UNIT 1 ELECTROSTATICS

1. Write two limitations of Coulomb's law.
2. What are the unit and dimensions of permittivity of free space?
3. Calculate the electrostatic force between two α- particles at a distance of 2x10-5m between them.
4. Why do electric field lines never cross each other?
5. Derive an expression for the electric field at a point on the equatorial line of an electric dipole.
6. Does an electric dipole always experience a torque, when placed in uniform electric field? Support your answer with reason.
7. How an electrostatic potential is related to the electric field at a point?
8. No work is done in moving a test charge over an equipotential surface. Why?
9. Derive an expression for the potential energy of an electric dipole in an external uniform electric field.
10. What is meant by 'electrostatic shielding'?
11. Derive an expression for the capacitance of a parallel plate capacitor? On what factors does the capacitance of a parallel plate capacitor depend?
12. Define dielectric constant in terms of the capacitance of a capacitor.
13. In a parallel plate capacitor, how is the capacity affected, when without changing the charge.

a. The distance between the plates is doubled.

b. Area of the plates is halved.

14. Derive an expression for the energy stored in a parallel plate capacitor with air as the core material of the capacitor.
15, Two point charges of charge values Q and q are placed at a distance of x and x/2 respectively from a third charge of charge value 4q, all charges being in the same straight line. Calculate the magnitude and nature of charge Q, such that the net force experienced by the charge q is zero.

16. If the electric field is given by 6i+3j+4k, calculate the electric flux through a surface of area 20 units lying in Y-Z plane.
17. Show graphically variation of electric field due to a charged conducting sphere with distance and briefly explain it.
18. Explain why the electric field inside a conductor placed in an external electric field is zero.
19. Two capacitors of capacitances 2μF and 2μF are connected first in series and then parallel. What is the ratio of their capacitances?

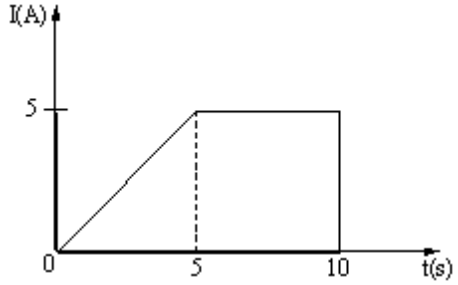
UNIT 2 CURRENT ELECTRICITY

1. What do you mean by relaxation time of free electrons in metals?

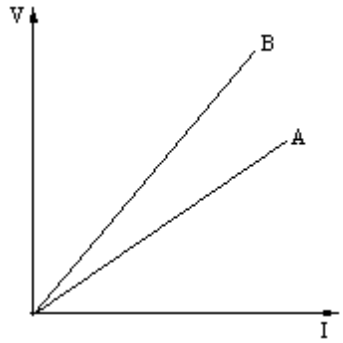
2. Bends in rubber pipe reduce the flow of water through it. How would the bends in a wire affect electrical resistance?

3. In an electric kettle, water boils in 20 minutes after the kettle is switched on. With the same supply voltage if the water is to boil in 10 minutes, should the length of the heating element be decreased or increased?

4. Show a plot of current I through the cross-section of a wire over a time interval of 10 s. Find the amount of charge that flows through the wire during this time period.

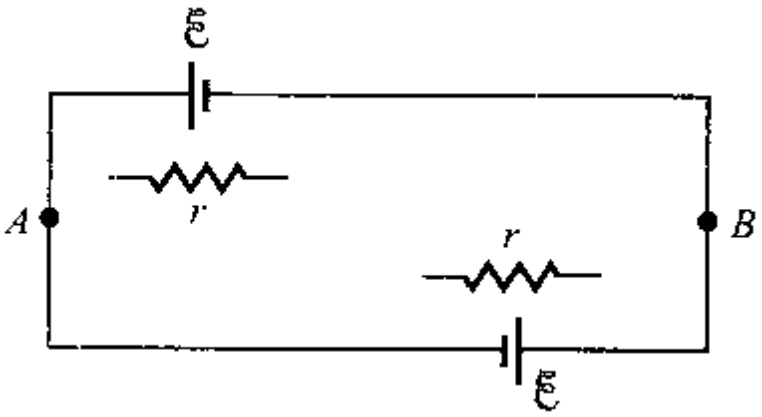


5. V – I graphs for parallel and series combination of two metallic resistors are shown in figure. Which graph represents parallel combination? Justify your answer.



