JIPMER

2016

PHYSICS

1. In radioactive decay process, the negatively charged emitted β-particles are
   (a) the electrons present inside the nucleus
   (b) the electrons produced as a result of the decay of neutrons inside the nucleus
   (c) the electrons produced as a result of collisions between atoms
   (d) the electrons orbiting around the nucleus
2. The maximum number of possible interference maxima for slit-separation equal to twice the wavelength in Young's double-slit experiment, is
   (a) infinite (b) five
   (c) three (d) zero
3. Two spherical conductors B and C having equal radii and carrying equal charges in them repel each other with a force F when kept apart at some distance. A third spherical conductor having same radius as that of B but uncharged, is brought in contact with B, then brought in contact with C and finally removed away from both. The new force of repulsion between B and C is
   (a) $\frac{F}{4}$ (b) $\frac{3F}{4}$
   (c) $\frac{F}{8}$ (d) $\frac{3F}{8}$
4. In gamma ray emission from a nucleus
   (a) both the neutron number and the proton number change
   (b) there is no change in the proton number and the neutron number
   (c) only the neutron number changes
   (d) only the proton number changes
5. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its coordinates at a later time are $(\sqrt{3}, 3)$. The path of the particle makes with the x-axis an angle of
   (a) 30° (b) 45°
   (c) 60° (d) 0°
6. A wheel has angular acceleration of 3.0 rad/s^2 and an initial angular speed of 2.00 rad/s. In a time of 2 s it has rotated through an angle (in radian) of
   (a) 6 (b) 10
   (c) 12 (d) 4
7. The resistance of an ammeter is 13Ω and its scale is graduated for a current upto 100 A. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750 A by this meter. The value of shunt resistance is
   (a) 20 Ω (b) 2Ω
   (c) 0.2Ω (d) 2 kΩ
8. Under the influence of a uniform magnetic field a charged particle is moving in a circle of radius R with constant speed v. The time period of the motion
   (a) depends on v and not on R
   (b) depends on both R and v
   (c) is independent of both R and v
   (d) depends on R and not on v
9. The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flux ϕ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where ϕ is in weber, t is time in second and ϕ_0 is a constant, the output voltage across the secondary coil is
   (a) 90 V (b) 120 V
   (c) 220 V (d) 30 V
10. The frequency of a light wave in a material is 2×10^{14} Hz and wavelength is 5000 Å. The refractive index of material will be
    (a) 1.40 (b) 1.50
    (c) 3.00 (d) 1.33

11. A car moves from X to Y with a uniform speed v_u and returns to Y with a uniform speed v_d. The average speed for this round trip is

(a) $\frac{2v_dv_u}{v_d + v_u}$ (b) $\sqrt{v_uv_d}$

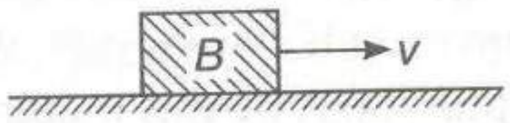
(c) $\frac{v_dv_u}{v_d + v_u}$ (d) $\frac{v_u + v_d}{2}$

12. A particle executes simple harmonic oscillation with an amplitude a. The period of oscillation is T. The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is

(a) $\frac{T}{4}$ (b) $\frac{T}{8}$

(c) $\frac{T}{12}$ (d) $\frac{T}{2}$

13. A block B is pushed momentarily along a horizontal surface with an initial velocity v. If μ is the coefficient of sliding friction between B and the surface, block B will come to rest after a time



(a) $\frac{v}{g\mu}$ (b) $\frac{g\mu}{v}$

(c) $\frac{g}{v}$ (d) $\frac{v}{g}$

14. Two radioactive substances A and B have decay constants 5λ and λ respectively. At $t = 0$ they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $\left(\frac{1}{e}\right)^2$ after a time interval

