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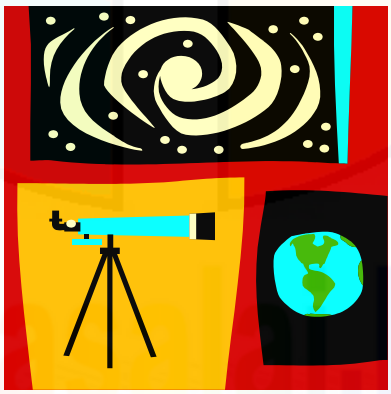

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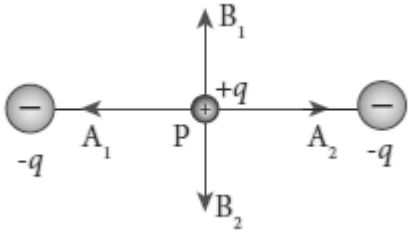
1. Electrostatics

1. Two identical point charges of magnitude –q are fixed as shown in the figure below. A third charge +q is placed midway between the two charges at the point P. Suppose this charge +q is displaced a small distance from the point P in the directions indicated by the arrows, in which direction(s) will +q be stable with respect to the displacement?

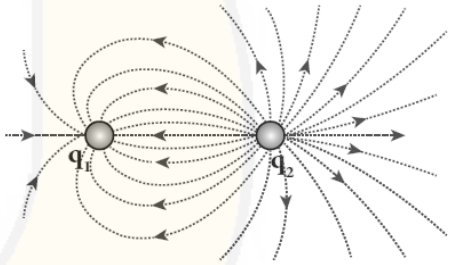


a) A_1 and A_2 *b)* B_1 and B_2
c) both directions *d)* No stable

2. Which charge configuration produces a uniform electric field?

a) point charge
b) infinite uniform line charge
c) uniformly charged infinite plane
d) uniformly charged spherical shell

3. What is the ratio of the charges $\left|\frac{q_1}{q_2}\right|$ for the following electric field line pattern?

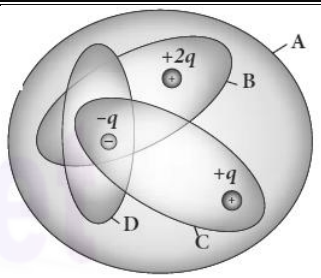


a) $\frac{1}{5}$ *b)* $\frac{25}{11}$
c) 5 *d)* $\frac{11}{25}$

4. An electric dipole is placed at an alignment angle of 30° with an electric field of $2 \times 10^5\ N\ C^{-1}$. It experiences a torque equal to 8 N m. The charge on the dipole if the dipole length is 1 cm is

a) *4 mC* *b)* *8 mC* *c)* *5mC* *d)* *7 mC*

5. Four Gaussian surfaces are given below with charges inside each Gaussian surface. Rank the electric flux through each Gaussian surface in increasing order.



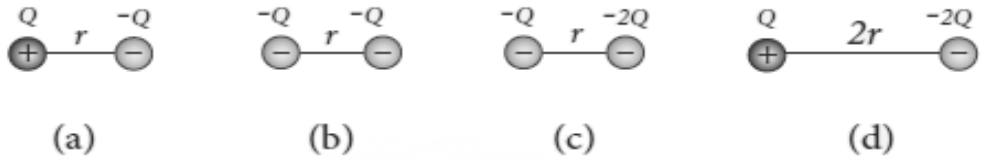
a) $D < C < B < A$ *b)* $A < B = C < D$
c) $C < A = B < D$ *d)* $D > C > B > A$

6. The total electric flux for the following closed surface which is kept inside water _____

a) $\frac{80q}{\varepsilon_o}$ *b)* $\frac{q}{40\varepsilon_o}$
c) $\frac{q}{80\ \varepsilon_o}$ *d)* $\frac{q}{160\varepsilon_o}$

7. Two identical conducting balls having positive charges q_1 and q_2 are separated by a center to center distance r. If they are made to touch each other and then separated to the same distance, the force between them will be
   a) less than before *b)* same as before
   c) more than before *d)* zero

8. Rank the electrostatic potential energies for the given system of charges in increasing order.

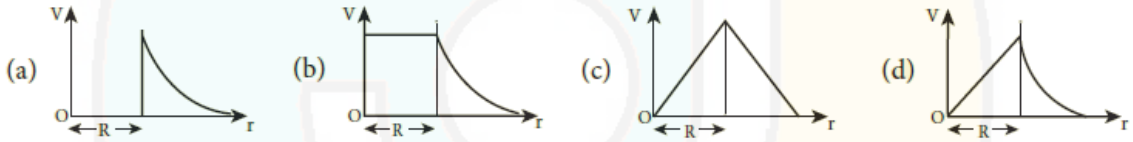


(a) (b) (c) (d)

a) 1=4<2<3 *b)* 2=4<3<1 *c)* 2=3<1<4 *d)* 3<1<2<4

9. An electric field $\vec{E} = 10\,x\,\hat{\imath}$ exists in a certain region of space. Then the potential difference V = $V_o - V_A$, where V_o is the potential at the origin and V_A is the potential at x = 2 m is:
   a) 10 V *b)* - 20 V *c)* + 20 V *d)* - 10 V

10. A thin conducting spherical shell of radius R has a charge Q which is uniformly distributed on its surface. The correct plot for electrostatic potential due to this spherical shell is

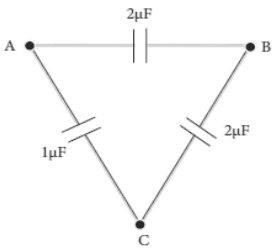


11. Two points A and B are maintained at a potential of 7 V and -4 V respectively. The work done in moving 50 electrons from A to B is
   a) $8.80 \times 10^{-17} J$ *b)* $-8.80 \times 10^{-17} J$
   c) $4.40 \times 10^{-17} J$ *d)* $5.80 \times 10^{-17} J$

12. If voltage applied on a capacitor is increased from V to 2V, choose the correct conclusion.
   a) Q remains the same, C is doubled
   b) Q is doubled, C doubled
   c) C remains same, Q doubled
   d) Both Q and C remain same

13. A parallel plate capacitor stores a charge Q at a voltage V. Suppose the area of the parallel plate capacitor and the distance between the plates are each doubled then which is the quantity that will change?
   a) Capacitance *b)* Charge
   c) Voltage *d)* Energy density

14. Three capacitors are connected in triangle as shown in the figure. The equivalent capacitance between the points A & C is



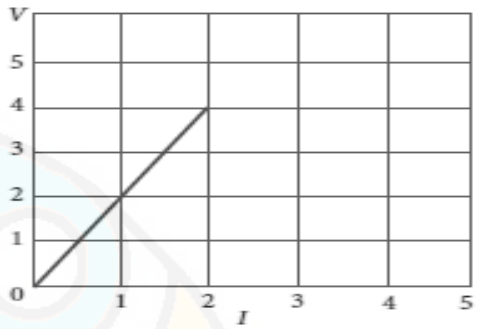
   a) 1 μF *b)* 2 μF
   c) 3 μF *d)* $\frac{1}{4}\ \mu F$

Ans: a

15. Two metallic spheres of radii 1 cm and 3 cm are given charges of $-1 \times 10^{-2}\ C$ and $5 \times 10^{-2}\ C$ respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is
a) $3 \times 10^{-2}\ C$ *b)* $4 \times 10^{-2}\ C$ *c)* $1 \times 10^{-2}\ C$ *d)* $2 \times 10^{-2}\ C$

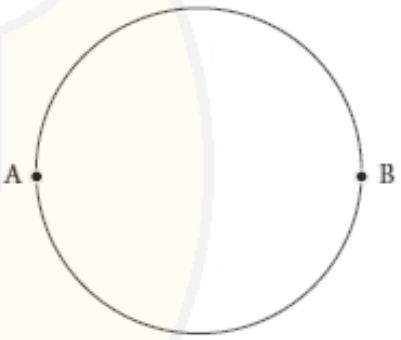
2. Current Electricity

1. The following graph shows current versus voltage values of some unknown conductor. What is the resistance of this conductor?



a) **2 Ω** *b)* **4 Ω**
c) **8 Ω** *d)* **1 Ω**

2. A wire of resistance 2 ohms per meter is bent to form a circle of radius 1m. The equivalent resistance between its two diametrically opposite points, A and B as shown in the figure is



a) $\pi\ \Omega$ *b)* $\frac{\pi}{2}\ \Omega$
c) $2\pi\ \Omega$ *d)* $\frac{\pi}{4}\ \Omega$

3. A toaster operating at 240 V has a resistance of 120 Ω. The power is
a) 400 W *b)* 2 W *c)* 480 W *d)* 240 W

4. A carbon resistor of $(47 \pm 4.7)k\Omega$ to be marked with rings of different colours for its identification. The colour code sequence will be
a) Yellow – Green – Violet – Gold *b)* Yellow – Violet – Orange – Silver
c) Violet – Yellow – Orange – Silver *d)* Green – Orange – Violet - Gold

5. What is the value of resistance of the following resistor? (Brown, Black, Yellow)
a) 100 kΩ *b)* 10 kΩ *c)* 1 kΩ *d)* 1000 kΩ

6. Two wires of A and B with circular cross section made up of the same material with equal lengths. Suppose $R_A = 3\ R_B$, then what is the ratio of radius of wire A to that of B?
a) 3 *b)* $\sqrt{3}$ *c)* $\frac{1}{\sqrt{3}}$ *d)* $\frac{1}{3}$

7. A wire connected to a power supply of 230 V has power dissipation P_1. Suppose the wire is cut into two equal pieces and connected parallel to the same power supply. In this case power dissipation is P_2. The ratio $\frac{P_2}{P_1}$ is
a) 1 *b)* 2 *c)* 3 *d)* 4

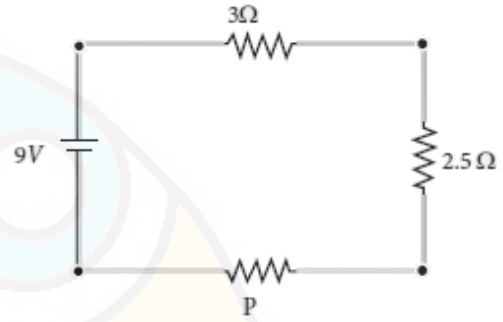
8. In India electricity is supplied for domestic use at 220 V. It is supplied at 110 V in USA. If the resistance of a 60W bulb for use in India is R, the resistance of a 60W bulb for use in USA will be

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

9. In a large building, there are 15 bulbs of 40W, 5 bulbs of 100W, 5 fans of 80W and 1 heater of 1kW are connected. The voltage of electric mains is 220V. The minimum capacity of the main fuse of the building will be

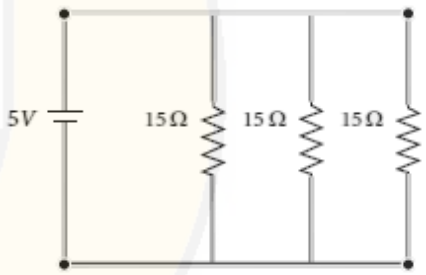
a) 14A *b)* 8A *c)* $10A$ *d)* $12A$

10. There is a current of 1.0 A in the circuit shown below. What is the resistance of P?



a) 1.5 Ω *b)* 2.5 Ω *c)* 3.5 Ω *d)* 4.5 Ω

11. What is the current out of the battery?



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

12. The temperature coefficient of resistance of a wire is 0.00125 per °C. At 300 K, its resistance is 1 Ω. The resistance of the wire will be 2 Ω at

a) 1154 K *b)* 1100 K *c)* 1400 K *d)* 1127 K

13. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is

a) **0.2 Ω** *b)* **0.5 Ω** *c)* **0.8 Ω** *d)* **1.0 Ω**

14. A piece of copper and another of germanium are cooled from room temperature to 80 K. The resistance of

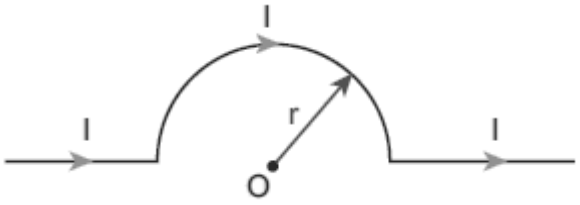
a) each of them increases
b) each of them decreases
c) copper increases and germanium decreases
d) copper decreases and germanium increases

