**Static Electricity**

**Question 1:**

aa. **TRUE** or **FALSE:**

Electrostatic experiments work best on wet days because the presence of water conducts charge, allowing objects to easily gain a charge.

a. True b. False

**Question 2:**

aa. **TRUE** or **FALSE:**

A neutral object acquires a positive charge by gaining positive electrons from another object.

a. True b. False

**Question 3:**

aa. **TRUE** or **FALSE:**

If a neutral object acquires a charge of -1.6•10-19 C, then it has gained a few electrons.

a. True b. False

**Question 4:**

aa. **TRUE** or **FALSE:**

There are three kinds of electric charge - positive, negative and neutral.

a. True b. False

**Question 5:**

aa. **TRUE** or **FALSE:**

Like-charged objects repel each other and unlike-charged objects attract each other.

a. True b. False

**Question 6:**

aa. **TRUE** or **FALSE:**

Dragging your feet across the carpet on a dry day creates a charge.

a. True b. False

**Question 7:**

aa. **TRUE** or **FALSE:**

The unit of measurement used for charge is the ampere.

a. True b. False

**Question 8:**

aa. **TRUE** or **FALSE:**

Conductors cannot become charged by frictional rubbing.

a. True b. False

**Question 9:**

aa. **TRUE** or **FALSE:**

Induction charging requires that a charged object be touched to a neutral object.

a. True b. False

**Question 10:**

aa. **TRUE** or **FALSE:**

An electrical ground is a relatively large object which serves as an infinite reservoir of electrons.

a. True b. False

**Question 11:**

aa. **TRUE** or **FALSE:**

Field forces (such as electric force or gravitational force) do not exist when objects are in contact with each other.

a. True b. False

**Question 12:**

aa. **TRUE** or **FALSE:**

Electric field (**E**) is a vector quantity. Its direction at any given location is the direction of the force exerted upon any test charge placed at that location.

a. True b. False

**Question 13:**

aa. **TRUE** or **FALSE:**

As more and more positive charge accumulates on the dome of a Van de Graaff generator, the electric field strength increases; this causes air to ionize and can ultimately lead to a discharge and a visible *lightning bolt*.

a. True b. False

**Question 14:**

aa. **TRUE** or **FALSE:**

For irregularly-shaped conductors, the **E** field is greatest at locations where the conducting object is flattest.

a. True b. False

**Question 15:**

aa. **TRUE** or **FALSE:**

Lightning rods are placed on homes to protect them from lightning. They work because the electric field is weak around the lightning rods; thus, there is little flow of charge between the lightning rods/home and the charged clouds.

a. True b. False

**Question 16:**

aa. An object that is charged negatively has \_\_\_\_\_.

a. more protons than neutrons b. more electrons than protons

c. more protons than electrons d. more electrons than neutrons

**Question 17:**

aa. An object becomes charged positively in an electrostatic experiment if \_\_\_\_.

a. it gains some protons b. it loses some electrons

c. it loses all its electrons

**Question 18:**

aa. The unit of measurement used for electric charge is the \_\_\_\_\_.

a. e- b. Volt c. ampere

d. electron e. Coulomb

**Question 19:**

aa. A neutral atom contains \_\_\_\_\_.

a. only neutrons b. no protons nor neutrons

c. no protons nor electrons d. no charged particles whatsoever

e. the same number of protons as electrons

**Question 20:**

aa. Insulators are different than conductors in that insulators \_\_\_\_.

a. do not contain any charge b. do not allow charge to freely move

c. do not contain electrons or protons d. have a weaker affinity for electrons

**Question 21:**

aa. A balloon is charged by rubbing it with animal fur. It is then pressed against a wooden cabinet. The balloon and cabinet attract, seeming to defy the force of gravity. This attraction is best explained by \_\_\_\_.

a. induction charging of the wood b. frictional charging of the wood

c. polarization of wood molecules d. polarization of balloon molecules

**Question 22:**

aa. The effect of a charged balloon *sticking* to a cabinet is most often noticed for cabinets that are \_\_\_\_.

a. insulators b. conductors c. charged objects

**Question 23:**

aa. Coulomb's law can be stated in equation form as

**Felect = k·Q1·Q2/R2**

In this equation, **Q** stands for the \_\_\_\_\_.

