectly smooth 45° inclined plane. The coefficient of kinetic friction between the object and the surface of inclined plane is:
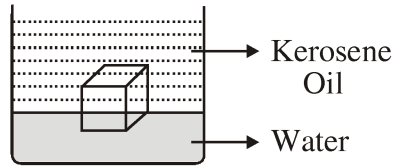
(1) $1 - n^2$ (2) $\sqrt{1 - n^2}$ (3) $1 - \dfrac{1}{n^2}$ (4) $\sqrt{1 - \dfrac{1}{n^2}}$

Question ID : 87827056090

Ans.   Official Answer NTA (3)

Sol.

34. A cube of ice floats partly in water and partly in kerosence oil. The ratio of volume of ice immersed in water to that in kerosene oil (specific gravity of Kerosene oil = 0.8, specific gravity of ice = 0.9) :

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(1) 5 : 4   (2) 1 : 1   (3) 9 : 10   (4) 8 : 9

Question ID : 87827056094

Ans.   Official Answer NTA (2)

Sol.

35.   A plane progressive wave is given by $y = 2 \cos 2\pi (330t - x)$ m. The frequency of the wave is :
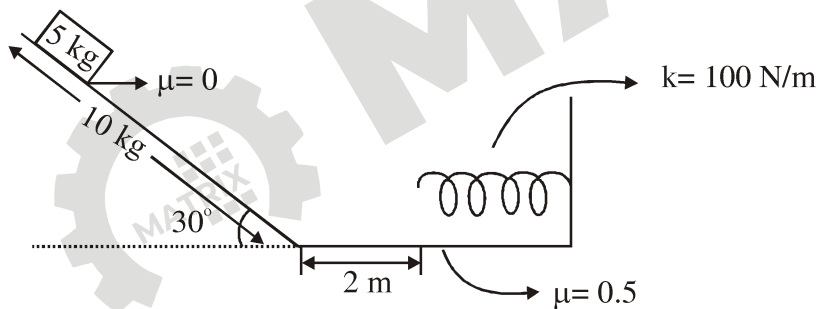
(1) 165 Hz   (2) 330 Hz   (3) 340 Hz   (4) 660 Hz

Question ID : 87827056101

Ans.   Official Answer NTA (2)

Sol.

36.   A block is simply released from the top of an inclined plane as shown in the figure above. The maximum compression in the spring when the block hits the spring is:

(1) $\sqrt{6}$ m   (2) 1 m   (3) $\sqrt{5}$ m   (4) 2 m

Question ID : 87827056091

Ans.   Official Answer NTA (4)

Sol.

37.   A long straight wire of radius a carries a steady current I. The current is uniformly distributed across its cross section. The ratio of the magnetic field at a/2 and 2a from axis of the wire is:

(1) 3 : 4   (2) 1 : 1   (3) 1 : 4   (4) 4 : 1

Question ID : 87827056099

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Ans.   Official Answer NTA (2)

Sol.

38.   The angle of projection for a projectile to have same horizontal range and maximum height is:
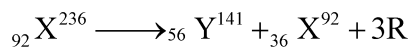
(1) $\tan^{-1}\left(\dfrac{1}{2}\right)$ (2) $\tan^{-1}(2)$ (3) $\tan^{-1}\left(\dfrac{1}{4}\right)$ (4) $\tan^{-1}(4)$

Question ID : 87827056089

Ans.   Official Answer NTA (4)

Sol.

39.   In a hypothetical fission reaction

$$_{92}X^{236} \longrightarrow {}_{56}Y^{141} + {}_{36}X^{92} + 3R$$

The identity of emitted particles (R) is:

(1) γ-radiations   (2) Neutron   (3) Electron   (4) Proton

Question ID : 87827056105

Ans.   Official Answer NTA (2)

Sol.

40.   There are 100 divisions on the circular scale of a screw gauge of pitch 1 mm. With no measuring quantity in between the jaws, the zero of the circular scale lies 5 divisions below the reference line. The diameter of a wire is then measured using this screw gauge. It is found that 4 linear scale divisions are clearly visible while 60 divisions on circular scale coincide with the reference line. The diameter of the wire is:

(1) 4.60 mm   (2) 3.35 mm   (3) 4.65 mm   (4) 4.55 mm

Question ID : 87827056106

Ans.   Official Answer NTA (4)

Sol.

41.   A coil of negligible resistance is connected in series with 90 Ω resistor across 120 V, 60 Hz supply. A voltmeter reads 36 V across resistance. Inductance of the coil is:

(1) 2.86 H   (2) 0.91 H   (3) 0.76 H   (4) 0.286 H

Question ID : 87827056100

Ans.   Official Answer NTA (3)

Sol.