15. In Joule's heating law, when ***I*** and ***t*** are constant, if the ***H*** is taken along the y axis and I^2 along the x axis, the graph is

a) straight line *b)* parabola *c)* circle *d)* ellipse

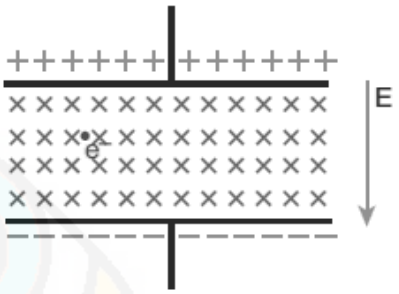
3. Magnetism And Magnetic Effects Of Electric Current

1. The magnetic field at the center O of the following current loop is



a) $\frac{\mu_o I}{4r}\otimes$ *b)* $\frac{\mu_o I}{4r}\odot$
c) $\frac{\mu_o I}{2r}\otimes$ *d)* $\frac{\mu_o I}{2r}\odot$

2. An electron moves straight inside a charged parallel plate capacitor of uniform charge density σ. The time taken by the electron to cross the parallel plate capacitor when the plates of the capacitor are kept under constant magnetic field of induction $\vec{B}$ is



a) $\varepsilon_o \frac{elB}{\sigma}$ *b)* $\varepsilon_o \frac{lB}{\sigma l}$
c) $\varepsilon_o \frac{lB}{e\sigma}$ *d)* $\varepsilon_o \frac{lB}{\sigma}$

3. The force experienced by a particle having mass m and charge q accelerated through a potential difference V when it is kept under perpendicular magnetic field $\vec{B}$ is

a) $\sqrt{\frac{2q^3BV}{m}}$ *b)* $\sqrt{\frac{q^3B^2V}{2m}}$ *c)* $\sqrt{\frac{2q^3B^2V}{m}}$ *d)* $\sqrt{\frac{2q^3BV}{m^3}}$

4. A circular coil of radius *5 cm* and *50 turns* carries a current of *3 ampere*. The magnetic dipole moment of the coil is

a) $1.0\ amp-m^2$ *b)* $1.2\ amp-m^2$ *c)* $0.5\ amp-m^2$ *d)* $0.8\ amp-m^2$

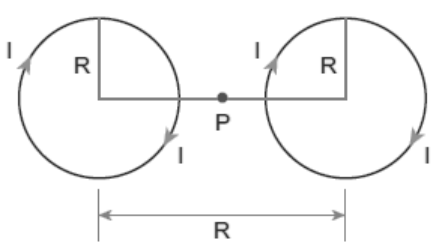
5. A thin insulated wire forms a plane spiral of $N = 100$ *tight turns* carrying a current $I = 8\ mA$ (milli ampere). The radii of inside and outside turns are $a = 50\ mm$ and $b = 100\ mm$ respectively. The magnetic induction at the center of the spiral is

a) $5\ \mu T$ *b)* $7\ \mu T$ *c)* $8\ \mu T$ *d)* $10\ \mu T$

6. Three wires of equal lengths are bent in the form of loops. One of the loops is circle, another is a semi-circle and the third one is a square. They are placed in a uniform magnetic field and same electric current is passed through them. Which of the following loop configuration will experience greater torque?

a) circle *b)* semi-circle
c) square *d)* all of them

7. Two identical coils, each with N turns and radius R are placed coaxially at a distance R as shown in the figure. If I is the current passing through the loops in the same direction, then the magnetic field at a point P which is at exactly at $\frac{R}{2}$ distance between two coils is

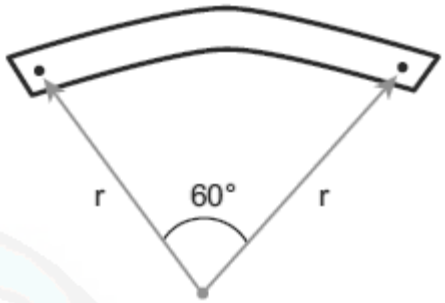


a) $\frac{8N\mu_o I}{\sqrt{5}R}$ *b)* $\frac{8N\mu_o I}{5^{3/2}R}$
c) $\frac{8N\mu_o I}{5R}$ *d)* $\frac{4N\mu_o I}{\sqrt{5}R}$

8. A wire of length l carries a current I along the Y direction and magnetic field is given by $\vec{B} = \frac{\beta}{\sqrt{3}}(\hat{\imath} + \hat{\jmath} + \hat{k})T$. The magnitude of Lorentz force acting on the wire is

a) $\sqrt{\frac{2}{3}}\beta Il$ *b)* $\sqrt{\frac{1}{3}}\beta Il$ *c)* $\sqrt{2}\beta Il$ *d)* $\sqrt{\frac{1}{2}}\beta Il$

9. A bar magnet of length l and magnetic moment M is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be



a) M *b)* $\frac{3}{\pi}M$

c) $\frac{2}{\pi}M$ *d)* $\frac{1}{2}M$

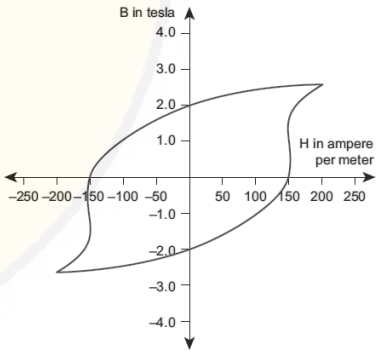
10. A non-conducting charged ring of charge q, mass m and radius r is rotated with constant angular speed ω. Find the ratio of its magnetic moment with angular momentum is

a) $\frac{q}{m}$ *b)* $\frac{2q}{m}$ *c)* $\frac{q}{2m}$ *d)* $\frac{q}{4m}$

11. The vertical component of Earth's magnetic field at a place is equal to the horizontal component. What is the value of *angle of dip* at this place?

a) 30° *b)* 45° *c)* 60° *d)* 90°

12. The B_H curve for a ferromagnetic material is shown in the figure. The material is placed inside a long solenoid which contains *1000 turns/cm*. The current that should be passed in the solenoid to demagnetize the ferromagnet completely is



a) 1.00 mA *b)* 1.25 mA

c) 1.50 mA *d)* 1.75 mA

13. Two short bar magnets have magnetic moments *1.20 Am^2* and *1.00 Am^2* respectively. They are kept on a horizontal table parallel to each other with their north poles pointing towards the south. They have a common magnetic equator and are separated by a distance of *20.0 cm*. The value of the resultant horizontal magnetic induction at the mid-point O of the line joining their centers is (Horizontal components of Earth's magnetic induction is *3.6×10^{-5} Wb m^{-2}*)

a) 3.60 x *10^{-5} Wb m^{-2}* *b)* 3.50 x *10^{-5} Wb m^{-2}*

c) 2.56 x *10^{-4} Wb m^{-2}* *d)* 2.20 x *10^{-4} Wb m^{-2}*

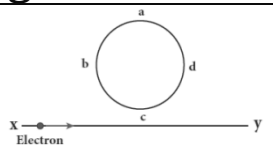
14. A flat dielectric disc of radius R carries an excess charge on its surface. The surface charge density is σ. The disc rotates about an axis perpendicular to its plane passing through the center with angular velocity ω. Find the magnitude of the torque on the disc if it is placed in a uniform magnetic field whose strength is B which is directed perpendicular to the axis of rotation

a) $\frac{1}{4}\sigma\omega\pi BR$ *b)* $\frac{1}{4}\sigma\omega\pi BR^2$ *c)* $\frac{1}{4}\sigma\omega\pi BR^3$ *d)* $\frac{1}{4}\sigma\omega\pi BR^4$

15. A simple pendulum with charged bob is oscillating with time period T and let θ be the angular displacement. If the uniform magnetic field is switched *ON* in a direction perpendicular to the plane of oscillation then
   a) time period will decrease but θ will remain constant
   b) time period remain constant but θ will decrease
   c) both T and θ will remain the same
   d) both T and θ will decrease

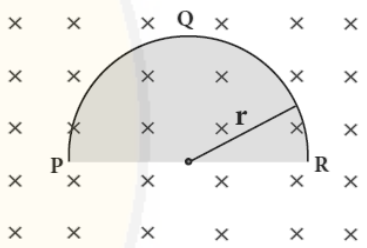
4. Electromagnetic Induction And Alternating Current

1. An electron moves on a straight line path XY as shown in the figure. The coil *abcd* is adjacent to the path of the electron. What will be the direction of current, if any, induced in the coil?



   a) The current will reverse its direction as the electron goes past the coil
   b) No current will be induced
   c) *abcd*
   d) *adcb*

2. A thin semi-circular conducting ring (PQR) of radius r is falling with its plane vertical in a horizontal magnetic field B, as shown in the figure. The potential difference developed across the ring when its speed v, is

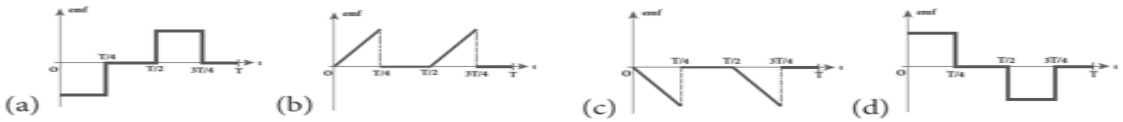


   a) Zero
   b) $\frac{Bv\pi r^2}{2}$ and P is at higher potential
   c) πrBv and R is at higher potential
   d) $2rBv$ and R is at higher potential

3. The flux linked with a coil at any instant t is given by $\emptyset_B = 10t^2 - 50t + 250$. The induced emf at t = 3s is
   a) *-190 V* *b)* *-10 V* *c)* *10 V* *d)* *190 V*

4. When the current changes from *+2A* to *−2A* in *0.05 s*, an emf of *8 V* is induced in a coil. The co-efficient of self-induction of the coil is
   a) *0.2 H* *b)* *0.4 H* *c)* *0.8 H* *d)* *0.1 H*

5. The current ***i*** flowing in a coil varies with time as shown in the figure. The variation of induced emf with time would be



6. A circular coil with a cross-sectional area of *4 cm²* has *10 turns*. It is placed at the centre of a long solenoid that has *15 turns/cm* and a cross-sectional area of *10 cm²*. The axis of the coil coincides with the axis of the solenoid. What is their mutual inductance?
   a) 7.54 *μH* *b)* 8.54 *μH* *c)* 9.54 *μH* *d)* 10.54 *μH*

7. In a transformer, the number of turns in the primary and the secondary are *410* and *1230* respectively. If the current in primary is *6A*, then that in the secondary coil is
   a) 2 *A* *b)* 18 *A* *c)* 12 *A* *d)* 1 *A*

8. A step-down transformer reduces the supply voltage from *220 V* to *11 V* and increase the current from *6 A* to *100 A*. Then its efficiency is
   a) *1.2* *b)* *0.83* *c)* *0.12* *d)* *0.9*

9. In a series RL circuit, the resistance and inductive reactance are the same. Then the phase difference between the voltage and current in the circuit is
   a) $\frac{\pi}{4}$ *b)* $\frac{\pi}{2}$ *c)* $\frac{\pi}{6}$ *d)* *zero*

10. In an electrical circuit, R, L, C and AC voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and current in the circuit is $\frac{\pi}{3}$. Instead, if C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is
    a) $\frac{1}{2}$ *b)* $\frac{1}{\sqrt{2}}$ *c)* 1 *d)* $\frac{\sqrt{3}}{2}$

11. In a series resonant *RLC* circuit, the voltage across *100* Ω resistor is *40 V*. The resonant frequency ω is *250 rad / s*. If the value of *C* is *4 μF*, then the voltage across *L* is
    a) *600 V* *b)* *4000 V* *c)* *400 V* *d)* *1 V*

12. An inductor *20 mH*, a capacitor *50 μF* and a resistor *40 Ω* are connected in series across a source of emf *v = 10 sin 340 t*. The power loss in AC circuit is
    a) *0.76 W* *b)* *0.89 W* *c)* *0.46 W* *d)* *0.67 W*

