Honors Physics Electrostatics HW, part 2 (Homework)

1.
A proton moves 3.0 cm parallel to a uniform electric field of E = 220 N/C.
(a) How much work is done on the proton by the field?
(b) What change occurs in the potential energy of the proton?
(c) What potential difference did the proton move through?

2.
A potential difference of 88 mV exists between the inner and outer surfaces of the membrane of a cell. The inner surface is negative relative to the outer surface. How much work is required to eject a positive sodium ion (Na^+) from the interior of the cell?

3.
The difference in potential between the accelerating plates of a T.V. set is about 20000 V. If the distance between these plates is 1.5 cm, find the magnitude of the uniform electric field in this region.

4.
A pair of oppositely charged, parallel plates are separated by 5.39 mm. A potential difference of 600 V exists between the plates.
(a) What is the magnitude of the electric field strength between the plates?
(b) What is the magnitude of the force on an electron between the plates?
(c) How much work must be done on the electron to move it to the negative plate if it is initially positioned 2.95 mm from the positive plate?

5.
An electron moves from one plate to another across which there is a potential difference of 2400 V.
(a) Find the speed with which the electron strikes the positive plate.
(b) Repeat part (a) for a proton moving from the positive to the negative plate.

6.
(a) Find the potential 3.00 cm from a proton.
(b) What is the potential difference between two points that are 3.00 cm and 6.00 cm from a proton?

7.
Calculate the speed of
(a) an electron that has a kinetic energy of 500 eV and
(b) a proton that has a kinetic energy of 500 eV.

8.

In Rutherford's famous scattering experiments that led to the planetary model of the atom, alpha particles (having charges of $+2e$ and masses of 6.6×10^{-27} kg) were fired toward a fixed gold nucleus with charge $+79e$. An alpha particle, initially very far from the gold nucleus, is fired at 1.7×10^{7} m/s directly toward the gold nucleus, as in Figure P16.19. How close does the alpha particle get to the gold nucleus before turning around?

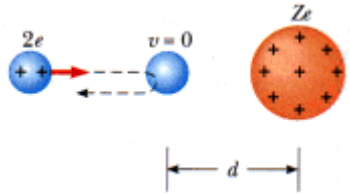

Figure P16.19.

9.
The potential difference between a pair of oppositely charged parallel plates is 437 V.
(a) If the spacing between the plates is doubled without altering the charge on the plates, what is the new potential difference between the plates?
(b) If the plate spacing is doubled while the potential difference between the plates is kept constant, what is the ratio of the final charge on one of the plates to the original charge?

10.
The plates of a parallel-plate capacitor are separated by 0.110 mm. If the material between the plates is air, what plate area is required to provide a capacitance of 3.00 pF?

11.
A series circuit consists of a 0.048 μF capacitor, a 0.080 μF capacitor, and a 380 V battery. Find the charge
(a) on each of the capacitors;
(b) on each of the capacitors if they are reconnected in parallel across the battery.

12.
Three capacitors, C_1 = 3.00 μF, C_2 = 5.00 μF, and C_3 = 9.00 μF, are connected together.
(a) Find the effective capacitance of the group if they are all in parallel.
(b) Find the effective capacitance of the group if they are all in series.

13.

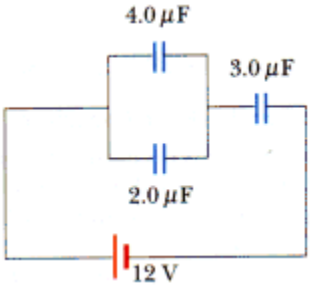

Figure P16.29.

(a) Find the equivalent capacitance of the group of capacitors in Figure P16.29.
(b) Find the charge on and the potential difference across each.

Charges
Potential Differences