6. A potential difference V is applied across a conductor of length L and diameter D. How are the electric field E and the resistance R of conductor affected when in turn (*i*) V is halved, (*ii*) L is halved and (*iii*) D is doubled? Justify your answer in each case.

7. Two identical storage batteries, each having emf and internal resistance *r*, are connected, as shown in Fig. 3. Determine the potential difference set up between the points *A* and *B*.



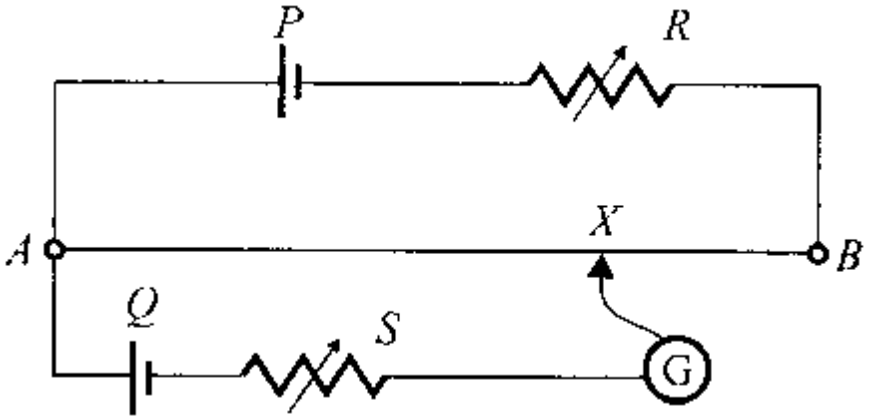
8. Describe with the help of circuit diagram how a potentiometer can be used to compare the e.m.f. of two cells.

9. Define resistivity and state its SI unit. State and explain how the resistivity of a conductor varies with temperature.

10. Two identical cells of emf 1.5 V each joined in parallel provide supply to an external circuit consisting of two resistances of 17 each joined in parallel. A very high resistance voltmeter reads the terminal voltage of cells to be 1.4 V. Calculate the internal resistance of each cell. Q Q11 A negligibly small current is passed through a wire of length 15 m and uniform cross-section 6.0 × 10−7 m2, and its resistance is measured to be 5.0 Ω. What is the resistivity of the material at the temperature of the experiment? Ω

11. (a) Three resistors 1 Ω, 2 Ω, and 3 Ω are combined in series. What is the total resistance of the combination? (b) If the combination is connected to a battery of emf 12 V and negligible internal resistance, obtain the potential drop across each resistor.

12. The variation of potential difference V with length *l* in case of two potentiometers X and Y is as shown in the given diagram. Which one of these two will you prefer for comparing emfs of two cells and why?
13 In the potentiometer circuit shown in fig. 9 the balance (null) point is at X.
State with reason, where the balance point will be shifted when
(i) Resistance *R is* increased, keeping all parameters unchanged.
(*ii*) Resistance S is increased, keeping *R* constant.
(iii) Cell *P is* replaced by another cell whose e.m.f. is lower than that of cell Q.



UNIT 3 MAGNETISM AND MAGNETIC EFFECT OF ELECTRIC CURRENT
Q1. A beam of electrons projected along +X axis, experiences a force due to a magnetic field along +Y axis. What is the direction of magnetic field?
Q2. Why should the spring/suspension wire in a moving coil galvanometer have low torsional constant?

Q3. For a Para magnetic material, plot the variation of intensity of magnetisation with temperature.

