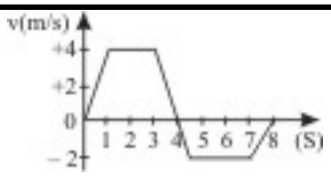
1. The velocity time graph of a linear motion is shown below. The distance from the origin after 8 seconds is



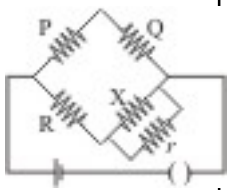
(a) 18 metres (b) 16 metres
(c) 8 metres (d) 6 metres

2. A stone is dropped into a well 44.1m deep. After how much time the sound will be heard if the velocity of the sound is 330 m/s ?
(a) 6s (b) 3.13 s (c) 6.26 s (d) 1.56 s

3. A block of mass 2 kg rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is
(a) 9.8 N (b) $0.7 \times 9.8 \times \sqrt{3}$ N
(c) $9.8 \times \sqrt{3}$ N (d) 0.7×9.8 N

4. A wire of length l and cross-sectional area A is made of a material of Young's modulus Y. If the wire is stretched by an amount x, the work done is
(a) $\frac{YAx^2}{2L}$ (b) $\frac{YAx}{2L^2}$ (c) $\frac{YAx}{2L}$ (d) $\frac{YAx^2}{}$

5. P, Q, R and X are four coils of wire 2, 2, 2 and 3Ω resistance respectively arranged to form a Wheatstone's bridge. Calculate the value of the resistance with which the coil X must be shunted in order that the bridge may be balanced



(a) 2Ω (b) 3Ω (c) 4Ω (d) 6Ω

6. In the figure, there are two semi circles of radii r_1 and r_2 in which a current i is flowing. The magnetic induction at centre O will be

(a) $\frac{\mu_0 i}{4}(r_1 + r_2)$ (b) $\frac{\mu_0 i}{4}(r_1 - r_2)$
(c) $\frac{\mu_0 i}{4}\frac{r_1 + r_2}{r_1 r_2}$ (d) $\frac{\mu_0 i}{2}\left[\frac{r_1 + r_2}{r_1 r_2}\right]$ L

7. A deflection magnetometer is adjusted in the usual way. When a magnet is introduced the deflection observed is θ, and the period of oscillation of the needle in the magnetometer is T. When the magnet is removed, the period of oscillation is T_0. The relation between T and T_0 is
(a) $T^2 = T_0^2/\cos\theta$ (b) $T^2 = T_0^2 \cos\theta$
(c) $T^1 = T_0 \cos\theta$ (d) $T = T_0/\cos\theta$

8. A bar magnet A of magnetic moment M_A is found to oscillate at a frequency twice that of magnet B of magnetic moment M_B when placed in a vibrating magnetometer. We may say that
(a) $M_A = 2M_B$ (b) $M_A = 8M_B$
(c) $M_A = 4M_B$ (d) $M_B = 8M_A$

9. A tangent galvanometer has a coil with 50 turns and radius equal to 4 cm. A current of 0.1 A is passing through it. The plane of the coil is set parallel to the earth's magnetic meridian. If the value of the earth's horizontal component of the magnetic field is 7×10^{-5} tesla and $\mu_0 = 4\pi \times 10^{-7}$ Wb/Am, then the deflection in the galvanometer needle will be
(a) 45° (b) 48.2° (c) 50.7° (d) 52.7°

10. A moving coil galvanometer of resistance 50 ohms gives a full scale deflection when a current 0.5mA is passed through it. To convert it to a voltmeter of range 10 volt, the resistance required to be placed in series is
(a) 2000 Ω (b) 20000 Ω (c) 1995 Ω (d) 19950 Ω

11. As a result of radioactive decay a $_{92}U^{238}$ nucleus is changed to a $_{91}Pa^{234}$ nucleus. During this decay, the particles emitted are
(a) 1 proton and 2 neutrons (b) 1 α-particle and 1 β-particle
(c) 2 β-particles and 1neutron (d) 1 β-particles and 1 proton

