PHYSICS

1. The bob of a simple pendulum performs S.H.M. with period 'T' in air and with period 'T_1' in water. Relation between 'T' and 'T_1' is (neglect friction due to water, density of the material of the bob is = $\frac{9}{8}\times10^3$ kg/m^3, density of water = 1 g/cc)

   A) $T_1 = 3\ T$ B) $T_1 = 2\ T$ C) $T_1 = T$ D) $T_1 = \frac{T}{2}$

2. In a capillary tube of radius 'R', a straight thin metal wire of radius 'r' (R > r) is inserted symmetrically and one end of the combination is dipped vertically in water such that the lower end of the combination is at same level. The rise of water in the capillary tube is [T = surface tension of water, ρ = density of water, g = gravitational acceleration]

   A) $\frac{T}{(R+r)\rho g}$ B) $\frac{R\rho g}{2T}$ C) $\frac{2T}{(R-r)\rho g}$ D) $\frac{(R-r)\rho g}{T}$

3. When open pipe is closed from one end then third overtone of closed pipe is higher in frequency by 150 Hz than second overtone of open pipe. The fundamental frequency of open end pipe will be

   A) 75 Hz B) 150 Hz C) 225 Hz D) 300 Hz

4. A disc of radius 'R' and thickness $\frac{R}{6}$ has moment of inertia 'I' about an axis passing through its centre and perpendicular to its plane. Disc is melted and recast into a solid sphere. The moment of inertia of a sphere about its diameter is

   A) $\frac{I}{5}$ B) $\frac{I}{6}$ C) $\frac{I}{32}$ D) $\frac{I}{64}$

5. Let a steel bar of length 'l', breadth 'b' and depth 'd' be loaded at the centre by a load 'W'. Then the sag of bending of beam is (Y = Young's modulus of material of steel)

   A) $\frac{Wl^3}{2bd^3Y}$ B) $\frac{Wl^3}{4bd^3Y}$ C) $\frac{Wl^2}{2bd^3Y}$ D) $\frac{Wl^3}{4bd^2Y}$

6. In potentiometer experiment, null point is obtained at a particular point for a cell on potentiometer wire x cm long. If the length of the potentiometer wire is increased without changing the cell, the balancing length will (Driving source is not changed)

   A) increase B) decrease C) not change D) becomes zero

7. An iron rod is placed parallel to magnetic field of intensity 2000 A/m. The magnetic flux through the rod is 6×10^{-4} Wb and its cross-sectional area is 3 cm^2. The magnetic permeability of the rod in $Wb/A-m$ is

   A) 10^{-1} B) 10^{-2} C) 10^{-3} D) 10^{-4}

8. Alternating current of peak value $\left(\frac{2}{\pi}\right)$ ampere flows through the primary coil of the transformer. The coefficient of mutual inductance between primary and secondary coil is 1 henry. The peak e.m.f. induced in secondary coil is
   (Frequency of a.c. = 50 Hz)

   A) 100 V B) 200 V C) 300 V D) 400 V

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9. An electron of mass 'm' has de-Broglie wavelength 'λ' when accelerated through potential difference 'V'. When proton of mass 'M', is accelerated through potential difference '9V', the de-Broglie wavelength associated with it will be (Assume that wavelength is determined at low voltage)

A) $\frac{\lambda}{3}\sqrt{\frac{M}{m}}$ B) $\frac{\lambda}{3}\cdot\frac{M}{m}$ C) $\frac{\lambda}{3}\sqrt{\frac{m}{M}}$ D) $\frac{\lambda}{3}\cdot\frac{m}{M}$

10. Interference fringes are produced on a screen by using two light sources of intensities 'I' and '9I'. The phase difference between the beams is $\frac{\pi}{2}$ at point P and π at point Q on the screen. The difference between the resultant intensities at point P and Q is

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

11. Which of the following quantity does **NOT** change due to damping of oscillations ?

A) Angular frequency B) Time period
C) Initial phase D) Amplitude

12. If the end correction of an open pipe is 0.8 cm then the inner radius of that pipe will be

A) $\frac{1}{3}$cm B) $\frac{2}{3}$cm C) $\frac{3}{2}$cm D) 0.2 cm

13. A progressive wave is represented by y = 12 sin (5t – 4x) cm. On this wave, how far away are the two points having phase difference of 90° ?

