**Physics 121 Common 1 Exam** **Signature:**_____

**Name (Print):** _____ **4 Digit ID:**_____ **Section:** _____

## Instructions:

- Answer all questions. Questions 1 through 16 are multiple choice questions worth 5 points each. You may need to do some calculation. Answer each of these on the Scantron sheet using #2 pencil. You may use backs of the question papers for extra space. Questions A and B are work-out problems worth 10 points each. Show all work and answer them on the exam booklet.
- Be sure your name and section number are on both the Scantron form and the exam booklet. Also write your name, id, and section at the top of pages 5 and 6, which may be separated for grading.
- You may use one side of an 8.5 x 11 sheet or two sides of a 5x8 card as a formula sheet. A default formula sheet is also provided (see the laast page). Make sure to bring your own calculator
- Please turn off any cell phones, pagers, communication or entertainment devices, etc. .Sharing of calculators is not permitted. Students are not to communicate with each other once the test has started. If you have questions or need something call your proctor or instructor.

**1**. The electrostatic force between two negatively charged cubes, 10 cm. on each side, with $Q_1$= -7 μC and $Q_2$= -4 μC is:

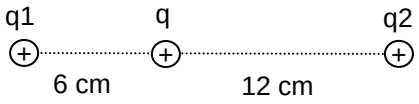
A) Attractive. The force on cube 1 is twice as large as the force on cube 2.
B) Attractive. The force on cube 1 is equal to the force on cube 2.
C) Zero.
D) Repulsive. The force on cube 1 is twice as large as the force on cube 2.
E) **Repulsive. The force on cube 1 is equal to the force on cube 2**.

**2**. The force acting on an electron 100 cm from a positive .1 μC point charge in a vacuum is:

A) 2.8 x $10^{+10}$ N. Repulsive
B) 1.0 x $10^{-19}$ N. Attractive
C) 1.4 x $10^{-12}$ N. Repulsive
D) **1.4 x $10^{-16}$ N. Attractive**
E) 1.6 x $10^{-16}$ N. Attractive

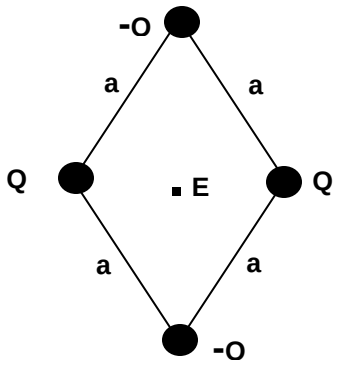
**3**. A positively charged particle with q= 2 μC is placed between two other positively charged particles with $q_1$= 9 x $10^{-3}$ C and $q_2$= 3 x $10^{-3}$ C as shown on the figure. The distance between $q_1$ and q is 6 cm and the distance from q to $q_2$ is 12 cm. What are the magnitude and direction of the total force acting on the middle particle?

**A) 4.1 x $10^{+4}$ N. right**
B) 2.8 x $10^{+9}$ N, right
C) 4.9 x $10^{+4}$ N, left
D) 4.9 x $10^{+4}$ N, right
E) 9.0 x $10^{+9}$ N, left



**4**. The magnitude Q of the charge on four balls is 12 μC distributed uniformly on the surface of each one. Two are positive and tqo are negative as shown in the sketch. They are placed at the corners of the diamond as shown in the diagram. Each of the sides has length a = 3 cm. What are the magnitude and direction of the electric field at the center of the diamond shape?

A) $24.1 \times 10^{13}$ N/C. Down
B) $1.6 \times 10^{12}$ N/C. Up
C) $7.9 \times 10^{19}$ N/C. Left
D) $1.4 \times 10^{10}$ N/C. Right
E) **Zero**




**5.** For an isolated sphere of charge, which of the following statements about the electric field outside it is correct?

A) It is directly proportional to the distance from the sphere.
B**) It is inversely proportional to the square of the distance from the sphere.**
C) It is directly proportional to the square of the distance from the sphere.
D) It is inversely proportional to the distance from the sphere.
E) None of the above.