12. In thermo ionic emission, the thermo ionic current varies with temperature of the filament as
(a) T (b) T^2 (c) T^{-1} (d) $1/T^2$

13. If two tuning forks A and B are sounded together, they produce 4 beats per second. A is then slightly loaded with wax, they produce two beats when sounded again. The frequency of A is 256 Hz. The frequency of B will be
(a) 250 Hz (b) 252 Hz (c) 260 Hz (d) 262 Hz

14. Two organ pipes, each closed at one end, give 5 beats per second, when emitting their fundamental notes. If their lengths are in the ratio 50 : 51, their fundamental frequencies (in Hz) are
(a) 250, 255 (b) 255, 260 (c) 260, 265 (d) 265, 270

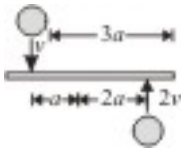
15. The vector sum of n coplanar forces, each of magnitude F, when each force is making an angle of $2\pi/n$ with the proceeding one, is
(a) zero (b) nF (c) $F/2$ (d) $nF/2$

16. A ball rolls off the top of a stairway with a horizontal velcoity u m/s. If the steps are h metres high and b metres wide, the ball will hit the edge of the nth step, if
(a) $n = 2hu/gb^2$ (b) $n = 2hu^2/gb^2$
(c) $n = 2hu^2/gb$ (d) $n = hu^2/gb^2$

17. A block slides down an inclined plane of slope of angle θ with a constant velocity v. It is then projected up the plane with an initial velocity u. The distance up to which it will rise before coming to rest is
(a) $\frac{4g\sin\theta}{u^2\sin\theta}$ (b) $\frac{4g\sin\theta}{u\sin\theta}$
(c) $\frac{4g}{}$ (d) $\frac{4g}{}$

18. A geostationary satellite is orbiting the earth at a height of $6R$ above the surface of the earth, R being the radius of the earth. The time period of another satellite at a height of $2.5R$ from the surface of earth is
(a) $6\sqrt{2}\,h$ (b) $6\,h$ (c) $6/\sqrt{2}\,h$ (d) $10\,h$

19. A uniform bar of length $6a$ and mass $8m$ lies on a smooth horizontal table. Two point masses m moving in the same horizontal plane with speeds $2v$ and v respectively strike the bar as shown in the figure and stick to the bar after collision.



Denoting angular velocity about the centre of mass, total energy and velocity of centre mass by ω, E and v_c respectively, we have after collision

(a) $v_c = 0$ (b) $\omega = 3v/5a$
(c) $\omega = v/5\alpha$ (d) $E = 3/5\, mv^2$

20. A spherical ball of radius r and relative density 0.5 is floating in equilibrium in water with half of it immersed in water. The work done in pushing the ball down so that whole of it is just immersed in water is (ρ is the density of water)

(a) $\frac{12}{4}\pi r^4 \rho g$ (b) $0.5\,\rho r g$
(c) $\frac{3}{2}\pi r^4 \rho g$ (d) $\frac{3}{4}\pi r^4 \rho g$

21. Two equal negative charges $-q$ are fixed at point $(0, a)$ and $(0, -a)$ on the Y- axis. A positive charge Q is released from rest at point $(2a, 0)$ on the X-axis. The charge Q will

(a) execute simple harmonic motion about origin
(b) move to the origin and remain at rest
(c) move to infinity
(d) execute oscillatory but not simple harmonic motion

22. A 3.628 kg freight car moving along a horizontal rail road spur track at 7.2 km/hour strikes a bumper whose coil springs experience a maximum compression of 30 cm in stopping car. The elastic potential energy of the springs at the instant when they are compressed 15cm is

(a) 18.14 J (b) 181.4 J (c) 1.814 J (d) 1814 J

23. A metallic rod l cm long A cm^2 in cross section is heated through $t°$ C. If Young's modulus of elasticity of the metal is E and the mean coefficient of linear expansion is α per degree celsius, then the compressional force required to prevent the rod from expanding along its length is

