Physics Sample Paper

Section-1

Q 1. The ratio of the forces between two small spheres with constant charge (a) in air (b) in a medium of dielectric constant K is

a) 1 : K **b)** K : 1 **c)** 1 : K^2 **d)** K^2 : 1

Q 2. In Millikan's oil drop experiment an oil drop carrying a charge Q is held stationary by a potential difference 2400 V between the plates. To keep a drop of half the radius stationary the potential difference had to be made 600 V. What is the charge on the second drop

a) Q/4 **b)** Q/2 **c)** Q **d)** 3Q/2

Q 3. In a conductor 4 coulombs of charge flows for 2 seconds. The value of electric current will be

a) 4 volts **b)** 4 amperes **c)** 2 amperes **d)** 2 volts

Q 4.

The strength of the magnetic field at a point r near a long straight current carrying wire is B. The field at a distance $\frac{r}{2}$ will be

a) B/2 **b)** B/4 **c)** 2B **d)** 4B

Q 5. The current flowing in two coaxial coils in the same direction. On increasing the distance between the two, the electric current will

a) Increase **b)** Decrease **c)** Remain unchanged **d)** The information is incomplete

Q 6. An electric lamp is connected to 220 V, 50 Hz supply. Then the peak value of voltage is

a) 210 V **b)** 211 V **c)** 311 V **d)** 320 V

Q 7. Which of the following waves have the maximum wavelength?

a) X-rays **b)** Infrared rays **c)** UV rays **d)** Radio waves

Q 8. On heating a liquid, the refractive index generally

a) Decreases **b)** Increases or decreases depending on the rate of heating

c) Does not change **d)** Increases

Q 9. Soap bubble appears coloured due to the phenomenon of

a) Interference **b)** Diffraction **c)** Dispersion **d)** Reflection

Q 10.

The resistors of resistances 2 Ω, 4 Ω and 8 Ω are connected in parallel, then the equivalent resistance of the combination will be

a) $\frac{8}{7}\Omega$

b) $\frac{7}{8}\Omega$

c) $\frac{7}{4}\Omega$

d) $\frac{4}{9}\Omega$

Q 11. Cathode rays enter into a uniform magnetic field perpendicular to the direction of the field. In the magnetic field their path will be

a) Straight line **b)** Circle **c)** Parabolic **d)** Ellipse

Q 12. According to the Rutherford's atomic model, the electrons inside the atom are

a) Stationary **b)** Not stationary **c)** Centralized **d)** None of these

Q 13. A nucleus of uranium decays at rest into nuclei of thorium and helium. Then

a) The helium nucleus has more momentum than the thorium nucleus

b) The helium nucleus has less kinetic energy than the thorium nucleus

c) The helium nucleus has more kinetic energy than the thorium nucleus

d) The helium nucleus has less momentum than the thorium nucleus

Q 14. The de-Broglie wavelength of an electron in the first Bohr orbit is

a) Equal to one-fourth the circumference of the first orbit **b)** Equal to half 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

Q 15. A square loop of side 1 m and resistance 1 Ω is placed in a magnetic field of 0.5 T. If the plane of loop is perpendicular to the direction of magnetic field, the magnetic flux through the loop is :

a) Zero weber **b)** 1 weber **c)** 0.5 weber **d)** 2 weber

Q 16. When a positive q charge is taken from lower potential to a higher potential point, then its potential energy will

a) Decrease **b)** Increases **c)** Remain unchanged **d)** Become zero

Q 17. The conductivity of a superconductor is

a) Infinite **b)** Very large **c)** Very small **d)** Zero

Q 18. A charged particle enters a magnetic field H with its initial velocity making an angle of 45° with H. The path of the particle will be

a) A straight line **b)** A circle **c)** An ellipse **d)** A helix

Q 19. A coil having 500 square loops each of side 10 cm is placed normal to a magnetic flux which increases at the rate of 1.0 tesla/second. The induced e.m.f. in volts is

a) 0.1 **b)** 0.5 **c)** 1 **d)** 5

Q 20.

An alternating voltage $E = 200\sqrt{2}\ \sin(100\ t)$ is connected to a 1 *microfarad* capacitor through an ac ammeter. The reading of the ammeter shall be

a) 10 mA **b)** 20 mA **c)** 40 mA **d)** 80 mA

Q 21.