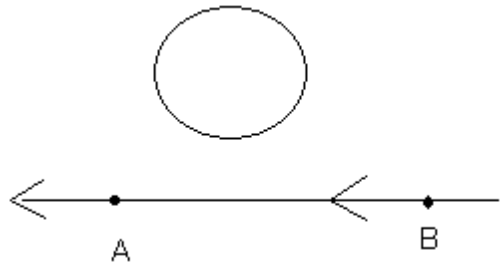
Q4. A particle with charge q moving with a velocity v moving in the plane of paper enters a uniform magnetic field B acting perpendicular to paper and pointing inwards. Why does the kinetic energy of the charge particle not change while moving in the field?
Q5. How will the magnetic field strength at the centre of the circular coil carrying current change, if the current through the coil is doubled and radius is halved?
Q6.Can moving coil galvanometer be used to detect an a.c. in a Circuit? Give reason.

Q7. Deduce an expression for the magnetic dipole moment of an electron orbiting around the central nucleus.
Q8. Using Ampere's circuital law, derive an expression for magnetic field along the axis of a current carrying toroidal solenoid of N number of turns having radius r.
Q9. Define the terms magnetic inclination and horizontal component of earth's magnetic field at a place. Establish the relation between them.
Q10. A galvanometer has a resistance of 30Ω. It gives full scale deflection with a current of 2 mA. Calculate the value of resistance needed to convert it into an ammeter of range 0-0.3A.
Q11. Derive an expression for magnetic field on the axial line of circular loop of radius 'a' and carrying current I at a distance x from the centre.
Q12. A rectangular coil of N turns and area of cross section A is placed in uniform magnetic field B with area vector making angle with B. Derive an expression for torque on the coil.
Q13. Draw a schematic sketch of a cyclotron. Explain briefly how it works and how it is used to accelerate the charged particle
i) Show that the time period of ions in a cyclotron is independent of both the speed and radius of circular path.
ii) What is resonance condition? How is it used to accelerate the charged particle?
Q14. Two straight long parallel conductors carry currents I1 and I2 in the same direction. Deduce an expression for the force per unit length between them.

Q15. a) With the help of a diagram, explain the principle and working a moving coil galvanometer.

b) What is the importance of radial magnetic field and how is it produced.
c) While using moving coil galvanometer as a voltmeter a high resistance in series is required whereas in an ammeter a shunt is used. Why?
Q16. Derive an expression for the magnetic field along the axis of air cored solenoid, using Ampere's circuital law. Sketch the magnetic field lines for a finite solenoid. Explain why the field at exterior is weak while at the interior it is uniform and strong.
Q17.A charged particle moving in a uniform magnetic field penetrates a layer of lead and thereby loses one half of its kinetic energy. How does the radius of curvature of its path change?
Q18. Why diamagnetism is almost independent of temperature?
Q19. Three identical specimens of magnetic materials nickel, antimony and aluminium are kept in a uniform magnetic field. Draw the modification of field lines in each case

UNIT 4 ELECTROMAGNETIC INDUCTION AND AC
Q1. The current in the direction from B-A is decreasing, what is the direction of induced current in the metallic loop kept above the wire?



Q2. How does the self inductance of an air core coil changes when –
(i) no. of lines in the coil is decreased

(ii) an iron rod is introduced in the coil

Q3. Why does the metallic piece become very hot when it is surrounded by a coil carrying high frequency ac?
Q4. Draw impedance triangle of LCR series circuit.
Q5. The magnetic flux linked with the coil at any instant t is given by . What is the emf induced in the coil at t = 5 sec? 100 80 6 3 t t
Q6. A sinusoidal emf E=200 sin 314t is applied to a resistor of 10 Ω resistance, calculate
(i) rms value of voltage

(ii) rms value of current

(iii) Power dissipated as heat in watt.
Q7.Why eddy currents are reduced in a laminated core?
Q8. Discuss the phenomenon of resonance in LCR series circuit. A capacitor of 15 Ω and 101.5mH inductor are placed in series with a 50 Hz AC source. Calculate the capacity of capacitor if the current is observed in phase with voltage.
Q9. Self inductance of an air core inductor increases from 0.01mH to 10 mH on introducing an iron core into it. What is the relative permeability of the core used?
Q10. When a.c. is fed to a moving coil galvanometer it shows no deflection. Why?

