CUET (UG)
Physics Sample Paper - 7
Solved

Time Allowed: 45 minutes **Maximum Marks: 200**

General Instructions:

1. The test is of 45 Minutes duration.
2. The test contains 50 questions out of which 40 questions need to be attempted.
3. Marking Scheme of the test:

a. Correct answer or the most appropriate answer: Five marks (+5).
b. Any incorrectly marked option will be given minus one mark (-1).
c. Unanswered/Marked for Review will be given zero mark (0).

Attempt any 40 questions

1. Electric charges under the action of electric forces is called: **[5]**

a) electric field lines. b) electrostatic
c) electric flux d) electric field

2. A body can be negatively charged by **[5]**

a) Giving some protons to it b) Giving excess of electrons to it
c) removing some electrons from it d) Removing some neutrons from it

3. The dimensional formula of electric charge is: **[5]**

a) $[M^0L^0T^1A^{-1}]$ b) $[M^0L^0T^{-1}A^1]$
c) $[M^0L^0T^{-1}A^{-1}]$ d) $[M^0L^0T^1A^1]$

4. The ratio of charge to potential of a body is known as **[5]**

a) capacitance b) inductance
c) conductance d) resistance

5. Equipotentials at a great distance from a collection of charges whose total sum is not zero are approximately **[5]**

a) planes b) ellipsoids
c) spheres d) paraboloids

6. In Van de Graaff generator, the process of spraying the charge is called: **[5]**

a) gaseous discharge
b) avalanche discharge
c) electron discharge
d) corona discharge

7. Ammeter is always used **[5]**

a) in series with the element through which current is to be determined
b) in parallel with the element through which current is to be determined
c) to simulate the element across which voltage is to be determined
d) to simulate the element through which resistance is to be determined

8. Dimension of resistivity (or specific resistance) is: **[5]**

a) $ML^3T^{-2}I^{-1}$
b) $ML^2T^{-2}I^{-1}$
c) $ML^2T^{-2}I^{-2}$
d) $ML^3T^{-3}I^{-2}$

9. The instrument among the following which measures the emf of a cell most accurately is: **[5]**

a) potentiometer
b) a voltmeter
c) post office box
d) an ammeter

10. Magnetic field due to a straight solenoid at any point inside it is $B = \mu_0$ ni. Magnetic field at the end of the solenoid is **[5]**

a) B
b) $\frac{B}{2}$
c) $\frac{B}{4}$
d) 2B

11. A current carrying wire kept in a uniform magnetic field, will experience a maximum force when it is **[5]**

a) at an angle of 60^o to the magnetic field
b) parallel to the magnetic field
c) at an angle of 45^o to the magnetic field
d) perpendicular to the magnetic field

12. A coil carrying an electric current is placed in a uniform magnetic field: **[5]**

a) emf is induced

b) torque is produced and emf is induced

c) torque is produced

d) Momentum is produced

13. When a charged particle moving with velocity $\vec{v}$ is subjected to a magnetic field of induction $\vec{B}$, the force on it is non-zero. This implies that: **[5]**

a) angle between them is either zero or 180°

b) angle between them can have any value other than zero and 180°

c) angle between them can have any value other than 90°

d) angle between them is necessarily 90°

14. A jet plane is travelling towards west at a speed of 1800 km/h. If the Earth's magnetic field at the location has a magnitude of $5 \times 10^{-4} T$ and the dip angle is 30°, voltage difference developed between the ends of the wing having a span of 25 m is approximately **[5]**

a) 6.7 V

b) 4.3 V

c) 5.5 V

d) 3.1 V

15. A closely wound solenoid of 800 turns and area of cross section $2.5 \times 10^{-4} m^2$ carries a current of 3.0 A. It is free to turn about the vertical direction and a uniform horizontal magnetic field of 0.25 T is applied. Magnitude of torque on the solenoid when its axis makes an angle of 30° with the direction of applied field is **[5]**

a) 0.075 J

b) 0.09 J

c) 0.065 J

d) 0.06 J

16. Tesla is the unit of **[5]**

a) magnetic induction

b) electric field

c) electric flux

d) magnetic flux

17. The magnetic moment has dimensions of **[5]**

a) $[L^2A]$

b) $[L^2T^{-1}A]$

c) $[LT^{-1}A]$

d) [LA]

