CH.. CHHABIL DASS PUBLIC SCHOOL

SESSION 2021-22

PHYSICS WORKSHEET

CLASS XII

WorkSheet

Class-12

SUB: PHYSICS

UNIT-ELECTROSTATICS

1. What does $q_1+q_2=0$ signify in electrostatics?

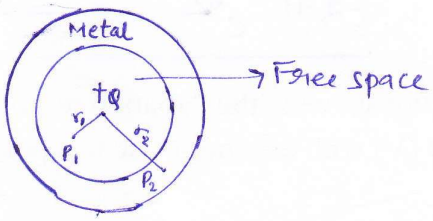
2. The dielectric constant of water is 80. What is its permittivity? (Ans:$7.08*10^{-10}C^2/NM^2$)

3. Why do electric field lines not form close loop?

4. What is the work done in moving a test charge q through a distance of 1cm along the equatorial axis of an electric dipole? (Ans: zero)

5. Two Cu spheres of the same radius, one hollow and the other solid, are charged to the same potential. Which one, if any , of the two, will have more charge?

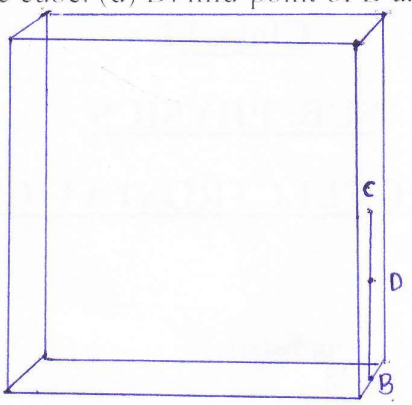
6. A small sphere carrying charge +Q is located at the centre of a spherical cavity in a large uncharged metal sphere.(see figure) .Use Gauss theorem to find electric field at points $P_1$and P_2.



(Ans: (a)$E_1=1/4\pi\varepsilon_0(Q/r_1^2)$,(b)$E_2=0$)

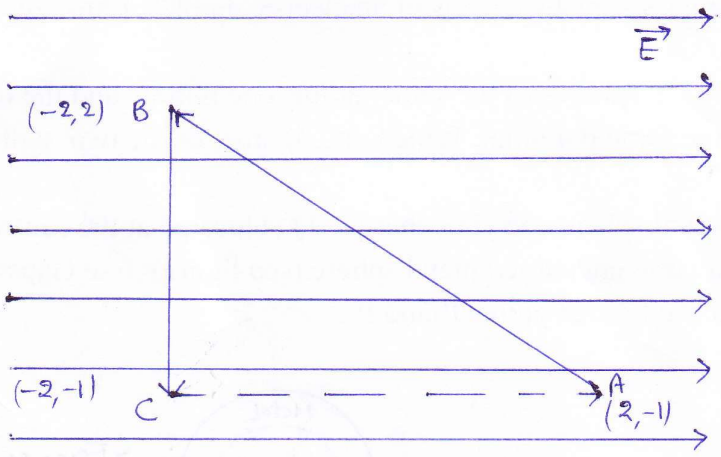
7. What will be the total flux through the faces of the cube(see figure) with side of length a if a charge q is placed at:

A: a corner of the cube. (b) B: mid-point of an edge of the cube. (c) C: centre of a face of the cube. (d) D: mid-point of B and C.



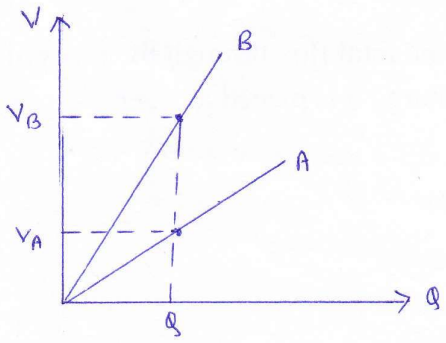
(Ans:(a)$q/8\varepsilon_0$.(b)$q/4\varepsilon_0$.(c)$q/2\varepsilon_0$.(d)$q/2\varepsilon_0$)

8. A test charge 'q' is moved without acceleration from A to C along the path from A to B and then from B to C in electric field E as shown in figure. (i) Calculate the potential difference between A and C. (ii) At which point (of the two) is the electric potential more and why?

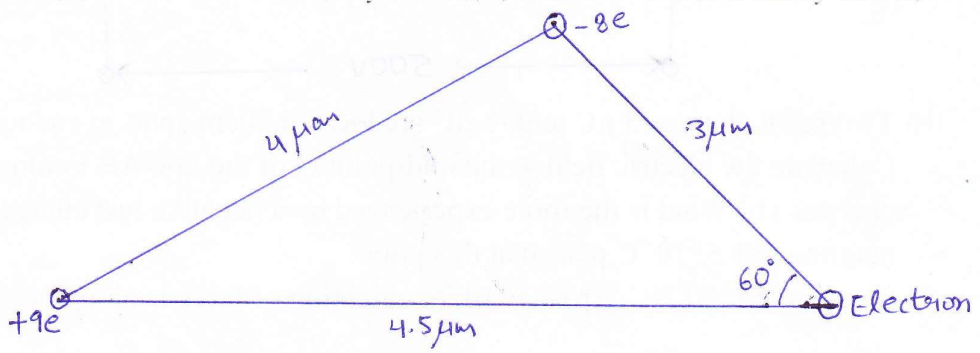


9. Draw a plot showing the variation of (a) electric field (E) and (b) electric potential (V) with distance r due to a point charge Q.

10. The graph (see figure) , shows the variation of voltage V across the plates of two capacitors A and B versus increase of charge Q stored in them. Which of the capacitors has higher capacitance? Give reason for your answer. (Ans: since $V_B > V_A . C_A > C_B$)



11. An electron is near a positive ion of charge +9e and a negative ion of charge -8e. (see figure)
Find the magnitude and direction of the resultant force on the electron.
(Ans: (a)$1.78*10^{-10}$N.vertically down.(b)$1.95*10^{14}m/s^2$.vertically down)

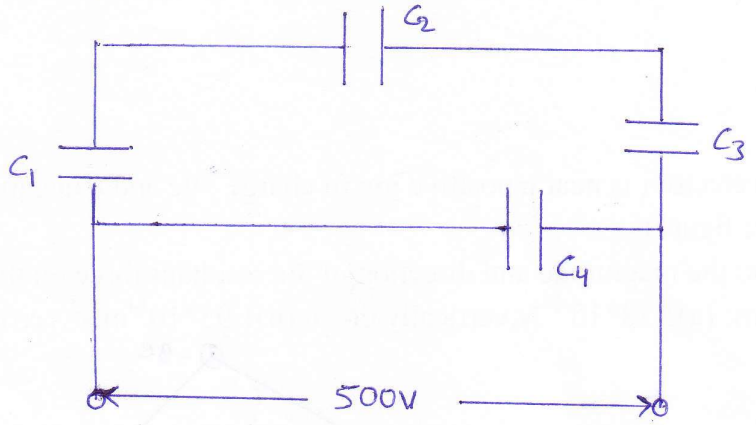


12. A charge q is placed at the centre of the line joining two equal charges. each equal to Q. Show that the system of three charges will be in equilibrium if q = -Q/4.

13. A capacitor of 200pF is charged by a 300V battery. The battery is then disconnected and the charged capacitor is connected to another uncharged capacitor of 100pF. Calculate the difference between the final energy stored in the combined system and the initial energy stored in the single capacitor.
(Ans:$3*10^{-0}$J)

14. A parallel plate capacitor is charged by a battery. After sometime the battery is disconnected and a dielectric slab with its thickness equal to the plate separation is inserted between the plates. How will (i) the capacitance of the capacitor be affected. (ii) pot. Diff. between the plates and (iii) the energy stored in the capacitor be affected? Justify your answer in each case.
(Ans: (i) $C=KC_0$.(ii) $V=V_0/K$.(iii)$U=U_0/K$)

15. A network of four capacitors each of 12μF capacitance is connected to a 500V supply as shown in figure. Determine (a) equivalent capacitance of the network and (b) charge on each capacitor. (Ans: (a) C_{eq}=16 μF.
(b) $Q_4=6*10^{-3}C$, $Q_1=Q_2=Q_3=2*10^{-3}C$)