**6.** Which of the following is NOT true of the electric field near an infinitely large conducting plane?

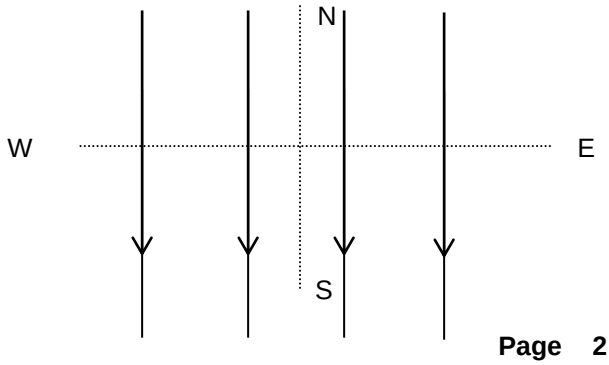
A) **It is inversely proportional to the square of the distance from the plane.**
B) It is directly proportional to the surface charge density.
C) It is a constant at all distances from the charged plane.
D) The field lines are all parallel.
E) All of the above.

**7.** For an infinite line of charge, which of the following is true of the electric field?

A) It is directly proportional to the distance from the charged line.
B) It is a constant for all distances from the charged line.
C) It is directly proportional to the square of the distance from the charged line.
D) It is inversely proportional to the square of the distance from the charged line.
E) **None of the above.**

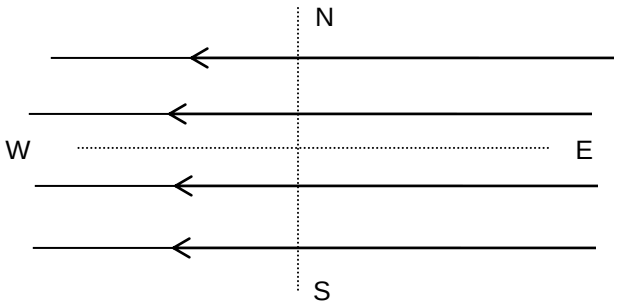
**8.** The field lines for a uniform electric field point south as shown. If a proton is released somewhere in the field, which way will it move?

A) West
B) East
C) **South**
D) North
E) Closer to the proton



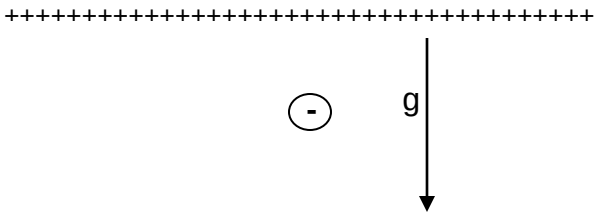
**9.** A negatively charged particle is placed in a uniform electric field directed West. What are the magnitude and direction of the particle's acceleration if its charge is q= -6 μC, its mass m = 2 grams, and the value of electric field E is 6 $x10^{-6}$ N/C? Select the closest answer:

A) West. a = 1.8 $x10^{-8}$ $m/s^2$
B) East. a = 1.8 $x10^{-3}$ $m/s^2$
C) West. a = 1.8 $x10^{+3}$ $m/s^2$
D) **East. a = 1.8 $x10^{-8}$ $m/s^2$**
E) East. a = 1.8 $x10^{-5}$ $m/s^2$



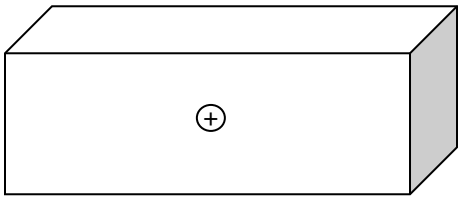

**10**. An electron with mass m = 9.11 x $10^{-31}$ kg is released at rest above very large positively charged non-conducting charged sheet lying horizontally as shown. What should the surface charge density σ on this sheet be to keep the electron balanced at rest above the ground?