18. The magnetic moment (μ) of a revolving electron around the nucleus varies with principal quantum number n as **[5]**

a) $\mu \propto n$

b) $\mu \propto \frac{1}{n}$

c) $\mu \propto \frac{1}{n^2}$

d) $\mu \propto n^2$

19. The force between two magnetic poles is F. If the distance between the poles and pole strengths of each pole are doubled, then the force experienced is: **[5]**

a) F

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

c) 2F

d) $\frac{F}{2}$

20. The resistance of a circular coil of 50 turns and 10 cm diameter is 5Ω. What must be the potential difference across the ends of the coil so as to nullify the earth's magnetic field (B_H = 0.314 gauss) at the centre of the coil? How should the coil be placed to achieve this result? **[5]**

a) 0.25 V with the plane of the coil in the magnetic meridian

b) 0.5 V with the plane of coil normal to the magnetic meridian

c) 0.5 V with the plane of the coil in the magnetic meridian

d) 0.25 V with the plane of coil normal to the magnetic meridian

21. The susceptibility of a paramagnetic material is χ at 27° C. At what temperature will its susceptibility be $\frac{\chi}{2}$? **[5]**

a) 54° C

b) 327° C

c) 237° C

d) 1600° C

22. The current in the primary coil of a pair of coils changes from 7 A to 3 A in 0.4 s. The mutual inductance between the two coils is 0.5 H. The induced emf in the secondary coil is **[5]**

a) 75 V

b) 220 V

c) 100 V

d) 50 V

23. A loop, made of straight edges has six corners at A(0, 0, 0), B(L, 0, 0) C(L, L, 0), D(0, L, 0) E(0, L, L) and F(0, 0, L). A magnetic field $\mathbf{B} = B_o(\hat{\mathbf{i}} + \hat{\mathbf{k}})$T is present in the region. The flux passing through the loop ABCDEFA (in that order) is **[5]**

a) $2\ B_oL^2$Wb

b) $4\ B_oL^2$Wb

c) $\sqrt{2}B_oL^2$Wb

d) B_oL^2Wb

24. The magnetic flux linked with a coil (in Wb) is given by the equation: **[5]**
$\phi = 5\,t^2 + 3\,t + 16$
The induced e.m.f. in the coil in the fourth second will be

a) 10 V
b) 145 V
c) 210 V
d) 108 V

25. A coil of resistance 400 Ω is placed in a magnetic field. If the magnetic flux ϕ (Wb) linked with the coil varies with times t (sec) as $\phi = 50t^2 + 4$, the current in the coil at t = 2 sec is: **[5]**

a) 0.1 A
b) 1 A
c) 0.5 A
d) 2 A

26. A 50 mH coil carries a current of 2A. The energy stored in the coil is: **[5]**

a) 0.1 J
b) 10 J
c) 0.5 J
d) 0.05 J

27. In a series RLC circuit R = 300 Ω, L = 60 mH, C = 0.50 μF applied voltage V = 50 V and ω = 10,000 rad/s. Inductive reactance X_L, capacitive reactance X_C and impedance Z are **[5]**

a) 600 Ω, 200 Ω and 500Ω
b) 450 Ω, 200 Ω and 450 Ω
c) 550 Ω, 300 Ω and 100 Ω
d) 500 Ω, 250 Ω and 500 Ω