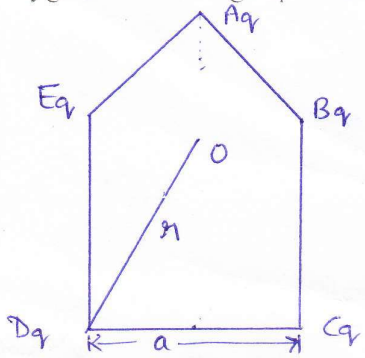


16. Two point charges 3 μC and -3 μC are located 20cm apart in vacuum. (a) Calculate the electric field at the mid-point O of the line AB joining the two charges. (b) What is the force experienced by a negative test charge of magnitude $1.5*10^{-9}C$ placed at this point.
(Ans: (a) $54*10^{5}NC^{-1}$, (b) $8.1*10^{-3}N$, direction of force is along negative charge)

17. An infinite long cylinder of radius R carries a uniform volume density ρcm^{-3}. Obtain an expression for electric field at a point (a) inside. (b) outside the cylinder. (Ans: (a) $E=\rho r/2\varepsilon_0$. (b) $E=\rho R^2/2\,\varepsilon_0 r$)

18. Two charges q and -3q are placed fixed on x-axis separated by a distance 'd'. Where should a third charge 2q be placed such that it will not experience any force? (Ans: $x=\frac{1}{2}d(1+\sqrt{3})$ to the left of q)

19. Five charges , q each are placed at the corners of a regular pentagon of side 'a'.
(i) What will be the electric field at O ,the centre of the pentagon?
(ii) What will be electric field at O if the charge from one of the corners is removed?
(iii) What will be the electric field at O if the charge q at A is replaced by -q?
(b)How would your answer to (a) be affected if pentagon is replaced by n-sided regular polygon with charge q at each of its corners?

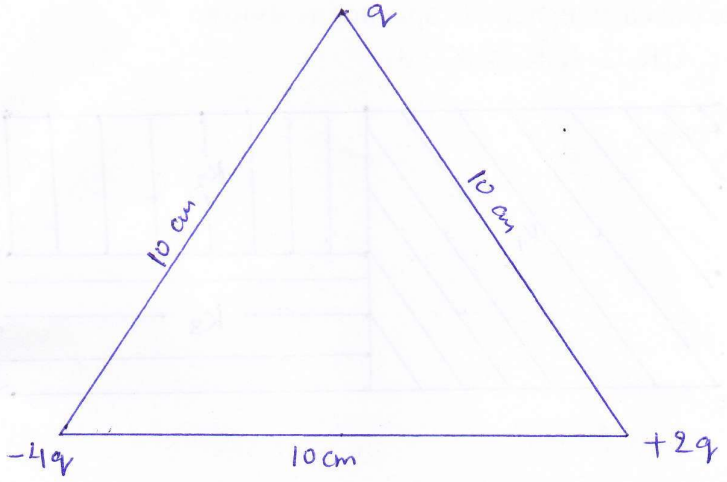


(Ans: (a)(i) zero.(ii) ¼||ε$_0$(q/r) along OA.(iii)) ¼||ε$_0$(2q/r) along OA.(b) same as in (a))

20. An infinite number of charges, each equal to q are placed along x-axis at x=1.x=2.x=4.x=8.... and so on. (a) Find the electric field at the point x=0 due to this set-up of charges. (b) What will be the electric field if in the above set up the consecutive charges have opposite sign. (Ans: (a) q/3||ε$_0$ (b)q/5||ε$_0$)

21. (a)Derive an expression for the torque experienced by n electric dipole kept in a uniform electric field.

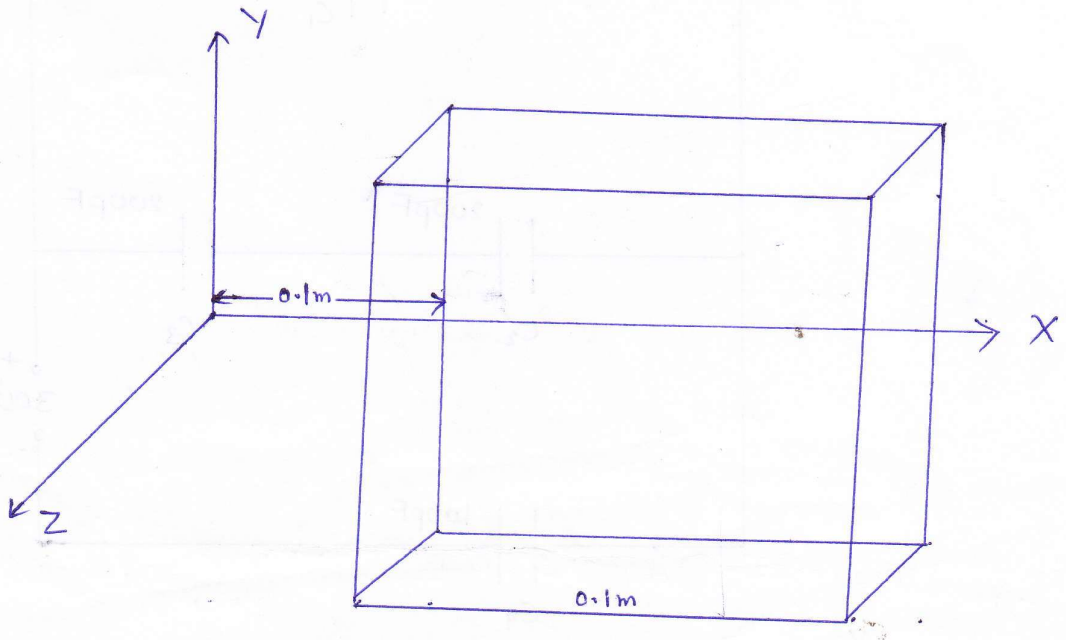
(b) Calculate the work done to dissociate the system of three charges placed on the vertices of a triangle as sown in figure. (q=1.6*10^{-10}C) (Ans: 2.3*10^{-8}J)



22.

(a) Define electric flux. Write its SI unit.

(b) The electric field components due to a charge inside the cube of side 0.1m are as shown.



$E_x=\alpha x$, where $\alpha=500N/C\text{-}m$: $E_y=0$ and $E_z=0$

Calculate (i) the flux through the cube, and (ii) the charge inside the cube.

(Ans: (i) $0.5Nm^2C^{-1}$. (ii) $q=4.4*10^{-12}C$)

23. Two tiny spheres carrying charges 1.5μC and 2.5μC are locate 30cm apart. Find the potential and electric field:

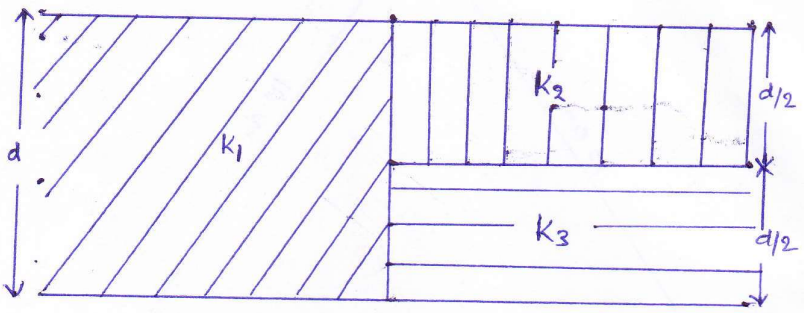
(a)At the mid-point of the line joining the two charges, and

(b)At a point 10 cm from this mid-point in a plane normal to the line and passing through the mid-point .

(Ans: (a) $2.4*10^5V$,$4.0*10^5Vm^{-1}$.(b) $2.0*10^5V$,$6.6*10^5Vm^{-1}$)

24. Calculate the capacitance of capacitor as shown:

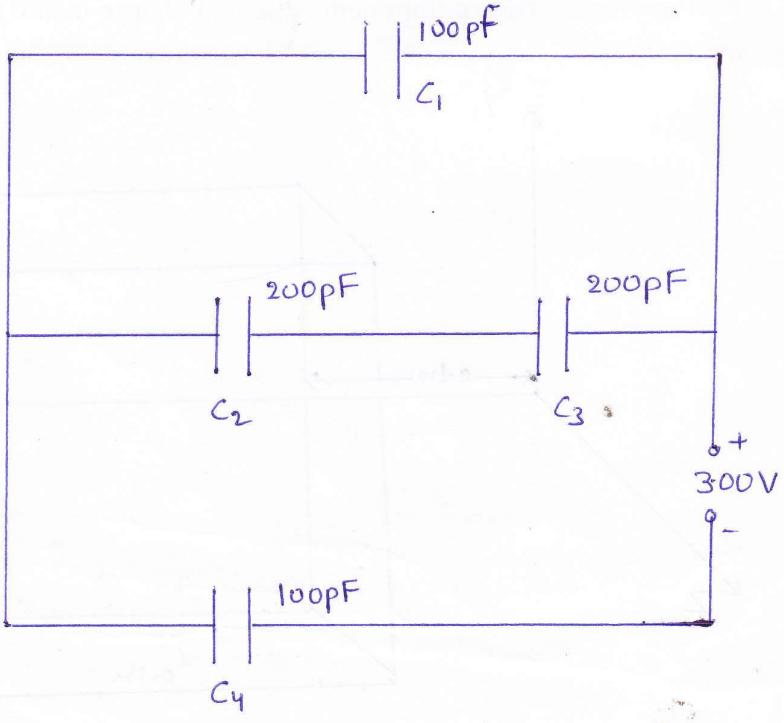
(Ans:$C=\varepsilon_0A[K_1/2+K_2K_3/K_2K_3]/d$)



25. Obtain the equivalent capacitance of the network in adjoining figure for a 300 V supply. Determine the charge and voltage across each capacitor.

