## PHYSICS

1. An ideal gas has pressure 'P', volume 'V' and absolute temperature 'T'. If 'm' is the mass of each molecule and 'K' is the Boltzmann constant then density of the gas is

   A) $\frac{Pm}{KT}$  B) $\frac{KT}{Pm}$  C) $\frac{Km}{PT}$  D) $\frac{PK}{Tm}$

2. A big water drop is formed by the combination of 'n' small water drops of equal radii. The ratio of the surface energy of 'n' drops to the surface energy of big drop is

   A) $n^2 : 1$  B) $n : 1$  C) $\sqrt{n} : 1$  D) $\sqrt[3]{n} : 1$

3. The ratio of binding energy of a satellite at rest on earth's surface to the binding energy of a satellite of same mass revolving around the earth at a height 'h' above the earth's surface is (R = radius of the earth)

   A) $\frac{2(R+h)}{R}$  B) $\frac{R+h}{2R}$  C) $\frac{R+h}{R}$  D) $\frac{R}{R+h}$

4. A particle performing S.H.M. starts from equilibrium position and its time period is 16 second. After 2 seconds its velocity is $\pi$ m/s. Amplitude of oscillation is $(\cos 45° = \frac{1}{\sqrt{2}})$

   A) $2\sqrt{2}$ m  B) $4\sqrt{2}$ m  C) $6\sqrt{2}$ m  D) $8\sqrt{2}$ m

5. In a sonometer experiment, the string of length 'L' under tension vibrates in second overtone between two bridges. The amplitude of vibration is maximum at

   A) $\frac{L}{3}, \frac{2L}{3}, \frac{5L}{6}$  B) $\frac{L}{8}, \frac{L}{4}, \frac{L}{2}$  C) $\frac{L}{2}, \frac{L}{4}, \frac{L}{6}$  D) $\frac{L}{6}, \frac{L}{2}, \frac{5L}{6}$

6. A wheel of moment of inertia 2 Kg $m^2$ is rotating about an axis passing through centre and perpendicular to its plane at a speed 60 rad/s. Due to friction, it comes to rest in 5 minutes. The angular momentum of the wheel three minutes before it stops rotating is

   A) 24 Kg $m^2$/s  B) 48 Kg $m^2$/s  C) 72 Kg $m^2$/s  D) 96 Kg $m^2$/s

7. The equation of the progressive wave is $Y = 3 \sin\left[\pi\left(\frac{t}{3} - \frac{x}{5}\right) + \frac{\pi}{4}\right]$ where x and Y are in metre and time in second. Which of the following is correct ?

   A) velocity V = 1.5 m/s  B) amplitude A = 3 cm

   C) frequency F = 0.2 Hz  D) wavelength $\lambda$ = 10 m

8. Two spherical black bodies have radii '$r_1$' and '$r_2$'. Their surface temperatures are '$T_1$' and '$T_2$'. If they radiate same power then $\frac{r_2}{r_1}$ is

   A) $\frac{T_1}{T_2}$  B) $\frac{T_2}{T_1}$  C) $\left(\frac{T_1}{T_2}\right)^2$  D) $\left(\frac{T_2}{T_1}\right)^2$

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9. The closed and open organ pipes have same length. When they are vibrating simultaneously in first overtone, produce three beats. The length of open pipe is made $\frac{1}{3}^{rd}$ and closed pipe is made three times the original, the number of beats produced will be

A) 8 B) 14 C) 17 D) 20

10. A lift of mass 'm' is connected to a rope which is moving upward with maximum acceleration 'a'. For maximum safe stress, the elastic limit of the rope is 'T'. The minimum diameter of the rope is (g = gravitational acceleration)

A) $\left[\frac{2m(g+a)}{\pi T}\right]^{\frac{1}{2}}$ B) $\left[\frac{4m(g+a)}{\pi T}\right]^{\frac{1}{2}}$

C) $\left[\frac{m(g+a)}{\pi T}\right]^{\frac{1}{2}}$ D) $\left[\frac{m(g+a)}{2\pi T}\right]^{\frac{1}{2}}$

