GURU GOBIND SINGH PUBLIC SCHOOL

SECTOR – V/B, BOKARO STEEL CITY

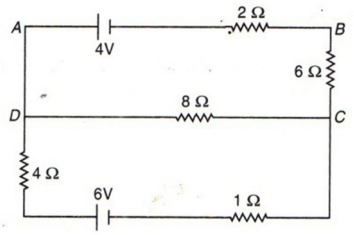
Class XII **Sub : Physics Assignment**

Chapter 01 (Electrostatics)

1. What is a dielectric? Why does the capacitance of a parallel plate capacitor increase on introduction of a dielectric in between its two plates? Derive an expression for the capacitance of such a capacitor having two identical plates each of area A and separated by distance x. The space between the plates has a medium of dielectric constant k.
2. Derive an expression for the energy stored in a parallel plates capacitor with air is a the medium between its plates.
   Air is now replaced by a dielectric medium of dielectric constant k. How does it change the total energy of the capacitor is
   (i) the capacitor remains connected to the same battery?
   (ii) The capacitor is disconnected from the battery?
3. Define the term electric field intensity. Write its SI unit. Derive an expression for the electric field intensity at a point on the(i) axis and (ii) equator of an electric dipole.
4. State Gauss' theorem in electrostatics. Use it to obtain an expression for the electric field intensity at a point near a uniformly charged infinite plate sheet.
5. A dielectric slab of thickness $'t'$ is kept in between the plates, each of area $'A'$, of a parallel plate capacitor separated by a distance $'d'$. Derive an expression for the capacitance of this capacitor for $t<<d$.
6. (a) Explain briefly how a capacitor stores energy on charging. Obtain an expression for the energy thus stored.
   (b) A battery of 10 V is connected to a capacitor of 0.1 F. The battery is now removed and the capacitor is then connected to a second uncharged capacitor of same capacitance. Calculate the total energy stored in the system.

Chapter 02 (Current Electricity)

7. State Kirchhoff's laws of an electrical network. Using Kirchhoff's laws, calculate the potential difference across the 8 ohm resistor.

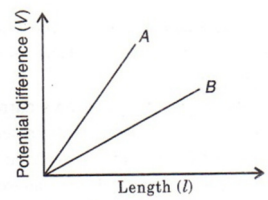


8. State the working principle of a potentiometer. Explain, with the help of a circuit diagram, how the emf of two primary cells are compared by using a potentiometer.
   In a potentiometer arrangement, a cell of emf 1.20 volt gives a balance point at 30 cm length of the wire. This cell is now replaced by another cell if unknown emf. If the ratio of the emfs of the two cell is 1.5, calculate the difference in the balancing length of the potentiometer wire in the two cases.
9. Deduce the condition for balance in a Wheatstone bridge. Using the principle of Wheatstone bridge, describe the method to determine the specific resistance of a wire in the laboratory. Draw the circuit diagram and write the formula used.

Write any two important precautions you would observe while performing the experiment.

10. State Kirchhoff's laws for an electrical network. Using Kirchhoff's laws, find the relation between the resistances for four arms of a Wheatstone bridge when the bridge is balanced. Draw a circuit diagram to determine the unknown resistance of a metallic conductor using a meter bridge.

11. The variation of potential difference with length in case of two potentiometers A and B is shown in the figure. Which of the two is preferred to find e.m.f. of a cell? Give reason for your answer. With the help of a circuit diagram, describe how e.m.f.s of two primary cells can be compared by using a potentiometer. Write two possible causes of potentiometer giving only one sided deflection in this method.

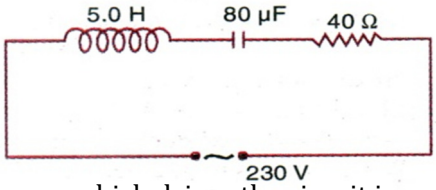


Chapter 03 (Magnetic Effects of Current & Magnetism)

12. A) Define coercivity and retentivity. How are soft iron and steel distinguished on the basis of these quantities? Sketch hyteresis loops for soft iron and steel and explain the differences.
    B)A short bar magnet is placed in magnetic meridian with its north pointing to south. Its magnetic moment is 2 Am^2. Neutral point is obtained at 10 cm from centre of magnet. Calculate horizontal component of earth's magnetic field.
13. Derive an expression for the potential energy of a dipole placed in a uniform magnetic field at angle θ with is. State and prove tangent law in magnetism.
14. Compare Dia, Para and Ferromagnetic materials on the basis of any six properties of these materials.
15. State Biot –Savart's law and show it mathematically. Find the magnetic field due to two infinitely long current carrying conductor carrying current I_1& I_2 separated with length 2r carrying current in opposite directions at left from wire 1 at r in the middle between the wires and in the right at r from wire 2.
16. Find the magnetic field due to a solenoid having length L ,number of turns N carrying current 4A. Also show the magnetic field at the centre and the sides of the solenoid.