a. mass of a charged object b. charge of a charged object

c. the current of a charged object d. the distance between charged objects

**Question 24:**

aa. Consider Coulomb's law equation and the diagram at the right. The **R** (or **d**) in the denominator of the equation represents the distance from \_\_\_.

a. A to B b. A to D c. A to G d. B to C

e. B to D ab. B to F ac. C to D ad. C to E

**Question 25:**

aa. Electrostatic forces are examples of \_\_\_\_ forces.

a. field b. contact c. gravitational

**Question 26:**

aa. Materials through which electrons can move readily are classified as \_\_\_\_\_.

a. insulators b. conductors c. semi-conductors

**Question 27:**

aa. A metal sphere rests upon an insulating stand. The metal sphere is charged positively. When touched by a plastic straw, the metal sphere \_\_\_\_\_.

a. loses its positive charge

b. acquires a negative charge

c. acquires even more positive charge

d. is not affected since plastic is an insulator

**Questions 28-29:**

aa. Charged rubber rods are placed near a neutral conducting sphere, causing a redistribution of charge on the spheres. Which of the diagrams below depict the proper distribution of charge on the spheres? Select all that apply.



aa. In the above situation with the charged rubber rod held near the conducting sphere, the conducting sphere is \_\_\_\_. Select all that apply.

a. polarize b. charged c. uncharged (neutral)

**Question 30:**

aa. Field forces are distinctly different than contact forces in that \_\_\_\_. Select all that apply.

a. they are capable of acting over spatial separations

b. they are generally much greater in magnitude than contact forces

c. the value is inversely proportional to the square of the separation distance

d. they produce an effect even when the objects experiencing them do not touch

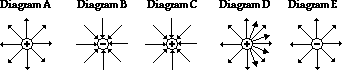
**Question 31:**

aa. An object is negatively charged. The electric field at locations surrounding the object is directed \_\_\_\_.

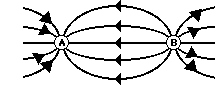
a. radially inwards b. radially outwards c. ... insufficient info to tell

**Question 32:**

aa. Electric field lines for several objects are shown below.



Which of these diagrams depict the proper rules of drawing electric field lines? Select all that apply.

**Question 33:**

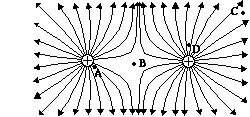
aa. Consider the electric field lines shown in the diagram at the right. From the diagram, it is apparent that object A is \_\_\_\_ and object B is \_\_\_\_.

a. -, + b. -, -

c. +, + d. +, -

e. insufficient info

**Question 34:**

aa. Consider the electric field lines drawn at the right for a configuration of two charges. Several locations are labeled on the diagram. Rank these locations in order of the electric field strength - from smallest to largest.

Smallest:

Largest:

**Questions 35-39:**

Suppose Object A creates an electric field. Object B - a test charge - is placed a distance **R** away in order to test the strength of the electric field (**E**) created by object A. The E value is given by the two equations:

Equation 1: **E = F / q**

Equation 2: **E = k·Q/R2**

aa. In **Equation 1** above, **q** stands for the charge of \_\_\_\_\_\_.

a. object A b. object B

c. ... nonsense! It matters not - either A or B

aa. In **Equation 2** above, **Q** stands for the charge of \_\_\_\_\_\_

a. object A b. object B

c. ... nonsense! It matters not - either A or B

aa. The charge of object A is doubled. This causes the electric field strength to \_\_\_.

a. double b. halve c. quadruple d. quarter

e. none of these

aa. The charge of object B is doubled. This causes the electric field strength to \_\_\_.

a. double b. halve c. quadruple d. quarter

e. none of these

aa. The distance between object A and object B is doubled. This causes the electric field strength to \_\_\_.

a. double b. halve c. quadruple d. quarter

e. none of these

**Question 40:**

aa. The unit on electric field strength is the \_\_\_\_\_\_.

a. Volt (V) b. Coulomb (C)

c. Newton/Coulomb (N/C) d. none of these

**Question 41:**

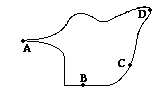
aa. When the sphere of a Van de Graaff generator gathers a charge, the charge \_\_\_.

a. resides only on the surface of the sphere

b. resides both on its surface and throughout its volume

c. resides mostly inside the sphere and only emerges outside when touched

**Question 42:**

aa. A diagram of an irregularly-shaped conductor is shown at the right. Four locations along the surface are labeled - A, B, C, and D. Rank these locations in increasing order of the strength of their electric field, beginning with the smallest electric field.

