

Colorado State University - Department of Physics

PH142 - Spring 2010

Midterm 1

Tuesday February 16, 2010, 5:00 p.m. - 6:50 p.m.

Name _____
(Please print clearly)

VERSION:

CSU Student ID # _____

Instructions:

- o When directed to do so, you must fill in your version letter for this test in the box on the bubble sheet, but wait to open your exam.
- o There are 12 multiple-choice questions. Attempt all problems. There is no penalty for wrong answers.
- o Allowed with you to take the exam: calculator; **one** sheet of paper with your notes, and as many blank sheets of paper as you want.
- o Not allowed: cell phones, PDA's, laptops, headphones, MP3 players, iPods or similar devices, and wireless devices of any kind.
- o Leave backpacks at front (or back) of the room.

Please read each problem carefully before starting to work.

DO NOT OPEN THIS EXAM UNTIL DIRECTED TO DO SO.

Good luck!

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

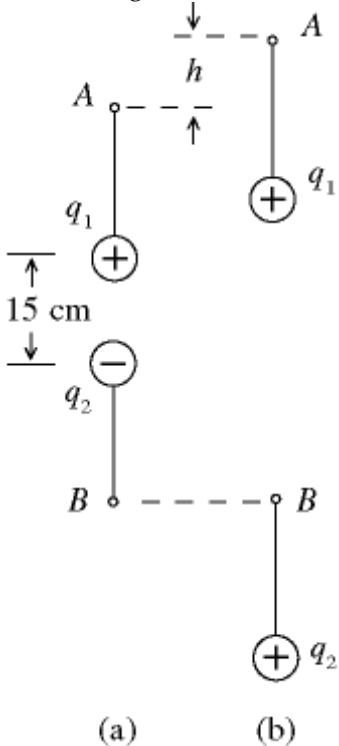
Situation 21.1

Two identical small conducting spheres are separated by 0.60m. The spheres carry different amounts of charge and each sphere experiences an attractive electric force of 10.8N. The total charge on the two spheres is $-24 \mu\text{C}$.

- 1) In Situation 21.1, the two spheres are connected by a slender conducting wire, which is then removed. The electric force on each sphere is closest to: 1) _____

- A) zero
- B) 3.6 N, attractive
- C) 5.4 N, attractive
- D) 5.4 N, repulsive
- E) 3.6 N, repulsive

Figure 21.5



(a)

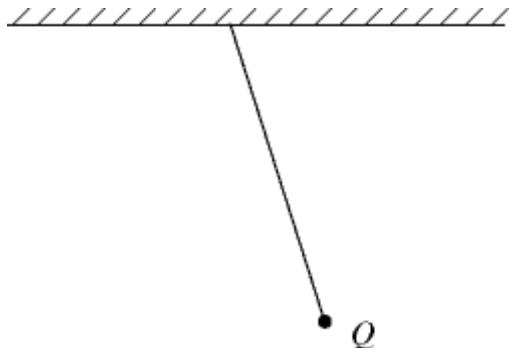
(b)

Two small insulating spheres are attached to silk threads. The spheres have equal masses of 40 g, and have electric charges of $q_1 = +2.0 \mu\text{C}$ and $q_2 = -2.0 \mu\text{C}$. The spheres are brought into the initial positions shown in Fig. (a), with a vertical separation of 15 cm between them.

- 2) In Fig. 21.5, the upper thread is slowly pulled upward, while point B is kept fixed. When point A has been raised through a height h , the lower sphere suddenly falls, as shown in Fig. (b). The height h is closest to: 2) _____

- A) 15 cm
- B) 17 cm
- C) 9 cm
- D) 11 cm
- E) 13 cm

Figure 21.6



- 3) A point charge Q of mass 8.50 g hangs from the horizontal ceiling by a light 25.0-cm thread. When a horizontal electric field of magnitude 1750 N/C is turned on, the charge hangs away from the vertical as shown in Fig. 21.6. The magnitude of Q is closest to:
- A) $27.5 \mu\text{C}$ B) $+3.0$ C) $55.0 \mu\text{C}$ D) $+3.5$ E) $47.6 \mu\text{C}$

3) _____

Situation 21.2

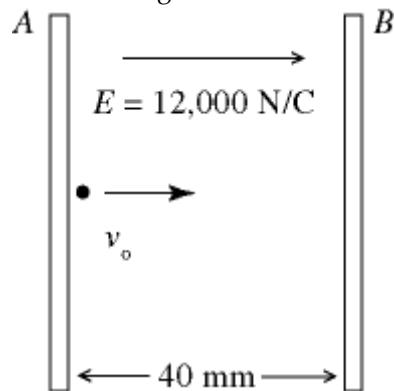
A 50-g insulating sphere carries a charge $Q = -60 \mu\text{C}$ and is suspended by a silk thread from a fixed point. An external electric field which is uniform and vertical is applied.

