1. A ray of light travels from an optically denser to a rarer medium. The critical angle for the two media is C. The maximum possible deviation of the ray will be :

(a) 2C (b) $\frac{\pi}{2} - C$

(c) $\pi - C$ (d) $\pi - 2C$

2. When one of the slits of Young's experiment is covered with a transparent sheet of thickness 4·8 mm, the central shifts to a position originally occupies by the 30th bright fringe. What should be the thickness of the sheet if the central fringe has to shift to the position occupied by 20th bright fringe ?

(a) 1·6 mm (b) 3·8 mm

(c) 3·2 mm (d) 7·6 mm

3. Light passes successively through two polarimeter tubes each of length 0·29 m. The first tube contains dextro rotatory solution of concentration 60 kg m^{-3} and specific rotation 0·01 rad m^2 kg^{-1}. The second tube contains laevo rotatory solution of concentration 30 kg m^{-5} and specific rotation 0·02 rad m^2 kg^{-1}. The net rotation produced is :

(a) 0° (b) 15°

(c) 10° (d) 20°

4. v_O and v_E represent the velocities, μ_O and μ_E the refractive indices of ordinary and extraordinary rays for a double refracting crystal. Then :

(a) $v_O \leq v_E, \mu_O \leq \mu_E$, if the crystal is quartz

(b) $v_O \geq v_E, \mu_O \leq \mu_E$, if the crystal is calcite

(c) $v_o \geq v_E, \mu_o \geq \mu_E$, if the crystal is quartz

(d) $v_o \leq v_E, \mu_o \geq \mu_E$, if the crystal is calcite.

5. A racing car moving towards a cliff, sounds its horn. The driver observes that the sound reflected from the cliff has a pitch one octave higher than the actual sound of the horn. If v is the velocity of sound, then the velocity of the car is :

(a) $v/2$ (b) $v/\sqrt{2}$

(c) $v/4$ (d) $v/3$

6. The de-Broglie wavelength of an electron in the first Bohr orbit is :

(a) equal to half the circumference of the first orbit

(b) equal to one fourth the circumference of the first orbit

(c) equal to the circumference of the first orbit

(d) equal to twice the circumference of the first orbit

7. Out of the following statements which is not true ?
   (a) Infrared radiations arise due to minor electron transitions in atoms.
   (b) Infrared radiations are used for long distance photography.
   (c) Sun is the natural source of infrared radiation.
   (d) Infrared radiations are detected by using a bolometer.

8. In nuclear fission the percentage of mass converted into energy is about :
   (a) 0·01% (b) 10%
   (c) 1% (d) 0·1%

9. If l_1, l_2, l_3 are the lengths of the emitter, base and collector of a transistor, then :
   (a) $l_3 < l_2 < l_1$ (b) $l_1 = l_2 = l_3$
   (c) $l_3 < l_1 < l_2$ (d) $l_3 < l_1 < l_2$

10. When the conductivity of a semiconductor is only due to breaking of covalent bonds, the semiconductor is called :
    (a) intrinsic (b) extrinsic
    (c) p-type (d) n-type

11. A very large number of balls are thrown vertically upwards in quick successions in such a way that the next ball is thrown when the previous one is at the maximum height. If the maximum height is 5 m, the number of balls thrown per minute is :
    (take $g = 10\ m/s^2$)
    (a) 80 (b) 120
    (c) 40 (d) 60

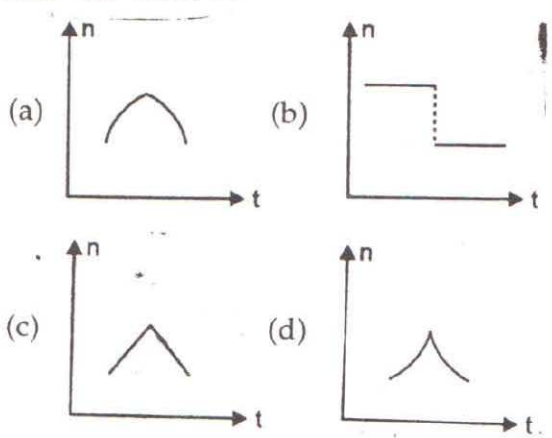
12. The light reflected by a plane mirror may form a real image :
    (a) if the rays incident on the mirror are converging
    (b) if the rays incident on the mirror are diverging
    (c) under no circumstances
    (d) if the object is placed very close to the mirror.

