JEE-MAIN EXAM APRIL, 2025

Date: - 04-04-2025 (SHIFT-2)

PHYSICS

SECTION-A

1. For the determination of refractive index of glass slab, a travelling microscope is used whose main scale contains 300 equal divisions equals to 15 cm. The vernier scale attached to the microscope has 25 divisions equals to 24 divisions of main scale. The least count (LC) of the travelling microscope is (in cm) :

(1) 0.002 (2) 0.0005 (3) 0.001 (4) 0.0025

2. A wheel is rolling on a plane surface. The speed of a particle on the highest point of the rim is $8\,\mathrm{m/s}$. The speed of the particle on the rim of the wheel at the same level as the centre of wheel, will be :

(1) $4\sqrt{2}\,\mathrm{m/s}$ (2) $8\sqrt{2}\,\mathrm{m/s}$ (3) $8\,\mathrm{m/s}$ (4) $4\,\mathrm{m/s}$

3. Consider a n-type semiconductor in which n_e and n_h are number of electrons and holes, respectively.

(A) Holes are minority carriers

(B) The dopant is a pentavalent atom

(C) $n_e n_h \neq n_i^2$

(where n_i is number of electrons or holes in semiconductor when it is intrinsic form)

(D) $n_e n_h \geqslant n_i^2$

(E) The holes are not generated due to the donors

Choose the correct answer from the options given below :

(1) (A), (C), (D) only (2) (A), (B), (E) only

(3) (A), (B), (C) only (4) (A), (C), (E) only

4. A cylindrical rod of length 1 m and radius 4 cm is mounted vertically. It is subjected to a shear force of $10^5\,\mathrm{N}$ at the top. Considering infinitesimally small displacement in the upper edge, the angular displacement θ of the rod axis from its original position would be: (shear moduli, $G = 10^{10}\,\mathrm{N/m^2}$)

(1) $1/4\pi$ (2) $1/40\pi$ (3) $1/2\pi$ (4) $1/160\pi$

5. An object is kept at rest at a distance of 3R above the earth's surface where R is earth's radius. The minimum speed with which it must be projected so that it does not return to earth is: (Assume $\mathrm{M}=$ mass of earth, $\mathrm{G}=$ Universal gravitational constant)

(1) $\sqrt{\frac{\mathrm{GM}}{\mathrm{R}}}$ (2) $\sqrt{\frac{3GM}{\mathrm{R}}}$ (3) $\sqrt{\frac{\mathrm{GM}}{2\mathrm{R}}}$ (4) $\sqrt{\frac{2\mathrm{GM}}{\mathrm{R}}}$

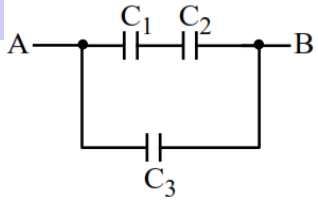
6. Consider a rectangular sheet of solid material of length $l=9\mathrm{cm}$ and width $\mathrm{d}=4\mathrm{cm}$. The coefficient of linear expansion is $\alpha=3.1\times10^{-5}\,\mathrm{K}^{-1}$ at room temperature and one atmospheric pressure. The mass of sheet $m=0.1\mathrm{kg}$ and the specific heat capacity $\mathrm{C_v}=900\,\mathrm{J\,kg^{-1}\,K^{-1}}$. If the amount of heat supplied to the material is $8.1\times10^{2}\,\mathrm{J}$ then change in area of the rectangular sheet is :

(1) $6.0\times10^{-7}\,\mathrm{m}^2$ (2) $3.0\times10^{-7}\,\mathrm{m}^2$ (3) $2.0\times10^{-6}\,\mathrm{m}^2$ (4) $4.0\times10^{-7}\,\mathrm{m}^2$

7. A finite size object is placed normal to the principal axis at a distance of 30 cm from a convex mirror of focal length 30 cm. A plane mirror is now placed in such a way that the image produced by both the mirrors coincide with each other. The distance between the two mirrors is :

(1) 7.5 cm (2) 22.5 cm (3) 45 cm (4) 15 cm

8. Three parallel plate capacitors C_1, C_2 and C_3 each of capacitance $5\mu\mathrm{F}$ are connected as shown in figure. The effective capacitance between points A and B, when the space between the parallel plates of C_1 capacitor is filled with a dielectric medium having dielectric constant of 4, is :



(1) $9\mu\mathrm{F}$ (2) $7.5\mu\mathrm{F}$ (3) $30\mu\mathrm{F}$ (4) $22.5\mu\mathrm{F}$

9. Match List - I with List - II.

List – I	List - II
(A) Isobaric	(I) $\Delta Q=\Delta W$
(B) Isochoric	(II) $\Delta\mathrm{Q}=\Delta\mathrm{U}$
(C) Adiabatic	(III) $\Delta\mathrm{Q}=$ zero
(D) Isothermal	(IV) $\Delta\mathrm{Q}=\Delta\mathrm{U}+\mathrm{P}\Delta\mathrm{V}$

$\Delta\mathrm{Q}=$ Heat supplied

$\Delta W=$ Work done by the system

$\Delta U =$ Change in internal energy

$P =$ Pressure of the system

$\Delta V =$ Change in volume of the system

Choose the correct answer from the options given below :

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

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

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

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

10. Given below are two statements :

Statement (I): The dimensions of Planck's constant and angular momentum are same.

