UNIT 01
ELECTROSTATICS

1 Marks Questions:

Q.1 A certain region has cylindrical symmetry of electric field. Name the charge distribution producing such a field.

Q.2 Represent graphically the variation of electric field with distance, for a uniformly charged plane sheet.

Q.3 How will the radius of a flexible ring change if it is given positive charge?

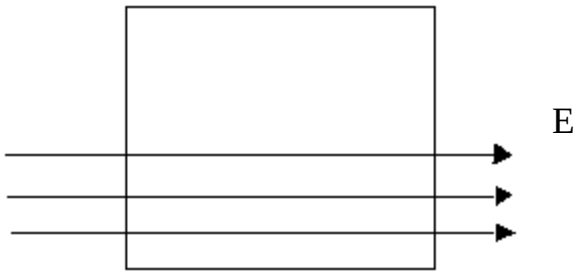
Q.4 Five Charges of equal amount (q) are placed at five corners of a regular hexagon of side 10 cm. What will be the value of sixth charge placed at sixth corner of the hexagon so that the electric field at the centre of hexagon is zero ?.

Q.5 Two conducting spheres of radii r_1 & r_2 are at same potential. What is the ratio of charges on the spheres?.

Q.6 Why do we use nitrogen or methane gas in Van-de-Graff generator ?

Q.7 An electric charge q is placed at one of the corner of a cube of side 'a'. What will be the electric flux through its one of the face?

Q.8 A square surface of side L meters is in the plane of the paper. A uniform electric field E (volts/m), also in the plane of paper, is limited only to lower half of the square as shown in the diagram. What will be the electric flux (in SI units) associated with the surface.



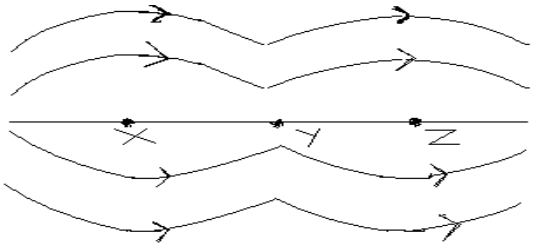
Q.9 Which of the following statement is true & why?

(A) $E_x = E_y = E_z$

(B) $E_x > E_y > E_z$

(C) $E_x = E_z < E_y$

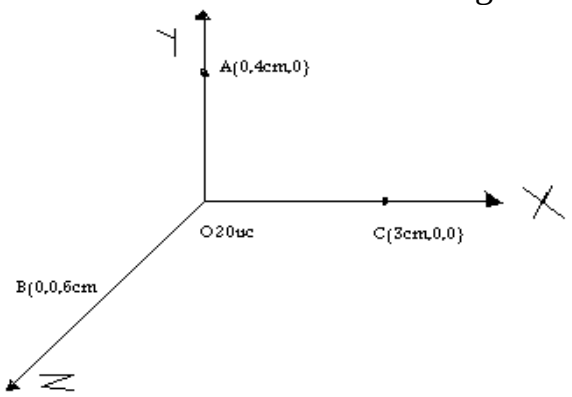
(D) $E_x < E_y < E_z$



Q.10 The distance of the field point on the equatorial plane of a small electric dipole is halved. By what factor will the electric field change for the dipole?

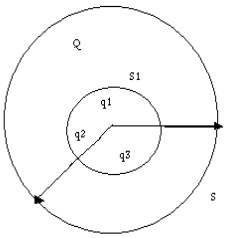
2 Marks Questions:

Q.11 A charge of 10 µc is brought from point A (0,4 cm,0) to C (3 cm,0,0) via point B (0,0,6 cm) in vacuum. Calculate the work done if the charge at origin is 20 µc.



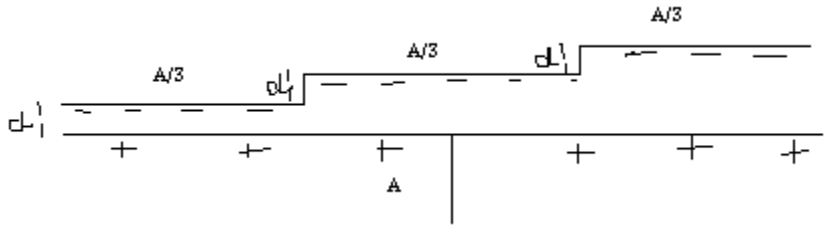
Q.12 A charged particle is free to move in an electric field. Will it always move along an electric line of force? Justify your answers?.

Q.13 The flux of the electrostatic fields, through the closed spherical surface S,' is found to be four times that through the closed sphere 'S1'. Find the magnitude of the charge Q . Given, q1= 1 µc,q2=-2µc and q3=9.854 µc



Q.14 A charge Q is divided in two parts q and Q - q separated by a distance R. If force between the two charges is maximum, find the relationship between q & Q.

Q.15 A capacitor is made of a flat plate of area A and second plate having a stair like structure as shown in figure below. If width of each stair is A/3 and height is d. Find the capacitance of the arrangement.



3 marks question:

Q16. A parallel plate capacitor is charged to potential V by a source of emf . After removing the source, the separation between the plates is doubled . How will the following change electric field change on each plate potential difference capacitance of the capacitor Justify your answer

Q 17 If N drops of same size ,each having the same charge ,coalesce to form a bigger drop . How will the following vary with respect to single small drop?

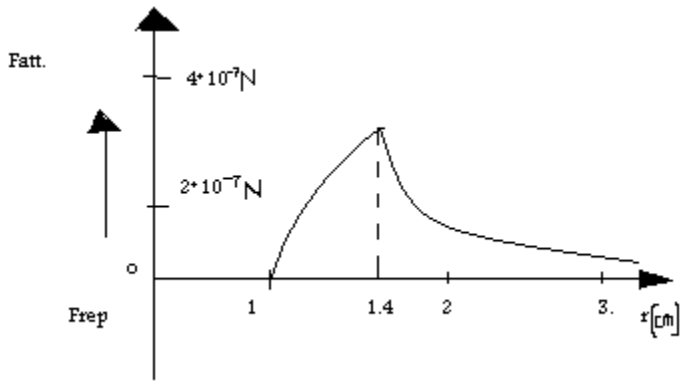
(i)Total charge on bigger drop

(ii) Potential on the bigger drop

(iii) The capacitance on the bigger drop

Q18 Work done to move a charge along a closed path inside an electric field is always zero, using this fact, prove that it is impossible to produce an electric field in which all limes of force would be parallel lines and density of their distribution would constantly increase in a direction perpendicular to the lines of force.

Q 19. The graph shows the electric force of repulsion on tiny charged conducting sphere A, as a function of its separation from a sphere B. The sphere B has 10 times the charge on the sphere A ; Explain the behavior of the force between separation 2cm and 1cm.



Q 20. Obtain the formula for electric field due to a long thin wire of uniform linear charge density without using Gauss's law.

UNIT 02 CURRENT ELECTRICITY

One mark questions

Q1. Under what conditions will Terminal potential difference of a cell be greater than its EMF?

Q2. A wire of resistivity p is stretched to twice its length. What will be its new resistivity?

Q3. Give the colour coding for a carbon resistor of 1 ohm having 5% tolerance?

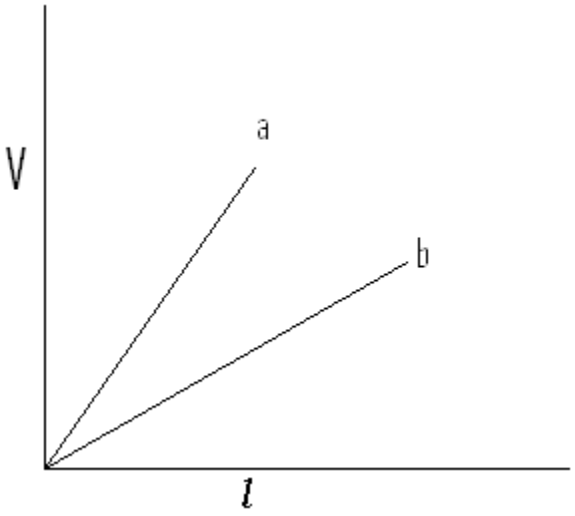
Q4. If the temperature of a metallic conductor increases how does the relaxation time of electrons in conductor change?

Q5. Write the dimensional formula of mobility of electrons.

Q6. Manganin is used in making standard resistance .give two reasons.

Q7. How does the drift velocity of electrons in a metallic conductor change, if the length of the conductor is doubled by stretching it, keeping the applied potential difference constant?

Q8. The variation of potential difference V with length l in case of two potentiometers 'a' and 'b' is shown in the graph given below.



Which one of these two will you prefer for comparing EMF of two cells? Give reason.

Q9. Why the terminal Potential is always less than EMF of a cell, while in use?

Q10. The conductivity of a semi conductor increases with the rise of temperature. Give reason.

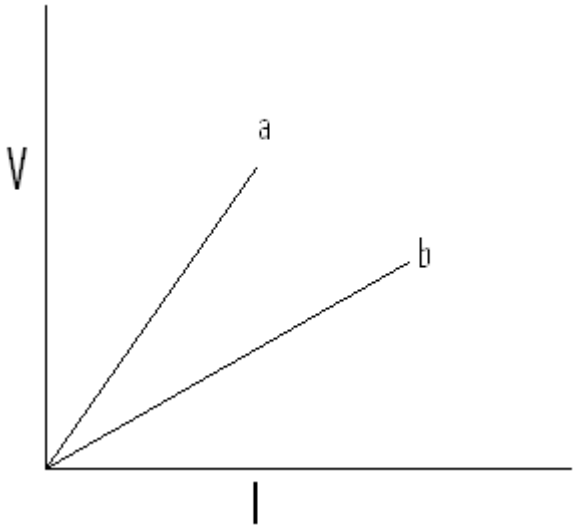
Two Marks Questions

Q11. N number of identical resistors each of resistance R is combined to get the maximum and minimum resistances, what is the ratio of the maximum to minimum resistance.

Q12. Two wires of equal length one of copper and other of manganin have same resistance. Which of the two wires will be thicker? Justify your answer with the help of suitable formula.