13. A convex is made up of three different materials as shown in the figure. For a point object places on its axis, the number of images formed are :
    (a) 5 (b) 1
    (c) 3 (d) 4

14. Light appears to travel in straight lines because :
    (a) light consists of very small particles
    (b) the frequency of light is very small
    (c) the velocity of light is different for different colours
    (d) the wavelength of light is very small.

15. In Young's double slit experiment, the central bright fringe can be identified :
    (a) as it a narrower than other bright fringes
    (b) by using white light instead of monochromatic light
    (c) as it has a greater intensity than other bright fringes
    (d) as it is wider than other bright fringes.

16. A railway engine whistling at a constant frequency moves with a constant speed. It goes past a stationary observer beside the railway track. Which of the following graphs best represent the variation of frequency of the sound n heard by the observer with the time t ?



17. The tension of a stretched string is increased by 69%. In order to keep its frequency of vibration constant, its length must be increased by :
(a) 30% (b) 20%
(c) 69% (d) $\sqrt{69}\%$

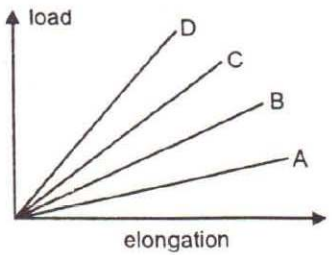
18. Under the same conditions of temperature and presssure, the velocity of sound in oxygen and hydrogen are v_O and v_H. Then :
(a) $v_O = 4v_H$ (b) $v_H = 4v_O$
(c) $v_O = v_H$ (d) $v_H = 16v_O$

19. 64 small drops of mercury, each of radius r and charge q coalesce to form a big drop. The ratio of the surface density of charge of each small drop with of the big drop is :
(a) 64 : 1 (b) 1 : 64
(c) 1 : 4 (d) 4 : 1

20. Two capacitors of capacitances 3 μF and 6 μF are charged to a potential of 12 V each. They are now connected to each other, with the positive plate to each joined to the negative plate to the other. The potential difference across each will be :
(a) 4 V (b) 6 V
(c) zero (d) 3 V

21. The resultant of two forces, one double the other in magnitude, is perpendicular to the smaller of the two forces. The angle between the two forces is :
(a) 120° (b) 60°
(c) 90° (d) 150°

22. The load versus elongation graph for four wires of the same materials is shown in the figure. The thinnest wire is represented by the line :



(a) OC (b) OD
(c) OA (d) OB

23. One kilogram of ice at 0°C is mixed with one kilogram of water at 80°C. The final temperature of the mixture is (take : specific heat of water $= 4200\ J\,kg^{-1}\,K^{-1}$, latent heat of ice $= 336\ kJ\,kg^{-1}$).
(a) 40°C (b) 60°C
(c) 0°C (d) 50°C

24. A Carnot's engine is made to work between 200°C and 0°C first and then between 0°C and –200°C. The ratio of efficiencies of the engine in the two cases is :
(a) 1 : 1·73 (b) 1·73 : 1
(c) 1 : 2 (d) 1 : 1

25. An object is placed 12 cm to the left of a converging lens of focal length 8 cm. Another converging lens of 6 cm focal length is placed at a distance of 30 cm. to the right of the first lens. The second lens will produce :
(a) a virtual enlarged image
(b) no image
(c) a real inverted image
(d) a real enlarged image

26. The resistance of an incandescent lamp is :
(a) smaller when switched on
(b) greater when switched off
(c) the same whether it is switch off or switch on
(d) greater when switched on