A) $\frac{\pi}{2}$ cm B) $\frac{\pi}{4}$ cm C) $\frac{\pi}{8}$ cm D) $\frac{\pi}{16}$ cm

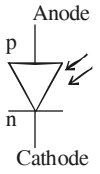
14. Two particles of masses 'm' and '9m' are separated by a distance 'r'. At a point on the line joining them the gravitational field is zero. The gravitational potential at that point is (G = Universal constant of gravitation)

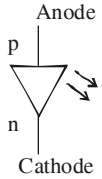
A) $-\frac{4Gm}{r}$ B) $-\frac{8Gm}{r}$ C) $-\frac{16Gm}{r}$ D) $-\frac{32Gm}{r}$

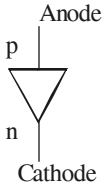
15. A black rectangular surface of area 'A' emits energy 'E' per second at 27°C. If length and breadth are reduced to $\frac{1}{3}^{rd}$ of initial value and temperature is raised to 327°C then energy emitted per second becomes

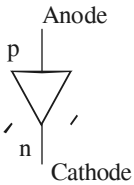
A) $\frac{4E}{9}$ B) $\frac{7E}{9}$ C) $\frac{10E}{9}$ D) $\frac{16E}{9}$

16. The schematic symbol of light emitting diode is (LED)

A) 

B) 

C) 

D) 

17. The amount of work done in increasing the voltage across the plates of capacitor from 5V to 10V is 'W'. The work done in increasing it from 10V to 15V will be

A) W B) 0.6 W C) 1.25 W D) 1.67 W

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18. Magnetic flux passing through a coil is initially 4×10^{-4} Wb. It reduces to 10% of its original value in 't' second. If the e.m.f. induced is 0.72 mV then 't' in second is
A) 0.3 B) 0.4 C) 0.5 D) 0.6

19. Resolving power of telescope increases when
A) wavelength of light decreases B) wavelength of light increases
C) focal length of eye-piece increases D) focal length of eye-piece decreases

20. When light of wavelength 'λ' is incident on photosensitive surface, the stopping potential is 'V'. When light of wavelength '3λ' is incident on same surface, the stopping potential is $\frac{'V'}{6}$. Threshold wavelength for the surface is
A) 2λ B) 3λ C) 4λ D) 5λ

21. For a gas $\frac{R}{C_v} = 0.4$, where 'R' is the universal gas constant and 'C_v' is molar specific heat at constant volume. The gas is made up of molecules which are
A) rigid diatomic B) monoatomic
C) non-rigid diatomic D) polyatomic

22. In vertical circular motion, the ratio of kinetic energy of a particle at highest point to that at lowest point is
A) 5 B) 2 C) 0.5 D) 0.2

23. Two wires having same length and material are stretched by same force. Their diameters are in the ratio 1 : 3. The ratio of strain energy per unit volume for these two wires (smaller to larger diameter) when stretched is
A) 3 : 1 B) 9 : 1 C) 27 : 1 D) 81 : 1

24. A ring and a disc roll on the horizontal surface without slipping with same linear velocity. If both have same mass and total kinetic energy of the ring is 4 J then total kinetic energy of the disc is
A) 3 J B) 4 J C) 5 J D) 6 J

25. When the observer moves towards the stationary source with velocity, 'V_1', the apparent frequency of emitted note is 'F_1'. When the observer moves away from the source with velocity 'V_1', the apparent frequency is 'F_2'. If 'V' is the velocity of sound in air and $\frac{F_1}{F_2} = 2$ then $\frac{V}{V_1} = ?$
A) 2 B) 3 C) 4 D) 5