Statement (II) : In Bohr's model electron revolve around the nucleus only in those orbits for which angular momentum is integral multiple of Planck's constant.

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

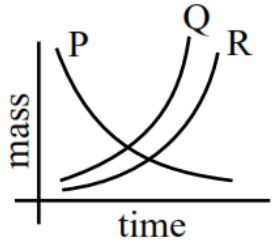
(1) Both Statement I and Statement II are incorrect

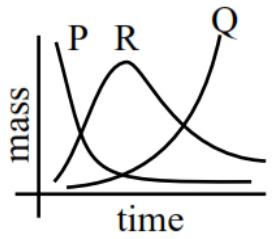
(2) Statement I is incorrect but Statement II is correct

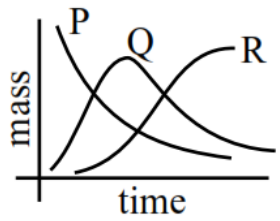
(3) Both Statement I and Statement II are correct

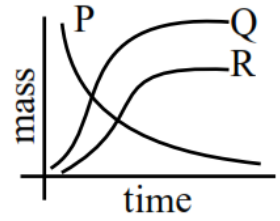
(4) Statement I is correct but Statement II is incorrect

11. A radioactive material P first decays into Q and then Q decays to non-radioactive material R. Which of the following figure represents time dependent mass of P, Q and R ?

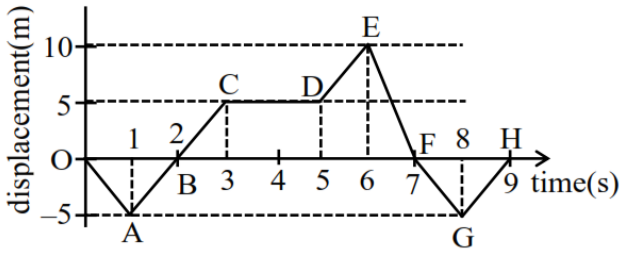
(1) 

(2) 

(3) 

(4) 

12. The displacement x versus time graph is shown below.



(A) The average velocity during 0 to 3 s is $10\,m/s$

(B) The average velocity during 3 to 5 s is $0\,m/s$

(C) The instantaneous velocity at $t=2s$ is $5m/s$

(D) The average velocity during 5 to 7 s and instantaneous velocity at $t=6.5s$ are equal

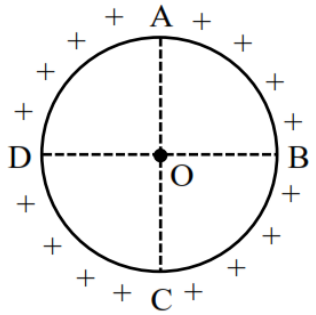
(E) The average velocity from $t=0$ to $t=9s$ is zero

Choose the correct answer from the options given below :

(1) (B), (C), (E) only (2) (A), (D), (E) only

(3) (B), (D), (E) only (4) (B), (C), (D) only

13. A metallic ring is uniformly charged as shown in figure. AC and BD are two mutually perpendicular diameters. Electric field due to arc AB at ' O ' is ' E ' in magnitude. What would be the magnitude of electric field at ' O ' due to arc ABC ?



(1) 2E (2) Zero (3) $E/2$ (4) $\sqrt{2}E$

14. In an electromagnetic system, a quantity defined as the ratio of electric dipole moment and magnetic dipole moment has dimension of $\left[M^P L^Q T^R A^5\right]$. The value of P and Q are :

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

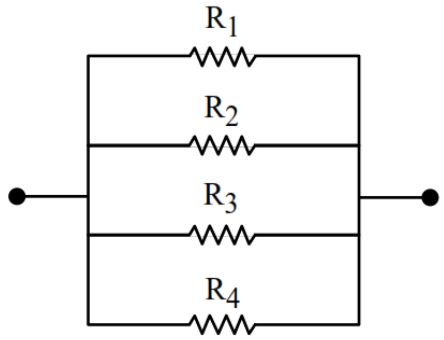
15. Two polarisers P_1 and P_2 are placed in such a way that the intensity of the transmitted light will be zero. A third polariser P_3 is inserted in between P_1 and P_2, at particular angle between P_2 and P_3. The transmitted intensity of the light passing the through all three polarisers is maximum. The angle between the polarisers P_2 and P_3 is :

