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PHYSICS

VICTORY

Prepared by
J.SHANMUGAVELU M.Sc, B.Ed
(P.G. Assist. in Physics)

EASY PHYSICS

Lions Mat. Hr. Sec. School , Paramakudi (2015 – 2016)

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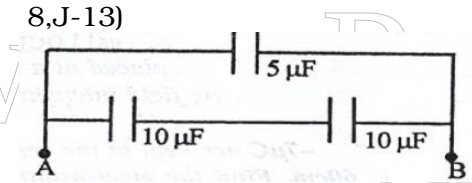
PHYSICS

PUBLIC 3 , 5 MARK PROBLEMS
(MAR 2006 – OCT 2015)

1.ELECTROSTATICS

PUBLIC '3' MARK PROBLEMS

1. calculate the effective capacitance of the combination shown in the figure.(O – 8,J-13)



2. Three capacitors each of capacitance 9 pF are connected in series. Find effective capacitance. (M – 08)

3. Calculate the potential at a point due to a charge of 4×10^{-7} C located at 0.09 m away from it. (M–12,M-14)

4. Three capacitors each of capacitance 9 pF are connected in parallel. Find effective capacitance.

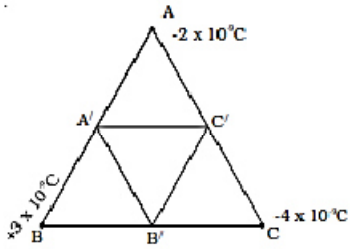
5. A sample of HCl gas is placed in an electric field of 2.5×10^{4} N C^{-1}. The dipole moment of each HCl molecule is 3.4×10^{-30} C m. Find the maximum torque that can act on a molecule. [M – 15]

6. A point charge causes an electric flux of -6×10^{3} Nm^{2} C^{-1} to pass through a spherical Gaussian surface of 10 cm radius centred on the charge.
   (i) If the radius of the Gaussian surface is doubled, how much flux will pass through the surface?
   (ii) What is the value of charge? (J-15)

PUBLIC '5' MARK PROBLEMS:

7. A square of side 1.3 m has the charges +12 nC, -24 nC, +31 nC and 17 nC at its corners. Calculate the electric potential at its centre. [**J-07**] [compulsory]

8. Three charges -2×10^{-9} C, $+3 \times 10^{-9}$ C and -4×10^{-9} C are placed at the vertices of an of an equilateral triangle ABC of side 20 cm. calculate the workdone in shifting the charges from A, B and C to A_1, B_1 and C_1 respectively. Which are the mid-points of the sides of triangles? [J-11]



9. Two positive charges 12 μC and 8 μC respectively are 10 cm apart. Find the workdone in bringing them 4 cm closer, so that they 6 cm apart. [J-08]

10. Two capacitors of unknown capacitances are connected in series and parallel. If the net capacitances in the two combinations are 6 μF and 25 μF respectively, find their capacitances. [O-08]

11. The plates of parallel plate capacitor have and area 90 cm^2 each and are separated by 2.5mm. The capacitor is charged by connecting it into a 400 V supply. How much electrostatic energy is stored by the capacitor? [J-09,O-13]

12. A parallel plate capacitor has an area 200 cm^2 and the separation between the plates is 1mm. Calculate i) the potential difference between the plates if 1 nC charge is given to the capacitor. ii) With the same charge (1nC) if the separation is increased to 2 mm, what is the new potential difference and iii) the electric field between the plates. [M-06]

13. Three capacitors each of capacitance 9 pF are connected in series i) What is the total capacitance of the combination? ii) What is the potential difference across each capacitor if the combination is connected to 120 V supply? [J-06,O-06,J-11]

14. Two capacitors of capacitances 0.5 μF and 0.75 μF are connected in parallel and the combination to 110 V battery. Calculate the charge from the source and the charge on each capacitor. [**J-07**] [compulsory]

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2 - CURRENT ELECTRICITY

PUBLIC '3' MARK PROBLEMS:

1. If 6.25×10^{18} electrons flow through a given cross - section of a conductor in unit time, find the current. (given charge of electron is 1.6×10^{-19}) [M-10,J-11]

2. A manganin wire of length 2 m has a diameter of 0.4 mm with a resistance of 70Ω. Find the resistivity of the material. [J-06,M-13]

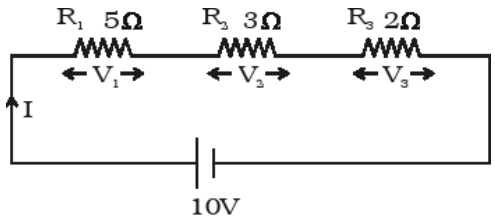
3. The resistance of nichrome wire at 0^0C is 10Ω. If the temperature coefficient of resistance is $0.004/^0$C, find its resistance at boiling point of water. Comment on the result. [J-07,O-07,M-08,O-10,11,O-12,O-13,J-15]

4. The resistance of nichrome wire at 0^0C is 4Ω. What will be the resistance of the wire at 100^0C if the temperature coefficient of resistance of platinum is $0.0038/^0$C? [M-07,J-09,J-10]

