

question,answer

what are electric charges and fields,"This chapter introduces electrostatics, the study of stationary electric charges. Key concepts include the properties of electric charge, Coulomb's law (which quantifies the force between two charges), and the concept of an electric field as a region of influence around a charge."

what is electrostatic potential and capacitance,"Electrostatic potential is the work done to move a unit positive charge from infinity to a point in an electric field. Capacitance is the ability of a system (a capacitor) to store electrical energy in an electric field."

what is current electricity,"This chapter deals with the flow of electric charges (electric current). Key concepts include Ohm's law ($V=IR$), electrical resistance, resistivity, Kirchhoff's laws for analyzing circuits, and electrical power."

what are moving charges and magnetism,"A moving charge produces a magnetic field. This chapter explores the magnetic force on a moving charge (Lorentz force), the motion of charges in magnetic fields, and the magnetic field produced by a current-carrying wire (Biot-Savart law and Ampere's circuital law)."

what is magnetism and matter,"This chapter explores the magnetic properties of materials. It classifies materials as diamagnetic, paramagnetic, or ferromagnetic based on their response to an external magnetic field. It also discusses Earth's magnetic field."

what is electromagnetic induction,"Electromagnetic induction is the production of an electromotive force (EMF) or voltage across an electrical conductor in a changing magnetic field. This principle, discovered by Faraday, is the basis for electric generators and transformers."

what is alternating current,"Alternating current (AC) is an electric current that periodically reverses direction. This chapter analyzes AC circuits containing resistors, inductors, and capacitors, and introduces concepts like impedance, resonance, and AC generators."

what are electromagnetic waves,"Electromagnetic (EM) waves are waves composed of oscillating electric and magnetic fields that propagate through space. They do not require a medium and travel at the speed of light. The electromagnetic spectrum includes radio waves, microwaves, visible light, and X-rays."

what is ray optics and optical instruments,"Ray optics, or geometric optics, treats light as rays that travel in straight lines. It explains reflection (by mirrors) and refraction (by lenses). It's used to understand the working of optical instruments like telescopes and microscopes."

what is wave optics,"Wave optics treats light as a wave and is used to explain phenomena that ray optics cannot, such as interference (as in Young's double-slit experiment), diffraction (the bending of waves around obstacles), and polarization."

what is the dual nature of radiation and matter,"This concept proposes that light and matter exhibit both wave-like and particle-like properties. Light can behave as a particle (photon), as seen in the photoelectric effect, and particles like electrons can behave as waves (de Broglie waves)."

what are atoms,"This chapter explores the structure of the atom, focusing on models like Rutherford's and Bohr's model. Bohr's model successfully explained the spectral lines of the hydrogen atom by postulating quantized energy levels for electrons."

what are nuclei,"This topic deals with the atomic nucleus, its composition (protons and neutrons), size, and properties. It covers radioactivity (the spontaneous decay of unstable nuclei), nuclear fission (splitting of a heavy nucleus), and nuclear fusion (combining of light nuclei), all of which release enormous energy."

what is semiconductor electronics,"Semiconductors are materials with conductivity between that of a conductor and an insulator (e.g., silicon, germanium). This chapter covers semiconductor physics, p-n junction diodes, transistors, and their applications in building electronic circuits like rectifiers and amplifiers, forming the basis of modern electronics."