- 4) In Situation 21.2, the applied electric field has a magnitude of 3000 N/C and is directed downward. The tension in the thread is closest to:

A) 0.3 N B) 0.4 N C) 0.7 N D) 0.5 N E) 0.2 N

4) _____

Figure 21.7



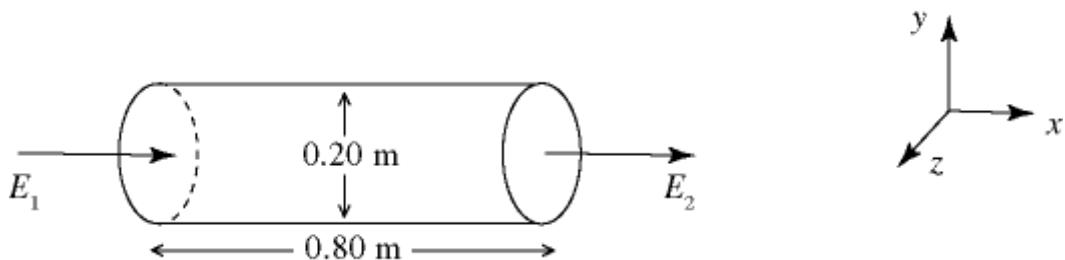
A pair of charged conducting plates produces a uniform field of 12,000 N/C, directed to the right, between the plates. The separation of the plates is 40 mm.

- 5) In Fig. 21.7, an electron is projected from plate A , directly toward plate B , with an initial velocity $v_0 = 1.0 \times 10^7 \text{ m/s}$. The closest approach of the electron to plate B is closest to:

A) 18 mm B) 24 mm C) 16 mm D) 20 mm E) 22 mm

5) _____

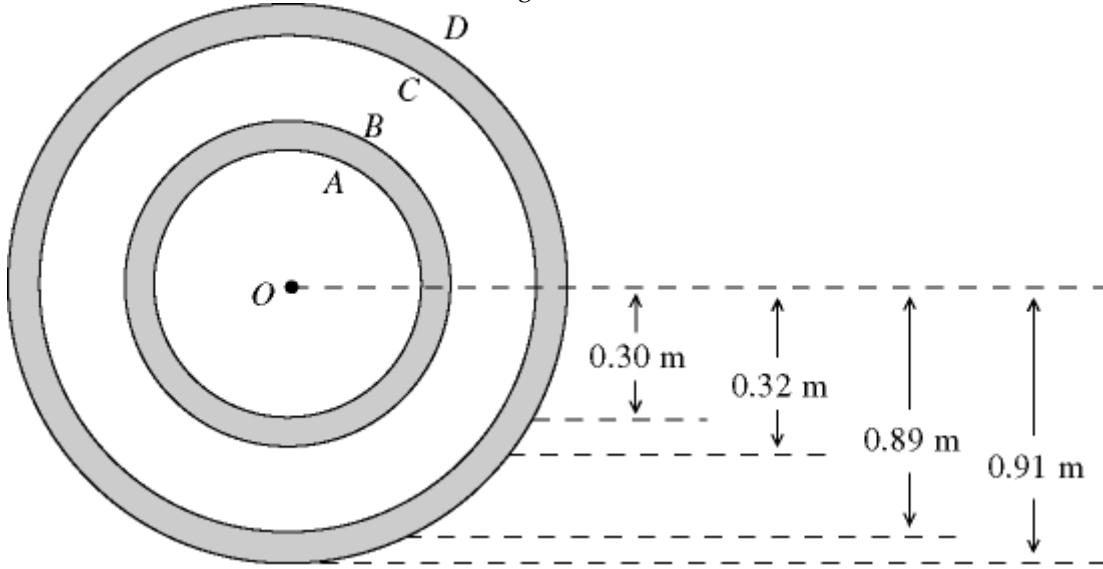
Figure 22.1



- 6) A nonuniform electric field is directed along the x -axis at all points in space. This magnitude of the field varies with x , but not with respect to y or z . The axis of a cylindrical surface, 0.80 m long and 0.20 m in diameter, is aligned parallel to the x -axis. The electric fields E_1 and E_2 , at the ends of the cylindrical surface, have magnitudes of 2000 N/C and 1000 N/C respectively, and are directed as shown. In Fig. 22.1, the charge enclosed by the cylindrical surface is closest to:

