

**TEST PAPER OF JEE(MAIN) EXAMINATION – 2019**

**(Held On Wednesday 09<sup>th</sup> JANUARY, 2019) TIME : 02 : 30 PM To 05 : 30 PM**

**PHYSICS**

1. Two plane mirrors are inclined to each other such that a ray of light incident on the first mirror ( $M_1$ ) and parallel to the second mirror ( $M_2$ ) is finally reflected from the second mirror ( $M_2$ ) parallel to the first mirror ( $M_1$ ). The angle between the two mirrors will be :

- (1)  $90^\circ$  (2)  $45^\circ$  (3)  $75^\circ$  (4)  $60^\circ$

Ans. (4)

2. In a Young's double slit experiment, the slits are placed 0.320 mm apart. Light of wavelength  $\lambda = 500$  nm is incident on the slits. The total number of bright fringes that are observed in the angular range  $-30^\circ \leq \theta \leq 30^\circ$  is:

- (1) 320 (2) 641 (3) 321 (4) 640

Ans. (2)

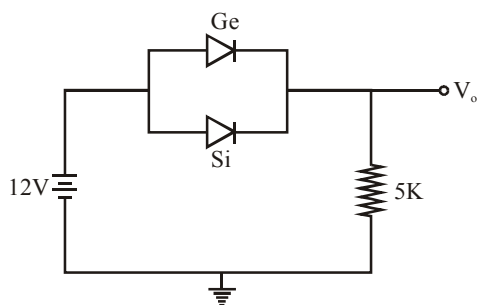
3. At a given instant, say  $t = 0$ , two radioactive substances A and B have equal activities. The ratio  $\frac{R_B}{R_A}$  of their activities after time  $t$  itself decays with time  $t$  as  $e^{-3t}$ . [If the half-life of A is  $m_1$ , the half-life of B is :

- (1)  $\frac{\ln 2}{2}$  (2)  $2 \ln 2$

- (3)  $\frac{\ln 2}{4}$  (4)  $4 \ln 2$

Ans. (3)

4. Ge and Si diodes start conducting at 0.3 V and 0.7 V respectively. In the following figure if Ge diode connection are reversed, the value of  $V_o$  changes by : (assume that the Ge diode has large breakdown voltage)



- (1) 0.6 V (2) 0.8 V (3) 0.4 V (4) 0.2 V

Ans. (3)

5. A rod of mass 'M' and length '2L' is suspended at its middle by a wire. It exhibits torsional oscillations; If two masses each of 'm' are attached at distance 'L/2' from its centre on both sides, it reduces the oscillation frequency by 20%. The value of ratio  $m/M$  is close to :

- (1) 0.17 (2) 0.37  
(3) 0.57 (4) 0.77

Ans. (2)

6. A 15 g mass of nitrogen gas is enclosed in a vessel at a temperature  $27^\circ\text{C}$ . Amount of heat transferred to the gas, so that rms velocity of molecules is doubled, is about : [Take  $R = 8.3$  J/ K mole]

- (1) 10 kJ (2) 0.9 kJ (3) 6 kJ (4) 14 kJ

Ans. (1)

7. A particle is executing simple harmonic motion (SHM) of amplitude A, along the x-axis, about  $x = 0$ . When its potential Energy (PE) equals kinetic energy (KE), the position of the particle will be :

- (1)  $\frac{A}{2}$  (2)  $\frac{A}{2\sqrt{2}}$

- (3)  $\frac{A}{\sqrt{2}}$  (4) A

Ans. (3)

8. A musician using an open flute of length 50 cm produces second harmonic sound waves. A person runs towards the musician from another end of a hall at a speed of 10 km/h. If the wave speed is 330 m/s, the frequency heard by the running person shall be close to :

- (1) 753 Hz (2) 500 Hz  
(3) 333 Hz (4) 666 Hz

Ans. (4)

9. In a communication system operating at wavelength 800 nm, only one percent of source frequency is available as signal bandwidth. The number of channels accommodated for transmitting TV signals of band width 6 MHz are (Take velocity of light  $c = 3 \times 10^8$  m/s,  $h = 6.6 \times 10^{-34}$  J-s)