A radio receiver antenna that is $2\,m$ long is oriented along the direction of the electromagnetic wave and receives a signal of intensity $5\times10^{-16}W/m^2$. The maximum instantaneous potential difference across the two ends of the antenna is

a) 1.23 μV **b)** 1.23 mV **c)** 1.23 V **d)** 12.3 mV

Q 22. When a biconvex lens of glass having refractive index 1.47 is dipped in a liquid, it acts as a plane sheet of glass. This implies that the liquid must have refractive index.

a) equal to that of glass **b)** less than one **c)** greater than that of glass **d)** less than that of glass

Q 23.

Two slits in Young's experiment have width in the ratio 1 : 25. The ratio of intensity at the maxima and minima in the interference pattern, $\frac{I_{max}}{I_{min}}$ is

a) $\frac{49}{121}$

b) $\frac{4}{9}$

c) $\frac{9}{4}$

d) $\frac{121}{49}$

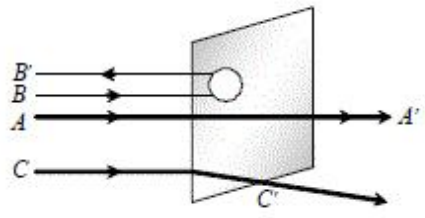
Q 24.

The threshold frequency for a photosensitive metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on this metal, the cut-off voltage for the photoelectron emission is nearly

a) 1 V **b)** 2 V **c)** 3 V **d)** 5 V

Q 25.

A beam of fast moving alpha particles were directed towards a thin film of gold. The parts A′, B′ and C′ of the transmitted and reflected beams corresponding to the incident parts A, B and C of the beam, are shown in the adjoining diagram. The number of alpha particles in



a) B' will be minimum and in C' maximum **b)** A' will be maximum and in B' minimum

c) A' will be minimum and in B' maximum **d)** C' will be minimum and in B' maximum

Q 26. Fusion reaction takes place at high temperature because

a) nuclei break up at high temperature

b) atoms get ionised at high temperature

c) kinetic energy is high enough to overcome the coulomb repulsion between nuclei

d) molecules break up at high temperature

Q 27. If a full wave rectifier circuit is operating from 50 Hz mains, the fundamental frequency in the ripple will be:

a) 25 Hz **b)** 50 Hz **c)** 70.7 Hz **d)** 100 Hz

Q 28. Through which mode of propagation, the radio waves can be sent from one place to another

a) Ground wave propagation **b)** Sky wave propagation **c)** Space wave propagation **d)** All of them

Q 29. Light with an energy flux of 25×10^4 W m^{-2} falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2, the average force exerted on the surface is

a) 1.25×10^{-6} N **b)** 2.50×10^{-6} N **c)** 1.20×10^{-6} N **d)** 3.0×10^{-6} N

Q 30. A hollow insulated conducting sphere is given a positive charge of 10μC. What will be the electric field at the centre of the sphere if its radius is 2 meters

a) Zero **b)** 5 μCm^{-2} **c)** 20 μCm^{-2} **d)** 8 μCm^{-2}

Q 31. When one electron is taken towards the other electron, then the electric potential energy of the system

a) Decreases **b)** Increases **c)** Remains unchanged **d)** Becomes zero

Q 32. At what temperature will the resistance of a copper wire become three times its value at 0°C (Temperature coefficient of resistance for copper = 4×10^{-3} per ^oC)

a) 400^oC **b)** 450^oC **c)** 500^oC **d)** 550^oC

Q 33. An electron enters a region where electrostatic field is 20N/C and magnetic field is 5T. If electron passes undeflected through the region, then velocity of electron will be

a) $0.25ms^{-1}$ **b)** $2ms^{-1}$ **c)** $4ms^{-1}$ **d)** $8ms^{-1}$

Q 34. A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not depend upon -

a) area of loop **b)** shape of loop **c)** value of current **d)** magnetic field

Q 35. Dynamo core is laminated because

a) Magnetic field increases **b)** Magnetic saturation level in core increases

c) Residual magnetism in core decreases **d)** Loss of energy in core due to eddy currents decreases

