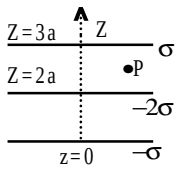
IIT - JEE 2005 Physics Question Paper (Screening)

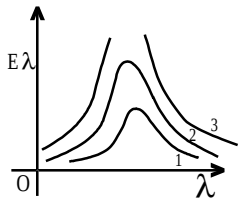
1. In YDSE, an electron beam is used to obtain interference pattern. If speed of electron is increased then
   (a) no interference pattern will be observed. (b) distance between two consecutive fringes will increase
   (c) distance between two consecutive fringes will decrease
   (d) distance between two consecutive fringes remains same.
2. Ratio of area of hole to beaker is 0.1. Height of liquid in beaker is 3m, and hole is at the height of 52.5 cm from the bottom of beaker, find the square of the velocity of liquid coming out from the hole
   (a) 50 $(m/s)^2$ (b) 50.5 $(m/s)^2$ (c) 51 $(m/s)^2$ (d) 42 $(m/s)^2$
3. A thin concave and a thin convex lens are in contact. The ratio of the magnitude of power of two lenses is 2/3 and focal length of combination is 30 cm, then the focal length of individual lenses are
   (a) -15 cm, 10 cm (b) -75 cm, 50 cm (c) 75 cm, -50 cm (d) 75 cm, 50 cm
4. An open organ pipe resonated with frequency 'f_1' and 2nd harmonic. Now one end is closed and the frequency is slowly increased then it resonates with frequency f_2 and nth harmonic then
   (a) n = 3, $f_2 = \frac{3}{4}f_1$ (b) n = 5, $f_2 = \frac{3}{4}f_1$ (c) n = 3, $f_2 = \frac{5}{4}f_1$ (d) n = 5, $f_2 = \frac{5}{4}f_1$
5. Three infinitely charged sheets are kept parallel to x - y plane having charge densities as shown. Then the value of electric field at 'P' is



   (a) $\frac{-4\sigma}{\epsilon_0}\hat{k}$ (b) $\frac{4\sigma}{\epsilon_0}\hat{k}$ (c) $\frac{-2\sigma}{\epsilon_0}\hat{k}$ (d) $\frac{2\sigma}{\epsilon_0}\hat{k}$
6. Two litre of water at initial temperature of 27^0C is heated by a heater of power 1 kW. If the lid of kettle is opened, then heat is lost at the constant rate of 160 J/s. Find the time required to raise the temperature of water to 77^0C with the lid open (Specific heat of water 4.2 kJ/kg)
   (a) 5 min 40 sec (b) 14 min 20 sec (c) 8 min 20 sec (d) 16 min 10 sec
7. A particle is confined to rotate in a circular path with decreasing linear speed, then which of the following is correct?
   (a) $\vec{L}$ (angular momentum) is conserved about the centre. (b) only direction of angular momentum $\vec{L}$ is conserved.
   (c) It spirals towards the centre. (d) Its acceleration is towards the centre
8. A photon of energy 10.2 eV collides inelastically with a Hydrogen atom in ground state. After a certain time interval of few micro seconds another photon of energy 15.0 eV collides inelastically with the same hydrogen atom, then the observation made by a suitable detector is
   (a) 1 photon with energy 10.2 eV and an electron with energy 1.4 eV
   (b) 2 photons with energy 10.2 eV (c) 2 photons with energy 1.4 eV
   (d) one photon with energy 3.4 eV and 1 electron with energy 1.4 eV
9. The atomic number (Z) of an element whose k_α wavelength is λ is 11. The atomic number of an element whose k_α wavelength is 4λ is equal to
   (a) 6 (b) 11 (c) 44 (d) 4

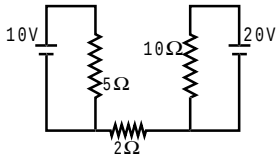
Note: Based on the memory

10. The graph shown in the figure represents energy density E_λ versus λ for three sources sun, welding arc, tungsten filament. For λ_{max}, correct combination will be

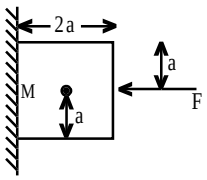


(a) 1 - Tungsten, 2 - Welding arc, 3 - Sun (b) 1 - Sun, 2 - Tungsten, 3 - Welding arc,
(c) 1 - Sun, 2 - Welding arc, 3 - Tungsten (d) 1 - Welding arc, 2 - Sun, 3 - Tungsten

11. Find current in $2\,\Omega$ resistor
(a) 0 (b) 2A (c) 4A (d) 1A

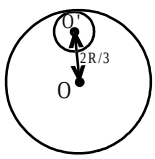


12. In the figure shown, a cubical block is held stationary against a rough wall by applying force 'F' then ***incorrect*** statement among the following is



(a) frictional force, f = Mg (b) F = N, N is normal reaction
(c) F does not apply any torque (d) N does not apply any torque