Q13. A resistor of 24 ohm resistance is bent in the form of a loop as shown in the figure. Calculate effective resistance between points A and B?

Q14. V-I graph for metallic wire at two different temperature ‘a’ and ‘b’ is shown in fig. Which of the two temperatures is higher and why?



Q15. Explain why the I-V characteristics of a resistor are obtained to deviate from a straight line from higher values of current as shown below:

Three Marks Question-

Q16. Two resistances are in the ratio 1:4 if these are connected in parallel their total resistance becomes 20 ohm. Find the value of each resistance.

Q17. A household circuit has a fuse of 5A rating. Calculate the maximum number of bulbs of rating 60W-220V each which can be connected in the household circuit.

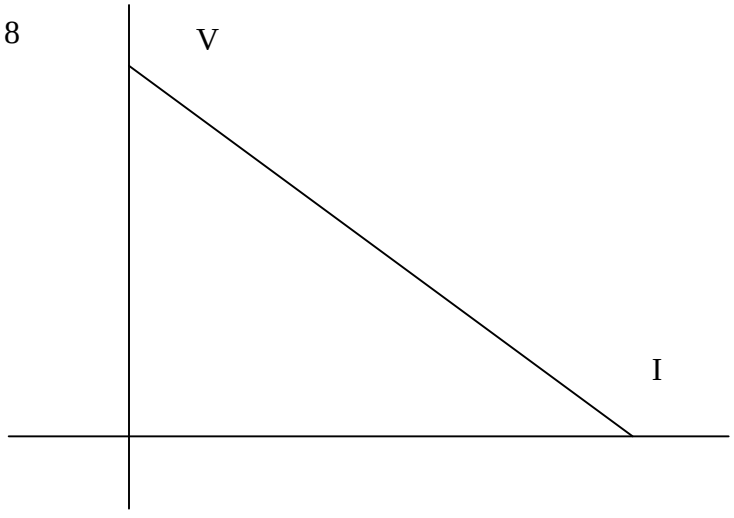
Q18. Calculate current in each branch.

Q19. Two identical cells of EMF E and internal resistance r whether joined in series or in parallel give the same current, when connected to external resistance of 1 ohm. Find internal resistance of each cell.

Q20. 4 cells of identical EMF E, internal resistance r are connected in series to a variable resistor. The following graph shows the variation of terminal voltage of the combination with the current output:

1.What is the EMF of each cell?

2.calculate the internal resistance of each cell.



Unit 03 Chapter: Magnetic Effects of Current

1 Mark

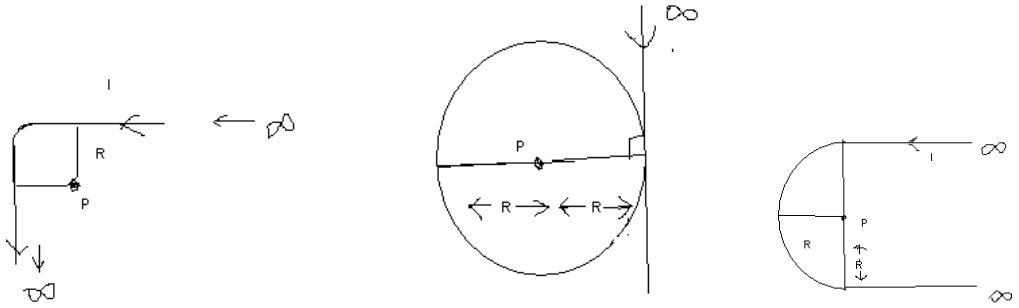
1. A Current 'I' flows along the length of an infinitely long straight thin walled pipe. What is the magnetic field at any point on the axis of pipe?
2. The Earth's core contains iron but geologists do not regard this as a source of Magnetic Field, Why?
3. Is the Resistance of Voltmeter larger than or smaller than the resistance of Galvanometer from which it is converted.
4. A Magnetic Field dipole placed in a Magnetic Field experiences a net force. What can you say about the Nature of Magnetic Field?
5. Earth's Magnetic Field does not affect working of moving Coil Galvanometer. Why?
6. Which type of Magnetism exists in all substances?
7. For what orientation P.E. of a Magnetic dipole placed in uniform Magnetic Field minimum?
8. How does a ferromagnetic material change its Magnetic properties if it is heated beyond its curie temperature?
9. A bar magnet is cut into two pieces, along its length. How will its pole strength be affected?
10. What is the work done by a magnetic force, in displacing a charged particle?

2 marks

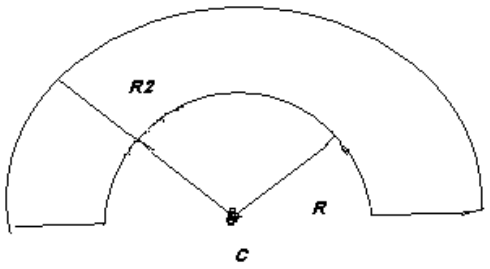
11. If two identical galvanometers, one is to be converted into ammeter and other into millimeter, which will require a shunt of large Resistance.
12. A bar magnet is held stationery in Magnetic meridian. Another similar magnet is kept parallel to it such that their midpoints lie on their perpendicular bisector. If the second magnet is free to move, what type of Motion will it have? Translatory, rotatory or both? Justify your answer.
13. Two parallel wires carrying current in same direction attract each other. What about two beams of electrons traveling parallel, and in same direction to each other?
14. Retentivity of steel is slightly smaller than soft iron. Still, steel is preferred to soft iron for making permanent magnets. Why?"
15. A wire of certain length is bent to form a circular coil of a single turn. If the same wire is bent into coil of smaller radius so as to have two turns. What will be the ratio of Magnetic fields at center of coil in each case for same value of current?

3 marks

16. Three sections of Current carrying conductors having same current are shown in figure. In which case, the Magnetic Field produced at P is Maximum? Find its value also.



17. Two wire loops formed by joining two semicircular wires of radii R_1 and R_2 carries a current I as shown in fig. What is the Magnetic field at C.?



18. A solenoid 0.4 M long has a layout of windings of 500 turns each. A 5cm long wire of mass 2Kg lies inside the solenoid near its centre and normal to axis. The wire is connected to an external battery which supplies a 4A current in the wire. Calculate the value of current to support the weight of wire.

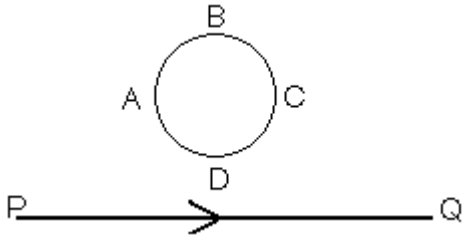
19. A metallic rod of mass 0.3kg/m is not allowed to roll on a smooth inclined Plane of angle 30 degree with horizontal by flowing a current in the rod. A magnetic field of 0.15T is acting in vertical direction. Calculate current flowing in the rod.

20. A bar magnet is placed in magnetic meridian with its north pole towards North. Its length is 10cm and magnetic moment is $0.4 Am^2$. Find the Horizontal component of earth's magnetic field, if neutral point is at a distance of 10cm from mid point of magnet.

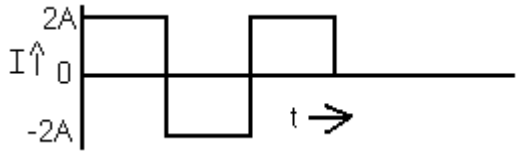
UNIT-04
ELECTROMAGNETIC INDUCTION & ALTERNATING CURRNT

1.MARK QUESTIONS:

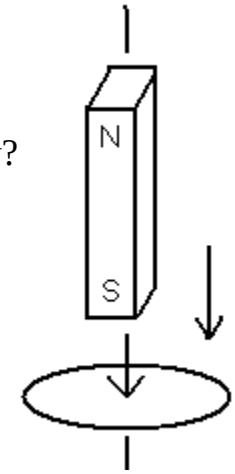
1. What is the magnitude of the induced current in the circular loop-A B C D of radius r, if the straight wire PQ carries a steady current of magnitude I ampere ?



2. Two identical loops ,one of copper and another of aluminium are rotated with the same speed in the same M.F. .In which case ,the induced (a) e.m.f (b)current will be more and why?
3. Why is spark produced in the switch of a fan, when it is switched off ?
4. Coils in the resistance boxes are made from doubled up-insulated wire. Why?
5. A galvanometer connected in an A.C. circuit does not show any deflection. Why?
6. A capacitor blocks D.C. but allows A.C to pass through it. Explain. Why?
7. Can we use transformer to step up D.C. voltage? If not, why?
8. Calculate the r.m.s value of alternating current shown in the figure.

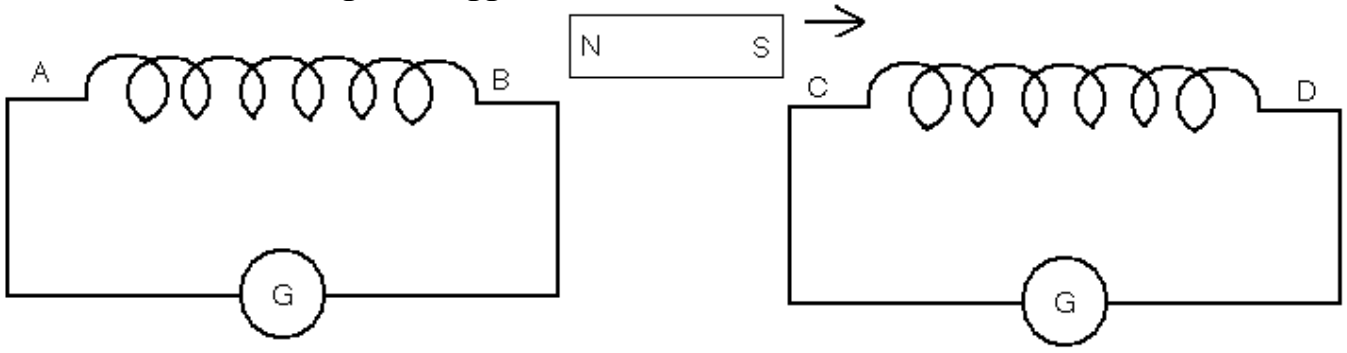


9. The algebraic sum of potential drop across the various – elements in LCR circuit is not equal to the applied voltage. Why?
10. A copper ring is held horizontally and bar magnet is dropped through the ring with its length along the axis of the ring. Will the acceleration of the falling magnet be equal to, greater than or less than that due to gravity?

