Consortium of Medical Engineering and Dental Colleges of Karnataka

(COMEDK-2007)

PHYSICS

1. A ray of light is travelling from glass to air. (Refractive index of glass = 1.5) The angle of incidence is 50^0. The deviation of the ray is

1) $Sin^{-1}\left[\frac{Sin\,50^0}{1.5}\right] - 50^0$ 2) $50^0 - Sin^{-1}\left[\frac{Sin 50^0}{1.5}\right]$

3) 80^0 4) 0^0

2. A vessel of height 2 d is half filled with a liquid of refractive index $\sqrt{2}$ and the other half with a liquid of refractive index n. (The given liquids are immiscible). Then the apparent depth of the inner surface of the bottom of the vessel (neglecting the thickness of the bottom of the vessel) will be

1) $\frac{nd}{d+\sqrt{2n}}$ 2) $\frac{\sqrt{2n}}{d\left(n+\sqrt{2}\right)}$

3) $\frac{d\left(n+\sqrt{2}\right)}{n\sqrt{2}}$ 4) $\frac{n}{d\left(n+\sqrt{2}\right)}$

3. A ray of light is incident normally on one face of a right angled isosceles prism. It then grazes the hypotenuse. The refractive index of the material of the prism is

1) 1.732 2) 1.5

3) 1.414 4) 1.33

4. Two thin equiconvex lenses each of focal length 0.2 m are placed coaxially with their optic centres 0.5 m apart. Then the focal length of the combination is

1) 0.1 m 2) – 0.1 m

3) 0.4 m 4) – 0.4 m

5. A prism of a certain angle deviates the red and blue rays by 8^0 and 12^0 respectively. Another prism of the same angle deviates the red and blue rays by 10^0 and 14^0 respectively. The prisms are small angled and made of different materials. The dispersive powers of the materials of the prisms are in the ratio

1) 11 : 9 2) 6 : 5

3) 9 : 11 4) 5 : 6

6. The electro magnetic theory of light failed to explain

1) Interference
2) Diffraction
3) Polarisation
4) Photo electric effect

7. Light from two coherent sources of the same amplitude A and wavelength λ illuminates the screen. The intensity of the central maximum is I_0. If the sources were incoherent, the intensity at the same point will be

1) $\frac{I_0}{2}$
2) I_0
3) $2I_0$
4) $4I_0$

8. In Young's double slit experiment with sodium vapour lamp of wavelength 589 nm and the slits 0.589 mm apart, the half angular width of the central maximum is

1) $Sin^{-1}0.1$
2) $Sin^{-1}0.001$
3) $Sin^{-1}0.0001$
4) $Sin^{-1}0.01$

9. A single slit Fraunhoffer diffraction pattern is formed with white light. For what wavelength of light the third secondary maximum in the diffraction pattern coincides with the second secondary maximum in the pattern for red light of wavelength $6500\overset{0}{A}$?

1) $9100\overset{0}{A}$
2) $4642.8\overset{0}{A}$
3) $4100\overset{0}{A}$
4) $4400\overset{0}{A}$

10. The head lights of a jeep are 1.2 m apart. If the pupil of the eye of an observer has a diameter of 2 mm and light of wavelength $5896\overset{0}{A}$ is used, what should be the maximum distance of the jeep from the observer if the two head lights are just separated?

1) 3.39 m
2) 3.39 km
3) 33.9 m
4) 33.9 km

11. When the angle of incidence is 60^0 on the surface of a glass slab, it is found that the reflected ray is completely polarised. The velocity of light in glass is

1) $3\times10^8 ms^{-1}$ 2) $2\times10^8 ms^{-1}$

3) $\sqrt{3}\times10^8 ms^{-1}$ 4) $\sqrt{2}\times10^8 ms^{-1}$

12. A 20 cm length of a certain solution causes right handed rotation of 38^0. A 30 cm length of another solution causes left handed rotation of 24^0. The optical rotation caused by 30 cm length of a mixture of the above solutions in the volume ratio 1 : 2 is