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42. Water boils in an electric kettle in 20 minutes after being switched on. Using the same main supply, the length of the heating element should be _____ to _____ times of its initial length if the water is to be boiled in 15 minutes.

    (1) decreased, $\dfrac{4}{3}$ (2) increased $\dfrac{3}{4}$ (3) decreased, $\dfrac{3}{4}$ (4) increased, $\dfrac{4}{3}$

Question ID : 87827056098

Ans.   Official Answer NTA (3)

Sol.

43. A proton and an electron have the same de Broglie wavelength. If K_p and K_e be the kinetic energies of proton and electron respectively, then choose the correct relation:

    (1) $K_p < K_e$ (2) $K_p = K_e^2$ (3) $K_p = K_e$ (4) $K_p > K_e$

Question ID : 87827056103

Ans.   Official Answer NTA (1)

Sol.

44. If M_0 is the mass of isotope $^{12}_{5}B$, M_p and M_n are the masses of proton and neutron, then nuclear binding energy of isotope is:

    (1) $\left(M_0 - 5M_p \right) C^2$ (2) $\left(5M_p + 7M_n - M_0 \right) C^2$

    (3) $\left(M_0 - 5M_p - 7M_n \right) C^2$ (4) $\left(M_0 - 12M_n \right) C^2$

Question ID : 87827056104

Ans.   Official Answer NTA (2)

Sol.

45. A capacitor has air as dielectric medium and two conducting plates of area 12 cm^2 and they are 0.6 cm apart. When a slab of dielectric having area 12 cm^2 and 0.6 cm thickness is inserted between the plates, one of the conducting plates has to be moved by 0.2 cm to keep the capacitance same as in previous case. The dielectric constant of the slab is: (Given $\in_0 = 8.834 \times 10^{-12}$ F/m)

    (1) 1.33   (2) 1   (3) 0.66   (4) 1.50

Question ID : 87827056097

Ans.   Official Answer NTA (4)

Sol.

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46. Least count of a vernier caliper is $\dfrac{1}{20N}$ cm. The value of one division on the main scale is 1 mm. Then the number of divisions of main scale that coincide with N divisions of vernier scale is:

    (1) $\left(\dfrac{2N-1}{20N}\right)$　　(2) $\left(\dfrac{2N-1}{2}\right)$　　(3) $(2N-1)$　　(4) $\left(\dfrac{2N-1}{2N}\right)$

Question ID : 87827056107

Ans.　Official Answer NTA (2)

Sol.

47. Given below are two statements:

    Statement (I) : The mean free path of gas molecules is inversely proportional to square of molecular diameter.

    Statement (II): Average kinetic energy of gas molecules is directly proportional to absolute temperature of gas.

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

    (1) Both Statement I and Statement II are true　(2) Both Statement I and Statement II are false

    (3) Statement I is false but Statement II is true　(4) Statement I is true but Statement II is false

Question ID : 87827056096

Ans.　Official Answer NTA (1)

Sol.

48. A diatomic gas ($\gamma = 1.4$) does 100 J of work in an isobaric expansion. The heat given to the gas is:

    (1) 490 J　　　(2) 150 J　　　(3) 350 J　　　(4) 250 J

Question ID : 87827056095

Ans.　Official Answer NTA (3)

Sol.

49. Two satellite A and b go round a planet in circular orbits having radii 4 R and R respectively. If the speed of A is 3 v, the speed of B will be:

    (1) 3 v　　　(2) 4/3 v　　　(3) 12 v　　　(4) 6 v

Question ID : 87827056093

Ans.　Official Answer NTA (4)

Sol.

50. A thin circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its

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centre and perpendicular to its plane with angular velocity ω. If another disc of same dimensions but of mass M/2 is placed gently on the first disc co-axially, then the new angular velocity of the system is:
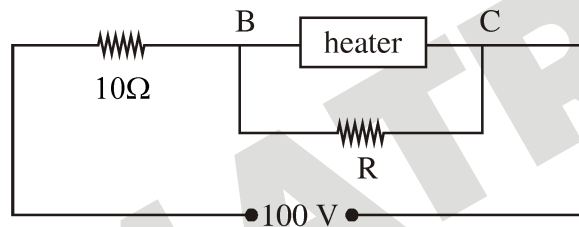
(1) 3/2 ω (2) 2/3 ω (3) 5/4 ω (4) 4/5 ω

Question ID : 87827056092

Ans. Official Answer NTA (2)

Sol.