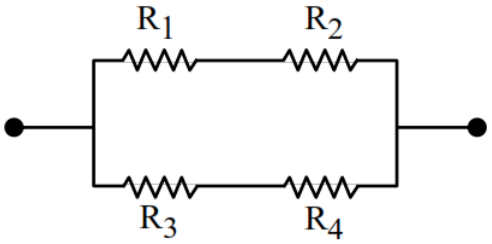
(1) π (2) π (3) $\frac{\pi}{4}$ (4) $\frac{\pi}{3}$

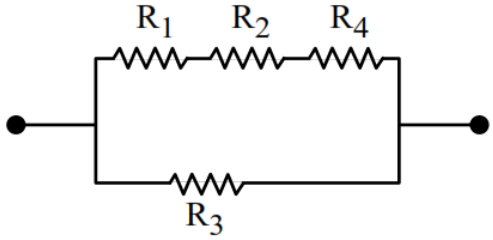
16. A block of mass 25 kg is pulled along a horizontal surface by a force at an angle 45° with the horizontal. The friction coefficient between the block and the surface is 0.25. The block travels at a uniform velocity. The workdone by the applied force during a displacement of 5 m of the block is :

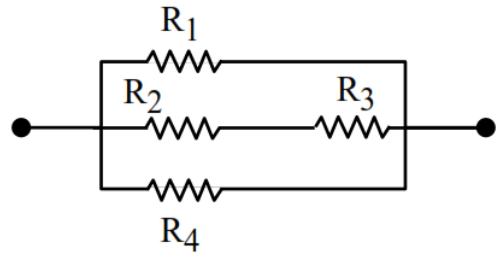
(1) 735 J (2) 245 J (3) 970 J (4) 490 J

17. From the combination of resistors with resistances values $R_1 = R_2 = R_3 = 5\Omega$ and $R_4 = 10\Omega$, which of the following combination is the best circuit to get an equivalent resistance of 6Ω ?

(1) 

(2) 

(3) 

(4) 

18. There are two vessels filled with an ideal gas where volume of one is double the volume of other. The large vessel contains the gas at 8 kPa at 1000 K while the smaller vessel contains the gas at 7 kPa at 500 K. If the vessels are connected to each other by a thin tube allowing the gas to flow and the temperature of both vessels is maintained at 600 K, at steady state the pressure in the vessels will be (in kPa).

(1) 18 (2) 6 (3) 24 (4) 4.4

19. There are 'n' number of identical electric bulbs, each is designed to draw a power p independently from the mains supply. They are now joined in series across the mains supply. The total power drawn by the combination is :

(1) $\frac{p}{n}$ (2) P (3) $\frac{p}{n^2}$ (4) np

20. Displacement of a wave is expressed as $x(t) = 5\cos\left(628t + \frac{\pi}{2}\right)m$. The wavelength of the wave when its velocity is $300\,m/s$ is : $(\pi = 3.14)$

(1) 0.33 m (2) 0.5 m (3) 3 m (4) 5 m

SECTION-B

21. If an optical medium possesses a relative permeability of $\frac{10}{\pi}$ and relative permittivity of $\frac{1}{0.0885}$, then the velocity of light is greater in vacuum than that in this medium by _____ times. $\left(\mu_0 = 4\pi \times 10^{-7}\,H/m, \epsilon_0 = 8.85 \times 10^{-12}\,F/m, c = 3 \times 10^8\,m/s\right)$

22. A particle of charge $1.6\mu C$ and mass $16\mu g$ is present in a strong magnetic field of 6.28 T . The particle is then fired perpendicular to magnetic field. The time required for the particle to return to original location for the first time is _____ s. $(\pi = 3.14)$

23. An inductor of self inductance 1 H is connected in series with a resistor of $100\pi \text{ohm}$ and an ac supply of 100π volt, 50 Hz. Maximum current flowing in the circuit is _____ A.

24. In a Young's double slit experiment, two slits are located 1.5 mm apart. The distance of screen from slits is 2 m and the wavelength of the source is 400 nm . If the 20 maxima of the double slit pattern are contained within the central maximum of the single slit diffraction pattern, then the width of each slit is $x \times 10^{-3}$ cm , where x-value is _____ .

25. A solid sphere with uniform density and radius R is rotating initially with constant angular velocity (ω_1) about its diameter. After some time during the rotation its starts loosing mass at a uniform rate, with no change in its shape. The angular velocity of the sphere when its radius become $R/2$ is $x\omega_1$. The value of x is _____ .

NTA ANSWER

1.	**(1)**	**2.**	**(1)**	**3.**	**(2)**	**4.**	**(4)**	**5.**	**(3)**	**6.**	**(3)**	**7.**	**(1)**
8.	**(1)**	**9.**	**(3)**	**10.**	**(4)**	**11.**	**(3)**	**12.**	**(1)**	**13.**	**(4)**	**14.**	**(2)**
15.	**(3)**	**16.**	**(2)**	**17.**	**(2)**	**18.**	**(2)**	**19.**	**(1)**	**20.**	**(3)**	**21.**	**(6)**
22.	**(10)**	**23.**	**(1)**	**24.**	**(15)**	**25.**	**(32)**						