CUET PRACTICE PAPER- 2

PHYSICS

1. A soap bubble is given a negative charge, then its radius
- a) decreases
- b) increases
- c) remains unchanged
- d) nothing can be predicted as information is insufficient

2. If two bodies are rubbed and one of them acquires q1 charge and another acquires q2 charge, then ratio of q1: q 2 is

a) 1: 2 b) 2: 1 c) – 1: 1 d) 1: 4

3. An electric shock is experienced on opening the door of a car due to
- a) heating of car engine
- b) motion of car
- c) discharge of electric charge
- d) None of the above 2

4. The electric potential inside a conducting sphere
- a) Increases from centre to surface c) Remains constant from centre to surface
- b) Decreases from centre to surface d) Is zero at every point inside

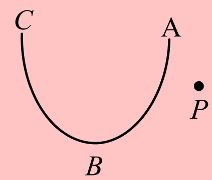
5. Two parallel conducting plates of a capacitor of capacitance C containing charges Q and-- 2Q at a distance d apart. Find out potential difference between the plates of capacitors.

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

6. A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but has a thickness ¾ d where d is the separation of the plates. The ratio of capacitance C (in the presence of dielectric) to the Capacitance C_0 (in the absence of the dielectric) is

a) 3K/K+4 b) 3K/4 c) 4K/K+3 d) 4K/3

7. In the following diagram the work done in moving a point charge from point P to point A, B and C is respectively as W_A, W_B and W_C then



a) $W_A = W_B = W_C$ b) $W_A = W_B = W_C = 0$ c) $W_A > W_B > W_C$ d) $W_A < W_B < W_C$

8. The charges Q, -q and -q are placed at the vertices of an equilateral triangle of side $10cm$. The potential at the midpoint in between −q and -q, if q=5μC is:

a)-6.4 × 10^5 V b) -12.8 ×10^4 V c) 6.4 × 10^5 V d) -12.8 × 10^5 V

9. The potential energy of system of two equal negative point charges of 2μC each held 1m apart in air is ($k = 9 \times 10^9$ SI unit)

a) 36J b) 3.6 × 10^{-3} J c)3.6 J d) 3.6 × 10^{-2} J

10. The plate separation in a parallel plate condenser is d and plate area is A. If it is charged to V volt and battery is disconnected then the work done in increasing the plate separation to 2d will be

a) $\frac{3\epsilon_0 A V^2}{2d}$ b) $\frac{\epsilon_0 A V^2}{d}$ c) $\frac{2\epsilon_0 A V^2}{d}$ d) $\frac{\epsilon_0 A V^2}{2d}$

11. In a closed box, there is a series connection of twelve cells, each with an electromotive force (emf) of E volts. However, some of these cells are wrongly connected with their positive and negative terminals reversed. The circuit includes an ammeter, an external resistance of R ohms, and a two-cell battery (consisting of cells of the same type as the previous ones) connected perfectly in series. When the 12-cell battery and the 2-cell battery are aiding each other, the current in the circuit is measured as 3A. Conversely, when they oppose each other, the current is measured as 2A. Determine the number of cells in the 12-cell battery that are connected incorrectly.

a) 4 b) 3 c) 2 d) 1

12. An ammeter gives full scale deflection when current 2.0 A is passed in it. To convert it into 10 A range ammeter, the ratio of its resistance and the shunt resistance will be.

a) 1: 8 b) 1: 10 c) 4: 1 d) 2: 1

13. In a metallic conductor with a non-uniform cross-section, which of the following quantity or quantities remain constant along the length of the conductor as the current flows steadily

a) current, electric field, drift speed
b) drift speed only
c) current and drift speed
d) current only

14. The relation between Electric field (E) and current density (J) is

a) $E \propto J^{-1}$ b) $E \propto J$ c) $E \propto \frac{1}{J^2}$ d) $E^2 \propto \frac{1}{J}$