28. You have a special light bulb with a very delicate wire filament. The wire will break if the current in it ever exceeds 1.50 A, even for an instant. What is the largest root-mean-square current you can run through this bulb? **[5]**

a) 1.26 A
b) 1.46 A
c) 1.06 A
d) 1.56 A

29. When a voltage measuring device is connected to AC mains, the meter shows the steady input voltage of 220V. This means **[5]**

a) the pointer of the meter is stuck by some mechanical defect
b) input voltage cannot be AC voltage, but a DC voltage.
c) maximum input voltage is 220V
d) the meter reads not v but $<v^2>$ and is calibrated to read $\sqrt{<v^2>}$

30. An electromagnetic radiation of frequency ν, wave-length λ, travelling with velocity c in air, enters a glass slab of refractive index μ. The frequency, wavelength and velocity of light in the glass slab will be respectively **[5]**

a) $\frac{\nu}{\mu}, \frac{\lambda}{\mu}$ *and* $\frac{c}{\mu}$

b) $\nu, \frac{\lambda}{\mu}$ *and* $\frac{c}{\mu}$

c) $v, 2\,\lambda$ *and* $\frac{c}{\mu}$

d) $\frac{2\,v}{\mu}, \frac{\lambda}{\mu}$ *and c*

31. It is necessary to use satellites for long distance TV transmission because **[5]**

a) Television signals are attenuated by ionosphere

b) Satellites transmit the signals all over the earth

c) Television signals are absorbed by ionosphere

d) Television signals are not properly reflected by the ionosphere

32. Transverse nature of electromagnetic waves is evident by **[5]**

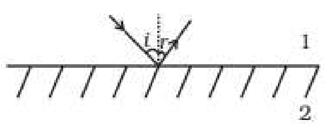
a) Polarization

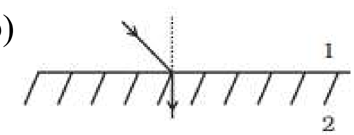
b) Reflection

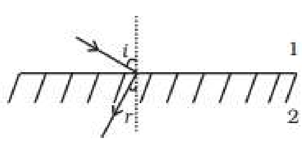
c) Diffraction

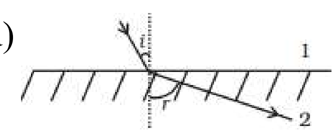
d) Interference

33. There are certain material developed in laboratories which have a negative refractive index Figure. A ray incident from air (medium 1) into such a medium (medium 2) shall follow a path given by **[5]**

a) 

b) 

c) 

d) 

34. A short pulse of white light is incident from air to a glass slab at normal incidence. After travelling through the slab, the first color to emerge is **[5]**

a) green

b) blue

c) violet

d) red

35. The principal behind optical fibre is: **[5]**

a) Total internal reflection

b) Both Total external reflection and Total internal reflection

c) Diffraction

d) Total external reflection

36. A plano-convex lens is made of glass of refractive index 1.5.The focal length f of the lens and radius of curvature R of its curved face are related as **[5]**

a) $f = \frac{R}{2}$

b) f = R

c) f = 2R

d) $f = \frac{3}{2R}$

37. In a wave, the path difference corresponding to a phase difference of ϕ is: **[5]**

a) $\frac{\pi}{\lambda}\phi$

b) $\frac{2\pi}{\lambda}\phi$

c) $\frac{\lambda}{2\pi}\phi$

d) $\frac{\lambda}{\pi}\phi$

38. Newton gave the corpuscular theory on the basis of: **[5]**

a) Wavefront

b) Newton's rings

c) Colours of thin films

d) Rectilinear motion

39. An electron (mass m) with an initial velocity $v = v_0\,\hat{i}$ is in an electric field $E = E_0\,\hat{j}$. If $\lambda_0 = \frac{h}{mv_o}$, it's de Breoglie wavelength at time t is given by **[5]**

a) $\frac{\lambda_0}{\left(1+\frac{e^2E_0^2t^2}{m^2v_0^2}\right)}$

b) λ_0

c) $\lambda_0\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}$

d) $\frac{\lambda_0}{\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}}$

40. If we consider electrons and photons of same wavelength, then they will have same **[5]**

a) velocity

b) momentum

c) angular momentum

d) energy

41. If the work function of a material is 2eV, then minimum frequency of light required to emit photo-electrons is **[5]**