1) right handed rotation of 3^0 2) left handed rotation of 3^0

3) right handed rotation of 14^0 4) left handed rotation of 14^0

13. Two identical charges repel each other with a force equal to 10 mgwt when they are 0.6 m apart in air.(g = 10 ms^{-2}) The value of each charge is

1) $2\mu C$ 2) $2nC$

3) $2\times10^{-7}C$ 4) $2mC$

14. The potential of the electric field produced by a point charge at any point (x, y, z) is given by $V = 3x^2 + 5$, where x, y, z are in metres and V is in volts. The intensity of the electric field at (–2, 1, 0) is

1) $-12Vm^{-1}$ 2) $+12Vm^{-1}$

3) $-17Vm^{-1}$ 4) $+17Vm^{-1}$

15. The potential of a large liquid drop when eight liquid drops are combined is 20V. Then the pontential of each single drop was

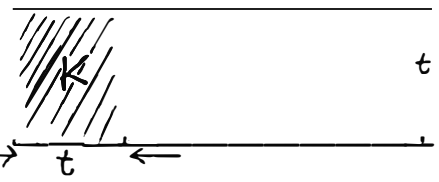
1) 2.5 V 2) 5 V

3) 7.5 V 4) 10 V

16. Two indentical capacitors each of capacitance $5\mu F$ are charged to potentials 2 kV and 1 kV respectively. The –ve ends are connected together. When the +ve ends are also connected together, the loss of energy of the system is

1) 1.25 J
2) 5 J
3) 0 J
4) 160 J

17. A parallel plate capacitor with air as the dielectric has capacitance C. A slab of dielectric constant K and having the same thickness as the separation between the plates is introduced so as to fill one-fourth of the capacitor as shown in the figure. The new capacitance will be



1) $\frac{KC}{4}$
2) $(K+1)\frac{C}{4}$
3) $(K+2)\frac{C}{4}$
4) $(K+3)\frac{C}{4}$

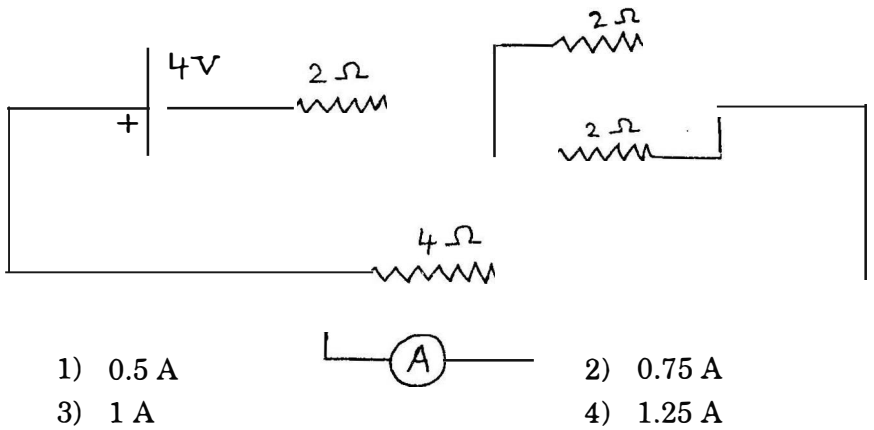
18. A current of 5 A is passing through a metallic wire of cross-sectional area $4\times10^{-6}\text{m}^2$. If the density of charge carriers of the wire is $5\times10^{26}\text{m}^{-3}$, the drift velocity of the electrons will be

1) $1\times10^{-2}\text{ms}^{-1}$
2) $1.56\times10^{-3}\text{ms}^{-1}$
3) $1.56\times10^{-2}\text{ms}^{-1}$
4) $1\times10^{2}\text{ms}^{-1}$

19. Two bulbs rated 25 W – 220 V and 100 W – 220 V are connected in series to a 440 V supply. Then,

1) both the bulbs fuse
2) neither of the bulbs fuses
3) 25 W bulb fuses
4) 100 W bulb fuses

