

Physics 202 MWF10:20 Spring 2008 (Ford) Name (printed) _____

Name (signature as on ID) _____ Lab Section _____

Exam I Chaps. 17-18 in Young&Geller 8e

Multiple choice questions. Circle the correct answer. No work need be shown and no partial credit will be given.

(5 pts) 1. A small object with negative charge is in a region of uniform electric field. The force that the electric field exerts on the object is in the $+x$ direction. What is the direction of the electric field?

- b (a) $+x$
(b) $-x$
(c) $+y$
(d) $-y$

(5 pts) 2. There is a uniform electric field in the $+x$ direction. Point a is at $x = 0.20$ m and point b is at the origin. Which statement about the potentials V_a and V_b at these two points is correct?

- a (a) $V_a < V_b$
(b) $V_a > V_b$
(c) $V_a = V_b$

(5 pts) 3. A small object with negative net charge moves from point a to point b . The potential at a is greater than the potential at b . That is, $V_a > V_b$. During the motion the only force acting on the object is the electric force. Which statement about the kinetic energy K_a of the object at a and the kinetic energy K_b at b is correct?

- b (a) $K_a = K_b$
(b) $K_a > K_b$
(c) $K_a < K_b$

(5 pts) 4. A parallel-plate capacitor with air between the plates is connected to a battery and the charge on the plates is Q . A dielectric is then inserted between the plates, while the battery remains connected to the plates. After the dielectric has been inserted, the charge on the plates is

- (a) less than Q
(b) Q
c (c) greater than Q

(5 pts) 5. A parallel-plate capacitor has charge Q on its plates. If the separation between the plates is increased, while the charge Q on the plates stays the same, the energy stored in the capacitor

- a
- (a) increases
 - (b) stays the same
 - (c) decreases

(5 pts) 6. A solid conducting sphere of radius R carries net positive charge q . If the electric potential at the surface of the sphere is 250 V, then the electric potential at the center of the sphere is

- b
- (a) zero
 - (b) 250 V
 - (c) 500 V
 - (d) infinite

(5 pts) 7. A hollow conducting sphere has inner radius a and outer radius b . The hollow sphere has net charge $+5q$, where q is a positive constant. A point charge $+2q$ is placed at the center of the hollow sphere, at $r = 0$. The total charge on the outer surface of the hollow sphere is

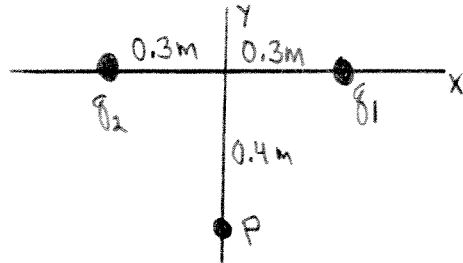
- e
- (a) zero
 - (b) $+2q$
 - (c) $+3q$
 - (d) $+5q$
 - (e) $+7q$
 - (f) $-2q$
 - (g) none of the above answers

(5 pts) 8. Two identical capacitors each have capacitance C . If the two capacitors are connected in series, the equivalent capacitance of the combination is

- a
- (a) less than C
 - (b) C
 - (c) greater than C

On the following problems show all your work. Partial credit will be given if earned. Write your answers in the blanks provided.

(20 pts) 9. Point charge $q_1 = -8.0 \times 10^{-9}$ C is on the $+x$ axis at $x = 0.30$ m. Point charge $q_2 = +5.0 \times 10^{-9}$ C is on the $-x$ axis at $x = -0.30$ m. Point P is on the $-y$ axis at $y = -0.40$ m.



a) What are the x and y components of the field produced by q_1 at point P ? (Be sure to indicate the sign of each component.)

$$\text{Ans. } x \quad \underline{+173 \text{ N/C}}$$
$$y \quad \underline{+230 \text{ N/C}}$$

b) What are the x and y components of the field produced by q_2 at point P ? (Be sure to indicate the sign of each component.)

$$\text{Ans. } x \quad \underline{+108 \text{ N/C}}$$
$$y \quad \underline{-144 \text{ N/C}}$$

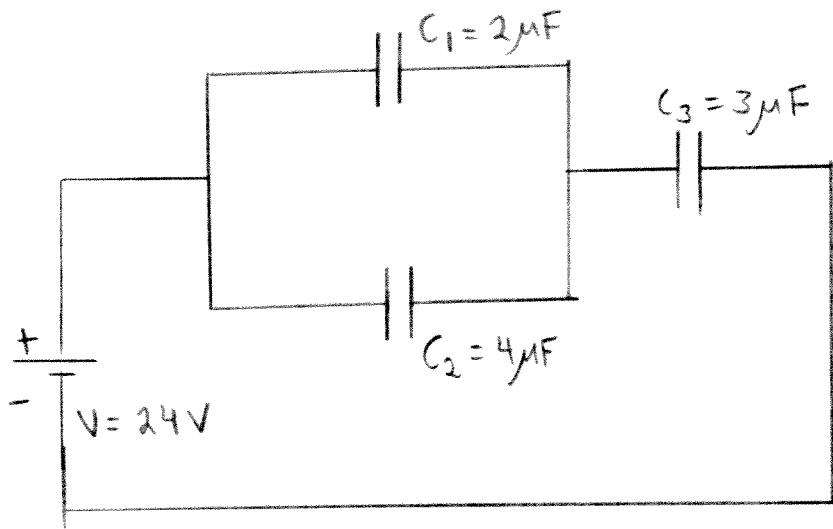
c) What is the magnitude of the total electric field at point P that is produced by these two point charges?

$$\text{Ans. } \underline{294 \text{ N/C}}$$

(20 pts) 10. A small plastic sphere with charge $q_1 = -4.0 \times 10^{-6}$ C and mass 5.0×10^{-3} kg is projected toward a point charge $q_2 = +6.0 \times 10^{-4}$ C. The small sphere has an initial speed of 2.0×10^2 m/s and initially is a large distance from q_2 . q_2 is held in place and doesn't move. What is the speed of the small plastic sphere when it is 0.200 m from q_2 ?

Ans. 288 m/s

(20 pts) 11. The capacitor network shown in the sketch is connected to a 24 V battery. Calculate the charge Q and potential difference V for each capacitor.



Ans. Q_1 16 μC
 Q_2 32 μC
 Q_3 48 μC
 V_1 8 V
 V_2 8 V
 V_3 16 V