a) 5.6 $\times 10^{14}$Hz

b) 4.8 $\times 10^{14}$Hz

c) 7.0 $\times 10^{14}$Hz

d) 6.4 $\times 10^{14}$Hz

42. An electron and proton have the same de-Broglie wavelength. Then K.E. of the electron is **[5]**

a) Zero

b) Equal to K.E. of the proton

c) Infinity

d) Greater than K.E. of proton

43. The energy of the electron revolving in the orbit of Bohr radius is **[5]**

a) 13.6 MeV

b) -13.6 eV

c) -13.6 MeV

d) 13.6 eV

44. The Bohr model of atom **[5]**

a) predicts continuous emission spectra for atoms

b) predicts the same emission spectra for all types of atoms

c) assumes that the angular momentum of electrons is quantized

d) uses Einstein's photoelectric equation

45. An X-ray tube operates on 30 kV. The minimum wavelength emitted is: **[5]**
(use h = 6.6 $\times$ 10^{-34} Js, c = 3 $\times$ 10^{8} m/s, e = 1.6 $\times$ 10^{-19} C)

a) 0.133 $\mathring{A}$

b) 6.6 $\mathring{A}$

c) 0.4 $\mathring{A}$

d) 1.2 $\mathring{A}$

46. Heavy stable nuclei have more neutrons than protons. This is because of the fact that **[5]**

a) nuclear forces between neutrons are weaker than that between protons

b) the electrostatic force between protons is repulsive

c) neutrons decay into protons through beta decay

d) neutrons are heavier than protons

47. In nuclear reaction: **[5]**
$_2He^4 + {}_zX^A \longrightarrow {}_{Z+2}Y^{A+3} + {}_Z \cdot M^A$
where M denotes

a) neutron

b) positron

c) electron

d) proton

48. Which one is not possible? **[5]**

a) $_1H^2 + {}_1H^2 \rightarrow 2He^4$

b) $_8O^{16} + {}_0n^1 \rightarrow {}_7N^{14} + 3\ {}_1H^1 + 2\ {}_{-1}\beta^0$

This reaction is not balanced properly.

c) ${}_{16}S^{32} + {}_{1}H^{1} \rightarrow {}_{17}Cl^{35} + {}_{2}He^{4}$

d) ${}_{7}N^{14} + {}_{0}n^{1} \rightarrow {}_{7}N^{16} + {}_{1}H^{1}$

49. The relation between the forward current I_f and saturation current I_s for p-n junction diode is: **[5]**

a) $I_f I_s = 1$

b) $I_f = I_s$

c) $I_f = I_s \left[\frac{qV}{KT} - 1\right]$

d) $I_f = I_s e^{(qV/KT)-1}$

50. Transmitter is a device that **[5]**

a) clips the message signal

b) inverts the message

c) makes the message contain parts of the spectrum

d) makes the message suitable for transmission and reception

Solutions

1.
(b) electrostatic
Explanation: Coulomb force, also called electrostatic force or Coulomb interaction, attraction. or repulsion of particles or objects because of their electric charges. The strength of the electric field is given by the electric field or the Coulomb field which is E = F/q.

2.
(b) Giving excess of electrons to it
Explanation: Giving excess of electrons to it.

3.
(d) $[M^0L^0T^1A^1]$
Explanation: As we know that,
Charge = current $\times$ time = AT = $[M^0L^0T^1A^1]$

4. **(a)** capacitance
Explanation: By definition of capacitance, $C = \frac{Q}{V}$

5.
(c) spheres
Explanation: Here we have to find out the shape of the equipotential surface. These surfaces are perpendicular to the field lines. So there must be an electric field which cannot be without charge. So the algebraic sum of all charges must not be zero. Equipotential surface at a great distance means that the space of charge is negligible as compared to distance. So the collection of charges is considered as a point charge. The electric potential due to point charge is given by $V=1/4\pi \in_0 r$. It means that potential due to a point charge is same for all equidistant points, which are at the same potential form spherical shape. The lines of the field from point charges are radial. So the equipotential surface (perpendicular to the field lines) form a sphere.