13. The instantaneous values of alternating current and voltage in a circuit are $i = \frac{1}{\sqrt{2}}\sin(100\pi t)\ A$ and $v = \frac{1}{\sqrt{2}}\sin(100\pi t + \frac{\pi}{3})\ V$. The average power in watts consumed in the circuit is
    a) $\frac{1}{4}$ *b)* $\frac{\sqrt{3}}{4}$ *c)* $\frac{1}{2}$ *d)* $\frac{1}{8}$

14. In an oscillating LC circuit, the maximum charge on the capacitor is Q. The charge on the capacitor when the energy is stored equally between the electric and magnetic fields is
    a) $\frac{Q}{2}$ *b)* $\frac{Q}{\sqrt{3}}$ *c)* $\frac{Q}{\sqrt{2}}$ *d)* Q

15. $\frac{20}{\pi^2}$ *H* inductor is connected to a capacitor of capacitance *C*. The value of *C* in order to impart maximum power at *50 Hz* is
    a) 50 *μF* *b)* 0.5 *μF* *c)* 500 *μF* *d)* 5 *μF*

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5. Electromagnetic Waves

1. The dimension of $\frac{1}{\mu_o \varepsilon_o}$ is
   a) $[LT^{-1}]$ *b)* $[L^2T^{-2}]$ *c)* $[L^{-1}T]$ *d)* $[L^{-2}T^2]$

2. If the amplitude of the magnetic field is $3 \times 10^{-6}\ T$, then amplitude of the electric field for a electromagnetic waves is
   a) $100\ V\,m^{-1}$ *b)* $300\ V\,m^{-1}$ *c)* $600\ V\,m^{-1}$ *d)* $900\ V\,m^{-1}$

3. Which of the following electromagnetic radiation is used for viewing objects through fog?
   a) microwave *b)* gamma rays *c)* X- rays *d)* infrared rays

4. Which of the following are false for electromagnetic waves?
   a) transverse *b)* mechanical waves
   c) longitudinal *d)* produced by accelerating charges

5. Consider an oscillator which has a charged particle and oscillates about its mean position with a frequency of *300 MHz*. The wavelength of electromagnetic waves produced by this oscillator is
   a) *1 m* *b)* *10 m* *c)* *100 m* *d)* *1000 m*

6. The electric and the magnetic field, associated with an electromagnetic wave, propagating along X axis can be represented by
   a) $\vec{E} = E_o\,\hat{j}$ and $\vec{B} = B_o\,\hat{k}$ *b)* $\vec{E} = E_o\,\hat{k}$ and $\vec{B} = B_o\,\hat{j}$
   c) $\vec{E} = E_o\,\hat{\imath}$ and $\vec{B} = B_o\,\hat{j}$ *d)* $\vec{E} = E_o\,\hat{j}$ and $\vec{B} = B_o\,\hat{\imath}$

7. In an electromagnetic wave in free space the *rms* value of the electric field is $3\ V\,m^{-1}$. The peak value of the magnetic field is
   a) $1.414 \times 10^{-8}\ T$ *b)* $1.0 \times 10^{-8}\ T$
   c) $2.828 \times 10^{-8}\ T$ *d)* $2.0 \times 10^{-8}\ T$

8. During the propagation of electromagnetic waves in a medium:
   a) electric energy density is double of the magnetic energy density
   b) electric energy density is half of the magnetic energy density
   c) electric energy density is equal to the magnetic energy density
   d) both electric and magnetic energy densities are zero

9. If the magnetic monopole exists, then which of the Maxwell's equation to be modified?
   a) $\oint \vec{E}.\overrightarrow{dA} = \frac{Q_{closed}}{\varepsilon_o}$ *b)* $\oint \vec{E}.\overrightarrow{dA} = 0$
   c) $\oint \vec{E}.\overrightarrow{dA} = \mu_o$ *d)* $\oint \vec{E}.\overrightarrow{dl} = -\frac{d}{dt}\Phi_B$

10. A radiation of energy E falls normally on a perfectly reflecting surface. The momentum transferred to the surface
    a) $\frac{E}{c}$ *b)* $2\frac{E}{c}$ *c)* Ec *d)* $\frac{E}{c^2}$

11. Which of the following is an electromagnetic wave?
a) α – rays *b)* β – rays *c)* γ – rays *d)* all of them

12. Which one of them is used to produce a propagating electromagnetic wave?
a) an accelerating charge
b) a charge moving at constant velocity
c) a stationary charge
d) an uncharged particle

13. Let $E = E_o \sin(10^6 x - \omega t)$ be the electric field of plane electromagnetic wave, the value of ω is
a) $0.3 \times 10^{-14}\ rad\ s^{-1}$ *b)* $3 \times 10^{-14}\ rad\ s^{-1}$
c) $0.3 \times 10^{14}\ rad\ s^{-1}$ *d)* $3 \times 10^{14}\ rad\ s^{-1}$

14. Which of the following is NOT true for electromagnetic waves?
a) it transport energy *b)* it transport momentum
c) it transport angular momentum
d) in vacuum, it travels with different speeds which depend on their frequency

15. The electric and magnetic fields of an electromagnetic wave are
a) in phase and perpendicular to each other
b) out of phase and not perpendicular to each other
c) in phase and not perpendicular to each other
d) out of phase and perpendicular to each other

6. Optics

1. The speed of light in an isotropic medium depends on,
a) its intensity
b) its wavelength
c) the nature of propagation
d) the motion of the source with respect to medium

2. A rod of length *10 cm* lies along the principal axis of a concave mirror of focal length *10 cm* in such a way that its end closer to the pole is *20 cm* away from the mirror. The length of the image is,
a) *2.5 cm* *b)* *5 cm* *c)* *10 cm* *d)* *15 cm*

3. An object is placed in front of a convex mirror of focal length of *f* and the maximum and minimum distance of an object from the mirror such that the image formed is real and magnified.
a) *2f* and *c* *b)* *c* and ∞ *c)* *f* and *O* *d)* None of these

4. For light incident from air on a slab of refractive index *2*, the maximum possible angle of refraction is,
a) 30° *b)* 45° *c)* 60° *d)* 90°

5. Stars twinkle due to,
a) reflection *b)* total internal reflection *c)* refraction *d)* polarization

6. If the velocity and wavelength of light in air is V_a and λ_a and that in water is V_w and λ_w, then the refractive index of water is,
   a) $\frac{V_w}{V_a}$ *b)* $\frac{V_a}{V_w}$ *c)* $\frac{\lambda_w}{\lambda_a}$ *d)* $\frac{V_a}{V_w}\frac{\lambda_a}{\lambda_w}$

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

8. The radius of curvature of curved surface at a thin planoconvex lens is *10 cm* and the refractive index is *1.5*. If the plane surface is silvered, then the focal length will be,
   a) *5 cm* *b)* *10 cm* *c)* *15 cm* *d)* *20 cm*

9. An air bubble in glass slab of refractive index *1.5* (near normal incidence) is *5 cm* deep when viewed from one surface and *3 cm* deep when viewed from the opposite face. The thickness of the slab is,
   a) *8 cm* *b)* *10 cm* *c)* *12 cm* *d)* *16 cm*

10. A ray of light travelling in a transparent medium of refractive index *n* falls, on a surface separating the medium from air at an angle of incidents of 45^o. The ray can undergo total internal reflection for the following *n*,
    a) *n = 1.25* *b)* *n = 1.33* *c)* *n = 1.4* *d)* *n = 1.5*

11. A plane glass is placed over a various coloured letters (violet, green, yellow, red) The letter which appears to be raised more is,
    a) red *b)* yellow *c)* green *d)* violet

12. Two point white dots are *1 mm* apart on a black paper. They are viewed by eye of pupil diameter *3 mm* approximately. The maximum distance at which these dots can be resolved by the eye is, [take wavelength of light, $\lambda = 500\ nm$]
    a) *1 m* *b)* *5 m* *c)* *3 m* *d)* *6 m*

13. In a Young's double-slit experiment, the slit separation is doubled. To maintain the same fringe spacing on the screen, the screen-to-slit distance D must be changed to,
    a) $2D$ *b)* $\frac{D}{2}$ *c)* $\sqrt{2}D$ *d)* $\frac{D}{\sqrt{2}}$

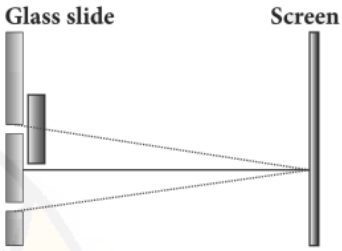
14. Two coherent monochromatic light beams of intensities *I* and *4I* are superposed. The maximum and minimum possible intensities in the resulting beam are
    a) *5I* and *I* *b)* *5I* and *3I* *c)* *9I* and *I* *d)* *9I* and *3I*

15. When light is incident on a soap film of thickness $5 \times 10^{-3}\ cm$, the wavelength of light reflected maximum in the visible region is 5320 Å. Refractive index of the film will be,
    a) *1.22* *b)* *1.33* *c)* *1.51* *d)* *1.83*

16. First diffraction minimum due to a single slit of width $1.0 \times 10^{-5}\ cm$ is at 30°. Then wavelength of light used is,
a) 400 Å *b)* 500 Å *c)* 600 Å *d)* 700 Å

17. A ray of light strikes a glass plate at an angle 60°. If the reflected and refracted rays are perpendicular to each other, the refractive index of the glass is,
a) $\sqrt{3}$ *b)* $\frac{3}{2}$ *c)* $\sqrt{\frac{3}{2}}$ *d)* 2

18. One of the of Young's double slits is covered with a glass plate as shown in figure. The position of central maximum will,



a) get shifted downwards
b) get shifted upwards
c) will remain the same
d) data insufficient to conclude

19. Light transmitted by Nicol prism is,
a) partially polarised *b)* unpolarised
c) plane polarised *d)* elliptically polarised

20. The transverse nature of light is shown in,
a) interference *b)* diffraction
c) scattering *d)* polarisation

7. Dual Nature Of Radiation And Matter

1. The wavelength λ_e of an electron and λ_p of a photon of same energy E are related by
a) $\lambda_p \propto \lambda_e$ *b)* $\lambda_p \propto \sqrt{\lambda_e}$ *c)* $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$ *d)* $\lambda_p \propto \lambda_e^2$

2. In an electron microscope, the electrons are accelerated by a voltage of *14 kV*. If the voltage is changed to *224 kV*, then the de Broglie wavelength associated with the electrons would
a) increase by 2 times *b)* decrease by 2 times
c) decrease by 4 times *d)* increase by 4 times

3. A particle of mass $3 \times 10^{-6}\ g$ has the same wavelength as an electron moving with a velocity $6 \times 10^{6}\ m\ s^{-1}$. The velocity of the particle is
a) $1.82 \times 10^{-18}\ m\ s^{-1}$ *b)* $9 \times 10^{-2}\ m\ s^{-1}$
c) $3 \times 10^{-31}\ m\ s^{-1}$ *d)* $1.82 \times 10^{-15}\ m\ s^{-1}$

4. When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ, the stopping potential is $\frac{V}{4}$. Th e threshold wavelength for the metallic surface is
a) 4λ *b)* 5λ *c)* $\frac{5}{2}\lambda$ *d)* 3λ

5. If a light of wavelength *330 nm* is incident on a metal with work function *3.55 eV*, the electrons are emitted. Then the wavelength of the emitted electron is (Take $h = 6.6 \times 10^{-34}\ J\ s$)
   a) $< 2.75 \times 10^{-9}\ m$ *b)* $\geq 2.75 \times 10^{-9}\ m$
   c) $\leq 2.75 \times 10^{-12}\ m$ *d)* $< 2.5 \times 10^{-10}\ m$

6. In photoelectric emission, a radiation whose frequency is *4* times threshold frequency of a certain metal is incident on the metal. Then the maximum possible velocity of the emitted electron will be
   a) $\frac{hc}{\lambda}$ *b)* $\frac{2hc}{\lambda}$ *c)* $\frac{hc}{3\lambda}$ *d)* $\frac{hc}{2\lambda}$

