Three marks Questions and Answers

+2 Physics UNIT – 1 Electrostatics Year: 2012 -2013

1. State Coulomb's law in electrostatics. (J – 07, J – 10, O – 11, J – 12)

   Coulomb's law states that the force of attraction or repulsion between two point charges is directly proportional to the product of the charges and inversely proportional to the square of the distance between them. The direction of forces is along the line joining the two point charges.

2. Define: Coulomb. (M – 06, M – 10, O - 10)

   One Coulomb is defined as the quantity of charge, which when placed at a distance of 1 metre in air or vacuum from an equal and similar charge, experiences a repulsive force of 9 × 109 N.

3. Define: Electric potential. (M – 07, J - 09)

   The electric potential in an electric field at a point is defined as the amount of work done in moving a unit positive charge from infinity to that point against the electric forces.

4. State Gauss's law. (M – 09, J – 06 , O – 06, M - 11)

   The total flux of the electric field E over any closed surface is equal to $1/\varepsilon_o$ times the net charge enclosed by the surface.

   (i.e.) $\phi = q / \varepsilon_o$

5. During lightning, it is safer to sit inside car than in an open ground. Why? (M -06, J- 06, J -09, M-10)

   The metal body of the car provides electrostatic shielding, where the electric field is zero. During lightning the electric discharge passes through the body of the car.

6. What are polar molecules? Give an example. (M – 07)

   i) A polar molecule is one in which the centre of gravity of the positive charges is separated from the centre of gravity of the negative charges by a finite distance.

   ii) Examples : N2O, H2O, HCl, NH3.

   iii) They have a permanent dipole moment.

7. What is dielectric polarization? (O - 06, O – 09, O – 11)

   The alignment of the dipole moments of the permanent or induced dipoles in the direction of applied electric field is called polarisation or electric polarisation.

   The magnitude of the induced dipole moment p is directly proportional to the external electric field E.

   $\therefore$ $p \propto E$ or $p = \alpha E$, where α is the constant of proportionality and is called molecular polarisability.

8. What is action of points (corona discharge)? What is its use? (J – 07, O – 08)

   The leakage of electric charges from the sharp points on the charged conductor is known as action of points or corona discharge.

   This principle is used in the electrostatic machines for collecting charges and in lightning arresters (conductors).

9. Give any 3 properties of electric lines of force. (J – 10)

   Properties of lines of forces:

   (i) Lines of force start from positive charge and terminate at negative charge.
   (ii) Lines of force never intersect.
   (iii) The tangent to a line of force at any point gives the direction of the electric field (E) at that point.

10. State the law of conservation of electric charges.

The total charge in an isolated system always remains constant.

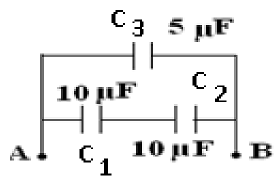
For example, Uranium (${}_{92}U^{238}$) can decay by emitting an alpha particle (${}_{2}He^{4}$ nucleus) and transforming tothorium (${}_{90}Th^{234}$).

$${}_{92}U^{238} \longrightarrow {}_{90}Th^{234} + {}_{2}He^{4}$$

Total charge before decay = +92e, total charge after decay = 90e + 2e.

Hence, the total charge is conserved. i.e. it remains constant.

11. In the given circuit, what is the effective capacitance between A and B. (O – 08)



i) $\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2}$

(OR)

$C_s = \frac{C1\,C2}{C_1 + C_2}$

$= \frac{10 \times 10}{10 + 10} = 100/20$

$= 5\ \mu F$

ii) $C_p = C_s + C_3$

$= 5 + 5 = 10\ \mu F$

12. What is an electric dipole? Define: the dipole moment. (O – 09, J – 11)

Two equal and opposite charges separated by a very small distance constitute an electric dipole.

Examples : Water, ammonia, carbon–dioxide and chloroform molecules

The dipole moment is the product of the magnitude of the one of the charges and the distance between them. ∴ Electric dipole moment, *p = q2d or 2qd.*

It is a vector quantity and acts from –q to +q. The unit of dipole moment is C m.

13. Define: Electric flux. Give its unit. (J – 08, J – 12)

The electric flux is defined as the total number of electric lines of force, crossing through the given area.

Its unit is N m^2 C^{-1}.

14. What is electrostatic shielding? (M – 08)

i) It is the process of isolating a certain region of space from external field.

ii) It is based on the fact that electric field inside a conductor is zero.

15. Three capacitors each of capacitance 3 pF are connected in parallel.

Find effective capacitance. (M – 08)

The effective capacitance $C_p = C_1 + C_2 + C_3$ = 9 + 9 + 9 = 27 pF

16. What are non-polar molecules? Give an example. (O – 10, J – 11)

i) A non-polar molecule is one in which the centre of gravity of the positive charges coincide with the centre of gravity of the negative charges.

ii) Example: O_2, N_2, H_2.

iii) The non-polar molecules do not have a permanent dipole moment.

17. What is a capacitor? Define: capacitance. (M – 09)

i) A capacitor is a device for storing electric charges.

ii) The capacitance of a conductor is defined as the ratio of the charge given to the conductor to the potential developed in the conductor.

18. What is microwave oven? How it works? (J – 08)

Microwave oven

It is used to cook the food in a short time. When the oven is operated, the microwaves are generated, which in turn produce a non-uniform oscillating electric field. The water molecules in the food which are the electric dipoles are excited by an oscillating torque. Hence few bonds in the water molecules are broken, and heat energy is produced.

This is used to cook food.

19. Write the applications of a capacitor. (O – 07, M – 11, M – 12)

Applications of capacitors.

(i) They are used in the ignition system of automobile engines to eliminate sparking.

(ii) They are used to reduce voltage fluctuations in power supplies and to increase the efficiency of power transmission.

(iii) Capacitors are used to generate electromagnetic oscillations and in tuning the radio circuits.

20. What do you mean by additive nature of charges ? Give an example. (O – 07)

Additive nature of charge

The total electric charge of a system is equal to the algebraic sum of electric charges located in the system.

For example, if two charged bodies of charges +2q, −5q are brought in contact, the total charge of the system is –3q.

21. Find the electric potential at a distance 0.09 m from a charge of 4×10^{-7} C. (M – 12)

The electric potential $V = (1/4\pi\varepsilon_o)\, q/r$

$= (9 \times 10^{9} \times 4 \times 10^{-7}) / 9 \times 10^{-2} = 4 \times 10^{4}$ volt.

***** **Best wishes** *****

1. Define: Drift velocity. (M – 07, O – 08, J - 09, O – 09, M – 10, M -11, O – 11)

   Drift velocity is defined as the velocity with which free electrons get drifted towards the positive terminal, when an electric field is applied.

2. Define: mobility. Give its unit. (O – 06 , M – 08, M – 09)

   The mobility is defined as the drift velocity acquired per unit electric field. The unit of mobility $m^2V^{-1}s^{-1}$.

3. State Ohm's law. (M – 06 , O – 07, O – 09, M -10)

   At a constant temperature, the steady current flowing through a conductor is directly proportional to the potential difference between the two ends of the conductor.

   (i.e.) V = IR

4. Give any three applications of the superconductors. (J – 07,O – 07,J – 06 ,O – 06, O – 07)

   i) High efficiency ore–separating machines may be built using superconducting magnets which can be used to separate tumor cells from healthy cells by high gradient magnetic separation method.

   ii) Since the current in a superconducting wire can flow without any change in magnitude, it can be used for transmission lines.

   iii) Superconductors can be used as memory or storage elements in computers.

5. State Kirchoff's first law in electricity. (J – 06 , M – 08)

   Kirchoff's first law (current law)

   The algebraic sum of the currents meeting at any junction in a circuit is zero. This law is a consequence of conservation of charges.

6. State Kirchoff's second law in electricity. (M – 07,J – 06,M – 08,M – 09,J– 11)

   Kirchoff's second law (voltage law)

   The algebraic sum of the products of resistance and current in each part of any closed circuit is equal to the algebraic sum of the emf's in that closed circuit. This law is a consequence of conservation of energy.

7. Compare the emf and the potential difference. (J – 07, O – 08, J – 11)

   Comparison of emf and potential difference

   1. The difference of potentials between the two terminals of a cell in an open circuit is called the electromotive force (emf) of a cell.
      The difference in potentials between any two points in a closed circuit is called potential difference.
   2. The emf is independent of external resistance of the circuit, whereas potential difference is proportional to the resistance between any two points.

8. State Faraday's laws of electrolysis. (M – 06, J – 06, J – 10,O -10)

   First Law : The mass of a substance liberated at an electrode is directly proportional to the charge passing through the electrolyte.

   Second Law : The mass of a substance liberated at an electrode by a given amount of charge is proportional to the chemical equivalent of the substance.

9. The resistance of a nichrome wire at 0^oC is 10 Ω. If the temperature coefficient of resistance is 0.004 / ^oC, find its resistance at boiling point of water. Comment on the result. (J –07,O –07,M –08,J –09,O – 10, O – 11)

   Resistance at boiling point of water $R_t = R_o(1+\alpha t)$

   $= 10\,(1 + (0.004 \times 100))$

   $R_t = 14\,\Omega$.

   Result : The resistance increases with the temperature.

10. The resistance of a platinum wire at 0^oC is 4 Ω. What will be the resistance at 100^oC, if the temperature coefficient of resistance is 0.0038 / ^oC. (M – 07,J – 10)

Resistance at $100^o C$ Rt = Ro (1+ α t)

= 4 (1 + (0.0038 × 100))

Rt = 5.52 Ω

Result : The resistance increases with the temperature.

11. Define: current density. Give its unit.

The quantity of charge passing per unit time through unit area, taken perpendicular to the direction of flow of charge at that point is called current density.

It is expressed in A m^{-2}.

12. What is superconductivity?

The ability of certain metals, their compounds and alloys to conduct electricity with zero resistance at very low temperatures is called superconductivity. The materials which exhibit this property are called superconductors.

13. If 6.25 X 10^{18} electrons flow through a given cross-section in unit time, find the current. (J – 11)

Solution : Current I = q / t = ne / t = (6.25 X 10^{18} X 1.6 X 10^{-19}) / 1 = 1 A

14. The colour codes of a carbon resistor are yellow, yellow, orange. Tolerance is 5%. Find the resistance.

The first yellow ring corresponds to 4. The second yellow ring corresponds to 4. The third orange ring corresponds to 10^3. Tolerance is 5%.