(Ans: $C_{eq}=200/3pF$,$Q_1=10^{-8}C$,$V_1=100V$.

$Q_2=Q_3=10^{-8}C$,$V_2=V_3=50V$,$Q_4=2.0*10^{-8}C$,$V_4=200V$)



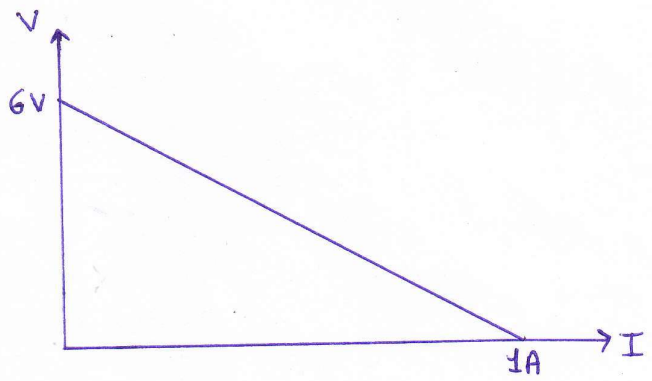
WorkSheet

Class-12

SUB: PHYSICS

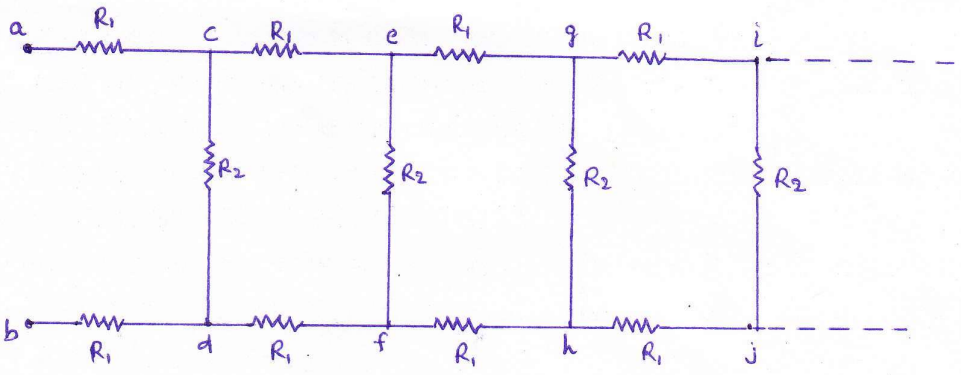
UNIT-CURRENT ELECTRICITY

1. Manganin or Eureka is used or making standard resistance coils. Why?
2. You are given a primary cell and a secondary cell of the same emf. From which cell will you be able to draw larger current and why? (Ans: Secondary cell because of low internal resistance)
3. The plot of the variation of pd across a combination of 3 identical cells in series versus current is shown in figure. What is the emf of each cell? (Ans:2V)

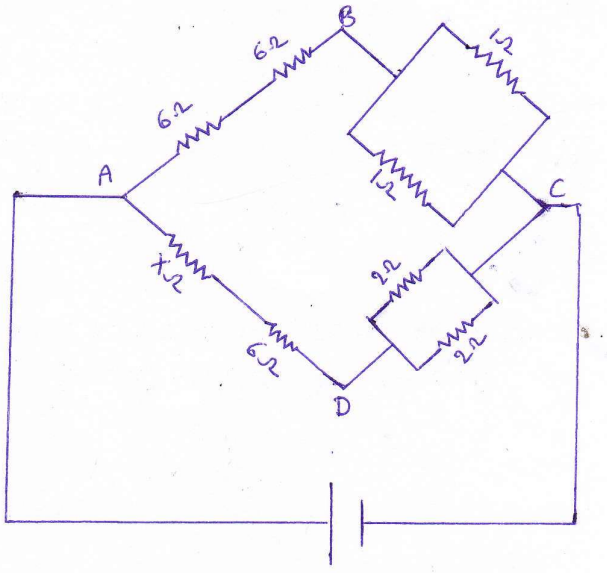


4. What is meant by sensitivity of a potentiometer?
5. What is the safest voltage you can put across a 98ohm, 0.5W resistor? (Ans: 7V)
6. Two wires X and Y have the same resistivity but their cross-sectional areas are in the ration 2:3 and their lengths in the ratio 1:2. They are first connected in series and then in parallel to a dc source. Find out the ratio of the drift speeds of the electrons in the two wires for the two cases. (Ans:2:1)

7. Define the terms resistivity and conductivity and state their units. Draw a graph showing the variation of resistivity with temperature for a typical semiconductor.
8. What is superconductivity, Explain. State two applications of superconductors.
9. When a resistance of 2 ohm is placed across the terminals of a battery, the current is 0.5A; when the resistance across the terminals is 5 ohm, the current is 0.25A. Calculate the emf of the battery. (Ans:1.5V)
10. What voltage drop will be there across a 1kW electric heater element whose resistance when hot is 40 ohm? (Ans: 200V)
11. As shown in figure, a network of resistors of resistances R_1 an R_2 extends off to infinity to the right. Prove that the total resistance R_T of the network is equal to $R_T=R_1+(R_1^2+2R_1R_2)^{1/2}$

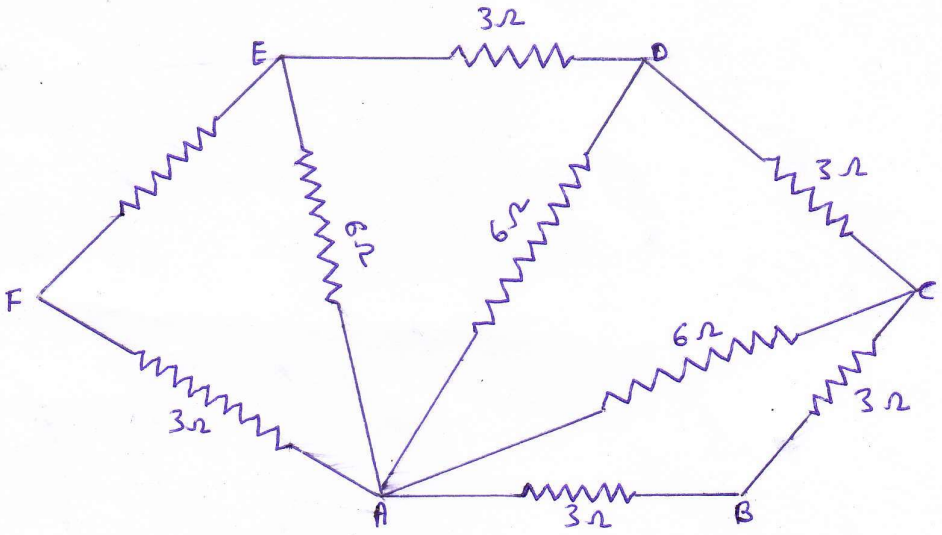


12. For what value of unknown resistance x, the pd between B and D is zero in the arrangement shown in figure. (Ans: 18 ohm)

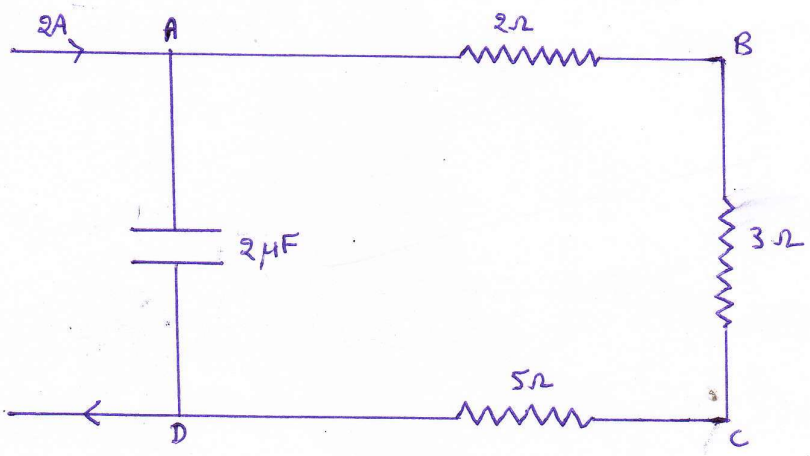


13. Derive expressions for the equivalent emf and internal resistance for the parallel combination of two cells with emf's ε_1 and ε_2 and internal resistances r_1 and r_2 respectively. What are the corresponding formulae for the series combination? (Ans: $\varepsilon_{eq}=\varepsilon_1 r_2+\varepsilon_2 r_1/r_1+r_2; r_{eq}=r_1+r_2/r_1 r_2, \varepsilon_{series}=\varepsilon_1+\varepsilon_2, r_{series}=r_1+r_2$)

