25PY101 (S2): Engineering Physics

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Test 2: CGS to SI Conversion

Name:_____ Total marks: 20

Registration No.:_____

Instructions:
1. Each blank carries 1 mark.
2. Report measured quantities in scientific notation.
3. Extra marks for reporting in engineering notation.

Conversion factors

1. $1\,\mathrm{cm}^3 =$ _____ m^3
2. $1\,\mathrm{cm}^2/(\mathrm{V{\cdot}s}) =$ _____ $\mathrm{m}^2/(\mathrm{V{\cdot}s)}$
3. $1\,\mathrm{cm}^{-3} =$ _____ m^{-3}
4. $1\,\mathrm{V/cm} =$ _____ $\mathrm{V/m}$
5. $1\,\mathrm{A/cm}^2 =$ _____ $\mathrm{A/m}^2$
6. $1\,\mathrm{S/cm} =$ _____ $\mathrm{S/m}$
7. $1\,\Omega \cdot \mathrm{cm} =$ _____ $\Omega \cdot \mathrm{m}$
8. $1\,\mu\Omega \cdot \mathrm{cm} =$ _____ $\Omega \cdot \mathrm{m}$
9. $1\,\mathrm{F/cm} =$ _____ $\mathrm{F/m}$
10. $1\,\mathrm{fs} =$ _____ s

Measured quantities

1. A cube of side 2.5 cm has a volume of 15.6 cm^3.
   In SI units, the volume is _____ m^3.

2. The electron mobility in GaAs is 8500 $\mathrm{cm}^2/\mathrm{V{\cdot}s}$.
   In SI units, $\mu =$ _____ $\mathrm{m}^2/\mathrm{V{\cdot}s}$.

3. A doped silicon sample has carrier concentration $4.8 \times 10^{16}\,\mathrm{cm}^{-3}$.
   In SI units, $n =$ _____ m^{-3}.

4. Doping concentration is 1 ppm. The atomic density is $5 \times 10^{22}\,\mathrm{cm}^{-3}$. In SI units, the doping concentration is _____ m^{-3}.

5. The breakdown field in air is approximately 30 kV/cm.
   In SI units, $E =$ _____ V/m.

6. A current density of 25 $\mathrm{A/cm}^2$ flows through a contact.
   In SI units, $J =$ _____ $\mathrm{A/m}^2$.

7. A semiconductor has conductivity $3.5 \times 10^{-3}\,\mathrm{S/cm}$.
   In SI units, $\sigma =$ _____ S/m.

8. The resistivity of copper is $1.68 \times 10^{-6}\,\Omega \cdot \mathrm{cm}$.
   In SI units, $\rho =$ _____ $\Omega\,\mathrm{m}$.

9. The resistivity of tungsten is $8.55\,\mu\Omega \cdot \mathrm{cm}$.
   In SI units, $\rho =$ _____ $\Omega\,\mathrm{m}$.

10. A coaxial cable has capacitance $2.1 \times 10^{-11}\,\mathrm{F/cm}$.
    In SI units, $C' =$ _____ F/m.

Hints (Geometrical / Scaling Analogies)

- Volume scales as (length)^3: multiply by 10^{-6}.
- Mobility scales as area: multiply by 10^{-4}.
- Carrier concentration is per volume: multiply by 10^6.
- Electric field is volts per length: multiply by 10^2.
- Current density is per area: multiply by 10^4.
- Conductivity $= J/E \Rightarrow 10^4/10^2 = 10^2$.
- Resistivity $= 1/\sigma \Rightarrow 10^{-2}$.
- Micro–ohm·cm adds 10^{-6}: multiply by 10^{-8}.
- Capacitance per length (area/length): multiply by 10^2.
- milli $\rightarrow$ micro $\rightarrow$ nano $\rightarrow$ femto.

End of Test