6.
(d) corona discharge
Explanation: corona discharge

7. **(a)** in series with the element through which current is to be determined
Explanation: Ammeter is a device used to measure current. Since it has to allow the complete current flowing in the circuit through it, it has to be connected in series. For this reason, ammeters have very low values of resistances so that they do not add to the value of resistance connected in the circuit.

8.
(d) $ML^3T^{-3}I^{-2}$

Explanation: As $\rho = \frac{m}{ne^2\tau}$

$$[\rho] = \frac{[M]}{\left[L^{-3}\right][IT]^2[T]} = ML^3T^{-3}I^{-2}$$

9. **(a)** potentiometer
Explanation: The instrument among the following which measures the emf of a cell most accurately is a potentiometer.

10.
(b) $\frac{B}{2}$
Explanation: Magnetic field at the end of a current carrying solenoid is half of the magnetic field inside it.

11.
(d) perpendicular to the magnetic field
Explanation: F = Bilsin θ
θ is the angle between the direction of current and the direction of magnetic field.
So, when $\theta = 90^o$, the force is maximum.

12.
(c) torque is produced
Explanation: A torque $\tau = mB\sin\theta$ acts on the coil.

13.
(b) angle between them can have any value other than zero and 180 °
Explanation: When the angle between $\vec{v}$ and $\vec{B}$ has any value other than zero and 180 ° (so that sinθ is non-zero), the magnetic force on the charged particle will be non-zero.

14.
(d) 3.1 V
Explanation: $e = (B\sin\phi)vl = 5 \times 10^{-4} \times \frac{1}{2} \times 500 \times 25 = 3.1\text{V}$

15. **(a)** 0.075 J
Explanation: m = NIA = 0.6 J/T
Torque = mBsinθ = 0.6 × 0.25 × 0.5 = 0.075 J

16. **(a)** magnetic induction
Explanation: magnetic induction

17. **(a)** $[L^2A]$
Explanation: Magnetic moment = Current × area
$[M] = [L^2A]$

18. **(a)** $\mu \propto n$
Explanation: Orbital magnetic moment of an electron,

$\mu = n\frac{eh}{4\pi m_e}$ i.e., $\mu \propto n$

19. **(a)** F

Explanation: $F\alpha\frac{q_m q_m^{'}}{r^2}$

Hence $\frac{F^{'}}{F} = (\frac{2q_m 2q_m^{'}}{4r^2})/\frac{q_m q_m^{'}}{r^2} = 1$

or F' = F

20.

(d) 0.25 V with the plane of coil normal to the magnetic meridian

Explanation: $B_H = \frac{\mu_0 NI}{2r}$

$0.314 \times 10^{-4} = \frac{4\pi \times 10^{-7} \times 50 \times V}{10 \times 10^{-2} \times 5}$

$V = \frac{0.314 \times 10^{-6}}{4 \times 3.14 \times 10^{-7}}$ V

$= \frac{1}{4}V = 0.25$ V

The field of the coil acts normal to its plane. So the plane of the coil should be normal to the magnetic meridian to nullify the earth's field.

21.

(b) 327° C

Explanation: $\frac{\chi_2}{\chi_1} = \frac{T_2}{T_1}$

$T_2 = \frac{\chi_1}{\chi_2} \cdot T_1 = \frac{\chi}{\chi/2}(273 + 27)K = 600\ K = 327°\ C$

22.