(a) $EA\alpha t$ (b) $EA\alpha t/(1 + \alpha t)$
(c) $EA\alpha t/(1 - \alpha t)$ (d) $El\alpha t$

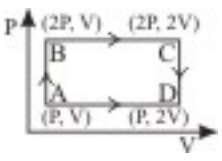
24. A refrigerator works between 3° C and 40° C. To keep the temperature of the refrigerator space constant, 60 calories of heat are to be removed every second. The power required is (J = 4.2 joules/cal)

(a) 33.78 watt (b) 6.77 watt (c) 7.77 watt (d) 10.77 watt

25. The ratio of specific heat capacity at constant pressure to the specific heat capacity at constant volume is 5/3 for a certain ideal gas. 8m^3 of this gas at initial pressure of 2.43×10^5 N/m^2 are allowed to expand adiabatically until the volume is 27m^3. At the end of this expansion, the pressure of gas is

(a) 1.17×10^5 N/m^2 (b) 1.08×10^5 N/m^2
(c) 0.72×10^5 N/m^2 (d) 0.32×10^5 N/m^2

26. An ideal monoatomic gas is taken round the cycle $ABCDA$ as shown in figure. The work done during the cycle is



(a) PV (b) $2PV$ (c) $PV/2$ (d) zero

27. The earth receives at its surface radiation from the sun at the rate of 1400 W/m^2. The distance of the centre of the sun from the surface of the earth is 1.5×10^{11} m and the radius of the sun is 7.0×10^8 m. Treating sun as a black body, it follows from the above data that its surface temperature is (given $\sigma = 5.7 \times 10^{-8}$ Js^{-1} m^{-2} K^{-4})

(a) 5801 K (b) 106 K (c) 50.1 K (d) 5801° C

28. A sphere, a cube and a thin circular plate all made of same material and having the same mass are initially heated to temperature of 200° C. Which of them cools fastest when left in air at room temperature ?

(a) sphere (b) cube
(c) circular plate (d) all at the same rate

29. A convex lens of focal length 40cm is in contact with a concave lens of focal length 25 cm. The power of the combination is

(a) – 1.5 diopters (b) – 6.5 diopters
(c) + 6.5 diopters (d) + 6.67 diopters

30. A thin prism P_1 with angle 4° and made from glass of refractive index 1.54 is combined with another prism P_2 made from glass of refractive index 1.72 to produce disperson without deviation. The angle of prism P_2 is

(a) 5.33° (b) 4° (c) 3° (d) 2.6°

31. An astronomical telescope has an angular mangnification of magnitude 5 for distant objects. The separation between the objective and eyepiece is 36 cm and the final image is formed at infinity. The focal length f_0 of the objective and f_e of eyepiece are

(a) $f_0 = 45$ cm, $f_e = -9$ cm (b) $f_0 = 50$ cm, $f_e = 10$ cm
(c) $f_0 = 7.2$ cm, $f_e = 5$ cm (d) $f_0 = 30$ cm, $f_e = 6$ cm

32. In a two slit experiment with monochromatic light fringes are obtained on a screen placed at some distance from the slits. If the screen is moved by 5×10^{-2} m towards the slits, the change in fringe width is 3×10^{-5} m. If separation between the slits is 10^{-3} m, the wavelength of light used is

(a) 6000Å (b) 5000Å (c) 3000Å (d) 4500Å

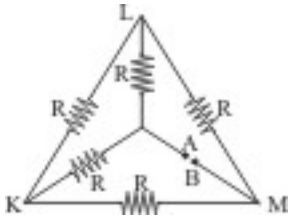
33. The diameter of moon is 3.5×10^3 km and its distance from the earth is 3.8×10^5 km. It is seen by a telescope having the focal length of the objective and the eyepiece as 4 m and 10 cm respectively. The magnifying power of the telescope is approximately

