Last Name_____   First Name_____

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

1) A spherical metallic shell carries a charge 2q. A point charge q is placed at the center of the shell. When electrostatic equilibrium is reached, what is the charge carried by the outer surface of the shell?

    A) 0   B) q   C) 4q   D) 2q   E) 3q

2) A spherical metallic shell carries a charge 2q. A point charge q is placed at the center of the shell. When electrostatic equilibrium is reached, what is the charge carried by the inner surface of the shell?

    A) 2q   B) -q   C) q   D) 3q   E) 0

3) If the electric potential is given by $V(x,y,z) = xy - 3z^{-2}$, then the electric field has a y–component

    A) $x + y - 6z^{-3}$.   B) $x + y$.   C) $-x$ D) x.   E) y.

4) An electric dipole of dipole moment $\vec{p} = p_0\hat{i} + p_0\hat{j}$ is placed in a uniform electric field $\vec{E} = E_0\hat{i}$. What is the value of the torque applied on the dipole by the electric field?

    A) The torque is equal to zero.

    B) $\vec{\tau} = -p_0E_0\hat{k}$

    C) $\vec{\tau} = p_0E_0\hat{k}$

    D) $\vec{\tau} = -p_0E_0\hat{i}$

    E) $\vec{\tau} = -p_0E_0\hat{j}$

5) The figure below shows the variations of the electric potential V (in arbitrary units) as a function of the position x (also in arbitrary units). Which of the choices below correctly describes the orientation of the electric field along the x axis?
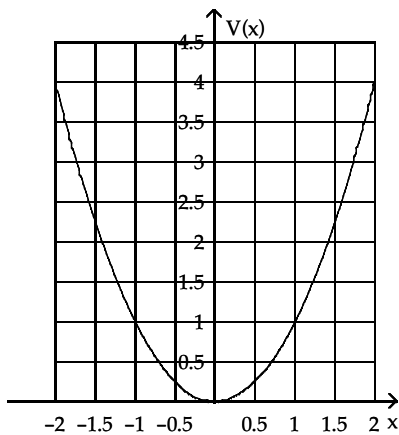

    A) E is negative from x = –2 to x = 2

    B) More information is needed to answer the question

    C) E is positive from x = –2 to x = 2

    D) E is negative from x = –2 to x = 0, and positive from 0 to x= 2

    E) E is positive from x = –2 to x = 0, and negative from 0 to x= 2

6) A ring of negative, uniform charge density is placed on the xz-plane with the center of the ring at the origin. A positive charge moves along the y axis toward the center of the ring as shown in the figure below. At the moment the charge passes through the center of the ring
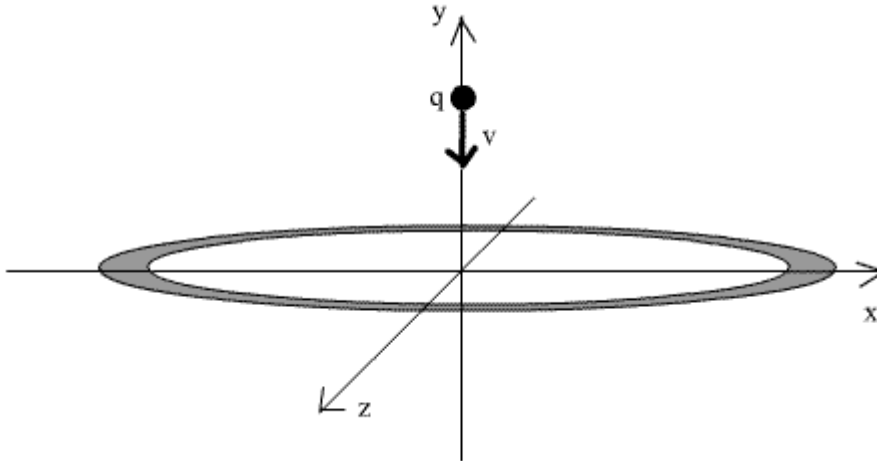

A) its velocity and its acceleration reach their maximum values.

B) its velocity is zero and its acceleration is maximum.

C) its velocity and its acceleration have non-zero values but neither is at its maximum.

D) its velocity and its reach are both equal to zero.

E) its velocity is maximum and its acceleration is zero.

7) Two charges Q_1 and Q_2 of equal magnitudes and opposite signs are positioned as shown in the figure below. Which of the shown arrows represents correctly the electric field at point P?
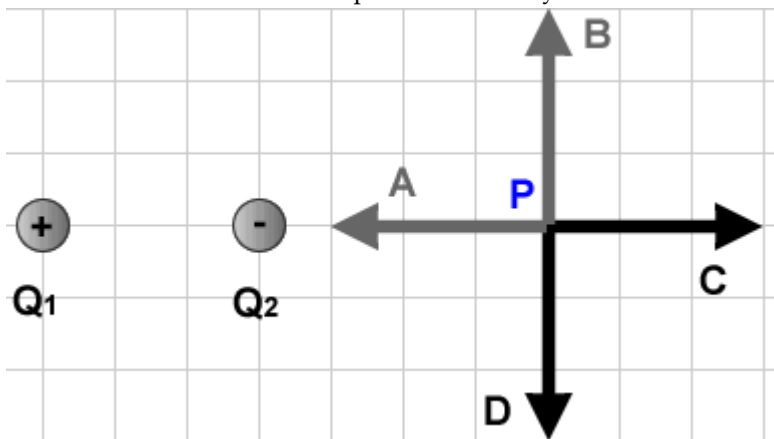
A) A

B) The field is equal to zero at point P.