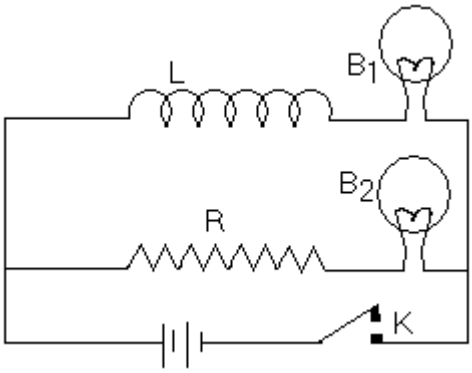


2 marks question

11. A magnet is moved in the direction indicated by an arrow between two coil A B and C D as shown in the figure. Suggest the direction of current in each coil.

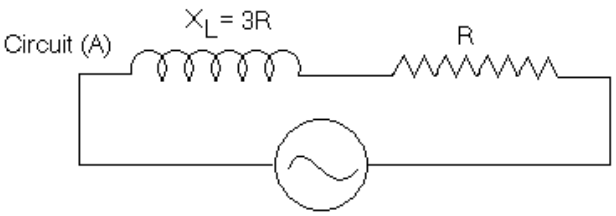


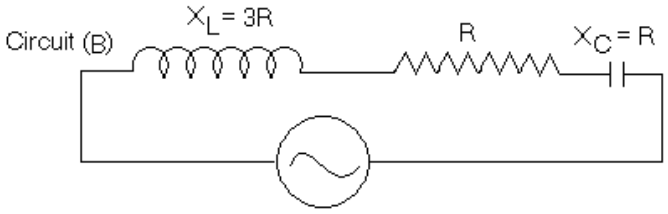
12. Figure shows an inductor L and a resistance R connected in parallel to a battery through a switch. The resistance R is same as that of the coil that makes L. Two identical bulbs are put in each arm of the circuit.
Which of the bulbs lights up earlier, when K is closed?
Will the bulbs be equally bright after same time?



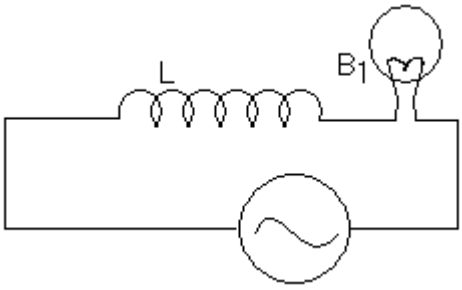
13. How does the self inductance of a coil change, when
Number of turns in the coil is decreased.
An iron rod is introduced into it.
Justify your answer in each case.

14. Figure shows two electric circuits A and B. Calculate the ratio of power factor of the circuit B to the Power factor of the circuit A.





15. An inductor L of reactance X_L is connected in series with a bulb B to an A.C. source as shown in the figure. Briefly explain how does the brightness of the bulb change when
(a) Number of turns of the inductor is reduced and
(b) A capacitor of reactance $X_C = X_L$ is included in series in the same circuit.

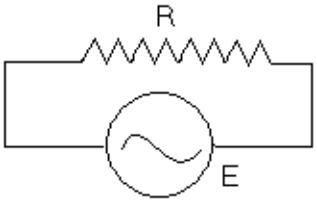


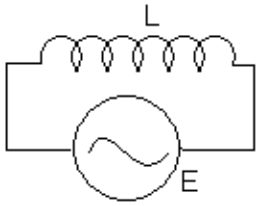
3 Marks Question:-

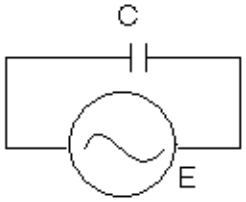
16. When a series combination of a coil of inductance L and a resistor of resistance R is connected across a 12 V-50 Hz supply, a current of 0.5.A Flows through the circuit. The current differs in phase from applied voltage by $\frac{\Pi}{3}$ radian. Calculate the value of L and R.

17. An A.C. generator is connected to a sealed box through a pair of terminals. The box may contain R L C or the series combination of any two of the three elements. Measurements made outside the box reveal that:
E=75 Sin ωt (in volt) and
I= 1.2 Sin $(\omega t + \frac{\Pi}{5})$(in ampere)
Name the circuit elements
What is the Power factor of the circuit?
What is the rate, at which energy is delivered by the generator to the circuit?

18. Figure (a), (b) and (c) Show three alternating circuits with equal currents. If frequency of alternating emf be increased, what will be the effect on currents In the three cases. Explain.







19. Does the current in an A.C. circuit lag, lead or remain in phase with the voltage of frequency υ applied to the circuit when
(i) $\upsilon = \upsilon_r$ (ii) $\upsilon < \upsilon_r$ (iii) $\upsilon > \upsilon_r$
where υ_r is the resonance frequency.

20. Two different coils have self inductance L_1=8 mH and L_2 = 2 mH.
At a certain instant, the current in the two coils is increasing at the same constant rate and the power supplied to the two coils is same. Find the ratio of (a) induced voltage (b) current and (c) energy stored in the two coils at that instant?

UNIT 05
(EM waves)

1 MARK QUESTIONS:

Q1: Does the colour of radiation depend on its frequency or on wavelength.

Q2: What physical quantity is the same for X-rays of wavelength 1^{A}, green light of wavelength $5500A^{0}$ & radiation of wavelength 21cm?

Q3: Electromagnetic radiations with wavelength:
1): λ_1 are used to kill germs in water purifiers.
2): λ_2 are used in T.V communication system.

2 MARK QUESTIONS:

Q4: Why stationary charges & constant currents do not produce electromagnetic waves?

Q5: If the electric field that constitutes an electromagnetic wave conservative? Justify your answer.

Q6: The radio waves, the infrared, the visible ray are EM radiations. Then how are they different from each other?

3 MARK QUESTIONS:

Q7: Suppose that the electric field of an electromagnetic radiation wave in vacuum is $E=(3.1N/C \cos[1.8rad/m]y+5.4 \times 10^{6} rad/s)t]$

1): What is wavelength, λ?
2): What is frequency, ν?
3): What is magnitude of the magnetic field of the wave?

Q8: Although in an electromagnetic wave the ratio of the electric field to the magnetic field is a constant still we say that the vision of our eye is due to only electric field.

UNIT 06
Optics

1 Mark

Q1: A partially plane polarised beam of light is passed through a polaroid. Show graphically the variation of the transmitted light intensity with angle of rotation of the Polaroid.

Q2: Soap bubble shows beautiful colours in sun light. Why?

Q3: Coloured spectrum is observed, whenwe see through a muslin cloth. Why?

Q4: Why value of the Brewster angle for transparent medium is different for light of different colours?

Q5: Why is diffraction effect more predominant through the slit formed by two blades than by slit formed by two fingers?

Q6: Why is light from two individual sources of equal wavelength is incoherent?

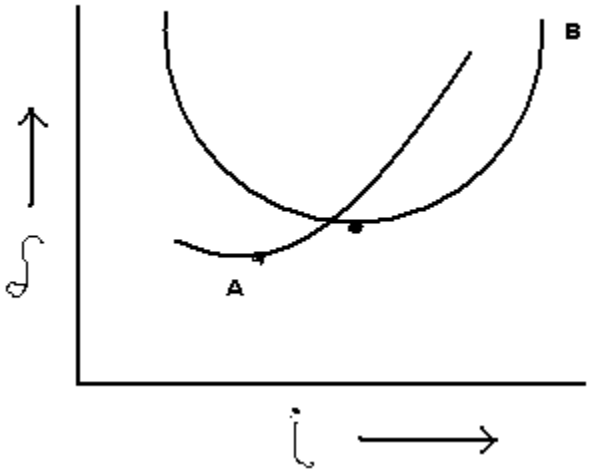
Q7: Which principle is used in L.C.D (liquid crystal display) in T.V & computers?

Q8. How does the focal length of a convex lens change if monochromatic red light is used instead of monochromatic blue light?

Q9. How many angles of incidence are possible when the angle of deviation is minimum?

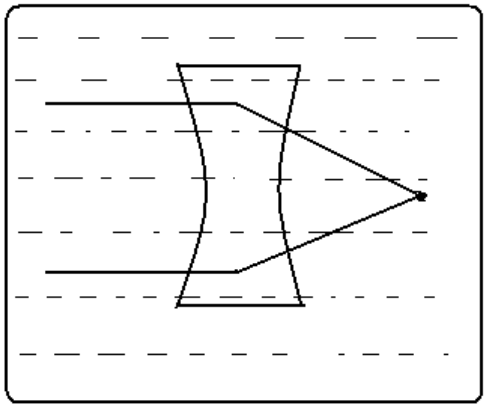
Q10. The lens shown in the figure is made of two different transparent materials. A point object is placed on its axis. How many images of the object will be formed?

Q11. The graph shows the variation of the angle of deviation with the angle of incidence for the two glass prism A & B. which glass prism has the larger refractive index?



Q12. A simple microscope using single lens often shows colored image of a white source. Why?

Q13. A concave lens is immersed in a liquid and image formed is shown in the figure. Whose refractive index is greater, glass or the liquid?



Q14. Why focal lengths of the eye piece and objective both should be short in the case of a compound microscope?

Q15. You are given 3 lenses having powers as P1=6D, P2=3D & P3=12D. Which two of these lenses will you select to construct a microscope?

Q16. How is the intensity of scattered light related to the wavelength of light?

Q17. The far point of myopic person is 80cm in front of the eye. The power of the lens required to enable him to see very distant objects clearly is -1.25D. Does the lens magnify the very distant objects?

2 Marks

Q18: Two towers on top of two hills are 40km apart. The line joining them passes 40m above a hill halfway between the towers. What is the largest wavelength of radio waves, which can be sent between the towers without appreciable diffraction effects?