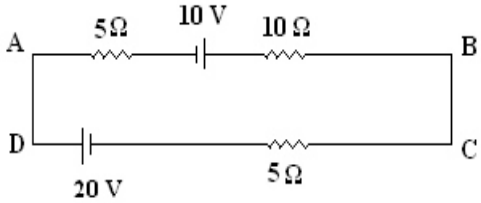
5. Two wires of same material and length have resistances 5 Ω and 10 Ω respectively. Find the ratio of radii of the two wires. [M-09]

6. An iron box of 400 W power is used daily for 30 minutes. If the cost per unit is 75 paise, find the weekly expense on using the iron box. [J-08,12]

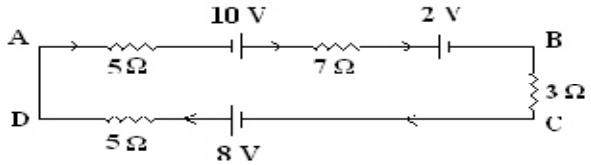
7. Three resistors are connected in series with 10 V supply as shown in the fig. Find the voltage drop across each resistor. [M-06,]



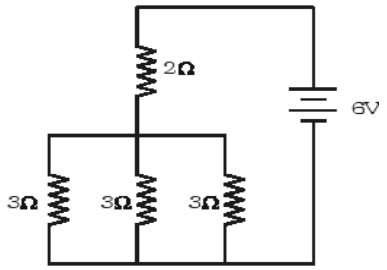
8. Find the magnitude and direction of the current in the following circuit (M–11)



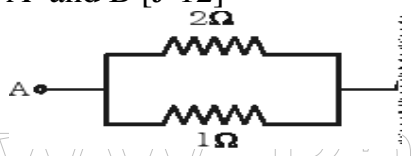
9. In the following circuit, calculate the current through the circuit. Mention its direction. [O-06,J-10,]



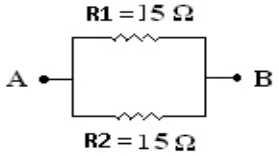
10. In the given circuit, what is the total resistance and current supplied by the battery. [O-09]



11. From the following network find the effective resistance between A and B [J-12]



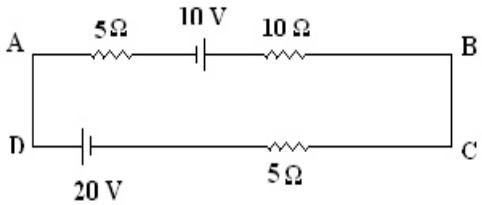
12. Find the effective resistance between A and B. (J – 12)



13. An incandescent lamp is operated at 240 V and the current is 0.5 A. What is the resistance of the lamp? [M-14]

14. A 1.5 V carbon-zinc dry cell is connected across a load of 1000 Ω. Calculate the current and power supplied to it. (J-14)

15. In the circuit find the magnitude and direction of the current . (O-14)



16. A cell has a potential difference of 6 V in an open circuit, but it falls to 4 V when a current of 2 A is drawn from it. Find the internal resistance of the cell. **(O-15)**

PUBLIC '5' MARK PROBLEMS:

17. What is the drift velocity of an electron in a copper conductor having area 10×10^{-6} m^2 and carrying a current of 2A. Assume that there are 10×10^{28} electrons/m^3. [**J-10**] [compulsory]

18. A copper wire 10^{-6} m^2 area of cross section, carries a current of 2 A. If the number of electrons per cubic metre is 8×10^{28}, calculate the current density and average drift velocity. (Given e = 1.6×10^{-19} C)[M-09]

19. The resistance of a filed coil measures 50 Ω at 20 ^{0}C and 65 Ω at 70 ^{0}C. Find the temperature coefficient of resistance. [J-13]

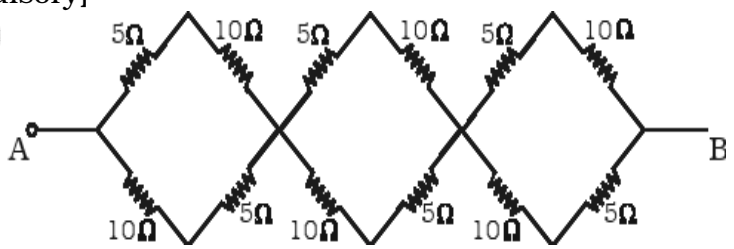
20. An iron box of 400 W power is used daily for 30 minutes. If the cost per unit is 75 paise, find the weekly expense on using the iron box. [J-12]

21. Find the current flowing across three resistors 3 Ω , 5 Ω and 2 Ω connected in parallel to a 15 V supply. Also find effective resistance and total current drawn from the supply. [**O-10,M-15**] [compulsory]

