1. A ray of light enters from a rarer to a denser medium. The angle of incidence is i. Then the reflected and refracted rays are mutually perpendicular to each other. The critical angle for the pair of media is

   1) $Sin^{-1}(Tan\, i)$ 2) $Tan^{-1}(Sin\, i)$

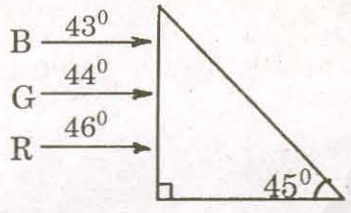
   3) $Sin^{-1}(Cot\, i)$ 4) $Cos^{-1}(Tan\, i)$

2. A fish in water (refractive index n) looks at a bird vertically above in the air. If y is the height of the bird and x is the depth of the fish from the surface, then the distance of the bird as estimated by the fish is

   1) $x + y\left(1 - \frac{1}{n}\right)$ 2) $x + ny$

   3) $x + y\left(1 + \frac{1}{n}\right)$ 4) $y + x\left(1 - \frac{1}{n}\right)$

3. Figure shows a mixture of blue, green and red coloured rays incident normally on a right angled prism. The critical angles of the material of the prism for red, green and blue are 46^0, 44^0 and 43^0 respectively. The arrangement will separate



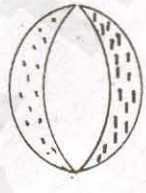
   1) red colour from blue and green
   2) blue colour from red and green
   3) green colour from red and blue
   4) all the three colours.

4. A convex and a concave lens seperated by distance d are then put in contact. The focal length of the combination

   1) decreases 2) increases

   3) becomes 0 4) remains the same

5. A convex lens is made of 3 layers of glass of 3 different materials as in the figure. A point object is placed on its axis. The number of images of the object are



   1) 1
   2) 2
   3) 3
   4) 4

(Space for Rough Work)

6. If μ_0 is permeability of free space and ϵ_0 is permittivity of free space, the speed of light in vacuum is given by

1) $\sqrt{\mu_0 \epsilon_0}$ 2) $\sqrt{\mu_0 / \epsilon_0}$

3) $\sqrt{\frac{1}{\mu_0 \epsilon_0}}$ 4) $\sqrt{\epsilon_0 / \mu_0}$

7. In Young's double slit experiment, a third slit is made in between the double slits. Then

1) intensity of fringes totally disappears.
2) only bright light is observed on the screen.
3) fringes of unequal width are formed.
4) contrast between bright and dark fringes is reduced.

8. The maximum number of possible interference maxima when slit separation is equal to 4 times the wavelength of light used in a double slit experiment is

1) ∞ 2) 9

3) 8 4) 4

9. In a Fraunhofer diffraction experiment at a single slit using a light of wavelength 400 nm, the first minimum is formed at an angle of 30^0. The direction θ of the first secondary maximum is given by

1) $Sin^{-1}\ 2/3$ 2) $Sin^{-1}\ 3/4$

3) $Sin^{-1}\ 1/4$ 4) $Tan^{-1}\ 2/3$

10. Maximum diffraction takes place in a given slit for

1) γ - rays 2) ultraviolet light

3) infrared light 4) radio waves

(Space for Rough Work)

11. An unpolarised beam of intensity I_0 falls on a polaroid. The intensity of the emergent light is

1) $I_0/2$ 2) I_0

3) $I_0/4$ 4) Zero

12. Which of the following is a dichroic crystal ?

1) Quartz 2) Tourmaline

3) Mica 4) Selenite

13. Two identical metal spheres charged with $+12\,\mu F$ and $-8\,\mu F$ are kept at certain distance in air. They are brought into contact and then kept at the same distance. The ratio of the magnitudes of electrostatic forces between them before and after contact is