A) 8.55 x $10^{-1}$ $C/m^2$
B) 2.35 x $10^{-6}$ $C/m^2$
C) 1.8 x $10^{-18}$ $C/m^2$
D**) 9.88 x $10^{-22}$ $C/m^2$**
E) 1.84 $C/m^2$



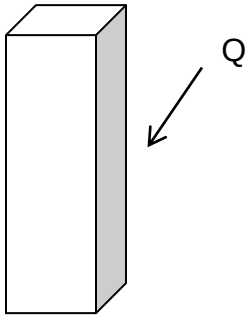

**11**. Find the electric flux through the surface of a rectangular Gaussian surface with a charge of 3.1 C. placed at it's center. The ends of the box are squares whose sides are 4.0 cm. The length is 8.0 cm.

A) 4.5 x $10^{+11}$ N $m^2/C$
B) **3.5 x $10^{+11}$ N $m^2/C$**
C) 0.1 x $10^{-16}$ N $m^2/C$
D) 4.4 x $10^{-10}$ N $m^2/C$
E) Insufficient information



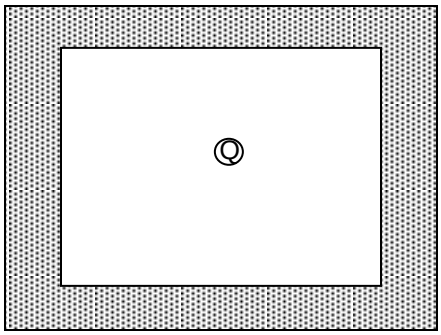

**12**. A charge Q is placed on an isolated, hollow metal rectangular solid with closed ends as shown. How will this charge be distributed after a while?

A) The charge will be distributed uniformly over the volume of the solid.
B) The charge will continuously move along the surface, creating a constant current.
C) The charge will be concentrated as a point charge at the center of the solid.
D) **The charge will be distributed over the outer surface of the solid.**
E) The charge will be distributed over the outer and inner surfaces of the solid.



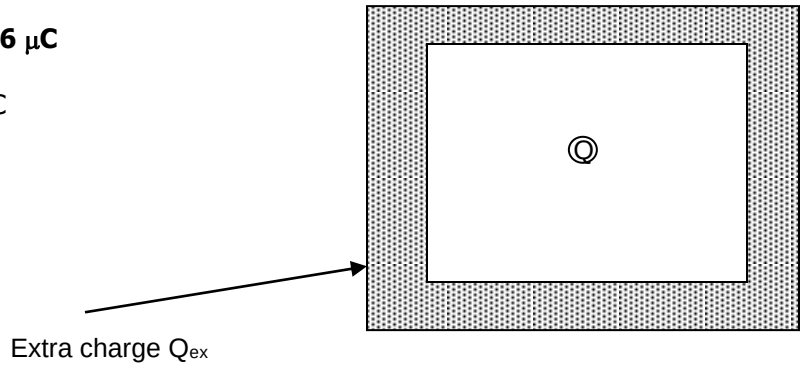
**13.** A negative charge Q = - 2 μC is placed inside a neutral cubical conducting box with a cavity in it. The length of the side of the inner cavity is a and the outer box's side length is b. What charges will be induced at the inner and outer surfaces of the box?

A) Inner charge = –2 μC. Outer charge = +2 μC
B**) Inner charge = +2 μC. Outer charge = -2 μC**
C) Inner charge = 0 μC. Outer charge = -2 μC
D) Inner charge = +2 μC. Outer charge = 0 μC
E) Inner charge = 0 μC. Outer charge = 0 μC



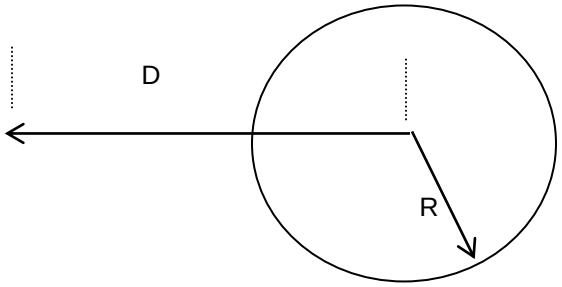

**14**. The same negative charge Q = - 2 μC is placed inside the same box in the problem above, but now in addition, an extra negative charge of $Q_{ex}$ = - 4 μC. is initially placed on the the inner surface of the cavity. What will the charges be on the inner and outer surfaces of the box after some time has passed?