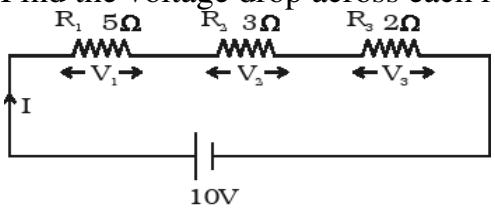
22. In a metre bridge, the balancing length for a 10 Ω resistance in left gap is 51.8 cm. Find the unknown resistance and specific resistance of a wire of length 108 cm and radius 0.2 mm. [**O-10**, J-12] [compulsory]

23. The effective resistances are 10 Ω , 2.4 Ω when they are connected in series and parallel respectively. What are the resistances of individual resistors? [**M-07,**M-10,O-11,**M-15**] [compulsory]

24. In the given network, calculate the effective resistance between A and B . [**M-07**,O-11] [compulsory]



25. Three resistors are connected in series with 10 V supply as shown in the fig. Find the voltage drop across each resistor. [**J-10**,J-12] [compulsory]



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3– EFFECTS OF ELECTRIC CURRENT

PUBLIC '3' MARK PROBLEMS:

1. Calculate the resistance of the filament of a 100 W, 220 V electric bulb [O-07]

2. A long straight wire carrying a current produces a magnetic induction of 4×10^{-6} T at a point 15 cm from the wire. Calculate the current through the wire. (J – 12)

3. A conductor of length 50 cm carrying a current of 5 A is placed perpendicular to a magnetic field of induction 2×10^{-3} T. find the force on the conductor. [O-13]

PUBLIC '5' MARK PROBLEMS:

4. A long straight wire carrying a current produces a magnetic induction of 4×10^{-6} T at appoint 15 cm from the wire. Calculate the current through the wire. [O-07]

5. A circular coil of 50 turns and radius 25 cm carries a current of 6A. It is suspended in a uniform magnetic field of induction 10^{-3} T. The normal to the plane of the coil makes an angle of 60^0 with the field. Calculate the torque of the coil.

6. A circular coil of radius 20 cm has 100 turns of wire and it carries a current of 5A. Find the magnetic induction at a point along its axis at a distance of 20 cm from the Centre of the coil. [M-06,O-06,**M-09,** J - 15] [compulsory]

7. A rectangular coil of 500 turns and of area 6×10^{-4} m^2 is suspended inside a radial magnetic field of induction 10^{-4} T by a suspension wire of torsional constant 5×10^{-10} Nm per degree. Calculate the current required to produce deflection of 10^0. **[**J-06,**O-09,M-13,O-15**] [compulsory]

8. A moving coil galvanometer of resistance 20 Ω produces full scale deflection for a current of 50 mA. How will you convert the galvanometer into i) an ammeter of range 20 A and ii) a voltmeter of range 120 volt? [M-07,**M-09**, J-13, M-15] [compulsory]

9. A galvanometer of resistance 40 Ω produces full scale deflection for a current of 2 mA. How will you convert the galvanometer into voltmeter of range 20 V? [O-10]

10. The deflection galvanometer falls from 50 divisions to 10 divisions when 12Ω resistance is connected across the galvanometer. Calculate the galvanometer resistance. [O-12]

11. Two parallel wires each of length 5 m are placed at a distance of 10 cm apart in air. They carry equal currents along the same direction and experience a mutually attractive force of 3.6×10^{-4} N. Find the current through the conductors. **[O-09,**J-10,**M-13**] [compulsory]

12. Two straight infinitely long parallel wires carrying equal current placed at a distance of 20 cm apart experience a mutually attractive force of 4.9×10^{-5} N per unit length of the wire. Calculate the current. [O-11]

13. In a hydrogen atom electron moves in an orbit of radius 0.5 A^0 making 10^{16} revolutions per second. Determine the magnetic moment associated with orbital motion of the electron. (Given : $e = 1.6 \times 10^{-19}$ C) [J-08]

14. A current of 4 A flows through 5 turns coil of a tangent galvanometer having a diameter of 30 cm. if the horizontal component of Earth's magnetic induction is 4×10^{-5}T. find the deflection produced in the coil. [given $\mu_0 = 4\pi \times 10^{-7}$ Hm^{-1}] [M-14]

15. A rectangular coil of area 20 cm × 10 cm with 100 turns of wire is suspended in a radial magnetic field of induction 5×10^{-3} T. If the galvanometer shows an angular deflection of 15^0 for a current of 1mA, find the torsional constant of the suspension wire.[J-14]

16. In a tangent galvanometer, a current of 1 A produces a deflection of 30°. Find the current required to produce a deflection 60°.(O-14)

17. A uniform magnetic field of induction 0.5 T acts perpendicular to the plane of the Dees of a cyclotron. Calculate the frequency of the oscillator to accelerate protons. (mass of proton $=1.67 \times 10^{-27}$ kg) (O-15) compulsory

Prepared by
Shanmugavelu.J M.Sc, B.Ed
[P.G Assist in Physics]
Lions Mat. Hr. Sec. School
Ph. No: 9952223467
Email : shaam.breeze@gmail.com

4.ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENT

PUBLIC '3' MARK PROBLEMS:

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

2. If the rate change of current of 2 As^{-1} induces an emf of 10 mV in a solenoid, what is self- inductance of the solenoid?