20. The current passing through the ideal ammeter in the circuit given below is



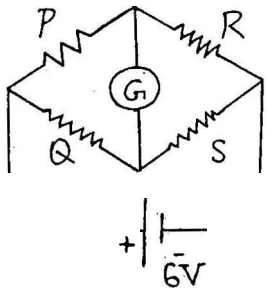
1) 0.5 A
2) 0.75 A
3) 1 A
4) 1.25 A

21. In the Wheatstone's network given below,

$P = 10\,\Omega$, $Q = 20\,\Omega$

$R = 15\,\Omega$, $S = 30\,\Omega$

The current passing through the battery (of negligible internal resistance) is



1) 0.72 A
2) 0.18 A
3) 0 A
4) 0.36 A

22. A circular coil carrying a certain current produces a magnetic field *Bo* at its centre. The coil is now rewound so as to have 3 turns and the same current is passed through it. The new magnetic field at the centre is

1) $3Bo$
2) $\frac{Bo}{3}$
3) $9Bo$
4) $\frac{Bo}{9}$

23. A proton and a deuteron with the same initial kinetic energy enter a magnetic field in a direction perpendicular to the direction of the field. The ratio of the radii of the circular trajectories described by them is

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

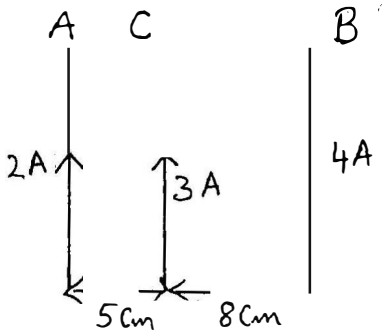
24. Two tangent galvanometers *A* and *B* have coils of radii 8 cm and 16 cm respectively and resistance $8\,\Omega$ each. They are connected in parallel with a cell of emf 4 *V* and negligible internal resistance. The deflections produced in the T.G's *A* and *B* are 30^0 and 60^0 respectively. If *A* has 2 turns, then *B* must have

1) 2 turns
2) 6 turns
3) 12 turns
4) 18 turns

25. A charged particle is moving in a magnetic field of strength *B* perpendicular to the direction of the field. If *q* and *m* denote the charge and mass of the particle respectively. Then the frequency of rotation of the particle is

1) $f = \frac{2\pi m}{qB}$
2) $f = \frac{2\pi^2 m}{qB}$
3) $f = \frac{qB}{2\pi m^2}$
4) $f = \frac{qB}{2\pi m}$

26. A and B are two infinitely long straight parallel conductors. C is another straight conductor of length 1 m kept parallel to A and B as shown in the figure. Then the force experienced by C is



1) towards B equal to $0.6\times10^{-5}N$
2) towards A equal to $5.4\times10^{-5}N$
3) towards B equal to $5.4\times10^{-5}N$
4) towards A equal to $0.6\times10^{-5}N$

27. An electric bulb has a rated power of 50 W at 100 V. If it is used on an a.c. source 200 V, 50Hz, a choke has to be used in series with it. This choke should have an inductance of

1) 1.1 H
2) 0.1 H
3) 1 mH
4) 0.1 mH

28. An inductance of $\frac{200}{\pi}$mH, a capacitance of $\frac{10^{-3}}{\pi}$F and a resistance of 10Ω are connected in series with an a.c. source 220 V, 50Hz. The phase angle of the circuit is

1) $\frac{\pi}{3}$
2) $\frac{\pi}{2}$
3) $\frac{\pi}{4}$
4) $\frac{\pi}{6}$

29. A stepdown transformer reduces the voltage of a transmission line from 2200 V to 220 V. The power delivered by it is 880 W and its efficiency is 88%. The input current is