A) Inner charge = 0 μC. Outer charge = -6 mC
B**) Inner charge = + 2 μC. Outer charge = -6 μC**
C) Inner charge = -6 μC, Outer charge = -2 μC
D) Inner charge = – 4 μC. Outer charge = +2 μC
E) Inner charge = +2 μC, Outer charge = -2 μC




**15**. A solid, conducting sphere has a net positive charge of Q = 4.5 C on it. It's radius R is 3.0 m. What is the magitude of the electric field at a distance D of 9.0 m. from the center of the sphere.

A) 9 x $10^9$ N/C
B) 0.0 N/C
C) 1.0 x $10^9$ N/C
D) **5 x $10^8$ N/C**
E) 1.0 x $10^8$ N/C




**16**. For same solid, charged conducting sphere of the problem above, find the magnitude of the electric field at a distance D = 0.5 m. from the center of the sphere.

A) 9.0 x $10^9$ N/C
**B) 0.0 N/C**
C) 1.0 x $10^9$ N/C
D) 0.5 x $10^9$ N/C
E) 2.25 x $10^9$ N/C

**PHYS 121 Common Exam 1 – Sample Exam 2** **SCORE**_____

**NAME**_____

The exam is closed book and closed notes.

**Make sure you put your name on the SCANTRON form.**

$e = 1.6\times10^{-19}$ C; $m_e = 9.11\times10^{-31}$kg $k = 8.99\times10^{9}$ Nm$^2$/C$^2$; $k = \frac{1}{4\pi\varepsilon_0}$; $\varepsilon_0 = 8.85\times10^{-12}$ C$^2$/ Nm$^2$ ;

$F = k\frac{q_1 q_2}{r^2}$; $E = k\frac{q_1}{r^2}$; $F = qE$ $F = ma$ $x = v_0t + 1/2at^2$

$\lambda = \frac{Q}{L}$ $\sigma = \frac{Q}{A}$ $\Phi = \int EdA = \frac{q_{encl}}{\varepsilon_0}$ $E = \frac{\sigma}{2\varepsilon_0}$ $E = \frac{\lambda}{2\pi\varepsilon_0 r}$ $E = \frac{qr}{4\pi\varepsilon_0 R^3}$

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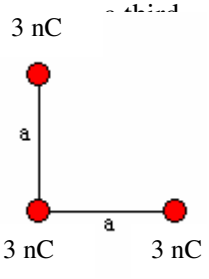
1. A 3-nC charge is placed at the origin, an identical charge is placed 0.002 m from the origin on the x identical charge is placed 0.002 m from the origin on the y axis. The magnitude of the force on the cha




**A. 0.029 N**
B. 0.077 N
C. 1.27 N
D. 0.890 N
E. 1.021 N

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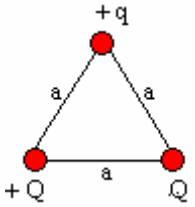
2. Charges Q, -Q, and q are placed at the vertices of an equilateral triangle as shown. The total force exerted on the charge q is:




A. toward charge Q
B. toward charge - Q
C. away from charge Q
D. at right angle to the line joining Q and -Q
**E. parallel to the line joining Q and -Q**

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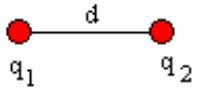
3. Two fixed particles of charges $q_1 = 1.6\times10^{-9}$ C and $q_2 = 3.6\times10^{-9}$ C are on the x axis, 16 cm apart. How far from $q_1$ along x axis the net electric field is zero?