3. Calculate the mutual inductance between two coils when a current of 4 A changing to 8 A. in 0.5 s, in one coil, induces an emf of 50 mV in the other coil. [M-06,M-09, J - 15]

4. An air craft having a wingspan of 20.48 m flies due north at a speed of 40 ms^{-1}. If the vertical component of earth's magnetic field at the place is 2×10^{-5} T, calculate the induced emf between the ends of the wings. [J-06,M-08,J-10, O-10,M-11]

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

6. In an ideal transformer has transformation ration 1:20. If the input power and the primary voltage are 600 mW and 6 V respectively, find the primary and secondary currents. [O-08]

7. 11 kW power is transmitted at 22000 V through a wire of resistance 2 Ω. Calculate the power loss (J-14)

8. A solenoid of length 1 m and 0.05 m diameter has 500 turns. If a current of 2 A passes through the coil, calculate the co-efficient of self-induction of the coil. [M-13]

9. A coil of area of cross section 0.5 m^2 with 10 turns is in a plane perpendicular to a uniform magnetic field of 0.2 Wb/m^2. Calculate the flux through the coil. [M-07]

10. A capacitor of capacitance 2 μF is in an ac circuit of frequency 1000 Hz. If the rms value of the applied emf is 10 V, find the effective current flowing through the circuit. (J – 08,O-15)

11. A capacitor of capacitance 2 μF is in an ac circuit of frequency 1000 Hz. Find the capacitive reactance of the capacitor? (O-15)

12. Calculate the capacitive reactance of a capacitor of capacitance 2 μF in an Ac circuit of frequency 1000 Hz. .[J-09]

13. Write the equation of a 25 cycle current sine wave having rms value of 30 A. [O-11,M-12,J-13]

14. Magnetic field through a coil having 200 turns and cross sectional area 0.04 m^2 changes from 0.1 wbm^{-2} to 0.04 wbm^{-2} in 0.02 sec. find the induced emf.[M-14]

15. A train runs at a speed of 180 km/hr on a railway track with the two rails insulated from each other and the ground and connected to a millivoltmeter. If the vertical component of earth's magnetic field is 0.2×10^{-4} Wb/m^2 and the distance of separation between the rails is 1m. what would be the reading in the voltmeter ?(O-14)

16. An a.c generator consists of a coil of 10,000 turns and of area 100 cm^2. The coil rotates at an angular speed of 140 rpm in a uniform magnetic field of 3.6×10^{-2} T. Find the maximum value of the emf induced. [M - 15]

PUBLIC '5' MARK PROBLEMS:

17. An a.c generator consists of a coil of 10,000 turns and of area 100 cm^2. The coil rotates at an angular speed of 140 rpm in a uniform magnetic field of 3.6×10^{-2} T. Find the maximum value of the emf induced. [J-09]

Prepared by
Shanmugavelu.J M.Sc, B.Ed
[P.G Assist in Physics]
Lions Mat. Hr. Sec. School
Ph. No: 9952223467
Email : shaam.breeze@gmail.com

5.ELECTROMAGNETIC WAVES AND WAVE OPTICS

PUBLIC '3' MARK PROBLEMS:

1. An LC resonant circuit contains a capacitor 400 pF and an inductor100 μH. It is sent into oscillations coupled to an antenna. Calculate the wavelength of the radiated electromagnetic wave.[M-13]

2. In Young's experiment, the width of the fringes obtained with light of wavelength 6000 Å is 2 mm. Calculate the fringe width if the entire apparatus is immersed in a liquid of refractive index 1.33.[J-06,M-11, O-14]

3. A light of wavelength 6000 Å falls normally on a thin air film, 6 dark fringes are seen between two points. Calculate the thickness of the air film.[M-06, J – 08, J – 09, J – 11]

4. A light of wavelength 5890 Å falls normally on a thin air film, 6 dark fringes are seen between two points. Calculate the thickness of the air film. .[O-07]

5. Two slits 0.3 mm apart are illuminated by light of wavelength 4500 Å. The screen is placed at 1 m distance from the slits. Find the separation between the second bright fringe on both sides of the central maximum.[O-06,J-08,09,11]

6. In young's double slit experiment the distance between the slits is 1.99 mm. the distance between slit and screen is 1 m. If the band width is 0.35 mm, calculate the wave length of light used.[M-12]

7. In Newton's rings experiment the diameter of certain order of dark ring is measured to be double that of second ring. What is the order of the ring?[M-07,J-07, O – 11]

8. The refractive index of the medium is $\sqrt{3}$. Calculate the angle of refraction if the unpolarised light is incident on it at the polarising angle of the medium.[O-09,O-12]

9. A plano – convex lens of radius 3 m is placed on an optically flat glass plate and is illuminated by monochromatic light. The radius of the 8th dark ring is 3.6 mm. Calculate the wavelength of light used.[O-10,J-12,M-15]