(a) 4 (b) 56 (c) 560 (d) 5.6

34. A tuning fork vibrating with a sonometer having 20 cm wire produces 5 beats per second. The beat frequency does not change if the length of the wire is changed to 21 cm. The frequency of the tuning fork (in Hz) must be

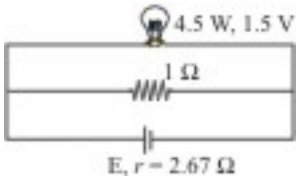
(a) 200 (b) 210
(c) 205 (d) 215

35. Each of the resistance in the network shown is equal to R. The resistance between the terminals A and B is



(a) R (b) $5R$
(c) $3R$ (d) $6R$

36. A torch bulb rated as 4.5W, 1.5V is connected as shown in the figure. The emf of the cell, needed to make the bulb glow at full intensity is



(a) 4.5 V (b) 1.5 V
(c) 2.67 V (d) 13.5 V

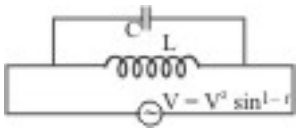
37. A thermocouple is made of iron and constantan. Given that thermo emfs of iron and constantan against platinum are +1600 and –3400 micro volt per 100° C difference of temperature, the emf developed per °C difference of temperature between the junction of iron and constantan in microvolt per degree celsius is
(a) –18 (b) 1600 (c) –3400 (d) –1800

38. An electron (mass = 9×10^{-31} kg, charge = 1.6×10^{-9} C) moving with a velocity of 10^6 m/s enters a region where magnetic field exists. If it describes a circle of radius 0.10 m, the intensity of the magnetic field must be
(a) 1.8×10^{-4} T (b) 5.6×10^{-5} T
(c) 14.4×10^{-5} T (d) 1.3×10^{-6} T

39. In a vibration magnetometer, the time period of a bar magnet oscillating in horizontal component of earth's magnetic field is 2 s. When the magnet is brought near and parallel to it, the time period reduces to 1s. The ratio H/F of the horizontal component H and the field F due to magnet will be
(a) 3 (b) 1/3 (c) $\sqrt{3}$ (d) $1/\sqrt{3}$

40. The two rails of a railway track, insulated from each other on the ground, are connected to a millivoltmeter. What is the reading of the millivoltmeter when a train passes at a speed of 180 km/h along the track, given that the horizontal component of earth's magnetic field is 0.2×10^{-4} Wb/m^2 and rails are separated by 1 metre ?
(a) 10^{-2} volt (b) 100 mV (c) 1 volt (d) 1 mV

41. For the circuit shown, the current through the inductor is 0.9 A, while the current through the condenser is 0.4A
(a) current drawn from generator I = 1.13 A
(b) $\omega = 1/(1.5\,LC)$ (c) I = 0.5 A (d) I = 0.6 A



42. How much electrical energy in kilowatt hour is consumed in operating ten 50 watt bulbs for 10 hours per day in a month of 30 days ?
(a) 1500 (b) 15000 (c) 15 (d) 150

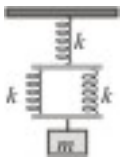
43. In the Bohr's model of hydrogen atom, the electron moves around the nucleus in a circular orbit of radius 5×10^{-11} metres. Its time period is 1.5×10^{-16} s. The current associated with the electron motion is
(a) 0 (b) 1.6×10^{-19} A (c) 0.17 A (d) 1.07×10^{-3} A

44. Work-function of molybdenum is 5 eV. If ultraviolet light of wavelength 1000 Å falls upon it, the maximum velocity of the ejected photo electrons will be ($h = 6.6 \times 10^{-34}$ Js, $e = 1.6 \times 10^{-19}$ C, $m = 9 \times 10^{-31}$ kg and 1 eV = 1.6×10^{-19} joule)
(a) 1.6×10^6 m/s (b) 1.6×10^4 m/s
(c) 1.6×10^5 m/s (d) 1.6×10^2 m/s