A) 0.28 nC B) -0.60 nC C) 1.2 nC D) -1.2 nC E) -0.28 nC

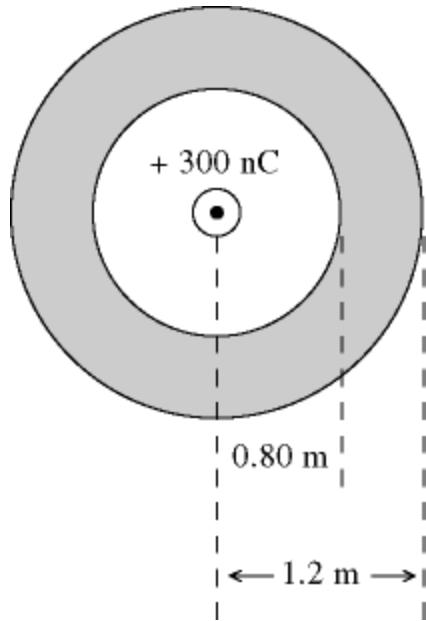
Figure 22.3



- 7) Two hollow conducting spheres have a common center O . The dimensions of the spheres are as shown. A charge of -200 nC is placed on the inner conductor and a charge of +20 nC is placed on the outer conductor. The inner and outer surfaces of the spheres are respectively denoted by A , B , C , and D , as shown. In Fig. 22.3, the radial component of the electric field, at a point that is 0.95 m from O , is closest to:

A) +1800 N/C
B) +200 N/C
C) -200 N/C
D) -1800 N/C
E) zero

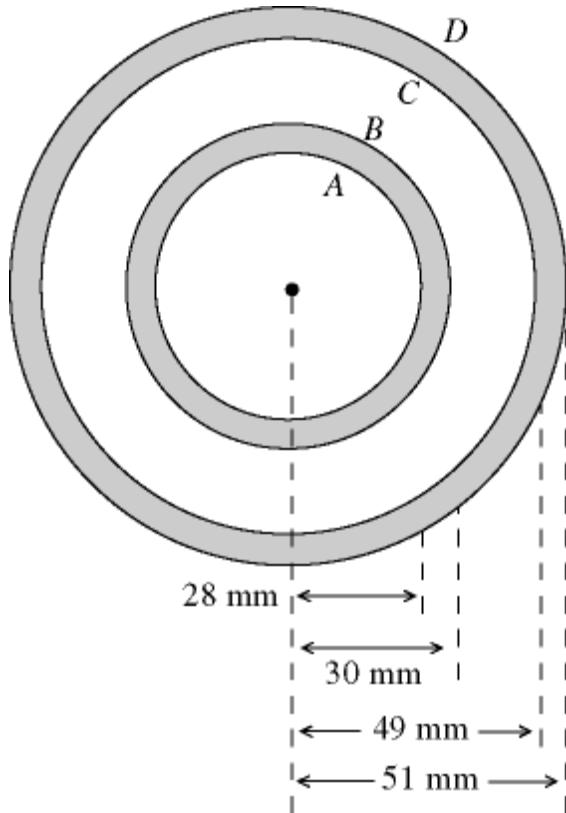
Figure 22.4



A hollow conducting sphere has radii of 0.80 m and 1.20 m. The sphere carries a charge of -500 nc. A point charge of +300 nC is present at the center.

- 8) In Fig. 22.4, the radial component of the electric field at a point that is 0.60 m from the center is 8) _____
closest to:
- A) zero
 - B) +7500 N/C
 - C) -7500 N/C
 - D) +5000 N/C
 - E) -5000 N/C

Figure 22.6



- 9) The cross section of a long coaxial cable is shown, with radii as given. The linear charge density on the inner conductor is -40 nC/m and the linear charge density on the outer conductor is -20 nC/m . The inner and outer cylindrical surfaces are respectively denoted by A, B, C, and D, as shown. In Fig. 22.6, the radial component of the electric field at a point that is 34 mm from the axis is closest to:
- A) $+11,000 \text{ N/C}$
 B) $-21,000 \text{ N/C}$
 C) $+21,000 \text{ N/C}$
 D) $-11,000 \text{ N/C}$
 E) zero

9) _____

Situation 22.1

Electric charge is uniformly distributed inside a sphere of radius 0.30 m. The electric field at a point which is 0.50 m from the center of the sphere is $15,000 \text{ N/C}$, and is directed radially outward.

- 10) In Situation 22.1, the maximum magnitude of the electric field is closest to:
- A) $42,000 \text{ N/C}$
 B) $48,000 \text{ N/C}$
 C) $30,000 \text{ N/C}$
 D) $25,000 \text{ N/C}$
 E) $36,000 \text{ N/C}$

10) _____

Figure 22.2



- 11) In Fig. 22.2, three hollow, concentric spherical conductors are charged as follows:

11) _____

The inner sphere carries charge Q

The middle sphere carries charge $-2Q$

The outer sphere carries charge $-Q$.

What is the charge on the outer surface of the middle sphere?

A) zero

B) $+2Q$

C) $+Q$

D) $-Q$

E) $-2Q$

Situation 21.2

A 50-g insulating sphere carries a charge $Q = -60 \mu\text{C}$ and is suspended by a silk thread from a fixed point. An external electric field which is uniform and vertical is applied.

- 12) In Situation 21.2, the applied electric field holds the sphere in place above the fixed point of suspension, and the tension in the thread is 0.35 N. The applied electric field, including direction, is closest to:

12) _____

A) 14,000 N/C, upward

B) 8000 N/C, downward

C) 8000 N/C, upward

D) 2000 N/C, upward

E) 14,000 N/C, downward