10. A 300 mm long tube containing 60 cc of sugar solution produces a rotation of 9° when placed in a polarimeter. If the specific rotation is 60°, calculate the quantity of sugar contained in the solution.[M-06,09,J-13, J-15]

PUBLIC '5' MARK PROBLEMS:

11. A soap film of refractive index 1.33, is illuminated by white light incident at an angle 30°. The reflected light is examined by spectroscope in which dark band corresponding to the wavelength 5893Å is found. Calculate the smallest thickness of the film.**[O-07]** [Compulsory]

12. A soap film of refractive index 1.34, is illuminated by white light incident at an angle 30°. The reflected light is examined by spectroscope in which dark band corresponding to the wavelength 5893Å is found. Calculate the smallest thickness of the film.**[O-08]** [Compulsory]

13. A soap film of refractive index 1.33, is illuminated by white light incident at an angle 30°. The reflected light is examined by spectroscope in which dark band corresponding to the wavelength 6000Å is found. Calculate the smallest thickness of the film.[O-13]

14. A monochromatic light of wavelength 589 nm is incident on a water surface having refractive index 1.33. Find the velocity, frequency and wavelength of light in water.**[M-11]** [Compulsory]

15. A monochromatic light of wavelength 5893 Å is incident on a water surface having refractive index 1.33. Find the velocity, frequency and wavelength of light in water.**[O-08]** [Compulsory]

16. In Young's experiment a light of frequency 6×10^{14} Hz is used. Distance between the centres of adjacent fringes is 0.75 mm. Calculate the distance between the slits, if the screen is 1.5 m away.**[O-07,O-14 , J-15]** [Compulsory]

17. A parallel beam of monochromatic light is allowed to incident normally on a plane transmission grating having 5000 lines per centimetre. A second order spectral line is found to be diffracted at an angle 30°. Find the wavelength of the light.**[**M-08,**M-10**, **J-15]** [Compulsory]

18. In a Newton's rings experiment the diameter of the 20th dark ring was found to be 5.82 mm and that of the 10th ring 3.36 mm. If the radius of the plano-convex lens is 1 m. Calculate the wavelength of light used.**[M-10,**M-14,O-15**]** [Compulsory]

19. A plane transmission grating has 5000 lines/cm. Calculate the angular separation in second order spectrum of red line 7070 Å and blue line 5000 Å.[J-13]

20. A plano – convex lens of radius 3 m is placed on an optically flat glass plate and is illuminated by monochromatic light. The radius of the 8th dark ring is 3.6 mm. Calculate the wavelength of light used.**[M-11]** [Compulsory]

21. In Newton's rings experiment the diameter of certain order of dark ring is measured to be double that of second ring. What is the order of the ring?[J-14]

22. In Young's double slit experiment two coherent sources of intensity ratio of 64 : 1, produce interference fringes. Calculate the ratio of maximium and minimum intensities.(O-14)

Prepared by
Shanmugavelu.J M.Sc, B.Ed
[P.G Assist in Physics]
Lions Mat. Hr. Sec. School
Ph. No: 9952223467
Email : shaam.breeze@gmail.com

6.ATOMIC PHYSICS

PUBLIC '3' MARK PROBLEMS:

1. A beam of electrons moving with a uniform speed of 4×10^7 ms^{-1} is projected normal to the uniform magnetic field where $B = 1 \times 10^{-3}$ Wb/m^2. What is the path of the beam in magnetic field?[M-12]

2. The Rydberg constant for hydrogen is $1.097 \times 10^7 m^{-1}$. Calculate the short wavelength limits of Lyman series.[O-06,]

3. Calculate the short wave length limit of lymen series.($R=1.097 \times 10^7 ms^{-1}$)[O-09]
   Data : $R = 1.097 \times 10^7 m^{-1}$For short wavelength limit of Lyman Series, $n_1 = 1$, $n_2 = \infty$, $\lambda_s = ?$

4. The Rydberg constant for hydrogen atom is $1.097 \times 10^7 m^{-1}$. Calculate the long wavelength limits of Lyman series[M- 15]

5. Calculate the longest wavelength that can be analysed by a rock salt crystal of spacing d = 2.82Å in the first order.[J– 06,O – 08,M – 09, J -10, O–10, M-11,J– 12]

6. In Bragg's spectrometer, the glancing angle for first order spectrum was observed to be 8º. Calculate the crystal lattice spacing, if the wave length of the X – ray is 0.7849 Å

7. An X ray diffraction of a crystal gave the closest line at an angle of 6º27′. If the wavelength of X ray is 0.58Å, find the distance between the two cleavage planes.[M-06,O-13, O-14,O-15]

8. How much should be the voltage of an X ray tube so that the electrons emitted from the cathode may give an X ray of wavelength 1Å after striking the target.[J-07,M-13]

9. Find the minimum wavelength of X rays produced by an X ray tube at 1000kV.[M-10,J-13]

10. The minimum wave length of X-rays produced by a Coolidge tube is 0.05 nm. Find the operating voltage of Coolidge tube[J-11]

11. An electron beam passes through a transverse magnetic field of 2×10^{-3} tesla and an electric field E of 3.4×10^4 V/m acting simultaneously. If the path of the electrons remain undeviated, calculate the speed of electrons.?[M-14]