The resistance value is 44 X 10^3 ± 5% or 44 KΩ ± 5%

15. Define: the temperature coefficient of resistance. (J – 08, M - 11)

The ratio of increase in resistance per degree rise in temperature to its resistance at 0^o C is called as temperature coefficient of resistance . Its unit is per ^oC.

16. What are secondary cells? Give an example?

i) They are rechargeable.
ii) The chemical reactions that take place in secondary cells are reversible.
iii) The active materials that are used up when the cell delivers current can be reproduced by passing current through the cell in opposite direction.

Examples: lead acid accumulator and alkali accumulator.

17. Give any three uses of secondary cells. (O – 08, O – 11)

i) The secondary cells are rechargeable.
ii) They have very low internal resistance.
iii) They can deliver a high current if required.
iv) They are used in all automobiles like cars, two wheelers, trucks etc.

18. What are the changes that occur at the superconducting transition temperature? (J – 10)

At the transition temperature the following changes are observed :

(i) The electrical resistivity drops to zero.
(ii) The conductivity becomes infinity
(iii) The magnetic flux lines are excluded from the material.

19. A manganin wire of length 2m has a diameter of 0.4 mm with a resistance of 70 ohm. Find its resistivity. (J-06)

ρ = (P X π r^2) / L = (70 X 22 X 2 X 10^{-4} X 2 X 10^{-4}) / 7 X 2

= 44 X 10^{-7} = 4.4 X 10^{-6} Ωm = 4.4 μ Ωm

20. Distinguish between electric power and electric energy. (J – 08 , J - 09)

Electric power

i) Electric power is defined as the rate of doing electric work.
ii) Electric power is the product of potential difference and current strength.
iii) Unit: watt

Electric energy

1) Electric energy is defined as the capacity to do work.
2) Its unit is joule.

21. An iron box of 400 W power is used daily for 30 minutes. If the cost per unit is 75 paise, find the weekly expense on using the iron box. (J – 08)

Energy consumed in 30 minutes = Power × time in hours

= $400 \times \frac{1}{2} = 200$ W h

Energy consumed in one week = $200 \times 7 = 1400$ Wh = 1.4 unit

Cost / week = Total units consumed × rate/ unit

= 1.4×0.75 = Rs.1.05

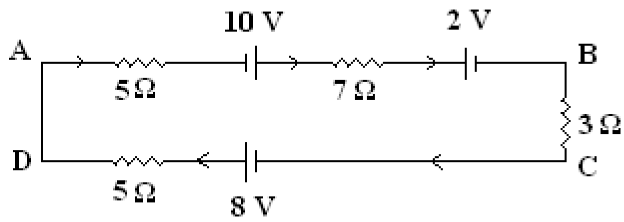
22. Two wires of same material and same length have resistances 5 and 10 respectively. Find the ratio of radii of the two wires. (M – 09)

$R = \rho l / A = \rho l / \pi r^2$

$R_1 = \rho l / A = \rho l / \pi r_1^2$; $R_2 = \rho l / A = \rho l / \pi r_2^2$

$R_2 / R_1 = r_1^2 / r_2^2$ $\therefore$ $r_1 / r_2 = \sqrt{R_2} / \sqrt{R_1} = \sqrt{10} : \sqrt{5} = \sqrt{2} : 1$

23. In the given circuit, calculate the current through the circuit and mention its direction. (M – 06)



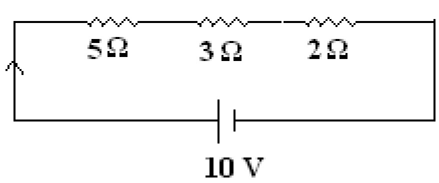
Let the current be I.

$7I + 3I + 5I + 5I = 10 + 8 - 2$

(i.e) $20I = 16$ $\therefore$ $I = 0.8$ A

Current flows along the path ABCD.

24. In the given circuit, calculate the potential differences across each resistor. (O – 06)



Solution :

i) Rs = R1 + R2 + R3 = 10 Ω

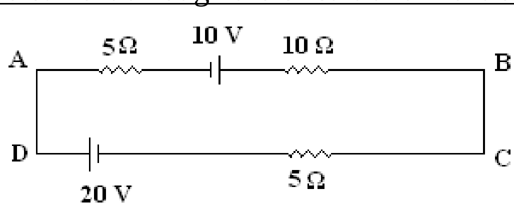
ii) Current in circuit I = V / Rs = 10 / 10 = 1 A

iii) Voltage drop across R1, V1 = IR1 = 1 × 5 = 5V

Voltage drop across R2, V2 = IR2 = 1 × 3 = 3V

Voltage drop across R3, V3 = IR3 = 1 × 2 = 2V

25. In the given circuit, calculate the current through the circuit and mention its direction. (M – 11)



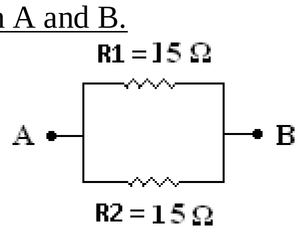
Let the current be I.

$5I + 10I + 5I = 10 + 20$

(i.e) $20I = 30$ $\therefore$ Current $I = 1.5$ A

Current flows along the path ABCD.

26. Find the effective resistance between A and B. (J – 12)



$1/R_p = 1/R_1 + 1/R_2$

$R_p = R_1 R_2 / (R_1 + R_2)$ = = 15 X15 / 30 = 7.5 ohm

27. Define critical temperature. (M – 12)

The temperature at which electrical resistivity of the material suddenly drops to zero and the material changes from normal conductor to a superconductor is called the transition temperature or critical temperature T_C.

***** **Best wishes** *****

1. State Joule's law of heating.

The heat produced in a conductor is
(i) directly proportional to the square of the current for a given R
(ii) directly proportional to resistance R for a given I and
(iii) directly proportional to the time of passage of current.

(i.e.) $H = I^2Rt$

2. Why nichrome is used as heating element in electric heating devices? (J – 07, M -10)

Nichrome, an alloy of nickel and chromium is used as the heating element for the following reasons.
(1) It has high specific resistance
(2) It has high melting point
(3) It is not easily oxidized

3. What is a fuse wire?

Fuse wire

i) Fuse wire is an alloy of lead 37% and tin 63%. It is connected in series in an electric circuit.
ii) It has high resistance and low melting point.
iii) When large current flows through a circuit due to short circuiting, the fuse wire melts due to heating and hence the circuit becomes open. The electric appliances are saved from damage.

4. What is Seebeck effect?

Seebeck discovered that in a circuit consisting of two dissimilar metals like iron and copper, an emf is developed when the junctions are maintained at different temperatures.

Two dissimilar metals connected to form two junctions is called thermocouple. The emf developed in the circuit is thermo electric emf. The current through the circuit is called thermoelectric current. This effect is called thermoelectric effect or Seebeck effect.

5. What is neutral temperature? (O – 08)

Keeping the temperature of the cold junction constant, the temperature of the hot junction is gradually increased. The thermo emf rises to a maximum at a temperature (θ_n) called neutral temperature.

6 What is temperature of inversion?

Keeping the temperature of the cold junction constant, the temperature of the hot junction is gradually increased. The thermo emf rises to a maximum at a temperature (θ_n) called neutral temperature and then gradually decreases and eventually becomes zero at a particular temperature (θ_i) called temperature of inversion. Beyond the temperature of inversion, the thermoemf changes sign and then increases.

7. Define: Peltier coefficient and write its unit. (J – 06, J – 11, M – 12)

The amount of heat energy absorbed or evolved at one of the junctions of a thermocouple when one ampere current flows for one second (one coulomb) is called Peltier coefficient. It is denoted by π. Its unit is volt.

8. Define: Thomson effect.

Thomson suggested that when a current flows through unequally heated conductors, heat energy is absorbed or evolved throughout the body of the metal.

9. State Maxwell's right hand cork screw rule.

Maxwells's right hand cork screw rule:

If a right handed cork screw is rotated to advance along the direction of the current through a conductor, then the direction of rotation of the screw gives the direction of the magnetic lines of force around the conductor.

10. How is a galvanometer converted into (a) an ammeter and (b) a voltmeter? (J – 09)

A galvanometer is converted into an ammeter by connecting a low resistance in parallel with it. The low resistance connected in parallel with the galvanometer is called shunt resistance.

A galvanometer can be converted into a voltmeter by connecting a high resistance in series with it.

11. Define: Tangent law. (M – 11)

A magnetic needle suspended at a point where there are two crossed fields at right angles to each other will come to rest in the direction of the resultant of the two fields.

According to tangent Law,

$$B = B_h \tan \theta$$

12. What are the limitations of a cyclotron? (O – 06, J - 10)

Limitations

(i) Maintaining a uniform magnetic field over a large area of the Dees is difficult.
(ii) At high velocities, relativistic variation of mass of the particle upsets the resonance condition.
(iii) At high frequencies, relativistic variation of mass of the electron is appreciable and hence electrons cannot be accelerated by cyclotron.

13. State Fleming's left hand rule. (O – 10)

Fleming's Left Hand Rule.

The forefinger, the middle finger and the thumb of the left hand are stretched in mutually perpendicular directions. If the forefinger points in the direction of the magnetic field, the middle finger points in the direction of the current, then the thumb points in the direction of the force on the conductor.

14. Define: ampere in terms of force (M – 08 , J – 08, O – 11)

Ampere is defined as that constant current which when flowing through two parallel infinitely long straight conductors of negligible cross section and placed in air or vacuum at a distance of one metre apart, experience a force of 2×10^{-7} newton per unit length of the conductor.

15. How can we increase the current sensitivity of a galvanometer? (O – 09)

The current sensitivity of a galvanometer can be increased by

(i) increasing the number of turns
(ii) increasing the magnetic induction
(iii) increasing the area of the coil
(iv) decreasing the couple per unit twist of the suspension wire.

16. In a galvanometer, increasing the current sensitivity does not necessarily increase voltage sensitivity. Explain (M – 07)

An interesting point to note is that, increasing the current sensitivity does not necessarily, increase the voltage sensitivity. When the number of turns (n) is doubled, current sensitivity is also doubled (from the equation $\theta / I = nBA / C$). But increasing the number of turns correspondingly increases the resistance (G). Hence voltage sensitivity remains unchanged.

17. Give any two differences between Peltier effect and Joule's law of heating. (M – 06)

Joule's law of heating	Peltier effect
Takes place throughout the conductor.	Takes place at the junctions.
Heat produced is proportional to the square of the current.	Heat produced or absorbed is proportional to the the current.
Irreversible process.	Reversible process

18. Define: current sensitivity of a galvanometer.

The current sensitivity of a galvanometer is defined as the deflection produced when unit current passes through the galvanometer.