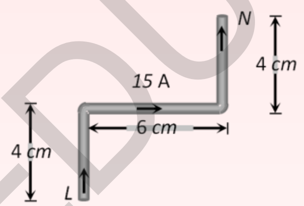
15. *A wire* 150cm *long and* 1.0 mm *diameter has a resistance of* 0.9 ohm, *the electrical resistivity of the material is*

a) 6.36×10^{-6} ohm × m b) 2.23×10^{-6} ohm × m
c) 1.17×10^{-6} ohm × m d) 3.18×10^{-6} ohm × m

16. A brass rectangular plate 15cm × 5cm is to be electroplated with copper. If we wish to coat it with a layer of 0.02 mm thick both sides, how much time will it take with a constant current of 2A? Given ECE of copper is 33×10^{-5} g C^{-1} and density of copper is 8.9 g cm^{-3}.

a) 2025 s b) 4060 s c) 4000 s d) 8000

17. When a wire AB carrying a current of 15 A is bent into the shape depicted below and placed in a magnetic field of 3 T, which is perpendicular to the plane of the paper and directed outward, the wire will undergo a force. Determine the value of force.

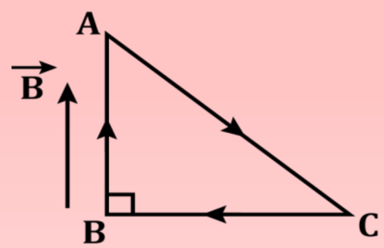


a) Zero b) 5 N c) 3 N d) 4.5 N

18. When a beam of electrons passes through mutually perpendicular electric and magnetic fields, it remains undeflected. However, if the electric field is switched off while maintaining the same magnetic field, the electrons will continue to move in

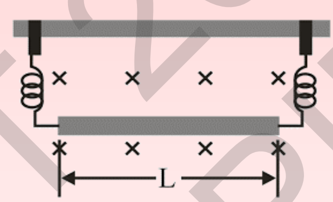
a) In an elliptical orbit b) In a circular orbit
c) Along a parabolic path d) Along a straight line

19. Consider a closed loop in the shape of a right-angled isosceles triangle ABC, carrying a current. The loop is placed in a uniform magnetic field that is aligned with the side AB. If the magnetic force experienced by the side BC is denoted as F, determine the force exerted on the side AC of the triangle.



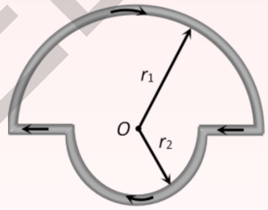
a) $-\sqrt{2}F$ b) -F c) F d) $\sqrt{2}F$

20. A 44.0g wire of length L=98.0cm is suspended by a pair of flexible leads in a uniform magnetic field of magnitude 0.440 T (see figure). What is the (a) magnitude and (b) direction (left or right) of the current required to remove the tension in the supporting leads?



a) *10A, right* b) *20A left* c) *10 A left* d) *none of these*

21. Consider the figure shown, which consists of two semicircles with radii r_1 and r_2, through which a current i is flowing. Find the magnetic induction at the centre point O.



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

22. A magnetic dipole is placed at right angles to the direction of lines of force of magnetic induction B. If it is rotated through an angle of 180°, then the work done is

$a)$ MB b) $2\ MB$ c) $-2\ MB$ d) Zero

23. A domain in a ferromagnetic substance is in the form of a cube of side length $1\ \mu m$. If it contains 8×10^{10} atoms and each atomic dipole has a dipole moment of $9 \times 10^{-24}\ A\ m^2$, then magnetization of the domain is

$a)$ $7.2 \times 10^5\ \text{A m}^{-1}$ b) $7.2 \times 10^3\ \text{A m}^{-1}$ c) $7.2 \times 10^9\ \text{A m}^{-1}$ d) 7.2×10^{12} A m

24. A bar magnet is placed north-south with its north pole due north. The points of zero magnetic field will be in which direction from center of magnet

a) North and south b) East and west
c) North-east and south-west d) North-east and south-east

25. If a magnetic dipole of dipole moment M rotated through an angle θ with respect to the direction field H, then the work done is

