St John Baptist De La Salle Catholic School, Addis Ababa Homework 6 2nd Quarter

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Notes, and use of other aids is allowed. Read all directions carefully and write your answers in the space provided. To receive full credit, you must show all of your work. Cheating or indications of cheating and similar answers will be punished accordingly.

Information

- The homework is due on Thursday, January 5th.
- You should Work on it **individually** and consult me if you have any questions. As I have reiterated multiple times, cheating will have a serious consequence.
- For purposes of neatness and simplicity of grading, you should do the homework on an A-4 paper.

Questions

- 1. A parallel-plate capacitor has a capacitance of 20μ F. If the separation between the plates of the capacitor is 20mm, and the plates are squares of side length 3cm. If the plates store a charge of 20μ C, what is the potential difference across the plates of the capacitor. Find the energy stored in the capacitor.
- 2. What is a dielectric and what role does it play in capacitors? Why does the presence of dielectric materials increase the capacitance of capacitors?
- 3. Calculate the work done by a 1.5V battery as it charges a 35nF capacitor in the flash unit of a camera.
- 4. Teflon has a dielectric constant of 2.1. If Teflon was placed between the plates of the capacitor in question 1, find
 - Teflon's permissivity
 - The capacitance of the capacitor with teflon as a dielctric.

Additional Challenge Problems

As usual, the following problems are not required to be submitted, but I highly suggest you work on them

- 5. Show, mathematically that the capacitance of a parallel plate capacitor of area A and plate separation distance d has a capacitance of $C = \epsilon_0 \frac{A}{d}$. In addition, show that when a dielectric with a constant of κ is added between the plates, show that the capacitance changes to $C = \kappa \epsilon_0 \frac{A}{d}$
- 6. Consider a region in space where a uniform electric field of E = 1000 N/C points in the positive X direction. Answer the following questions:
 - What is the orientation of the equipotential surfaces?
 - If you move in the negative X direction, does electric potential decrease or increase?
 - What is the distance between the +20 V and +10 V potentials?