Q 36. When 100V 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

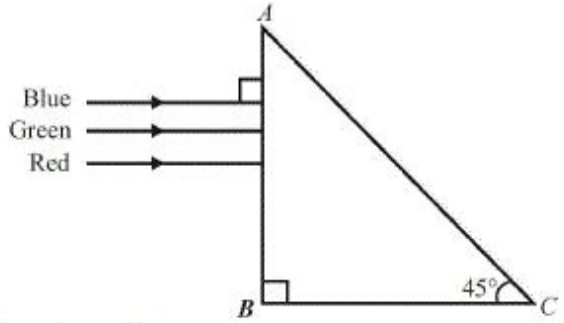
a) 0.55 H **b)** 5.5 mH **c)** 0.55 mH **d)** 55 mH.

Q 37. The maximum distance upto which TV transmissionfrom a TV tower of height h can be received isproportional to

a) $h^{1/2}$ **b)** h^3 **c)** h **d)** h^2

Q 38.

A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive index of the material of the prism for the above red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively.



The prism will

a) not separate the three colours at all

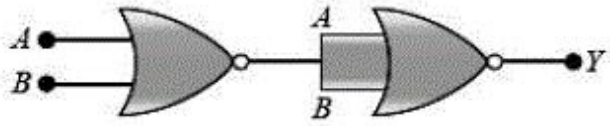
b) separate the red colour part from the green and blue colours

c) separate the blue colour part from the red and green colours

d) separate all the three colours from one another

Q 39.

In the following circuit, the output Y for all possible inputs A and B is expressed by the truth table:



a)

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

b)

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

c)

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

d)

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

Q 40. The earth's magnetic field at a certain place has a horizontal component 0.3 Gauss and the total strength 0.5 Gauss. The angle of dip is

a) $\tan^{-1}\frac{3}{4}$

b) $\sin^{-1}\frac{3}{4}$

c) $\tan^{-1}\frac{4}{3}$

d) $\sin^{-1}\frac{3}{5}$

Read the following case/passage and answer the questions from 41 to 45:

If a charged particle is projected in a magnetic field, it experiences a magnetic force $\vec{F}$. If the velocity $\vec{v}$ of the charged particle is along the magnetic field $\vec{B}$, it experiences no force. The direction of $\vec{F}$ is perpendicular to both the velocity $\vec{v}$ and to the magnetic field $\vec{B}$. The direction of the force is opposite for positive and negative charges.

In general, we can find the force by the relation: $\vec{F} = q\left(\vec{v}\times\vec{B}\right)$

If the velocity $\vec{v}$ is perpendicular to a uniform magnetic field, the path of the charged particle is circular of radius $r = \frac{mv}{qB}$, where m is the mass of the charged particle

Q 41. Choose the correct statement

a) Magnetic force changes speed as well as the direction of motion of charged particle.

b) Magnetic force can change speed but not the direction of motion of charged particle.

c) Magnetic force can change direction of motion but cannot change speed of the charged particle.

d) Magnetic force can neither change speed nor direction of motion of charged particle.

Q 42. A charged particle travelling with a velocity 'v', enters a region of uniform magnetic field perpendicular to its direction of motion. The kinetic energy of the charge particle will _____ while moving in the magnetic field.

a) reduce **b)** increase **c)** remain same **d)** become zero

Q 43. Which among the following will have the largest radius of circular path, when projected perpendicular to a uniform magnetic field with the same velocity?

a) electron **b)** proton **c)** neutron **d)** photon

Q 44. A particle of mass 1gm carrying a charge 10–6C is projected into a region of uniform magnetic field 2T with a velocity 100 m/s perpendicular to the magnetic field. Find the radius of the circular path followed by the particle.

a) 50 km **b)** 50 m **c)** 5 km **d)** 500 km

Q 45. A charge particle goes undeflected through a region of uniform magnetic field.
Choose the correct option

a) The charge must be an electron

b) The velocity must be perpendicular to the magnetic field

c) The magnetic field and velocity are in the same direction

d) The velocity is equally inclined with the magnetic field and the magnetic force

Read the following case/passage and answer the questions from 46 to 50:

Interference is based on the superposition principle. According to this principle, at a particular point in the medium, the resultant displacement produced by a number of waves is the vector sum of the displacements produced by each of the waves.