1) 12 : 1 2) 8 : 1

3) 24 : 1 4) 4 : 1

14. A small conducting sphere of radius r is lying concentrically inside a bigger hollow conducting sphere of radius R. The bigger and smaller spheres are charged with Q and q $(Q > q)$ and are insulated from each other. The potential difference between the spheres will be

1) $\frac{1}{4\pi\epsilon_0}\left(\frac{q}{r}-\frac{q}{R}\right)$ 2) $\frac{1}{4\pi\epsilon_0}\left(\frac{q}{R}-\frac{Q}{r}\right)$

3) $\frac{1}{4\pi\epsilon_0}\left(\frac{q}{r}-\frac{Q}{R}\right)$ 4) $\frac{1}{4\pi\epsilon_0}\left(\frac{Q}{R}+\frac{q}{r}\right)$

15. The charges Q, $+q$ and $+q$ are placed at the vertices of an equilateral triangle of side l. If the net electrostatic potential energy of the system is zero, then Q is equal to

1) $-q/2$ 2) $-q$

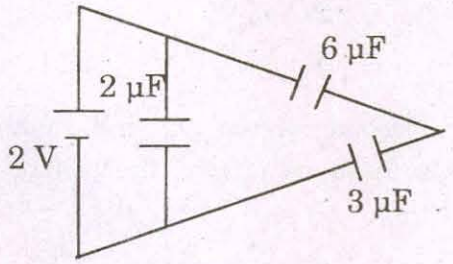
3) $+q/2$ 4) zero

(Space for Rough Work)

16. How many $6\mu F$, 200 V condensers are needed to make a condenser of $18\mu F$, 600 V?

1) 9 2) 18
3) 3 4) 27

17. The total energy stored in the condenser system shown in the figure will be

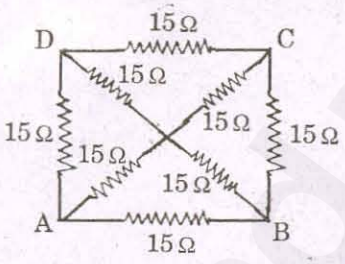


1) $2\mu J$ 2) $4\mu J$
3) $8\mu J$ 4) $16\mu J$

18. A metal wire is subjected to a constant potential difference. When the temperature of the metal wire increases, the drift velocity of the electron in it

1) increases, thermal velocity of the electron decreases
2) decreases, thermal velocity of the electron decreases
3) increases, thermal velocity of the electron increases
4) decreases, thermal velocity of the electron increases

19. The equivalent resistance between the points A and B will be (each resistance is 15 Ω)



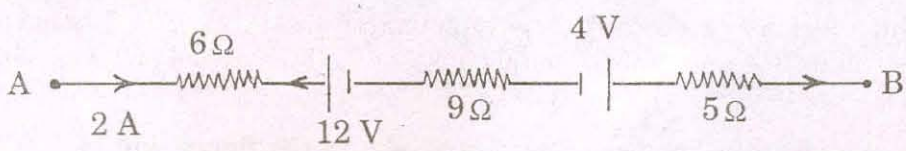
1) 30 Ω
2) 8 Ω
3) 10 Ω
4) 40 Ω

20. The terminals of a 18 V battery with an internal resistance of 24 Ω are connected to a circular wire of resistance 24 Ω at two points distant at one quarter of the circumference of a circular wire. The current through the bigger arc of the circle will be

1) 0.75 A 2) 1.5 A
3) 2.25 A 4) 3 A

(Space for Rough Work)

21. The potential difference between A and B in the following figure is

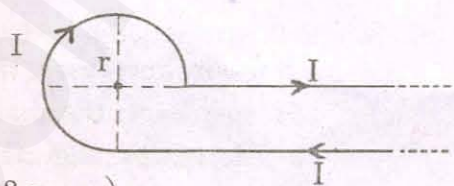


1) 32 V
2) 48 V
3) 24 V
4) 14 V

22. The magnetic field at the centre of a circular current carrying conductor of radius r is B_c. The magnetic field on its axis at a distance r from the centre is B_a. The value of $B_c : B_a$ will be

