Name: _____ Date: _____

**1.** The dipole moment of an electric dipole in a 300-N/C electric field is initially perpendicular to the field, but it rotates so it is in the same direction as the field. If the moment has a magnitude of $2 \times 10^{-9}$ C · m, the work done by the field is:

**A)** $-12 \times 10^{-7}$ J
**B)** $-6 \times 10^{-7}$ J
**C)** 0
**D)** $6 \times 10^{-7}$ J
**E)** $12 \times 10^{-7}$ J

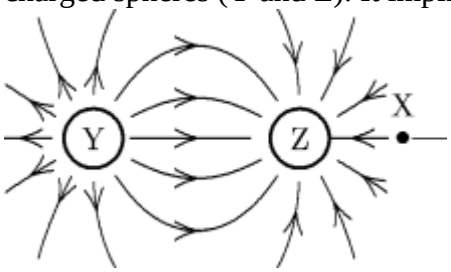
**2.** A 200-N/C electric field is in the positive *x* direction. The force on an electron in this field is:

**A)** 200 N in the positive *x* direction
**B)** 200 N in the negative *x* direction
**C)** $3.2 \times 10^{-17}$ N in the positive *x* direction
**D)** $3.2 \times 10^{-17}$ N in the negative *x* direction
**E)** 0

**3.** The torque exerted by an electric field on an electric dipole is:

**A)** parallel to the field and perpendicular to the dipole moment
**B)** parallel to both the field and dipole moment
**C)** perpendicular to both the field and dipole moment
**D)** parallel to the dipole moment and perpendicular to the field
**E)** not related to the directions of the field and dipole moment

**4.** The diagram shows the electric field lines in a region of space containing two small charged spheres (Y and Z). It implies that:




**A)** Y is negative and Z is positive
**B)** the magnitude of the electric field is the same everywhere
**C)** the electric field is strongest midway between Y and Z
**D)** the electric field is not zero anywhere (except infinitely far from the spheres)
**E)** Y and Z must have the same sign

**5.** A uniform electric field of 300 N/C makes an angle of 25º with the dipole moment of an electric dipole. If the torque exerted by the field has a magnitude of $2.5 \times 10^{-7}$ N · m, the magnitude of the dipole moment must be:

**A)** $8.3 \times 10^{-10}$ C · m
**B)** $9.2 \times 10^{-10}$ C · m
**C)** $2.0 \times 10^{-9}$ C · m
**D)** $8.3 \times 10^{-5}$ C · m
**E)** $1.8 \times 10^{-4}$ C · m

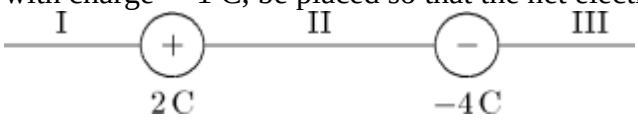
**6.** Choose the correct statement concerning electric field lines:

**A)** field lines may cross
**B)** field lines are close together where the field is large
**C)** field lines point away from a negatively charged particle
**D)** a charged point particle released from rest moves along a field line
**E)** none of these are correct

**7.** Let $k$ denote $1/4\pi\varepsilon_0$. The magnitude of the electric field at a distance $r$ from an isolated point particle with charge $q$ is:

**A)** $kq/r$
**B)** $kr/q$
**C)** $kq/r^3$
**D)** $kq/r^2$
**E)** $kq^2/r^2$

**8.** Two charged particles are arranged as shown. In which region could a third particle, with charge + 1 C, be placed so that the net electrostatic force on it is zero?




**A)** I only
**B)** I and II only
**C)** III only
**D)** I and III only
**E)** II only

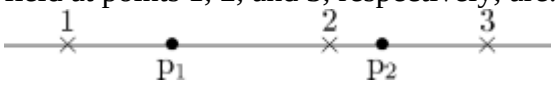
**9.** A charged particle is placed in an electric field that varies with location. No force is exerted on this charge:

**A)** at locations where the electric field is zero
**B)** at locations where the electric field strength is $1/(1.6 \times 10^{-19})$ N/C
**C)** if the particle is moving along a field line
**D)** if the particle is moving perpendicularly to a field line
**E)** if the field is caused by an equal amount of positive and negative charge

**10.** When the dipole moment of an electric dipole in a uniform electric field rotates to become more nearly aligned with the field:

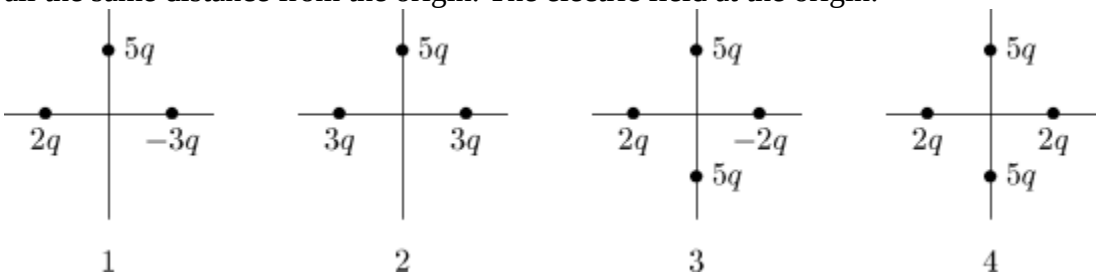
**A)** the field does positive work and the potential energy increases
**B)** the field does positive work and the potential energy decreases
**C)** the field does negative work and the potential energy increases
**D)** the field does negative work and the potential energy decreases
**E)** the field does no work