13. A capacitor ($C = 4.0\,\mu F$) is connected through a resistor ($R = 2.5\ M\Omega$) across a battery of negligible internal resistance of voltage 12 volts. The time after which the potential difference across the capacitor becomes three times to that of resistor is ($\ln 2 = 0.693$)
(a) 13.86 sec (b) 6.48 sec (c) 3.24 sec (d) 20.52 sec
14. If a star converts all of its Helium into Oxygen nucleus, find the amount of energy released per nucleus of oxygen. He = 4.0026 amu, O = 15.9994 amu
(a) 7.26 MeV (b) 7 MeV (c) 10.24 MeV (d) 5.12 MeV
15. In a resonance tube with tuning fork of frequency 512 Hz, first resonance occurs at water level equal to 30.3 cm and second resonance occurs at 63.7 cm. The maximum possible error in the speed of sound is
(a) 51.2 cm/s (b) 102.4 cm/s (c) 204.8 cm/s (d) 153.6 cm/s
16. A circular disc of radius R/3 is cut from a circular disc of radius R and mass 9 M as shown. The moment of inertia of remaining disc about 'O' perpendicular to the plane of the disc is



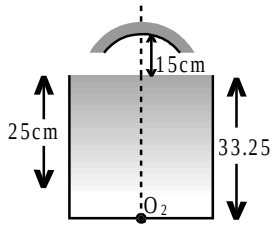
(a) $4MR^2$ (b) $9MR^2$ (c) $\frac{37}{9}MR^2$ (d) $\frac{40}{9}MR^2$

17. Which of the following process does not occur through convection
(a) Boiling of water (b) Land breeze and Sea breeze
(c) Circulation of air around furnace (d) Heating of glass bulb through filament

18. Which of the following does not have the same dimension?
(a) Electric flux, Electric field, Electric dipole moment (b) Pressure, stress, Young's modulus
(c) Electromotive force, Potential difference, Electric voltage (d) Heat, Potential energy, Work done

19. One calorie is defined as the heat required to raise the temperature of 1 gm of water by 1^0C in a certain interval of temperature and at certain pressure. The temperature interval and pressure is
(a) 13.5^0C to 14.5^0C & 76 mm of Hg (b) 6.5^0C to 7.5^0C & 76 mm of Hg
(c) 14.5^0C to 15.5^0C & 760 mm of Hg (d) 98.5^0C to 99.5^0C & 760 mm of Hg

20. A tank of height 33.25 cm is completely filled with liquid (μ = 1.33). An object is placed at the bottom of tank on the axis of concave mirror as shown in the figure. Image of the object is formed 25 cm below the surface of the liquid, then focal length of the mirror is



(a) 10 cm (b) 15 cm (c) 20 cm (d) 25 cm

21. A spherical body of area A and emmissivity σ = 0.6 is kept inside a perfectly black body. Total heat radiated by the body at temperature T
(a) 0.4 σ AT^4 (b) 0.8 σ AT^4 (c) 0.6 σ AT^4 (d) 1.0 σ AT^4

22. Temperature of a gas is 20^0C and pressure is changed from 1.01×10^5 Pa to 1.165×10^5 Pa. If volume is decreased isothermally by 10%. Bulk modulus of gas is
(a) 1.55×10^5 (b) 0.155×10^5 (c) 1.4×10^5 (d) 1.01×10^5

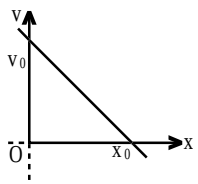
23. T_1 is the time period of simple pendulum. The point of suspension moves vertically upwards according to $y = kt^2$, where k = 1 m/s^2. New time period is T_2, then $\frac{T_1^2}{T_2^2}$=? ($g = 10\,m/s^2$)
(a) 4/5 (b) 6/5 (c) 5/6 (d) 1

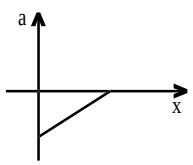
24. A galvanometer with resistance 100 Ω is converted to ammeter with a resistance of 0.1 Ω. The galvanometer shows full scale deflection with a current of 100 μA. Then the minimum current in the circuit for full scale deflection of galvanometer will be
(a) 100.1 mA (b) 10.01 mA (c) 1.001 mA (d) 0.1001 mA

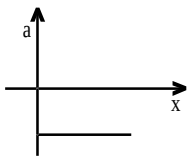
25. Ideal gas is contained in a thermally insulated and rigid container and it is heated through a resistance 100 Ω by passing a current of 1 A for five minutes, then change in internal energy of the gas is
(a) 0 kJ (b) 30 kJ (c) 10 kJ (d) 20 kJ

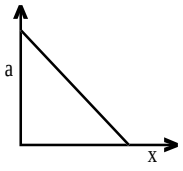
26. In Young's double slit experiment the angular position of a point on the central maxima whose intensity is one fourth of maximum intensity
(a) $\sin^{-1}(\lambda/d)$ (b) $\sin^{-1}(\lambda/2d)$ (c) $\sin^{-1}(\lambda/3d)$ (d) $\sin^{-1}(\lambda/4d)$

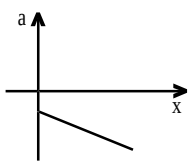
27. Depict the shown v - x graph in a - x graph.



(a) 

(b) 

(c) 

(d) 

28. A cylindrical conducting rod is kept with its axis along positive z-axis, where a uniform magnetic field exists parallel to z-axis. The current induced in the cylinder is
(a) zero (b) clockwise as seen from +z axis.
(c) anti-clockwise as a seen from +z axis (d) opposite to the direction of magnetic field.