Smallest:

Largest:

**Question 43:**

aa. Two negatively charged objects will \_\_\_\_\_.

a. attract b. repel c. not interact with

**Question 44:**

aa. Two positively-charged objects will \_\_\_\_\_.

a. attract b. repel c. not interact with

**Question 45:**

aa. A positively-charged and a negatively-charged object will \_\_\_\_\_.

a. attract b. repel c. not interact with

**Question 46:**

aa. A positively-charged object and a neutral object will \_\_\_\_\_.

a. attract b. repel c. not interact with

**Question 47:**

aa. A negatively-charged object and a neutral object will \_\_\_\_\_.

a. attract b. repel c. not interact with

**Question 48:**

aa. Two objects with the same type of charge will \_\_\_\_\_.

a. always repel each other

b. always attract each other

c. neither attract nor repel each other

d. usually attract each other, but on rare occasions repel each other

e. usually repel each other, but on rare occasions attract each other

**Question 49:**

aa. In typical electrostatic experiments, protons cannot be gained nor lost from an atom because they are \_\_\_\_\_.

a. negatively charged

b. positively charged

c. less massive than electrons

d. tightly bound in the atom’s nucleus

e. loosely bound outside the atom’s nucleus

ab. more massive than electrons

ac. ... nonsense! Protons could be gained or lost from any atom.

**Question 50:**

aa. A neutral object becomes positively-charged in an electrostatic demonstration by \_\_\_\_\_.

a. losing protons to another object

b. losing electrons to another object

c. gaining protons from another object

d. gaining electrons from another object

e. creating additional electrons to add to its usual number

ab. creating additional protons to add to its usual number

**Question 51:**

aa. A neutral object becomes negatively-charged in an electrostatic demonstration by \_\_\_\_\_.

a. losing protons to another object

b. losing electrons to another object

c. gaining protons from another object

d. gaining electrons from another object

e. creating additional electrons to add to its usual number

ab. creating additional protons to add to its usual number

**Question 52:**

aa. The charges on several spheres are shown. (Note that there are 8 individual charge signs on each sphere.)



Which spheres are positively-charged? Circle all that apply.

**Question 53:**

aa. A plastic golf tube is rubbed with animal fur and becomes charged. The plastic's affinity for electrons is greater than the fur's affinity for electrons. The result of the process is that \_\_\_\_\_. Choose two answers.

a. the animal fur remains neutral

b. the plastic golf tube remains neutral

c. the animal fur becomes charged negatively

d. the animal fur becomes charged positively

e. the plastic golf tube becomes charged negatively

ab. the plastic golf tube becomes charged positively

**Question 54:**

aa. A strip of tape - labeled **A** - is placed upon the table. A second strip of tape - labeled **B** - is placed on top of it. The two pieces of tape are pulled off the table and then suddenly pulled apart from each other. How could you tell which piece of tape is charged negatively?

a. Bring each tape near some neutral paper bits; the one that repels the paper bits is negative.

b. Bring each tape near some neutral paper bits; the one that attracts the paper bits is negative.

c. Bring each tape near a negatively-charged balloon; the one which attracts the balloon is negative.

d. Bring each tape near a negatively-charged balloon; the one which repels the balloon is negative.

e. Bring each tape near some neutral paper bits; the one that doesn't interact with the paper bits is negative.