Q 46. For maximum brightness (Intensity) the path difference should be:

a) $\frac{\lambda}{2}$

b) $\frac{3\lambda}{2}$

c) $\frac{5\lambda}{2}$

d) λ

Q 47. If the distances between the slits is doubled then fringe width will be

a) half **b)** doubled **c)** tripled **d)** None

Q 48. If the intensities of the two coherent source of light is I_0 and $4I_0$ respectively, then the maximum intensity due to interference will be:

a) $4I_0$ **b)** $3I_0$ **c)** $9I_0$ **d)** I_0

Q 49. In the above part the minimum intensity due to interference will be:

a) I_0 **b)** $2I_0$ **c)** $3I_0$ **d)** $4I_0$

Q 50. The maximum number of possible interference maxima for slit separation equal to twice the wavelength in Young's double slit experiment is:

a) Zero **b)** three **c)** five **d)** infinite

Physics Sample Paper

1	**c**	2	**b**	3	**c**	4	**c**	5	**a**	6	**c**	7	**d**	8	**a**	9	**a**	10	**d**	11	**b**	12	**b**	13	**c**	14	**c**	15	**c**	16	**b**
17	**a**	18	**d**	19	**d**	20	**b**	21	**a**	22	**a**	23	**c**	24	**b**	25	**b**	26	**c**	27	**d**	28	**d**	29	**b**	30	**a**	31	**b**	32	**c**
33	**c**	34	**b**	35	**d**	36	**a**	37	**a**	38	**b**	39	**c**	40	**c**	41	**c**	42	**c**	43	**b**	44	**a**	45	**c**	46	**d**	47	**a**	48	**c**
49	**a**	50	**c**																												

Q 1. Ans: **c** **Solution:**

$$F_a = \frac{q_1 q_2}{4\pi\varepsilon_0 r^2}, F_b = \frac{q_1 q_2}{K 4\pi\varepsilon_0 r^2} \Rightarrow F_a : F_b = K : 1$$

Q 2. Ans: **b** **Solution:**

In balance condition

$$\Rightarrow QE = mg \Rightarrow Q\frac{V}{d} = \left(\frac{4}{3}\pi r^3 \rho\right) g$$

$$\Rightarrow Q \propto \frac{r^3}{V} \Rightarrow \frac{Q_1}{Q_2} = \left(\frac{r_1}{r_2}\right)^3 \times \frac{V_2}{V_1}$$

$$\Rightarrow \frac{Q}{Q_2} = \left(\frac{r}{\frac{r}{2}}\right)^3 \times \frac{600}{2400} = 2 \Rightarrow Q_2 = \frac{Q}{2}$$

Q 3. Ans: **c** **Solution:**

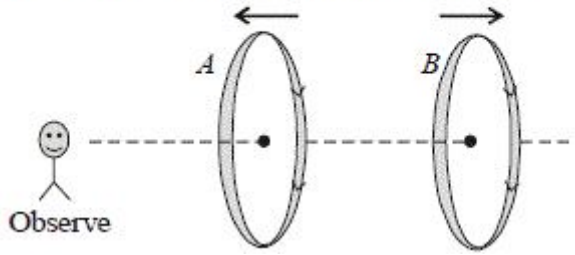
$$i = \frac{q}{t} = \frac{4}{2} = 2 \text{ ampere}$$

Q 4. Ans: **c** **Solution:**

$$B \propto \frac{1}{r} \Rightarrow \frac{B_1}{B_2} = \frac{r_2}{r_1} \Rightarrow \frac{B}{B_2} = \frac{\frac{r}{2}}{r} \Rightarrow B_2 = 2B$$

Q 5. Ans: **a** **Solution:**

Induced current in both the coils assist the main current so current through each coil increases.



Q 6. Ans: **c** **Solution:**

$$V_0 = V_{rms} \times \sqrt{2} = 220 \times \sqrt{2} = 311.08V$$

Q 7. Ans: **d** **Solution:**

$$\lambda_{Radiowaves} > \lambda_{UV\ rays} > \lambda_{J\ Rays} > \lambda_{X-rays}$$

Q 8. Ans: **a** **Solution:**

$$\text{Refractive index} \propto \frac{1}{(\text{Temperature})}$$

Q 9. Ans: **a** **Solution:** Phenomenon of interference of light takes place.