Current sensitivity $\theta / I = nBA / C$

19. Define: magnetic moment of a current loop.

The magnetic moment of a current loop is defined as the product of the current and the loop area. Its direction is perpendicular to the plane of the loop.

Magnetic dipole of moment M = IA

20. Calculate the resistance of the filament of a 100W, 220 V electric bulb. (O – 07)

Power $P = V^2 / R$ $\therefore$ Resistance $R = V^2 / P$

$= (220 \times 220)/100 = 484$ ohm.

21. Define: ampere's circuital law. (M – 09)

The line integral $\vec{B} \cdot d\vec{l}$ for a closed curve is equal to μ_o times the net current Io through the area bounded by the curve.

22. Define : end rule.

End rule

When looked from one end, if the current through the solenoid is along clockwise direction, the nearer end corresponds to south pole and the other end is north pole.

When looked from one end, if the current through the solenoid is along anti-clock wise direction, the nearer end corresponds to north pole and the other end is south pole

23. The magnetic induction at a point 15 cm from a long straight wire carrying a current is 4×10^{-6} T. Calculate the current. (J – 12)

$B = \mu_o I / 2\pi a$ $\quad I = 2\pi a \times B / \mu_o$

Current $I = 2\pi \times 15 \times 10^{-2} \times 4 \times 10^{-6} / 4\pi \times 10^{-7} = 3A$

$$$$$ Best wishes $$$$$

+2 PHYSICS

UNIT -4 Electromagnetic induction and Alternating current

1. Define: magnetic flux.

Magnetic flux (ϕ):

The magnetic flux (ϕ) linked with a surface held in a magnetic field (B) is defined as the number of magnetic lines of force crossinga closed area (A).

(i. e) $\phi = BA \cos \theta$

2. What is electromagnetic induction? (M – 08)

The phenomenon of producing an induced emf due to the changes in the magnetic flux associated with a closed circuit is known as electromagnetic induction.

3. State Faraday's laws of electromagnetic induction. (J – 06 , J – 07 , O – 07)

First law

Whenever the amount of magnetic flux linked with a closed circuit changes, an emf is induced in the circuit.

The induced emf lasts so long as the change in magnetic flux continues.

Second law

The magnitude of emf induced in a closed circuit is directly proportional to the rate of change of magnetic flux linked with the circuit.

4. State Lenz's law. (O – 08, J - 10)

Lenz's law states that the induced current produced in a circuit always flows in such a direction that it opposes the change or cause that produces it.

5. State Fleming's right hand rule. (M – 07, M – 09 , O – 09,M – 10, J – 11)

Fleming's right hand rule

The forefinger, the middle finger and the thumb of the right hand are held in the three mutually perpendicular directions. If the forefinger points along the direction of the magnetic field and the thumb is along the direction of motion of the conductor, then the middle finger points in the direction of the induced current. This rule is also called generator rule.

6. Define: self inductance. (J – 09)

The coefficient of self induction of a coil is numerically equal to the opposing emf induced in the coil when the rate of change of current through the coil is unity.

The unit of self inductance is henry (H).

7. What are the methods of inducing emf in a circuit? (M – 06 , J – 06, O -10, M – 11, M - 12)

The induced emf can be produced by changing

(i) the magnetic induction (B)

(ii) area enclosed by the coil (A) and

(iii) the orientation of the coil (θ) with respect to the magnetic field.

8. Give the differences between AF choke and RF choke. (J – 08)

Audio – frequency (A.F) chokes	Radio frequency (R. F) chokes: or high frequency (H.F) chokes
1) used in low frequency a.c. circuit.	1) used in high frequency a.c. circuit
2) an iron core is used.	2) air chokes are used.
3) the inductance may be high	3) the inductance may be low
4) used in fluorescent tubes.	4) used in wireless receiver circuits.

9. Write the equation of a 25 cycle current sine wave having rms value of 30 A. (O – 11, M - 12)

Data : ν = 25 Hz, Irms = 30 A

Solution :

$$i = I_o \sin \omega t$$
$$= I_{rms} \sqrt{2} \sin 2\pi \nu t$$
$$i = 30\sqrt{2} \sin 2\pi \times 25\, t = 42.42 \sin 157\, t$$

10. What is efficiency of a transformer?

Efficiency of a transformer is defined as the ratio of output power to the input power.

η = output power / input power

11. What are the various energy losses of a transformer?

__Energy losses in a transformer:__

(1) ***Hysteresis loss*** **(2)** ***Copper loss*** **(3)** ***Eddy current loss (Iron loss)*** **(4)** ***Flux loss***

12. Define: rms value of AC. (J – 07, O – 09)

__RMS value of a.c.__

The rms value of alternating current is defined as that value of the steady current, which when passed through a resistor for a given time, will generate the same amount of heat as generated by an alternating current when passed through the same resistor for the same time.

13. A capacitor blocks d.c. but allows a.c. Why ? (O – 11)

Capacitive reactance $X_C = 1 / \omega C$

$= 1 / 2\pi \nu C$

where ν is the frequency of the a.c. supply.

In a d.c. circuit, $\nu = 0$ $\therefore$ $XC = \infty$

Thus a capacitor offers infinite resistance to d.c. and blocks the d.c.

For an a.c., the capacitive reactance varies inversely as the frequency of a.c. and also inversely as the capacitance of the capacitor.

14. What is acceptor circuit ? Give the uses of it.

Acceptor circuit

The series resonant circuit is often called an 'acceptor' circuit. By offering minimum impedance to current at the resonant frequency it is able to select or accept most readily this particular frequency among many frequencies.

In radio receivers the resonant frequency of the circuit is tuned to the frequency of the signal desired to be detected. This is usually done by varying the capacitance of a capacitor.

15. Define: Q- factor. (O – 06, J – 11)

The Q factor of a series resonant circuit is defined as the ratio of the voltage across a coil or capacitor to the applied voltage.

i.e. Q = *voltage across L or C / applied voltage*

16. Calculate the mutual inductance between two coils when a current of 4 A changing to 8 A in 0.5 s in one coil, induces an emf of 50 mV in the other coil. (M – 06, M – 09)

Induced emf $e = - M\, dI/dt$

$M = - e / (dI/dt)$

$M = - (50 \text{ X } 10^{-3})/ (8 – 4)/0.5$

$= - 6.25 \times 10^{-3}$ H = -6.25 mH.

17. Define the unit of self inductance. (J – 12)

One henry is defined as the self-inductance of a coil in which a change in current of one ampere per second produces an opposing emf of one volt.

18. An aircraft having awing span of 20.48 m flies at a speed of 40 ms^{-1}. If the vertical component of the earth's magnetic field is $2 \text{ X } 10^{-5}$ T,calculate the emf induced between the ends of the wings.

(J – 06, M – 08, J – 10, O -10, M - 11)

Data : l = 20.48 m; v = 40 ms−1; B = 2 × 10−5T; e = ?

Solution : $e = - B l v = - 2 \times 10^{-5} \times 20.48 \times 40$

$e = - 0.0164$ volt

Negative sign is due to Lenz law.

19. An aircraft having awing span of 10 m flies at a speed of 720 kmph. If the vertical component of the earth's magnetic field is 3 X 10 $^{-5}$ T, calculate the emf induced between the ends of the wings. (O – 06)

Solution : e $= -Blv$

$= -3 \times 10^{-5} \times 10 \times 720 \times 5 / 18$

e $= -0.06$ volt

Negative sign is due to Lenz law.

20. A coil of area of cross section 0.5 m^2 with 10 turns is in a plane perpendicular to a magnetic field of 0.2 wb / m^2. Calculate the flux through the coil. (M – 07)

Magnetic flux φ = BA cos θ

= 10 X 0.5 X 0.2 X cos 0

= 1 wb.

21. Why can a DC ammeter not read AC ? (O – 07)

1) dc ammeter cannot measure ac because ac is changing continuously and periodically and a dc ammeter can just measure a constant current.
2) The typical moving coil dc ammeter is based on the torque generated on a current carrying loop in a magnetic field provided by a permanent magnet.
3) Since the current in an ac averages to zero--it is chaging too fast even at 60 Hz, the meter does not have time to respond to this because of the inertia of the coil. The average torque the coil experiences in a given time interval is zero and hence there is no deflection.

22. A capacitor of capacitance 2 μF is in an ac circuit of frequency 1000 Hz. If the rms value of the applied emf is 10 V, find the effective current flowing through the circuit. (J – 08)

Solution:

Capacitive reactance X_C = $1 / \omega C$

= $1 / 2\pi \nu C$

= 1 / 2 X 3.14 X 1000 X 2 X 10 $^{-6}$

= 79.6 Ω

Irms = E_{eff} / X_C

= 10 / 79.6 = 0.126 A

23. In an ideal transformer, the transformer ratio is 1 : 20.The input voltage and the input power are 6 V and 600 mW respectively. Calculate the primary and the secondary currents. (O – 08)

Solution:

EpIp = 600 mW = 600 X 10^{-3} W

Primary current Ip = EpIp / Ep = 600 X 10^{-3}/ 6 = 100 X 10 $^{-3}$A

Ip / Is = 1 /20

Secondary current Is = Ip X 20 = 2000 X 10 $^{-3}$ A = 2 A

24. A capacitor of capacitance 2 μF is in an ac circuit of 1000 Hz. Calculate the reactance of it. (J – 09)

Solution:

Capacitive reactance X_C = $1 / \omega C$

= $1 / 2\pi \nu C$

= 1 / 2 X 3.14 X 1000 X 2 X 10 $^{-6}$

= 79.6 Ω

25. An emf of 5 V is induced when the current in the coil changes at the rate of 100 As^{-1}. Find the coefficient of self induction. (M – 10)

Solution:

Induced emf e = - L dI/dt

Coefficient of self induction L = - e / (dI/dt)

= - 5 / 100

L = 0.05 H

****** **Best wishes** *****

+2 PHYSICS Unit – 5 Electromagnetic waves and wave optics

1. What are emissive and absorption spectra? (M – 06)

Emission spectrum:

When the light emitted directly from a source is examined with a spectrometer, the emission spectrum is obtained. Every source has its own characteristic emission spectrum.

Absorption spectrum:

When the light emitted from a source is made to pass through an absorbing material and then examined with a spectrometer, absorption spectrum is obtained.

2. A 300 mm long tube containing 60 cc of sugar solution produces a rotation of 9^0 when placed in a polarimeter If the specific rotation is 60^0, calculate the quantity of sugar contained in the solution (M – 06, M – 09)

Data : l = 300 mm = 30 cm = 3 decimeter

$\theta = 9^o$; $S = 60^o$; v = 60 cc

m = ?