26. Three parallel plate air capacitors are connected in parallel. Each capacitor has plate area $\frac{'A'}{3}$ and the separation between the plates is 'd', '2d' and '3d' respectively. The equivalent capacity of combination is (ϵ_0 = absolute permittivity of free space)
A) $\frac{7\epsilon_0 A}{18d}$ B) $\frac{11\epsilon_0 A}{18d}$ C) $\frac{13\epsilon_0 A}{18d}$ D) $\frac{17\epsilon_0 A}{18d}$

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27. In an oscillator, for sustained oscillations, Barkhausen criterion is $A\beta$ equal to (A = voltage gain without feedback, β = feedback factor)

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

28. Light of wavelength 'λ' which is less than threshold wavelength is incident on a photosensitive material. If incident wavelength is decreased so that emitted photoelectrons are moving with same velocity then stopping potential will

A) increase B) decrease C) be zero D) become exactly half

29. A ray of light travelling through rarer medium is incident at very small angle 'i' on a glass slab and after refraction its velocity is reduced by 20%. The angle of deviation is

A) $\frac{i}{8}$ B) $\frac{i}{5}$ C) $\frac{i}{2}$ D) $\frac{4i}{5}$

30. The maximum frequency of transmitted radio waves above which the radio waves are no longer reflected back by ionosphere is _____ (N = maximum electron density of ionosphere, g = acceleration due to gravity)

A) gN B) gN^2 C) $g\sqrt{N}$ D) g^2N^2

31. Wire having tension 225 N produces six beats per second when it is tuned with a fork. When tension changes to 256 N, it is tuned with the same fork, the number of beats remain unchanged. The frequency of the fork will be

A) 186 Hz B) 225 Hz C) 256 Hz D) 280 Hz

32. Assuming the expression for the pressure exerted by the gas on the walls of the container, it can be shown that pressure is

A) $\left[\frac{1}{3}\right]^{rd}$ kinetic energy per unit volume of a gas

B) $\left[\frac{2}{3}\right]^{rd}$ kinetic energy per unit volume of a gas

C) $\left[\frac{3}{4}\right]^{th}$ kinetic energy per unit volume of a gas

D) $\frac{3}{2}\times$ kinetic energy per unit volume of a gas

33. A mass 'm_1' connected to a horizontal spring performs S.H.M. with amplitude 'A'. While mass 'm_1' is passing through mean position another mass 'm_2' is placed on it so that both the masses move together with amplitude 'A_1'. The ratio of $\frac{A_1}{A}$ is ($m_2 < m_1$)

A) $\left[\frac{m_1}{m_1+m_2}\right]^{\frac{1}{2}}$ B) $\left[\frac{m_1+m_2}{m_1}\right]^{\frac{1}{2}}$ C) $\left[\frac{m_2}{m_1+m_2}\right]^{\frac{1}{2}}$ D) $\left[\frac{m_1+m_2}{m_2}\right]^{\frac{1}{2}}$

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34. A particle moves along a circle of radius 'r' with constant tangential acceleration. If the velocity of the particle is 'v' at the end of second revolution, after the revolution has started then the tangential acceleration is

A) $\frac{v^2}{8\pi r}$ B) $\frac{v^2}{6\pi r}$ C) $\frac{v^2}{4\pi r}$ D) $\frac{v^2}{2\pi r}$

35. Two strings A and B of same material are stretched by same tension. The radius of the string A is double the radius of string B. Transverse wave travels on string A with speed 'V_A' and on string B with speed 'V_B'. The ratio $\frac{V_A}{V_B}$ is

A) $\frac{1}{4}$ B) $\frac{1}{2}$ C) 2 D) 4

36. From Brewster's law, except for polished metallic surfaces, the polarising angle
A) depends on wavelength and is different for different colours
B) independent of wavelength and is different for different colours
C) independent of wavelength and is same for different colours
D) depends on wavelength and is same for different colours

37. Two particles X and Y having equal charges after being accelerated through same potential difference enter a region of uniform magnetic field and describe a circular paths of radii 'r_1' and 'r_2' respectively. The ratio of the mass of X to that of Y is

A) $\frac{r_1}{r_2}$ B) $\sqrt{\frac{r_1}{r_2}}$ C) $\left[\frac{r_2}{r_1}\right]^2$ D) $\left[\frac{r_1}{r_2}\right]^2$