$a)$ $MH \sin\theta$ b) $MH(1 - \sin\theta)$ c) $MH \cos\theta$ d) $MH(1 - \cos\theta)$

26. The magnetic moment of a magnet is 0.1 amp × m^2. It is suspended in a magnetic field of intensity$3 \times 10^{-4}\ \text{Wbm}^{-2}$. The couple acting upon it when deflected by 30° from the magnetic field is

a)1×10^{-5}N m b) 1.5×10^{-5}N m c) 2×10^{-5}N m d) 2.5×10^{-5}N m

27. A coil of 500 turns is wound on a book and this book is lying on the table. The vertical component of earth's magnetic field is 0.9×10^{-4} T and the area of the coil is $0.1\ \text{m}^{-2}$. The book is turned over once about a horizontal axis is 0.5 s. This average emf induced in the coil is

a) 0.03 V b) 0.018 V c) Zero d) 2.5 V

28. In a transformer with a primary winding of 300 turns and a secondary winding of 100 turns, if the current in the secondary winding is 60 A, determine the current in the primary winding.

a) 20 A b) 80 A c) 160 A d) 800

29. If an 7 Ω resistance and 13 Ω reactance is present in an ac series circuit, then the impedance of the circuit will be

a) 20 ohm b) 5 ohm c) 10 ohm d) $14\sqrt{2}$ ohm

30. The frequency of an alternating voltage is 20 cycles/sec and its amplitude is 200V. Then the r. m. s. value of voltage is

a) 141.3V b) 84.8V c) 70.7V d) 56.5V

31. The instantaneous values of current and emf in an ac circuit are $I = 1/2 \sin 314\, t$ amp and $E = \sqrt{3} \sin(314\, t - \pi/6)$ V respectively. The phase difference between E and I will be

a) $-\pi/6$ rad b) $-\pi/3$ rad c) $\pi/6$ rad d) $\pi/3$ rad

32. Ground waves have wavelength

a) Less than 200 m b) Equal to 200 m c) More than 200 m d) All of these

33. A plane Electromagnetic Waves travelling along the X-direction has a wavelength of 3 mm. The variation in the electric field occurs in the Y-direction with an amplitude 66 Vm^{-1}. The equations for the electric and magnetic fields as a function of x and t are respectively

a) $E_y = 33 \cos \pi \times 10^{11} \left(t - \frac{x}{c}\right)$,
$B_z = 1.1 \times 10^{-7} \cos \pi \times 10^{11} \left(t - \frac{x}{c}\right)$

b) $E_y = 11 \cos 2\pi \times 10^{11} \left(t - \frac{x}{c}\right)$,
$B_y = 11 \times 10^{-7} \cos 2\pi \times 10^{11} \left(t - \frac{x}{c}\right)$

c) $E_x = 33 \cos \pi \times 10^{11} \left(t - \frac{x}{c}\right)$,
$B_x = 11 \times 10^{-7} \cos \pi \times 10^{11} \left(t - \frac{x}{c}\right)$

d) $E_y = 66 \cos 2\pi \times 10^{11} \left(t - \frac{x}{c}\right)$,
$B_z = 2.2 \times 10^{-7} \cos 2\pi \times 10^{11} \left(t - \frac{x}{c}\right)$

34. The frequency 1057 MHz of radiation arising from two close energy levels in hydrogen belongs to

a) Radio waves b) Infrared waves c) Micro waves d) $\gamma -$ rays

35. Maxwell in his famous equation of electromagnetism introduced the concept

a) AC current b) DC current c) Displacement current d) Impedance

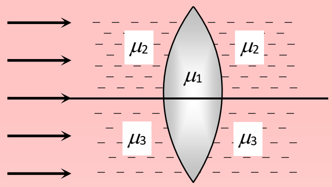
36. In a plane electromagnetic wave electric field varies with time having an amplitude 1 Vm^{-1}. The frequency of wave is 0.5×10^{15} Hz. The wave is propagation along X-axis. What is the average energy density of magnetic field?