Solution :

$$S = \theta / l \times c$$
$$= \theta / l \times (m/v)$$
$$m = (\theta \times v) / l\,s$$
$$= 9 \times 60 / 3 \times 60$$
$$m = 3\text{ g}$$

3. Why does the sky appear blue in colour ? (J – 06)

According to Rayleigh's scattering law, the shorter wavelengths are scattered much more than the longer wavelengths. The blue appearance of sky is due to scattering of sunlight by the atmosphere. Blue light is scattered to a greater extent than red light.

This scattered radiation causes the sky to appear blue.

4. In Young's double slit experiment, the width of the fringe obtained with light of wavelength 6000^0A is 2 mm. Calculate the fringe width if the entire apparatus is immersed in a liquid of refractive index 1.33 (J – 06 ,M – 11)

Data : λ = 6000 Å = 6×10^{-7} m; β = 2mm = 2×10^{-3} m

μ = 1.33; β' = ?

Solution :

$$\beta' = D\lambda' / d = D\lambda / \mu d$$
$$= \beta / \mu$$
$$\beta' = 2 \text{ X } 10^{-3} / 1.33$$
$$= 1.5 \times 10^{-3} \text{ m (or) } 1.5 \text{ mm}$$

5. What is band emission spectrum? Give an example. (O – 06)

It consists of a number of bright bands with a sharp edge at one end but fading out at the other end. Band spectra are obtained from molecules. It is the characteristic of the molecule.

Example: Calcium or Barium salts in a bunsen flame and gases like carbon–di–oxide, ammonia and nitrogen in molecular state in the discharge tube give band spectra.

6. A light of wavelength 6000^0A falls normally on a thin air film, 6 dark fringes are seen between two points. Calculate the thickness of the film. (O – 06, J – 08, J – 09, J – 11)

$$2\mu t = n\lambda$$

Thickness of the film $t = n\lambda / 2\mu$

$$= 6 \text{ X } 6000 \text{ X } 10^{-10} / 2$$
$$= 1.8 \text{ X } 10^{-6} \text{ m.}$$

7. What is Tyndal scattering? (M – 07, J – 09, J – 10, O - 10)

Tyndal scattering

When light passes through a colloidal solution its path is visible inside the solution. This is because, the light is scattered by the particles of solution. The scattering of light by the colloidal particles is called Tyndal scattering.

8. In Newton's ring experiment, the diameter of certain order of dark ring is measured to be double that of the second ring. What is the order of the ring? (M – 07 , J – 07, O – 11)

Data : $d_n = 2d_2$; $n = ?$

$d_n^2 = 4nR\lambda$

$d_2^2 = 8R\lambda$

$d_n^2 / d_2^2 = n / 2$

$(4d_2^2 / d_2^2) / (n / 2)$

$\therefore$ n = 8.

9. Define: optic axis of a crystal. (J – 07, J - 10)

Inside a double refracting crystal there is a particular direction in which both the rays travel with same velocity. This direction is called optic axis.

The refractive index is same for both rays and there is no double refraction along this direction.

10. Define: specific rotation? (M – 08, M – 10)

Specific rotation for a given wavelength of light at a given temperature is defined as the rotation produced by one-decimeter length of the liquid column containing 1 gram of the active material in1cc of the solution. (i.e) $S = \theta / lc$

11. Two slits 0.3 mm apart are illuminated by light of wavelength 4500 ^{0}A. The screen is placed at a distance 1m from the slits. Find the separation between the second bright fringe on both sides of the central maximum. (M - 08)

Data : $d = 0.3$ mm $= 0.3 \times 10^{-3}$ m ; $\lambda = 4500$ Å $= 4.5 \times 10^{-7}$ m,

$D = 1$ m ; $n = 2$; $2x = ?$

$2x = (2 D \text{ X } n\lambda) / d$

$= 2 \text{ X} 1 \text{ X } 2 \text{ X } 4.5 \text{ X } 10^{-7} / 0.3 \text{ X } 10^{-3}$

$\therefore 2x = 6 \times 10^{-3}$ m (or) 6 mm

12. State any three uses of IR rays. (O – 08)

(i) Infrared lamps are used in physiotherapy.

(ii) Infrared photographs are used in weather forecasting.

(iii) As infrared radiations are not absorbed by air, thick fog, mist etc, they are used to take photograph of long distance objects.

(iv) Infra red absorption spectrum is used to study the molecular structure.

13. State the conditions to achieve total internal reflection. (O – 08)

For total internal reflection to take place

(i) light must travel from a denser medium to a rarer medium and

(ii) (ii) the angle of incidence inside the denser medium must be greater than the critical angle.

14. On what factors does the amount of optical rotation depend? (J – 08 , J – 11)

The amount of optical rotation depends on :

(i) thickness of crystal

(ii) density of the crystal or concentration in the case of solutions.

(iii) wavelength of light used

(iv) the temperature of the solutions.

15. State Huygen's principle. (O – 09, O – 11,M – 12)

<u>**Huygen's principle:**</u>

(i) every point on a given wave front may be considered as a source of secondary wavelets which spread out with the speed of light in that medium and

(ii) the new wavefront is the forward envelope of the secondary wavelets at that instant.

16. Distinguish between interference and diffraction fringes. (O – 07)

Interference	Diffraction
1) It is due to the superposition of secondary wavelets from two different wavefronts produced by two coherent sources.	1) It is due to the superposition of secondary wavelets emitted from various points of the a. same wave front.
2) Fringes are equally spaced.	2) Fringes are unequally spaced.
3) Bright fringes are of same intensity	3) Intensity falls rapidly
4) Comparing with diffraction, it has large number of fringes	4) It has less number of fringes.

17. A light of wavelength 5890^0A falls normally on a thin air film, 6 dark fringes are seen between two points. Calculate the thickness of the film. (O – 07)

$$2\mu t = n\lambda$$

Thickness of the film $t = n\lambda / 2\mu$

$= 6 \times 5890 \times 10^{-10} / 2$

$= 1.767 \times 10^{-6}$ m.

18. Why the centre of Newton's rings pattern appear dark? (M – 09)

The thickness of the air film at the point of contact of lens L with glass plate P is zero. Hence, there is no path difference between the interfering waves. So, it should appear bright.

But the wave reflected from the denser glass plate has suffered a phase change of π while the wave reflected at the spherical surface of the lens has not suffered any phase change. Hence the point O appears dark.

19. The refractive index of a medium is √3. Calculate the angle of refraction if the unpolarised light is incident on it at the polarizing angle of the medium. (O – 09)

$\mu = \tan i_p = \sqrt{3}$

Hence, $i_p = 60°$

Angle of refraction $r = 90° - i_p$

$= 90° - 60° = 30°$

20. A plano–convex lens of radius 3 m is placed on a flat glass plate and is illuminated by monochromatic light. The radius of the 8^{th} dark ring is 3.6 mm. Calculate the wavelength of the light used.(O – 10 , J – 12)

Data : R = 3m ; n = 8 ; r8 = 3.6 mm = 3.6 × 10−3 m ; λ = ?

Solution : $r_n = \sqrt{nR\lambda}$

$r_n^2 = nR\lambda$

$\lambda = r_n^2 / nR = (3.6 \times 10^{-3})^2 / 8 \times 3$

$= 5400 \times 10^{-10}$ m (or) 5400 A^0

21. Distinguish between Fresnel and Fraunhofer diffractions? (M -10, J – 12)

	Fresnel diffraction	Fraunhofer diffraction
1)	The source and the screen are at finite distances from the obstacle producing diffraction.	The source and the screen are at infinite distances from the obstacle producing diffraction.
2)	The wave front undergoing diffraction is either spherical or cylindrical.	The wavefront undergoing diffraction is plane.
3)	The diffracted rays can not be brought to focus with the help of a convex lens.	The diffracted rays which are parallel to one another are brought to focus with the help of a convex lens.

22. What is fluorescence?

When an atomic or molecular system is excited into higher energy state by absorption of energy, it returns back to lower energy state in a time less than 10^{-5} second and the system is found to glow brightly by emitting radiation of longer wavelength.When ultra violet light is incident on certain substances, they emit visible light. This phenomenon is called fluorescence.

23. State Brewster's law. (M – 11)

Brewster's law

The tangent of the polarising angle is numerically equal to the refractive index of the medium.

(i.e.) $\tan i_p = \mu$

24. What is Raman shift?

In 1928, Sir C.V. Raman discovered experimentally, that the monochromatic light is scattered when it is allowed to pass through a substance. The scattered light contains some additional frequencies other than that of incident frequency. This is known as Raman effect.

25. What are the uses of Raman spectrum?

(i) It is widely used in almost all branches of science.
(ii) Raman Spectra of different substances enable to classify them according to their molecular structure.
(iii) In industry, Raman Spectroscopy is being applied to study the properties of materials.
(iv) It is used to analyse the chemical constitution.

26. In Young's double slit experiment, the distance between the slits is 1.9 mm. The distance between the slit and the screen is 1 m. If the bandwidth is 0.35 mm, calculate the wavelength of the light used. (M – 12)

Bandwidth $\beta = D\,\lambda / d$

$\lambda = \beta\, d / D$

$= 35 \times 10^{-5} \times 1.9 \times 10^{-3} / 1$

$= 66.5 \times 10^{-8}\text{m} = 6650\ \text{A}^0$.

27. What are uses of ultra-violet radiations?

<u>Uses of ultra−violet radiations:</u>

(i) They are used to destroy the bacteria and for sterilizing surgical instruments.
(ii) These radiations are used in detection of forged documents, finger prints in forensic laboratories.
(iii) They are used to preserve the food items.
(iv) They help to find the structure of atoms.

28. What are electromagnetic waves?

According to Maxwell, an accelerated charge is a source of electromagnetic radiation.
In an electromagnetic wave, electric and magnetic field vectors are at right angles to each other and both are at right angles to the direction of propagation.
They possess the wave character and propagate through free space without any materialmedium.
These waves are transverse in nature.

29. Define: grating element.

The combined width of a slit and a ruling in a plane diffraction grating is called as a grating element.

30. What are coherent sources?

Two sources are said to be coherent if they emit light waves of the same wave length and start with same phase or have a constant phase difference.

********* Best wishes *********

+2 PHYSICS Unit – 6 Atomic Physics

1. What are the conditions to achieve the laser action? (M – 06, J – 07)

Conditions to achieve laser action

(i) There must be an inverted population i.e. more atoms in the excited state than in the ground state.

(ii) The excited state must be a metastable state.