1) $1 : \sqrt{2}$
2) $1 : 2\sqrt{2}$
3) $2\sqrt{2} : 1$
4) $\sqrt{2} : 1$

23. Current 'I' is flowing in a conductor shaped as shown in the figure. The radius of the curved part is r and the length of straight portion is very large. The value of the magnetic field at the centre O will be

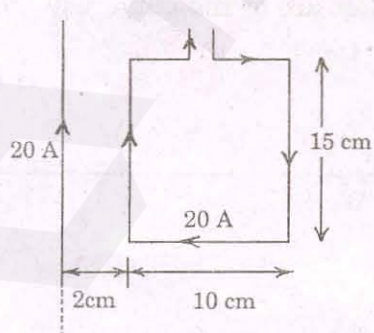


1) $\frac{\mu_0 I}{4\pi r}\left(\frac{3\pi}{2}+1\right)$
2) $\frac{\mu_0 I}{4\pi r}\left(\frac{3\pi}{2}-1\right)$
3) $\frac{\mu_0 I}{4\pi r}\left(\frac{\pi}{2}+1\right)$
4) $\frac{\mu_0 I}{4\pi r}\left(\frac{\pi}{2}-1\right)$

24. Two tangent galvanometers A and B are identical except in their number of turns. They are connected in series. On passing a current through them, deflections of 60^0 and 30^0 are produced. The ratio of the number of turns in A and B is

1) 1 : 3
2) 3 : 1
3) 1 : 2
4) 2 : 1

25. The resultant force on the current loop $PQRS$ due to a long current carrying conductor will be



1) $10^{-4}N$
2) $3.6 \times 10^{-4}N$
3) $1.8 \times 10^{-4}N$
4) $5 \times 10^{-4}N$

(Space for Rough Work)

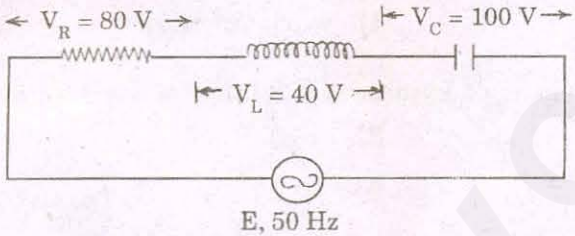
26. A certain current on passing through a galvanometer produces a deflection of 100 divisions. When a shunt of one ohm is connected, the deflection reduces to 1 division. The galvanometer resistance is

1) 100 Ω
2) 99 Ω
3) 10 Ω
4) 9.9 Ω

27. Two similar circular loops carry equal currents in the same direction. On moving the coils further apart, the electric current will

1) increase in both
2) decrease in both
3) remain unaltered
4) increases in one and decreases in the second

28. The value of alternating emf E in the given circuit will be



1) 220 V
2) 140 V
3) 100 V
4) 20 V

29. A current of 5A is flowing at 220 V in the primary coil of a transformer. If the voltage produced in the secondary coil is 2200 V and 50% of power is lost, then the current in the secondary will be

1) 2.5 A
2) 5 A
3) 0.25 A
4) 0.5 A

30. For a series LCR circuit at resonance, the statement which is not true is

1) Peak energy stored by a capacitor = peak energy stored by an inductor
2) Average power = apparent power
3) Wattless current is zero
4) Power factor is zero

(Space for Rough Work)

31. Solar spectrum is an example for

1) line emission spectrum
2) continuous emission spectrum
3) band absorption spectrum
4) line absorption spectrum

32. When a piece of metal is illuminated by a monochromatic light of wavelength λ, then stopping potential is $3Vs$. When same surface is illuminated by light of wavelength 2λ, then stopping potential becomes Vs. The value of threshold wavelength for photoelectric emission will be