7. A photoelectric surface is illuminated successively by monochromatic light of wavelength λ and $\frac{\lambda}{2}$. If the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times that in the first case, the work function at the surface of material is
   a) $\sqrt{\frac{hv_o}{m}}$ *b)* $\sqrt{\frac{6hv_o}{m}}$ *c)* $2\sqrt{\frac{hv_o}{m}}$ *d)* $\sqrt{\frac{hv_o}{2m}}$

8. Two radiations with photon energies *0.9 eV* and *3.3 eV* respectively are falling on a metallic surface successively. If the work function of the metal is *0.6 eV*, then the ratio of maximum speeds of emitted electrons will be
   a) 1 : 4 *b) 1 : 3* *c) 1 : 1* *d) 1 : 9*

9. A light source of wavelength 520 nm emits 1.04×10^{15} photons per second while the second source of 460 nm produces 1.38×10^{15} photons per second. Then the ratio of power of second source to that of first source is
   a) 1.00 *b) 1.02* *c) 1.5* *d) 0.98*

10. The mean wavelength of light from sun is taken to be 550 nm and its mean power is $3.8 \times 10^{26} W$. The number of photons received by the human eye per second on the average from sunlight is of the order of
    a) 10^{45} *b)* 10^{42} *c)* 10^{54} *d)* 10^{51}

11. The threshold wavelength for a metal surface whose photoelectric work function is 3.313 eV is
    a) 4125 Å *b)* 3750 Å *c)* 6000 Å *d)* 2062.5 Å

12. A light of wavelength 500 nm is incident on a sensitive plate of photoelectric work function 1.235 eV. The kinetic energy of the photo electrons emitted is be (Take $h = 6.6 \times 10^{-34}\ J\ s$)
    a) 0.58 eV *b) 2.48 eV* *c) 1.24 eV* *d) 1.16 eV*

13. Photons of wavelength λ are incident on a metal. The most energetic electrons ejected from the metal are bent into a circular arc of radius *R* by a perpendicular magnetic field having magnitude *B*. The work function of the metal is
    a) $\frac{hc}{\lambda} - m_e + \frac{e^2 B^2 R^2}{2m_e}$ *b)* $\frac{hc}{\lambda} + 2m_e\left(\frac{e\,BR}{2m_e}\right)^2$
    c) $\frac{hc}{\lambda} - m_e c^2 - \frac{e^2 B^2 R^2}{2m_e}$ *d)* $\frac{hc}{\lambda} - 2m_e\left(\frac{e\,BR}{2m_e}\right)^2$

14. The work functions for metals A, B and C are *1.92 eV, 2.0 eV* and *5.0 eV* respectively. The metals which will emit photoelectrons for a radiation of wavelength 4100Å is/are
a) A only *b)* both A and B *c)* all these metals *d)* none

15. Emission of electrons by the absorption of heat energy is called _____ emission.
a) photoelectric *b)* field *c)* thermionic *d)* secondary

8. Atomic And Nuclear Physics

1. Suppose an alpha particle accelerated by a potential of V volt is allowed to collide with a nucleus whose atomic number is Z, then the distance of closest approach of alpha particle to the nucleus is
a) $14.4\ \frac{Z}{V}$ Å *b)* $14.4\ \frac{V}{Z}$ Å *c)* $1.44\ \frac{Z}{V}$ Å *d)* $1.44\ \frac{V}{Z}$ Å

2. In a hydrogen atom, the electron revolving in the fourth orbit, has angular momentum equal to
a) h *b)* $\frac{h}{\pi}$ *c)* $\frac{4h}{\pi}$ *d)* $\frac{2h}{\pi}$

3. Atomic number of H-like atom with ionization potential *122.4 V* for $n = 1$ is
a) 1 *b)* 2 *c)* 3 *d)* 4

4. The ratio between the first three orbits of hydrogen atom is
a) *1:2:3* *b)* *2:4:6* *c)* *1:4:9* *d)* *1:3:5*

5. The charge of cathode rays is
a) positive *b)* negative *c)* neutral *d)* not defined

6. In J.J. Thomson e/m experiment, a beam of electron is replaced by that of muons (particle with same charge as that of electrons but mass 208 times that of electrons). No deflection condition is achieved only if
a) B is increased by 208 times *b)* B is decreased by 208 times
c) B is increased by 14.4 times *d)* B is decreased by 14.4 times

7. The ratio of the wavelengths for the transition from $n = 2$ to $n = 1$ in Li^{++}, He^{+} and H is
a) *1:2:3* *b)* *1:4:9* *c)* *3:2:1* *d)* *4:9:36*

8. The electric potential between a proton and an electron is given by $V = V_o \ln\left(\frac{r}{r_o}\right)$, where r_o is a constant. Assume that Bohr atom model is applicable to potential, then variation of radius of n^{th} orbit r_n with the principal quantum number n is
a) $r_n \propto \frac{1}{n}$ *b)* $r_n \propto n$ *c)* $r_n \propto \frac{1}{n^2}$ *d)* $r_n \propto n^2$

9. If the nuclear radius of ^{27}Al is *3.6* fermi, the approximate nuclear radius of ^{64}Cu is
a) 2.4 *b)* 1.2 *c)* 4.8 *d)* 3.6

10. The nucleus is approximately spherical in shape. Then the surface area of nucleus having mass number A varies as
a) $A^{2}/_{3}$ *b)* $A^{4}/_{3}$ *c)* $A^{1}/_{3}$ *d)* $A^{5}/_{3}$

11. The mass of a $^{7}_{3}Li$ nucleus is *0.042 u* less than the sum of the masses of all its nucleons. The binding energy per nucleon of $^{7}_{3}Li$ nucleus is nearly
a) *46 MeV* *b)* *5.6 MeV* *c)* *3.9 MeV* *d)* *23 MeV*

12. M_p denotes the mass of the proton and M_n denotes mass of a neutron. A given nucleus of binding energy *B*, contains *Z* protons and *N* neutrons. The mass *M(N,Z)* of the nucleus is given by(where *c* is the speed of light)
a) $M\,(N,Z) = NM_n + ZM_p - Bc^2$ *b)* $M\,(N,Z) = NM_n + ZM_p + Bc^2$
c) $M\,(N,Z) = NM_n + ZM_p - B/c^2$ *d)* $M\,(N,Z) = NM_n + ZM_p + B/c^2$

13. A radioactive nucleus (initial mass number A and atomic number Z) emits 2α and 2 positrons. The ratio of number of neutrons to that of proton in the final nucleus will be
a) $\frac{A-Z-4}{z-2}$ *b)* $\frac{A-Z-2}{z-6}$ *c)* $\frac{A-Z-4}{z-6}$ *d)* $\frac{A-Z-12}{z-4}$

14. The half-life period of a radioactive element A is same as the mean life time of another radioactive element B. Initially both have the same number of atoms. Then
a) A and B have the same decay rate initially *b)* A and B decay at the same rate always
c) B will decay at faster rate than A *d)* A will decay at faster rate than B.

15. A system consists of N_o nucleus at t = 0. The number of nuclei remaining after half of a half-life (that is, at time $t = \frac{1}{2}T_{\frac{1}{2}}$)
a) $\frac{N_o}{2}$ *b)* $\frac{N_o}{\sqrt{2}}$ *c)* $\frac{N_o}{4}$ *d)* $\frac{N_o}{8}$

9. Semiconductor Electronics

1. The barrier potential of a silicon diode is approximately,
a) 0.7 *V* *b)* 0.3 *V* *c)* 2.0 *V* *d)* 2.2 *V*

2. Doping a semiconductor results in
a) The decrease in mobile charge carriers *b)* The change in chemical properties
c) The change in the crystal structure *d)* The breaking of the covalent bond

3. A forward biased diode is treated as
a) An open switch with infinite resistance
b) A closed switch with a voltage drop of 0 V
c) A closed switch in series with a battery voltage of 0.7V
d) A closed switch in series with a small resistance and a battery.

4. If a half –wave rectified voltage is fed to a load resistor, which part of a cycle the load current will flow?
a) $0° - 90°$ *b)* $90° - 180°$ *c)* $0° - 180°$ *d)* $0° - 360°$

5. The primary use of a Zener diode is
   a) Rectifier *b)* Amplifier *c)* Oscillator *d)* Voltage regulator

6. The principle in which a solar cell operates
   a) Diffusion *b)* Recombination *c)* Photovoltaic action *d)* Carrier flow

7. The light emitted in an LED is due to
   a) Recombination of charge carriers
   b) Reflection of light due to lens action
   c) Amplification of light falling at the junction
   d) Large current capacity

8. When a transistor is fully switched on, it is said to be
   a) Shorted *b)* Saturated
   c) Cut-off *d)* Open

9. The specific characteristic of a common emitter amplifier is
   a) High input resistance *b)* Low power gain
   c) Signal phase reversal *d)* Low current gain

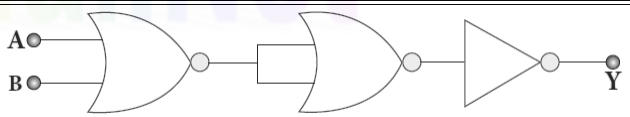
10. To obtain sustained oscillation in an oscillator,
    a) Feedback should be positive
    b) Feedback factor must be unity
    c) Phase shift must be 0 or 2π
    d) All the above

11. If the input to the NOT gate is A = 1011, its output is
    a) 0100 *b) 1000* *c) 1100* *d) 0011*

12. The electrical series circuit in digital form is
    a) AND *b) OR* *c) NOR* *d) NAND*

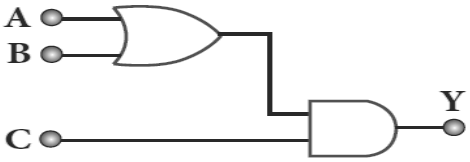
13. Which one of the following represents forward bias diode?
    a. 0 V, R, −2 V
    b. −4 V, R, −3 V
    c. −2 V, R, +2 V
    d. −3 V, R, +5 V

14. The given electrical network is equivalent to



    a) AND gate *b)* OR gate *c)* NOR gate *d)* NOT gate

15. The output of the following circuit is 1 when the input ABC is



    a) 101 *b)* 100
    c) 110 *d)* 010

10. Communication Systems

1. The output transducer of the communication system converts the radio signal into _____
   a) Sound *b)* Mechanical energy *c)* Kinetic energy *d)* None of the above

2. The signal is affected by noise in a communication system
   a) At the transmitter *b)* At the modulator *c)* In the channel *d)* At the receiver

3. The variation of frequency of carrier wave with respect to the amplitude of the modulating signal is called _____
   a) Amplitude modulation *b)* Frequency modulation
   c) Phase modulation *d)* Pulse width modulation

4. The internationally accepted frequency deviation for the purpose of FM broadcasts.
   a) *75 kHz* *b)* *68 kHz* *c)* *80 kHz* *d)* *70 kHz*

5. The frequency range of *3 MHz* to *30 MHz* is used for
   a) Ground wave propagation *b)* Space wave propagation
   c) Sky wave propagation *d)* Satellite communication

11. Recent Developments In Physics

1. The particle size of *ZnO* material is *30 nm*. Based on the dimension it is classified as
   a) Bulk material *b)* Nanomaterial
   c) Soft material *d)* Magnetic material

2. Which one of the following is the natural nanomaterial?
   a) Peacock feather *b)* Peacock beak *c)* Grain of sand *d)* Skin of the Whale

3. The blue print for making ultra durable synthetic material is mimicked from
   a) Lotus leaf *b)* Morpho butterfly *c)* Parrot fish *d)* Peacock feather

4. The method of making nanomaterial by assembling the atoms is called
   a) Top down approach *b)* Bottom up approach
   c) Cross down approach *d)* Diagonal approach

5. "Sky wax" is an application of nano product in the field of
   a) Medicine *b)* Textile *c)* Sports *d)* Automotive industry

6. The materials used in Robotics are
   a) Aluminium and silver *b)* Silver and gold
   c) Copper and gold *d)* Steel and aluminum

7. The alloys used for muscle wires in Robots are
   a) Shape memory alloys *b)* Gold copper alloys
   c) Gold silver alloys *d)* Two dimensional alloys

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8. The technology used for stopping the brain from processing pain is
   a) Precision medicine *b)* Wireless brain sensor
   c) Virtual reality *d)* Radiology

9. The particle which gives mass to protons and neutrons are
   a) Higgs particle *b)* Einstein particle *c)* Nanoparticle *d)* Bulk particle

10. The gravitational waves were theoretically proposed by
   a) Conrad Rontgen *b)* Marie Curie
   c) Albert Einstein *d)* Edward Purcell

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1. ELECTROSTATICS

SHORT ANSWER QUESTIONS (BOOK BACK)

1. What is meant by quantisation of charges?
2. Write down Coulomb's law in vector form and mention what each term represents.
3. What are the differences between Coulomb force and gravitational force?
4. Write a short note on superposition principle.
5. Define 'Electric field'.
6. What is mean by 'Electric field lines'?
7. The electric field lines never intersect. Justify.
8. Define 'Electric dipole'
9. What is the general definition of electric dipole moment?
10. Define 'electrostatic potential".
11. What is an equipotential surface?
12. What are the properties of an equipotential surface?
13. Give the relation between electric field and electric potential.
14. Define 'electrostatic potential energy'.
15. Define 'electric flux'
16. What is meant by electrostatic energy density?
17. Write a short note on 'electrostatic shielding'.
18. What is Polarisation?
19. What is dielectric strength?
20. Define 'capacitance'. Give its unit.
21. What is 'action of points' or 'corona discharge'?