(iii) The emitted photons must stimulate further emission. This is achieved by the use of the reflecting mirrors at the ends of the system.

2. An X-ray diffraction of a crystal gave a closest line at an angle of $6^o27'$. If the wavelength of X-ray is $0.58A^o$, find the distance between the two cleavage planes. (M – 06)

$$2d \, Sin\theta = n\lambda$$

Here, n = 1.

$$d = \lambda / 2 \, Sin\theta$$

$$d = 0.58 / 2 \text{ X } Sin \, 6^o27'$$

$$d = 0.58 / 2 \text{ X } 0.1123$$

Hence, distance between the two cleavage planes $d = 2.582 \, A^0$

3. What is the principle of Millikan's oil drop method? (J – 06, M – 12)

Principle

This method is based on the study of the motion of uncharged oil drop under free fall due to gravity and charged oil drop in a uniform electric field.

By adjusting uniform electric field suitably, a charged oil drop can be made to move up or down or even kept balanced in the field of view for sufficiently long time and a series of observations can be made.

4. Calculate the longest wavelength that can be analysed by a rock salt crystal of spacing $d = 2.82 \, A^o$ in the first order. (J – 06, O – 08, M – 09, J -10, O – 10, M - 11, J – 12)

Data : $d = 2.82$ Å $= 2.82 \times 10^{-10}$ m ; $n = 1$; $\lambda max = ?$

Solution : For longest wavelength, $(\sin\theta)_{max} = 1$

$$\therefore 2d \, (\sin\theta)_{max} = \lambda_{max}$$

$$\text{(or) } \lambda_{max} = 2 \times 2.82 \times 10^{-10} \times 1 \;\; / \;\; 1$$

$$\lambda_{max} = 5.64 \times 10^{-10} \text{ m}$$

5. What are the characteristics of laser beam? (O – 06, J – 09, M – 10 , J – 10, J – 12)

Characteristics of laser

The laser beam (i) is monochromatic. (ii) is coherent, with the waves, all exactly in phase with one another, (iii) does not diverge at all and (iv) is extremely intense.

6. The Rydberg's constant for hydrogen is 1.097 X 10^7 ms^{-1}. Calculate the shortest wavelength limit of Lyman series. (O – 06, O – 09)

Data : R = 1.097 × 10^7 m^{-1}

For short wavelength limit of Lyman Series,

$n_1 = 1$, $n_2 = \infty$, $\lambda_s = ?$

Solution: The wave number for Lyman series is,

$$\bar{\nu} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

For short wavelength limit,

$$\bar{\nu}_s = \frac{1}{\lambda_s} = R\left[\frac{1}{1^2} - \frac{1}{\infty^2}\right] = R$$

$$\therefore \lambda_s = \frac{1}{R} = \frac{1}{1.097 \times 10^7}$$

$$= 911.6\ A^o$$

7. State Moseley's law. (M – 07, M – 08, M – 09, M - 11)

The frequency of the spectral line in the characteristic X-ray spectrum is directly proportional to the square of the atomic number (Z) of the element considered.

i.e $\nu \propto Z^2$ or $\nu = a(Z - b)$
where *a and b are constants depending upon the particular* spectral line.

8. Define: ionisation potential. (M – 07, O - 10)

The ionisation potential is that accelerating potential which makes the impinging electron acquire sufficient energy to knock out an electron from the atom and thereby ionise the atom. 13.6 V is the ionisation potential of hydrogen atom.

9. What is ionisation potential energy? (J – 09)

For hydrogen atom, the energy required to remove an electron from first orbit to its outermost orbit($n=\infty$) is 13.6-0 = 13.6eV. This energy is known as the ionization potential energy for hydrogen atom.

10. How much should be the voltage of an X-ray tube so that the electrons emitted from the cathode may give an X-ray of wavelength 1 A^o after striking the target? (J – 07)

$\lambda_{min} = 12400\ A^0 / V$

Hence, $V = 12400\ A^0 / \lambda_{min}$

$= 12400\ A^0 / 1\ A^o = 12400$ volt

11. What is hologram? (O – 07)

Holography

When an object is photographed by a camera, a two dimensional image of three dimensional object is obtained. A three dimensional image of an object can be formed by holography.

In ordinary photography, the amplitude of the light wave is recorded on the photographic film. In holography, both the phase and amplitude of the light waves are recorded on the film. The resulting photograph is called hologram.

12. Write down two important facts of Laue experiment on X-ray diffraction. (O – 07, J – 08)

The Laue experiment has established following two important facts :

(i) X–rays are electro magnetic waves of extremely short wave length.

(ii) The atoms in a crystal are arranged in a regular three dimensional lattice.

13. Write any three medical applications of laser. (M – 08,O – 09,J – 11,O – 11)

Medical applications

(i) In medicine, micro surgery has become possible due to narrow angular spread of the laser beam.

(ii) It can be used in the treatment of kidney stone, tumour, in cutting and sealing the small blood vessels in brain surgery and retina detachment.

(iii) The laser beams are used in endoscopy.

(iv) It can also be used for the treatment of human and animal cancer.

14. Write any three applications of laser in industry. (J – 08)

Industrial applications

(i) The laser beam is used to drill extremely fine holes in diamonds, hard sheets etc.,

(ii) They are also used for cutting thick sheets of hard metals and welding.

(iii) The laser beam is used to vapourize the unwanted material during the manufacture of electronic circuit on semiconductor chips.

(iv) They can be used to test the quality of the materials.

15. Explain any one of the drawbacks of Rutherford atom model. (O – 08)

According to classical electromagnetic theory, the accelerating electron must radiate energy at a frequency proportional to the angular velocity of the electron. Therefore, as the electron spiral towards the nucleus, the angular velocity tends to become infinity and hence the frequency of the emitted energy will tend to infinity. This will result in a continuous spectrum with all possible wavelengths.

16. Find the minimum wavelength of X-rays produced by an X-ray tube operating at 1000 kV. (M – 10)

$$\lambda_{min} = 12400\ A^0 \ / \ V$$

$$\text{Hence,}\quad \lambda_{min} = 12400 \times 10^{-10} / 10^{6}$$

$$= 0.0124\ A^0$$

17. The minimum wavelength of X-rays produced in a Coolidge tube is 0.05 nm. Find the operating voltage of the Coolidge tube. (J – 11)

$$\lambda_{min} = 12400\ A^0 \ / \ V = 0.5 \times 10^{-10}\ m$$

$$\text{Hence,}\quad V = 12400\ A^0 \ / \ \lambda_{min}$$

$$= 12400\ A^0/(1/2)A^o = 24800 \text{ volt}$$

18. What is excitation potential energy of an atom?

The energy required to raise an atom from its normal state into an excited state is called excitation potential energy of the atom.

For example, the energy required to transfer the electron in hydrogen atom from the ground state to the first excited state = (13.6-3.4) = 10.2eV.

19. What is fine structure of spectral lines?

When the spectral line of hydrogen atom is examined by spectrometers having high resolving power, it is found that a single line is composed of two or more close components. This is known as the fine structure of spectral lines. Bohr's theory could not explain the fine structure of spectral lines.

20. What are Stark and Zeeman effects?

It is found that when electric or magnetic field is applied to the atom, each of the spectral line split into several lines. The former effect is called as Stark effect, while the latter is known as Zeeman effect.

21. Give the differences between hard X-rays and soft X-rays.

Soft X-rays	Hard X -Rays
1. Wavelength is 4Å or above	1. Wavelength is in the order of 1Å
2. Have lesser frequency and hence lesser energy.	2. Have high frequency and high energy
3. Have low penetrating power.	3. Have high penetrating power.
4. They are produced at low potential.	4. They are produced at high potential.

22. Give the drawbacks of Sommerfeld's atom model. (O – 11)

Drawbacks of Sommerfeld's atom model:

(i) It could not explain the distribution and arrangement of electrons in atoms.

(ii) Sommerfeld's model was unable to explain the spectra of alkali metals such as sodium, potassium etc.

(iii) It could not explain Zeeman and Stark effect.

(iv) This model does not give any explanation for the intensities of the spectral lines.

23. Give the applications of Moseley's law.

(i) The elements are arranged in the periodic table according to the atomic numbers and not according to the atomic weights.

(ii) led to the discovery of new elements like hafnium (72), technetium (43), rhenium (75) etc.

(iii) helpful in determining the atomic number of rare earths, thereby fixing their position in the periodic table.

24. What is Maser? Give the principle of it.

1) The term MASER stands for Microwave Amplification by Stimulated Emission of Radiation.
2) The working of maser is similar to that of laser.

3) The maser action is based on the principle of population inversion followed by stimulated emission.

4) The emitted photon belongs to the microwave frequencies.

25. A beam of electrons moving with a speed of 4×10^{7} ms^{-1} is projected normal to a magnetic field of $B = 10^{-3}$ Wb m-2. What is the path of the beam in the magnetic field? (M – 12)

Solution : Since, the electrons are released normally to the magnetic field, the electrons travel in a circular path.

$$\therefore Bev = mv^2 / r$$

$$r = mv / Be = 9.11 \times 10^{-31} \times 4 \times 10^{7} / 10^{-3} \times 1.6 \times 10^{-19}$$

Radiusof the path $r = 0.2275$ m.

***** Best wishes *****

1. What is photoelectric effect?

   Photoelectric emission is the phenomena by which a good number of substances, chiefly metals, emit electrons under the influence of radiation such as γ rays, X-rays, ultraviolet and even visible light.

2. What is cut-off or stopping potential? (O – 09)

   The minimum negative (retarding) potential given to the anode for which the photo electric current becomes zero is called the cut-off or stopping potential.

3. Define : threshold frequency.

   The minimum frequency of incident radiation below which the photoelectric emission is not possible completely, however high the intensity of incident radiation may be.

   The threshold frequency is different for different metals.

4. What is dual character of light?

   Light behaves as particles of energy in the higher energy region and as waves in the lower energy region.

5. State any three laws of photo electric emission?

   (i) For a given photo sensitive material, there is a minimum frequency called the threshold frequency, below which emission of photoelectrons stops completely, however great the intensity may be.

   (ii) For a given photosensitive material, the photo electric current is directly proportional to the intensity of the incident radiation, provided the frequency is greater than the threshold frequency.

   (iii) The photoelectric emission is an instantaneous process. i.e. there is no time lag between the incidence of radiation and the emission of photo electrons.

   (iv) The maximum kinetic energy of the photo electrons is directly proportional to the frequency of incident radiation, but is independent of its intensity.