38. When an electron in Hydrogen atom revolves in stationary orbit, it
A) does not radiate light though its velocity changes
B) does not radiate light and velocity remains unchanged
C) radiates light but its velocity is unchanged
D) radiates light with the change of energy

39. The magnetic field (B) inside a long solenoid having 'n', turns per unit length and carrying current 'I' when iron core is kept in it is (μ_0 = permeability of vacuum, χ = magnetic susceptibility)

A) $\mu_0 nI(1-\chi)$ B) $\mu_0 nI\chi$ C) $\mu_0 nI^2(1+\chi)$ D) $\mu_0 nI(1+\chi)$

40. In balanced metre bridge, the resistance of bridge wire is $0.1\,\Omega$ / cm . Unknown resistance 'X' is connected in left gap and 6Ω in right gap, null point divides the wire in the ratio 2 : 3. Find the current drawn from the battery of 5 V having negligible resistance.

A) 1 A B) 1.5 A C) 2 A D) 5 A

41. In Bohr's theory of Hydrogen atom, the electron jumps from higher orbit 'n' to lower orbit 'p'. The wavelength will be minimum for the transition

A) n = 5 to p = 4 B) n = 4 to p = 3 C) n = 3 to p = 2 D) n = 2 to p = 1

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42. Two identical parallel plate air capacitors are connected in series to a battery of e.m.f. 'V'. If one of the capacitor is completely filled with dielectric material of constant 'K', then potential difference of the other capacitor will become

A) $\frac{K}{V(K+1)}$ B) $\frac{KV}{K+1}$ C) $\frac{K-1}{KV}$ D) $\frac{V}{K(K+1)}$

43. The LC parallel resonant circuit

A) has a very high impedance B) has a very high current

C) acts as resistance of very low value D) has zero impedance

44. A galvanometer of resistance $30\,\Omega$ is connected to a battery of emf 2V with $1970\,\Omega$ resistance in series. A full scale deflection of 20 divisions is obtained in the galvanometer. To reduce the deflection to 10 divisions, the resistance in series required is

A) $4030\,\Omega$ B) $4000\,\Omega$ C) $3970\,\Omega$ D) $2000\,\Omega$

45. Two coherent sources 'P' and 'Q' produce interference at point 'A' on the screen where there is a dark band which is formed between 4^{th} bright band and 5^{th} bright band. Wavelength of light used is $6000\,\text{Å}$. The path difference between PA and QA is

A) 1.4×10^{-4} cm B) 2.7×10^{-4} cm C) 4.5×10^{-4} cm D) 6.2×10^{-4} cm

46. A liquid drop having surface energy 'E' is spread into 512 droplets of same size. The final surface energy of the droplets is

A) 2E B) 4E C) 8E D) 12E

47. Let 'M' be the mass and 'L' be the length of a thin uniform rod. In first case, axis of rotation is passing through centre and perpendicular to the length of the rod. In second case axis of rotation is passing through one end and perpendicular to the length of the rod. The ratio of radius of gyration in first case to second case is

A) 1 B) $\frac{1}{2}$ C) $\frac{1}{4}$ D) $\frac{1}{8}$

48. A simple pendulum of length 'l' has maximum angular displacement 'θ'. The maximum kinetic energy of the bob of mass 'm' is
(g = acceleration due to gravity)

A) $mgl(1+\cos\theta)$ B) $mgl(1+\cos^2\theta)$

C) $mgl(1-\cos\theta)$ D) $mgl(\cos\theta-1)$

49. Angular speed of hour hand of a clock in degree per second is

A) $\frac{1}{30}$ B) $\frac{1}{60}$ C) $\frac{1}{120}$ D) $\frac{1}{720}$

50. The value of gravitational acceleration 'g' at a height 'h' above the earth's surface is $\frac{g}{4}$ then (R = radius of earth)

A) h = R B) $h=\frac{R}{2}$ C) $h=\frac{R}{3}$ D) $h=\frac{R}{4}$

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