# JEE-MAIN EXAM APRIL, 2024

**Date: - 09-04-2024 (SHIFT-2)**

## PHYSICS

### SECTION-A

**1.** A nucleus at rest disintegrates into two smaller nuclei with their masses in the ratio of 2 : 1. After disintegration they will move :-

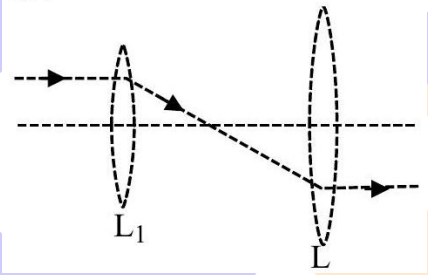
(1) In opposite directions with speed in the ratio of 1:2 respectively

(2) In opposite directions with speed in the ratio of 2:1 respectively

(3) In the same direction with same speed.

(4) In opposite directions with the same speed.

**2.** The following figure represents two biconvex lenses $L_1$ and $L_2$ having focal length 10 cm and 15 cm respectively. The distance between $L_1$ & $L_2$ is :




(1) 10 cm (2) 15 cm (3) 25 cm (4) 35 cm

3. The temperature of a gas is –78ºC and the average translational kinetic energy of its molecules is K. The temperature at which the average translational kinetic energy of the molecules of the same gas becomes 2 K is :

(1) –39ºC (2) 117ºC (3) 127ºC (4) –78ºC

4. A hydrogen atom in ground state is given an energy of 10.2 eV. How many spectral lines will be emitted due to transition of electrons?

(1) 6 (2) 3 (3) 10 (4) 1

5. The magnetic field in a plane electromagnetic wave is $B_y = \left(3.5\times10^{-5}\right)\sin\left(1.5\times10^{3}x + 0.5\times10^{11}t\right)T$ . The corresponding electric field will be

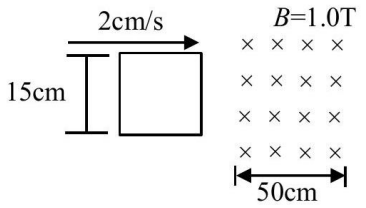
(1) $E_y = 1.17\sin\left(1.5\times10^{3}x + 0.5\times10^{11}t\right)Vm^{-1}$

(2) $E_z = 105\sin\left(1.5\times10^{3}x + 0.5\times10^{11}t\right)Vm^{-1}$

(3) $E_z = 1.17\sin\left(1.5\times10^{3}x + 0.5\times10^{11}t\right)Vm^{-1}$

(4) $E_y = 10.5\sin\left(1.5\times10^{3}x + 0.5\times10^{11}t\right)Vm^{-1}$

6. A square loop of side 15 cm being moved towards right at a constant speed of 2 cm/s as shown in figure. The front edge enters the 50 cm wide magnetic field at t = 0. The value of induced emf in the loop at t = 10 s will be :

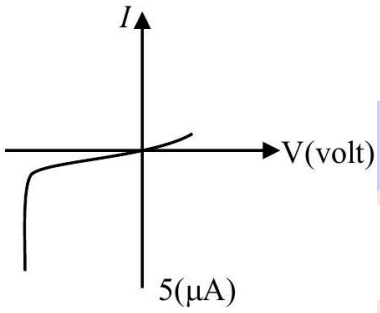



(1) 0.3 mV (2) 4.5 mV (3) zero (4) 3mV

7. Two cars are travelling towards each other at speed of 20 m $s^{-1}$ each. When the cars are 300 m apart, both the drivers apply brakes and the cars retard at the rate of 2 $ms^{-2}$. The distance between them when they come to rest is :

(1) 200 m (2) 50 m (3) 100 m (4) 25 m

8. The I – V characteristics of an electronic device shown in the figure. The device is :




(1) a solar cell

(2) a transistor which can be used as an amplifier

(3) a zener diode which can be used as voltage regulator

(4) a diode which can be used as a rectifier

9. The excess pressure inside a soap bubble is thrice the excess pressure inside a second soap bubble. The ratio between the volume of the first and the second bubble is :

(1) 1:9 (2) 1:3 (3) 1:81 (4) 1:27

10. The de-Broglie wavelength associated with a particle of mass m and energy E is $h/\sqrt{2mE}$. The dimensional formula for Planck's constant is :