14. Find the effective resistance between the points A and B in figure: (Ans : 2ohm)



15. Calculate the energy stored in the capacitor shown in the circuit when the current in the circuit is 2A. (Ans: 400μJ)



16. Answer the following

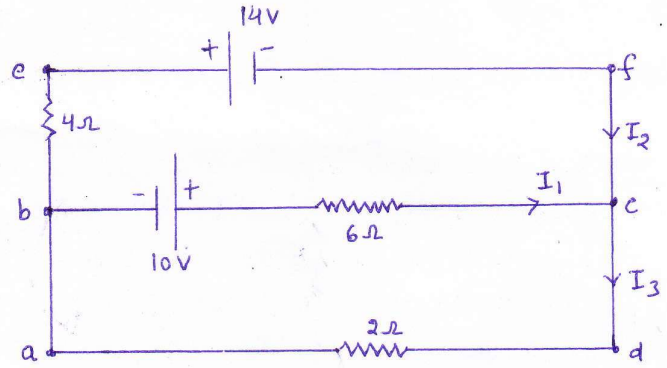
(a): Why are the connections between the resistors in a metre-bridge made of thick copper strips?

(b) Why is it generally preferred to obtain the balance point in the middle of the metre- bridge wire?

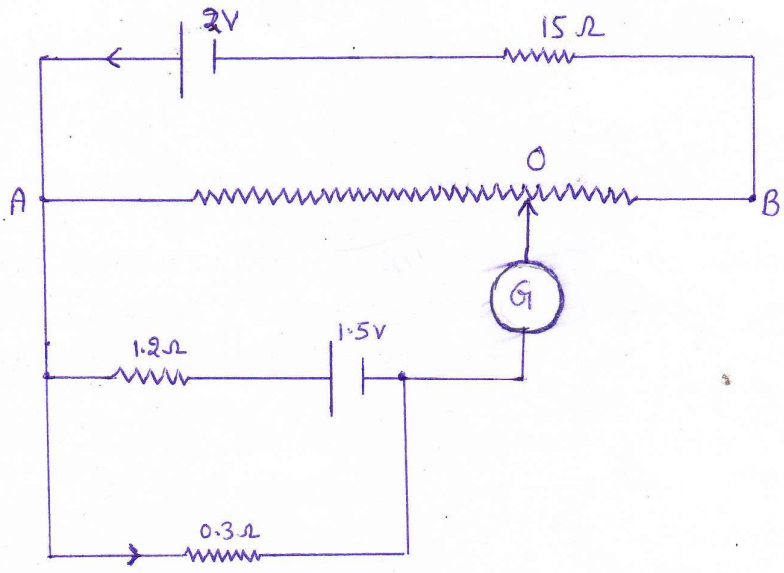
(c) Which material is used for the metre-bridge and why?

17. Describe briefly with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a cell?

18. Find the current I_1, I_2 and I_3 in the circuit shown in figure. Also find the pd between b and c. (Ans: I_1=2A,I_2=-3A,I_3=-1A,V_b-V_c=2V)



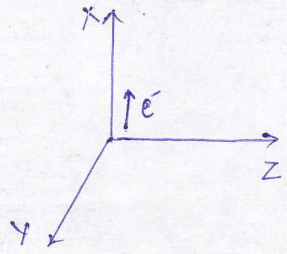
19. AB is 1m long uniform wire of 10ohm resistance. Other data are shown in figure. Calculate (a) potential gradient along AB and (b) length AO when the galvanometer shows no defection. (Ans: (a) $8*10^{-3}$V/cm,(b) 37.5cm)



20. When two resistance wires are in the two gaps of a metre-bridge, the balance point was found to be (1/3)m from the zero end. When a 6 ohm coil is connected in series with the smaller of the two resistances, the balance point is shifted to (2/3)m from the same end. Find the resistances of the two wires. (Ans: 2ohm,4ohm)
21. Derive Ohm's law on the basis of electron drift. What are the limitations of Ohm's law?
22. The region between two concentric conducting spheres with radii a and b is filled with a conducting material with resistivity ρ.
(a) Show that the resistance between the spheres is given by $R=\rho/4\pi(1/a-1/b)$.
(b) Derive an expression for the current density as a function of radius, in terms of the potential difference V_{ab} between the spheres. (Ans:$V_{ab}ab/\rho(b-a)r^2$)
(c) Show that the result in part (a) reduces to $\rho l/A$ where $l=(b-a)$ when the separation l between the spheres is small.
23. (i) State Kirchhoff's rules of electric circuits and using these rules derive Wheatstone bridge principle.
(ii) Draw a circuit diagram to determine the unknown resistance of a metallic conductor using a metre-bridge.
24. Describe the principle and construction of a potentiometer. Explain how a potentiometer can be used to compare the emf's of cells.
25. A house is fitted with eight lamps (each of 40W) and two fans, each taking a current of 0.25A. The energy is supplied at 220V. If the lamps are lighted for 3 hours a day and fans work or 6 hours a day, find the bill for 30 days. The cost of the energy is at the rate of 40 paisa per kWh.(Ans:Rs19.44)

Worksheet
Class XII
Subject: Physics
Topic: Magnetic effect of current

Ques1.State Biot-Savart's law.
Ques2.What is the force experienced by a stationary charge in a magnetic field?
Ques3.What can be the cause of helical motion of a charged particle ?
Ques4.An electron with speed v enters at right angle in a region of uniform magnetic field B.Write the expression for the radius of the path it follows.
Ques5.Write two factors by which the current sensitivity of a moving coil galvanometer can be increased.
Ques6.Among alpha,beta and gamma radiation, which get deflected by magnetic field?
Ques7.An electron and a proton, having equal momenta, enter auniform magnetic field at right
angles to the field lines.What will be the ratio of curvature of their trajectories?
Ques8.A beam of electron projected along + xaxis, experiences a force due to a magnetic field along the +yaxis.What is the direction of the magnetic field?



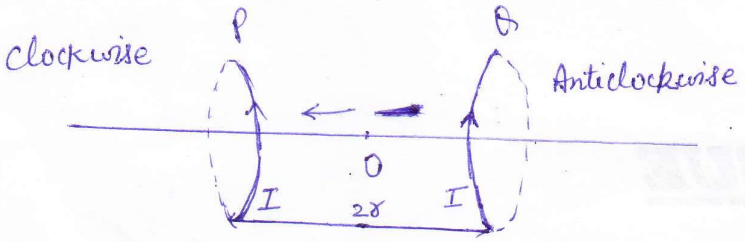
Ques9.A wire of length L is bent into a semi circular loop. Use biot-savart's law to deduce an expression for the magnetic field at the centre due to current I passing through it?
Ques10.A hydrogen ion of mass 'm' and the charge 'q' travels with the speed 'v' along a circle of radius 'r' in a uniform magnetic field of flux density 'B' .Obtain the expression for the magnatic force on the ion and determine its time period.

Ques11.Derive a formula for the force between two parallel straight conductors carrying current in opposite directions and write the nature of force . Hence , define an ampere.

Ques12.Explain how will you convert a galvanometer into a voltmeter to read a maximum potential difference of V volts .Can one use a voltmeter to measure the emf of the cell?justify your answer.

Ques13.A long straight wire of a circular cross section of radius a carries a steady current I.The current is uniformly distributed across the cross section. Apply Ampere's circuital law to calculate the magnetic field at a point in a region for (1)r<a and(2)r> a?

