PHY 232C, INTRODUCTORY PHYSICS II, EXAM I, Sep. 15, 2003

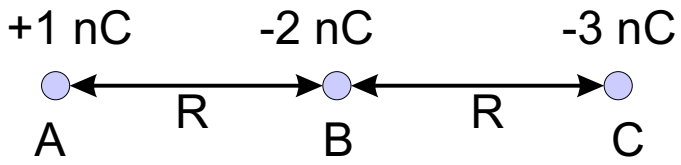
Choose the best answer.

1. How many protons are needed to produce a total charge of 3.204×10^{-6} C?

   (a) 0.5
   (b) 2.0×10^{13}
   (c) 1.602×10^{9}
   (d) 3.204×10^{14}
   (e) 6.93×10^{3}

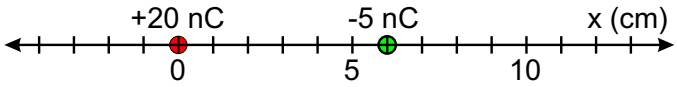
2. Two charged point particles attract each other with a force of magnitude F. If the distance between the particles is increased by a factor of 3 and the charge of one of the particles is increased by a factor of 27, by what factor will the new force increase relative to the old one?

   (a) 1/3
   (b) one to one (no increase)
   (c) 3
   (d) 81
   (e) 1/9



3. Three charges, A, B and C are lined up as shown above. Which statement is FALSE?

   (a) A feels a force to the right.
   (b) B feels a force to the right.
   (c) C feels a force to the right.
   (d) The potential energy of A (relative to being positioned at ∞) is negative.
   (e) The potential energy of C (relative to being positioned at ∞) is positive.

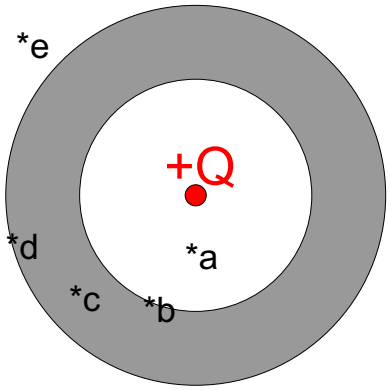


4. Consider the two charges shown above at $x = 0$ and $x = 6$ cm. At what position(s) x is the electic field zero?

   (a) -12 cm
   (b) -6 cm and 3 cm
   (c) 4.0 cm
   (d) 4.8 cm and 8.0 cm
   (e) 12.0 cm

5. Consider the same two charges from the previous problem. At what position(s) x is the voltage zero?

   (a) -12 cm
   (b) -6 cm and 3 cm
   (c) 4.0 cm
   (d) 4.8 cm and 8.0 cm
   (e) 12.0 cm



6. Consider a thick spherical conducting shell with NO NET CHARGE. A point charge, $+Q$ is placed at its center. Which statement is FALSE?

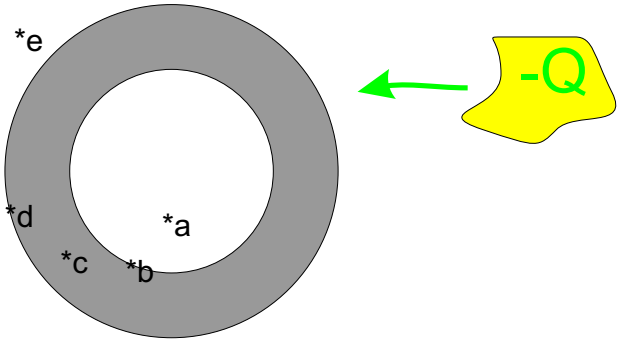
   (a) The electric field at a equals zero.

   (b) The electric field at c equals zero.

   (c) The voltage at b equals the voltage at d.

   (d) The inner surface of the shell carries a charge $-Q$.

   (e) The electric field at e is the same as it would be if the shell were removed.



7. Now consider an initially neutral thick conducting shell. Electrons are added to the shell until the net charge of the shell is $-Q$. Which statement is FALSE?

   After the negative electrons have all been moved to the shell,

   (a) the electric field at a equals zero.

   (b) the electric field at c equals zero.

   (c) the voltage at b equals the voltage at d.

   (d) the inner surface of the shell carries a charge $+Q$.

   (e) the outer surface of the shell carries a charge $-Q$.

8. The electric field is measured on opposite sides of a thin conducting surface just outside the surface. On one side the electric field is measured to be 4000 N/C, and is directed into the surface. On the other side it is measured to be 2000 V/m and is also pointed into the surface (anti-parallel to the field on the other side). What is the surface charge density? (charge per unit area).

   (a) 5.31×10^{-8} C/m^2

   (b) -5.31×10^{-8} C/m^2

   (c) 1.77×10^{-8} C/m^2

   (d) -1.77×10^{-8} C/m^2

   (e) 3.54×10^{-8} C/m^2

9. A constant electric field of magnitude 500 V/m is pointed in the $+x$ direction. A charge of -3.0 nC is moved from $(x = 2m, y = 5m)$ to $(x = 5m, y = 9m)$. How much work was involved in moving the charge?

   (a) 4.5×10^{-6}J
   (b) 6.0×10^{-6}J
   (c) -6.0×10^{-6}J
   (d) 7.5×10^{-6}J
   (e) -7.5×10^{-6}J

10. The potential difference between two parallel conducting plates is 2000 V. An alpha particle with mass 6.50×10^{-27} kg and charge 3.20×10^{-19} C is released from one plate. What is the speed of the alpha particle when it reaches the other plate?

    (a) 6.06×10^{4} m/s
    (b) 1.11×10^{5} m/s
    (c) 2.22×10^{5} m/s
    (d) 4.44×10^{5} m/s
    (e) 8.88×10^{5} m/s

11. A positive charge of 4.0 μC is fixed at the origin. From a very far distance, a charge of 2.0 μC and mass 5.0 g is fired directly towards the origin with a velocity of 80 m/s. What is the closest distance that the second charge comes within the origin before it returns to its original position?

    (a) 211 m
    (b) 23.2 m
    (c) 43.2 cm
    (d) 1.98 cm
    (e) 4.50 mm