

Time: 20 Minutes

Max. Marks: 17

SECTION "A" (MULTIPLE CHOICE QUESTION)

- Choose the correct answer for each from the given options:
 - The number of electrons in one coulomb is:
 6.1×10^{20} * 6.1×10^{18} * 6.25×10^{18} * 1.6×10^{19}
 - This device converts electrical energy into mechanical energy:
 generator * transformer * electric motor * transistor
 - This force is experienced by a current-carrying conductor placed in a uniform magnetic field:
 $\vec{F} = I(\vec{l} \times \vec{B})$ * $\vec{F} = I(\vec{V} \times \vec{B})$
 $\vec{F} = I(\vec{V} \times \vec{B})$ * $\vec{F} = I(\vec{E} \times \vec{B})$
 - Stefan Boltzmann's law is:
 $E = \sigma T$ * $E = \sigma T^2$ * $E = \sigma T^3$ * $E = \sigma T^4$
 - The rest mass of a photon is:
 1 * -1 * zero * infinite
 - Balmer series of Hydrogen atom spectrum lies in the:
 radiowave region * infrared region
visible region * ultraviolet region
 - When a nucleus emits a Beta particle, its atomic number:
increases * decreases * remains the same
 sometime increases, sometime decreases
 - This device is used to make the path of ionizing particles visible:
 Geiger Muller counter * Wilson cloud chamber
 Van Dee Graff Generator * Cyclotron
 - In treating localized cancerous tumour, a narrow beam of this is used:
 α - rays from Cobalt - 60 * β - rays from Cobalt - 60
 γ - rays from Cobalt - 60 * laser from Cobalt - 60
 - In an isothermal expansion, the Entropy of the system:
Increases * Decreases
 Becomes zero * Remains constant
 - This is a highly ionizing particle:
 α * β * γ * Proton
 - If separation between the plates and the area of plates of a parallel plates capacitor are doubled, then the capacity will:
 become fourfold * become One-fourth
 become double * remain the same
 - A temperature of 50°C is equal to:
 105°F * 60°F * 122°F * 120°F
 - The electrical energy dissipated as heat in a resistor is:
 V^2R * V^2Rt * I^2Rt * I^2R
 - A device consisting of ammeter, voltmeter and ohmmeter is called:
 Potentiometer * Multimeter * CRO * VTVM
 - These are Donor impurities:
 Li and Ga * Ge and Si * Sb and As * In and Ga
 - Laser is produced due to the:
stimulated emission of radiation
 stimulated absorption of radiation
 spontaneous emission of radiation
 spontaneous absorption of radiation

PHYSICS

2016

Time: 2 Hours 40 Minutes

Marks: 68

SECTION 'B' (SHORT-ANSWER QUESTIONS)(40)

NOTE: Answer any 10 questions from this section.

- The high temperature reservoir of a Carnot engine is at 200°C and has an efficiency of 35%. To increase the efficiency to 45% by how many degrees should the temperature of cold reservoir be decreased if the temperature of the high temperature reservoir remains constant?
- Define Thermal Expansion. Prove the $\alpha = \frac{1}{3}\beta$.
- Prove that $\frac{1\text{Volt}}{\text{metre}} = \frac{1\text{Newton}}{\text{coulomb}}$, name the physical quantity
- Find the resistance at 100°C of a Silver wire, 1 mm in diameter and 1000 cm long.
- An iron core solenoid with 600 turns has a cross section area of 2.0 cm^2 . A current of 4.0 ampere passing through it produces $B = 0.4\text{ weber/m}^2$. What emf is produced in it, if the current is turned off in 0.2 second? What is its self-inductance?
- Sodium surface is shone with light of wavelength $3 \times 10^{-7}\text{ m}$. Find the kinetic energy of the emitted photo electrons and the cutoff wavelength of Sodium. Work function of Sodium is 2.46 eV.
- Find the shortest and the longest wavelength of emitted photons in Hydrogen spectra in Pfund series.
- The number of atoms per gram of $^{226}_{88}\text{Ra}$ is 2.666×10^{21} and it decays with a half life of 1622 years. Find the activity and decay constant of the sample.
- An α -particle of charge $3.2 \times 10^{-19}\text{C}$ and mass $6.68 \times 10^{-27}\text{ kg}$ is held motionless between two horizontal parallel plates separated by 10 cm. Find the potential difference between the plates.
- How is a galvanometer converted into voltmeter? Give the related mathematical expression.
- A proton of charge $1.6 \times 10^{-19}\text{ C}$ and mass $1.67 \times 10^{-27}\text{ kg}$ is accelerated by a potential difference of $6 \times 10^5\text{ volts}$. Then it enters perpendicularly into a magnetic field of intensity 0.5 Tesla. Find the radius of the circular path of the proton.
- How does the temperature affect the resistance of a conductor? Derive an expression for the resistance of the conductor at $t^\circ\text{C}$.
- Describe the function of a PN-Junction as a halfwave rectifier.
- Find the binding energy and the packing fraction in MeV of $^{126}_{52}\text{Te}$ given that $m_p = 1.0078\text{u}$, $m_n = 1.0086\text{u}$, $m_{\text{Te}} = 125.9033\text{u}$ and $1\text{u} = 931.5\text{ MeV}$.
- Derive the expression for the equivalent capacitance when 3 capacitors are connected in series or in parallel.

SECTION 'C' (DETAILED- ANSWER QUESTIONS)

NOTE: Answer 2 questions from this section. (28)

- State Gauss's Law. Derive an expression for the electric field intensity at a point close to infinitely large sheet, having uniform positive charge distribution.
 - What is Compton effect? Derive an expression for the Compton shift in the wavelength.
- What is a Transformer? Write its types with the help of a clear diagram, give its construction and working and derive the relevant expression.
 - Using Bohr's atomic theory, derive expressions for the following:
 - The energy of an electron in the n th orbit of hydrogen atom. Given: $r_n = \frac{h^2 n^2}{Kme^2}$.
 - The wavelength of photons emitted in the hydrogen spectrum.
- State Faraday's laws of Electromagnetic induction. Explain Mutual induction and derive an expression for mutual inductance.
 - Describe Carnot cycle and derive an expression for the efficiency of Carnot heat engine. **OR** Give the construction and working of Geiger Muller Counter.