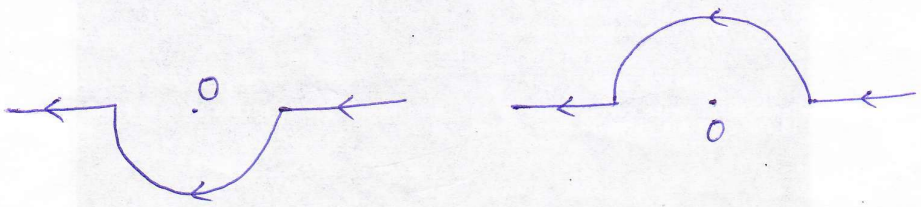
Ques14.Two identical circular loops P and Q, each of radius r and carring equal currents are kept in the parallel planes having a common axis passing through O. The direction of current in P is clockwise and in Q is anticlockwise as seen from O which is equidistant from the loops P and Q.Find the magnitude of the net magnetic field at O.



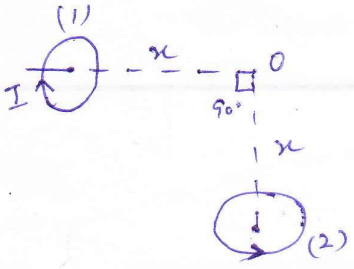
Ques15.A straight wire carrying a current of 12A is bent into a semi circular arc of radius 2.0cm as shown in the figure .What is the magnetic field B at O due to

(1)Straight segments,

(2)The semi circular arc?



Qies16.Two very small identical circular loop (1)and (2) carrying equal current I are placed vertically (with respect to the plane of the paper) with their geometrical axes perpendicular to each other as shown in the figure



.Find the magnitude and the direction of the net magnatic field produced at point O.

Ques17.An element $\Delta\vec{l} = \Delta x\hat{i}$ is placed at the origin (as shown in the figure) and carries a current I=2A. Find out the magnetic field at a point P on the Y axis at a distance of 1.0m due to the element Δx=w cm .Also give the direction of the field produced. [Given below]

Ques18.Explain using a labeled diagram,the principle and working of MCG .what is the function of(1) Uniform radial magnetic field

Define the terms (1)current sensitivity (2)voltage sensitivity of a galvanometer .Why does increasing the current sensitivity not necessarily increase voltage sensitivity.

Ques19.Show diagramatically the behaviour of magnetic field lines in the presence of (1)Paramagnetic and (2)Diamagnetic substances .How does one explain this distinguishing feature ?

Ques20.(1) Deduce an expression for the frequency of a charged particle in a magnetic field and show that it is independent of velocity or energy of the particle.

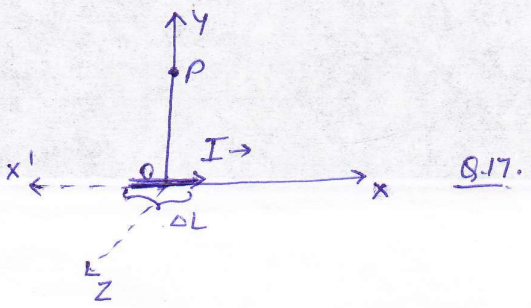
(2)Draw a schematic sketch of a cyclotron. Explain giving the essential details of its construction. How it is used to accelerate the charged particles?

Ques21.An particle and a proton are released from the centre of cyclotron and made to accelerate

(1)Can both be accelerated at the same cyclotron frequency? Give a reason to justify your answer?

(2)When they are accelerated in turn which of the two will have higher velocity at the exit slit of the dees ?

Ques22.Two long parallel wires carry currents I1 and I2 flowing in the same direction .When a third current carrying wire is placed parallel and coplanar in between the two ,find the condition when the third wire would experience no force due to these two wires.



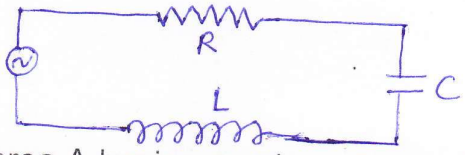
Q.17.

WORKSHEET
CLASS XII
SUBJECT: PHYSICS
TOPIC: EMI AND ALTERNATING CURRENT

Q.1. In a series LCR circuit, VL= Vc= Vr. What is the value of power factor?

Q.2. Determine the current and quality factor at resonance for a series LCR circuit with L=1.00mH, C=1.00nF and R=100ohm connected to an a.c. source having peak voltage of 100V.

Q.3. The figure shows a series LCR circuit with L =5.0H, C=80 uF, R=40 ohm connected to a variable frequency 240V source. Calculate-
(a)The angular frequency of the source which derives the circuit at resonance.
(b)The current at the resonating frequency.
(c)The rms potential drop across the capacitor at resonance.



Q.4. A rectangular coil of area A having number of terms N is rotated at 'f' revolution per second in a uniform magnetic field B. The field being perpendicular to the coil. Prove that the maximum emf induced in a coil is $2\pi f$ NBA. ?

Q.5. Derive the expression for the magnetic field due to a solenoid of length '2 l' radius 'a' having 'n' number of turns per unit length and carrying a steady current 'I' at a point on the axial line, distance 'r' from the centre of the solenoid. How does this expression compare with the axial magnetic field due to a bar magnet of magnetic moment 'm'?

Q.6. The magnetic flux passing perpendicular to the plane of a coil is varying according to the relation $\phi=6t^2+7t+1$ where ϕ is in milliweber. What is the magnitude of e.m.f. induced in the loop when t=2 sec.?

Q.7. What is called Q factor of an LCR circuit? Also discuss the sharpness of resonance and half power frequencies.

Q.8. Two circular coils, one of radius r and the other of radius R are placed coaxially with their centres coinciding. For R>>r, obtain an expression for the mutual inductance of the arrangement.

Q.9. A copper rod of length L rotates with an angular speed w on a uniform magnetic field B. Find the emf developed between the two ends of the rod. Given that the field is perpendicular to the medium of the rod.

(3) A thin iron sheet is placed between the two coils other factors remaining the same? Justify your answer in each case.

Q.19. A jet plane is travelling west at the speed of 1800km h^-1.What is the voltage difference developed between the ends of the wing 25 m long, if the earth's magnetic field at the location has a magnitude of 5.0 ×10^-4 T and the dip angle is 30°.

Q.20 A capacitance of 50uF and inductance of 0:2015 H are connected in series. If the resistance of the circuit is negligible, find the frequency at resonance occurs.

Q.21 A 60V and 10W lamp is to be run on 100V, 60Hz A.C mains. Calculate the inductance of the choke coil required. How much pure resistance would be necessary in the circuit to achieve the same result.

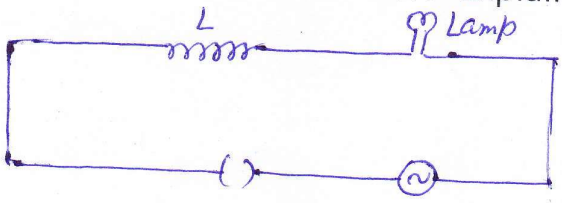
Q.22 A voltage V=Vo sin wt is applied to a series L-C-R circuit .Derive the expression for the average power dissipated over a cycle. Under what conditions is (i) no power dissipated even through the circuit

(ii) maximum power dissipated in the circuit?

Q.23 A wheel with 10 metallic spokes each 0.5 m long is rotated with a speed of 120 rev/min in a plane normal to the earth's magnetic field at that place. If the magnitude of field is 0.4 G, what is the induced emf between the axle and the rim of the wheel.

Q.24 An alternating e.m.f is applied to a circuit containing an inductance and capacitance in series. The resistance of the circuit is negligible find the condition for resonance.

Q.25 A lamp is connected in series with an inductor and an A.C source . What happens to the brightness of the lamp when the key is plugged in and an iron rod is inserted inside the inductor? Explain.



Work Sheet
Class - 12
SUB: PHYSICS
Unit - (EMW)

Q.1 How are radio waves produced?

Q.2 Write one method each of (i) production and
(ii) detection of microwaves.

Q.3 Name the part of electromagnetic spectrum whose wavelength lies in the range of 10^{-2}m. Give its one use.

Q.4 To which part of the electromagnetic spectrum does a wave of frequency $5x10^{19}$ Hz belong?

Q.5 Considering the case of a parallel plate capacitor being charged Show that how one is required to generalize Amperes circuital law to include the term due to displacement current.

Q.6 (a) When the oscillating electric and magnetic field are along x-and y-direction respectively.
(i) Point out the direction of propagation of EMW.
(ii) Express the velocity of propagation in terms of the amplitudes of the oscillating electric and magnetic fields.
(b) How do you show that the em waves carries energy and momentum?

Q.7 What are the directions of electric and magnetic field vectors relative to each other and relative to the direction of propagation of EMW

Q.8 Welders wear special goggles or face masks with glass window to protect their eyes from EM radiations. Name the radiations and write the range of their frequency.

Q.9 A capacitor made of two parallel plates each of area A and separation d is being charged by an external ac source. Show that the displacement current inside the capacitor is the same as the current charging the capacitor.