Q 10. Ans: **d** **Solution:**

$$\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{4+2+1}{8} \Rightarrow R_{eq} = \frac{8}{7}\Omega.$$

Q 11. Ans: **b**

Q 12. Ans: **b**

Q 13. Ans: **c**

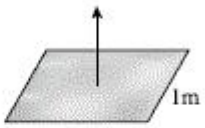
$$mvr_n = \frac{nh}{2\pi} \Rightarrow pr_n = \frac{nh}{2\pi} \Rightarrow \frac{h}{\lambda} \times r_n = \frac{nh}{2\pi}$$

$$\Rightarrow \lambda = \frac{2\pi r_n}{n}, \text{ for first orbit } n = 1 \text{ so } \lambda = 2\pi r_1$$

= Circumference of first orbit

Q 14. Ans: **c** **Solution:**

Figure below shows the square loop mentioned in question with its area vector in normal direction



As angle between $\vec{B}$ & $\vec{A}$ is zero, flux is given as

$$\phi = B.A.\cos 0$$

$$\Rightarrow \quad \phi = 0.5 \times (1) \times 1$$

$$\Rightarrow \quad \phi = 0.5 \text{ Wb}$$

Q 15. Ans: **c** **Solution:**

Δ P.E. = Work done by external agent

$= (V_f q - V_i q)\, V_f > V_i \Rightarrow \Delta P.E. > 0$ i.e.P.E. will increase

Q 16. Ans: **b** **Solution:**

A particular temperature, the resistance of a superconductor is zero $\Rightarrow G = \frac{1}{R} = \frac{1}{0} = \infty$

Q 17. Ans: **a** **Solution:**

Q 18. Ans: **d** **Solution:** The component of velocity perpendicular to H will make the motion circular while that parallel to H will make it move along a straight line. The two together will make the motion helical.

$$|e| = N\left(\frac{\Delta B}{\Delta t}\right).A\cos\theta$$

$= 500 \times 1 \times (10 \times 10^{-2})^2 \cos 0 = 5V.$

Q 19. Ans: **d** **Solution:**

$$\text{Reading of ammeter} = i_{rms} = \frac{V_{rms}}{X_C} = \frac{V_0 \omega C}{\sqrt{2}}$$

$$= \frac{200\sqrt{2} \times 100 \times (1 \times 10^{-6})}{\sqrt{2}} = 2 \times 10^{-2} A = 20\, mA$$

Q 20. Ans: **b** **Solution:**

$$I = \frac{1}{2}\varepsilon_0 C E_0^2$$

$$\Rightarrow E_0 = \sqrt{\frac{2I}{\varepsilon_0 C}} = \sqrt{\frac{2 \times 5 \times 10^{-16}}{8.85}} = 0.61 \times 10^{-6}\, \frac{V}{m}$$

$$\text{Also } E_0 = \frac{V_0}{d} \Rightarrow V_0 = E_0 d = 0.61 \times 10^{-6} \times 2 = 1.23 \mu V$$

Q 21. Ans: **a** **Solution:**

By using lens maker's formula

$$\frac{1}{f}=\left(\frac{\mu_g}{\mu_L}-1\right)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

where μ_g is the refractive index of the material of the lens and μ_L is the refractive index of the liquid in which lens is dipped. As the biconvex lens when dipped in a liquid acts as a plane glass, therefore

or $\mu_g=\mu_L$

Q 22. Ans: **a** **Solution:**

As, intensity $I \propto W$ (width of slit)

and $I \propto A^2$

So, $\frac{I_1}{I_2}=\frac{W_1}{W_2}=\frac{A_1^2}{A_2^2}$

But $\frac{W_1}{W_2}=\frac{1}{25}$ (from question)

$$\therefore \frac{A_1^2}{A_2^2}=\frac{1}{25} \text{ or } \therefore \frac{A_1}{A_2}=\sqrt{\frac{1}{25}}=\frac{1}{5}$$

$$\therefore \frac{I_{max}}{I_{min}}=\frac{(A_1+A_2)^2}{(A_1-A_2)^2}=\frac{\left(\frac{A_1}{A_2}+1\right)^2}{\left(\frac{A_1}{A_2}-1\right)^2}$$

$$=\frac{\left(\frac{1}{5}+1\right)^2}{\left(\frac{1}{5}-1\right)^2}=\frac{\left(\frac{6}{5}\right)^2}{\left(-\frac{4}{5}\right)^2}=\frac{36}{16}=\frac{9}{4}$$

