Electricity and Magnetism study handout 4

Covering sections 5.4 - 6.4

Revisits learning outcomes 3, 8, 14, 17 and 18

Covers learning outcomes 20 - 25

Non-assessed questions

1. What is the purpose of placing a dielectric material between the plates of a capacitor?

2. What would the dielectric constant of an ideal conductor be?

3. If water has such a high dielectric constant why is it used infrequently in capacitors?

4. Is the dielectric constant of a material likely to increase or decrease with temperature?

5. A dielectric slab of thickness t is inserted between the plate of a parallel plate capacitor where $d > t$. Find an expression for the capacitance.

6. Estimate the electrostatic energy density of air when it is at its breakdown field strength

7. Find an expression for the energy density inside a dielectric

8. Would the displacement current be higher or lower if a capacitor is charged with a dielectric present?

9. How often do materials actually obey Ohm's law

10. How does drift velocity vary with wire diameter?

11. A silver wire $2.6\ \text{mm}$ in diameter transfers a charge of $420\ \text{C}$ in $80\ \text{minutes}$. Silver contains 5.8×10^{28} free electrons per cubic metre. What is the current in the wire, the current density in the wire and the drift velocity of electrons in the wire?

Electromagnetism discussion problem 4, 26th February - 2nd March, the continuity equation

(Put on here to save paper.)

Section 6.2 looks at a flow of charge. Considering a flow of mass instead, in the form of, say, the flowing of a river, follow the working of the section to derive the continuity equation for mass.

E&M MCQs 2 for completion by Wednesday 28th February:

Mainly capacitance

1. A parallel plate capacitor is charged by a battery. The battery is then disconnected and the plates of the capacitor are moved apart to double their original separation. The potential difference between the plates:

a) Falls to zero
b) Falls, but not to zero
c) Stays the same
d) Increases to some finite value
e) Becomes infinite? **(2.5 marks)**

2. A parallel plate capacitor is charged by a battery. The battery remains connected and the plates of the capacitor are moved apart to double their original separation. The potential difference between the plates

a) Falls to zero
b) Falls, but not to zero
c) Stays the same
d) Increases to some finite value
e) Becomes infinite? **(2.5 marks)**

3. For question (1) does the energy stored in the capacitor:

a) Fall to zero
b) Fall, but not to zero
c) Stay the same
d) Increase to some finite value
e) Become infinite? **(2.5 marks)**

4. For question (2) does the energy stored in the capacitor:

a) Fall to zero
b) Fall, but not to zero
c) Stay the same
d) Increase to some finite value
e) Become infinite? **(2.5 marks)**