Q.10 A capacitor of capacitance C is being charged by connecting it across a dc source along with an ammeter. Will the ammeter show a momentary deflection and the resulting continuity of current in the circuit? Write the expression for the current inside the capacitor.

Q.11 A charging current for a capacitor is 0.25A, what is the displacement current across it?

Q.12 The amplitude of the magnetic field part of a harmonic EMW in vacuum is B =510 T. What is the amplitude of the electric field part of the wave?

Q.13 A plane EMW of frequency 25 MHz travels in free space along 'x – direction. At a particular point in space and time the electric vector is E=6.3V/m j. Calculate B at this point.

Q.14 If the earth did not have atmosphere, would its average surface temperature be higher or lower than what it is now? Explain.

Q.15 An EMW exerts pressure on the surface on which it is incident. Justify.

Q.16 What do you mean by EMW. Give its four properties.

Q.17 A variable frequency a.c source is connected to a capacitor. Will the displacement current increase or decrease with increase in frequency.

Q.18 Give the ratio of velocities of light rays of wave length 4000 and 8000 A in vacuum.

Q.19 How are Microwaves Produced? Why is it necessary in microwave ovens to select the frequency of microwaves to match the resonance frequency of water molecules?

Q.20 The Magnetic field in a plane EMW is given by

$B= 2x10^{-7}$ Sin $(.5x10^{3}\ x + 1.5x\ 10^{11}\ t)T$

(a) What is the wavelength and frequency of the wave?

(b) Write an expression for the electric field.

Work Sheet
Class - 12
SUB: PHYSICS
Unit – Optics (Ray Optics)

Q.1 Two lenses of power 10 D and -5D are placed in contact.

(i) Calculate the power of lens combination.

(ii) Where should an object be held from the lens, so as to obtain a virtual image of magnification 2 ?

Q.2 An illuminated object and a screen are placed 90 cm part. Determine the focal length and nature of the lens required to produce a clear image on the screen, twice the size of the object.

Q.3 (a) State the conditions for total internal reflection to occur.

(b) Calculate the speed of light in the medium whose critical angle is 45^0.

Q.4 A converging & diverging lens of equal focal lengths are placed co-axially in contact. Find the power & the focal lengths of the combination.

Q.5 A small candle 2.5 cm in size is places 27cm in front of a concave mirror of radius of curvature 38 cm. At what distance from the mirror should a screen be placed in order to receive a sharp image? Describe the nature and size of the image if the candle is moved closer to the mirror, how should the screen be moved? (-5cm).

Q.6 A small bulb is placed at the bottom of a tank containing water to a depth of 80 cm. what is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water is 4/3.

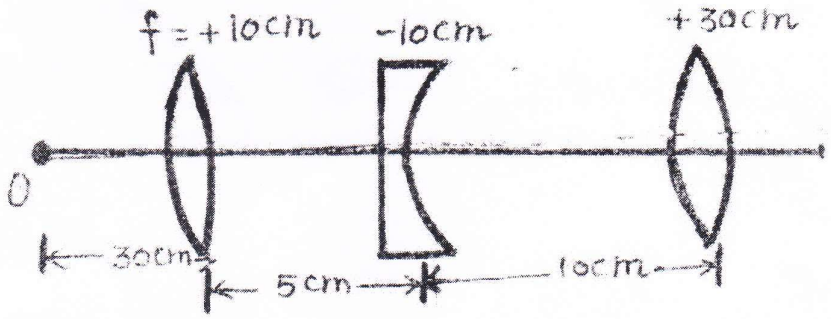
Q.7 A compound microscope consists of an objective lens of focal length 2cm and an eyepiece of focal length 6.25cm separated by a distance of 15cm. How far from the objective should an object be placed in order to obtain the final image at (i) the least distance of the distinct vision

(D=25 cm) (ii) infinity. What is the magnifying power of the microscope in each case?

Q.8 A compound microscope uses an objective lens of focal length 4cm and eyepiece lens of focal length 10cm. An object is placed at 6 cm from the objective lens. Calculate magnifying power of the compound microscope. Also calculate the length of the microscope?

Q.9 A person with a normal near point (25cm) using a compound microscope with an objective of focal length 8mm and eye piece of focal length 2.5cm bring an object placed 9mm from the objective in sharp focus. What is the separation between the two lenses? What is the magnifying power of microscope?

Q.10 Find the position of the image formed of the object 'o' by the lens combination given in the fig.



Q.11 The radii of curvature of the faces of a double convex lens are 10 & 15cm if the length of the lens is 12cm, find refractive index of material of lens.

Q.12 A ray of light passing through an equilateral triangular prism air undergoes minimum deviation when angle of incidence is $3/4^{th}$ of the angle of prism. Calculate the speed of light in the prism.

Worksheet
Class-XII
Sub.: Physics
Unit-Optics (Wave Optics)

Q.1 What is the shape of the wavefront in each of the following cases:
(a) Light diverging from a point source.

(b) Light emerging out of a convex lens when a point source is placed at its focus.

(c) The point of the wavefront of light from a distant star intercepted by the Earth.

Q.2 (a) The refractive index of glass is 1.5. What is the speed of light in glass? (Speed of light in vacuum is 3.0×10^8 m s^{-1})

(b) Is the speed of light in glass independent of the colour of light? If not, which of the two colours red and violet travels slower in a glass prism? (Max. for Red Colour)

Q.3 When monochromatic light travels from one medium to another its wavelength changes but frequency remains the same. Explain.

Q.4 Draw the shape of the wavefront coming out of a concave morror when a plane wave is incident on it.

Q.5 State the reason, why two independent sources of light cannot be considered as coherent sources.

Q.6 Is the law of conservation of energy obeyed by interference phenomenon of light?

Q.7 State the conditions which must be satisfied for two light sources to be coherent.

Q.8 Draw an intensity distribution graph for diffraction due to a single-slit.

Q.9 Sketch the variation of intensity of the interference pattern in Young's double-slit experiment.

Q.10 Show that the superposition of the waves originating from two coherent sources s_1 and s_2 having displacements $y_1 = a \cos \omega t$ and $y_2 = a \cos (\omega t + \emptyset)$ at a point produce a resultant intensity $I_R = 4a^2 \cos^2 \frac{\emptyset}{2}$. Hence, write the conditions for the appearance of dark and bright fringes.

Q.11 (a) State two conditions for obtaining coherent sources.

(b) In Young's arrangement to produce interference pattern show that dark and bright fringes appearing on the screen are equally spaced.

Q.12 What is the effect in the interference fringes in Young's double0slit experiment, if (i) the separation between the slits is halved, (ii) the source slit is moved closer to the double-slit? Justify your answer.

Q.13 Laser light of wavelength 630 nm incident on a pair of slits produces an interference pattern in which the bright fringes are separated by 8.1 mm. A second light produces an interference pattern in which the fringes are separated by 7.2 mm. Calculate the wavelength is the second light.

Q.14 In a single-slit diffraction experiment, a monochromatic source of light of wavelength 'λ' illuminates a narrow slit of width 'a'. Show giving appropriate reasoning, that the half angular width of the central maximum in the observed pattern is (nearly) equal to $\frac{\lambda}{a}$.

Q.15 How is the diffraction pattern due to a single-slit different from the interference pattern obtained in Young's double-slit experiment?

Q.16 Yellow light (λ = 6000 Å) illuminates a single-slit of width 1×10^{-4} m. Calculate (i) the distance between two dark lines in either side of the central maximum when the diffraction pattern is views on a screen kept 1.5 m away from the slit, (ii) the angular spread of the first diffraction minima.

Q.17 Light of wavelength 500nm falls from a distance on a slit 0.50 mm wide. Find the distance between the two dark bands, on either side of the central bright band, of the diffraction pattern observed on a screen placed 2m from the slits.

Q.18 Does conservation law of energy hold good for interference or diffraction pattern? If yes how and if no, why?

Q.19 For a single-slit of width "a", the first minimum of the interference pattern of a monochromatic light of wavelength λ occurs by at an angle of $\frac{\lambda}{a}$. At the same angle of $\frac{\lambda}{a}'$ we get a maximum for two narrow slits separated by a distance "a", Explain.