27. A superconductor exhibits perfect :
(a) ferromagnetism
(b) ferrimagnetism
(c) diamagnetism
(d) paramagnetism

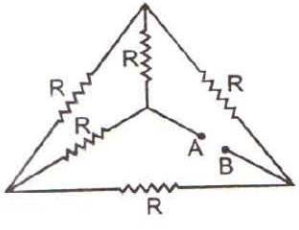
28. A magnet is dropped down an infinitely long vertical copper tube. Then :
(a) the magnet moves with continuously decreasing velocity and ultimately comes to rest
(b) the magnet moves with continuosly increasing velocity and ultimately acquires a constant terminal velocity
(c) the magnet moves with continuously increasing velocity and acceleration
(d) the magnet moves with continuosly increasing velocity but constant acceleration.

29. Whenever a hydrogen atom emits a photon in the Balmer series, it :
(a) may emit another photon in the Paschen series
(b) need not emit any more photon
(c) may emit another photon in the Balmer series
(d) must emit another photon in the Lyman series.

30. The SI unit of radioactivity is :
(a) Rutherford (b) Roentgen
(c) Becqueral (d) Curie.

31. An ammeter and a voltmeter are joined in series to a cell. Their readings are A and V respectively. If a resistance is now joined in parallel with the voltmeter, then :
(a) A will decrease, V will increase
(b) A will increase, V will decrease
(c) both A and V will increase
(d) both A and V will increase

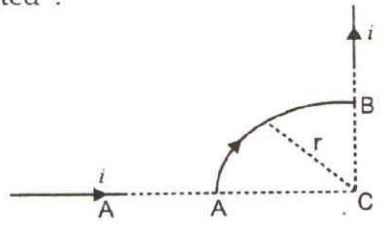
32. If each of the resistance of the network shown in figure is R, the equivalent resistance between A and B is :



(a) $3R$ (b) $5R$
(c) $R/2$ (d) R

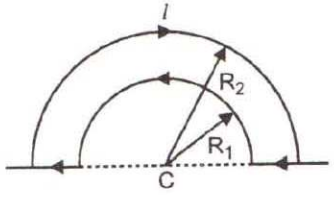
33. A cell supplies a current of 0·9 A through a 2Ω resistor and a current of 0·3 A through a 7Ω resistor. The internal resistance of the cell is :
(a) 1·2 Ω (b) 2·0 Ω
(c) 0·5 Ω (d) 1·0 Ω

34. A wire carrying current i is shaped as shown. Section AB is a quarter circle of radius r. The magnetic field is directed :



(a) perpendicular to the plane of the paper and directed into the paper
(b) at an angle $\pi/4$ to the plane of the paper
(c) along the bisector of the angle ACB away from AB
(d) along the bisector of ACB towards AB.

35. The wire loop formed by joining two semicircular sections of radii R_1 and R_2 and centre C, carries a current I as shown. The magnetic field at C has a magnitude :



(a) $\frac{\mu_0 I}{2}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ (b) $\frac{\mu_0 I}{4}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$
(c) $\frac{\mu_0 I}{2}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$ (d) $\frac{\mu_0 I}{4}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$

36. To increase both the resolving power and magnifying power of a telescope :

(a) the focal length of the objective has to be increased
(b) both the focal length and aperture of the objective has to be increased
(c) the wavelength of light has to be decreased
(d) the aperture of the objective has to be increased

37. Forty one tuning forks are arranged in increasing order of frequencies such that every fork gives 5 beats with the next. The last fork has a frequency that is double the frequency of the first fork is :
(a) 210 (b) 400
(c) 205 (d) 200

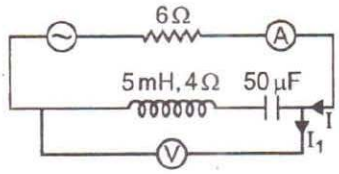
38. In a stationary wave all the particles :
(a) in the region between two nodes vibrate in same phase
(b) on either side of a node vibrate in same phase
(c) of the medium vibrate in same phase
(d) in the region between two antinodes vibrate in same phase.