Q19: Laser light of wavelength 630nm incident on a pair of slits produces an interference pattern in which the bright fringes are separated by 8.1nm. A second light produces an interference pattern in which the fringes are separated by 7.2mm. Calculate the wavelength of the second light.

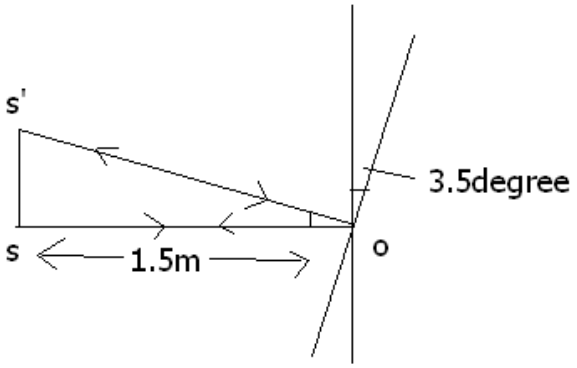
Q20 Draw the graph showing the variation of v with u for a convex lens.

Q21 A boy, 1.50m tall with his eye level at 1.38m, stands before a mirror fixed on a wall. Indicate by means of a ray diagram, how the mirror should be positioned so that he can view himself fully. What should be the minimum length of the mirror?

Q22 How is an optical fibre a better device than a coaxial cable?

Q23 How is a person looking at a mesh of crossed wires able to see the vertical wires more distinctly than horizontal wires?

Q24 A small plane mirror is attached to the suspension wire of moving coil galvanometer. When the light from a lamp falls on the mirror, it retraces the path and puts a spot on the screen, 1.5m away from the mirror. What is the displacement of the spot if the coil deflects 3.5o?



3 Marks

Q25: A point object placed in front of a plane mirror produces a virtual image whose distance from the mirror is equal to the object distance from the mirror. Use Huygens's Principle to deduce it.

Q26: When a low flying aircraft passes overhead, we sometimes notice a shaking of the picture on our T.V screen. Suggest a possible explanation?

Q27: In Young's double slit experiment using monochromatic light of wavelength λ, the intensity at a point on the screen where path difference λ is K units. What is the intensity of light at a point where path difference is $\lambda/3$?

Q28. Two lenses of power -15D and 5D are in contact with each other

a) What is focal length of this combination?

b) An object of size 4cm is placed at 20cm from this combination. Calculate position and size of image.

Q29. The principle section of Glass prism is an isosceles ΔPQR with PQ=PR. The face PR is silvered. A ray is incident perpendicularly on face PQ and after two reflections it emerges from base QR normal to it. Find angle QPR of Prism.

Q30. The resolution limit of eye is 1minute at a distance of r km from the eye, two person stands with a lateral separation of 3m. Calculate the distance r so that the two persons are just resolved by the naked eye.

Q31. An astronomical telescope consist of two thin lens set 36cm apart and has a magnifying power 8. Calculate the focal length of the lens.

Q32. A fish at a depth of $\sqrt{7}$cm below the surface of water sees the outside world through a circular horizon. What is the radius of the circular horizon? Refractive index of water w.r.t. air is 4/3.

UNIT 07
DUAL NATURE OF MATTER AND RADIATION

One Mark questions--

1) According to the quantum theory, what happens when the intensity of light increases?
2) If a LASER of power 3.98MW produces a monochromatic light of energy 2.48eV, how many photons per second, on an average, are emitted by the source?
3) Can all photons from a monochromatic light source emit photo-electrons of same kinetic energy?
4) What is maximum frequency of X-rays produced by 30KV electrons?
5) A nucleus of mass M, initially at rest splits into two fragments of masses M'/3 and 2M'/3(M>M'). Find the ratio of de-Broglie wavelengths of two fragments.
6) What does the slope of the Graph between frequency v/s stopping potential represent?
7) What is the nature of graphical relation between frequency of incident radiation and the stopping potential?
8) On which factor the magnitude of saturation photoelectric current depends upon?
9) The work function of aluminium is4.2eV. If two photons each of energy 3.5eV strike an electron of aluminium sheet then what will be the speed of electrons?
10) Write down the rest mass of photon?

Two marks questions--

11. Calculate the number of photons in 6.62J of radiation energy of frequency 10^{12} Hz. Given $h=6.62*10^{-34}$ Js.
12. When photons of energy hν falls on an aluminium plate (of work function E_o),photoelectrons of maximum kinetic energy K are ejected. If the frequency of radiation is doubled, find the maximum kinetic energy of the ejected photoelectrons.
13. If electron, proton and helium have same momentum, then write relation between de-Broglie's wavelengths of the above particles.
14. The energy of a photon is equal to the Kinetic energy of proton. Let λ_1 be the de-Broglie wavelength of the proton and λ_2 be the wavelength of the photon. Find the ratio λ_1/λ_2 in terms of energy 'E' of photon.
15. Draw the Graph which represents the variation of particle momentum and associated de-Broglie wave length?

Three marks questions--

16. Alkali metals are most suitable for photoelectric effect. Explain why?
17. Show that the product of the slope of the stopping potential versus frequency graph and the electronic charge gives the value of Planck's constant.
18. When radiation of wavelength λ is incident on a metallic surface, the stopping potential is 4.8 volts. If the same surface is illuminated with a radiation of double the wavelength, then the stopping potential becomes 1.6 volts. What is the threshold wavelength for the surface?
19. A source of 25 watt emits monochromatic light of wavelength 6600Å. If efficiency for photoelectric emission is 3 %, then find the photoelectric current.
20. What is the De-broglie wavelength of a nitrogen molecule in air at 300K? Assume that the molecule is moving with the root mean square speed of molecules at this temperature. (Atomic mass of nitrogen is = 14.0076u)

UNIT 08
ATOMS AND NUCLEI

1 Marks Questions:

1. Initially the number of nuclei of a radioactive substance are 100. At t=1s these numbers become 80. Find the number of nuclei undecayed at t=2s.
2. Draw a graph of rate of formation of 'Y' against time 't' when a radioactive nucleus 'X' decays to a stable nucleus 'Y'?
3. A particle mass 'm' is projected from ground with velocity 'u' making angle 'θ' with the horizontal what will be the de-Broglie wave length of the particle at the highest point?
4. The difference between n^{th} and $(n + 1)^{th}$ Bohr's radius of hydrogen atom is equal to $(n — 1)^{th}$ Bohr's radius. What is the value of n?
5. In the following nuclear fission reaction, N is the number of neutrons released in the fission of one $_{92}U^{235}$

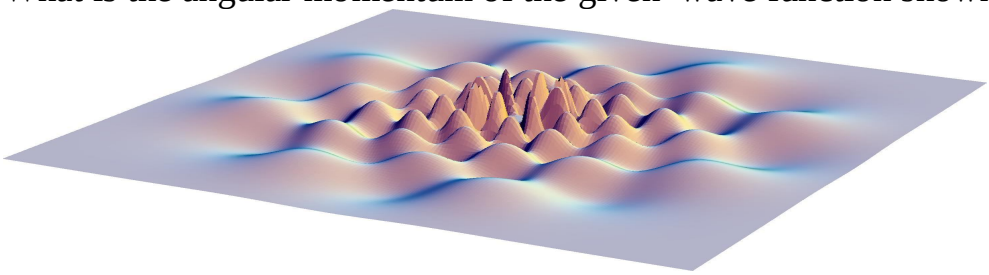
$$U^{235} + {}_0n^1 \rightarrow {}_{38}Sr^{94} + {}_{54}Xe^{140} + N$$

What is N here?

6. Some scientists have predicted that a global nuclear war on earth would be followed 'nuclear winter'. What would cause 'nuclear winter'?
7. The electron in the hydrogen atom passes from the n = 4 energy level to the n = 1 level. What is the maximum number of photons that can he emitted, and minimum number?
8. An electron is accelerated through a potential difference of 220 V. What is its energy in electron volts.
9. What is the Bohr's frequency condition?
10. The mass number of He is 4 and that of sulphur is 32 .By what factor the radius of sulphur nucleus is larger than that of helium ?

2 Marks Questions:

11. A radioactive sample has 20 times of safe activity limit. After how many half lives will the radioactive sample be safe?
12. What is the angular momentum of the given wave function shown below, which is



for an electron in a hydrogen atom.

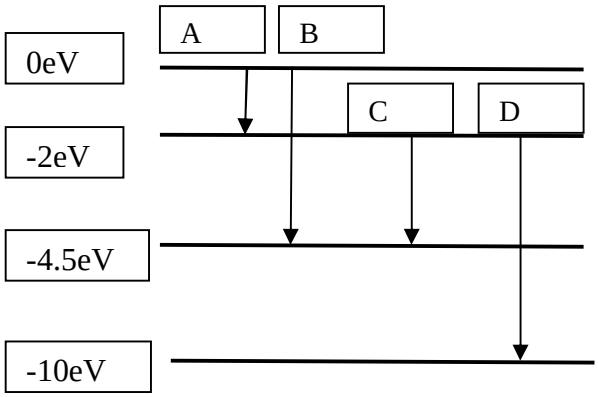
13. The binding energy of an electron in the ground state of He is equal to 24.6 eV. What is the energy required to remove both the electrons?
14. For a hydrogen-like atom, if electrons move from lower energy level to higher energy levels, then what will happen to its KE and PE ?
15. Obtain Bohr's quantization condition of angular momentum on the basis of wave picture of electron.

3 marks question:

16. In the fusion reaction $_1H^2 + _1H^2 \longrightarrow _2He^3 + _0n^1$, the masses of deuteron, helium and neutron expressed in amu are 2.015, 3.017 and 1.009 respectively. If 1 kg deuterium undergoes complete fusion, find the amount of total energy released.
    1amu = 931.5 MeV/c^2
17. $_{19}K^{40}$ isotope of potassium has a half-life of l.4 x10^9 yr and decays to form stable argon, $_{18}Ar^{40}$. A sample of rock has been taken which contains both potassium and argon in the ratio 1 :7, *i.e.*

$$\frac{\text{no. of } K^{40} \text{ atoms}}{\text{no. of Ar } ^{40} \text{ atoms}} = 1/7$$

    Assuming that when rock is formed no Ar ^{40}was present in the sample and none has escaped subsequently. Determine the age of rock.
18. The energy levels of an atom are as shown below. Which one of the transitions will result in the emission of a photon of wavelength 275 nm?