SHORT ANSWER QUESTIONS (CONCEPTUAL)

22. What is Electrostatics?
23. What is called triboelectric charging?
24. Like charges repels. Unlike charges attracts. Prove.
25. State conservation of electric charges.
26. State Coulomb's law in electrostatics
27. Define relative permittivity.
28. Define one coulomb (1 C)
29. Define linear charge density.
30. Define surface charge density.
31. Define volume charge density.
32. Define potential difference. Give its unit.
33. State Gauss law.

34. During lightning, it is safer to sit inside bus than in an open ground or under tree. Why?
35. Define electrostatic induction.
36. Define dielectrics or insulators.
37. What are called non-polar molecules? Give examples.
38. What are called polar molecules? Give examples.
39. Define electric susceptibility.
40. Define dielectric breakdown.
41. What is called a capacitor?

SHORT ANSWER QUESTIONS (3 Mark Questions)

1. Discuss the basic properties of electric charge.
2. Define superposition principle. Explain how superposition principle explains the interaction between multiple charges.
3. Explain Electric field at a point due to system of charges (or) Superposition of electric fields.
4. List the properties of electric field lines.
5. Derive an expression for torque experienced by an electric dipole placed in the uniform electric field.
6. Obtain an expression electric potential at a point due to a point charge.
7. Obtain an expression for potential energy due to a collection of three point charges which are separated by finite distances.
8. Obtain an expression for electrostatic potential energy of a dipole in a uniform electric field.
9. Explain the process of electrostatic induction.
10. Derive an expression for capacitance of parallel plate capacitor.
11. Derive an expression for energy stored in capacitor
12. Explain in detail how charges are distributed in a conductor and the principle behind the lightning conductor.
13. Explain the principle, construction and action of lightning conductor.
14. Give the applications and disadvantage of capacitors
15. Define equipotential surface. Give its properties.
16. Write a note on microwave oven.

LONG ANSWER QUESTIONS (5 mark Questions)

1. Explain in detail Coulomb's law and its various aspects.
2. Define electric field. Explain its various aspects.
3. How do we determine the electric field due to a continuous charge distribution? Explain.
4. Calculate the electric field due to a dipole on its axial line.
5. Calculate the electric field due to a dipole on its equatorial line.
6. Derive an expression for electro static potential due to electric dipole.
7. Obtain an expression for electric field due to an infinitely long charged wire.
8. Obtain an expression for electric field due to an charged infinite plane sheet.

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UNIT - 1

9. Obtain an expression for electric field due to an uniformly charged spherical shell.
10. Discuss the various properties of conductors in electrostatic equilibrium.
11. Obtain Gauss law from Coulomb's law.
12. Explain dielectrics in detail and how an electric field is induced inside a dielectric.
13. Explain in detail the effect of dielectric placed in a parallel plate capacitor when the capacitor is disconnected from the battery.
14. Explain in detail the effect of dielectric placed in a parallel plate capacitor when the battery remains connected to the capacitor.
15. Derive the expression for resultant capacitance, when capacitors are connected in series
16. Derive the expression for resultant capacitance, when capacitors are connected in parallel.
17. Explain in detail the construction and working of Van de Graff generator.

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UNIT - 1

2. CURRENT ELECTRICITY

SHORT ANSWER QUESTIONS (BOOK BACK)

1. Current is a scalar quantity. Why?
2. Differentiate drift velocity and mobility?
3. Define current density.
4. Give the microscopic form of Ohm's law.
5. Give the macroscopic form of Ohm's law.
6. What are called ohmic and non ohmic materials?
7. Define resistivity of the material.
8. Define temperature coefficient of resistivity.
9. Define Superconductivity.
10. Distinguish electric energy and electric power.
11. Prove that the expression for power in an electrical circuit is P = VI
12. Write down the various equations for power.
13. State Kirchoff's first law (current rule or junction rule)
14. State Kirchoff's second law (voltage rule or loop rule)
15. State the principle of potentiometer.
16. Define the internal resistance of the cell.
17. State Joule's law of heating.
18. Define Seebeck effect.
19. Define Thomson's effect.
20. Define Peltier effect.
21. What are the applications of Seebeck effect?

SHORT ANSWER QUESTIONS (CONCEPTUAL)

22. Define current electricity.
23. Define electric current.
24. What is called conventional current?
25. What are called free electrons and positive ions?
26. Define one ampere (1 A)
27. Define resistance of the conductor.
28. What are the factors that the resistance depends on?
29. Define conductivity of the material.
30. Repairing the electrical connection with the wet skin is always dangerous. Why?
31. What is called electric cell (battery)?
32. Define electromotive force.
33. Give the sign convention followed by the Kirchoff's current rule.
34. Give the sign convention followed by the Kirchoff's votage rule.
35. What is called Galvanometer?
36. What is called Joule's heating effect of current?
37. What are the properties of the substance used as heating element?
38. Write a note on electric fuses.
39. Write a note on circuit breakers (trippers)
40. Write a note on electric bulb or lamp.

SHORT ANSWER QUESTIONS (3 MARKS)

1. Obtain an expression for drift velocity. How it is related with the mobility?
2. Derive the relation between the drift velocity and the current.
3. Write a note on carbon resistors.
4. Define temperature coefficient of resistivity. Obtain an expression for it.

5. Write a note on electric cells in series.
6. Write a note on electric cells in parallel.
7. Explain the principle of potentiometer.
8. Explain Seebeck effect. Give its applications.
9. Explain Peltier effect.
10. Distinguish between Peltier effect and Joule's effect.
11. Explain Thomson effect.

LONG ANSWER QUESTIONS (5 MARKS)

1. Describe the microscopic model of current and obtain general form of Ohm's law.
2. Obtain the macroscopic form of Ohm's law from its microscopic form and discuss its limitation.
3. Explain the equivalent resistance of a series and parallel resistor network.
4. Explain the determination of the internal resistance of a cell using voltmeter.
5. Explain Kirchhoff's law.
6. Obtain the condition for bridge balance in Wheatstone's bridge.
7. Explain the determination of unknown resistance using meterbridge.
8. How the emf of two cells are compared using potentiometer?
9. Explain the method of measurement of internal resistance of a cell using potentiometer.

3. MAGNETISM AND MAGNETIC EFFECTS OF ELECTRIC CURRENT

SHORT ANSWER QUESTIONS (BOOK BACK)

1. Define magnetic field.
2. Define magnetic flux. Give its unit.
3. Define magnetic dipole moment.
4. State Coulomb's inverse square law of magnetism.
5. Define magnetic susceptibility.
6. Define magnetic permeability.
7. State Ampere's circuital law.
8. State Biot-Savart law.
9. What are called dia, para and ferro magnetic material?
10. What is Hysteresis?

SHORT ANSWER QUESTIONS (CONCEPTUAL)

11. Define magnetism. Give its applications.
12. Define Geomagnetism or Terrestrial magnetism.
13. What are the elements of the Earth's magnetic field?
14. Define geographic meridian and magnetic meridian.
15. Define magnetic declination.
16. For Chennai, the magnetic declination angle is $-1^\circ\, 8'$. Why it is negative?
17. Define magnetic inclination or dip.
18. Define horizontal component of Earth's magnetic field.
19. Calculate the tangent of magnetic inclination or angle of dip.
20. Define pole strength of the magnet.
21. What are the types of magnet?
22. Define magnetic flux density.
23. Distinguish between uniform and non-uniform magnetic field.
24. Discuss the types of force between two magnetic pole strength.
25. What happens when a bar magnet is freely suspended in uniform and non-uniform magnetic field?
26. State tangent law.
27. Define magnetizing field.
28. Define relative permeability.
29. Define intensity of magnetization.
30. Define magnetic induction or total magnetic field.
31. What are the classifications of magnetic materials?
32. Define Meissner effect.
33. Define Curie's law.
34. Define curie temperature.
35. State Curie - Weiss law.
36. Define hysteresis loss.
37. What are the types of ferromagnetic materials?
38. State right hand thumb rule.
39. State Maxwell's right hand cork screw rule.
40. Define magnetic dipole moment of current loop.
41. State right hand thumb rule.
42. Define gyro-magnetic ratio.
43. Define Bohr magneton.
44. Define Lorentz force.
45. Define one tesla.
46. What are the limitations of cyclotron?

47. Write a note on fast-neutron cancer therapy.
48. State Fleming's left hand rule (FLHR).
49. Define one ampere.
50. Define figure of merit of a galvanometer.
51. Define current sensitivity of a galvanometer.
52. How the current sensitivity of galvanometer can be increased?
53. Why Phosphor - bronze is used as suspension wire?
54. Define voltage sensitivity of the galvanometer.
55. How galvanometer can be converted in to ammeter?
56. How galvanometer can be converted in to voltmeter?
57. Why ammeter should always connected in series to the circuit?
58. Why voltmeter should always connected in parallel to the circuit?

SHORT ANSWER QUESTIONS (3 Marks)

1. What are the properties of bar magnet?
2. Write a note on pole strength.
3. Give the properties of magnetic field lines.
4. Explain Coulomb's inverse square law in magnetism.
5. Calculate the torque acting on a bar magnet in uniform magnetic field.
6. Obtain an expression for potential energy of a bar magnet placed in an uniform magnetic field.
7. What are the precausions taken while using tangent galvanometer (TG)
8. Using the relation $\vec{B} = \mu_o(\vec{H} + \vec{M})$ show that $\chi_m = \mu_r - 1$
9. Explain Dia magnetism.
10. Explain Para magnetism.
11. Explain Ferro magnetism.
12. List the properties of Diamagnetic materials.
13. List the properties of Paramagnetic materials.
14. List the properties of Ferromagnetic materials.
15. Explain the applications of hysteresis loop.
16. Explain the magnetic field around a straight current carrying conductor.
17. What are the differences between soft and hard ferromagnetic materials?
18. Explain the magnetic field around the current carrying circular loop.
19. State and explain Biot-Savart law.
20. Explain the current loop acts as a magnetic dipole and calculate its dipole moment.
21. Give the difference between Coulomb's law and Biot-Savart's law.
22. Explain current carrying solenoid behaves like a bar magnet.
23. Write a note in MRI.
24. Define Lorentz force. Give the properties of Lorentz magnetic force.
25. Write a note on velocity selector.
26. How Galvanometer can be converted in to Ammeter.
27. How Galvanometer can be converted in to voltmeter?
28. Differentiate Scalar, Vector and Tensor.