(d) 50 V

Explanation: Induced emf $= |\varepsilon| = M\frac{di}{dt}$

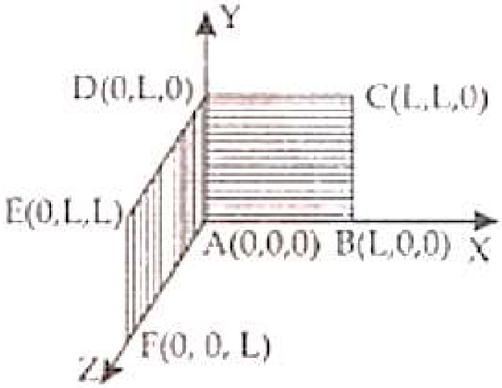
$= 0.5 \times (\frac{4}{0.04})$

$= 50$ V

23. **(a)** 2 B_0L^2Wb

Explanation:

The loop can be considered in two planes:



i. Plane of ABCDA is in X-Y plane So its vector $\vec{A}$ is in Z-direction so
   $A_1 = |A|\hat{k} = L^2\hat{k}$

ii. Plane of DEFAD is in Y-Z plane
   So $A_2 = |A|i = L^2 i$
   $\therefore A = A_1 + A_2 = L^2(\hat{i} + \hat{k})$
   $B = B_0 (i + k)$
   the magnetic flux linked with uniform surface of area A in uniform magnetic field is given by, $\phi = B \cdot A = B_0(i + k) \cdot L^2(i + k) = B_0L^2[i. i + i. k + k. i + k. k]$
   $= B_0L^2[1 + 0 + 0 + 1] \because \cos 90° = 0$
   $= 2 B_0L^2$Wb

24. **(a)** 10 V

Explanation: As induced emf, $|e| = \frac{d\phi}{dt}$

$= \frac{d}{dt}\left(5t^2 + 3t + 16\right)$

$= 10t + 3$

So, at $t = 3s, induced\ |\ e\ |\ is = 10 \times 3 + 3 = 33V$

So, at $t = 4s, induced\ |\ e\ |\ is = 10 \times 4 + 3 = 43V$

Therefore emf induced in the fourth second s given by $= 43 - 33 = 10V$

25.

(c) 0.5 A

Explanation: $\varepsilon = -\frac{d\phi}{dt} = -100t$

$I(at = 2s) = \frac{|\varepsilon|}{R}$

$= \frac{100 \times 2}{400} = 0.5\ A$

26. **(a)** 0.1 J

Explanation: Energy stored in the coil is

$E = \frac{1}{2}Li^2$

$L = 50mH = 50 \times 10^{-3}$

i = 2A

Thus, $E = \frac{1}{2} \times 50 \times 10^{-3} \times 2 \times 2 = 0.1\ J$

27. **(a)** 600 Ω, 200 Ω and 500Ω

Explanation: Given that

$R = 300\Omega$

$L = 60mH = 60 \times 10^{-3}H$

$C = 0.5\mu F = 0.5 \times 10^{-6}F$

V = 50 volt

$\omega = 10000 rad/s$

Inductive reactance, $X_L = \omega L = 10000 \times 60 \times 10^{-3} = 600\Omega$

Capacitive reactance, $X_C = \frac{1}{\omega C} = \frac{1}{10000 \times 0.5 \times 10^{-6}} = 200\Omega$

Impedance, $Z = \sqrt{R^2 + \left(X_L - X_C\right)^2} = \sqrt{300^2 + (600 - 200)^2} = \sqrt{300^2 + 400^2} = 500\Omega$

28.

(c) 1.06 A

Explanation: Maximum value of current, $i_0 = 1.5A$

Thus, root-mean-square current,

$i_{rms} = \frac{i_0}{\sqrt{2}} = \frac{1.50}{\sqrt{2}} = 1.06A$

29.

(d) the meter reads not v but $<v^2>$ and is calibrated to read $\sqrt{< v^2 >}$

Explanation: the meter reads not v but $<v^2>$. The voltmeter connected to AC mains calibrated to read rms value $\sqrt{< v^2 >}$

30.