A. 2.4 cm
B. 4.8 cm
**C. 6.4 cm**
D. 9.6 cm
E. 12 cm

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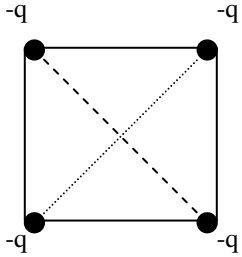
4. Four negative charges q = -6nC form a square, 12 cm on a side, as shown in figure below. What is the magnitude of electric field at the center of the square ?




A. 20 N/C
B. 15 N/C
C. 10 N/C
D. 5 N/C
**E. 0**

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**Version B**

5. An electron traveling north enters a region where the electric field is uniform and points north. The electron:
A. speeds up
**B. slows down**
C. continues with the same speed in the same direction
D. moves with the same speed in the opposite direction
E. none of the above

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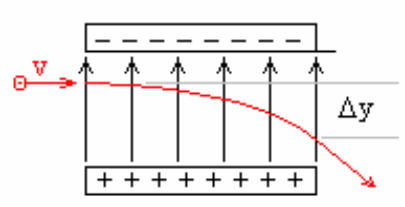
6. An electron moving along x axis with a constant speed v = $5x10^6$ m/s **i** enters the region of a uniform electric field of E = 150 N/C **j** . What is the vertical displacement y of the electron 4 ns later?




A. 0.15 cm
B. 0.20 cm
**C. 0.02 cm**
D. 0.01 cm
E. 5.0 cm

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7. A point charge q = 1.45 nC is placed in the center of a spherical cavity of an isolated spherical conductor of inner radius 4 cm and outer radius 12 cm The area charge density on the inner surface is
A. -15.7nC/$m^2$
B. 28.4nC/$m^2$
C. -45.7nC/$m^2$
**D. - 72.1nC/$m^2$**
E. -152.7nC/$m^2$

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8. Charge is distributed uniformly on the surface of large, flat plate. The electric field 8 cm from the plates is 40 N/C. The electric field 12 cm from the plate is:
A. 20 N/C
B. 25 N/C
C. 30 N/C
D. 35 N/C
**E. 40 N/C**

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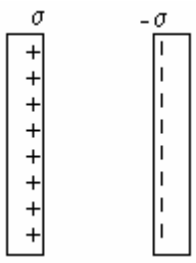
9. Two large metal plates face each other. They are 5 cm apart and have equal surface charge densities of 9 nC/$m^2$ of opposite sign on their inner surfaces. The electric field midway between them is:




A. 540 N/C
**B. 1017 N/C**
C. 2350 N/C
D. 4165 N/C
E. 8245 N/C

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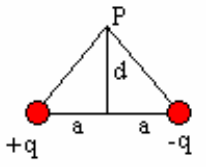
10. Two identical charges of opposite sign are located on a horizontal axis. If a = 20 cm , d = 40 cm and q = 8 nC, what is the electric field ( in unit-vector notation) at p on a vertical axis as shown in the figure?




A. 184**i**
B. - 284**j**
**C. 322 i**
D. 448 **j**
E. - 448 **I**

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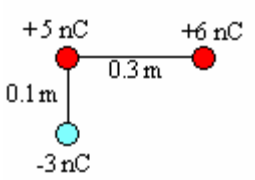
1. Three point charges are arranged as shown in the figure. Calculate the magnitude and direction of the net electric force on the -3 nC charge.




2. A solid, insulating sphere of radius 8 cm has a total positive charge of 45 nC uniformly distributed throughout its volume. Concentric with this sphere is an uncharged, conduction hollow sphere whose inner radius is 20 cm and its outer radius is 25 cm.

a) Calculate the magnitude of the electric field 5 cm from the center of the insulating sphere

b) Calculate the magnitude of the electric field 12 cm from the center of the insulating sphere

c) Calculate the magnitude of the electric field 22 cm from the center of the insulating sphere

d) Calculate the magnitude of the electric field 30 cm from the center of the insulating sphe