

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?

- (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)  $V_a < V_b$
- (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?

- (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) 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) 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

- (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

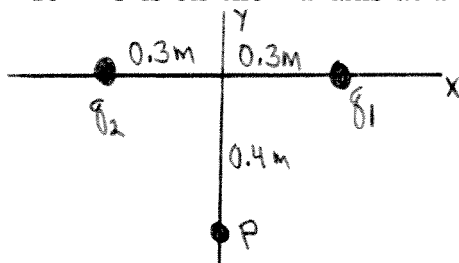
- (a) zero
- (b)  $+2q$
- (c)  $+3q$
- (d)  $+5q$
- (e)  $+7q$
- (f)  $-2q$
- (g) none of the above answers

(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) 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.)

Ans.  $x$  \_\_\_\_\_

$y$  \_\_\_\_\_

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.)

Ans.  $x$  \_\_\_\_\_

$y$  \_\_\_\_\_

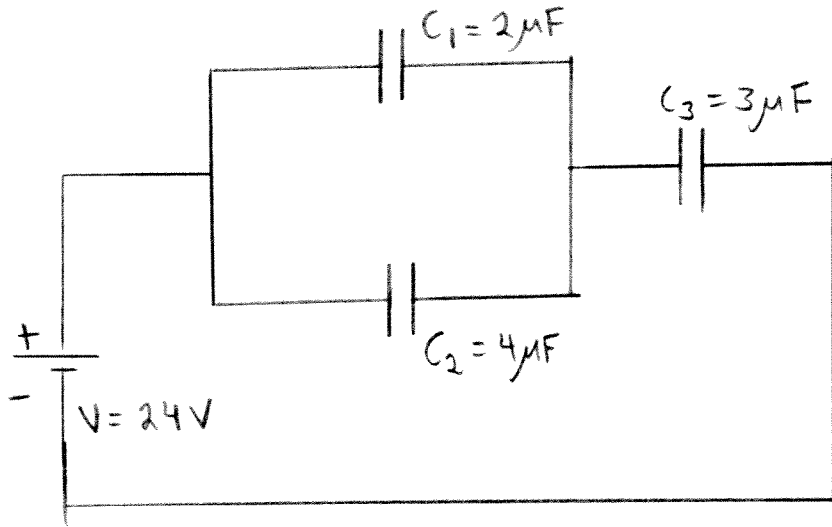
c) What is the magnitude of the total electric field at point  $P$  that is produced by these two point charges?

Ans. \_\_\_\_\_

(20 pts) 10. A small plastic sphere with charge  $q_1 = -4.0 \times 10^{-6}$  C and mass  $5.0 \times 10^{-3}$  kg is projected toward a point charge  $q_2 = +6.0 \times 10^{-4}$  C. The small sphere has an initial speed of  $2.0 \times 10^2$  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. \_\_\_\_\_

(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.  $Q_1$  \_\_\_\_\_

$Q_2$  \_\_\_\_\_

$Q_3$  \_\_\_\_\_

$V_1$  \_\_\_\_\_

$V_2$  \_\_\_\_\_

$V_3$  \_\_\_\_\_