1) 4.65 A
2) 0.465 A
3) 0.0465 A
4) 4.65 mA

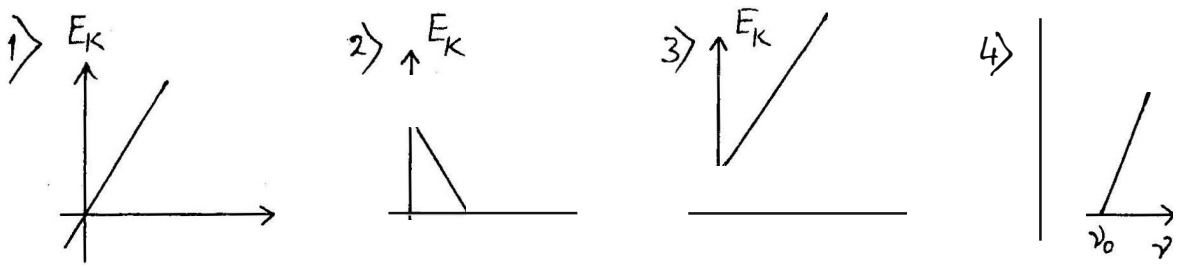
30. Current in a coil changes from 4 A to zero in 0.1 second and the emf induced is 100 V. The self inductance of the coil is

1) 4 H
2) 2.5 H
3) 0.4 H
4) 0.25 H

31. All components of the electromagnetic spectrum in vacuum have the same

1) Frequency
2) Wavelength
3) Velocity
4) Energy

32. Which one of the following graphs represents the variation of maximum kinetic energy (E_K) of the emitted electrons with frequency ν in photoelectric effect correctly ?



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

33. A and B are two metals with threshold frequencies 1.8×10^{14} Hz and 2.2×10^{14} Hz. Two identical photons of energy 0.825 eV each are incident on them. Then photoelectrons are emitted in

1) A alone
2) B alone
3) in both A and B
4) in neither A nor B

(Take $h = 6.6 \times 10^{-34}$ Js)

34. The ionization energy of L_i^{++} is equal to

1) hcR
2) 2 hcR
3) 6 hcR
4) 9 hcR

35. Electrons in a certain energy level $n = n_1$ can emit 3 spectral lines. When they are in another energy level $n = n_2$. They can emit 6 spectral lines. The orbital speeds of the electrons in the two orbits are in the ratio

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

36. The deBroglie wavelength of a proton (charge = $1.6\times10^{-19}C$, mass = $1.6\times10^{-27}kg$) accelerated through a p.d of 1 kV is

1) 0.9 nm
2) $7\overset{0}{A}$
3) 0.9×10^{-12} m
4) $600\overset{0}{A}$

37. A radio active element forms its own isotope after 3 consecutive disintegrations. The particles emitted are

1) 2α particles and 1β particle
2) 2β particles and 1γ particle
3) 2β particles and 1α particle
4) 3β particles

38. A radio active substance contains 10,000 nuclei and its half life period is 20 days. The number of nuclei present at the end of 10 days is

1) 7,500
2) 8,000
3) 9,000
4) 7,070

39. In Raman effect, Stokes' lines are spectral lines having

1) wavelength greater than that of the original line.
2) wavelength less than that of the original line.
3) wavelength equal to that of the original line.
4) frequency greater than that of the original line.

40. The principle of LASER action involves

1) Stimulated emission
2) Population inversion
3) Amplification of particular frequency emitted by the system
4) All of these

41. The volume of a nucleus is directly proportional to .....

1) $A^{1/3}$ 2) $\sqrt{A}$

3) A^3 4) A

(Where A = mass number of the nucleus)

42. An electron is

1) A lepton 2) A nucleon

3) Baryon 4) Hadron

43. Minority carriers in a p-type semiconductor are

1) Holes 2) Free electrons

3) Both holes and free electrons 4) Neither holes nor free electrons

44. In a reverse biased diode when the applied voltage changes by 1 V, the current is found to change by $0.5\,\mu A$. The reverse bias resistance of the diode is

1) $2\,\Omega$ 2) $200\,\Omega$

3) $2\times10^6\,\Omega$ 4) $2\times10^5\,\Omega$

45. The truth table given below is for

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(A and B are the inputs, Y is the output)

1) NAND 2) XOR

3) AND 4) NOR

46. The dimensional formula for impulse is

1) $ML^{-1}T^{-1}$ 2) $M^{-1}LT^{-1}$

3) $ML^{-1}T$ 4) MLT^{-1}

47. The maximum height attained by a projectile when thrown at an angle θ with the horizontal is found to be half the horizontal range. Then θ –