UNIT 5 E M WAVES

1. What oscillates in e.m. waves? Are these waves longitudinal or transverse?
2. What is the ratio of speed of gamma rays and radio waves in vacuum?
3. Why can light waves travel in vacuum, whereas sound waves cannot do so?
4. Which waves are used
(i) in mobile phones
(ii) in look through fog.
(iii) in radar
(iv) in geostationary satellites
(v) To study structure a properties of atoms and molecules.

5. Write two applications each of
(i) microwaves
(ii) infrared waves
(iii) radio waves
6. What role does ozone layer play for human survival?
7. A radio can tune into any station, the 7.5 MHz to 12MHz band. What is the corresponding wavelength band?

8. How does a charge q oscillating at certain frequency produce electromagnetic waves.

9. Which of the following can act as the source of e.m. waves?
(i) A charge moving with constant velocity

(ii) A charge moving in circular orbit

(iii) An accelerated charge

(iv) A charge at rest
10. Give reason for decrease or increase in velocity of light, when it moves from air to glass and glass to air respectively.

UNIT 6 OPTICS

Q.1 Two points A and B are situated at the same distance from the source of light, but in opposite direction from it. What is the phase difference between the light waves passing through A and B?

Q.2 The critical angle between a given transparent medium and air is denoted by ic, A ray of light in air enters this transparent medium at an angle of incidence equal to the polarizing angle(ip). Deduce a relation for the angle of refraction (rp) in terms of ic.

Q.3 What happens to the shining of diamond if it is dipped in a transparent oil?

Q.4 A lens whose radii of curvature are different is forming the image of an object placed on its axis. If the lens is placed with its faces reversed, will the position of the image change?

Q.5 What happens to focal length of a convex lens, when it is immersed in water?

Q.6 A glass prism is held in water. How is the angle of minimum deviation affected?

Q.7 You are provided with four lenses of focal length 1 cm, 3cm, 10cm and 100cm. Which two would you prefer for a microscope and which two for a telescope?

Q.8 Only the stars near the horizon twinkle while those overhead do not twinkle. Why?

Q.9 No interference pattern is detected when two coherent sources are infinitely close to each other. Why?

Q.10 Radio waves diffract pronouncedly around the buildings, while light waves, which are also e.m. waves do not, why?

Q.11 A light ray suffers minimum deviation, while passing through a prism of refractive index 1.5 and refracting angle 600. Calculate the angle of deviation and angle of incidence.

Q.12 In Young's double slit experiment = 500nm, d=1.0mm and D=1.0 metre. Find the minimum distance from the central maximum for which the intensity is half of the maximum intensity.

Q.13 The lower half of the concave mirror's reflecting surface is covered with an opaque non-reflecting material. How the image gets affected?

Q.14 Sun glasses (goggles) have curved surfaces, but they do not have any power. Why?

Q.15 What change in focal length do you expect if monochromatic light of orange colour is replaced by blue light?

Q.16 Far point of a myopic person is 60cm in front of the eye. What is the power of the lens required to enable him to see distant objects clearly.

Q.17 Velocity of light in a liquid is 0.9 x 108m/s. If a ray of light passes from liquid into the air calculate the value of critical angle.

Q.18 A convex lens of f = 20cm and n = 1.5 is immersed in water. What happens to the nature of the lens? Also calculate the new focal length.

Q.19 The bottom of a container is a 4.0 cm thick glass. (=1.5) slab. The container contains two immiscible liquids A and B of depths 6.0 cm and 8.0 cm respectively. What is the apparent position of a scratch on the outer surface of the bottom of the glass slab when viewed through the container? Refractive indices of A and B are 1.4 and 1.3 respectively.