C) D

D) B

E) C

8) If a charge is located at the center of a spherical volume and the electric flux through the surface of the sphere is ϕ_O, what is the flux through the surface if the radius of the sphere doubles?

    A) 0.125 ϕ_O B) 8 ϕ_O C) 0.500 ϕ_O D) ϕ_O E) 5 ϕ_O

9) The figure below shows equipotentials surrounding a pair of charges Q_A and Q_B. The value of the potential half-way between the charges is indicated. Which of the statements below applies to the charges?
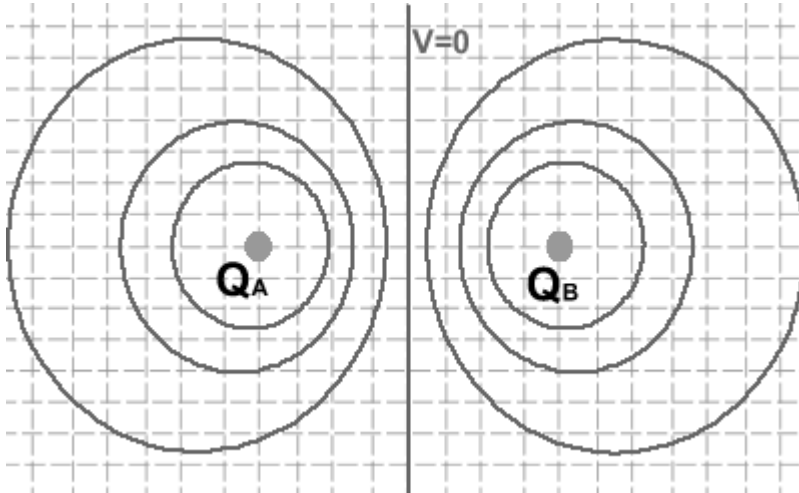

    A) The two charges have the same sign but different magnitudes

    B) The two charges have the same sign and equal magnitudes

    C) The two charges have opposite signs and equal magnitudes

    D) The two charges have opposite signs and different magnitudes

    E) Nothing can be said about the charges

10) When five equal positive charges are uniformly spaced along the x–axis, the force on the next to last charge on the right is

    A) zero.

    B) possibly in the negative y–direction.

    C) possibly in the positive y–direction.

    D) to the right.

    E) to the left.

11) For the assembly of charges shown below, which graph best depicts the y-component of the electric field, E_y, for points along the y-axis?
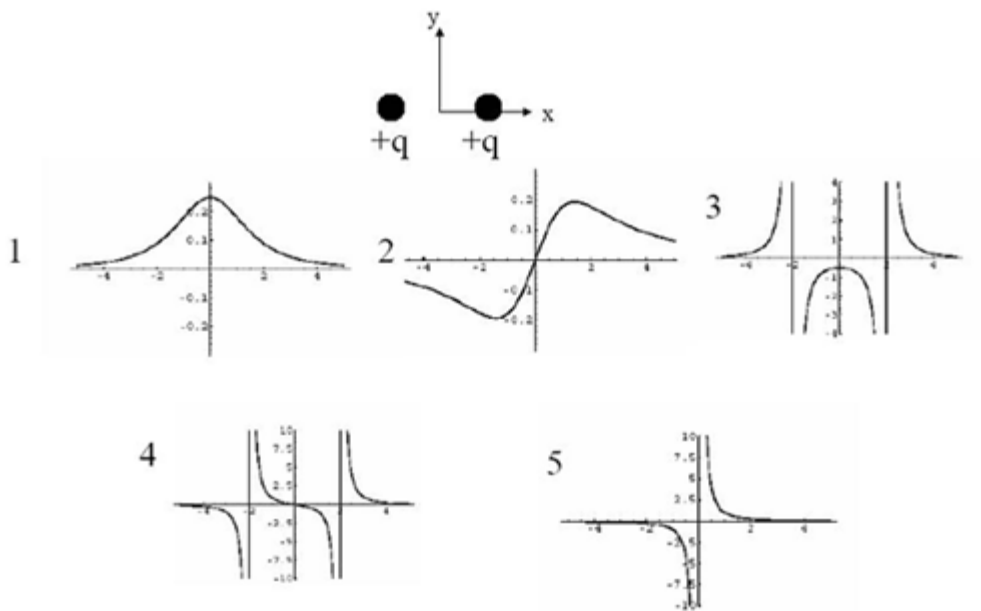
A) 1   B) 2   C) 3   D) 4   E) 5