PUBLIC '5' MARK PROBLEMS:

12. An electron beam passes through a transverse magnetic field of 2×10^{-3} tesla and an electric field E of 3.4×10^{4} V/m acting simultaneously. If the path of the electrons remain undeviated, calculate the speed of electrons. If the electric field is removed, what will be the radius of the electron path?[O-10]

13. Wavelength of Balmer second line is 4861Å. Calculate the wavelength of first line.[M-07]

14. In Bragg's spectrometer, the glancing angle for first order spectrum was observed to be 8°. Calculate the wavelength of X-ray, if $d = 2.82 \times 10^{-10}$ m. At what angle will the second maximum occur?[J-07]

15. An α – particle is projected with an energy of 4 MeV directly towards a gold nucleus. Calculate the distance of its closest approach. Given : atomic number of gold = 79 and atomic number of α particle = 2.[M-08]

7.DUAL NATURE OF RADIATION AND MATTER RELATIVITY

PUBLIC '3' MARK PROBLEMS:

1. What is De broglie wavelength of an electron of kinetic energy 120 eV? [J-07,J-08,]

2. Calculate the threshold wave length of certain metal of work function 1.8 eV. [O-08]

3. Find de Broglie wavelength of electron in the fourth orbit of hydrogen atom. [J-11]

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

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

PUBLIC '5' MARK PROBLEMS:

6. What is De broglie wavelength of an electron of kinetic energy 120 eV? [S-12]

7. The work function of iron is 4.7 eV. Calculate the cut off frequency and the corresponding cut-off wave length for this metal? **[J-09**,M-12] [Compulsory]

8. How fast would a rocket have to go relative to an observer for its length to be corrected to 99% of its length at rest? **[M-12,** O-07,J-11,J-**14]** [Compulsory]

9. A metallic surface when illuminated by light of wavelength 3333 A^0 emits electrons with energies upto 0.6 eV. Calculate the work function of the metal. [O-09,J-12,M-13]

10. The time interval measured by an observer at rest is 2.5×10^{-8} s. What is the time interval measured by an observer moving with a velocity v = 0.73 C ? **[J-09]** [Compulsory]

11. A proton is moving at a speed of 0.900 time the velocity of light. Find its kinetic energy in joule and in MeV. [M-11]

12. The rest mass of an electron is 9.1×10^{-31} kg. What will be its mass if it moves with $4/5^{th}$ of the speed of light?**[J-14]** [Compulsory]

13. At what speed is a particle moving if the mass is equal to three times its rest mass.(O-14,J-15)

14. Calculate the de Broglie wave length of an electron, if the speed is 10^5 ms^{-1}. (Given $m = 9.1 \times 10^{-31}$ kg; $h = 6.626 \times 10^{-34}$ Js) (O-15)

8.NUCLEAR PHYSICS

PUBLIC '3' MARK PROBLEMS:

1. The half life of radon is 3.8 days. Calculate its mean life[M-07, O-09, J – 09, J-10]

2. The half-life of $_{84}Po^{218}$ is 3 minute. What percentage of the sample has decayed in 15 minutes?[O-07,J-13]

3. The radioactive isotope $_{84}Po^{214}$ undergoes a successive disintegration of two α–decays and two β-decays. Find the atomic number and mass number of the resulting isotope.[J-09,O-14,J-15]

4. Tritium has a half life of 12.5 years. What fraction of the sample of will be left over after 25 years?[M-10]

5. Tritium has a half life of 12.5 years. What fraction of the sample of will be left over after 50 years?[J-12,O-12]

6. What percentage of given radioactive substance will be left after 5 half life periods?[M-11]

7. Calculate the number of atoms in one gram of $_3Li^6$?(Avagadro number = 6.023×10^{23})[O-11]

PUBLIC '5' MARK PROBLEMS:

8. Calculate the binding energy and binding energy per nucleon of $_{20}Ca^{40}$ nucleus. Given, mass of 1 proton = 1.007825 amu ; mass of 1 neutron = 1.008665 amu ; mass of $_{20}Ca^{40}$ nucleus = 39.96259 amu

9. Find the energy released when two $_1H^2$ nuclei fuse together to form a single $_2He^4$ nucleus. Given, the binding energy per nucleon of $_1H^2$and $_2He^4$ are 1.1 MeV and 7.0 MeV respectively.**[J-06,O-12]** [Compulsory]

10. Calculate the energy released in the reaction $_{13}Al^{27} + {}_1H^2 \rightarrow {}_{12}Mg^{25} + {}_2He^4$. Given mass of $_{13}Al^{27}$ nucleus = 26.981535amu, mass of $_1H^2$ = 2.014102 amu, mass of $_{12}Mg^{25}$ =24.98584 amu, mass of $_2He^4$ =4.002604.**[O-12]** [Compulsory]

11. The binding energy per nucleon for $_6C^{12}$ nucleus is 7.68 MeV and that for $_6C^{13}$ is 7.47 MeV. Calculate the energy required to remove a neutron from $_6C^{13}$ nucleus.[M-09, M - 15]