51. A heater is designed to operate with a power of 1000 W in a 100 V line. It is connected in combination with a resistance of 10 Ω and a resistance R, to a 100 V mains as shown in figure. For the heater to operate at 62.5 W, the value of R should be _____ Ω.

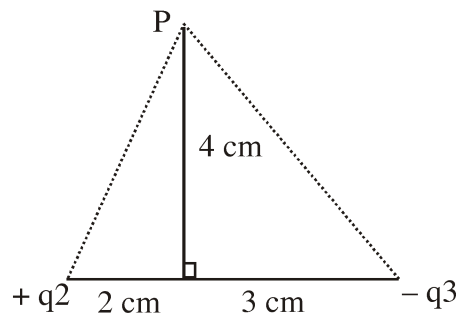Question ID : 87827056113

Ans. Official Answer NTA (5)

Sol.

52. An object of mass 0.2 kg executes simple harmonic motion along x-axis with frequency of $\left(\dfrac{25}{\pi}\right)$ Hz. At the position x = 0.04 m the object has kinetic energy 0.5 J and potential energy 0.4 J. The amplitude of oscillation is _____ cm.

Question ID : 87827056111

Ans. Official Answer NTA (6)

Sol.

53. If the net electric field at point P along Y axis is zero, then the ratio of $\left|\dfrac{q_2}{q_3}\right|$ is $\dfrac{8}{5\sqrt{x}}$, where x = _____.

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Question ID : 87827056112

Ans.   Official Answer NTA (5)

Sol.

54.   A body of mass m thrown horizontally with velocity v from the top of the tower of height H touches the ground at a distance of 100 m from the foot of the tower. A body of mass 2M thrown at a velocity $\dfrac{v}{2}$ from the top of the tower of height 4 H will touch the ground at a distance of _____ m.

Question ID : 87827056108

Ans.   Official Answer NTA (100)

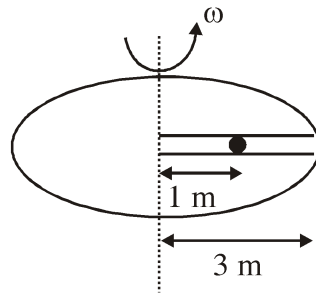Sol.

55.   The coercivity of a magnet is 5×10^3 A/m. The amount of current required to be passed in a solenoid of length 30 cm and the number of turns 150, so that the magnet gets demagnetised when inside the solenoid is _____ A.

Question ID : 87827056114

Ans.   Official Answer NTA (10)

Sol.

56.   A circular table is rotating with an angular velocity of ω rad/s about its axis (see figure). There is a smooth groove along a radial direction on the table. A steel ball is gently placed at a distance of 1 m on the groove. All the surfaces are smooth. If the radius of the table is 3 m, the radial velocity of the ball w.r.t. the table at the time ball leaves the table is $x\sqrt{2}\omega$ m / s, where the value of x is _____ .

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Question ID : 87827056109

Ans.   Official Answer NTA (2)

Sol.

57.   Two slits are 1 mm apart and the screen is located 1 m away from the slits. A light of wavelength 500 nm is used. The width of each slit to obtain 10 maxima of the double slit pattern within the central maximum of the single slit pattern is _____ × 10⁻⁴ m.
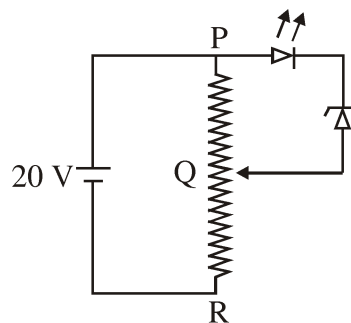
Question ID : 87827056116

Ans.   Official Answer NTA (2)

Sol.

58.   An alternating emf $E = 110\sqrt{2}\sin 100t$ volt is applied to a capacitor of 2 μF, the rms value of current in the circuit is _____ mA.

Question ID : 87827056115

Ans.   Official Answer NTA (22)

Sol.

59.   A potential divider circuit is connected with a dc source of 20 V, a light emitting diode of glow in voltage 1.8 V and a zener diode of breakdown voltage of 3.2 V. The length (PR) of the resistive wire is 20 cm. The minimum length of PQ to just glow the LED is _____ cm.

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Question ID : 87827056117

Ans.   Official Answer NTA (5)

Sol.

60.   Small water droplets of radius 0.01 mm are formed in the upper atmosphere and falling with a terminal velocity of 10 cm/s. Due to condensation, if 8 such droplets are coalesced and formed a larger drop, the new terminal velocity will be _____ cm/s.

Question ID : 87827056110

Ans.   Official Answer NTA (40)

Sol.

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