11. A ceiling fan rotates about its own axis with some angular velocity. When the fan is switched off, the angular velocity becomes $\left(\frac{1}{4}\right)^{th}$ of the original in time 't' and 'n' revolutions are made in that time. The number of revolutions made by the fan during the time interval between switch off and rest are (Angular retardation is uniform)

A) $\frac{4n}{15}$ B) $\frac{8n}{15}$ C) $\frac{16n}{15}$ D) $\frac{32n}{15}$

12. A disc of moment of inertia '$I_1$' is rotating in horizontal plane about an axis passing through a centre and perpendicular to its plane with constant angular speed '$\omega_1$'. Another disc of moment of inertia '$I_2$' having zero angular speed is placed coaxially on a rotating disc. Now both the discs are rotating with constant angular speed '$\omega_2$'. The energy lost by the initial rotating disc is

A) $\frac{1}{2}\left[\frac{I_1+I_2}{I_1 I_2}\right]\omega_1^2$ B) $\frac{1}{2}\left[\frac{I_1 I_2}{I_1-I_2}\right]\omega_1^2$

C) $\frac{1}{2}\left[\frac{I_1-I_2}{I_1 I_2}\right]\omega_1^2$ D) $\frac{1}{2}\left[\frac{I_1 I_2}{I_1+I_2}\right]\omega_1^2$

13. A particle performs linear S.H.M. At a particular instant, velocity of the particle is 'u' and acceleration is '$\alpha$' while at another instant velocity is 'v' and acceleration is '$\beta$' $(0<\alpha<\beta)$. The distance between the two positions is

A) $\frac{u^2-v^2}{\alpha+\beta}$ B) $\frac{u^2+v^2}{\alpha+\beta}$ C) $\frac{u^2-v^2}{\alpha-\beta}$ D) $\frac{u^2+v^2}{\alpha-\beta}$

14. The observer is moving with velocity '$v_0$' towards the stationary source of sound and then after crossing moves away from the source with velocity '$v_0$'. Assume that the medium through which the sound waves travel is at rest. If 'v' is the velocity of sound and 'n' is the frequency emitted by the source then the difference between apparent frequencies heard by the observer is

A) $\frac{2n v_0}{v}$ B) $\frac{n v_0}{v}$ C) $\frac{v}{2n v_0}$ D) $\frac{v}{n v_0}$

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15. A metal rod of length 'L' and cross-sectional area 'A' is heated through 'T' °C. What is the force required to prevent the expansion of the rod lengthwise ?

[Y = Young's modulus of the material of rod, $\alpha$ = coefficient of linear expansion]

A) $\frac{YA\alpha T}{(1-\alpha T)}$ B) $\frac{YA\alpha T}{(1+\alpha T)}$ C) $\frac{(1-\alpha T)}{YA\alpha T}$ D) $\frac{(1+\alpha T)}{YA\alpha T}$

16. A solid sphere of mass 2 kg is rolling on a frictionless horizontal surface with velocity 6 m/s. It collides on the free end of an ideal spring whose other end is fixed. The maximum compression produced in the spring will be (Force constant of the spring = 36 N/m).

A) $\sqrt{14}$ m B) $\sqrt{2.8}$ m C) $\sqrt{1.4}$ m D) $\sqrt{0.7}$ m

17. A flywheel at rest is to reach an angular velocity of 24 rad/s in 8 second with constant angular acceleration. The total angle turned through during this interval is

A) 24 rad B) 48 rad C) 72 rad D) 96 rad

18. Two uniform wires of the same material are vibrating under the same tension. If the first overtone of the first wire is equal to the second overtone of the second wire and radius of the first wire is twice the radius of the second wire then the ratio of the lengths of the first wire to second wire is

A) $\frac{1}{3}$ B) $\frac{1}{4}$ C) $\frac{1}{5}$ D) $\frac{1}{6}$

19. When one end of the capillary is dipped in water, the height of water column is 'h'. The upward force of 105 dyne due to surface tension is balanced by the force due to the weight of water column. The inner circumference of the capillary is