a) $1.1 \times 10^{-12} J\, m^{-3}$ b) $2.2 \times 10^{-12} J\, m^{-3}$ c) $3.3 \times 10^{-12} J\, m^{-3}$ d) $4.4 \times 10^{-12} J\, m^{-3}$

37. For a telescope with the maximum possible magnification, we would choose the lenses with the longest focal lengths. Therefore, select the lenses with focal lengths of 100 cm and 10 cm.

a) 100 cm, 0.3 cm b) 10 cm, 0.3 cm c) 10 cm, 4 cm d) 100 cm, 4 cm

38. In the given setup, a double convex lens made of a material with refractive index μ_1 is positioned between two liquids with refractive indices μ_2 and μ_3, where $\mu_2 > \mu_1 > \mu_3$. When a wide, parallel beam of light is directed towards the lens from the left, the lens will cause the light rays to

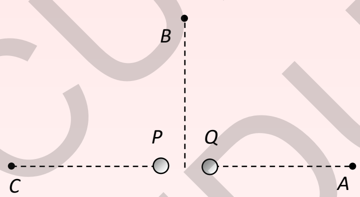


a) A single convergent beam
b) Two different convergent beams
c) Two different divergent beams
d) A convergent and a divergent beam

39. In Young's double slit experiment, carried out with light of wavelength $\lambda = 6000$ Å, the distance between the slits is 0.5 mm and the screen is at 100 cm from the slits. The central maximum is at x = 0. The third maximum (taking the central maximum as zeroth maximum) will be at x equal to

a) 1.67 cm
b) 3.6 cm
c) 0.5 cm
d) 5.0 cm

40. In the given figure, P and Q represent two coherent sources with equal intensity, emitting radiation of wavelength 20 m. The separation between P and Q is 5.0 m, and the phase of P is 90° ahead of the phase of Q. A, B, and C are three observation points located equidistantly from the midpoint of PQ. What will be the ratio of the intensities of radiation at points A, B, and C?



a) 0: 1: 4
b) 4: 1: 0
c) 0: 1: 2
d) 2: 1: 0

41. At a rate of 2.5 calories per cm^2 per minute, energy from the sun is received on Earth. Assuming the average wavelength of solar light is 5000 Å, how many photons are received on Earth per cm^2 per minute? (Given: Planck's constant, $h = 6.6 \times 10^{-34}$ Js, and 1 calorie = 4.2 J)

a) 1.5×10^{13}
b) 2.6×10^{13}
c) 2.3×10^{19}
d) 1.75×10^{19}

42. The de-Broglie wavelength is proportional to

a) $\lambda \propto \frac{1}{v}$
b) $\lambda \propto \frac{1}{m}$
c) $\lambda \propto \frac{1}{p}$
d) $\lambda \propto p$

43. Excitation energy of a hydrogen like atom in its first excitation state is 54.4eV. Energy needed to remove the electron from the ion in ground state is

a) 40.8 eV b) 27.2 eV c) 54.4 eV d) 13.6 eV

44. The energy equivalent to 2 mg of matter in MeV is

a) 11.2×10^{22} b) 56.25×10^{24} c) 11.2×10^{26} d) 56.25×10^{28}

45. Approximately, what is the minimum potential difference between the base and emitter needed to turn on a silicon transistor?

a) 1 V b) 3 V c) 5 V d) 4.2 V

46. When testing a functioning transistor with labelled legs A, B, and C using a multimeter, there is no conduction observed between legs A and B. However, connecting the common (negative) terminal of the multimeter to leg C and the other (positive) terminal to either leg A or leg B shows some resistance on the multimeter. Based on this information, what can be deduced about the behaviour or characteristics of the transistor?

