

PHY 167, SPRING 2020, TEST 1 (Practice)

(3 points maximum for each problem, 15 points maximum for the whole)

1. Electric charges  $Q_1 = Q$ ,  $Q_2 = 2Q$ , and  $Q_3 = 3Q$  are placed at  $\mathbf{r}_1 = (1,0,0)a$ ,  $\mathbf{r}_2 = (0,1,0)a$ , and  $\mathbf{r}_3 = (0,0,1)a$ . Find the electric field  $\mathbf{E}$  at  $\mathbf{r} = (1,1,1)a$ .

2. Four charged particles are placed at the corners of a square of side  $L$ . The charges are the following:  $Q$  (left top),  $-2Q$  (right top),  $-2Q$  (left bottom),  $Q$  (right bottom),  $Q > 0$ . Calculate the forces acting on each charge. Indicate the direction of these forces.

3. In the Millikan experiment, an oil droplet of mass  $m$  is levitating under the influence of the compensating gravity and electrical forces. If the electric field is created by the voltage  $V$  over the distance  $d$ , what is the charge  $q$  of the particle?

4. A capacitor consists of two metallic plates of rectangular form with the sides  $a$  and  $b$ , and they are placed at the distance  $d$  from each other. The voltage on the capacitor is  $V$ . What is the charge  $Q$  on the capacitor?

5. What current is drawn from the household circuit by a 1000 W hairdryer? What is the resistance of the hairdryer? (Analytical answer is necessary!)