LONG ANSWER QUESTIONS (5 Marks)

1. Discuss Earth's magnetic field in detail.
2. Calculate the magnetic induction at a point on the axial line of a bar magnet.
3. Obtain the magnetic induction at a point on the equatorial line of a bar magnet.
4. What is tangent law? Discuss in detail. Explain the principle, construction and working of tangent galvanometer.
5. Define Hysteresis. Explain it with help of diagram.
6. Deduce the relation for magnetic induction at a point due to an infinitely long straight conductor carrying current.
7. Obtain a relation for the magnetic induction at a point along the axis of a circular coil carrying current.
8. Compute the magnetic dipole moment of revolving electron. Define bohr magneton.
9. Using Ampere's law, obtain an expression for magnetic field due to the current carrying wire of infinite length.
10. Obtain an expression for magnetic field due to long current carrying solenoid.
11. Obtain the magnetic fields at various points on the toroid.
12. Obtain the expression for force on a moving charge in a magnetic field.
13. Describe the principle, construction and working of Cyclotron.
14. Obtain an expression for the force on a current carrying conductor placed in a magnetic field.
15. Obtain a force between two long parallel current carrying conductors. Hence define ampere.
16. Deduce expressions for torque on a current loop placed in magnetic field when unit vector $\hat{n}$ is perpendicular to $\vec{B}$
17. Deduce expressions for torque on a current loop placed in magnetic field when unit vector $\hat{n}$ is at an angle θ with $\vec{B}$
18. Describe the principle, construction and working of moving coil galvanometer.

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UNIT - 3

4. ELECTROMAGNETIC INDUCTION AND ALTERNATE CURRENT

SHORT ANSWER QUESTIONS (BOOK BACK)

1. Define electromagnetic induction.
2. State Faraday's laws of electromagnetic induction.
3. State Lenz's law.
4. State Fleming's right hand rule.
5. What are called eddy currents? How are they produced?
6. What the methods of producing induced emf?
7. What is called inductor?
8. What is called self induction?
9. What is called mutual induction?
10. State the principle of AC generator (alternator)
11. What are the advantages of stationary armature - rotating field alternator?
12. Distinguish between step up and step down transformer.
13. Define mean value or average value of AC.
14. Define RMS value of AC.
15. Define phasor and phasor diagram.
16. Define resonance.
17. Define resonance frequency.
18. Define Q - factor or quality factor.
19. Define wattless current.
20. Define power factor.
21. What are called LC oscillations?

SHORT ANSWER QUESTIONS (CONCEPTUAL)

22. Define magnetic flux.
23. What is the importance of electromagnetic induction?
24. A spherical stone and a spherical metallic ball of same size and mass are dropped from the same height. Which one will reach earth's surface first? Justify your answer.
25. Define self inductance or coefficient of self induction.
26. Define the unit of self inductance (one henry)
27. Define mutual inductance or coefficient of mutual induction.
28. How an emf is induced by changing the magnetic field?
29. What is called AC generator or alternator?
30. State single phase AC generator.
31. State three phase AC generators.
32. What are the advantages of three phase AC generators?
33. What is called transformer?
34. State the principle of transformer.
35. Define the efficiency of the transformer.
36. Define Sinusoidal alternating voltage.
37. Define effective value of alternating current.
38. The common house hold appliances, the voltage rating is specified as 230 V, 50 Hz. What is the meaning of it?
39. Define Phasor diagram
40. Draw the phasor diagram for an alternating voltage $v = V_m \sin \omega t$
41. Define inductive reactance.
42. An inductor blocks AC but it allows DC. Why?
43. Define capacitive reactance.

44. A capacitor blocks DC but it allows AC. Why?
45. What are the applications of series RLC resonant circuit?
46. Resonance will occur only in LC circuits. Why?
47. Define power in an AC circuits.
48. Define Flux linkage.
49. Define impedance of RLC circuit.

SHORT ANSWER QUESTIONS (3 Marks)

1. Establish the fact that the relative motion between the coil and the magnet induces an emf in the coil of a closed circuit.
2. Prove that experimentally if the current in a one closed circuit changes, an emf is induced in another circuit.
3. How we understood the conclusions obtained from Faraday's experiment.
4. State and explain Faraday's laws of electromagnetic induction.
5. Give an illustration of determining direction of induced current by using Lenz's law.
6. Show that Lenz's law is in accordance with the law of conservation of energy.
7. Obtain an expression for motional emf from Faraday's law.
8. Obtain an expression for motional emf from Lorentz force.
9. Explain energy conservation.
10. Define eddy currents. Demonstrate the production of eddy currents.
11. What are the drawbacks of Eddy currents? How it is minimized?
12. Explain self induction and define coefficient of self induction on the basis of (1) magnetic flux and (2) induced emf
13. How will you define the unit of inductance?
14. Discuss the physical significance of inductance.
15. Assuming that the length of the solenoid is large when compared to its diameter, find the equation for its inductance.
16. An inductor of inductance 'L' carries an electric current ' *i* '. How much energy is stored while establishing the current in it?
17. Explain mutual induction. Define coefficient of mutual induction on the basis of (1) magnetic flux and (2) induced emf
18. Show that the mutual inductance between a pair of coils is same ($M_{12}=M_{21}$)
19. How will you induce an emf by changing the area enclosed by the coil.
20. Explain various energy losses in a transformer.
21. Discuss the advantages of AC in long distance power transmission.
22. Obtain the expression for average value of alternating current.
23. Obtain an expression for RMS value of alternating current.
24. Draw the phasor diagram and wave diagram for that current 'i' leads the voltage 'V' by phase angle of 'Φ'
25. Find out the phase relationship between voltage and current in a pure resistive circuit.
26. Find out the phase relationship between voltage and current in a pure inductive circuit.
27. Find out the phase relationship between voltage and current in a pure capacitive circuit.
28. Explain resonance in series RLC circuit.
29. Define quality factor. Obtain an expression for it.
30. Obtain an expression for average power of AC over a cycle. Discuss its special cases.
31. Write a note on wattfull current and wattles current.
32. Define power factor in various ways. Give some examples for power factor.
33. What are the advantages and disadvantages of AC over DC?
34. Show that the total energy is conserved during LC oscillations.

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UNIT - 4

LONG ANSWER QUESTIONS (5 Marks)

1. Explain the applications of eddy currents (or) Foucault currents.
2. Show mathematically that the rotation of a coil in a magnetic field over one rotation induces an alternating emf of one cycle.
3. Elaborate the standard construction details of AC generator.
4. Explain the working of a single - phase AC generator with necessary diagram.
5. How the three different emfs are generated in a three-phase AC generator? Show the graphical representation of these three emfs.
6. Explain the principle, construction and working of transformer.
7. Derive an expression for phase angle between the applied voltage and current in a series RLC circuit.
8. What are called LC oscillations? Explain the generation of LC oscillations..
9. Compare the electromagnetic oscillations of LC circuit with the mechanical oscillations of block-spring system to find the expression for angular frequency of LC oscillators mathematically.

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UNIT - 4

5. ELECTROMAGNETIC WAVES

SHORT ANSWER QUESTIONS (BOOK BACK)

1. Define displacement current.
2. Define electro magnetic waves.
3. Give the modified form of Ampere's circuital law.
4. Define intensity of electromagnetic wave.
5. Define Fraunhofer lines.

SHORT ANSWER QUESTIONS (CONCEPTUAL)

6. Define radiation pressure.
7. What is called pointing vector? Give its unit.
8. Define electromagnetic spectrum.
9. Define dispersion.
10. Define emission spectra.
11. Define absorption spectra.
12. What are the uses of Fraunhofer lines?

SHORT ANSWER QUESTIONS (3 Marks)

1. Discuss briefly the experiment conducted by Hertz to produce and detect electromagnetic spectrum.
2. Obtain an expression for energy density associated with an electromagnetic wave propagating in vacuum or free space.
3. Explain the sources of electromagnetic waves.
4. Write a note on Radio waves.
5. Write a note on infra microwaves.
6. Write a note on infra red rays.
7. Write a note visible light.
8. Write a note on ultra violet rays.
9. Write a note on X - rays.
10. Write a note on gamma rays.

SHORT ANSWER QUESTIONS (5 Marks)

1. 1. Write down Maxwell equations in integral form.
2. Explain the modification of Ampere's circuital law.
3. Explain the properties of electromagnetic waves.
4. Explain in detail the emission spectra.
5. Explain in detail the absorption spectra.

6. OPTICS

SHORT ANSWER QUESTIONS (BOOK BACK)

1. State the laws of reflection.
2. What is the angle of deviation due to reflection?
3. What are the characteristics of the image formed by the plane mirror?
4. Obtain the relation between focal length (f) and radius of curvature (R) of the spherical mirror.
5. What are the Cartesian sign conventions for a spherical mirror?
6. Define optical path.
7. State the laws of refraction.
8. What is the angle of deviation due to refraction?
9. What is the principle of reversibility?
10. Define relative refractive index.
11. Obtain the equation for apparent depth.
12. Why do stars twinkle?
13. Define critical angle and total internal reflection
14. Obtain an expression for critical angle.
15. Obtain the reason for glittering of diamond.
16. What are mirage and looming?
17. Write a note on the prisms making using of total internal reflection.
18. What is Snell's window (or) Radius of illumination?
19. Write a note on optical fibres.
20. Write a note on an endoscope.
21. What are the sign conventions for lens on focal length?
22. Arrive at lens equation from lens maker's formula.
23. Define power of a lens.
24. Define angle of minimum deviation.
25. What is called dispersion of light?
26. Why does sky appears blue colour?
27. How are rainbows formed?
28. Why does sky and Sun looks reddish during sunset and sunrise?
29. Why does cloud appears as white colour?
30. State Rayleigh's scattering law.
31. What are the salient features of corpuscular theory of light?
32. Write a note on wave theory of light.
33. Write a note on electromagnetic wave theory .
34. Write a short note on quantum theory of light.
35. Define wave front.
36. State Huygens's principle.
37. Define interference.
38. What is phase of a wave?
39. Give the relation between phase difference and path difference.
40. What are called coherent sources?
41. Write a note on intensity or amplitude division.
42. Write a note on wavefront division.
43. Write a note on Source and images method.
44. What is bandwidth of interference pattern?
45. What is diffraction?
46. Distinguish between Fresnel and Fraunhofer diffraction.
47. Discuss the special cases on first minimum in Fraunhofer diffraction.
48. What is Fresnel's distance? Obtain an expression for it.

49. What is diffraction grating?
50. What are resolution and resolving power?
51. Distinguish between interference and diffraction.
52. What is Rayleigh's criterion?
53. Define polarization.
54. Distinguish between unpolarized and plane polarized light.
55. Discuss polarization by selective absorption.
56. State and prove Malus' law.
57. Discuss how a plane polarized and partially polarized light will be analyzed using analyzer?
58. List the uses of polaroids.
59. State and prove Brewster's law
60. What is polarizer and analyzer?
61. Defined angle of polarization.
62. Define double refraction.
63. Write a note on pile of plates.
64. Define uniaxial crystal and biaxial crystal.
65. Discuss about Nicol prism.
66. Distinguish between near point focusing and normal focusing.
67. Explain polarization by scattering.
68. Discuss about simple microscope and obtain the equations for magnification for near point focusing and normal focusing.
69. What is the use of an erecting lens in a terrestrial telescope?
70. Why is oil immersed objective preferred in a microscope?
71. What are the merits and demerits of reflecting telescope?
72. What is the use of collimator in spectrometer?
73. What are the uses of spectrometer?
74. What is myopia? What is its remedy?
75. What is hypermetopia? What is its remedy?
76. What is presbyopia?
77. What is astigmatism?

SHORT ANSWER QUESTIONS (CONCEPTUAL)

78. Define reflection.
79. Write a note on real and virtual images formed by a plane mirror.
80. What are the conditions for nature of objects and images regarding plane mirror.
81. What is Spherical mirrors? Mention it types.
82. Distinguish convex mirror and concave mirror?
83. Define paraxial rays and marginal rays.
84. Define refractive index.
85. What is called refraction?
86. Define (1) centre of curvature, (2) Radius of curvature (3) pole, (4) principal axis, (5) focus or focal point, (6) focal length, (7) focal plane
87. What are the conditions to achieve total internal reflection?
88. What is Rayleigh's scattering?
89. How we locate the image formation in spherical mirrors?
90. Write the characteristics of refraction?
91. Write a note on prism.
92. Define dispersive power.
93. What is Dual nature of light ?
94. Write a note on wave nature of light.