12. Calculate the energy released in the following reaction. ${}_3Li^6 + {}_0n^1 \rightarrow {}_2He^4 + {}_1H^3$ Given mass of ${}_3Li^6$ nucleus = 6.015126 amu, Mass of ${}_1H^3$ nucleus = 3.016049 amu, Mass of ${}_2He^4$ nucleus = 4.002604 amu, Mass of ${}_0n^1$ = 1.008665 amu[O-11]

13. If the mass defect of the nucleus ${}_6C^{12}$ is 0.098 amu, then calculate the binding energy per nucleon.

14. The disintegration constant λ of a radioactive element is 0.00231 per day. Calculate its half life and mean life.[M-10]

15. Calculate the time required for 60% of a sample of radon to undergo decay. Given $T_{½}$ of radon = 3.8 days**[M-08,**M-13**]** [Compulsory]

16. A piece of bone from an archaeological site is found to give a count rate of 15 counts per minute. A similar sample of fresh bone gives a count rate of 19 counts per minute. Calculate the age of the specimen. Given : T½ = 5570 years **[M-06,**O-11,**M-14]** [Compulsory]

17. Show that the mass of radium (${}_{88}Ra^{226}$) with an activity of 1 curie is almost a gram. Given $T_{½}$ = 1600 years; 1 curie = 3.7×10^{10} disintegrations per second.**[**O-06,**M-08, M-**12**]** [Compulsory]

18. A reactor is developing energy at the rate of 32 MW. Calculate the required number of fissions per second of ${}_{92}U^{235}$. Assume that energy per fission is 200 MeV.**[J-06,J-08,**J-11,O-09,**M-14]** [Compulsory]

19. Calculate the energy released when 1 kg of ${}_{92}U^{235}$ undergoes nuclear fission. Assume, energy per fission is 200 MeV. Avagadro number = 6.023×10^{23}. Express your answer in kilowatt hour also.**[M-06,**J-08,**O-13]** [Compulsory]

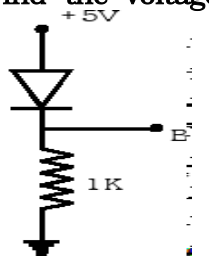
20. A carbon specimen found in a cave contained a fraction of 1/8 of C^{14} to that present in a living system. Calculate the approximate age of the specimen. Given $T_{1/2}$ for ${}_6C^{12}$ = 5560 years**[O-13]** [Compulsory]

21. Calculate the mass of coal required to produce the same energy as that produced by the fission of 1 kg of U^{235}.
Given ; heat of combustion of coal = 33.6×10^6 J/kg,
1 ton = 1000 kg. Energy per fission of U^{235} = 200 MeV. 1eV = 1.6×10^{-19} J.
Avagadro number N = 6.023×10^{23}. **[J-08]** [Compulsory]

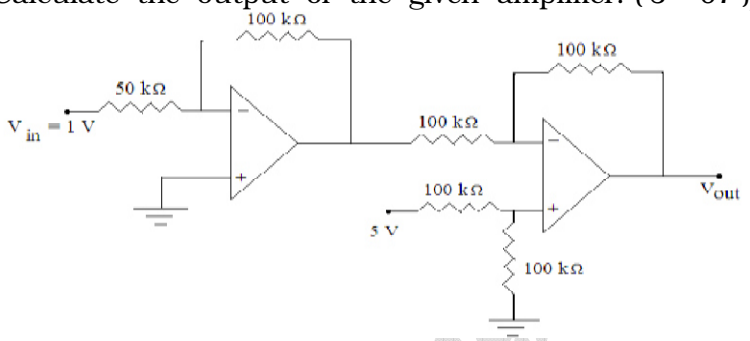
9.SEMICONDUCTOR DEVICES AND THEIR APPLICATIONS

PUBLIC '3' MARK PROBLEMS:

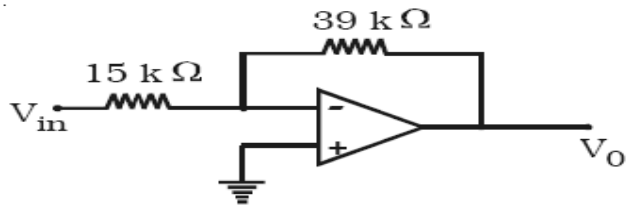
1. Find the voltage at the point B in the figure (Silicon diode is used).(J – 14)



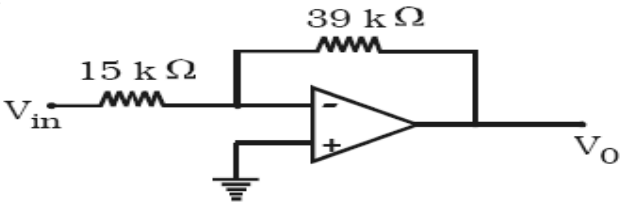
2. Calculate the output of the given amplifier. (J – 07)