**Question 55:**

aa. The law of conservation of charge would suggest that charges are neither created nor destroyed. This implies that \_\_\_\_\_.

a. once an object becomes charged, it will keep its charge forever

b. an object can acquire a charge; but that charge will eventually disappear

c. objects become charged positively and negatively by the transfer of electrons

d. objects don't ever acquire a charge; their protons and electrons simply separate apart

e. in an ideal world without friction or air resistance, charges always maintain a constant speed

**Question 56:**

aa. Materials through which charges have difficulty moving are called \_\_\_\_.

a. insulators b. conductors c. electators

d. engineers e. polar materials

**Question 57:**

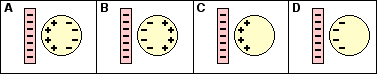
aa. Materials through which charges move easily are called \_\_\_\_.

a. insulators b. conductors c. electators

d. engineers e. polar materials

**Question 58:**

aa. A metal sphere (shown in yellow below) is neutral. A negatively-charged plastic golf tube (shown in *pink* below) is brought near to it.



Which one of the diagrams best represents the charge distribution on the neutral metal sphere when the negatively-charged plastic tube is held nearby?

**Question 59:**

aa. Two objects with the opposite type of charge will \_\_\_\_\_.

a. always repel each other

b. always attract each other

c. neither attract nor repel each other

d. usually repel each other, but on rare occasions attract each other

e. usually attract each other, but on rare occasions repel each other

**Question 60:**

aa. A neutral object and a charged object will \_\_\_\_\_.

a. always attract each other

b. always repel each other

c. neither attract nor repel each other

d. attract if the charged object is charged with a negative type of charge

e. repel if the charged object is charged with a negative type of charge

ab. repel if the charged object is charged with a positive type of charge

ac. attract if the charged object is charged with a positive type of charge

**Questions 61-63:**

Two charged strips of tape are hung from a horizontal bar. Tape A is positively charged and tape B is negatively charged.

aa. A third object - object C - is observed to repel tape A. Object C will \_\_\_\_\_ tape B.

a. also repel  b. certainly attract c. neither attract nor repel

d. either attract or repel (but you can't be certain of which)

e. ... nonsense! You can't be that sure of anything in this life.

aa. A fourth object - object D - is observed to attract tape A. Object D will \_\_\_\_\_ tape B.

a. also repel  b. certainly attract c. neither attract nor repel

d. either attract or repel (but you can't be certain of which)

e. ... nonsense! You can't be that sure of anything in this life.

aa. A fifth object - object E - is observed to attract both tape A and tape B. Object E is \_\_\_\_\_.

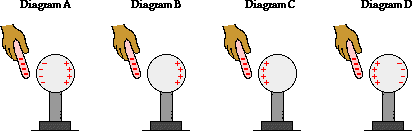
a. bipolar b. indecisive c. charged negatively

d. electrically neutral e. charged positively

ab. an impartial charge

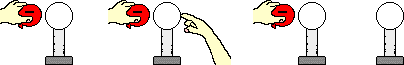
**Question 64:**

aa. A negatively-charged object is brought near to but not touching a **neutral** conducting sphere. How would charge distribute itself on the **neutral** sphere?



**Questions 65-68:**

A negatively-charged balloon is brought near a neutral conducting sphere. While the balloon is near, the sphere is touched (grounded). The ground is removed, while the balloon is still near.



aa. The sphere is being charged by the method of \_\_\_\_.

a. conduction b. deduction c. induction

d. oxidation e. friction ab. reduction

aa. The sphere will acquire a \_\_\_\_ charge as a result of this process. (1 allowed attempt)

a. positive b. negative

aa. The balloon will \_\_\_\_\_.

a. become neutral

b. become positive

c. maintain the same amount of negative charge

d. lose a bit of its negative charge, but still remain negative

e. ... nonsense! It is impossible to predict the ultimate charge of the balloon.

aa. The sphere acquired its charge by \_\_\_\_\_.

a. losing protons to the balloon b. losing electrons to the balloon

c. gaining electrons from the balloon d. gaining protons from the balloon

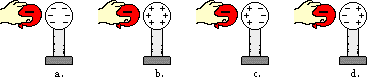
e. losing protons to the finger(ground) ab. losing electrons to the finger(ground)

ac. gaining electrons from the finger(ground)

ad. gaining protons from the finger(ground)

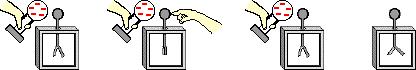
**Question 69:**

aa. A negatively-charged balloon is brought near a neutral conducting sphere as shown below. As it approaches, charge within the sphere will distribute itself in a very specific manner. Which one of the diagrams below properly depicts the distribution of charge in the sphere?