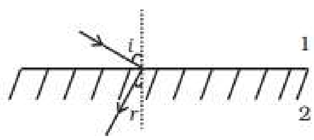
(b) $v, \frac{\lambda}{\mu}\ and\ \frac{c}{\mu}$

Explanation: The frequency of electromagnetic waves does not change, when it goes from medium to another medium.
The wavelength of the electromagnetic waves in the medium becomes λ/μ.

The velocity of the electromagnetic waves in the medium becomes, $v = \frac{c}{\mu}$

31.
(d) Television signals are not properly reflected by the ionosphere
Explanation: Television signals are of high frequencies and high energies. Thus, these signals are not reflected by the ionosphere hence satellites are necessary for television transmission.

32. **(a)** Polarization
Explanation: Only transverse waves can be polarized. Longitudinal waves do not undergo polarization.
Whereas both, transverse and longitudinal waves can undergo interference, diffraction and reflection.

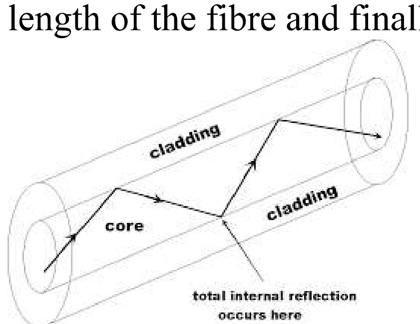
33.
(c) 

Explanation: According to Snell's law, μ= sini/sinr, The materials with negative refractive index responds to Snell's law just the opposite way. If incident ray from air (Medium 1) incident on those materials, the ray refract or bend the same side of the normal.

34.
(d) red
Explanation: $\because$ c = $v\lambda$ and v is constant during refraction so $c \propto \lambda$. The velocity of red color is maximum in the glass as $\lambda_V < \lambda_R$

OR In air, all the colours of light travel with the same velocity with the same velocity, but in glass, velocities of different colors are different. Velocity of red color is largest and velocity of violet color is smallest. Therefore, after travelling through the glass slab, red color will emerge first.

35. **(a)** Total internal reflection
Explanation: Optical fibres are fabricated with high-quality composite glass/quartz fibres. Each fibre consists of a core and cladding. The refractive index of the material of the core is higher than that of the cladding. When a signal in the form of light is directed at one end of the fibre at a suitable angle, it undergoes repeated total internal reflections along the length of the fibre and finally comes out at the other end as shown in figure.



36.

(c) $f = 2R$

Explanation: $\frac{1}{f} = (\frac{\mu_2}{\mu_1} - 1)(\frac{1}{R_1} - \frac{1}{R_2})$

For plano convex lens, R_1 = infinite and R_2 = -R

Hence, $\frac{1}{f} = (1.5 - 1)(\frac{1}{\infty} - \frac{1}{-R})$

or f = 2R

37.

(c) $\frac{\lambda}{2\pi}\phi$

Explanation: For any two waves with the same frequency, path difference and phase difference are related as:

$\Delta x = \frac{\lambda}{2\pi}\Delta\phi$

38.

(d) Rectilinear motion

Explanation: Newton's corpuscular theory of light is based on the following points:

1. Light consists of very tiny particles known as "corpuscles".
2. These corpuscles on emission from the source of light travel in a straight line with high velocity.
3. These particles are emitted from a source of light in all directions.

39.

(d) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$

Explanation: Initial de Broglie wavelength of electron, $\lambda_0 = \frac{h}{mv_0}$

Force on electron in electric field, $\bar{F} = -e\bar{E} = -eE_0\hat{j}$

Acceleration of electron, $\bar{a} = \frac{\bar{F}}{m} = \frac{eE_0}{m}\hat{j}$

It is acting along negatively y-axis.

The initial velocity of electron along x-axis $\bar{v}_{x0} = v_0\hat{i}$. initial velocity of electron along y-axis $\bar{v}_{yo} = 0$. Velocity of electron after time t along x-axis, $\bar{v}_x = v_0\hat{i}$

($\therefore$ there is no acceleration of electron along x-axis.)

