Physics 112
Sample Exam Questions #1

The following situation applies to problems #1 and #2: A –2-C charge is located at (–1 m, 0 m) and two +2-C charges are located at (+2 m, 0 m). An electron is located at the origin.

1. What is the magnitude of the net electric ***field*** experienced by the electron at the origin, produced by the three charges described above?

   A. 9.0×10^{9} N/C
   B. 1.8×10^{10} N/C
   C. 2.7×10^{10} N/C
   D. 3.6×10^{10} N/C
   E. 5.4×10^{10} N/C
   F. 1.44×10^{-9} N/C
   G. 2.88×10^{-9} N/C
   H. 4.32×10^{-9} N/C
   I. 5.76×10^{-9} N/C
   J. 8.64×10^{-9} N/C

2. Suppose the electron in problem #1 were replaced with a proton. Then the net ***force*** on the proton, compared to the net force on the electron, would be:

   A. larger in magnitude, but in the same direction
   B. larger in magnitude, and in the opposite direction
   C. equal in magnitude, and in the same direction
   D. equal in magnitude, but in the opposite direction
   E. smaller in magnitude, but in the same direction
   F. smaller in magnitude, and in the opposite direction

3. A 5-C charge is fixed at the origin. At the point (1 m, –2 m) the x component of the electric field is:

   A. less than zero, with magnitude equal to the y component.
   B. equal to zero, with magnitude equal to the y component.
   C. greater than zero, with magnitude equal to the y component.
   D. less than zero, with magnitude **not** equal to the y component.
   E. equal to zero, with magnitude **not** equal to the y component.
   F. greater than zero, with magnitude **not** equal to the y component.

4. A –1-C charge is located on the x axis at x = –2 m, and a +2-C charge is located on the x axis at x = +4 m. Where on the x axis must you put a +6-C charge to ensure that the ***net electric field*** at the origin has ***zero*** magnitude?

A. x = +4 m
B. x = +3 m
C. x = +2 m
D. x = +1 m
E. x = 0 m.
F. x = –1 m
G. x = –2 m
H. x = –3 m
I. x = –4 m
J. x = –5 m

5. An object with a mass of 2 kg and a net charge of 4 μC is shot from a gun aimed at the origin. The gun is located 20 km from the origin; the initial speed of the object is 3 m/s. A particle with a charge of 0.001 C is fixed at the origin. How close will the object get to the origin before it slows to a stop and starts back the other way?

A. 1 m
B. 2 m
C. 3 m
D. 4 m
E. 5 m
F. 6 m
G. 8 m
H. 9 m
I. 12 m
J. 16 m

6. Two positive point charges Q and 3Q are separated by a distance R. [No other charges are present, and there is no external electric field.] If the charge Q experiences a force of magnitude 12 N when the separation is R, what is the magnitude of the force *on the charge 3Q* when the separation is 2R?

A. 1 N
B. 2 N
C. 3 N
D. 4 N
E. 6 N
F. 8 N
G. 9 N
H. 12 N
I. 18 N
J. 24 N

7. A positive charge sits at the location x = 5.2 m, y = 3 m. What is the direction of the electric field at the origin, measured with respect to the positive-x axis?

A. 0°
B. 30°
C. 45°
D. 60°
E. 90°
F. 120°
G. 150°
H. 210°
I. 240°
J. 300°

8. You are told to measure the electric field in an empty room where the electric field is known to be uniform throughout. You find that a particle with a 3-C charge, placed 1 m from the center of the room, experiences a force of 18 N in the direction of north. After you leave, taking your particle with you, someone else enters the room and makes force measurements on a particle with a charge of –6 C. If they place their particle at a point two meters from the center of the room, they should report that the electric field in the room is:

A. 1.5 N/C pointing north
B. 1.5 N/C pointing south
C. 3.0 N/C pointing north
D. 3.0 N/C pointing south
E. 6.0 N/C pointing north
F. 6.0 N/C pointing south
G. 9.0 N/C pointing north
H. 9.0 N/C pointing south
I. 12.0 N/C pointing north
J. 12.0 N/C pointing south

9. What is the magnitude of the electrical force on an electron that is located 65 centimeters from a proton? *No partial credit. Answer must be within 10% of correct answer to get credit. Units missing or incorrect: –1 point.*

Answer: _____

10. *(show your work for partial credit.)* Suppose there is a uniform electric field in a large region including the origin. Somebody comes in, places an electron at the point (–2 m, 0 m), makes some measurements, and then takes it away. Then you come in, place a 2-μC charge at the point (+1m, 0 m), and measure a force of 3N directed "up" acting on your charge. Complete this chart to indicate the magnitude and direction of the force ***and*** the electric field experienced both by your charge, and by the electron.

	magnitude of force	direction of force (up or down)	magnitude of field	direction of field (up or down)
2-μC charge	3 N	up		
electron				