REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) Calculate the time constant for charging the capacitor in the circuit shown.

\[ \tau = RC = \left( \frac{1}{R_{1} + R_{c}} \right) \cdot \tau \]

\[ = \frac{100 \times 200}{100 + 200} \cdot 300 \times 10^{-12} = 2 \times 10^{-8} \text{ (s)} \]

(b) Calculate the magnitude of the magnetic field, in Tesla, at the exact center of a circular loop of wire carrying a current of 14.5 A. The diameter of the loop is 17.0 cm.

\[ B = \frac{1}{2\pi} \frac{I}{\rho} = \frac{1.26 \times 10^{-6} \times 14.5}{2 \times 3.14 \times 17 \times 10^{-2}} = 1.08 \times 10^{-4} \text{ (T)} \]

(c) Assume the earth's magnetic field is exactly 1.00 gauss. Calculate the radius of the orbit of an electron moving perpendicular to this field at a velocity of \(2.1 \times 10^6\) m/s.

\[ \frac{m_0 v^2}{\epsilon_0 B} \Rightarrow R = \frac{mv}{\epsilon_0 B} = \frac{8.11 \times 10^{-31} \times 2.1 \times 10^{14}}{1.6 \times 10^{-19} \times 10^{-6}} = 0.121 \text{ m} \]

(d) Two parallel wires carry a DC current of 55.0 amperes. If the wires are 4.00 m apart, calculate the magnitude of the force on each meter of wire.

\[ \frac{F}{I} = \frac{1.26 \times 10^{-6} \times (14.5)^2}{2 \times 3.14 \times 4} = 1.52 \times 10^{-4} \]

(e) Calculate the capacitance of a parallel plate capacitor if the plates are circular with diameter 17.0 cm. The plates are 0.25 mm apart (in air).

\[ C = \frac{\epsilon_0 \cdot \pi \cdot d}{d} = 8.85 \times 10^{-12} \times \left( \frac{17 \times 10^{-2}}{2.5 \times 10^{-6}} \right)^2 = 8.02 \times 10^{-6} \text{ (F)} \]