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C2 Charge Carriers

Data: Magnitude of the charge on an electron = 1.60×10^{-19} C

Free electron density of copper [Cu] = 10^{29} m⁻³

Free electron density of germanium [Ge] = 10^{20} m⁻³

- C2.1 How many electrons are needed to carry a charge of -6.00 C?
- C2.2 How many electrons flow past a point each second in a 5.0 mA electron beam?
- C2.3 Alpha particles have twice the charge of an electron. What is the current caused by a radioactive source which emits 3000 alpha particles per second?
- C2.4 An electron gun emits 3.0×10^{21} electrons in two minutes. What is the beam current?
- C2.5 Assume all wires have a circular cross section. Calculate the values to complete the gaps in the table:

Diameter /mm	Cross sectional area /mm ²	Material	Current /A	Drift velocity /m s ⁻¹
	2.5	Copper	13	(a)
	0.75	Copper	6.0	(b)
1.0		Copper	(c)	0.0050
	(d)	Copper	2.0	0.20
(e)		Germanium	2.0	0.20

- C2.6 In an experiment, a current of 3.5 A is being passed through a copper sulphate solution in a 10 cm cubical container, with the electrical terminals being opposite faces. This contains equal numbers of Cu²⁺ and SO₄²⁻ ions which have respectively +2 and -2 electron charge units. Assuming that the two ions have equal speed in the solution, and that there are 6.0×10^{26} of each per cubic metre of the solution, work out their mean speed.