Chapter 04 (Electromagnetic Induction & Alternating Current)

17. The given circuit diagram show a series LCR circular connected to a variable frequency 230 V source.

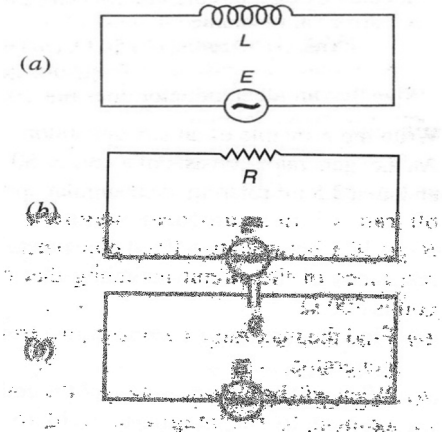


(i). Determine the source frequency which drives the circuit in resonance.
(ii). Obtain the impedance of the circu8it and the amplitude of current tat the resonating frequency.
(iii). Determine the rms potential drops across the three elements of the circuit.
(iv). How do you explain the observation that the algebraic sum of the voltages across the three elements obtained in (iii) is greater than the supplied voltage?

18. With the help of a neat labelled diagram, explain the principle, construction and working of an a.c. generator. Also derive the mathematical formula of emf and alternating current.
19. Explain, with the help of a neat and labelled diagram, the principle, construction and working of a transformer.Also discuss losses in transformer, how these loses can be minimized?
20. What is induced emf? Write Faraday's law of electromagnetic induction. Express it mathematically. A conducting rod of length $'l'$, with one end pivoted, is rotated with a uniform angular speed $'\omega'$ in a vertical plane, normal to a uniform magnetic field $'B'$. Deduce an expression for the emf induced in this rod.

In India, domestic power supply is at 220 V, 50 Hz, while in USA it is 110V, 50 Hz. Give one advantage and one disadvantage of 220 V supply over 110V supply.

21. Figure (a), (b) and (c) show three a.c. circuits in which equal currents are flowing. If the frequency of emf be increased, how will the current be affected in these circuits? Give reason for your answer.



An a.c. circuit consists of a series combination of circuit elements $'X'$and $'Y'$. The current is ahead of the voltage in phase by $\pi/4$. If element $'X'$ is a pure resistor of 100 Ω, (i) name the circuit element $'Y'$ and (ii) calculate the rms value of current, if rms value of voltage is 141 V.

Chapter 05 (Electromagnetic Waves)

22. When can a charge act as a source of electromagnetic waves? How are the directions, of the electric and magnetic field vectors, in an electromagnetic wave, related to each other and to the direction of propagation of the wave? Which physical quantity, if any, has the same value for waves belonging to the different parts of the electromagnetic spectrum?
23. Which constituent radiation of the electromagnetic spectrum is used
    (i) in radar,
    (ii) to photograph internal parts of a human body,
    (iii) for taking photograph of the sky during night and foggy conditions?
    (iv) to kill germs & bacteria of food & water.
    (v) night photography,
    (vi) Hot-Spot Communication .
    Give one reason for your answer in each case.
24. (i) Derive an expression for the maximum distance up to which signals transmitted by a T.V. tower can reach.(ii) Derive the expression for maximum range up to experiment set up to produce electromagnetic waves. Explain its principle.

Chapter 06 (Optics (Ray optics & Wave optics))

25. Derive the expression for the refractive index of the material of the of the prism in terms of the angle of the prism and angle of minimum deviation. Use this formula to calculate the angel of minimum deviation for an equilateral triangular prism of refractive index $\sqrt{3}$.
26. Draw a labeled ray diagram of an astronomical telescope for the near point adjustment. You are given three lenses of powers 0.5 D, 4 D, 10 D. State with reason, which two lenses will you select for constructing a good astronomical telescope. Calculate the resolving power of t his telescope, assuming the diameter of the objective lens to be 6 cm and the wavelength of light used to be 540 nm.
27. (i) Draw a labeled ray diagram of a compound microscope, showing the formation of image at the near point of the eye.
    (ii) A compound microscope uses an objective lens of focal length 4 cm and eye lens of focal length 10 cm. An object is placed at 6 cm from the objective lens.
    (a) Calculate magnifying power of the compound microscope, if the final image is formed at the near point.
    (b) Calculate the length of the compound microscope also.

28. Show by a diagram the image formation of a point by a thin double convex lens having radii of curvature R_1 and R_2. Hence derive the formula $\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$, where f is the focal length and is refractive index of material of the lens.
29. What is interference of light? Write two essential conditions for sustained interference pattern to be produced on the screen.
    Draw a graph showing the variation of intensity versus the position on the screen in Young's experiment when (a) both the slits are opened and (b) one of the slits is closed.
    What is the effect on the interference pattern in Young's double slit experiment when :
    (i) screen is moved closer to the plane of slits?
    (ii) Separation between two slits is increased.
    Explain your answer in each case.
30. What is diffraction of light? Draw a graph showing the variation of intensity with angle in a single slit diffraction experiment. Write one feature which distinguishes the observed pattern from the double slit interference pattern. How would the diffraction pattern of a single slit be affected when :
    (i) the width of the slit is decreased?
    (ii) the monochromatic source of light is replaced by a source of white light?
31. What are coherent sources of light? State two conditions for two light sources to be coherent.
    Derive a mathematical expression for the width of interference fringes obtained in Young's double slit experiment with the help of a suitable diagram.