39. A cylindrical tube, open at both ends, has a fundamental frequency f_0 in air. The tube is dipped vertically into water such that half of its length is inside water. The fundamental frequency of the air column now is :
(a) f_0 (b) $3f_0/4$
(c) $2f_0$ (d) $f_0/2$

40. A man x can hear upto 10 kHz and another man y upto 2 kHz. A note of frequency 500 Hz is produced before them from a stretched string then both will hear sounds of :
(a) different pitch but same quality
(b) same pitch but different quality
(c) same pitch and same quality
(d) different pitch and different quality.

41. When 100 V D.C. is applied across a coil, a current of 1 A flows through it. When 100 V A.C. of 50 Hz is applied to the same coil only 0·5 A flows. The inductance of the coil is :
(a) 5·5 mH (b) 0·55 mH
(c) 55 mH (d) 0·55 H.

42. In the circuit shown in the figure, the A.C. source gives a voltage $V = 20 \cos (2000t)$. Neglecting source resistance, the voltmeter and ammeter reading will be :



(a) 1·68 V, 0·47 A (b) 0 V, 0·47 A
(c) 5·6 V, 1·4 A (d) 0 V, 1·4 A

43. In the Bohr model of the hydrogen atom, let R, V and E represent the radius of the orbit, the speed of electron and the total energy of the electron respectively. Which of the following quantity is proportional to the quantum number n ?
(a) E/V (b) R/E
(c) VR (d) RE

44. In a sample of radioactive material, what percentage of the initial number of active nuclei will decay during one mean life ?
(a) 63% (b) 69·3%
(c) 37% (d) 50%

45. A caesium photocell, with a steady potential difference of 60 V across it, is illuminated by a bright point source of light 50 cm away. When the same light is places 1 cm. away, the photoelectrons emitted from the cell :
(a) are half as numerous
(b) are one quarter as numerous
(c) each carry one quarter of their previous energy
(d) each carry one quarter of their previous momentum.

46. The equation $y = A\cos^2\left[2\pi nt - 2\pi\frac{x}{y}\right]$ represents a wave with :
(a) amplitude $A/2$, frequency $2n$ and wavelength λ
(b) amplitude $A/2$, frequency $2n$ and wavelength $\lambda/2$
(c) amplitude A, frequency n and wavelength λ
(d) amplitude A, frequency $2n$ and wavelength 2λ

47. A light points fixed to one prong of a tuning fork touches a vertical plate. The fork is set vibrating and the plate is allowed to fall freely. If eight oscillations are counted when the plate falls through 10 cm, the frequency of the tuning fork is :
(a) 280 Hz (b) 360 Hz
(c) 56 Hz (d) 560 Hz

48. Three point charges are placed at the corners of an equilateral triangle. Assuming only electrostatic forces are acting. Then the system :
(a) will be in equilibrium if the charges rotate about the centre of the triangle
(b) can never be in equilibrium
(c) will be in equilibrium if the charges have the same magnitudes but different signs
(d) will be in equilibrium if the charges have different magnitude and different signs.

49. Two copper balls, each weighing 10 g are kept in air 10 cm apart. If one electron from every 10^6 atoms is transferred from one ball to the other, the coulomb force between them is :
(atomic weight of copper is 63·5)
(a) $2{\cdot}0 \times 10^4$ N (b) $2{\cdot}0 \times 10^{10}$ N
(c) $2{\cdot}0\ 10^6$ N (d) $2{\cdot}0 \times 10^8$ N

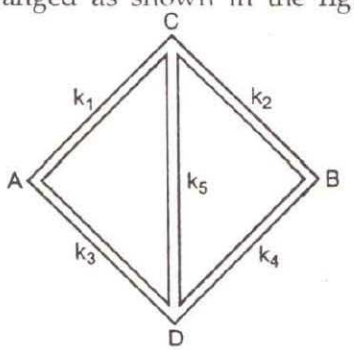
50. What fraction of the energy drawn from the charging battery is stored in a capacitor ?
(a) 75% (b) 100%
(c) 25% (d) 50%