19. How are protons, which are positively charged, held together inside a nucleus? Draw a graph between potential energy of a pair of nucleons as a function of their separation.
20. A neutron strikes a $_5B^{10}$nucleus with the subsequent emission of an alpha particle. Write the Corresponding nuclear reaction. Find the atomic number, mass number and the chemical name of the remaining nucleus.

UNIT 09
ELECTRONIC DEVICES

ONE MARK QUESTIONS

Q.1 How does the forbidden energy gap of an intrinsic semiconductor vary with the increase in temperature?

Q.2 Why is a semiconductor damaged by a strong current?

Q.3 What is the cause of a small current in reverse bias arrangement in p-n junction ?

Q.4 A piece of copper and a piece of silicon are both cooled down through the same temperature .How do their conductivity change?

Q.5 What happens when both the emitter and the collector of a transistor are forward biased?

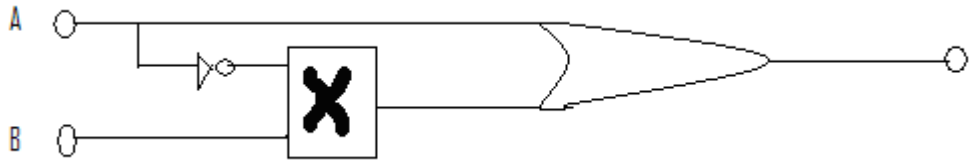
Q.6 Why does a transistor / radio receiver does not work in a railway carriage?

Q.7 Why a transistor can not be used as a rectifier ?

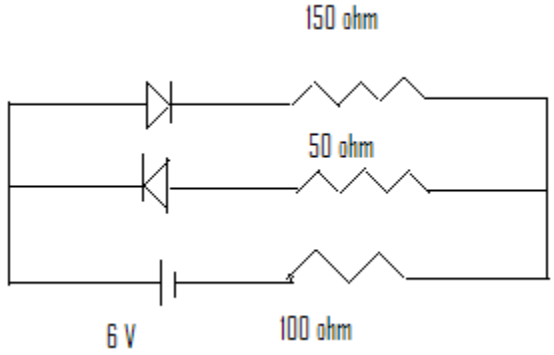
Q.8 Electrical circuit is used to get smooth d.c out put from a rectified circuit .write the name of the circuit .

Q.9 Identify the gate X ,If the truth table of the circuit is given below.

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



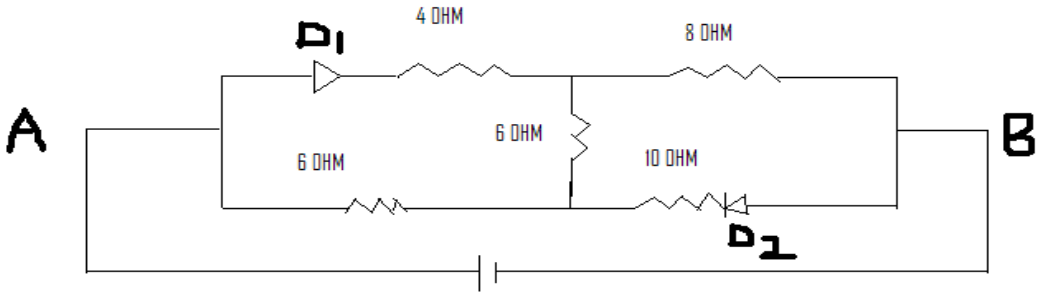
Q.10 The circuit shown below has two diodes each with forward resistance 50ohm with infinite reverse resistance ,if the battery voltage is 6 v ,find the current through the 100 ohm resistance?



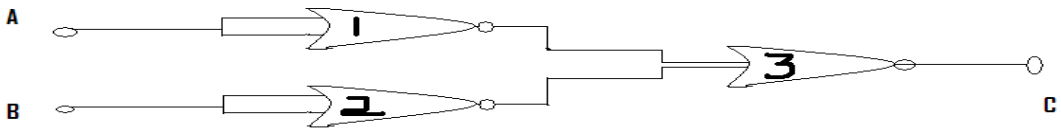
2 MARK QUESTIONS

Q.11 The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 2480 nm is incident on it. Find the band gap of the semiconductor .Given h= 6.63 x 10^{-34} js . C= 3 x 10^{8} m/s.

Q.12 What is equivalent resistance of the circuit .

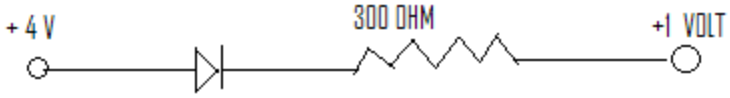


Q.13 Identify the gate represented by the blocks



Write the truth table.

Q.14 Consider the junction diode is ideal ,calculate the value of current in the given figure.

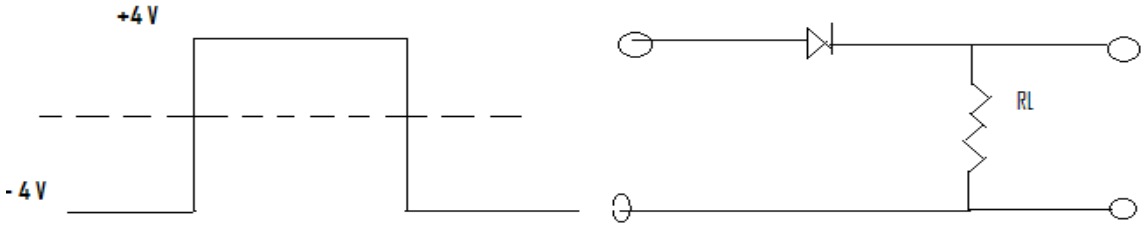


Q.15 Draw a curve between charge density (e) and the distance (r) near the forward bias p-n junction and explain it?

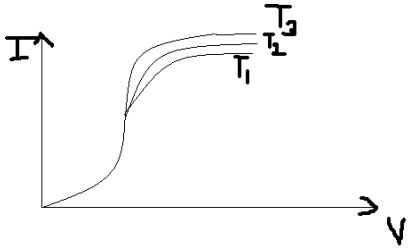
3 MARK QUESTIONS

Q.16 For a transistor ,the current amplification factor is 0.8, the transistor is connected in common emitter configuration .calculate the change in the collector current when the base current changes by 6 mA.

Q.17 If in the p-n junction diode a square input signal is 8 V then find out the output signal across R_L



Q.18 For a diode characteristics curves are given at different temperature. Find out the relation between temperatures in the given figure.



Q.19 Fiure shows a logic circuit of two inputs A and B and output C.The voltage waveforms A,B,C are shown in the figure .the logic circuit is

Q.20 When a transistor amplifier of current gain of 75 is given an input signal .

$V_i = 2 \sin (157t + \prod/2)$ the output signal is found to be

$V_O = 200 \text{ Sin}(157t + 3\prod/2)$

In which mode it is being used ,justify your result with proper explaination .

UNIT 10
COMMUNICATION SYSTEMS

1 Mark:

1. At a particular place at a distance of 10km from a transmission station a person can receive signals but not able to receive signals at 100km, suggest a method how he can receive signal at 11 km
2. A device is used to communicate through compute to computer name the device.
3. Why ground wave propagation is not suitable for high frequency?
4. Why microwaves are being used in RADAR?
5. Name the type of communication that uses carrier signals having frequencies in the range 10^{12} Hz
6. Why long distance radio broadcasts use short-wave bands?
7. A radio can tune to any station in the 7.5 MHz to 12 MHz band. What is the corresponding wavelength band?
8. Name the process by which exact reproduction of a document at a distant place can be received.
9. The transmitter A and receiver B are not visible to each other on earth surface even then they communicate to each other name the processes of communication.
10. How does the effective power radiated by an antenna vary with wavelength?

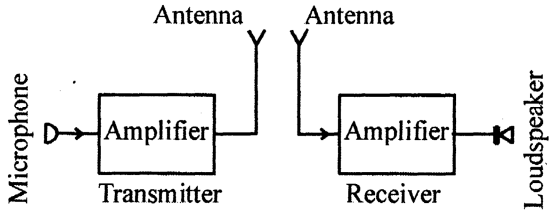
2 Marks

11. It is necessary to use satellites for long distance T.V. transmission. Justify?
12. With the help of necessary diagram make it clear that "taller the antenna, greater the coverage of the Television broadcast".
13. We do not choose to transmit an audio signal by just directly converting it to an e.m. wave of the same frequency, Give two reasons for the same
14. Distinguish between 'point to point' and 'broadcast' communication modes. Give one example of each
15. A transmitting antenna is 32 m high and the receiving antenna 100 m. Calculate the maximum. Distance between them for satisfactory communication in LOS mode. Assume radius of earth 6.4×10^6 m.

3 Marks

16. What does the term LOS communication mean? Name the types of waves that are used for this Communication which of the two-height of transmitting antenna and height of receiving antenna - Can affect the range over which this mode of communication remains effective?

17. A schematic arrangement for transmitting a message signal (20 Hz to 20 kHz) is given below:



Give two drawbacks from which this arrangement suffers.

Describe briefly with the help of a block diagram the alternative arrangement for the transmission And reception of the message signal.

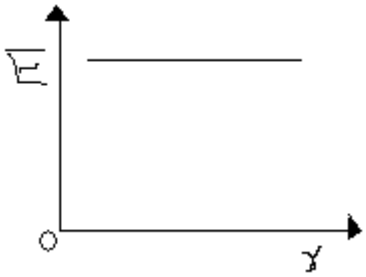
18. Frequencies higher than 10 MHz are found not to be reflected by the ionosphere on a particular Day at a place, calculate the maximum electron density of the ionosphere.
19. A message signal of frequency 15 kHz and peak voltage of 5 volts is used to modulate a carrier of Frequency 1 MHz and peak voltage of 20 volts, Determine (a) Modulation index (b) The side bands Produced
20. What is meant by ‘detection’ of a modulated carrier wave? Describe briefly the essential steps for detection

UNIT 01
ELECTROSTATICS

ANSWERS/HINTS

1 mark question

Q.1 Uniform linear charge distribution



Q.2 E is constant with r.