(a) $\frac{1}{4\lambda}$ (b) 4λ

(c) 2λ (d) $\frac{1}{2\lambda}$

15. A transformer is used to light a 100 W and 110 V lamp from a 220 V mains. If the main current is 0.5 A, the efficiency of the transformer is approximately

(a) 30% (b) 50%

(c) 90% (d) 10%

16. A charged particle (charge q) is moving in a circle of radius R with uniform speed v. The associated magnetic moment μ is given by

(a) $\frac{qvR}{2}$ (b) qvR^2

(c) $\frac{qvR^2}{2}$ (d) qvR

17. A steady current of 1.5 A flows through a copper voltameter for 10 min. If the electrochemical equivalent of copper is 30×10^{-5} g C^{-1}, the mass of copper deposited on the electrode will be

(a) 0.40 g (b) 0.50 g

(c) 0.67 g (d) 0.27 g

18. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular paths of radius R using a magnetic field B. If V and B are kept constant, the ratio $\left(\frac{\text{charge on the ion}}{\text{mass of the ion}}\right)$ will be proportional to

(a) $\frac{1}{R}$ (b) $\frac{1}{R^2}$

(c) R^2 (d) R

19. Three resistances P, Q, R each of 2Ω and an unknown resistance S form the four arms of a Wheatstone's bridge circuit. When a resistance of 6Ω is connected in parallel to S the bridge gets balanced. What is the value of S ?

(a) 2Ω (b) 3Ω

(c) 6Ω (d) 1Ω

20. Two satellites of earth, S_1 and S_2, are moving in the same orbit. The mass of S_1 is four times the mass of S_2. Which one of the following statements is true ?

(a) The time period of S_1 is four times that of S_2

(b) The potential energies of earth and satellite in the two cases are equal

(c) S_1 and S_2 are moving with the same speed

(d) The kinetic energies of the two satellites are equal

21. An observer moves towards a stationary source of sound, with a velocity one-fifth of the velocity of sound. What is the percentage increase in the apparent frequency ?

(a) Zero (b) 0.5%

(c) 5% (d) 20%

22. A coil of inductance 300 mH and resistance 2Ω is connected to a source of voltage 2 V. The current reaches half of its steady state value in

(a) 0.05 s (b) 0.1 s

(c) 0.15 s (d) 0.3 s

23. The refractive index of glass is 1.520 for red light and 1.525 for blue light. Let D_1 and D_2 be angles of minimum deviation for red and blue light respectively in a prism of this glass. then,

(a) $D_1 < D_2$

(b) $D_1 = D_2$

(c) D_1 can be less than or greater than D_2 depending upon the angle of prism

(d) $D_1 > D_2$

24. A particle of mass 100 g is thrown vertically upwards with a speed of 5 m/s. The work done by the force of gravity during the time the particle goes up is

(a) – 0.5 J (b) –1.25 J

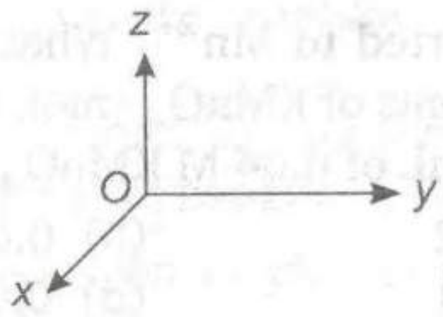
(c) 1.25 J (d) 0.5 J

25. A mass of M kg is suspended by a weightless string. The horizontal force that is required to displace it until the string makes an angle of 45° with the initial vertical direction is

(a) $Mg(\sqrt{2}+1)$ (b) $Mg\sqrt{2}$

(c) $\frac{Mg}{\sqrt{2}}$ (d) $Mg\,(\sqrt{2}-1)$

26. A force of $-F\,\hat{\mathbf{k}}$ acts on O, the origin of the coordinate system. The torque about the point $(1, -1)$ is



