

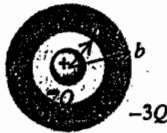
Exam IA
Physics 208

Name _____

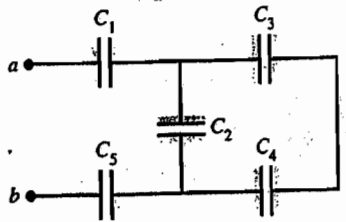
February 14, 2008

- 1.a. A negative charge $-0.500 \mu\text{C}$ exerts an attractive force with a magnitude of 0.600 N on an unknown charge 0.500 m away. What is the unknown charge (magnitude and sign)?
- b. A point charge $q = 6.0 \text{ nC}$ is at the center of a cube with sides of length 0.200 m . What is the electric flux through one of the six faces of the cube?
- c. A point charge has a charge of $6.00 \times 10^{-11} \text{ C}$. At what distance from the point charge is the electric potential 50.0 V ? Take the potential to be zero at an infinite distance from the charge.
- d. A parallel-plate air capacitor has a capacitance of 500 pF and a charge of magnitude $0.450 \mu\text{C}$ on each plate. The plates are 0.550 mm apart. What is the potential difference between the plates?
2. Two stationary point charges $+4.50 \text{ nC}$ and -1.20 nC are separated by a distance of 6.00 cm . An electron is released from rest between the two charges, 1.00 cm from the negative charge, and moves along the line connecting the two charges. What is its speed when it is 1.00 cm from the positive charge?

3. A conducting spherical shell with inner radius a and outer radius b has a negative point charge $-Q$ located at its center. The total charge on the shell is $-3Q$, and it is insulated from its surroundings (see figure). Using Gauss's law, derive expressions for the electric field magnitude in terms of the distance r from the center for the regions a) $r < a$, b) $a < r < b$, c) $r > b$.



- d. What is the surface charge density on the outer surface of the conducting shell?
- e. What is the potential at a distance r from the point charge if $r < a$?
- 4.a. In the figure below, $C_1 = C_3 = 6.2 \mu\text{F}$, and $C_2 = C_5 = C_4 = 5.0 \mu\text{F}$. The applied potential is $V_{ab} = 540 \text{ V}$. What is the equivalent capacitance of the network between points a and b ?



- b. Calculate the charge on each capacitor and the potential difference across each capacitor.