- (1)  $3.75 \times 10^6$  (2)  $4.87 \times 10^5$   
(3)  $3.86 \times 10^6$  (4)  $6.25 \times 10^5$

Ans. (4)

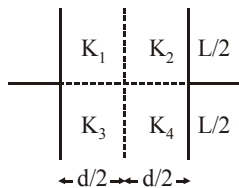
10. Two point charges  $q_1(\sqrt{10} \mu\text{C})$  and  $q_2(-25 \mu\text{C})$  are placed on the x-axis at  $x = 1 \text{ m}$  and  $x = 4 \text{ m}$  respectively. The electric field (in V/m) at a point  $y = 3 \text{ m}$  on y-axis is,

$$\left[ \text{take } \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2} \right]$$

- (1)  $(-63\hat{i} + 27\hat{j}) \times 10^2$
- (2)  $(81\hat{i} - 81\hat{j}) \times 10^2$
- (3)  $(63\hat{i} - 27\hat{j}) \times 10^2$
- (4)  $(-81\hat{i} + 81\hat{j}) \times 10^2$

Ans. (3)

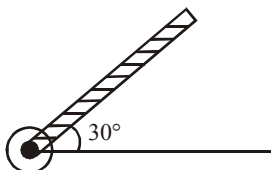
11. A parallel plate capacitor with square plates is filled with four dielectrics of dielectric constants  $K_1, K_2, K_3, K_4$  arranged as shown in the figure. The effective dielectric constant  $K$  will be :



- (1)  $K = \frac{(K_1 + K_2)(K_3 + K_4)}{2(K_1 + K_2 + K_3 + K_4)}$
- (2)  $K = \frac{(K_1 + K_2)(K_3 + K_4)}{(K_1 + K_2 + K_3 + K_4)}$
- (3)  $K = \frac{(K_1 + K_4)(K_2 + K_3)}{2(K_1 + K_2 + K_3 + K_4)}$
- (4)  $K = \frac{(K_1 + K_3)(K_2 + K_4)}{K_1 + K_2 + K_3 + K_4}$

Ans. (Bonus)

12. A rod of length 50cm is pivoted at one end. It is raised such that it makes an angle of  $30^\circ$  from the horizontal as shown and released from rest. Its angular speed when it passes through the horizontal (in  $\text{rad s}^{-1}$ ) will be ( $g = 10\text{ms}^{-2}$ )



- (1)  $\sqrt{30}$
- (2)  $\sqrt{\frac{30}{2}}$
- (3)  $\frac{\sqrt{30}}{2}$
- (4)  $\frac{\sqrt{20}}{3}$

Ans. (1)

13. One of the two identical conducting wires of length  $L$  is bent in the form of a circular loop and the other one into a circular coil of  $N$  identical turns. If the same current is passed in both, the ratio of the magnetic field at the central of the loop ( $B_L$ ) to that at the centre of the coil ( $B_C$ ), i.e.  $R \frac{B_L}{B_C}$  will be :

- (1)  $\frac{1}{N}$
- (2)  $N^2$
- (3)  $\frac{1}{N^2}$
- (4)  $N$

Ans. (3)

14. The energy required to take a satellite to a height 'h' above Earth surface (radius of Earth =  $6.4 \times 10^3 \text{ km}$ ) is  $E_1$  and kinetic energy required for the satellite to be in a circular orbit at this height is  $E_2$ . The value of h for which  $E_1$  and  $E_2$  are equal, is:

- (1)  $1.28 \times 10^4 \text{ km}$
- (2)  $6.4 \times 10^3 \text{ km}$
- (3)  $3.2 \times 10^3 \text{ km}$
- (4)  $1.6 \times 10^3 \text{ km}$

Ans. (3)

15. The energy associated with electric field is ( $U_E$ ) and with magnetic field is ( $U_B$ ) for an electromagnetic wave in free space. Then :