Q 23. Ans: **c** **Solution:**

According to Einstein's photoelectric equation we have $eV_0=h\upsilon-h\upsilon_0$

where, υ = frequency of incident radiation

υ_0 = Threshold frequency

V_0 = Cut-off or stopping potential

So $V_0=\frac{h}{e}(\upsilon-\upsilon_0)$

On putting the given values, we get

$$V_0=\frac{6.63\times10^{-34}\left(0.8\times10^{14}-3.3\times10^{14}\right)}{1.6\times10^{-19}}\approx 2V$$

Q 24. Ans: **b** **Solution:**

Q 25. Ans: **b** **Solution:**Because atom is hollow and whole mass of atom is concentrated in a small centre called nucleus.

Q 26. Ans: **c** **Solution:**Extremely high temperature needed as KE is high enough to overcome the repulsion between nuclei.

Q 27. Ans: **d** **Solution:**The fundamental ripple frequency in full wave rectifier is double that of input frequency because in each cycle there are two ripples produced.

Q 28. Ans: **d** **Solution:**Radio waves can be transmitted from one place to another as ground wave or sky wave or space wave

propagation.

$$\text{Average force } F_{av} = \frac{\Delta p}{\Delta t} = \frac{2IA}{c}$$

$$= \frac{2 \times 25 \times 10^4 \times 15 \times 10^{-4}}{3 \times 10^8}$$

Q 29. Ans: **b** **Solution:** $= 2.50 \times 10^{-6}$ N

Q 30. Ans: **a** **Solution:** The intensity of electric field inside a hollow conducting sphere is zero.

Potential energy of the system will be given by

$$= \frac{(-e)(-e)}{4\pi\varepsilon_0 r} = \frac{e^2}{4\pi\varepsilon_0 r}$$

Q 31. Ans: **b** **Solution:** As r decreases, potential energy increases.

Q 32. Ans: **c** **Solution:** By using $R_t = R_0(1 + \alpha t)$

$3 \times R_0 = R_0(1 + 4 \times 10^{-3} t) \Rightarrow t = 500^\circ C.$

Q 33. Ans: **c** **Solution:** $v = \frac{E}{B} = \frac{20}{5} = 4m/\sec$

Q 34. Ans: **b**

Q 35. Ans: **d**

For dc, $V = IR$ (R is resistance of inductor)

$100 = 1 \times R \Rightarrow R = 100\,\Omega.$

For ac, $Z = \sqrt{R^2 + X_L^2}$

$\therefore V = IZ$

$\Rightarrow 100 = 0.5\sqrt{R^2 + X_L^2}$

$\Rightarrow 100 = 0.5\sqrt{(100)^2 + X_L^2}$

$\Rightarrow 100 = \frac{5}{10}\sqrt{(100)^2 + X_L^2}$

$X_L^2 = (200)^2 - (100)^2 = 300 \times 100$

$\Rightarrow X_L = \sqrt{3 \times (100)^2} = 100\sqrt{3}$

$\Rightarrow \omega L = 100\sqrt{3} \Rightarrow 2\pi\upsilon L = 100\sqrt{3}$

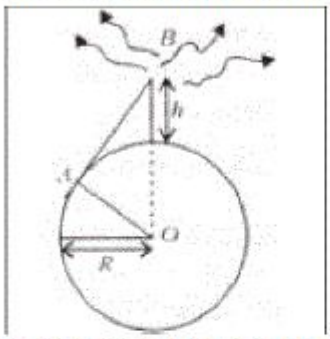
$\Rightarrow 2 \times \pi \times 50 \times L = 100\sqrt{3}$

$\Rightarrow 100 \times \pi L = 100\sqrt{3}$

$\therefore L = \frac{\sqrt{3}}{\pi} = \frac{\sqrt{3}}{3.14} \Rightarrow L = 0.55\,H.$

Q 36. Ans: **a** **Solution:**

If the height of the antenna is h, then themaximum distance upto which the TVtransmissionfor a TV tower can be received is proportionalto $h^{1/2}$.