Work Sheet
Class - 12
SUB: PHYSICS
Unit - (DUAL NATURE OF MATTER AND RADIATION)

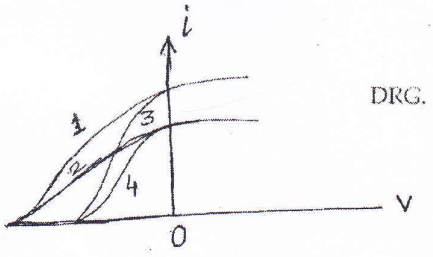
Q.1 X-ray of wavelength 0.82 A^0 fall on a metallic surface. Calculate the de-Broglie wavelength of the emitted photoelectrons. Neglect the work function of the metal surface. (Ans. 0.0998×10^{-10} m)

Q.2 Mention the significance of Davisson-Germer experiment. An *a – particle* and a proton are accelerated from rest through the same potential difference V. Calculate the ratio of their de-Broglie wavelength. (Ans. = $1/2\sqrt{2}$)

Q.3 An electron, an α-particle and a proton have same kinetic energy, Which one of these particles has the shortest de-Broglie wavelength?
(Ans. α Particle)

Q.4 The threshold frequency of a metal is ν_0. When the light of frequency $2\ \nu_0$ is incident on the metal plate, the maximum velocity of electron emitted is V_1. Velocity of electron emitted is V_2. Find the ratio of V_1. and V_2. (Ans. 1:2)

Q.5 The graph shown in figure shows the variation of photoelectric current (i) ad the applied voltage (V) for two different materials and for two different intensities of the incident radiation. Identify the pairs of curves that correspond to (i) different material. (ii) same intensity of incident radiation.



DRG.

Q.6 A proton and an alpha particle are accelerated through the same potential. Which one of the two has (i) greater valve of de-Broglie wavelength associated with it, and (ii) less – kinetic energy? Justify your answers.

(Ans. Kinetic energy of an α will be twice as that of a proton)

Q.7 The work function for a given photosensitive surface equals 2.5e V. when light of frequency v falls on this surface, the emitted photoelectrons are completely stopped by applying a retarding potential of 4.1 V. What is the value of v. (Ans. 1.6×10^{15}H)

Q.8 Show graphically how the stopping potential for a given photoelectric surface varies with the frequency of the incident radiation. What information can be obtained from the value of the intercept on the potential axis?

Q.9 De-Broglie wavelength associated with an electron accelerated through a potential difference 1 V is λ. What will be its wavelength when the accelerating potential is increased to 4 V?

Q.10 UV light is incident on two photosensitive materials which have work function W_1 and W_2 ($W_1 > W_2$). In which case will the kinetic energy of the emitted electrons will be greater?

Q.11 Two beams, one of red light and the other of blue light, of the same intensity, are incident on a metallic surface to emit photoelectrons. Which one of the two beams emits photoelectrons of greater kinetic energy?

Q.12 Radiation of frequency 10^{15} HZ is incident on three photosensitive surface A, B and C. Following observations are recorded:
Surface A : No photoemission occurs.
Surface B: Photoemission occurs but photoelectrons have zero energy.
Surface C : Photoemission occurs and photoelectrons have some kinetic energy.

Based on Einstein's photoelectric equation, explain this three observations.

WORKSHEET
CLASS: XII
SUBJECT: PHYSICS
TOPIC: ATOM AND NUCLEI

Q1.Obtain the expression for radius, velocity, frequency, kinetic, potential and total energy for the electron in H- atom using Bohr's hypothesis.

Q2.Draw a plot showing the variation of binding energy per nucleon versus the mass number A. Explain with the help of this plot the release of energy in the processes of nuclear fission and fusion.

Q3.Write any four characteristics properties of nuclear force.

Q4.(a)Define the terms (i)half-life ($T_{1/2}$) (ii)average life (τ).Find out their relationships with the decay constant(λ).

Q5.(a)Deduce the expression, $N=N0e^{-\lambda t}$,for the law of radioactive decay. (b)i.Write symbolically the process expressing the β+decay of $_{11}Na^{22}$.Also write the basic nuclear process underlying this decay.

Q6.Show that nuclear density in a given nucleus is independent of mass numberA.

Q7.Using Bohr's postulates for hydrogen atom, show that the total energy (E) of the electron in the stationary states can be expressed as the sum of kinetic energy (K) and potential energy (U), where K= -2U.Hence deduce the expression for the total energy in the nth energy level of hydrogen atom.

Q8.A nucleus $^{23}Ne_{10}$ undergoes β-decay and becomes $^{23}Na_{11}$.Calculate the maximum kinetic energy of electrons emitted assuming that the daughter nucleus and anti-neutrino carry negligible kinetic energy.(mass of $^{23}_{10}Ne$=22.994466 u)

(Mass of $^{23}_{11}Na$= 22.989770 u) (1u= 931.5 Me V/e^2)

Q9.Draw a plot of potential energy of a pair of nucleons as a function of their separations. Mark the regions where the nuclear force is (i) attractive and (ii)repulsive. Write any two characteristics features of nuclear forces.

Q10.Calculate the shortest wavelength in the Balmer series of hydrogen atom. In which region of hydrogen spectrum does this wavelength lie?

Q11.What is the nuclear radius of 125Fe, if that of 27Al is 3.6 Fermi? Ans. 6 Fermi

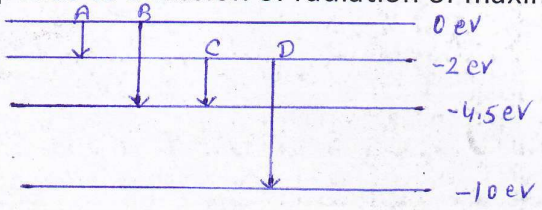
Q12.Two nuclei have mass numbers in the ratio 1:2. What is the ratio of their nuclei densities?

Q13.A radioactive nucleus 'A' undergoes a series of decays according to the following scheme.

$A \xrightarrow{\alpha} A_1 \xrightarrow{\beta} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{\gamma} A_4$

The mass no. and atomic no. of A are 180 and 72 respectively. What are these numbers of A_4?

Q14.(a)The energy levels of an atom are shown below. Which of them will result in the transition of a photon of wavelength 275nm? (b) Which transition corresponds to emission of radiation of maximum wavelength?



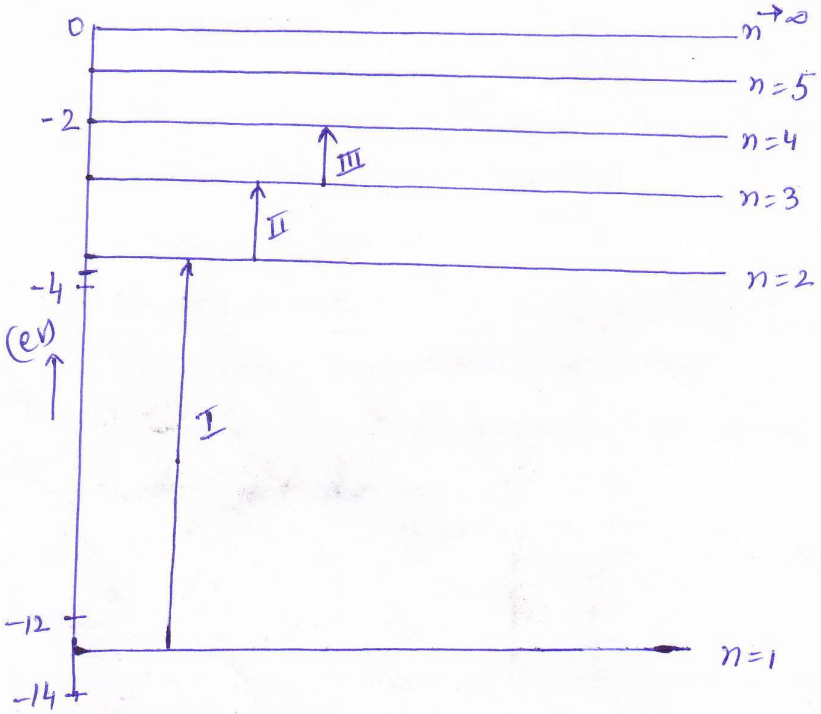
Q15. The energy of the electron in the ground state of hydrogen atom is -13. 6 eV.

(i)What does the negative sign signify? (ii)How much energy is required to take an electron in this atom from the ground state to the first excited state?

Q16.(a)What is meant by half-life of a radioactive element? (b)The half-life of a radioactive element is 30s. Calculate (i) the decay constant, and (ii)time taken by the sample to decay by $3/4^{th}$ of the initial value.

Q17.A radioactive isotope has a half-life of 5 years. How long will it take the activity to reduce to 3.125%?

Q18.Photons with a continuous range of frequencies are made to pass through a sample of rarefied hydrogen. The transition shown here indicate three of the spectral absorption lines in the continuous spectrum.



(i)Identify the spectral series of the hydrogen emission spectrum to which each of these three lines correspond.