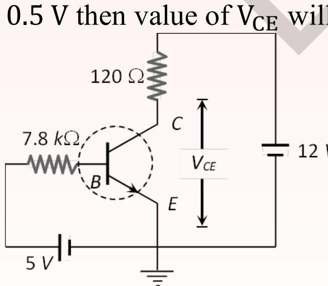
a) It is an n-p-n transistor with C as base
b) It is an p-n-p transistor with C as collector
c) It is an p-n-p transistor with C as emitter
d) It is an n-p-n transistor with C as collector

47. A gate has the following truth table

A	1	1	0	0
B	1	0	1	0
C	1	0	0	0

The gate is
a) NOR b) OR c) NAND d) AND

48. For the transistor circuit shown below, if $\beta = 100$, voltage drop between emitter and base is 0.5 V then value of V_{CE} will be



a) 2.4 V b) 5 V c) 4.8 V d) 0 V

49. With a semiconductor material having a band gap of 2.5 eV, what is the wavelength of the signal that can be detected by the p-n photodiode fabricated from this material?

a) 6000 Å b) 4000 nm c) 6000 nm d) 4000 Å

50. This question has statement-1 and statement -2. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - 1: Sky state of signals are used for long distance radio communication. These signals are in general, less stable than ground wave signals.
Statement -2: The state of ionosphere varies from hour to hour, day to day and seasons to seasons.

a) Statement-1 is true, statement-2 is false.
b) Statement-1 is true, statement-2 is true, statement-2 is the correct explanation of statement-1.
c) Statement-1 is true, statement-2 is true, statement-2 is not the correct explanation of statement-1.
d) Statement-1 is false, statement-2 is true.

---------------------------ANSWER KEY----------------------------------

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

HINTS AND SOLUTIONS

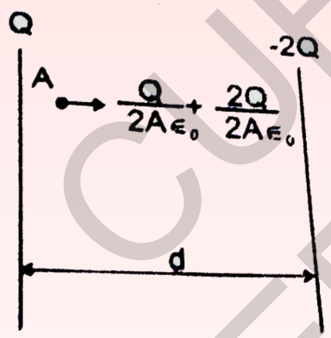
1. **(b)**
The reason for these experiences is the discharge of electric charges through our body, which was accumulated due to the rubbing of insulating surface

2. **(b)**
Whether the bubble is given negative charge or positive charge, the radius will increase in both cases because when positive charge is given to it, again the charges will repel each other and this will expand the bubble and the radius will increase.

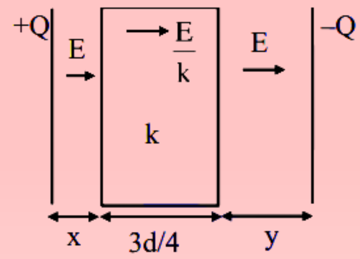
3. **(c)**
Based on formula

4. **(c)**
The Electric Field inside the conducting sphere is zero.

5. **(c)**
Hint



6. **d)**



$$x+y+\frac{3d}{4}=d$$

$$x+y=\frac{d}{4}$$

$$\frac{A\epsilon_0}{d}=C_0$$

$$\Delta V=Ex+\frac{E}{k}\times\frac{3d}{4}+Ey$$

$$=\frac{3Ed}{4k}+E(x+y)$$

$$\Delta V=E\left[\frac{3d}{4k}+\frac{d}{4}\right]$$

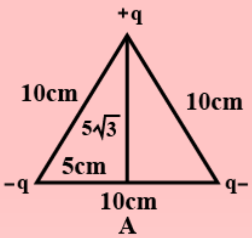
$$\Delta V=\frac{\sigma}{\epsilon_0}\left[\frac{3d+dk}{4k}\right]=\frac{Qd}{A\epsilon_0}\left[\frac{3+k}{4k}\right]$$

$$\frac{Q}{\Delta V}=C=\frac{A\epsilon_0}{d}\left[\frac{4k}{3+k}\right]=\frac{4kC_0}{k+3}$$

7. **b**)
When a positive charge is moved from one point to another in an electric of magnetic field, then under the influence of the field force acts on the particle and an external agent will have to do work against this force. But in the given case the charge moves under influence of no field, hence it does not experience any force therefore, no work is done.

$$W_A=W_B=W_C=0$$

8. d)



9. d)

Use

U= $kq_1 q_2/r$ and put the values.