1) 4λ
2) 8λ
3) $\frac{4}{3}\lambda$
4) 6λ

33. The maximum kinetic energy of emitted electrons in a photoelectric effect does not depend upon

1) wavelength
2) frequency
3) intensity
4) work function

34. The ratio of minimum wavelengths of Lyman and Balmer series will be

1) 1.25
2) 0.25
3) 5
4) 10

35. Hydrogen atom does not emit X-rays because

1) it contains only a single electron
2) energy levels in it are far apart
3) its size is very small
4) energy levels in it are very close to each other

(Space for Rough Work)

36. If an electron and a proton have the same de-Broglie wavelength, then the kinetic energy of the electron is

1) zero
2) less than that of a proton
3) more than that of a proton
4) equal to that of a proton

37. Two protons are kept at a separation of $40\overset{0}{A}$. F_n is the nuclear force and F_e is the electrostatic force between them. Then

1) $F_n >> F_e$
2) $F_n = F_e$
3) $F_n << F_e$
4) $F_n \approx F_e$

38. Blue colour of sea water is due to

1) interference of sunlight reflected from the water surface
2) scattering of sunlight by the water molecules
3) image of sky in water
4) refraction of sunlight

39. The ratio of the nuclear radii of elements with mass numbers 216 and 125 is

1) 216 : 125
2) $\sqrt{216} : \sqrt{125}$
3) 6 : 5
4) none of these

40. On bombarding U^{235} by slow neutron, 200 MeV energy is released. If the power output of atomic reactor is 1.6 MW, then the rate of fission will be

1) $5 \times 10^{22} /s$
2) $5 \times 10^{16} /s$
3) $8 \times 10^{16} /s$
4) $20 \times 10^{16} /s$

(Space for Rough Work)

41. The masses of two radioactive substances are same and their half lives are 1 year and 2 years respectively. The ratio of their activities after 6 years will be

1) 1 : 4 2) 1 : 2

3) 1 : 3 4) 1 : 6

42. $_{92}U^{235}$ undergoes successive disintegrations with the end product of $_{82}Pb^{203}$. The number of α and β particles emitted are

1) $\alpha = 6, \beta = 4$ 2) $\alpha = 6, \beta = 0$

3) $\alpha = 8, \beta = 6$ 4) $\alpha = 3, \beta = 3$

43. The most stable particle in Baryon group is

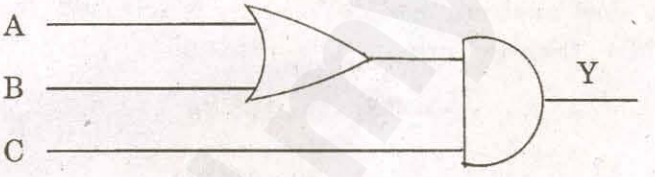
1) neutron 2) omega - particle

3) proton 4) lamda - particle

44. In an unbiased p-n junction

1) Potential at p is more than that at n
2) Potential at p is less than that at n
3) Potential at p is equal to that at n
4) Potential at p is +ve and that at n is –ve

45. To get an output $y = 1$ from the circuit shown, the inputs A, B and C must be respectively



1) 0, 1, 0 2) 1, 0, 0

3) 1, 0, 1 4) 1, 1, 0

(Space for Rough Work)

46. Dimensional formula for the universal gravitational constant G is

1) $M^{-1}L^{2}T^{-2}$ 2) $M^{0}L^{0}T^{0}$

3) $M^{-1}L^{3}T^{-2}$ 4) $M^{-1}L^{3}T^{-1}$

47. A body is projected vertically upwards. The times corresponding to height h while ascending and while descending are t_1 and t_2 respectively. Then the velocity of projection is (g is acceleration due to gravity)