Velocity of electron after time t along y-axis, $-\frac{eE_0}{m}t\hat{j}$

Magnitude of velocity of electron after time t is

$$|\bar{v}| = \sqrt{v_x^2 + v_y^2} = \sqrt{v_0^2 + \left(\frac{-eE_0}{m}t\right)^2} = v_0\sqrt{1 + \frac{e^2E_0^2t^2}{m^2v_0^2}}$$

de Broglie wavelength associated with electron at time t is

$$\lambda = \frac{h}{mv} = \frac{h}{mv_0\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}} = \frac{\lambda_0}{\sqrt{1+\frac{e^2E_0^2t^2}{m^2v_0^2}}}$$

40.

(b) momentum

Explanation: As $p = \frac{h}{\lambda}$, so electrons and photons having the same wavelength λ will have the same momentum p.

41.

(b) 4.8×10^{14}Hz

Explanation: $\phi_0 = hv_0$

$2 \times 1.6 \times 10^{-19} = 6.6 \times 10^{-34} \times v_0$

hence, the minimum frequency required is given by :-

$$v_0 = \frac{2 \times 1.6 \times 10^{-19}}{6.6 \times 10^{-34}} = 4.8 \times 10^{14} Hz$$

42.

(d) Greater than K.E. of proton

Explanation: $\lambda = \frac{h}{\sqrt{2mK}}$

Since, wavelength of electron and proton are equal,

$m_eKe = m_pK_p$

$K_e = (m_p/m_e)K_p$

K_e approximately equal to 1837 times K_p as $m_p = 1837\ m_e$,

Hence, $K_e > K_p$

43.

(b) -13.6 eV

Explanation: Atomic energies are expressed in electron volts (eV) rather than joules (J).

$E_n = -\frac{13.6}{n^2} eV$

The lowest state of the atom is that of the lowest energy, i.e., when n=1

Therefore, E_n = -13.6 eV

44.

(c) assumes that the angular momentum of electrons is quantized

Explanation: Bohr's model of atoms assumes that the angular momentum of electrons is quantized.

45.

(c) 0.4 $\mathring{A}$

Explanation: $\lambda_{min} = \frac{hc}{eV} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{1.6 \times 10^{-19} \times 30 \times 10^3}$

$= 0.4 \times 10^{-10}$ m $= 0.4\ \mathring{A}$

46.

(b) the electrostatic force between protons is repulsive

Explanation: Heavy nuclei, which are stable contain more neutrons than protons in their nuclei. The electrostatic force between proton-proton is repulsive which causes the un-stability of the nucleus.

47. **(a)** neutron

Explanation: 4 + A = A + 3 + A' = 1

2 + Z = Z + 2 + Z' = 0

Hence $_0^1M$ is a neutron.

48.

(b) $_8O^{16} + {_0n^1} \rightarrow {_7N^{14}} + 3\ {_1H^1} + 2\ {_{-1}\beta^0}$

This reaction is not balanced properly.

Explanation: $_8O^{16} + {_0n^1} \rightarrow {_7N^{14}} + 3\ {_1H^1} + 2\ {_{-1}\beta^0}$

49.

(d) $I_f = I_s e^{(qV/KT) - 1}$

Explanation: $I_f = I_s e^{(qV/KT) - 1}$

50.

(d) makes the message suitable for transmission and reception

Explanation: A transmitter is a set up that transmits the message to the receiving end through a communication channel.its main function is to modify the message signal in a form suitable for transmission over the channel and to transmit it.The transmitter is able to generate a radio frequency alternating current that is then applied to the antenna, which, in turn, radiates this as radio waves. There are many types of transmitters depending on the standard being used and the type of device; for example, many modern devices that have communication capabilities have transmitters such as Wi-Fi, Bluetooth, NFC and cellular.