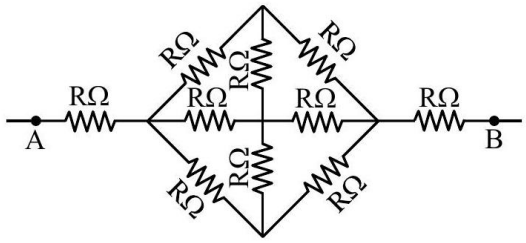
(1) $\left[ML^{-1}T^{-2}\right]$ (2) $\left[ML^{2}T^{-1}\right]$ (3) $\left[MLT^{-2}\right]$ (4) $\left[M^{2}L^{2}T^{-2}\right]$

11. A satellite of $10^3$ kg mass is revolving in circular orbit of radius 2R. If $\frac{10^4 R}{6}$ J energy is supplied to the satellite, it would revolve in a new circular orbit of radius :

(use g = 10 $m/s^2$, R = radius of earth)

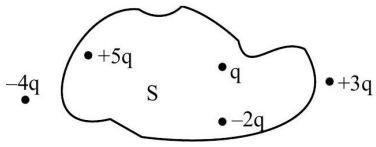
(1) 2.5 R (2) 3 R (3) 4R (4) 6R

12. The effective resistance between A and B, if resistance of each resistor is R, will be




(1) $\frac{2}{3}R$ (2) $\frac{8R}{3}$ (3) $\frac{5R}{3}$ (4) $\frac{4R}{3}$

13. Five charges +q, +5 q, –2q, +3q and –4q are situated as shown in the figure. The electric flux due to this configuration through the surface S is :




(1) $\frac{5q}{\epsilon_0}$ (2) $\frac{4q}{\epsilon_0}$ (3) $\frac{3q}{\varepsilon_0}$ (4) $\frac{q}{\varepsilon_0}$

14. A proton and a deutron ( q = +e, m = 2.0 u) having same kinetic energies enter a region of uniform magnetic field $\vec{B}$, moving perpendicular to $\vec{B}$. The ratio of the radius $r_d$ of deutron path to the radius $r_p$ of the proton path is :

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

15. UV light of 4.13 eV is incident on a photosensitive metal surface having work function 3.13 eV. The maximum kinetic energy of ejected photoelectrons will be :

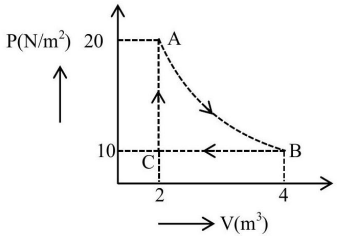
(1) 4.13 eV (2) 1eV (3) 3.13 eV (4) 7.26 eV

16. The energy released in the fusion of 2 Kg of hydrogen deep in the sun is $E_H$ and the energy released in the fission of 2 kg of $^{235}U$ is $E_U$. The ratio $\frac{E_H}{E_U}$ is approximately :

(Consider the fusion reaction as $4_1^1H + 2e^- \rightarrow {}_2^4He + 2v + 6\gamma + 26.7MeV$ , energy released in the fission reaction of $^{235}U$ is 200 MeV per fission nucleus and $N_A = 6.023 \times 10^{23}$)

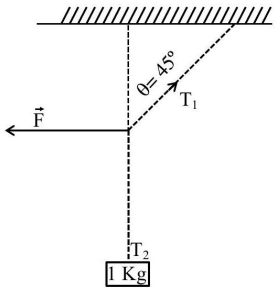
(1) 9.13 (2) 15.04 (3) 7.62 (4) 25.6

17. A real gas within a closed chamber at 27ºC undergoes the cyclic process as shown in figure. The gas obeys $PV^3 = RT$ equation for the path A to B. The net work done in the complete cycle is (assuming R = 8 J/mol K):




(1) 225 J (2) 205 J (3) 20 J (4) –20 J

18. A 1 kg mass is suspended from the ceiling by a rope of length 4 m. A horizontal force 'F' is applied at the mid point of the rope so that the rope makes an angle of 45º with respect to the vertical axis as shown in figure. The magnitude of F is :



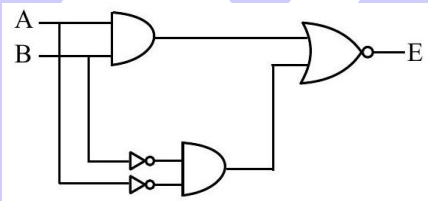

(1) $\frac{10}{\sqrt{2}}N$ (2) 1 N (3) $\frac{1}{10\times\sqrt{2}}N$ (4) 10 N

19. A spherical ball of radius $1\times10^{-4}$ m and density $10^5$ kg/m$^3$ falls freely under gravity through a distance h before entering a tank of water, If after entering in water the velocity of the ball does not change, then the value of h is approximately:

(The coefficient of viscosity of water is $9.8 \times 10^{-6}$ Ns/m$^2$)