6. Name the types of photoelectric cells.

   The photo electric cells are of three types:

   (i) Photo emissive cell
   (ii) Photo voltaic cell and
   (iii) Photo conductive cell.

7. Give three applications of photoelectric cells. (J – 06, M – 10,O – 10, J – 12)

   (i) Photoelectric cells are used for reproducing sound in cinematography.
   (ii) They are used for controlling the temperature of furnaces.
   (iii) Photoelectric cells are used for automatic switching on and off the street lights.
   (iv) Photoelectric cells are used in the study of temperature and spectra of stars.
   (v) Photoelectric cells are also used in obtaining electrical energy from sunlight during space travel.
   (vi) These cells are used in instruments measuring light illumination.
   (vii) These cells are used in opening and closing of door automatically.
   (viii) Photoelectric cells are used in burglar alarm and fire alarm.

8. What are de Broglie waves?

   Matter in motion must be accompanied by waves called de Broglie waves.

   de Broglie wavelength $\lambda = h / mv$

9. An electron beam is accelerated through a potential difference of 10^4 volt. Find the de Broglie wavelength.

$\lambda = 12.27\ A^o\ /\ \sqrt{V}$

$\lambda = 12.27\ A^o\ /\ \sqrt{10^4}$

$= 0.1227\ A^o$

10. What are the uses of an electron microscope? (M – 07)

Uses of electron microscope :

(i) It is used in the industry, to study the structure of textile fibres, surface of metals, composition of paints etc.

(ii) In medicine and biology, it is used to study virus, and bacteria.

(iii) In Physics, it has been used in the investigation of atomic structure and structure of crystals in detail.

11. Why X-rays are not used in microscopes?

1) the wavelength of X-rays is smaller than that of the visible light.

2) X-rays cannot be focussed as visible radiations are focussed using lenses.

3) X-rays can not be deflected by electric and magnetic fields.

12. What are the limitations of electron microscope? (M – 06, M – 09, M – 12)

An electron microscope is operated only in high vacuum. This prohibits the use of the microscope to study living organisms which would evaporate and disintegrate under such conditions.

13. What is a frame of reference?

A system of co-ordinate axes which defines the position of a particle in two or three dimensional space is called a frame of reference.

14. What are inertial and non-inertial frame of references? (O – 06, M – 08, O – 11)

(i) Inertial (or) unaccelerated frames:

Bodies in this frame obey Newton's law of intertia and other laws of Newtonian mechanics. In this frame, a body remains at rest or in continuous motion unless acted upon by an external force.

(ii) Non-inertial (or) accelerated frames:

A frame of reference is said to be a non-intertial frame, when a body not acted upon by an external force, is accelerated. In this frame, Newton's laws are not valid.

15. State the fundamental postulates of special theory of relativity? (O – 07, J – 09,M – 11)

The two fundamental postulates of the special theory of relativity are :

(i) The laws of Physics are the same in all inertial frames of reference.

(ii) The velocity of light in free space is a constant in all the frames of reference.

16. According to classical mechanics, what is the concept of time ? (J – 10)

According to classical mechanics,

(i) The time interval between two events has the same value for all observers irrespective of their motion.

(ii) If two events are simultaneous for an observer, they are simultaneous for all observers, irrespective of their position or motion.

17. The kinetic energy of an electron 120 eV. Calculate the de Broglie wavelength of electron. (J – 07, J – 08)

$\lambda = h / \sqrt{2mE}$

$\lambda = 6.626 \times 10^{-34} / \sqrt{2 \times 9.1 \times 10^{-31} \times 120 \times 1.6 \times 10^{-19}}$

$\lambda = 1.121 \times 10^{-10}$ m

18. The work function of a metal surface is 6.626×10^{-19} joule. Calculate the frequency of the radiation?

Work function W $= h\gamma_o$

The frequency of the radiation $\gamma_o = W / h$

$= 6.626 \times 10^{-19} / 6.626 \times 10^{-34}$

$= 10^{15}$ Hz.

19. Find the de Broglie wavelength of electron in the fourth orbit of hydrogen atom. (J – 11)

We know that, $\lambda = 2\pi r / n$

$\lambda_4 = 2\pi r_4 / 4$

$= 2\pi(4^2 r1) / 4$

$= 2 \times 3.14 \times 4 \times 0.53 \ A^0$

$= 13.313 \ A^0$

20. The work function of a metal surface is 1.8 eV. Calculate the threshold wavelength. (O – 08)

Work function $W = h\gamma_o = h C / \lambda_0$

$\lambda_0 = h C / W$

$= 6.626 \times 10^{-34} \times 3 \times 10^8 / 1.8 \times 1.6 \times 10^{-19}$

$= (19.878 / 2.88) \times 10^{-7}$ m

$= 6.902 \times 10^{-7}$ m

******* Best of luck *******

+2 Physics UNIT – 8 Nuclear Physics Three marks Q & A

1. Select the pairs of isotopes, isobars and isotones from the following nuclei:
   $_{11}Na^{22}$, $_{12}Mg^{24}$, $_{11}Na^{24}$, $_{10}Ne^{23}$ (M – 12)

   Isotopes are $_{11}Na^{22}$, $_{11}Na^{24}$
   Isobars are $_{12}Mg^{24}$, $_{11}Na^{24}$
   Isotones are $_{11}Na^{24}$, $_{10}Ne^{23}$

2. In $_{17}Cl^{35}$, calculate the number of protons, neutrons and electrons.
   Number of protons = 17, Number of electrons = 17, Number of neutrons = 18

3. Tritium has a half life period of 12.5 years. What fraction of the sample will be left over after 25 years? (M -10, J – 12)
   HLP = 12.5 years
   Number of HLPs in 25 years = 25 / 12.5 =2
   Fraction of the sample left over after 25 years = $(½)^2$ = ¼

4. Define: 1 amu
   One atomic mass unit is considered as one twelfth of the mass of carbon atom $_6C^{12}$.
   1 amu = 1.66×10^{-27} kg.

5. Define: mass defect. (O -10)
   The difference in the total mass of the nucleons and the actual mass of the nucleus is known as the mass defect.

6. Define: binding energy. (O – 09)
   The energy equivalent of mass defect is called as binding energy.
   ∴ Binding energy $= [Zm_p + Nm_n – m]\, c^2$
   $= \Delta m\, c^2$. Here, Δm is the mass defect.

7. Write any three findings of binding energy curve. (O – 06)
   (i) The binding energy per nucleon reaches a maximum of 8.8 MeV at A = 56, corresponding to the iron nucleus (26Fe56). Hence, iron nucleus is the most stable.
   (ii) The average binding energy per nucleon is about 8.5 MeV for nuclei having mass number ranging between 40 and 120. These elements are comparatively more stable and non radioactive.
   (iii) For higher mass numbers the curve drops slowly and the BE/A is about 7.6 MeV for uranium. Hence, they are unstable and radioactive.

8. What are nuclear forces?
   The force which overcomes the electrostatic repulsion between positively charged protons and binds the protons and neutrons inside the nucleus is called nuclear force.

9. State any three properties of the nuclear forces. (J – 08)
   (i) Nuclear force is charge independent.
   (ii) Nuclear force is the strongest known force in nature.
   (iii) Nuclear force is not a gravitational force.
   (iv) Nuclear force is a short range force.

10. What is artificial radioactivity? (J – 12)
    The phenomenon by which even light elements are made radioactive by artificial or induced methods is called artificial radioactivity.

11. What is α - decay? Give an example. (M – 06)
    α-***decay***
    When a radioactive nucleus disintegrates by emitting an α-particle, the atomic number decreases by two and mass number decreases by four.
    Example : Radium ($_{88}Ra^{226}$) is converted to radon ($_{86}Rn^{222}$) due to α−decay
    $$_{88}Ra^{226} \rightarrow {}_{86}Rn^{222} + {}_2He^4$$

12. Define: roentgen. (J – 07, O – 08)

One roentgen (1R) is defined as the quantity of radiation which produces 1.6×10^{12} pairs of ions in 1 gram of air.

13. Define: activity and Curie (O – 06, M – 08, M-10, O - 10)

The activity of a radioactive substance is defined as the rate at which the atoms decay.

Curie is defined as the quantity of a radioactive substance which gives 3.7×10^{10} disintegrations per second or 3.7×10^{10} becquerel.

14. State any three properties of the neutrons. (J – 06, M – 08, M – 09, J – 11)

(i) Neutrons are the constituent particles of all nuclei, except hydrogen.
(ii) As they are neutral particles,they are not deflected by electric and magnetic fields.
(iii) As neutrons are neutral, they can easily penetrate any nucleus.
(iv) Neutrons are stable inside the nucleus. But outside the nucleus they are unstable.

15. How do you classify the neutrons in terms of its kinetic energy? (J – 09)

Neutrons are classified according to their kinetic energy as
(a) slow neutrons and (b) fast neutrons.
Neutrons with energies from 0 to 1000 eV are called slow neutrons.
Neutrons with energies in the range between 0.5 MeV and 10 MeV are called fast neutrons.

16. Define: critical mass and critical volume. (O – 08)

The minimum size in which atleast one neutron is available for further fission reaction. The mass of the fissile material at the critical size is called critical mass.

The chain reaction is not possible if the size is less than the critical size.

17. What is a breeder reactor? (M – 09)

${}_{92}U^{238}$ and ${}_{90}Th^{232}$ are not fissile materials but are abundant in nature. In the reactor, these can be converted into a fissile material ${}_{94}Pu^{239}$ and ${}_{92}U^{233}$ respectively by absorption of neutrons.

The process of producing more fissile material in a reactor in this manner than consumed during the operation of the reactor is called breeding. A fast reactor can be designed to serve as a good breeder reactor.

18. What is the use of control rods? Mention any two control rods. (O – 07)

The control rods are used to control the chain reaction. They are very good absorbers of neutrons. The commonly used control rods are made up of elements like boron or cadmium. In our country, boron carbide (B_4C) is used as control rod.

19. Write short notes on proton – proton fusion in sun. (M -11)

Proton – Proton cycle

${}_1H^1 + {}_1H^1 \rightarrow {}_1H^2 + {}_1e^0 + \nu$ (emission of positron and neutrino)
${}_1H^1 + {}_1H^2 \rightarrow {}_2He^3 + \gamma$ (emission of gamma rays)
$2\,{}_2He^3 \rightarrow {}_2He^4 + 2\,{}_1H^1$

The reaction cycle is written as

$4\,{}_1H^1 \rightarrow {}_2He^4 + 2\,{}_1e^0 + 2\nu +$ energy (26.7 MeV)

Thus four protons fuse together to form an alpha particle and two Positrons with a release of large amount of energy.