**11.** Two protons ($p_1$ and $p_2$) are on the *x* axis, as shown below. The directions of the electric field at points 1, 2, and 3, respectively, are:



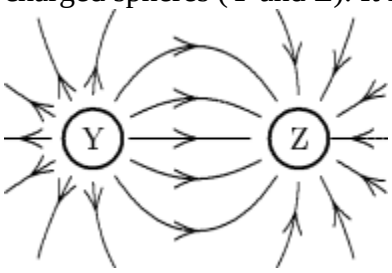

**A)** →, ←, →
**B)** ←, →, ←
**C)** ←, →, →
**D)** ←, ←, ←
**E)** ←, ←, →

**12.** The diagrams below depict four different charge distributions. The charged particles are all the same distance from the origin. The electric field at the origin:




**A)** is greatest for situation 1
**B)** is greatest for situation 3
**C)** is zero for situation 4
**D)** is downward for situation 1
**E)** is downward for situation 3

**13.** The diagram shows the electric field lines in a region of space containing two small charged spheres (Y and Z). It implies that:




**A)** Y is negative and Z is positive
**B)** the magnitude of the electric field is the same everywhere
**C)** the electric field is strongest midway between Y and Z
**D)** Y is positive and Z is negative
**E)** Y and Z must have the same sign

**14.** A possible unit for an electric field is:

**A)** J/(C · m)
**B)** J/C
**C)** J · C
**D)** J/m
**E)** none of these

**15.** An electron traveling north enters a region where the electric field is uniform and points west. The electron:

**A)** speeds up
**B)** slows down
**C)** veers east
**D)** veers west
**E)** continues with the same speed in the same direction

**16.** An electric field exerts a torque on an electric dipole only if:

**A)** the field is parallel to the dipole moment
**B)** the field is not parallel to the dipole moment
**C)** the field is perpendicular to the dipole moment
**D)** the field is not perpendicular to the dipole moment
**E)** the field is uniform

**17.** An electric field is most directly related to:

**A)** the momentum of a test charge
**B)** the kinetic energy of a test charge
**C)** the potential energy of a test charge
**D)** the force acting on a test charge
**E)** the charge carried by a test charge

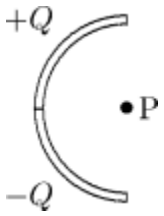
**18.** An isolated charged point particle produces an electric field with magnitude $E$ at a point 2 m away. At a point 1 m from the particle the magnitude of the field is:

**A)** $E$
**B)** $2E$
**C)** $4E$
**D)** $E/2$
**E)** $E/4$

**19.** An isolated charged point particle produces an electric field with magnitude $E$ at a point 2 m away from the charge. A point at which the field magnitude is $E/4$ is:

**A)** 1 m away from the particle
**B)** 0.5 m away from the particle
**C)** 2 m away from the particle
**D)** 4 m away from the particle
**E)** 8 m away from the particle

**20.** Positive charge $+Q$ is uniformly distributed on the upper half of a semicircular rod and negative charge $-Q$ is uniformly distributed on the lower half. What is the direction of the electric field at point P, the center of the semicircle?




**A)** ↑
**B)** ↓
**C)** ←
**D)** →
**E)** ↗

**21.** Two point particles, with charges of $q_1$ and $q_2$, are placed a distance $r$ apart. The electric field is zero at a point P between the particles on the line segment connecting them. This implies that:

**A)** $q_1$ and $q_2$ must have the same magnitude and sign
**B)** P must be midway between the particles
**C)** $q_1$ and $q_2$ must have the same sign but may have different magnitudes
**D)** $q_1$ and $q_2$ must have equal magnitudes and opposite signs
**E)** $q_1$ and $q_2$ must have opposite signs and may have different magnitudes

**22.** The magnitude of the electric field at a distance of 10 cm from an isolated point particle with a charge of $2 \times 10^{-9}$ C is:

**A)** 1.8 N/C
**B)** 180 N/C
**C)** 18 N/C
**D)** 1800 N/C
**E)** none of these

**23.** An electric dipole consists of a particle with a charge of $+ 6 \times 10^{-6}$ C at the origin and a particle with a charge of $-6 \times 10^{-6}$ C on the $x$ axis at $x = 3 \times 10^{-3}$ m. Its dipole moment is:

**A)** $1.8 \times 10^{-8}$ C · m, in the positive $x$ direction
**B)** $1.8 \times 10^{-8}$ C · m, in the negative $x$ direction
**C)** 0 because the net charge is 0
**D)** $1.8 \times 10^{-8}$ C · m, in the positive $y$ direction
**E)** $1.8 \times 10^{-8}$ C · m, in the negative $y$ direction

**24.** The magnitude of the force of a 400-N/C electric field on a point particle with a charge of 0.02 C is:

**A)** 8.0 N
**B)** $8 \times 10^{-5}$ N
**C)** $8 \times 10^{-3}$ N
**D)** 0.08 N
**E)** $2 \times 10^{11}$ N

**25.** Two thin spherical shells, one with radius $R$ and the other with radius $2R$, surround an isolated charged point particle. The ratio of the number of field lines through the larger sphere to the number through the smaller is:

**A)** 1
**B)** 2
**C)** 4
**D)** 1/2
**E)** 1/4

## Answer Key

**1.** D
**2.** D
**3.** C
**4.** D
**5.** C
**6.** B
**7.** D
**8.** A
**9.** A
**10.** B
**11.** E
**12.** C
**13.** D
**14.** A
**15.** C
**16.** B
**17.** D
**18.** C
**19.** D
**20.** B
**21.** C
**22.** D
**23.** B
**24.** A
**25.** A