95. Can two independent monochromatic sources acts as coherent sources?
96. Give the methods to obtain coherent light waves.
97. What are called constructive and destructive interference?
98. What are the conditions for obtaining clear and broad interference bands?
99. Brilliant colours are exhibited by the surface of oil films and soap bubbles. Why?
100. Define grating element and corresponding points.
101. Define plane of vibration and plane of polarization.
102. How an unpolarized light can be polarized?
103. Explain polarization by reflection.
104. Distinguish between ordinary ray and extra ordinary ray.
105. Define Optic axis.
106. What are the uses and drawbacks of Nicol prism?
107. Explain Young's double slit method.
108. What are called Airy's discs?
109. Give the reason for colourful appearance of the compact disc.

LONG ANSWER QUESTIONS (5 Marks)

1. Derive the mirror equation and the equation for lateral magnification.
2. Describe the Fizeau's method to determine speed of light.
3. Obtain the equation for radius of illumination (or) Snell's window.
4. Derive the equation for acceptance angle and numerical aperture of optical fibre.
5. Derive the equation for lateral displacement of light passing through a glass slab.
6. Derive equation for refraction at single spherical surface.
7. Obtain an equation for lateral magnification due to single spherical surface.
8. Obtain Lens maker formula and mention its significance.
9. Derive the equation for thin lens and obtain its magnification.
10. Derive the equation for effective focal length for lenses in contact.
11. Derive the equation for angle of deviation produced by at prism and thus obtain the equation for refractive index of material of the prism.
12. Derive the equation for effective focal length for lenses in out of contact.
13. What is dispersion? Obtain the equation for dispersive power of a medium.
14. Prove laws of reflection using Huygens principle.
15. Prove laws of refraction using Huygens principle.
16. Obtain the equation for resultant intensity due to interference of light.
17. Obtain the equation for Path difference and band width in Young's double slit experiment.
18. Obtain the equations for constructive and destructive interference for transmitted and reflected waves in thin films.
19. Discuss diffraction at single slit and obtain the condition for n^{th} minimum.
20. Discuss the experiment to determine the wavelength of monochromatic light using diffraction grating.
21. Discuss the diffraction at a grating and obtain the condition for m^{th} maximum.
22. Discuss the experiment to determine the wavelength of different colours using diffraction grating.
23. Explain about compound microscope and obtain the equation for magnification.
24. Discuss about astronomical telescope.
25. Explain the experimental determination of material of the prism using spectrometer.

7. DUAL NATURE OF RADIATION AND MATTER

SHORT ANSWER QUESTIONS (BOOK BACK)

1. Why do metals have large number of free electrons?
2. Define work function of a metal. Give its unit.
3. What is photo electric effect?
4. How does photo electric current vary with the intensity of the incident light?
5. Define intensity of light according to the quantum concept.
6. Define threshold frequency.
7. What is photo electric cell? Give its type.
8. Write the expression for the de Broglie wavelength associated with a charged particle of charge 'q' and mass 'm', when it is accelerated through a potential V.
9. What is De Broglie hypothesis?
10. Why we do not see the wave properties of a baseball?
11. A proton and an electron have same kinetic energy. Which one has greater de Broglie wavelength. Justify.
12. Write the relationship of de Broglie wavelength λ associated with a particle of mass m in terms of its kinetic energy K.
13. Name an experiment which shows wave nature of the electron. Which phenomenon was observed in this experiment using an electron beam?
14. An electron and an alpha particle have same kinetic energy. How are the de-Broglie wavelengths associated with them related?

SHORT ANSWER QUESTIONS (CONCEPTUAL)

15. Define surface barrier.
16. Define electron emission.
17. Define electron volt (eV)
18. What are called photo sensitive materials?
19. Define stopping potential.
20. What is the nature of light?
21. What is called matter waves or de Broglie waves?
22. List the properties of X - rays.
23. What is X -ray spectra? Give its types.
24. What factor does the quality and intensity of X - rays were depends?
25. What are called X - rays? Why are they so called?

SHORT ANSWER QUESTIONS (3 Marks)

1. State the laws of photo electric effect.
2. Explain why photoelectric effect cannot be explained on the basis of wave nature of light
3. Explain Einstein's explanation for the particle nature (quanta) of light.
4. Explain the concept of quantization of energy.
5. Write a note on the production of X - rays.
6. Write a note on continuous X - ray spectrum.
7. Explain the applications of X -rays.
8. Write a note on characteristic X - ray spectra.
9. Derive the expression of de Broglie wavelength.

LONG ANSWER QUESTIONS (5 Marks)

1. What do you mean by electron emission? Explain briefly various methods of electron emission.
2. Briefly discuss the observations of Hertz, Hallwachs and Lenard.
3. Explain the experimental set up for study of photo electric effect
4. Explain the effect of potential difference on photo electric current.
5. Explain how frequency of incident light varies with stopping potential.
6. List out the laws of photoelectric effect.
7. Explain the particle nature of light. List the characteristics of photons.
8. Obtain Einstein's photoelectric equation with necessary explanation.
9. Explain experimentally observed facts of photoelectric effect with the help of Einstein's explanation.
10. Explain photo electric cells and its types.
11. Give the construction and working of photo emissive cell.
12. Give the application of photo cells.
13. Derive an expression for de Broglie wavelength of electrons.
14. Describe briefly Davisson – Germer experiment which demonstrated the wave nature of electrons.
15. Briefly explain the principle and working of electron microscope.

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UNIT - 7

8. ATOMIC AND NUCLEAR PHYSICS

SHORT ANSWER QUESTIONS (BOOK BACK)

1. What are called cathode rays?
2. Give the properties of cathode rays.
3. Give the results of Rutherford alpha scattering experiment.
4. State the postulates of Bohr's atom model.
5. Define excitation energy.
6. Define ionization energy and ionization potential.
7. What are the drawbacks in Bohr atom model?
8. What is distance of closest approach?
9. Define impact parameter.
10. Write a general notation of nucleus of element X. What each term denotes?
11. What is isotope? Give an example.
12. What is isotone? Give an example.
13. What is isobar? Give an example.
14. Define atomic mass unit.
15. Show that nuclear density is almost constant for nuclei with Z > 10.
16. What is mass defect?
17. What is binding energy of a nucleus? Give its expression.
18. Calculate the energy equivalent to one atomic mass unit (1 u). Give the answer in eV unit.
19. Define average binding energy per nucleon?
20. Define radioactivity.
21. Give the symbolic representation of alpha decay, beta decay and gamma decay.
22. In alpha decay, why the unstable nucleus emits $^{4}_{2}He$ nucleus? Why it does not emit four separate nucleons?
23. What is mean life of nucleus? Give the expression.
24. What is half life of nucleus? Give the expression.
25. Define activity. Give its unit.
26. Define one curie.
27. What are the constituent particles of neutron and proton?

SHORT ANSWER QUESTIONS (CONCEPTUAL)

28. Define specific charge.
29. Write a note on Thomson's atom model.
30. What is distance of closest approach? Obtain expression for it.
31. What are the drawbacks of Rutherford atom model?
32. Define excitation potential.
33. Define atomic number and mass number.
34. What is the charge of nucleus?
35. Give the empirical formula for nuclear radius.
36. What is nuclear force?
37. Give the properties of nuclear forces?
38. Define disintegration energy.
39. Write a note on positron?
40. State the properties of neutrino.
41. State the law of radioactive decay.
42. Define one Becquerel.
43. Write a note on the discovery of neutron.
44. What is meant by nuclear fission?
45. List the properties of neutrons.

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UNIT - 8

46. Calculate the energy released per fission.
47. What is called chain reaction. Give its types.
48. What is called nuclear reactor?
49. What is nuclear fusion?
50. What is mean by thermo nuclear reactions?
51. What is the source of stellar energy?
52. Write a note on proton - proton cycle.
53. What are the conclusion made by Rutherford from the results of alpha scattering experiments.
54. What is radio carbon dating?
55. Write a note on smoke detector.

SHORT ANSWER QUESTIONS (CONCEPTUAL)

1. Explain the J.J. Thomson experiment to determine the specific charge of electron.
2. Discuss the Millikan's oil drop experiment to determine the charge of an electron.
3. Derive the expression for radius and energy of the n^{th} orbit of hydrogen atom using Bohr atom model.
4. Explain the spectral series of hydrogen atom.
5. Explain the variation of average binding energy with the mass number by graph and discuss its features.
6. Explain radio carbon dating.
7. Describe the working of nuclear reactor with a block diagram.
8. Briefly explain the elementary particles of nature.
9. Explain in detail the four fundamental forces.
10. Obtain the law of radioactivity (radioactive decay)
11. Obtain an expression for half life time and mean life time.

9. SEMICONDUCTOR ELECTRONICS

SHORT ANSWER QUESTIONS (BOOK BACK)

1. Define electron motion in a semiconductor.
2. Distinguish between intrinsic and extrinsic semiconductors.
3. Define doping.
4. How electron-hole pairs are created in a semiconductor material?
5. Draw the output waveform of a full wave rectifier.
6. A diode is called as a unidirectional device. Explain
7. Define reverse saturation current.
8. Distinguish between avalanche and zener breakdown.
9. Explain the need for a feedback circuit in a transistor oscillator.
10. Discuss the different modes of NPN and PNP transistor biasing.
11. Explain the current flow in a NPN transistor.
12. What is the phase relationship between the AC input and output voltages in a common emitter amplifier? What is the reason for the phase reversal?
13. Give the circuit symbol, Boolean expression, logical operation and truth table of AND gate.
14. Give the circuit symbol, Boolean expression, logical operation and truth table of OR gate.
15. Give the circuit symbol, Boolean expression, logical operation and truth table of NOT gate.
16. Give the circuit symbol, Boolean expression, logical operation and truth table of NAND gate.
17. Give the circuit symbol, Boolean expression, logical operation and truth table of NOR gate.
18. Give the circuit symbol, Boolean expression, logical operation and truth table of Ex-OR gate.
19. State Demorgan's theorems.

SHORT ANSWER QUESTIONS (CONCEPTUAL)

20. What is called electronics?
21. What are passive components and active components?
22. What is energy band?
23. What is valance band, conduction band and forbidden energy gap?
24. Define hole.
25. What is called P-type semiconductor?
26. What is N-type semiconductor?
27. Define junction potential or barrier potential.
28. What is P-N junction diode? Give its symbol.
29. What is called biasing? Give its types.
30. What is meant by rectification?
31. Differentiate forward bias and reverse bias.
32. What is mean by break down voltage?
33. What is called Zener diode? Give its circuit symbol.
34. Give the applications of Zener diode.
35. What is opto electronic devices?
36. What is light emitting diode (LED)?
37. Give the applications of LEDs.
38. What is photo diode? Give its circuit symbol.
39. Give the applications of photo diode.
40. What are called solar cells?
41. Write a note on bipolar junction transistor (BJT).
42. Discuss the different modes of transistor biasing.
43. Give the applications of solar cells.
44. What is called transistor amplifier?
45. Draw the circuit diagram of common base configurations of NPN transistor.

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46. Draw the circuit diagram of common emitter configurations of NPN transistor.
47. Draw the circuit diagram of common emitter configurations of NPN transistor.
48. Define input resistance of transistor.
49. Define output resistance of transistor.
50. Define forward current gain.
51. What is called transistor oscillator?
52. Give the types of an oscillator.
53. Give the relation between α and β
54. Give the applications of oscillator.
55. Draw the block diagram of an oscillator
56. Give the Barkhausen conditions for sustained oscillations.
57. Distinguish between analog and digital signal.
58. Distinguish between positive and negative logic.
59. What are called logic gates?
60. What is an integrated circuit?
61. What are the application of integrated circuits (ICs)
62. Distinguish between digital IC and analog IC
63. Why digital signals are preferred than analog signals?

LONG ANSWER QUESTIONS (5 Marks)

1. Explain the classification of solids on the basis of energy band theory.
2. Explain in detail the intrinsic semiconductor.
3. Elucidate the formation of a N-type and P-type semiconductors.
4. Explain the formation of PN junction diode. Discuss its V–I characteristics.
5. Draw the circuit diagram of a half wave rectifier and explain its working.
6. Explain the construction and working of a full wave rectifier.
7. Write a note on Zener diode. Explain the V – I characteristics of Zener diode.
8. Explain the working of Zener diode as a voltage regulator.
9. What is meant by light emitting diode? Explain its working principle with diagram.
10. Explain in detail about the photo diode.
11. Explain the working principle of Solar cell. Mention its applications.
12. Explain transistor action in Common Base Configuration.
13. Sketch the static characteristics of a common emitter transistor and bring out the essence of input and output characteristics.
14. Transistor functions as a switch. Explain.
15. Explain the action transistor as an oscillator.
16. Describe the function of a transistor as an amplifier with the neat circuit diagram. Sketch the input and output wave form.
17. State and prove De Morgan's First and Second theorems.
18. State Boolean laws. Elucidate how they are used to simplify Boolean expressions with suitable example.