Q.20 Give reasons for the following observations on the surface of the moon: (i) Sunrise and sunset are abrupt. (ii) Sky appears dark. (iii) A rainbow is never formed

UNIT 7 DUEL NATURE OF MATTER

1. What is a photon?

2. What is photoelectric effect?

3. What do you mean by work function of a photo metal?

4. What is threshold frequency?

5. Write down Einstein equation of photoelectric effect?

6. What are matter waves?

7. State laws of photoelectric effect?

8. Is photon a wave or a particle?

9. What is De-Broglie wavelength? Write down its relation?

10. Define one electron volt?

11. Draw the photoelectric current vs time graph.
12 Light of wave length 3500 A is incident on two metals A and B. Which metal yield photoelectric effect, if their work function are 4.2 e v and 1.9 e v respectively?

13 If the radiation of wave length 5000 A is incident on the surface of work function 1.2 eV, find the value of stopping potential?

14 Two metals A and B have work functions 2 eV and 4 eV respectively. Which metal has a lower threshold wave length for photoelectric effect?

15 Why are alkali metal metals most suited for photoelectric emission?

16 If the intensity of incident radiation on a metal surface is doubled, what happens to the kinetic energy of the electrons emitted?

17 Draw graph to show the variation of stopping potential with frequency of incident radiation . How will you find the value of planck's constant using this graph?

18 Derive a relation for De-Broglie wave length.

19 Which is the experiment which depicts the wave nature of electron? Explain it using a labelled diagram ?

20 Find the De-Broglie wave length associated with an electron having a kinetic energy of 54 eV?
21 Explain the laws of photoelectric effect on the basis of Einstein of Einstein equation of photoelectric effect?

22 . Name two phenomena which needs quantum theory for its explanation

23 Sodium and copper have work functions 2.3eV and 4.5eV respectively. Find the ratio of their wave length.

24 What is the approximate time taken by a photoelectron to come out after the photon strikes?

25 The maximum kinetic energy of photoelectrons emitted from a surface when photons of energy 6eV falls on it is 4 eV. What is the stopping potential in volt?

26 An electron, an α particle and a proton have the same kinetic energy. Which of these particles has the shortest, De Broglie wavelength?

27 A photon and an electron have got same De-Broglie wavelength. Which has greater kinetic energy? Explain

28 a) An X ray tube produces a continuous spectrum of radiation with its short wavelength end at 0.67A0. What is the maximum energy of a photon in the radiation? b) From your answer to (a), guess what order of accelerating voltage is required in such a tube?

29 The work function of a metal is 5.4 eV. a) Find the threshold frequency. b) Find the wavelength of the incident light if the photocurrent is brought to zero by a stopping potential 1.2V.

30. If the frequency of incident radiation on a photocell is doubled for the same intensity, what changes will you observe in (1) Kinetic energy of photo - electron emitted (2) Photoelectric current and (3) Stopping potential. Justify your answer

UNIT 8 **ATOMS AND NUCLEI**

Q.1 Why is neutron treated as effective bullet in nuclear reactions?
Q.2 What is the ratio of the nuclear densities of two nuclei having mass numbers in the ratio 1:4?
Q.3. How is a β-particle different from an electron?
Q4. Write the SI unit for the activity of a radioactive nuclide.
Q5. 'Heavy water is often used as a moderator in thermal nuclear reactors'- Give reason.
Q6. A nucleus of mass number A has a mass defect m. Give the formula for the B. E. per nucleon of this nucleus.
Q.7. Compare the radii of two nuclei with mass numbers 1 and 27.
Q8. Name two quantities which remain conserved during a nuclear reaction.
Q9. Name the most stable nucleus on the basis of the binding energy curve.
Q10. A radioactive substance has a half life of 30 days. What is the disintegration constant?
Q11. The decay constant for a given radioactive sample is 0.256 day-1. What is the percentage of the sample decayed in 4 days?
Q12. A 56kg sphere of U-235 constitutes a critical mass. If the sphere were flattened into a pancake shape, would it be still critical. Explain.
Q13. List two advantages of power production by nuclear fusion, over nuclear fission.
Q14. Why carbon is better than lead as a moderator in nuclear reactor?
Q15. Define atomic number and mass number. Distinguish between isotopes and isobars. Give examples.
Q16. Define the terms half life period and decay constant of a radioactive substance. Write their SI units & establish the relationship between the two.
Q17. Sketch a graph showing potential energy of a pair of nucleons as a function of their separation.