1) $Tan^{-1}\frac{1}{2}$ 2) $\frac{}{4}$

3) $\frac{\pi}{6}$ 4) $Tan^{-1}2$

48. A shell of mass 20 kg at rest explodes into two fragments whose masses are in the ratio 2 : 3. The smaller fragment moves with a velocity of 6 ms^{-1}. The kinetic energy of the larger fragment is

1) 360 J 2) 144 J

3) 216 J 4) 96 J

49. Water rises in plant fibres due to

1) Osmosis 2) Fluid pressure

3) Viscosity 4) Capillarity

50. The acceleration due to gravity becomes $\left(\frac{g}{2}\right)$ where g = acceleration due to gravity on the surface of the earth at a height equal to

1) $\frac{R}{2}$ 2) $2R$

3) $\frac{R}{4}$ 4) $4R$

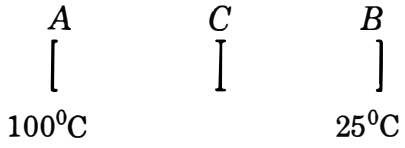
51. The cylindrical tube of a spray pump has a cross-section of 8 cm^2, one end of which has 40 fine holes each of area 10^{-8} m^2. If the liquid flows inside the tube with a speed of 0.15 $m.min^{-1}$, the speed with which the liquid is ejected through the holes is

1) 0.5 ms^{-1}
2) 0.05 ms^{-1}
3) 5 ms^{-1}
4) 50 ms^{-1}

52. During an adiabatic process, the cube of the pressure is found to be inversely proportional to the fourth power of the volume. Then the ratio of specific heats is

1) 1.4
2) 1.67
3) 1.33
4) 1

53. Two identical rods AC and CB made of two different metals having thermal conductivities in the ratio 2 : 3 are kept in contact with each other at the end C as shown in the figure. A is at 100^0C and B is at 25^0C. Then the junction C is at



1) 50^0C
2) 75^0C
3) 60^0C
4) 55^0C

54. 310 J of heat is required to raise the temperature of 2 moles of an ideal gas at constant pressure from 25^0C to 35^0C. The amount of heat required to raise the temperature of the gas through the same range at constant volume is

1) 452 J
2) 276 J
3) 144 J
4) 384 J

55. A Carnot's engine operates with source at 127^0C and sink at 27^0C. If the source supplies 40 kJ of heat energy, the work done by the engine is

1) 1 kJ
2) 4 kJ
3) 10 kJ
4) 30 kJ

56. The maximum particle velocity in a wavemotion is half the wave velocity. Then the amplitude of the wave is equal to

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

57. The ratio of the velocity of sound in hydrogen $\left(r=\frac{7}{5}\right)$ to that in helium $\left(r=\frac{5}{3}\right)$ at the same temperature is

1) $\frac{\sqrt{21}}{5}$
2) $\frac{\sqrt{42}}{5}$
3) $\sqrt{\frac{5}{21}}$
4) $\sqrt{\frac{5}{42}}$

58. An engine is moving towards a wall with a velocity 50 ms^{-1} emits a note of 1.2 kHz. Speed of sound in air = 350 ms^{-1}. The frequency of the note after reflection from the wall as heard by the driver of the engine is

1) 1.2 kHz
2) 1.6 kHz
3) 0.24 kHz
4) 2.4 kHz

59. A glass tube is open at both the ends. A tuning fork of frequency f resonates with the air column inside the tube. Now the tube is placed vertically inside water so that half the length of the tube is filled with water. Now the air column inside the tube is in unison with another fork of frequency f'. Then

1) $f'=\frac{f}{2}$
2) $f'=2f$
3) $f'=4f$
4) $f'=f$

60. The surface temperature of the Sun which has maximum energy emission at 500 nm is 6000 K. The temperature of a star which has maximum energy emission at 400 nm will be

1) 6500 K
2) 7500 K
3) 4500 K
4) 8500 K