(1) 2296 m (2) 2249 m (3) 2518 m (4) 2396 m

20.




| A | B | E |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | X |
| 1 | 0 | Y |
| 1 | 1 | 0 |

In the truth table of the above circuit the value of X and Y are :

(1) 1,1 (2) 1,0 (3) 0,1 (4) 0,0

## SECTION-B

21. A straight magnetic strip has a magnetic moment of 44Am$^2$. If the strip is bent in a semicircular shape, its magnetic moment will be

Am$^2$

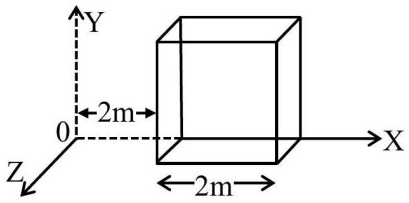
(Given $\pi = \frac{22}{7}$)

22. A particle of mass 0.50 kg executes simple harmonic motion under force F = –50(Nm$^{-1}$)x. The time period of oscillation is $\frac{x}{35}$s. The value of x is.

(Given $\pi = \frac{22}{7}$)

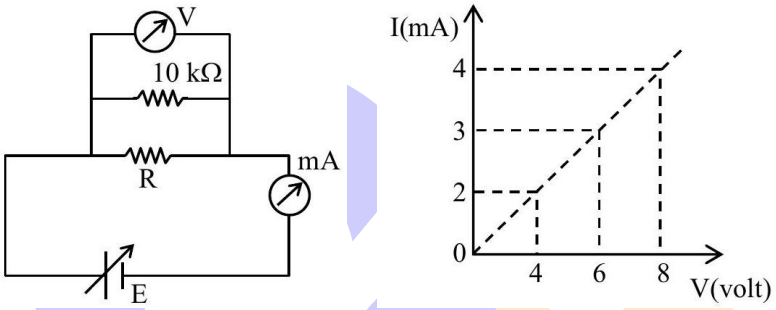
23. A capacitor of reactance $4\sqrt{3}\Omega$ and a resistor of resistance $4\Omega$ are connected in series with an ac source of peak value $8\sqrt{2}$ V. The power dissipation in the circuit is W.

24. An electric field $\vec{E} = (2 \times \hat{i})NC^{-1}$ exists in space. A cube of side 2 m is placed in the space as per figure given below. The electric flux through the cube is $Nm^2/C$.




**25.** A circular disc reaches from top to bottom of an inclined plane of length *l*. When it slips down the plane, if takes t. When it rolls down the plane then it takes $\left(\frac{\alpha}{2}\right)^{1/2}$ ts, , where $\alpha$ is

**26.** To determine the resistance (R) of a wire, a circuit is designed below, The V-I characteristic curve for this circuit is plotted for the voltmeter and the ammeter readings as shown in figure. The value of R is $\Omega$.




**27.** The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$ and its magnitude is half that of $\vec{B}$. The angle between vectors $\vec{A}$ and $\vec{B}$ is

**28.** Monochromatic light of wavelength 500 nm is used in Young's double slit experiment. An interference pattern is obtained on a screen When one of the slits is covered with a very thin glass plate (refractive index = 1.5), the central maximum is shifted to a position previously occupied by the $4^{th}$ bright fringe. The thickness of the glass-plate is $\mu$m.

**29.** A force $(3x^2 + 2x - 5)N$ displaces a body from x = 2 m to x = 4 m. Work done by this force is J.

**30.** At room temperature (27ºC), the resistance of a heating element is 50Ω. The temperature coefficient of the material is $2.4 \times 10^{-4}C^{-1}$. The temperature of the element, when its resistance is 62Ω, is ºC.

## NTA ANSWERS

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | **(1)** | **2.** | **(3)** | **3.** | **(2)** | **4.** | **(4)** | **5.** | **(2)** | **6.** | **(3)** | **7.** | **(3)** |
| **8.** | **(3)** | **9.** | **(4)** | **10.** | **(2)** | **11.** | **(4)** | **12.** | **(2)** | **13.** | **(2)** | **14.** | **(3)** |
| **15.** | **(2)** | **16.** | **(3)** | **17.** | **(2)** | **18.** | **(4)** | **19.** | **(3)** | **20.** | **(1)** | **21.** | **(28)** |
| **22.** | **(22)** | **23.** | **(4)** | **24.** | **(16)** | **25.** | **(3)** | **26.** | **(2500)** | **27.** | **(150)** | **28.** | **(4)** |
| **29.** | **(58)** | **30.** | **(1027)** | | | | | | | | | | |