(a) $F\,(\hat{\mathbf{i}} - \hat{\mathbf{j}})$ (b) $-F(\hat{\mathbf{i}} + \hat{\mathbf{j}})$

(c) $F(\hat{\mathbf{i}} + \hat{\mathbf{j}})$ (d) $-F(\hat{\mathbf{i}} - \hat{\mathbf{j}})$

27. If M_O is the mass of an oxygen isotope ${}_8O^{17}$, M_p and M_n are the masses of a proton and a neutron, respectively, the nuclear binding energy of the isotope is

(a) $(M_O - 8M_p)c^2$

(b) $(M_O - 8M_p - 9M_n)c^2$

(c) $M_O c^2$

(d) $(M_O - 17M_n)c^2$

28. A sound absorber attenuates the sound level by 20 dB. The intensity decreases by a factor of

(a) 1000 (b) 10000

(c) 10 (d) 100

29. Which of the following parameters does not characterise the thermodynamic state of matter ?

(a) Temperature (b) Pressure

(c) Work (d) Volume

30. A charged oil drop is suspended in uniform field of 3×10^4 V/m so that it neither falls nor rises. The charge on the drop will be (Take the mass of the charge $= 9.9 \times 10^{-15}$ kg and $g = 10\ m/s^2$)

(a) 3.3×10^{-18} C (b) 3.2×10^{-18} C

(c) 1.6×10^{-18} C (d) 4.8×10^{-18} C

31. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be

(a) $[ML^2T^{-3}I^{-1}]$ (b) $[ML^2T^{-2}]$

(c) $[ML^2T^{-1}I^{-1}]$ (d) $[ML^2T^{-3}I^{-2}]$

32. An alpha nucleus of energy $\frac{1}{2}mv^2$ bombards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to

(a) v^2 (b) $1/m$

(c) $1/v^4$ (d) $1/Ze$

33. The work of 146 kJ is performed in order to compress one kilo mole of a gas adiabatically and in this process the temperature of the gas increases by 7°C. The gas is ($R = 8.3\,J\ mol^{-1}\ K^{-1}$)

(a) diatomic

(b) triatomic

(c) a mixture of monoatomic and diatomic

(d) monoatomic

34. Diwali rocket is ejecting 50 g of gases/s at a velocity of 400 m/s. The accelerating force on the rocket will be

(a) 22 dyne (b) 20 N

(c) 20 dyne (d) 100 N

35. A frame made of metallic wire enclosing a surface area A is covered with a soap film. If the area of the frame of metallic wire is reduced by 50%, the energy of the soap film will be changed by

(a) 100% (b) 75%

(c) 50% (d) 25%

36. Mercury boils at 367°C. However, mercury thermometers are made such that they can measure temperature upto 500°C. This is done by

(a) maintaining vacuum above mercury column in the stem of the thermometer

(b) filling nitrogen gas at high pressure above the mercury column

(c) filling oxygen gas at high pressure above the mercury column
(d) filling nitrogen gas at low pressure above the mercury column

37. In a laboratory four convex lenses L_1, L_2, L_3 and L_4 of focal lengths 2, 4, 6 and 8 cm, respectively are available. Two of these lenses form a telescope of length 10 cm and magnifying power 4. The objective and eye lenses are respectively

(a) L_2, L_3 (b) L_1, L_4
(c) L_1, L_2 (d) L_4, L_1

38. A symmetric double convex lens is cut in two equal parts by a plane perpendicular to the principal axis. If the power of the original lens is 4D, the power of a cut lens will be

(a) 2D (b) 3D
(c) 4D (d) 5D

39. For a metallic wire, the ratio $\frac{V}{i}$ (V = applied potential difference and i = current flowing) is

(a) independent of temperature
(b) increases as the temperature rises
(c) decreases as the temperature rises
(d) increases or decreases as temperature rises depending upon the metal

40. The potential energy of a molecule on the surface of a liquid compared to one inside the liquid is

(a) zero (b) lesser
(c) equal (d) greater