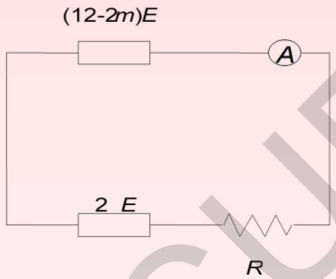
10. d)

$$W = (\varepsilon 0 \times AV2/2d)$$

11. d)

Let polarity of m cells in a 12 cells battery is reversed, then equivalent emf of the battery $=$ $(12 - 2m)E$

Now the circuit can be drawn as



When 12-cell battery and 2-cell battery aid each other, then current through the circuit

$$i_1 = \frac{(12-2m)E + 2E}{R}$$

or $\quad 3 = \dfrac{(14-2m)E}{R} \quad \ldots.(i)$

When they oppose each other, the current through the circuit.

$$i_2 = \frac{(12-2m)E - 2E}{R}$$

or $\quad 2 = \dfrac{(10-2m)E}{R} \quad \ldots(ii)$

Dividing Eq. (i) by Eq. (ii), we have

$$\frac{3}{2} = \frac{14-2m}{10-2m}$$

or $\quad 30 - 6m = 28 - 4m$

or $\quad 2m = 2$

or $\quad m = 1$

12. c)

$$S = \frac{i_g G}{(i - i_g)} \Rightarrow \frac{G}{S} = \frac{i = i_g}{i_g} = \frac{10-2}{2} = \frac{8}{2}$$

13. d)

When a steady current flows in a metallic conductor of non-uniform cross-section, the current flowing through the conductor is constant. Current density, electric field, and drift speed is inversely proportional to the area of cross-section. Therefore, they are not constant.

14. b)

Theory

15. a)

$$R = \frac{\rho L}{A} \Rightarrow 0.9 = \frac{\rho \times 1}{\frac{22}{7}(1.5 \times 10^{-3})^2}$$

$$\rho = 6.36 \times 10^{-6} ohm - m$$

16. a)

Mass of copper deposited,

$m =$ volume $\times$ density

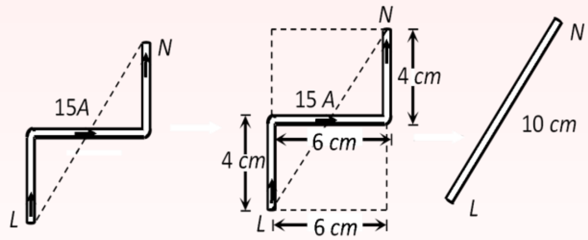
$=$ (area $\times$ thickness) $\times$ density

$= [(75) \times 0.002] \times 8.9$ g

$$t = \frac{m}{zI} = \frac{[(75)\times 0.002 \times 8.91]}{33\times 10^{-5}\times 2} = 2025\text{s}.$$

17. (d)

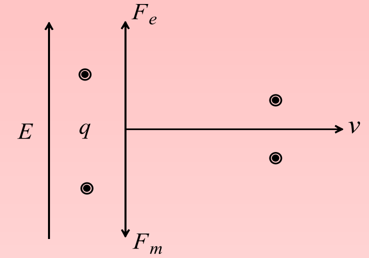
The given wire can be replaced by a straight wire as shown below



Hence force experienced by the wire

$$F = Bil = 3 \times 15 \times 0.1 = 4.5N$$

18. (b)
If both electric and magnetic fields are present and perpendicular to each other and the particle is moving perpendicular to both of them with $F_e = F_m$. In this situation $\vec{\mathbf{E}} \neq 0$ and $\vec{\mathbf{B}} \neq 0$.



But if electric field becomes zero, then only force due to magnetic field exists. Under this force, the charge moves along a circle

19. (b)
Force along AB is zero as magnetic field is along AB.
The net force on a current carrying loop is always zero.
Fnet=F on AB→+F on BC→+F
Hence on AC,
⟹0=0+F+ (F on AC)
Hence, F on AC is −F

20. (a)
The magnetic force on the wire must be upward and have a magnitude equal to the gravitational force mg on the wire. Since the field and the current are perpendicular to each other the magnitude of the magnetic force is given by FB=iLB, where L is the length of the wire. Thus,

iLB = mg ⟹ i= mg/LB

= 10A

(b) Applying the right-hand rule reveals that the current must be from left to right.