Chapter 07 (Dual Nature : Matter & Radiation)

32. Derive the expression for the de-Broglie wavelength of an electron moving under a potential difference of V volt.Describe Davisson the Germeer experiment ot establish the wave nature of electron. Draw a labeled diagram of the apparatus used.
33. Red light, however bright, cannot cause emission of electrons from a clean zinc surface. But even weak ultraviolet radiations can do so. Why?
    Draw the variation of maximum kinetic energy of emitted electrons with the frequency of incident radiation on a photosensitive surface. On the graph drawn, what do the following indicate (i) slop of the graph and (ii) intercept on energy axis?
34. Explain the term : 'stopping potential' and 'threshold frequency' in photoelectric emission. Draw a graph showing the variation of stopping potential with frequency of incident light in relation to photoelectric effect. Deduce an expression for the slope of this graph using Einstein's photoelectric equation.
35. Define the term "
    (a)(i) Work function, (ii) threshold frequency and (ii) stopping potential, with reference to photoelectric effect.
    (b) Calculate the maximum kinetic energy of electrons emitted from a photosensitive surface of work function 3.2 eV, for the incident radiation of wavelength 300 nm.

Chapter 08 (Atoms& Nuclei)

36. Explain how radioactive nuclei can emit β-particles even though atomic nuclei do not contain these particles. Hence explain why the mass number of a radioactive nuclide does not change during β-decay. Use the basic law of radioactive decay, to show that radioactive nuclei follow an exponential decay law. Hence obtain a formula, for the half-life of a radioactive nuclide, in terms of its disintegration constant.
37. Draw a labeled diagram for α-particle scattering experiment. Give Rutherford's observation and discuss the significance of this experiment. Obtain the expression which helps us to get an idea of the size of a nucleus, using these observations.

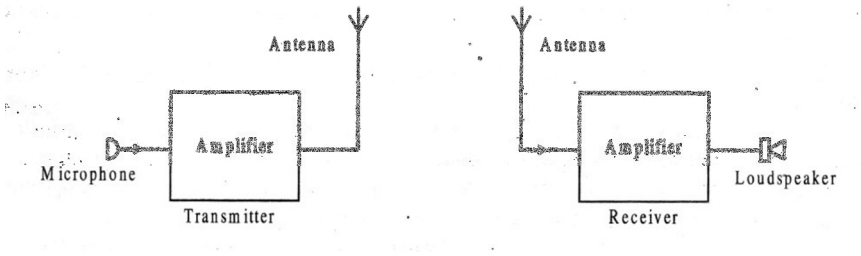
38. Draw the graph to show variation of binding energy per nucleon with mass number of different nuclei. Calculate binding energy per nucleon of $^{40}_{20}Ca$ nucleus.
Given : mass of $^{40}_{20}Ca$ = 39.962589 u
mass of proton = 1.007825 u
mass of neutron = 1.008665 u
1 atomic mass of unit (1 u) = 931 MeV
39. Explain what is meant by radioactive decay. A radioactive nucleus is represented by the symbol V. How is the new nucleus represented after the emission of -
(i) an alpha particle,
(ii) a beta particle and
(iii) a gamma ray? The activity of a source undergoing a single type of decay is I_0 at time t = 0. Obtain an expression in terms of the half-life $T_{1/2}$ for the activity I at any subsequent time t.

Chapter 09 (Semiconductor & Devices)

40. Explain the formation of energy band in solids and hence define conduction band and valence band.
41. Explain the use of a p-n junction diode as a rectifier. Draw the circuit diagram of a full wave rectifier and explain its working. Draw the input and output wave forms.
42. Distinguish between intrinsic and extrinsic semiconductors. Explain the formation of potential barrier nad depletion region in a p-n junciton.
43. What is Zener Diode? Draw the circuit diagram for its working.
44. Draw a labeled circuit diagram of common-emitter amplifier using a n-p-n transistor. Write the expression for its voltage gain. Explain why the input and the output signals are out of phase.
45. Define Logic gates? Why Logic gates are used? What are the different types of logic gates, draw symbol and Truth Table of each gates?

Chapter 10 (Communications)

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



Give two drawbacks from which this arrangement suffers.
Describe briefly with the help of a block diagram the alternative arrangement for the transmission and reception of the message signal.
47. (i) What is an analog signal? Explain the terms bandwidth and baseband.
(ii) What is a discrete signal? Explain briefly how an analog signal can be converted into an digital single. Enumerate some of the advantages of digital communications.
48. (i) What is amplitude modulation? Discuss its advantages and disadvantages.
(ii) What is meant by pulse-code modulation? What are its advantages over amplitude modulation?
(iii) What is an antenna? What roles does it play in communication system? What should be the length of a dipole antenna?
49. What is mobile communication ? Differentiate between mobile and cellular communications. Describe the system of 1G, 2G, 3G and 4G mobile communication system.
50. Define the following terms:
(i) Modem (ii) Fax Machine
(iii) Transmitter (iv) Receiver

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