(Surface tension of water = $7 \times 10^{-2}$ N/m)

A) 1.5 cm B) 2 cm C) 2.5 cm D) 3 cm

20. For a rigid diatomic molecule, universal gas constant R = nCp where 'Cp' is the molar specific heat at constant pressure and 'n' is a number. Hence n is equal to

A) 0.2257 B) 0.4 C) 0.2857 D) 0.3557

21. The depth 'd' at which the value of acceleration due to gravity becomes $\frac{1}{n}$ times the value at the earth's surface is (R = radius of earth)

A) $d = R\left(\frac{n}{n-1}\right)$ B) $d = R\left(\frac{n-1}{2n}\right)$ C) $d = R\left(\frac{n-1}{n}\right)$ D) $d = R^2\left(\frac{n-1}{n}\right)$

22. A particle is performing S.H.M. starting from extreme position. Graphical representation shows that, between displacement and acceleration, there is a phase difference of

A) 0 rad B) $\frac{\pi}{4}$ rad C) $\frac{\pi}{2}$ rad D) $\pi$ rad

23. The fundamental frequency of an air column in a pipe closed at one end is 100 Hz. If the same pipe is open at both the ends, the frequencies produced in Hz are

A) 100, 200, 300, 400, ... B) 100, 300, 500, 700, ...
C) 200, 300, 400, 500, ... D) 200, 400, 600, 800, ...

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24. For a particle moving in vertical circle, the total energy at different positions along the path
A) is conserved B) increases
C) decreases D) may increase or decrease

25. A simple pendulum of length 'L' has mass 'M' and it oscillates freely with amplitude 'A'. At extreme position, its potential energy is
(g = acceleration due to gravity)
A) $\frac{MgA^2}{2L}$ B) $\frac{MgA}{2L}$ C) $\frac{MgA^2}{L}$ D) $\frac{2MgA^2}{L}$

26. The frequencies for series limit of Balmer and Paschen series respectively are '$\upsilon_1$' and '$\upsilon_3$'. If frequency of first line of Balmer series is '$\upsilon_2$' then the relation between '$\upsilon_1$', '$\upsilon_2$' and '$\upsilon_3$' is
A) $\upsilon_1 - \upsilon_2 = \upsilon_3$ B) $\upsilon_1 + \upsilon_3 = \upsilon_2$ C) $\upsilon_1 + \upsilon_2 = \upsilon_3$ D) $\upsilon_1 - \upsilon_3 = 2\upsilon_1$

27. When three capacitors of equal capacities are connected in parallel and one of the same capacity is connected in series with its combination. The resultant capacity is 3.75 μF. The capacity of each capacitor is
A) 5 μF B) 6 μF C) 7 μF D) 8 μF

28. Sensitivity of moving coil galvanometer is 's'. If a shunt of $\left(\frac{1}{8}\right)^{th}$ of the resistance of galvanometer is connected to moving coil galvanometer, its sensitivity becomes
A) $\frac{s}{3}$ B) $\frac{s}{6}$ C) $\frac{s}{9}$ D) $\frac{s}{12}$

29. Two unknown resistances are connected in two gaps of a meter-bridge. The null point is obtained at 40 cm from left end. A 30 Ω resistance is connected in series with the smaller of the two resistances, the null point shifts by 20 cm to the right end. The value of smaller resistance in Ω is
A) 12 B) 24 C) 36 D) 48

30. In Fraunhofer diffraction pattern, slit width is 0.2 mm and screen is at 2 m away from the lens. If wavelength of light used is 5000 Å then the distance between the first minimum on either side of the central maximum is ($\theta$ is small and measured in radian)
A) $10^{-1}$ m B) $10^{-2}$ m C) $2 \times 10^{-2}$ m D) $2 \times 10^{-1}$ m