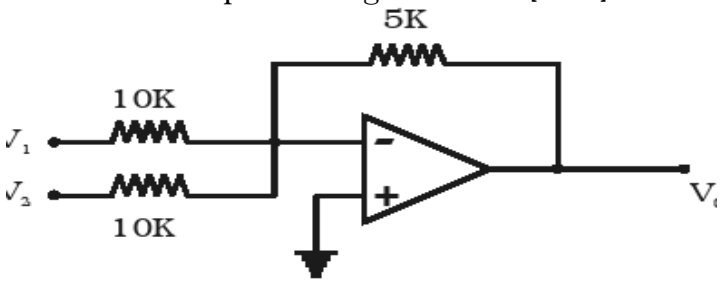
3. Find the output of the following ideal operational amplifier shown in the figure for input of V_{in} = 120 mV dc (J – 08,M-12,)



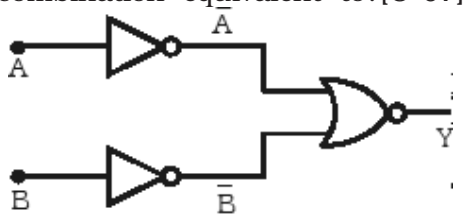
4. Find the output of the following ideal operational amplifier shown in the figure for input of V_{in} = -2.5 V dc [M- 15]



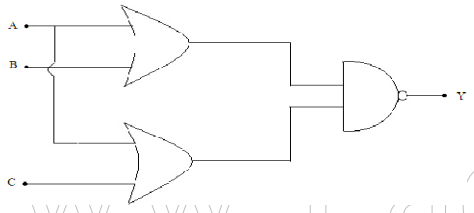
5. Find out the output of the given circuit[J-09]



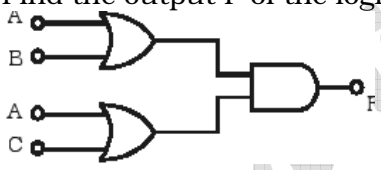
6. The output two NOT gates are NORed as shown in figure, What is this combination equivalent to?[O-07]



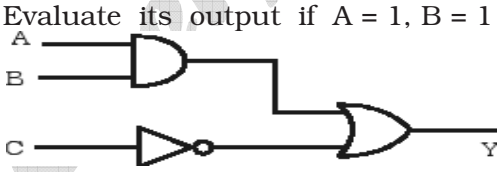
7. Find the output of the following logic circuit. (O – 08)



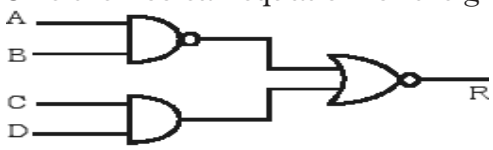
8. Find the output F of the logic circuit given below. [M-09, M-14]



9. What is the Boolean expression for the logic diagram shown in figure. Evaluate its output if A = 1, B = 1 and C = 1.[M-10]



10. Give the Boolean equation for the given logic diagram.[J-11]



11. The gain of the amplifier is 100. If 5% of the output voltage is fed back into the input through a negative feedback network. Find out the voltage gain after feedback. [M-07,O-11]

12. The gain of an amplifier without feedback is 100 and with positive feedback is 200, calculate the feedback fraction[M-06]

13. When the negative feedback is applied to an amplifier of gain 50,the gain after feedback falls to 25. Calculate the feedback ratio.]J-06,O-09,10,M-10, J-14]

14. The voltage gain of an amplifier without feedback is 100. If negative feedback is applied with feedback faction $\beta = 0.1$, calculate the voltage gain after fed back[O-06]

15. A transistor is connected in CE configuration. The voltage drop across the load resistance (R_C) 3 k is 6V. Find the base current. The current gain of the transistor is 0.97[M-08,J-10]

16. In common base transistor circuit Ic = 0.97 mA and I_B = 30 μA. Calculate the value of current gain(α). [J-13]

17. Collector current Ic=20 mA and base current I_B= 50 μA. Find current gain β of a Transistor. (J – 10)

18. The base current of the transistor is 50 μA and collector current is 25mA. Determine the values of β and α.[O-12,M-13,O-15]

19. The base current of transistor is 30 μA and collector current is 15 mA. Determine the value of current gain α (J-15)

20. Prove the Boolean equation **(A + B) (A + C) = A + BC** (M- 11,O-14)

21. Prove the following logic expression **($\bar{A}$+B) (A+B) = B** (O-13)

10.COMMUNICATION SYSTEMS

PUBLIC '5' MARK PROBLEMS:

1. A 10 MHz sinusoidal carrier wave of amplitude 10 mV is modulated by a 5 kHz sinusoidal audio signal wave of amplitude 6 mV. Find the frequency components of the resultant modulated wave and their amplitude.[M-11].

Prepared by
Shanmugavelu.J M.Sc, B.Ed
[P.G Assist in Physics]
Lions Mat. Hr. Sec. School
Ph. No: 9952223467
Email : shaam.breeze@gmail.com

Solution of this problems

Coming soon .....