1) $g\sqrt{t_1 t_2}$ 2) $\frac{g t_1 t_2}{t_1 + t_2}$

3) $\frac{g\sqrt{t_1 t_2}}{2}$ 4) $\frac{g(t_1 + t_2)}{2}$

48. A mass of 10 kg is suspended from a spring balance. It is pulled aside by a horizontal string so that it makes an angle of 60^0 with the vertical. The new reading of the balance is

1) 20 kg.wt 2) 10 kg.wt

3) $10\sqrt{3}$ kg.wt 4) $20\sqrt{3}$ kg.wt

49. A body weighs 50 grams in air and 40 grams in water. How much would it weigh in a liquid of specific gravity 1.5?

1) 30 grams 2) 35 grams

3) 65 grams 4) 45 grams

50. A body of mass 4 kg is accelerated upon by a constant force, travels a distance of 5 m in the first second and a distance of 2 m in the third second. The force acting on the body is

1) 2 N 2) 4 N

3) 6 N 4) 8 N

(Space for Rough Work)

51. A simple pendulum is suspended from the ceiling of a lift. When the lift is at rest its time period is T. With what acceleration should the lift be accelerated upwards in order to reduce its period to $T/2$? (g is acceleration due to gravity).

1) $2g$ 2) $3g$

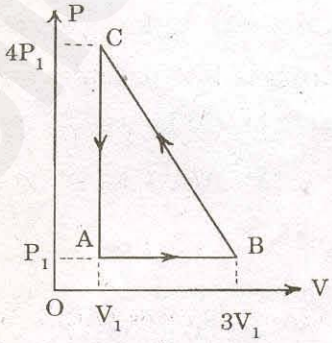
3) $4g$ 4) g

52. If γ is the ratio of specific heats and R is the universal gas constant, then the molar specific heat at constant volume C_v is given by

1) γR 2) $\frac{(\gamma-1)R}{\gamma}$

3) $\frac{R}{\gamma-1}$ 4) $\frac{\gamma R}{\gamma-1}$

53. An ideal gas is taken via path $ABCA$ as shown in figure. The network done in the whole cycle is



1) $3P_1V_1$

2) $-3P_1V_1$

3) $6P_1V_1$

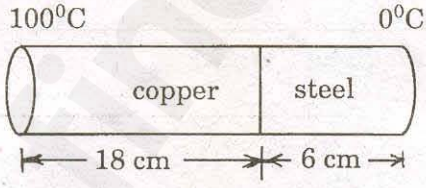
4) zero

54. In which of the processes, does the internal energy of the system remain constant ?

1) Adiabatic 2) Isochoric

3) Isobaric 4) Isothermal

55. The coefficient of thermal conductivity of copper is 9 times that of steel. In the composite cylindrical bar shown in the figure, what will be the temperature at the junction of copper and steel ?



1) 75^0C 2) 67^0C

3) 25^0C 4) 33^0C

(Space for Rough Work)

56. The equation of a simple harmonic wave is given by $y = 6Sin\,2\pi(2t - 0.1x)$, where x and y are in mm and t is in seconds. The phase difference between two particles 2 mm apart at any instant is

1) 18^0 2) 36^0

3) 54^0 4) 72^0

57. With what velocity should an observer approach a stationary sound source so that the apparent frequency of sound should appear double the actual frequency? (v is velocity of sound).

1) $v/2$ 2) $3v$

3) $2v$ 4) v

58. If a black body emits 0.5 joules of energy per second when it is at 27^0C, then the amount of energy emitted by it when it is at 627^0C will be

1) 40.5 J 2) 162 J

3) 13.5 J 4) 135 J

59. A string vibrates with a frequency of 200 Hz. When its length is doubled and tension is altered, it begins to vibrate with a frequency of 300 Hz. The ratio of the new tension to the original tension is

1) 9 : 1 2) 1 : 9

3) 3 : 1 4) 1 : 3

60. How many times more intense is a 60 dB sound than a 30 dB sound ?

1) 1000 2) 2

3) 100 4) 4

(Space for Rough Work)