51. A projectile is moving at 20 ms^{-1} at its highest point, where it breaks into equal parts due to an internal explosion. One part moves vertically up at 30 ms^{-1} with respect to the ground. Then the other part will move at :
(a) 20 ms^{-1} (b) $10\sqrt{31}$ ms^{-1}
(c) 50 ms^{-1} (d) 30 ms^{-1}

52. A body is projected vertically upwards from the surface of a planet of radius R with a velocity equal to half the escape velocity for that planet. The maximum height attained by the body is :
(a) $R/2$ (b) $R/3$
(c) $R/5$ (d) $R/4$

53. From the top of a tower a stone is thrown up which reaches the ground in a time t_1. A second stone thrown down with the same speed reaches the ground in a time t_2. A third stone released from rest from the same between reaches the ground in a time t_3. Then :
(a) $\frac{1}{t_3} = \frac{1}{t_2} - \frac{1}{t_1}$ (b) $t_3^2 = t_1^2 - t_2^2$
(c) $t_3 = \frac{t_1 + t_2}{2}$ (d) $t_3 = \sqrt{t_1\, t_2}$

54. Five rods of same dimensions are arranged as shown in the figure. They



have thermal conductivities k_1, k_2, k_3, k_4 and k_5 when points A and B are maintained at different temperatures. No heat flows through the central rod if :

(a) $k_1k_4 = k_2k_3$ (b) $k_1 = k_4$ and $k_2 = k_3$

(c) $\frac{k_1}{k_4} = \frac{k_2}{k_3}$ (d) $k_1k_2 = k_3k_4$

55. The energy spectrum of a black body exhibits a maximum around a wavelength λ_0. The temperature of the black body is now changed such that the energy is maximum around a wavelength $3\lambda_0/4$. The power radiated by the black body will now increase by a factor of :

(a) 64/27 (b) 256/81

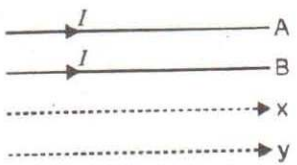
(c) 4/3 (d) 16/9

56. n identical bulbs, each designated to draw a power P from a certain voltage supply. The total power which they will draw is :

(a) P/n (b) P/n^2

(c) np (d) P

57. A and B are two conductors carrying a current I in the same direction. x and y are two electron beams moving in the same direction. Then there will be :



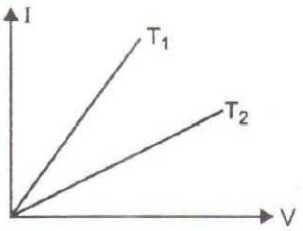
(a) attraction between A and B, repulsion between x and y

(b) repulsion between A and B, attraction between x and y

(c) attraction between A and B and x and y

(d) repulsion between A and B and x and y

58. The current-voltage graph for a given metallic conductor at two different temperature T_1 and T_2 are as shown in the figure. Then :



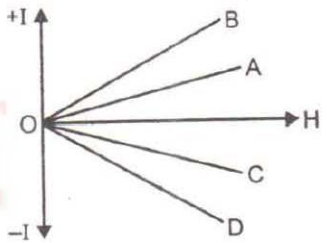
(a) $T_1 < T_2$

(b) nothing can be said about T_1 and T_2

(c) $T_1 = T_2$

(d) $T_1 > T_2$

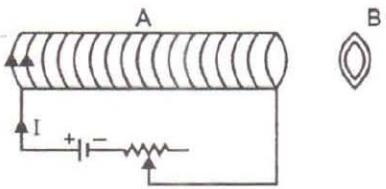
59. The variation of the intensity of magnetisation (I) with respect to the magnetising field (H) in a diamagnetic substance is described by the graph :



(a) OC (b) OD

(c) OA (d) OB

60. An aluminium ring B faces an electromagnet A. The current I through A can be altered. Then which of the following statements is correct ?



(a) If I decreases, A will repel B

(b) Whether I increases or decreases, B will not experience any force

(c) If I increases, A will repel B

(d) If I increases, A will attract B