20. What are cosmic rays? (J – 08, J -10)

The ionising radiation many times stronger than γ-rays entering the earth from all the directions from cosmic or interstellar space is known as cosmic rays. The name, cosmic rays was given by Millikan. The cosmic rays can be broadly classified into primary and secondary cosmic rays.

21. What percentage of a given radioactive substance will be left after 5 half -life periods? (M -11)

The remaining part of radioactive substance $= (\frac{1}{2})^5$

Hence, The percentage of remaining part of radioactive substance $= (\frac{1}{2})^5 \times 100\%$

$= 3.125\ \%$

22. What is pair production and pair annihilation? (M – 07, M – 06, J – 06)

Pair production:

The conversion of a photon into an electron−positron pair on its interaction with the strong electric field surrounding a nucleus is called pair production.

Pair annihilation :

The converse of pair production in which an electron and positron combine to produce a photon is known as annihilation of matter.

23. The half life of radon is 3.8 days. Calculate mean life. (M – 07, O – 09, J – 09)

Half Life Period HLP $T_{½}$ = 0.6931 / λ = 0.6931 τ

Hence, Mean life τ = $T_{½}$ / 0.6931 = 3.8 / 0.6931

= 5.483 days.

24. What are leptons? Give examples. (J – 07, M – 12)

Leptons:

Leptons are lighter particles having mass equal to or less than about 207 times the mass of an electron except neutrino and antineutrino.

This group contains particles such as electron, positron, neutrino, antineutrino, positive and negative muons. The electron and positron are the antiparticles.

Neutrino and antineutrino are also associated with β-ray emission. The neutrinos and antineutrinos are massless and chargeless particles, but carrier of energy and spin. Muons were discovered in cosmic ray studies.

25. The half life period of $_{84}Po^{218}$ is 3 minutes. What percentage of the sample has decayed in 15 minutes? (O – 07)

1 HLP = 3 minutes

In 15 minutes, there are 3 HLPs

The remaining part of radioactive substance = $(½)^3$

Hence, The percentage of remaining part of radioactive substance = $(½)^3$ X 100%

= 12.5 %

Decayed percentage = 100 – 12.5 = 87.5 %

26. The radioactive isotope $_{84}Pa^{214}$ undergoes a successive disintegration of two α decays and two β decays. Find the atomic number and the mass number of the resulting isotope. (J – 09)

For two α decays:

$_{84}Pa^{214} \rightarrow \; _{82}A^{210} \rightarrow \; _{80}B^{206}$

For two β decays :

$_{80}B^{206} \rightarrow \; _{81}C^{206} \rightarrow \; _{82}D^{206}$

The resulting isotope is lead with mass number 206 and atomic number 82. (Pb)

All the best

1. What is an intrinsic semiconductor? Give any two examples. (M – 06)
   i) A semiconductor which is pure and contains no impurity is known as an intrinsic semiconductor.
   ii) In an intrinsic semiconductor, the number of free electrons and holes are equal.
   Common examples of intrinsic semiconductors are pure germanium and silicon.

2. The gain of an amplifier without feedback is 100 and the gain of an amplifier with feedback is 200.Calculate the feedback fraction. (M – 06)

Solution : Voltage gain after feedback,

$A_f = A / 1 - A\beta$

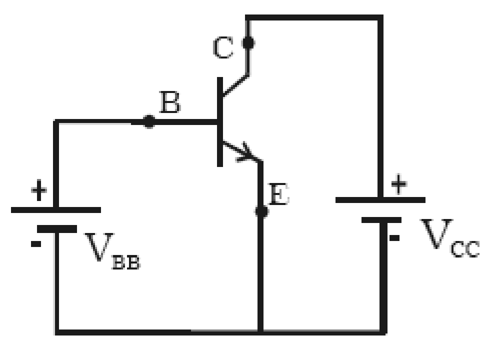
$200 = 100 / 1 - 100\beta$

$2 = 1 / 1 - 100\beta$

$2 - 200\beta = 1$ (i.e) $200\beta = 1$

$\beta = 1/200 = 0.005$

1. Draw the circuit diagram for NPN transistor in common emitter (CE) mode. (M – 06, O – 06)



C – collector E – emitter B – base

2. Mention any three advantages of integrated circuit. (M – 06, O – 06, J -10, J – 11)
   (i) Extremely small in size
   (ii) Low power consumption
   (iii) Reliability
   (iv) Reduced cost
   (v) Very small weight
   (vi) Easy replacement

3. Define input impedance of a transistor in CE mode. (J – 06, J – 11)

The input impedance of the transistor is defined as the ratio of small change in base – emitter voltage to the corresponding change in base current at a given V_{CE}.

$$\therefore \text{Input impedance, } r_i = \left(\frac{\Delta V_{BE}}{\Delta I_B}\right)_{V_{CE}}$$

4. Define output impedance of a transistor. (O – 08, O – 09)

The output impedance r_o is defined as the ratio of variation in the collector emitter voltage to the corresponding variation in the collector current at a constant base current in the active region of the transistor characteristic curves.

5. When the negative feedback is applied to an amplifier of gain 50, the gain falls to 25. Calculate the feedback ratio. (J – 06, O – 09, M-10, O-10)

$A_f = A / 1 + A\beta$

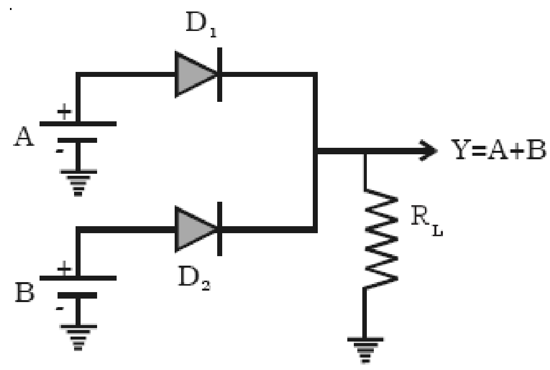
$25 = 50 / 1 + 50\beta$

$1 = 2 / 1 + 50\beta$

$1 + 50\beta = 2$ (i.e) $50\beta = 1$

$\beta = 1/50 = 0.02$

6. Draw circuit diagram for OR gate using diodes. (J – 06)



7. What is an extrinsic semiconductor? (J – 06, J – 08, O-10, M-11)

An extrinsic semiconductor is one in which an impurity with a valency higher or lower than the valency of the pure semiconductor is added, so as to increase the electrical conductivity of the semiconductor.

8. What is Zener breakdown? (O – 06, J – 07, M – 08)

(ii) Zener breakdown : When both sides of the PN junction are heavily doped, consequently the depletion layer is narrow. Zener breakdown takes place in such a thin narrow junction. When a small reverse bias is applied, a very strong electric field is produced across the thin depletion layer. This field breaks the covalent bonds, extremely large number of electrons and holes are produced, which give rise to the reverse saturation current (Zener current). Zener current is independent of applied voltage.

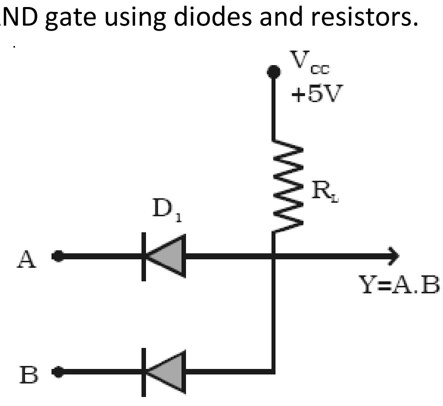
9. The voltage gain of an amplifier without feedback is 100. If negative feedback is applied with feedback fraction 0.1, calculate the voltage gain with feedback. (O – 06)

A_F = A / 1 + A β
= 100 / 1 + 100 X 1/10
= 100 / 11 = 9.09

10. What are advantages of negative network? (J – 07, J – 08, O – 07, M-11)

Following are the advantages of negative feedback.
(i) Highly stabilised gain.
(ii) Reduction in the noise level.
(iii) Increased bandwidth
(iv) Increased input impedance and decreased output impedance.
(v) Less distortion.

11. Draw circuit diagram for AND gate using diodes and resistors. (J – 07)



12. What is rectification? (M – 07, M - 09)

The process in which alternating voltage or alternating current is converted into direct voltage or direct current is known as rectification.

13. What is light emitting diode? Give any one of its uses. (M – 07)

A light emitting diode (LED) is a forward biased PN junction diode, which emits visible light when energized.

LEDs are used for instrument displays, calculators and digital watches.

14. When there is no feedback, the gain of the amplifier is 100. If 5% of the output voltage is fed back into the input through a negative network, find the voltage gain after feedback. (M – 07)

$A_F = A / 1 + A\beta$

$= 100 / 1 + 100 \times 5/100 = 100 / 6$

$= 16.66$

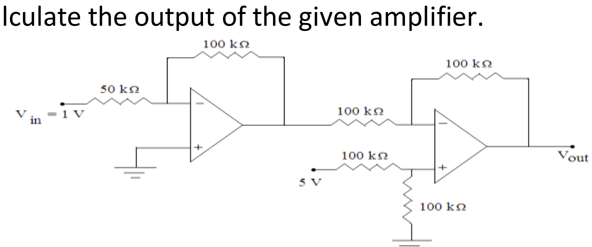
15. Collector current I_c=20 mA and base current I_b = 50 A. Find current gain β of a transistor. (J – 10)

$\beta = I_C / I_B$

$= 20 \times 10^{-3} / 50 \times 10^{-6}$

$= 400$

16. Calculate the output of the given amplifier. (J – 07)



For first OP-AMP,

$A_v = - R_f / R_{in} = -100/50 = -2$

$A_v = V_{out} / V_{in} = -2$

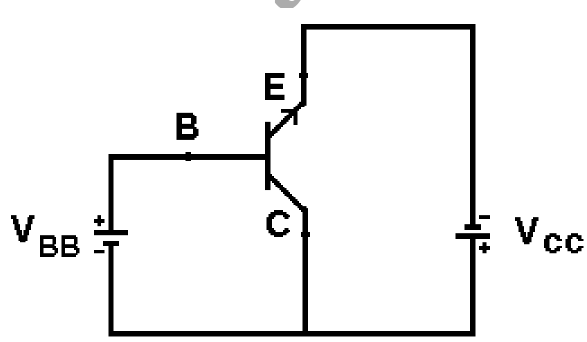
Hence, $V_{out} = -2 \times V_{in} = -2V$

For second OP-AMP,

$V_{out\,2} = V_1 - V_{out} = 5 - (-2)$

$= 7$ volt

17. Draw the circuit diagram for NPN transistor in common collector (CC) mode. (M – 08)



C – collector E – emitter B – base

18. State de Morgan's theorem. (M – 08, M – 09, J-10)

First theorem

"The complement of a sum is equal to the product of the complements." If A and B are the inputs, then $\overline{A+B} = \overline{A} \cdot \overline{B}$

Second theorem

"The complement of a product is equal to the sum of the complements." If A and B are the inputs, then $\overline{A \cdot B} = \overline{A} + \overline{B}$.