Q3. Increases due to repulsion

Q.4 6th Charge is Q

Q.5 $Q_1/Q_2=R_1/R_2$

Q.6 It transfers the leakage of Charge to earth through earthed steel chamber

Q.7 $Q/24\ \acute{\varepsilon}_0$

Q.8 Zero

Q9. $E_x=E_z<E_y$

Q.10 $E \alpha 1/r^3$ if r=r/2 , E= 8 times

2 marks question

Q 11 work done is independent of path

$w= \frac{1}{4}\pi\varepsilon_O\ q_1\ q_2\ (1/r_1- 1/r_2)$ putting the values & ans 15 J

Q 12 if charge is positive & at rest in electric field then it will move along electric line of force. If charge has initial velocity making some angle with electric field than it will along parabolic path.

Q 13 $\Phi'= 4\Phi$

$Q + q_1+ q_2+q_3/ \varepsilon_o= 4 X (q_1+q_2+q_3)/\varepsilon_o$

putting the values & finding $Q = 3*8.854\ \mu C$

Q 14. $F=K\ q(Q-q) / r\ 2$

for max. &min.$dF / dq=0$, $q=Q/2$

Q 15. All are in parallel

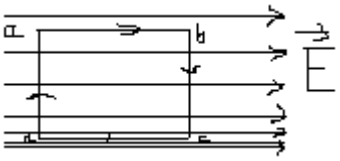
$C= \varepsilon_o A/3d+\varepsilon_o A/6d+ \varepsilon_o A/9d= 11\varepsilon_o A/18\ d$

3 marks question

Q.16 a. E same
b. Q same
c. V same
d. C is halved with reasons

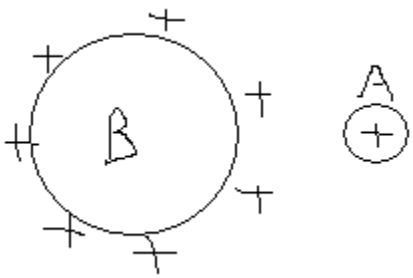
Q.17 i. N times the charge on small drop
ii. N 2/3 times the potential on small drop
iii N 1/3 times the capacitance on small drop

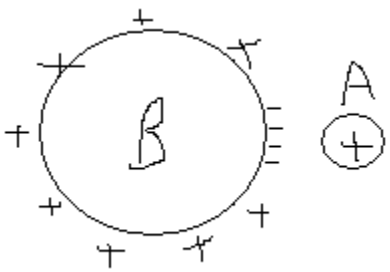
Q.18 If q is moved along abcd then $W_{abcda} = 0$
$W_{ab}+ W_{bc}+ W_{cd} +W_{da} = 0$



as E perpendicular to bc & da
so $W_{bc} = W_{da} = 0$
therefore $W_{ab}= -W_{cd}$
But W_{ab} can never be equal to W_{cd} as the lines of force are closer to cd
therefore $W_{cd} > W_{ab}$
therefore W_{abcda} is not equal to 0 hence such electric field E is impossible

Q.19 i As the charge move closer the charge on large sphere ` is redistributed as shown in diagram
ii As the spheres move more closer than the charge is redistributed as shown in diagram
iii Behaviour of force between 2 cm & 1 cm :
force of repulsion increases upto 1.4 cm & F rep. is max. at r=1.4 cm
If 1.2 cm<r<1.4 cm F rep. is decreasing Fatt. increases due to inductive effect.
At r=1.2 cm F rep. = F att. & if r<1.2 cm force is strongly attractive





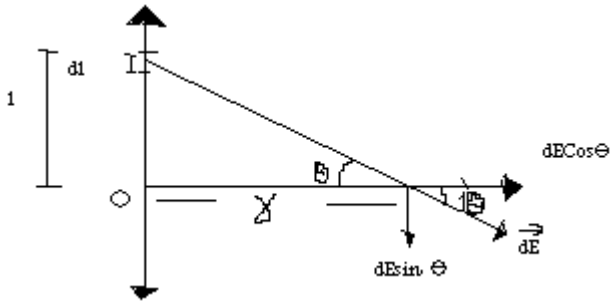
Q.20 X=q/length = q/l change on dl length

dq = λ dl At point l

dE = 1 / 4 π ε_o * dq /op2 = 1/ 4π ε_o * λ dl / r2 +l2 l= rtan Q

find dl .dE = 1 / 4 π ε_o λ cos θ dq/ r

integrate between -π/2 to +π /2 than E is λ/2π ε_o r



UNIT 02
CURRENT ELECTRICITY

ANSWERS-

1. during charging
2. uncharged
3. black, brown, black (gold)
4. decreases
5. $ML^3T^{-4}A^{-1}$
6. Low temp. Coefficient of resistance high Resistivity.
7. drift velocity halved
8. $k_b<k_a$ (k is the potential gradient)
9. T.P. =EMF - Ir
10. Due to increase in carrier density

Two Marks-

11. N^2:1
12. MANGANIN
13. 10/3 OHM
14. a>b
15. temp. increases
    slope decreases
    ohm law is disobeyed

Three Marks-

16. R1=25 ohm
    R2=100 ohm
17. no. of bulb=18
18. .I1=5/2A
    I2=5/8A
    I3=7/8A
19. r=1 ohm
20. (1)E=1.4 V
    (2)r=0.7 ohm.

Unit 03
Chapter: Magnetic Effects of Current [ANSWERS]

1. Zero.

2. Temperature in the core of earth is higher than Curie temperature of Iron.

3. Larger.

4. Non-uniform.

5. Magnitude of Earth's magnetic field is much smaller than magnitude of the field produced by poles of galvanometer.

6. Diamagnetism.

7. $\theta = 0$ (Dipole is parallel to field.)

8. Becomes Paramagnetic.

9. $M_1 = M/2$, $M=M/2$

10. Zero.

11. Millimeter will require larger resistance as a range of current is less for it.

12. Translatory, as two equal forces act on two ends, in same direction.

13. Two electron-beams will repel, as electrostatic force is larger than Lorentz force.

14. Coreceivity of steel is much larger than that of soft Iron.

15. $B_1 = \mu_0 I/2a$, Now $2a = 2\times a_1$

. . $a_1 = a/2$

$B_2 = \mu_0 NI/2a` = \mu_0\times 2I/2a$.

. . $B_1:B_2 = 1:4$.

16. In case B as magnetic field due to complete circle will be largest.

17. $B = \mu I/4(i/R_1-1/R_2)$.

18. Force on wire = weight of wire.

. .

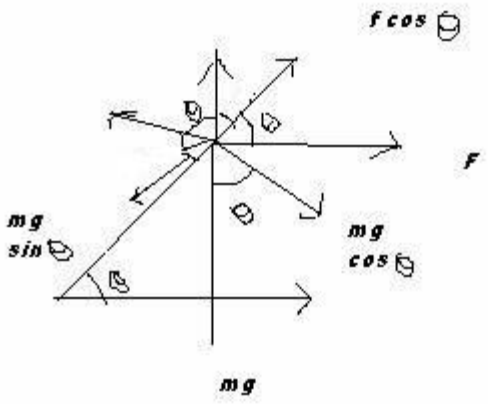
. . ILB = mg . . IL ($3\mu_0 NI'$) = mg

I' = mg/3Iln

19. Mg sinθ = f cosθ

Mg sinθ = ILB cosθ

I = mg×tanθ/IB = 11.32A



20. $B_H = \mu_0 \times 2mr / (4 \times 3.14(r^2 - a^2)^{1/2})$

UNIT-04
ELECTROMAGNETIC INDUCTION & ALTERNATING CURRNT

EMI & AC

Answers / Hints

1 mark Question

1. Zero Induced emf.
2. Induced emf will be same in the both but Induced Current will be more in Copper loop.
3. A large Induced emf is setup across the gap in the switch.
4. To cancel the effect of self Induced emf in the coil.
5. A galvanometer measures mean value of a.c., which is zero over a cycle.
6. $X_c = \frac{1}{2\pi\vartheta c} = \infty$
7. Magnetic flux linked with Primary coil does not vary with time so no Induced emf in secondary.
8. 2A.
9. Voltages across different elements of the LCR circuit are not in same phase.
10. Less than that due to gravity.

2 marks Question.

11. For Coil AB: Anticlockwise.
    For Coil CD: Anticlockwise.
12. i. The bulb B_2 will light up earlier.
    ii. The bulb B_1 will grow more brightly.
13. i. $L \alpha n^2 \Rightarrow$ L is decreased.
    ii. L will Increase.
14. $\sqrt{2}$.
15. (a) Bulb will grow more brightly.
    (b) Brightness of the bulb will become maximum.

3 marks Question.