21. (c)
The magnetic induction due to both semicircular parts will be in the same direction perpendicular to the paper inwards

$$\therefore B = B_1 + B_2 = \frac{\mu_0 i}{4r_1} + \frac{\mu_0 i}{4r_2} = \frac{\mu_0 i}{4}\left(\frac{r_1 + r_2}{r_1 r_2}\right)$$

22. (d)
$\theta_1 = 90°, \theta_2 = 270°,$
$W = -MB[\cos 270° - \cos 90°]$ =zero

23. (a)
The volume of the cubic domain is
$V(10^{-6} m)^3 = 10^{-18}\ m^3$
Net dipole moment $m_{net} = 8 \times 10^{10} \times 9 \times 10^{-24}\text{A m}^2$
$= 72 \times 10^{-14}\text{A m}^2$
Magnetization, $M = \frac{m_{net}}{\text{Domain volume}}$

$$= \frac{72 \times 10^{-14} A\ m^2}{10^{-18}\ m^3} = 72 \times 10^4\ A\ m^{-1}$$
$$= 7.2 \times 10^5\ A\ m^{-1}$$

24. (b)
Points of zero magnetic field *ie*, neutral points lie on equatorial line of magnetic *ie*, along east and west.

25. (d)
The potential energy of a magnetic dipole of magnetic moment M placed in magnetic field H is given as
$U_\theta = -\mathbf{M}.\mathbf{H} = -MH\cos\theta$
Where θ is angle between the vector **M** and **H**.
Initially the dipole possesses minimum potential energy U_0, therefore work requires to turn through angle θ is

$$W = U_\theta - U_0$$
$$= -MH\cos\theta - (-MH\cos\theta)$$
$$= -MH\cos\theta + MH$$
$$W = MH(1 - \cos\theta)$$

26. (b)
$\tau = MB\sin\theta = 0.1 \times 3 \times 10^{-4}\sin 30°$
$= 1.5 \times 10^{-5}$ N-m

27. (b)

$$e = \frac{-d\phi}{dt} = \frac{-NBA(\cos 0° - \cos 180°)}{dt}$$

$$= \frac{2\,NBA}{dt} = \frac{2\times500\times0.9\times10^{-4}\times0.1}{0.5}$$

$= 0.018$ V

28. (a)

$$i_P = \frac{n_s}{n_P} i_s = \frac{100}{300} \times 60 = 20 \text{ A}$$

29. (a)

Impedance $Z = \sqrt{R^2 + X^2} = \sqrt{(7)^2 + (13)^2} = 20\Omega$

30. (a)

$$V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{200}{1.414} = 141.4\, V$$

31. (a)

Phase difference relative to the current

$$\phi = \left(314t - \frac{\pi}{6}\right) - (314\, t) = -\frac{\pi}{6}$$

32. (a)

33. (d)

The equation of electric field occurring in Y-direction

$$E_y = 66 \cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

Therefore, for the magnetic field in Z-direction

$$B_z = \frac{E_y}{c}$$

$$= \left(\frac{66}{3\times10^8}\right)\cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

$$= 22 \times 10^{-8} \cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

$$= 22 \times 10^{-7} \cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

34. (a)

Radio waves have a frequency of 1057 M H z that result from two near hydrogen energy levels.

35. (c)

Maxwell explained the concept of displacement current using the case of a capacitor. That is when a capacitor starts charging, there is no charge conduction between the fields. However, due to charge accumulation in the plates with time, electric field changes causing the displacement current.