31. A radioactive element has rate of disintegration 10,000 disintegrations per minute at a particular instant. After four minutes it becomes 2500 disintegrations per minute. The decay constant per minute is
A) $0.2 \log_e 2$ B) $0.5 \log_e 2$ C) $0.6 \log_e 2$ D) $0.8 \log_e 2$

32. When the same monochromatic ray of light travels through glass slab and through water, the number of waves in glass slab of thickness 6 cm is same as in water column of height 7 cm. If refractive index of glass is 1.5 then refractive index of water is
A) 1.258 B) 1.269 C) 1.286 D) 1.310

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33. If the electron in hydrogen atom jumps from second Bohr orbit to ground state and difference between energies of the two states is radiated in the form of photons. If the work function of the material is 4.2 eV then stopping potential is

[Energy of electron in $n^{th}$ orbit = $-\frac{13.6}{n^2}$ eV]

A) 2 eV B) 4 eV C) 6 eV D) 8 eV

34. The magnetic moment of electron due to orbital motion is proportional to (n = principal quantum number)

A) $\frac{1}{n^2}$ B) $\frac{1}{n}$ C) $n^2$ D) n

35. Photodiode is a device

A) which is always operated in reverse bias
B) which is always operated in forward bias
C) in which photo current is independent of intensity of incident radiation
D) which may be operated in forward or reverse bias

36. Two coils P and Q are kept near each other. When no current flows through coil P and current increases in coil Q at the rate 10 A/s, the e.m.f. in coil P is 15 mV. When coil Q carries no current and current of 1.8 A flows through coil P, the magnetic flux linked with the coil Q is

A) 1.4 mWb B) 2.2 mWb C) 2.7 mWb D) 2.9 mWb

37. In Young's double slit experiment, in an interference pattern second minimum is observed exactly in front of one slit. The distance between the two coherent sources is 'd' and the distance between source and screen is 'D'. The wavelength of light source used is

A) $\frac{d^2}{D}$ B) $\frac{d^2}{2D}$ C) $\frac{d^2}{3D}$ D) $\frac{d^2}{4D}$

38. In communication system, the process of superimposing a low frequency signal on a high frequency wave is known as

A) Repeater B) Attenuation C) Modulation D) Demodulation

39. A bar magnet has length 3 cm, cross-sectional area 2 $cm^2$ and magnetic moment 3 $Am^2$. The intensity of magnetisation of bar magnet is

A) $2 \times 10^5$ A/m B) $3 \times 10^5$ A/m C) $4 \times 10^5$ A/m D) $5 \times 10^5$ A/m

40. The magnetic flux near the axis and inside the air core solenoid of length 60 cm carrying current 'I' is $1.57 \times 10^{-6}$ Wb. Its magnetic moment will be (cross-sectional area of a solenoid is very small as compared to its length, $\mu_0 = 4\pi \times 10^{-7}$ SI unit)

A) 0.25 A B) 0.50 A C) 0.75 A D) 1 A

41. On a photosensitive material, when frequency of incident radiation is increased by 30%, kinetic energy of emitted photoelectrons increases from 0.4 eV to 0.9 eV. The work function of the surface is

A) 1 eV B) 1.267 eV C) 1.4 eV D) 1.8 eV

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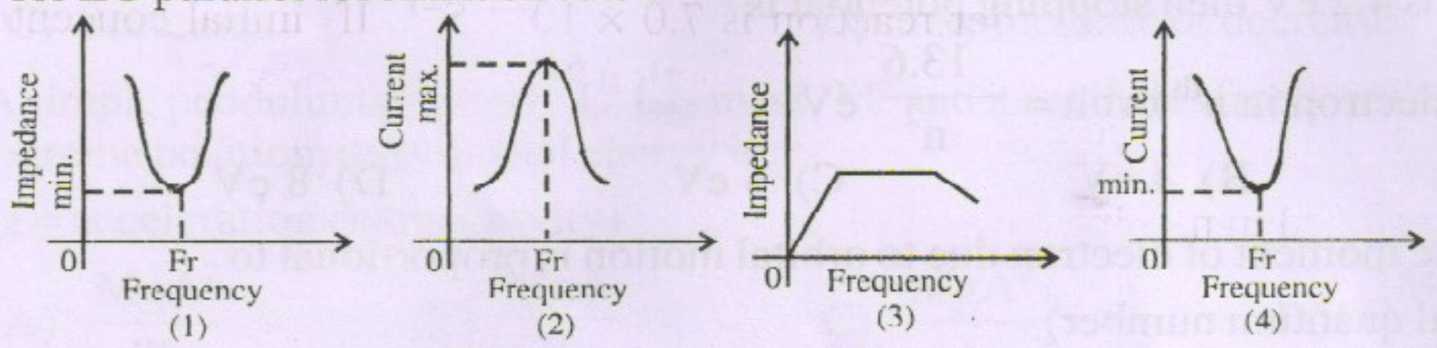
42. Out of the following graphs, which graph shows the correct relation (graphical representation) for LC parallel resonant circuit ?