Q18. What are impact parameter and angle of scattering? How are the two related to each other?

Q19. Will the neutron to proton ratio increase or decrease for the nucleus of an element during i) beta decay ii) alpha decay.

Q20. In an - particle scattering experiment, the kinetic energy of the particle is reduced to half. What will be the change in the distance of closest approach. Support your answer with necessary formula.

UNIT 9 SEMICONDUCTERS

1. Distinguish b/w n-type and p-type of semiconductor with suitable energy band diagram

2. Draw characteristics of forward and reverse biased PN-Junction.

3. What do you mean by potential barrier?

4. Why NAND gate is called universal gate?

5. Discuss how the 'OR' gate is realized from the NOR gate.

6. How two-input ‘ AND’ gate can be converted into a ‘NAND’ gate?

7. In a common emitter circuit ,if VCE is changed by 0.2 V ,collector current changes by 0.004 mA .Calculate the output resistance.

8. What will happen if emitter as well as collector in a transistor are reversed biased?

9. Can a two p-n junction diode placed back to back work as p-n-p transistor

10. Explain the working of zener diode as a voltage regulator.

11. Explain the term dynamic resistance of a diode with the help of V-I graph for a diode.

12. What is the ratio of the negative charge to the positive charge in an n-type semiconductor ?

13. A photodiode is fabricated from a semiconductor with a band gap of 2.8eV. Can it detect a wavelength of 600nm? Justify

14. Write the truth table for the following logic circuit
A .NAND . B NOR

15. What values of A and B should be used for the expression (A+B) . (A . B) = 1 to be true.

16. The base current of a transistor is 105μA and the collector current is 2.05mA Determine α, β and Ie. If a change in Ib by 2.7μA produces a change of 0.65mA is Ic, determine βa.c.

UNIT 10 COMMUNICATION

1 What is height of antenna if transmission frequency is 1 MHz?

2 Show diagrammatically the amplitude modulation.

3 Define guided & unguided transmission medium.

4 What do you mean by maximum line of sight distance (dm)? Write its formula?

5 Why can moon be not used as a communication satellite?

6 A tower has height of 100m. How much population is covered by the T.V broadcast if the average population density around the tower is 1500 Km sq. (radius of the Earth 6400Km)

7 why is ground wave transmission of signal restricted to a frequency of 1500 KHz?

8 What is the significance of modulation index? An audio signal of amplitude one half the carrier amplitude is used in amplitude modulation. Calculate modulation index?

9 What type of modulation is needed for the commercial broadcast of voice signals?

10 Why is the transmission of signals through a coaxial cable not possible for frequencies greater than 20 MHz?

11 Why is short wave band used for long distance radio broadcast?

12 Name an appropriate communication channel needed to send a signal of bandwidth 100 kHz over distance of 8 km
13 Why is FM preferred over AM for transmission of music?
14 Why modulation is needed to transmit signals?
15 State two factors by which the range of the transmission of signals by a TV tower can be increased.
16 How do we make the choice of communication channel?
17 By what factor the height of antenna must be increased in order to double the coverage range? Given radius of earth equal to 6400 km.
18 Which of the following frequencies will be suitable for beyond-the horizon communication using sky waves?
(a) 10 kHz (b) 10 MHz (c) 1 GHz (d) 1000 GHz
19. Name the type of communication system according to the mode of communication.
20. Name the device which can represent digital data by analog signals and vice versa.