36. (b)

In an electromagnetic wave, the average energy density of magnetic field μ_B = average energy density of electric filed $v_E = \frac{1}{4}\varepsilon_0 E_0^2$

$$= \frac{1}{4} \times (8.85 \times 10^{-12}) \times 1^2$$

$$= 2.21 \times 10^{-12}\ \text{Jm}^{-3}$$

37. (a)

$$m = -\frac{f_o}{f_e}$$

38. (d)

As $\mu_2 > \mu_1$, the upper half of the lens will become diverging

As $\mu_1 > \mu_3$, the lower half of the lens will become converging

39. (b)

Distance of third maxima from central maxima is

$$x = \frac{3\lambda D}{d} = \frac{3 \times 6000 \times 10^{-10} \times (100 \times 10^{-2})}{0.5 \times 10^{-3}}$$

$= 3.6cm$

40. (d)

Since P is ahead of Q by 90° and path difference between P and Q is $\lambda/4$. Therefore at A, phase difference is zero, so intensity is $4I$. At C it is zero and at B, the phase difference is 90°, so intensity is $2I$

41. **(c)**

Energy received from the sun $= 2.5 \text{ cal cm}^{-2}(\text{min})^{-1}$

$=10.4 \text{ J cm}^{-2} (\text{min})^{-1}$

Energy of 1 photon received from the sun

$$E = \frac{hc}{\lambda}$$

$$= \frac{6.6\times10^{-34}\times3\times10^{8}}{5000\times10^{-10}}$$

$$=3.96\times 10^{-19} \text{ J}$$

∴ Number of photons reaching the earth per cm^2 per minute will be

$$n = \frac{\text{energy received from sun}}{\text{energy of one photon}}$$

$$n = \frac{10.4}{3.96\times10^{-19}} = 2.62 \times 10^{19}$$

42. **(c)**

$$\lambda = \frac{h}{p} \Rightarrow \lambda \propto \frac{1}{p}$$

43. **(c)**

The excitation energy in the first excited state is

$$E = RhcZ^2\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = (13.6 \text{ eV}) \times Z^2 \times \frac{3}{4}$$

$$\therefore \quad 40.8 = 13.6 \times Z^2 \times \frac{3}{4}$$

$$\Rightarrow \quad Z = 2$$

So, the ion in problem is He^+. The energy of the ion in the ground state is

$$E = \frac{RhcZ^2}{1^2} = 13.6 \times 4 = 54.4 \text{ eV}$$

Hence, 54.4 eV is required to remove the electron from the ion.

44. **(a)**

1amu (or 1u) $=1.6605402 \times 10^{-27}$ kg

$= 1.6 \times 10^{-24}$ g

Moreover 1 amu is equivalent to 931 MeV

0r 1.6×10^{-24} g is equivalent to 931 MeV

∴ 2g is equivalent to $\frac{931}{1.6\times10^{-24}} \times 2$ MeV

and 10^{-3} g is equivalent to $\frac{931}{1.6\times10^{-24}} \times 2 \times 10^{-3}$MeV

$$= 11.2 \times 10^{23} \text{ MeV}$$

45. **(a)**

The minimum potential difference between the base and emitter required to turn on a silicon transistor is typically around 0.6 to 0.7 volts.

46. **(a)**

Since no conduction is found when multimeter is connected across A and B it means either both A and B are n-type or p-type. So, it means C is base. When C is connected to common terminal and conduction is seen when the other terminal is connected to A and B, so it means transistor is in p-n with C as base.

47. **(d)**

The Boolean expression for 'AND' gate is $C + A.B$

$\Rightarrow 1.1 = 1, 1.0 = 0, 0.1 = 0, 0.0 = 0$

48. **(c)**

$$i_b = \frac{5 - 0.5}{7.8} = 0.57\, mA \Rightarrow I_c = \beta\, I_b$$

$$= 100 \times 0.6\, mA$$

By using $V_{CE} = V_{CC} - I_c R_L = 12 - 60 \times 10^{-3} \times 120 = 4.8V$

49. **(d)**

$$E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{12400}{E(ev)} = \frac{12400}{2.5}$$

$$= 4960\text{Å}$$

This is the maximum wavelength i.e., the signals having wavelength greater than this value are not detected by photodiode.

50. (a)

Sky state of signal are used for long distance communication. The sky state signals are less stable than ground wave signals because of the variation of state of ionosphere.