A) (1) B) (2) C) (3) D) (4)

43. According to de-Broglie hypothesis, the wavelength associated with moving electron of mass 'm' is '$\lambda_e$' : Using mass energy relation and Planck's quantum theory, the wavelength associated with photon is '$\lambda_p$'. If the energy (E) of electron and photon is same then relation between '$\lambda_e$' and '$\lambda_p$' is

A) $\lambda_p \alpha \lambda_e$ B) $\lambda_p \alpha \lambda_c^2$ C) $\lambda_p \alpha \sqrt{\lambda_c}$ D) $\lambda_p \alpha \frac{1}{\lambda_e}$

44. A parallel plate air capacitor has capacity 'C' farad, potential 'V' volt and energy 'E' joule. When the gap between the plates is completely filled with dielectric

A) both V and E increase B) both V and E decrease
C) V decreases, E increases D) V increases, E decreases

45. The resistivity of potentiometer wire is $40 \times 10^{-8}$ ohm – metre and its area of cross-section is $8 \times 10^{-6}\ m^2$. If 0.2 ampere current is flowing through the wire, the potential gradient of the wire is

A) $10^{-1}$ V/m B) $10^{-2}$ V/m C) $10^{-3}$ V/m D) $10^{-4}$ V/m

46. In series LCR circuit R = 18 Ω and impedance is 33 Ω. An r.m.s. voltage 220 V is applied across the circuit. The true power consumed in a.c. circuit is

A) 220 W B) 400 W C) 600 W D) 800 W

47. Two parallel plate air capacitors of same capacity 'C' are connected in series to a battery of emf 'E'. Then one of the capacitors is completely filled with dielectric material of constant 'K'. The change in the effective capacity of the series combination is

A) $\frac{C}{2}\left[\frac{K-1}{K+1}\right]$ B) $\frac{2}{C}\left[\frac{K-1}{K+1}\right]$ C) $\frac{C}{2}\left[\frac{K+1}{K-1}\right]$ D) $\frac{C}{2}\left[\frac{K-1}{K+1}\right]^2$

48. The polarising angle for transparent medium is '$\theta$', '$v$' is the speed of light in that medium. Then the relation between '$\theta$' and '$v$' is (c = velocity of light in air)

A) $\theta = \tan^{-1}\left(\frac{v}{c}\right)$ B) $\theta = \cot^{-1}\left(\frac{v}{c}\right)$ C) $\theta = \sin^{-1}\left(\frac{v}{c}\right)$ D) $\theta = \cos^{-1}\left(\frac{v}{c}\right)$

49. Two identical light waves having phase difference '$\phi$' propagate in same direction. When they superpose, the intensity of resultant wave is proportional to

A) $\cos^2\phi$ B) $\cos^2 \phi/2$ C) $\cos^2 \phi/3$ D) $\cos^2 \phi/4$

50. For a transistor, $\alpha_{dc}$ and $\beta_{dc}$ are the current ratios, then the value of $\frac{\beta_{dc} - \alpha_{dc}}{\alpha_{dc} \cdot \beta_{dc}}$ is

A) 1 B) 1.5 C) 2 D) 2.5

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