Suppose that the height of the TV antenna be $h$andthe radius of the earth be $R$and $R>>h$.Let A bea receiving station. In the limit $h<<R$,we canassume that $BA$is a tangent to the surface of theearth. Then $\angle BAO = 90°$ and so

$BO^2 = AB^2 = AO^2 \Rightarrow (R+h)^2 = AB^2 + R^2$

$\Rightarrow AB^2 = R^2 + h^2 + 2Rh - R^2 = 2Rh + h^2$

as $h<<R$we neglect h^2 and so

$AB^2 = 2Rh \Rightarrow AB = \sqrt{2Rh}$ $\therefore AB \propto h^{1/2}$.

Q 37. Ans: **a** **Solution:**

As we know

$$\mu = \frac{1}{\sin C} = \frac{1}{\sin 45°} = \sqrt{2}$$

Here $\mu_{red} = 1.39$

$\mu_{green} = 1.44$

$\mu_{blue} = 1.47$

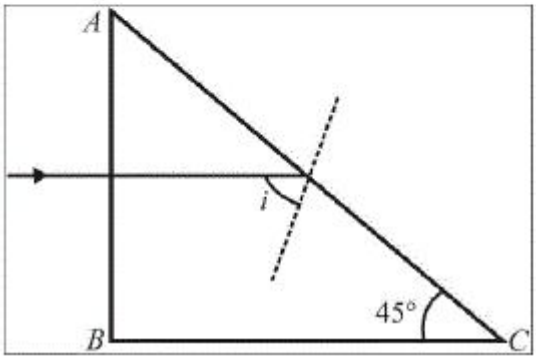
So

$\mu_{red} < \mu$

$\mu_{green} > \mu$

$\mu_{blue} > \mu$

So only red colour do not suffer *TIR*.



Q 38. Ans: **b** **Solution:**

In the given logic circuit first gate is NOR gate and it is followed by an inverter (equivalent to NOT gate) so final output Y is given as

$$Y = \overline{\overline{A+B}} = A+B$$

This is equivalent to OR gate for which truth table is given a

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

Q 39. Ans: **c** **Solution:**

$$B^2 = B_V^2 + B_H^2 \Rightarrow B_V = \sqrt{B^2 - B_H^2}$$

$$= \sqrt{(0.5)^2 - (0.3)^2} = 0.4$$

$$\text{Now } \tan\phi = \frac{B_V}{B_H} = \frac{0.4}{0.3} = \frac{4}{3} \Rightarrow \phi = \tan^{-1}\left(\frac{4}{3}\right).$$

Q 40. Ans: **c** **Solution:**

Q 41. Ans: **c** **Solution:** The magnetic force is always perpendicular to the velocity. Hence, it can change only change the direction of velocity not its magnitude (i.e., speed)

Q 42. Ans: **c** **Solution:** As the magnetic force cannot change the speed, hence the kinetic energy remains the same.

Q 43. Ans: **b** **Solution:** The radius of the circular path, $R = \frac{mv}{qB}$. Only electron and proton will be deflected by the magnetic field. As mass of proton is more than that of electron, hence, its radius will be more.

$$\text{Using, } R = \frac{mv}{qB} = \frac{(1\times10^{-3})\times100}{10^{-6}\times2} = 50 \times 10^3 \text{ m} = 50 \text{ km}.$$

Q 44. Ans: **a** **Solution:**

Q 45. Ans: **c** **Solution:** It can be any charge, provided the velocity and magnetic field are in same direction so that the magnetic force is zero.

Q 46. Ans: **d** **Solution:** For maxima, $\Delta x = n\lambda$.

Q 47. Ans: **a** **Solution:** $\because \beta = \frac{\lambda D}{d}$, As d double then β reduced to half.

$$I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2 = \left(\sqrt{I_0} + \sqrt{4I_0}\right)^2$$

Q 48. Ans: **c** **Solution:** $= 9I_0$

$$I_{min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2 = I_0.$$

Q 49. Ans: **a** **Solution:**

For maxima, $\delta x = n\lambda$

$\delta \sin\theta = n\lambda$ $\quad (d = 2\lambda)$

$2\lambda \sin\theta = n\lambda$

$$-1 \le \sin\theta = \frac{n}{2} \le 1$$

Q 50. Ans: **c** **Solution:** $-2 \le n \le 2 \Rightarrow n = 0, \pm 1, \pm 2.$