(ii)Which of these lines corresponds to the absorption of radiation of maximum wavelength?

Q19.In the study of Geiger-Marsden experiment on scattering of α-particles by a thin foil of gold, draw the trajectory of α-particles in the coulomb field of target nucleus. Explain briefly how one gets the information on the size of the nucleus from this study. From the relation $R=R_0 A^{1/3}$, where R_0 is constant and A is the mass number of the nucleus, show that nuclear matter density is independent of A.

Q20.(i)Using postulates of Bohr's theory of hydrogen atom, show that

(a)the radii of orbits increase as n^2 and

(b)the total energy of the electron increases as $1/n^2$, where n is the principal quantum number of the atom.

(ii)Calculate the wavelength of H_α-line in Balmer series of hydrogen atom. Given, Rydberg constant, $R= 1.097*10^7\ m^{-1}$.

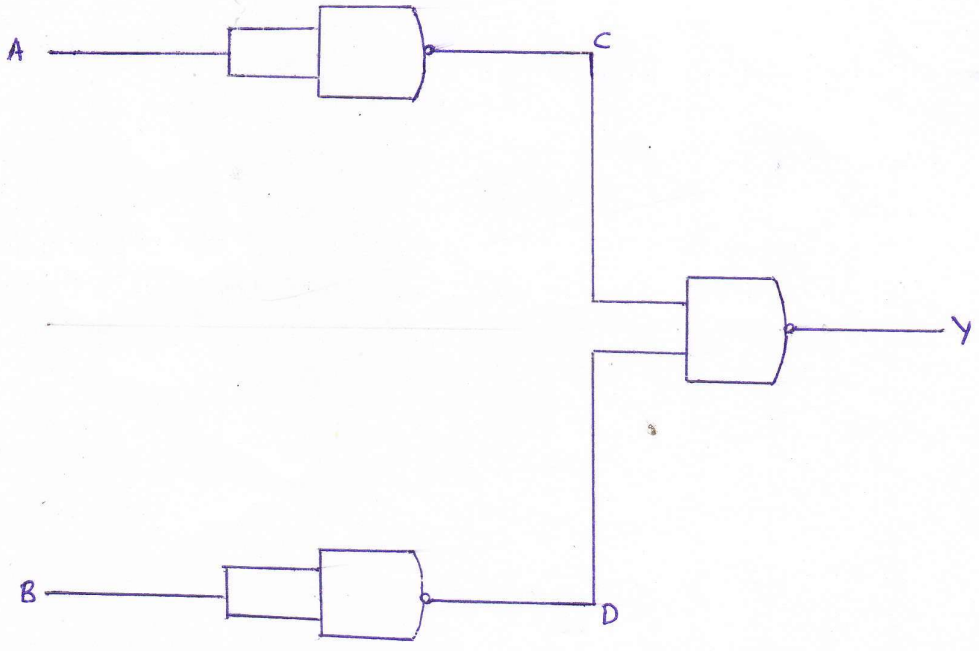
WorkSheet

Class-12

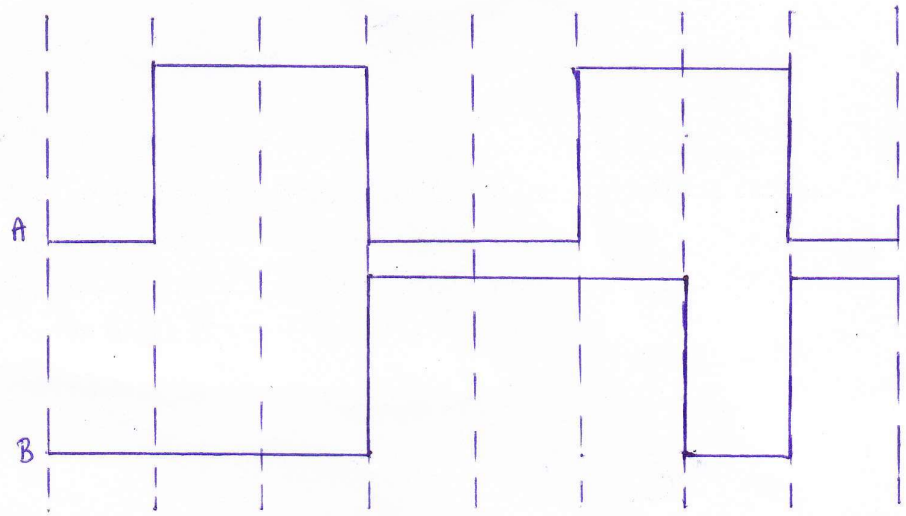
SUB: PHYSICS

UNIT-ELECTRONIC DEVICE

1. What happens to the width of depletion layer of a p-n junction when I is (i) forward biased, (ii) reverse biased? (Ans: (i)decrease,(ii) increase)
2. State the reason why GaAs is most commonly used in the making of solar cell? (Ans: It has higher absorption coefficient)
3. Why should a photo diode be operated at a reverse bias?
4. Name one impurity each, which when added to pure Si, produces (i) n-type, and (ii) p-type semiconductors. (Ans: (i) arsenic,(ii) Indium)
5. Name the semiconductor device that can be used to regulate an unregulated dc power supply. With the help of I-V characteristics of this device, explain its working principle.(Ans: Zener diode)
6. Write the truth table for the logic circuit shown below and identify the logic operation performed by this circuit.



7. Carbon and silicon both have four valance electrons each. How then are they distinguished?
8. Sketch the output waveform from an AND gate for the inputs A and B shown in the figure.



9. Give the circuit diagram of a common emitter amplifier using an n-p-n transistor. Draw the input and output waveforms of the signal. Write the expression for its voltage gain. (Ans: $A_v=\beta R_o/R_i$)
10. Draw a labelled diagram of a full wave rectifier circuit. State its principle. Show the input-output waveforms.
11. For a common emitter transistor amplifier, the audio signal voltage across the collector resistance of 2 kohm is 2V. If the current amplification factor of the transistor is 100, calculate (i) input signal voltage ,(ii) base current, and (iii) power gain. Given that the value of the base resistance is 1kohm. (Ans: (i)$V_I=10^{-2}$volts,(ii)$I_B=10^{-5}$A,(iii)$A_P=2*10^4$)
12. On the basis of the energy band diagrams distinguish between metals, insulators and semiconductors.
13. (a) Describe the working of light emitting diodes(LED's)
    (b) Which semiconductors are preferred to make LED's and why?
    (c) Give two advantages of using LED's over conventional incandescent low power lamps.

14. Why is zener diode considered as a special purpose semiconductor diode? Draw the I-V characteristics of a zener diode and explain briefly how reverse current suddenly increases at the breakdown voltage. Describe how a zener diode works to obtain a constant dc voltage from the unregulated dc output of a rectifier.

15. (i) Draw a circuit diagram to study the input and output characteristics of an n-p-n transistor in its common emitter configuration. Draw the typical input and output characteristics. (ii) Explain, with the help of a circuit diagram, the working of n-p-n transistor as a common emitter amplifier.

WorkSheet

Class-12

SUB: PHYSICS

UNIT-COMMUNICATION SYSTEM

1. What is sky wave propagation?
2. What should be the length of dipole antenna for a carrier wave of frequency $6*10^8$Hz? (Ans: 0.125m)
3. Why is ground wave transmission of signals restricted to a frequency of 1500 kHz?
4. Mention the function of the following used in communication system: (i) Transducer, (ii) Repeater, (iii) Transmitter, (iv) Bandpass filter.
5. For an amplitude modulated wave, the maximum amplitude is found to be 10V while the minimum amplitude is 2V. Calculate the modulation index. Why is modulation index generally kept less than one? (Ans: 2/3, to avoid distortion)
6. Draw a block diagram showing the important components in a communication system.
7. What is the range of frequencies used for TV transmission? What is common between these waves and light waves? (Ans:54MHz~890MHz)
8. Write two factors justifying the need of modulating a signal. A carrier wave of peak voltage 12V is used to transmit a message signal. What should be the peak voltage o the modulating signal in order to have a modulation index of 75%? (Ans: 9V)

9. A transmitting antenna at the top of a tower has a height of 36m and the eight of the receiving antenna is 49m. what is the maximum distance between them , for satisfactory communication in the LOS mode? (radius of earth=6400km) (Ans: 46.5km)
10. Draw a schematic sketch showing the (i) ground wave, (ii) sky wave, (iii) space wave modes of propagation. Write the frequency range of each of these modes of propagation.
11. What is amplitude modulation? Represent the process graphically. Write its two limitations.
12. Draw a plot of the variation of amplitude versus ω for an amplitude modulated wave. Define modulation index. State its importance for effective amplitude modulation.