- (1)  $U_E = \frac{U_B}{2}$
- (2)  $U_E < U_B$
- (3)  $U_E = U_B$
- (4)  $U_E > U_B$

Ans. (3)

16. A series AC circuit containing an inductor (20 mH), a capacitor ( $120 \mu\text{F}$ ) and a resistor ( $60\Omega$ ) is driven by an AC source of  $24 \text{ V}/50 \text{ Hz}$ . The energy dissipated in the circuit in 60 s is :

- (1)  $2.26 \times 10^3 \text{ J}$
- (2)  $3.39 \times 10^3 \text{ J}$
- (3)  $5.65 \times 10^2 \text{ J}$
- (4)  $5.17 \times 10^2 \text{ J}$

Ans. (4)

17. Expression for time in terms of  $G$  (universal gravitational constant),  $h$  (Planck constant) and  $c$  (speed of light) is proportional to :

- (1)  $\sqrt{\frac{Gh}{c^3}}$                       (2)  $\sqrt{\frac{hc^5}{G}}$   
 (3)  $\sqrt{\frac{c^3}{Gh}}$                       (4)  $\sqrt{\frac{Gh}{c^5}}$

Ans. (4)

18. The magnetic field associated with a light wave is given, at the origin, by

$$B = B_0 [\sin(3.14 \times 10^7 ct) + \sin(6.28 \times 10^7 ct)].$$

If this light falls on a silver plate having a work function of 4.7 eV, what will be the maximum kinetic energy of the photo electrons ?

$$(c = 3 \times 10^8 \text{ms}^{-1}, h = 6.6 \times 10^{-34} \text{J-s})$$

- (1) 7.72 eV                      (2) 8.52 eV  
 (3) 12.5 eV                      (4) 6.82 eV

Ans. (1)

19. Charge is distributed within a sphere of radius  $R$

with a volume charge density  $\rho(r) = \frac{A}{r^2} e^{-2r/a}$ ,

where  $A$  and  $a$  are constants. If  $Q$  is the total charge of this charge distribution, the radius  $R$  is :

- (1)  $\frac{a}{2} \log\left(1 - \frac{Q}{2\pi aA}\right)$                       (2)  $a \log\left(1 - \frac{Q}{2\pi aA}\right)$   
 (3)  $a \log\left(\frac{1}{1 - \frac{Q}{2\pi aA}}\right)$                       (4)  $\frac{a}{2} \log\left(\frac{1}{1 - \frac{Q}{2\pi aA}}\right)$

Ans. (4)

20. Two Carnot engines A and B are operated in series. The first one, A, receives heat at  $T_1 (= 600 \text{ K})$  and rejects to a reservoir at temperature  $T_2$ . The second engine B receives heat rejected by the first engine and, in turn, rejects to a heat reservoir at  $T_3 (= 400 \text{ K})$ . Calculate the temperature  $T_2$  if the work outputs of the two engines are equal :

- (1) 400 K    (2) 600 K    (3) 500 K    (4) 300 K

Ans. (3)

21. A carbon resistance has a following colour code. What is the value of the resistance ?



- (1)  $1.64 \text{ M}\Omega \pm 5\%$   
 (2)  $530 \text{ k}\Omega \pm 5\%$   
 (3)  $64 \text{ k}\Omega \pm 10\%$   
 (4)  $5.3 \text{ M}\Omega \pm 5\%$

Ans. (2)

22. A force acts on a 2 kg object so that its position is given as a function of time as  $x = 3t^2 + 5$ . What is the work done by this force in first 5 seconds ?