12) For the assembly of charges shown below, which graph best depicts the x-component of the electric field, E_x, for points along the x-axis?
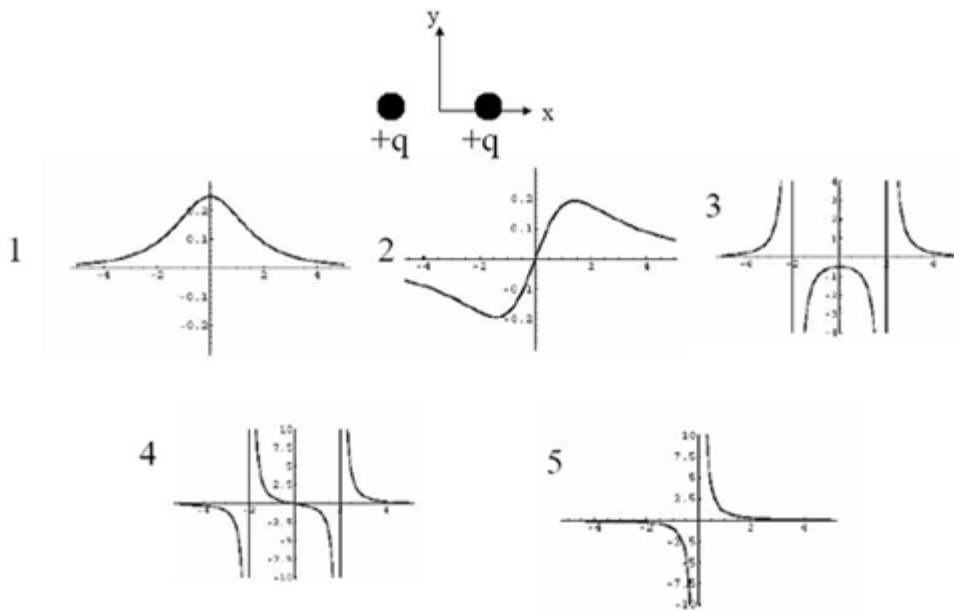
A) 1   B) 2   C) 3   D) 4   E) 5

13) Two charges $Q_A = +q$ and $Q_B = -3q$ are located on the x-axis at $x = 0$ and $x = d$ respectively. Where is the electric potential equal to zero?

A) $x = d/4$ B) $x = 2d/3$ C) $x = d/3$ D) $x = 3d/4$ E) $x = d/2$

14) A particle of positive charge q and mass m moving with a velocity $\vec{v} = v_0\hat{i}$ enters a region of space where there is an electric field $\vec{E} = E_0\hat{j}$. At time t after entering the electric field region, the velocity of the particle will be

A) $\vec{v} = v_0\hat{i} + v_0\hat{j}$.

B) $\vec{v} = v_0\hat{i} - (q E_0 t/m)\hat{j}$.

C) $\vec{v} = (q E_0 t/m)\hat{i} + (q E_0 t/m)\hat{j}$.

D) $\vec{v} = v_0\hat{i} + (q E_0 t/m)\hat{j}$.

E) $\vec{v} = (q E_0 t/m)\hat{i} + v_0\hat{j}$.

15) The figure below shows two arcs of a circle on which charges +Q and –Q have been spread uniformly. What is the value of the electric potential at the center of the circle?
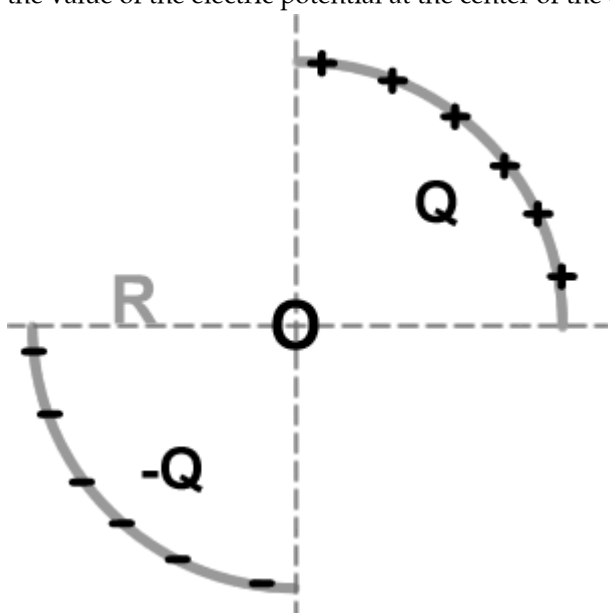
A) 0

B) $\dfrac{1}{4\pi\varepsilon_0}\dfrac{2Q}{R}$

C) $\dfrac{1}{4\pi\varepsilon_0}\dfrac{Q}{R^2}$

D) $\dfrac{1}{4\pi\varepsilon_0}\dfrac{Q}{R}$

E) $\dfrac{-1}{4\pi\varepsilon_0}\dfrac{Q}{R}$

Physics 102 Spring 2005: Test 1—Multiple-Choice Answers

	A	B	C	D	E
1					
2					
3					
4					
5					
6					
7					
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9					
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11					
12					
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