16. L=0.066 H, R=12
17. (a). Series combination of a register and a capacitor.
    (b). Power factor = $\cos\Phi = 0.81$
    (c). $P_{av} = E_v I_v \cos\Phi = 72.9$w
18. (i) No effect (ii) current will decrease (iii)Current will Increase.
19. (i) Current and Voltage are in the same phase.
    (ii) Current leads voltage by Phase angleΦ .
    (iii) Current lags behind voltage by Phase angleΦ .
20. $e = \frac{LdI}{dt} \Rightarrow \frac{e_1}{e_2} = 4$ As P= eI = const $\Rightarrow \frac{I_1}{I_2} = \frac{1}{4}$

    $\therefore \frac{U_1}{U_2} = \frac{1}{4}$

UNIT 05
(EM waves)

Answers

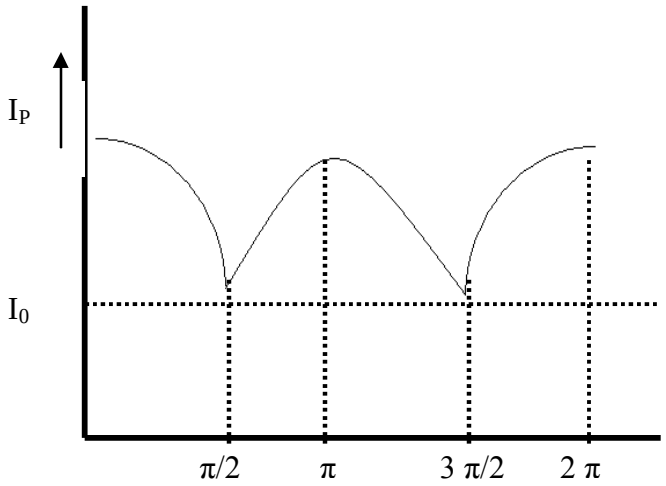
1. Frequency.
2. Speed.
3. 1) λ_1 corresponds to ultraviolet spectrum.
   2) λ_2 corresponds to radio waves.
4. A stationary charge & constant current produce a constant electric field & constant magnetic field respectively. A constant electric field can't generate a magnetic field likewise a constant magnetic field cannot generate a electric field. Hence, EM waves can't be produced.
5. No, the electric field produced by a time varying magnetic field is non conservative. So that electric field that constitutes the EM waves is non-conservative.
6. They are different because the way they interact with matter is different. Interaction depends on the energy of the EM waves, which in turn depends upon its frequency (E=hv).
7. 1): $\lambda=2\pi/k= 3.5m$.
   2): $\nu=w/2\pi = 5.4x10^6/2\pi = 0.86MHg$.
   3): $B_0 = E_0/C = 3.1/3x10^8 = 10nT$.
8. The vision of our eye is due to the force experienced by the moving charge on our retina. The moving charge experiences force both due to electric & magnetic fields.
   $F_E = qE$,
   $F_B = qVB$
   $F_E/F_B = E/VB$
   $= C/V$.

   $C/V>10^8$. Therefore moving particle oscillates primarily due to the electric field.

UNIT 06
Optics

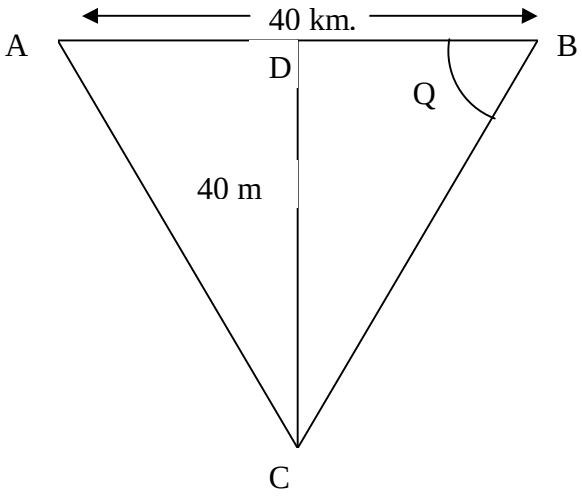
Answers

1. $Ip = I_0 \cos 2\theta$



2. Due to interference of light waves from upper & lower surfaces of soap bubble
3. Space between threads & muslin cloth behaves as fine slit. When sunlight falls on these slits; the diffraction of light takes place. As a result, the coloured spectrum is observed.
4. ip =tan-1(n),
   {n is inversely proportional to square of wavelength}
5. Diffraction effect is predominant only for a narrow & fine slit where size is comparable with the wavelength of light. Slit formed by two blades is fine & is of uniform width which can't be possible with fingers.
6. Because of unstable phase difference.
7. Principle of polarisation.
8. 1/f=(n2/n1-1)(1/r1-1/r2)
9. one
10. two
11. for B
12. Due to chromatic ab
13. R.I.of liquid is greater than R.I. of glass.
14. Angular magnification of eye piece is $(1+D/f_e)$. Hence f_e should be small and angular magnification of objective is approx. v/f_o , so f_o should be small.
15. $M \alpha 1/f_o f_e \alpha p_e p_o$
    High power lenses are required for objective and eye piece but $p_o > p_e$ hence p_3 is selected as objective and p_1 as eyepiece.
16. $I \alpha 1/\lambda^4$
17. No.

18.



$d\sin\theta = n\lambda$ or $\lambda = d\sin\theta/n$

For longest wavelength, n=1, $\sin\theta = \theta = \tan\theta$

$\lambda = d \times DC/BD$

$= 40 \times 40/20000$ (BD=40/2km)

$= 8m/100$

$= 8cm.$

19. $\beta = \lambda D/d$

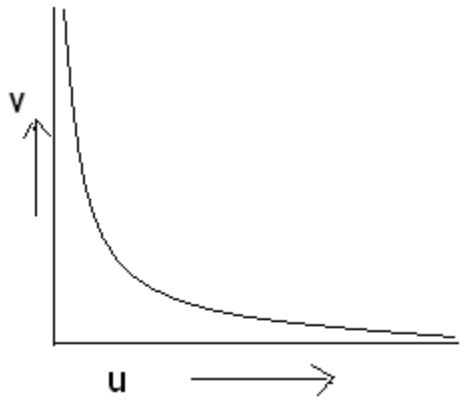
i.e $B2/B1 = \lambda 2/\lambda 1$

$\lambda 2 = B2\lambda/B1$

$\lambda 2 = 7.2 \times 630/8.1$

$\lambda 2 = 560nm.$

20.



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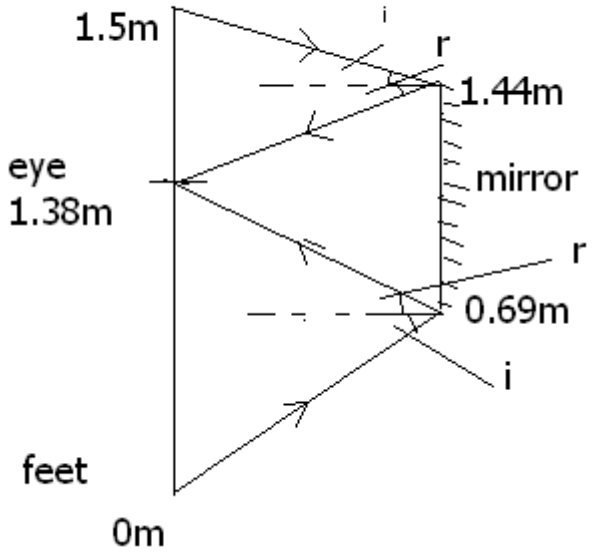


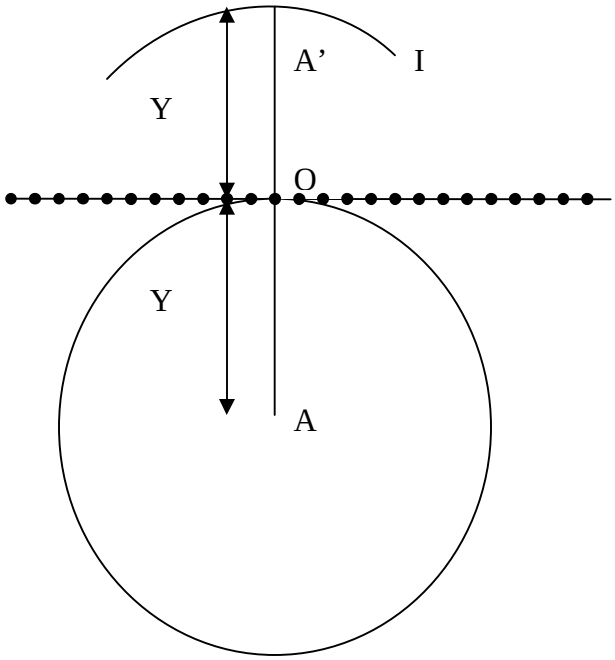
Top of mirror make
=(1.5+1.38)/3
=1.44m mark
Bottom of mirror mark
=(1.38+0)/2
=0.69m mark
height of the mirror
=1.44-0.69
=0.75m

22. Characteristic of optical fiber (no loss of energy and no external interference).
23. The cornea in front of the eye lens is not spherical in shape and produces greater resolution in vertical plane than in horizontal plane.

24. when mirror is deflected by θ then reflected light is deflected by 2θ
i.e. sos'=7o=(3.14*7)/180rad.
θ=ss'/os
(3.14*7)/180=ss'/1.5
ss'=18.4cm

3 Marks

25.



Treat A to be the spherical source of light. After time t, the wave front reach A' as wave front I . The image will be formed at A' represented by II. OA'=OA.

26. When a low flying aircraft passes overhead, the metallic body of the aircraft reflects T.V signal. A slight shaking of the picture on the T.V screen takes place due to interference of the reflected signal from the aircraft & the direct signal received by the antenna.

27. Intensity $I= 4I_0 \cos^2 \Phi/2$
When path difference is λ, phase difference is 2π
$I=4I_0 \cos^2 \pi= 4I_0 = K$ (given) . (1)

When path difference, $\Delta=\pi/3$, the phase difference
$\Phi'=2\pi \Delta / \lambda$
$=2\pi \times \lambda/ \lambda \times 3 = \pi/3$

$I'=4I_0 \cos^2 \pi/6$ (since K = 4I0)
$= K \cos^2 \pi/6= K \times \{1.73/2\}^2 = 3/4\ K.$

28. Apply formula of combination of thin lenses

$P = P1 + P2$

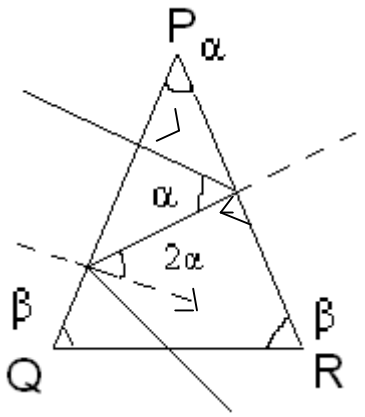
$f = 1/P$

Also , $1/f = 1/v – 1/u$.

29. $\alpha + 2\beta = 180^o$

also , $\beta = 2\alpha$

therefore , $5\ \alpha = 180^o$



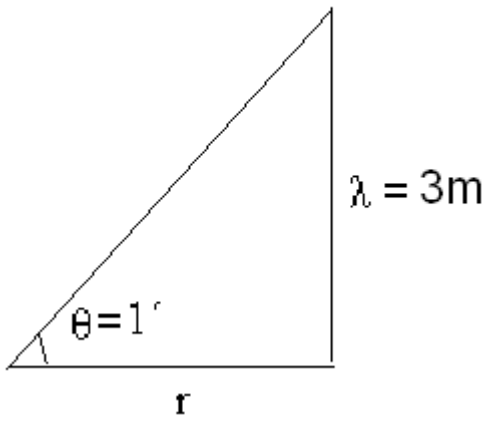
$\alpha = 36^o$

30. $\theta = x/r$

$\theta = 1' = 1/600 = 1/60 \times \pi/180$ rad.