45. A wooden cube just floats inside water when a 200 g mass is placed on it. When the mass is removed, the cube is 2 cm above the water level. The size of the cube is
(a) 5 cm (b) 10 cm (c) 15 cm (d) 20 cm

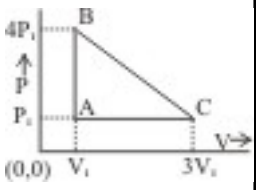
46. Water rises to a height of 16.3 cm in a capillary of height 18 cm above the water level. If the tube is cut at a height of 12 cm
(a) water will come as a fountain from the capillary tube
(b) water will stay at a height of 12 cm in the capillary tube
(c) the height of the water in the capillary will be 10.3 cm
(d) water will flow down the sides of the capillary tube

47. A body of mass m hangs from three springs each of spring constant k as shown in the figure. If the mass is slightly displaced and let go, the system will oscillate with time period
(a) $2\pi\sqrt{m/3k}$
(b) $2\pi\sqrt{3m/2k}$
(c) $2\pi\sqrt{2m/3k}$ (d) $2\pi\sqrt{3k/m}$



48. The dimensional formula for latent heat is
(a) $M^0L^2T^{-2}$ (b) ML^2T^{-2} (c) MLT^{-2} (d) ML^2T^{-1}

49. An ideal gas is taken around the cycle ABCA in P–V diagram. The net work done by the gas during the cycle is equal to
(a) $12\,P_1V_1$ (b) $6\,P_1V_1$
(c) $3\,P_1V_1$ (d) P_1V_1

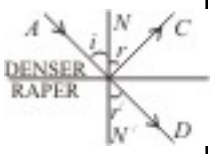


50. The pressure P of an ideal gas and its mean kinetic energy E per unit volume are related as
(a) $P = E/2$ (b) $P = E$ (c) $P = 3E/2$ (d) $P = 2E/2$

51. A bucket full of hot water is kept in a room and it cools from 75° C to 70° C in T_1 minutes, from 70° C to 65° C in T_2 minutes and from 65° C to 60° C in T_3 minutes.Then
(a) $T_1 = T_2 = T_3$ (b) $T_1 < T_2 < T_3$
(c) $T_1 > T_2 > T_3$ (d) $T_1 < T_2 > T_3$

52. Water in a lake is converted into ice at 0° C when the temperature of the atmosphere is –10° C. If it takes 7 hours for 1 cm to form ice, then the time required for the thickness of ice to increase from 1cm to 2 cm will be
(a) 7 hrs (b) 14 hrs (c) < 7 hrs (d) >14 hrs

53. A ray of light from a denser medium strikes a rare medium at angle of incidence i as shown. The reflected and refracted rays make an angle 90° with each other. The angles of reflection and refraction are r and r'. The critical angle is
(a) $\sin^{-1}(\tan r)$ (b) $\sin^{-1}(\tan i)$
(c) $\sin^{-1}(\tan r')$ (d) $\tan^{-1}(\sin i)$



54. A concave mirror and a convex lens are of the same focal length in air. When they are immersed in water,
(a) the concave mirror will have its focal length increased
(b) the convex lens will have its focal length increased
(c) they will have equal focal lengths, different from those in air
(d) they will have equal focal lengths, same as those in the air

55. A double convex lens of focal length 6cm is made of glass of refractive index 1.5. The radius of curvature of one surface is double that of the other surface. The value of small radius of curvature is
(a) 6 cm (b) 4.5 cm (c) 9 cm (d) 4 cm

56. A short sighted person can see distinctly only those objects which lie between 10cm and 100 cm from him. The power of the spectacle lens required to see a distant object is
(a) +0.5 D (b) –1 D (c) +2 D (d) +4 D

57. Light travels through a glass plate of thickness t and having refractive index μ. If c is the velocity of light in vacuum, the time taken by light to travel this thickness of glass is
(a) $t/\mu c$ (b) $t\mu c$ (c) $\mu t/c$ (d) tc/μ