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UNIT - 9

10. Communication Systems

SHORT ANSWER QUESTIONS (BOOK BACK)

1. Give the factors that are responsible for transmission impairments.
2. Distinguish between wireline and wireless communication? Specify the range of electromagnetic waves in which it is used.
3. What is called centre frequency or resting frequency?
4. What is mean by RADAR?
5. What do you mean by Internet of Things?

SHORT ANSWER QUESTIONS (CONCEPTUAL)

6. What is called modulation? Give its types.
7. What is the necessity of modulation?
8. Define amplitude modulation (AM)
9. Give the advantages and limitations of amplitude modulation (AM)
10. Define frequency modulation (FM)
11. Give the advantages and limitations of frequency modulation (FM)
12. Define phase modulation (PM)
13. Give the advantages of phase modulation (PM)
14. Compare FM and PM ?
15. What is called base band signals?
16. Define band width.
17. Define the size of the antenna.
18. What are the three modes of propagation of electromagnetic waves through space.
19. Write a note on Ground Wave Propagation.
20. Define Sky Wave Propagation.
21. Define skip distance.
22. Define skip zone or skip area.
23. What is Space Wave Propagation?
24. Define Fibre Optical Communication.
25. Write a note on Mobile Communication and give its applications.
26. Write a note on Internet and give its applications.
27. What are called noises?
28. Write a note on Global Positioning System.
29. Define Range.
30. What are repeaters?
31. Define attenuation.

LONG ANSWER QUESTIONS (5 Marks)

1. What is called modulation? Explain the types of modulation with help of necessary diagrams.
2. Elaborate on the basic elements of communication system with the necessary block diagram.
3. Explain the three modes of propagation of electromagnetic waves through space.
4. Explain satellite communication.
5. Explain the function of RADAR. Give its applications.
6. Give the applications of ICT in fisheries, mining and agriculture sectors.
7. Fiber optic communication is gaining popularity among the various transmission media-Justify.
8. Modulation helps to reduce the antenna size in wireless communication – Explain.

11. Recent Developments in Physics

SHORT ANSWER QUESTIONS (BOOK BACK)

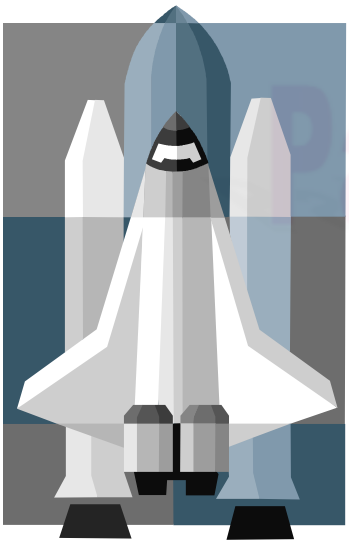
1. Distinguish between Nanoscience and Nanotechnology.
2. What is the difference between Nanomaterials and Bulk materials?
3. Give any two examples for "Nano" in nature.
4. Mention the advantages and disadvantages of Robotics.
5. Why steels are preferred to make robots?
6. Write a note on black holes.
7. What are sub atomic particles?

SHORT ANSWER QUESTIONS (CONCEPTUAL)

8. Give the interdisciplinary nature of nano technology.
9. What is robotics?
10. Explain how nano structures are made in the laboratory?
11. List the applications of Nano technology.
12. What are the components of robotics?
13. Give the types of robots.
14. What is artificial intelligence? What is its work?
15. Give the applications of robot in various fields.
16. Write a note on nano robots.
17. What is particle physics? Write down its recent development.
18. Write a note on Cosmology.
19. What are called gravitational waves?

LONG ANSWER QUESTIONS (5 Marks)

1. Explain Nano structure in nature with examples.
2. Comment on the recent advancement in medical diagnosis and therapy.
3. Discuss the functions of key components in Robots?
4. What are the possible harmful effects of usage of Nanoparticles? Why?
5. Discuss the applications of Nanomaterials in various fields.
6. Explain the various components of robotics.



All The Best

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UNIT - 11

+2 Physics Public Exam Question Paper
March 2020 [A – Type]

Part – I

Answer all questions.

1. The nucleus is approximately spherical in shape. Then the surface area of nucleus having mass number A varies as:
   a) $A^{5}/_{3}$ *b)* $A^{2}/_{3}$ *c)* $A^{4}/_{3}$ *d)* $A^{1}/_{3}$

2. The radius of curvature of curved surface at a thin planoconvex lens is 10 cm and the refractive index is 1.5. If the plane surface is silvered then the focal length will be:
   a) *20 cm* *b)* *5 cm* *c)* *10 cm* *d)* *15 cm*

3. In Bohr Atom model when the principal quantum number (n) increases the velocity of electron.
   a) increases and then decreases *b)* increases
   c) decreases *d)* remains constant

4. Charging current for a capacitor is 0.2 A, find the displacement current.
   a) zero *b)* *0.2 A* *c)* *0.4 A* *d)* *0.1 A*

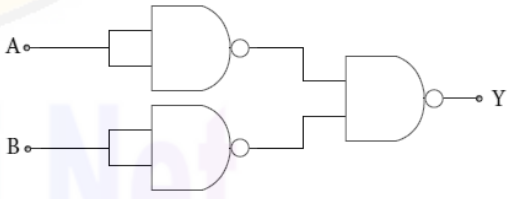
5. A light of wavelength *500 nm* is incident on a sensitive plate of phtoelectric work function 1.235 eV. The kinetic energy of the photo electrons emitted is: (Take $h = 6.6 \times 10^{-34}\ J\ s$)
   a) *1.16 eV* *b)* *0.58 eV* *c)* *2.48 eV* *d)* *1.24 eV*

6. Magnetic field at any point at a distance R due to a long straight conductor carrying current varies as:
   a) R^2 *b)* R *c)* $\frac{1}{R^2}$ *d)* $\frac{1}{R}$

7. Type of material which emits white Light in LED:
   a) *GaInN* *b)* *SiC* *c)* *AlGaP* *d)* *GaAsP*

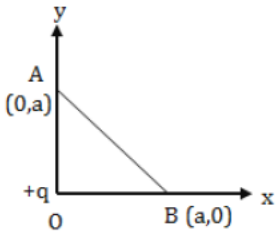
8. The frequency range of *30 MHz* to *400 MHz* is used for:
   a) Satellite communication *b)* Ground wave propagation
   c) Space wave propagation *d)* Sky wave propagation

9. The given electrical network is equivalent to:



   a) *NAND Gate* *b)* *OR Gate* *c)* *NOT Gate* *d)* *Ex-OR Gate*

10. In the given diagram a point charge +q is placed at the origin O. Work done in taking another point charge –Q from point A to point B is:

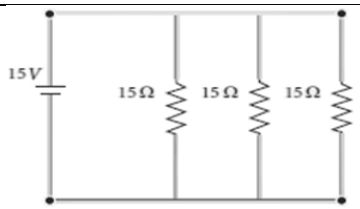


   a) $\frac{qQ}{4\pi\varepsilon_o a^2}\left(\frac{a}{\sqrt{2}}\right)$ *b)* zero
   c) $\left[\frac{-qQ}{4\pi\varepsilon_o a^2}\right]\sqrt{2}a$ *d)* $\left[\frac{qQ}{4\pi\varepsilon_o a^2}\right]\sqrt{2}a$

11. In an oscillating LC circuit, the maximum charge on the capacitor is Q. The charge on the capacitor when the energy is stored equally between the electric and magnetic field is:

a) Q *b)* $\frac{Q}{2}$ *c)* $\frac{Q}{\sqrt{3}}$ *d)* $\frac{Q}{\sqrt{2}}$

12. The current in the circuit is :



a) $4A$ *b)* $1A$

c) $2A$ *d)* $3A$

13. Two light waves form slit S1 and S2 on reaching points P and Q on a screen in Young's double slit experiment have a path difference zero and λ/4 respectively. The ration of light intensities at P and Q will be :

a) 4: 1 *b)* 3: 2 *c)* $\sqrt{2}$: 1 *d)* 2: 1

14. A particle of mass m, carrying charge q is accelerated through a potential of V (volt). When this accelerated charge comes under the influence of perpendicular magnetic field, the force acting on it is :

a) $\sqrt{\frac{2q^3BV}{m^3}}$ *b)* $\sqrt{\frac{2q^3BV}{m}}$ *c)* $\sqrt{\frac{q^3B^2V}{2m}}$ *d)* $\sqrt{\frac{2q^3B^2V}{m}}$

15. If voltage applied on a capacitor is increased from V to 2 V, choose the correct conclusion.

a) Both Q and C remain the same
b) Q remains the same, C is doubled
c) Q is doubled, C is doubled
d) C remains the same, Q is doubled

Part – II

Answer any SIX questions. Question No. 24 is compulsory:

16. What do you mean by doping?

17. What are the uses of X-rays?

18. An ideal transformer has 460 and 40000 turns in the primary and secondary coils respectively. Find the voltage developed per turn of the secondary coil if the transformer is connected to a 230 V AC main.

19. Distinguish between Fresnel and Fraunhofer types of diffraction

20. What is Corona discharge?

21. What is skip area?

22. What are the properties of neutrino?

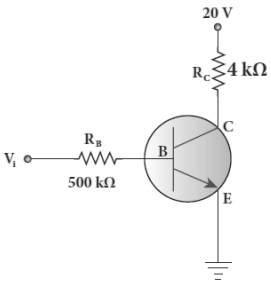
23. Two materials X and Y are magnetised whose intensity of magnetisation are 500 Am^{-1} and 2000 Am^{-1} respectively. The magnetising field is 1000 Am^{-1}. What is the ratio between the susceptibilities of the two materials?

24. Why electron is preferred over X-ray microscope?

Part – III

Answer any SIX questions. Question No. 33 is compulsory:

25. Explain the conversion of galvanometer into voltmeter.
26. The resistance of a nichrome wire at $0°\,C$ is 10Ω. If its temperature coefficient of resistance is $0.004\ /\ °C$, find its resistance at boiling point of water. Comment on the result.
27. What are the important inferences from the average binding energy curve?
28. In the circuit shown in the figure, the input voltage $V_i = 20\,V, V_{BE} = 0\,V$ and $V_{CE} = 0\,V$, What are the values of I_B, I_C and β



29. Derive the expression for equivalent capacitance, when capacitors are connected in parallel.
30. What are the advantages and disadvantages of AC over DC?
31. Two light sources of equal amplitudes interfere with each other. Calculate the ratio of maximum and minimum intensities.
32. Derive an expression for de-Broglie wavelength of electrons.
33. Modulation helps to reduce the antenna size in wireless communication-Explain.

Part – IV

Answer ALL the questions.

34. (a) Obtain the expression for the induced emf by changing relative orientation of the coil with the magnetic field (Graph not necessary)

(Or)

(b) Derive the mirror equation and the equation for lateral magnification.

35. (a) Deduce the expression for the force between two long parallel current carrying conductors.

(Or)

(b) Write down Maxwell equations in integral form.

36. (a) Describe Davisson – Germer experiment which demonstrated the wave nature of electrons.

(Or)

(b) (i) Derive an expression for the orbital energy of an electron in hydrogen atom using Bohr Theory.

(ii) An electron in Bohr's hydorgen atom has an energy of $-3.4\,eV$. What is angular momentum of the electron?

37. (a) Explain the working of the transistor as an oscillator.

(Or)

(b) Find out the phase relationship between voltage and current in a pure inductive circuit.

38. (a) State Gauss Law in electrostatica. Obtain an expression for Electric field due to an infinitely long charged wire.

(Or)

(b) How the emf of two cells are compared using potentiometer?