$r = x/\theta = 3 \times 60 \times 180 / \pi$

$=10.3$ km



31. M.P.$=f_o / f_e$ & $f_o + f_e = L$

$8 = f_o / f_e$ & $f_o + f_e = 36$

$8f_e + f_e = 36$

$f_e = 4$cm

$f_o = 32$cm

32. $\sin c = 1/\mu$

$\text{Sin}c = 3/4$

$c = \sin^{-1}(0.75) = 48.59^{o}$

also, $\tan c = r/\sqrt{7}$

$r = 3\text{cm}.$

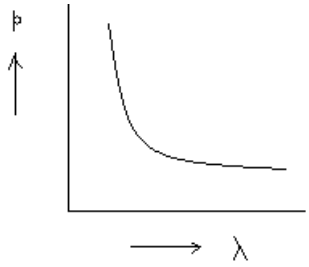
UNIT 07

DUAL NATURE OF MATTER AND RADIATION ANSWER KEY

1 MARKS ANSWERS

1. Number of the photons increases.
2. Number of the photons increases per second = total energy per second\
   energy of the photons
   $= 3.98\times10^{-3}$ j/sec
   3.98×10^{-19} joules
   $=10^{16}$ photons/sec
3. No
4. E/h = v
5. 1:1 ; $\lambda=h/p$
6. h/e
7. A straight line.
8. intencity of the light.
9. Zero.
10. zero.

2 MARKS ANSWERS

11. $n=e/r=10^{22}$
12. $k=hi-E_0$
    $=>E_0=hr-k$
    $k^{!} = h(2v)-E_{0=}2hr-(hr-k)$
    $K^{!} = k+hr.$
13. $\lambda_p= \lambda_e= \lambda_{he}$
14. $\lambda_1=h/\sqrt{2mE}$; $\lambda_2=h/p=hc/E$
    $\lambda_1 /\lambda_2=\sqrt{E}/c\sqrt{2m}$
15. 

THREE MARKS

16. Work function is less for alkali metals.
17. proof $ev_o=hv-hv_o$
    differention
    $e\Delta v_{o=}h\Delta v_o$
    $h=e(\Delta v_o/\Delta v)=e\times$slope
18. Putting the data in photoelectric equation and taking ratios
    $\lambda_o=4\lambda$
19. No of photons/sec = power/hv $=p\lambda/hc$
    $= 8.31 \times 10^{19}$

Each photon ejects one electron.
No. of electrons ejected = $\eta \times 8.31 \times 10^{19}$
$N=24.93x10^{17}$
Photochemical current $=Ne$
$=24.93x10^{17}x1.6x10^{-19}$
$=0.4$Ampere

20. $1amu=1.66x10^{-27}$ Kg
mass of N2 molecule$=2x14.0076x1.66x10^{-27}$ Kg
$v_{rms}=\sqrt{3KT/m}$
$=h/mv_{rms}=h/\sqrt{3KTm}$
$=6.63x10^{-34}/\sqrt{3x4.649x10^{-26}x1.38x10^{-23}x300}$
$=2.8x10^{-11}$m
$=.028$nm

UNIT 08
ATOMS AND NUCLEI

ANSWER

1 Marks Questions:

(1) 64

(2) expo. Graph

(3) $\frac{h}{mu\cos\theta}$

(4)We know ,$r_n \alpha n^2$

So $(n+1)^2 - n^2 = (n-1)^2 \Rightarrow n = 4$

(5)

(6)

(7)

(8) 220eV \

(9) $h\nu = E_{lower} - E_{higher}$

(10) 2

2 Marks Questions:

(11)The safe activity is present activity/2^0 since $\frac{R_o}{2^5} < \frac{R_o}{2^0} < \frac{R_o}{2^4}$ so sample safe between some time lying between4th and 5^{th} halve lives. Hence answer 5^{th} halve lives

(12) If we trace a circle going around the center, we run into a series of eight complete Wavelengths. Its angular momentum is $8\frac{h}{2\pi}$

.

(13) To remove Ist electron Energy required is 24.6 eV , after removing it became He^+ like Hydrogen atom whose B.E.is -4x13.6eV=-54.4eV.hence to remove both electron required energy=79eV

(14)For Hydrogen like atom, $TE = -\frac{Ze^2}{4\pi\varepsilon_0.2r}, KE = +\frac{Ze^2}{8\pi\varepsilon_0 r}, PE = -\frac{Ze^2}{4\pi\varepsilon_0 r}$ hence KE decreases, PE(less negative)increases.

(15) When an electron confine to move on a line of length l with velocity 'v' the de Broglie wavelength λ associated with electron is $\lambda = \frac{h}{p}$ and $\lambda = \frac{2l}{n}$, when an electron revolves in a circular orbit of radius *r;* then 2l=2πr

$$p = \frac{nh}{2\pi r} \quad \text{or} \quad p \times r = \frac{nh}{2\pi}$$

angular momentum (p×*r)* of electron is integral multiple of *h/2π.*
This is Bohr's quantization condition of angular momentum.

3 marks question:

(16) $\Delta m = 2(2.015) - (3.017 + 1.009) = 0.004 amu$ Find energy released per deuteron 3.726/2MeV
Then Number of deuterons in 1kg =N/2 hence energy released
$=3.01 \times 10^{26} \times 1.863 MeV = 9.0 \times 10^{13}$ J

(17) Age of the rock is 3 half lives of K nuclides. 4.2×10^{9} yr.

(18)Energy of photon is $E = \frac{hc}{\lambda} = 4.5 eV$ clearly transition B will be the result.

(19)

(20)

UNIT 09
ELECTRONIC DEVICES

ANSWERS

1-MARK QUESTIONS

1. unchanged because it is independent of temperature
2. due to heating, covalent bands brokes,hence semiconductor damaged.
3. due to minority charge carriers
4. as temperature cool down conductivity of Cu increases and Si decreases
5. it will be an saturation region and will not work as an amplifier
6. E.M signal do not find their entry in the railway carriage
7. for rectification ,two extreme layers must be of different types.
8. filter circuit
9. X is and gate
10. no current flow through D_2 current through 100 ohm is 0.02 A.

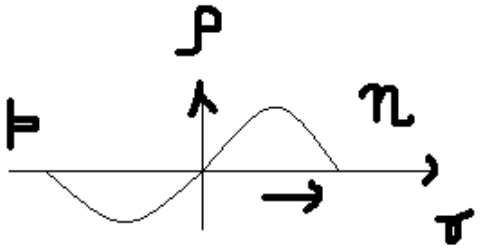
2-MARK QUESTIONS

11. $\Delta E=hc/\lambda=8.02 \times 10^{-20}$ J =0.5
12. D_1 is forward bias D_2 is reversed bias
    Effective resistance R=(4 x 12)/(4 +12) + 8=11 Ohm
    Due to reverse bias no current flow through resistance 10 ohm
13.

A	B	$\bar{A}$	$\bar{B}$	Y
0	0	1	1	0
1	0	0	1	0
0	1	1	0	0
1	1	0	0	1

I,II,III Both are NOR gate

14. p-n junction is reverse bias hence the value of current is zero .=
15.



The charge density near the p-n junction (in the depletion region)
Varies with distance(r)

3-MARK QUESTIONS

16. a=0.8
B= a/(1-a)

= 0.8/(1-0.8) = 4
$\Delta I_C = B \cdot \Delta I_b$ = 24 Ma

17.

Diode conducts only when it is forward bias.

18. $T_1 < T_2 < T_3$
at higher temperature cathode the larger is the value of saturation current

19. C=A.B
AND gate
20. current gain 75 i.e >1 and V_O differ by phase difference of $\prod$ so it being used as common emitter amplifier.

UNIT 10
COMMUNICATION SYSTEMS

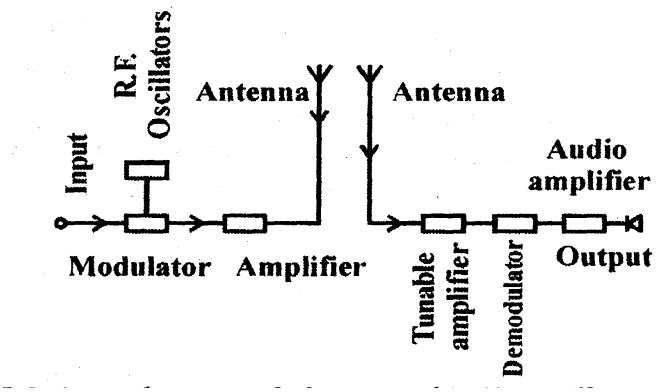
ANSWERS

(1) By using antenna
(2) Modem
(3) attenuation/power loss
(4) Linear propagation
(5) Optical fibers
(6)
(7) 40m, 25m
(8) Fax
(9) Satellite communication
(10) $p \alpha \frac{1}{\lambda^2}$
(11)
(12)

(13) For transmitting an EM wave signal the minimum size of the antenna
For an audio frequency wave the size of antenna will be extra large which is not feasible.
(ii) Effective power radiated by antenna is proportional to square of frequency. For an audio Frequency wave the radiated power will be extremely small.
(iii) If different programmes at audio frequencies are directly transmitted then on account Of limited bandwidth these programmes will get mixed up leading to disturbance.

(14) In point-to-point communication mode, the communication takes place over a link between a single transmitter and a receiver. Telephony is an example of point-to-point communication. In broadcast mode, there are a number of receivers corresponding to a single transmitter. Radio and television are examples of broadcast mode of communication.

(15) 45.5km
(16)
(17) (i) Signals cannot go very far without employing large amount of power, because Modulation is not done. (ii) Bandwidth is very short.
Alternative arrangement



(18)

(19) (a) 0.25

(b) 1015 kHz, 985 kHz

(20)