19. A transistor is connected in CE configuration. The voltage drop across the load resistance (R_c) 3 k is 6 V. Find the base current. The current gain **α** of the transistor is 0.97. (M – 08)

The voltage drop across the load resistance $= I_C R_C = 6V$

$I_C = 6 / R_C = 6 / 3 \times 10^3 = 2$ mA.

$\beta = \alpha / 1-\alpha = 0.97 / 1 - 0.97 = 32.33$

$I_B = I_C / \beta = 2 \times 10^{-3} / 32.33$

$= 61.86\ \mu A$

20. What is an integrated circuit? (J – 08, J – 09)

An integrated circuit (IC) consists of a single – crystal chip of silicon, containing both active (diodes and transistors) and passive (resistors, capacitors) elements and their interconnections.

21. What is meant by doping? (O – 08)

The process of addition of very small amount of impurity into an intrinsic semiconductor is called doping.

22. What the Barkhausen conditions for oscillations? (O – 07, O – 08, J – 09, M-10)

This condition means that (i) the loop gain $A\beta = 1$ and (ii) the net phase shift round the loop is 0^o or integral multiples of 2π.

These are called the Barkhausen conditions for oscillations.

23. Name the different methods of doping in a semiconductor. (O – 09)

There are three different methods of doping a semiconductor.

(i) The impurity atoms are added to the semiconductor in its molten state.

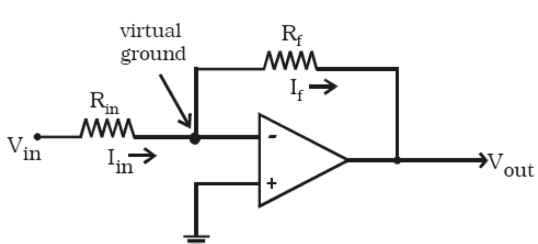
(ii) The pure semiconductor is bombarded by ions of impurity atoms.

(iii) When the semiconductor crystal containing the impurity atoms is heated, the impurity atoms diffuse into the hot crystal.

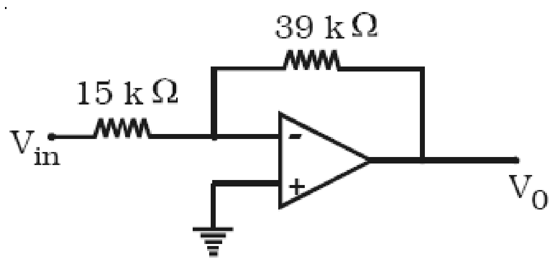
24. Give the important parameters of an operational amplifier. (O – 07)

The most important characteristics of OP-AMP are : (i) very high input impedance or even infinity which produces negligible current at the inputs, (ii) very high gain, (iii) very low output impedance or even zero, so as not to affect the output of the amplifier by loading.

25. Draw the circuit diagram of inverting amplifier using operational amplifier. (M – 11)



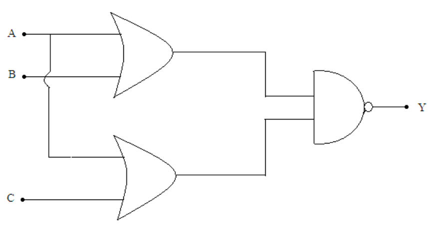
26. Find the output of the following ideal operational amplifier. (J – 08)



output of the OP.AMP $(V_o) = -\dfrac{R_f}{R_{in}} \times V_{in}$

$= -2.6 \times 120 \times 10^{-3} = -0.312V$

27. Find the output of the following logic circuit. (O – 08)



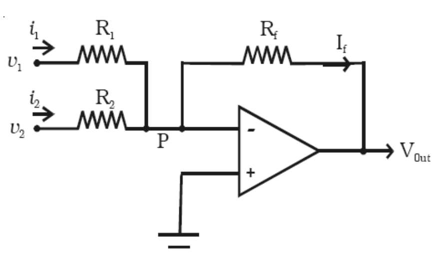
$Y = \overline{(A + B)(A + C)}$

$Y = \overline{(A+B)} + \overline{(A+C)}$

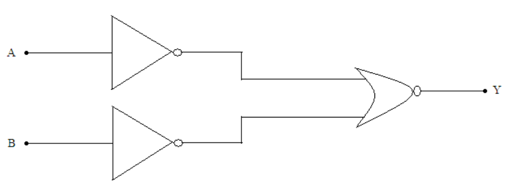
$= \overline{A.B} + \overline{A.C}$

$Y = \overline{A (BC)}$

28. Draw the circuit for summing amplifier. (M – 09)



29. Find the output of the following logic circuit. (O – 07)

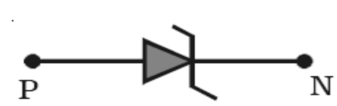


$Y = \overline{\overline{A} + \overline{B}} = \overline{\overline{A}} . \overline{\overline{B}}$

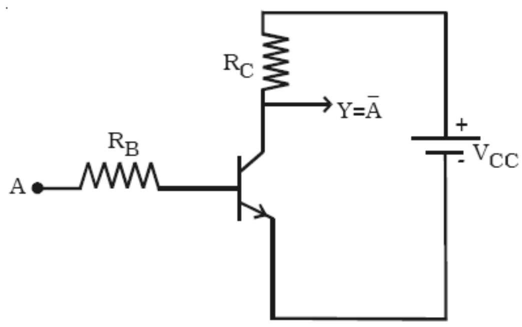
$= A . B$

30. What is a zener diode? Draw its symbol. (O – 09, O-10, O – 11)

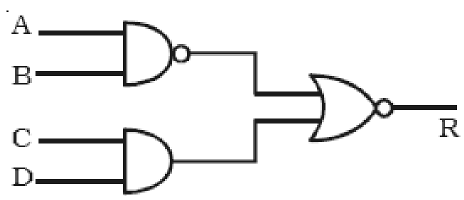
Zener diode is a reverse biased heavily doped semiconductor (silicon or germanium) PN junction diode, which is operated exclusively in the breakdown region.



31. Give the circuit diagram of NOT gate using a transistor. (J -10, O – 11)



32. Give the Boolean equation for the given logic diagram. (J – 11)



$$R = \overline{\overline{A.B} + C.D} = \overline{\overline{A.B}}\ .\ \overline{CD}$$

$$= AB(\overline{C} + \overline{D})$$

33. Prove the Boolean equation (A + B) (A + C) = A + BC (M- 11)

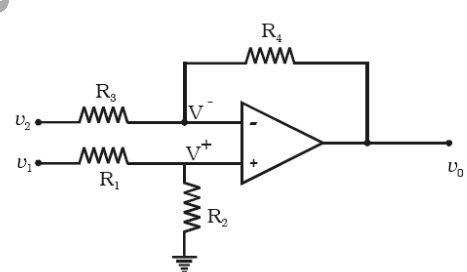
$(A+B)\ (A+C) = AA + AC + BA + BC$

$= A + AC + AB + BC = A(1+C+B) + BC = A + BC$

$[\because\ 1 + C + B = 1]$

$\therefore$ LHS = RHS, the given identity is proved.

34. Draw the circuit diagram of difference amplifier using operational amplifier. (J – 11)



1. Define: modulation factor in amplitude modulation. (M – 06, J – 08, O -09, J – 11, M – 10)

Modulation factor is defined as the ratio of the change of amplitude in carrier wave after modulation to the amplitude of the unmodulated carrier wave.

2. Write any three applications of RADAR. (J – 07)

(i) Air and sea navigation is made entirely safe

(ii) Radar systems are used for the safe landing of air crafts.

(iii) The pulses can be used for discovering the position of buried metals, oils and ores.

3. What is FAX? Give its uses. (O – 06)

Fax (or) Facsimile, is an electronic system for transmitting graphical information by wire or radio. It is used to send printed material by scanning and converting it into electronic signals. These signals modulate a carrier to be transmitted over the telephone lines.

4. What are the advantages of digital communication? (M – 07, J – 10)

Advantages

(i) The transmission quality is high and almost independent of the distance between the terminals.

(ii) The capacity of the transmission system can be increased.

(iii) The newer types of transmission media such as light beams in optical fibers and wave guides operating in the microwave frequency extensively use digital communication.

5. What is meant by skip distance? (J – 07, M – 08, J – 09, O – 10 , M – 11)

In the skywave propagation, for a fixed frequency, the shortest distance between the point of transmission and the point of reception along the surface is known as the *skip distance.*

6. What is the necessity of modulation? (O – 07)

In radio broadcasting, it is necessary to send audio frequency signal (eg. music, speech etc.) from a broadcasting station over great distances to a receiver. The music, speech etc., are converted into audio signals using a microphone. The energy of a wave increases with frequency. So, the audio frequency (20 – 20000 Hz) is not having large amount of energy and cannot be sent over long distances. The radiation of electrical energy is practicable only at high frequencies e.g. above 20 kHz. The high frequency signals can be sent through thousands of kilometres with comparatively small power.

7. Give any three advantages of optical fiber communication. (O – 08)

Advantages

(i) Transmission loss is low.

(ii) Fiber is lighter and less bulky than equivalent copper cable.

(iii) More information can be carried by each fiber than by equivalent copper cables.

(iv) There is no interference in the transmission of light from electrical disturbances or electrical noise.

8. What are the advantages of frequency modulation? (M – 09)

Advantages

(i) It gives noiseless reception. Noise is a form of amplitude variation and a FM receiver will reject such noise signals.

(ii) The operating range is quite large.

(iii) The efficiency of transmission is very high.

9. What is MODEM?

The name modem is the abbreviation of the term Modulator and Demodulator.
A modem is used to convert digital signals into analog signals capable of being transmitted over telephone lines. At the receiving end of the system, modem is used to demodulate the analog signals and

10. Define : bandwidth or channel width in Amplitude modulation.

The channel width is given by the difference between extreme frequencies i.e. between maximum frequency of USB and minimum frequency of LSB.

$\therefore$ Channel width = 2 × maximum frequency of the modulating signal

$$= 2 \times (f_s)_{max}$$

***** **Best wishes** *****