- (1) 850 J                      (2) 900 J  
 (3) 950 J                      (4) 875 J

Ans. (2)

23. The position co-ordinates of a particle moving in a 3-D coordinate system is given by

$$x = a \cos \omega t$$

$$y = a \sin \omega t$$

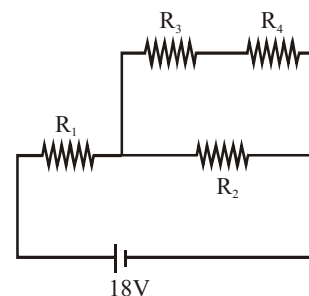
$$\text{and } z = a \omega t$$

The speed of the particle is :

- (1)  $a\omega$                       (2)  $\sqrt{3} a\omega$   
 (3)  $\sqrt{2} a\omega$                       (4)  $2a\omega$

Ans. (3)

24. In the given circuit the internal resistance of the 18 V cell is negligible. If  $R_1 = 400 \Omega$ ,  $R_3 = 100 \Omega$  and  $R_4 = 500 \Omega$  and the reading of an ideal voltmeter across  $R_4$  is 5V, then the value  $R_2$  will be :



- (1) 300  $\Omega$                       (2) 230  $\Omega$   
 (3) 450  $\Omega$                       (4) 550  $\Omega$

Ans. (1)

**MAJOR COMPUTER BASED TEST (CBT) SERIES**

**JEE (Advanced)- Target 2019**

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Test Dates: 3<sup>rd</sup> Feb, 21<sup>st</sup> & 28<sup>th</sup> April, 12<sup>th</sup> May

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25. A mass of 10 kg is suspended vertically by a rope from the roof. When a horizontal force is applied on the rope at some point, the rope deviated at an angle of  $45^\circ$  at the roof point. If the suspended mass is at equilibrium, the magnitude of the force applied is ( $g = 10 \text{ ms}^{-2}$ )
- (1) 200 N
  - (2) 100 N
  - (3) 140 N
  - (4) 70 N

Ans. (2)

26. In a car race on straight road, car A takes a time  $t$  less than car B at the finish and passes finishing point with a speed ' $v$ ' more than that of car B. Both the cars start from rest and travel with constant acceleration  $a_1$  and  $a_2$  respectively. Then ' $v$ ' is equal to :

- (1)  $\frac{a_1 + a_2}{2} t$
- (2)  $\sqrt{2a_1 a_2} t$
- (3)  $\frac{2a_1 a_2}{a_1 + a_2} t$
- (4)  $\sqrt{a_1 a_2} t$

Ans. (4)

27. A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. The output power is delivered at 230 V by the transformer. If the current in the primary of the transformer is 5A and its efficiency is 90%, the output current would be :

- (1) 25 A
- (2) 50 A
- (3) 35 A
- (4) 45 A

Ans. (4)

28. The top of a water tank is open to air and its water level is maintained. It is giving out  $0.74 \text{ m}^3$  water per minute through a circular opening of 2 cm radius in its wall. The depth of the centre of the opening from the level of water in the tank is close to :

- (1) 9.6 m
- (2) 4.8 m
- (3) 2.9 m
- (4) 6.0 m

Ans. (2)

29. The pitch and the number of divisions, on the circular scale, for a given screw gauge are 0.5 mm and 100 respectively. When the screw gauge is fully tightened without any object, the zero of its circular scale lies 3 divisions below the mean line.

The readings of the main scale and the circular scale, for a thin sheet, are 5.5 mm and 48 respectively, the thickness of this sheet is :

- (1) 5.755 mm
- (2) 5.725 mm
- (3) 5.740 mm
- (4) 5.950 mm

Ans. (2)

30. A particle having the same charge as of electron moves in a circular path of radius 0.5 cm under the influence of a magnetic field of 0.5 T. If an electric field of 100 V/m makes it to move in a straight path, then the mass of the particle is (Given charge of electron =  $1.6 \times 10^{-19} \text{ C}$ )

- (1)  $2.0 \times 10^{-24} \text{ kg}$
- (2)  $1.6 \times 10^{-19} \text{ kg}$
- (3)  $1.6 \times 10^{-27} \text{ kg}$
- (4)  $9.1 \times 10^{-31} \text{ kg}$

Ans. (1)

**MAJOR COMPUTER BASED TEST (CBT) SERIES**

**JEE (Main)- Target 2019**

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Test Dates: 24<sup>th</sup> & 31<sup>st</sup> March

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