**Questions 70-72:**

A negatively-charged metal sphere is brought near a neutral *leaf electroscope*. While the metal sphere is near, the electroscope is touched (grounded). The ground is removed, while the sphere is still near.



aa. The *leaf electroscope* is being charged by the method of \_\_\_\_.

a. conduction b. deduction c. induction

d. oxidation e. friction ab. reduction

aa. The *leaf electroscope* will acquire a \_\_\_\_ charge as a result of this process. (1 allowed attempt)

a. positive b. negative

aa. The *leaf electroscope* acquired its charge by \_\_\_\_\_.

a. losing protons to the finger(ground)

b. losing electrons to the finger(ground)

c. losing protons to the charged sphere

d. losing electrons to the charged sphere

e. gaining protons from the charged sphere

ab. gaining electrons from the charged sphere

ac. gaining protons from the finger(ground)

ad. gaining electrons from the finger(ground)

**Question 73:**

aa. Suppose that the leaves of an electroscope deflect outward from their natural vertical position. This is an indication that the electroscope has acquired \_\_\_\_\_.

a. a positive charge

b. a negative charge

c. an electrically neutral condition

d. an electrical charge - either positive or negative

e. a positive charge in one leaf and a negative charge in the other

**Question 74:**

aa. A *leaf electroscope* is charged with an unknown type of charge. A negatively-charged object is brought nearby the knob of the electroscope and the leaves deflect even further. This is evidence that the electroscope is charged with a \_\_\_\_\_ type of charge.

a. negative b. positive

c. ... nonsense! There is insufficient evidence to conclude what type of charge is on the electroscope.

**Question 75:**

aa. A *leaf electroscope* is charged with a positive charge. The leaves are deflected from their vertical position. Object **A** is brought nearby and the leaves of the electroscope are unaffected. This is evidence that Object **A** is \_\_\_\_\_.

a. negatively charged b. electrically neutral

c. positively charged

**Question 76:**

aa. An aluminum plate is charged positively. The plate is brought near to the knob of a *leaf electroscope*. The aluminum plate is touched to the knob and the leaves are deflected from the vertical position. In this example, the electroscope \_\_\_\_\_.

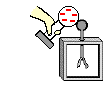
a. has become polarized

b. is acting somewhat magical

c. has been charged by the process of induction

d. has been charged by the process of conduction

**Questions 77-79:**

A conducting metal sphere is placed upon an insulating stand. The sphere is then given a negative charge. The sphere is then touched to the knob of a neutral electroscope.

aa. The electroscope becomes charged with a \_\_\_\_\_. (1 allowed attempt)

a. negative charge b. positive charge

c. ... nonsense! This would not charge the electroscope

aa. The electroscope acquires this type of charge because \_\_\_\_\_.

a. electrons are transferred from the electroscope to the metal sphere

b. protons are transferred from the metal sphere to the electroscope

c. protons are transferred from the electroscope to the metal sphere

d. electrons are transferred from the metal sphere to the electroscope

aa. As a result of the charging process, the metal sphere \_\_\_\_.

a. becomes positively charged

b. becomes electrically neutral

c. remains negatively charged

**Question 80:**

aa. A metal sphere is electrically neutral. It is touched by a positively-charged metal rod. As a result, the metal sphere becomes charged by conduction. This occurs because the metal sphere \_\_\_\_\_.

a. lost protons to the rod b. lost electrons to the rod

c. gained protons from the rod d. lost negative protons to the rod

e. gained positive electrons from the rod

ab. gained negative electrons from the rod

ac. ... nonsense. The metal sphere would acquire a negative charge.

**Question 81:**

aa. Charged plastic tubes are placed near a neutral conducting sphere, causing a redistribution of charge on the spheres. Which of the diagrams below depict the proper distribution of charge on the neutral spheres? Select all that apply.



**Question 82:**

aa. The electrical force between two objects is 36.0 N. If the distance between the objects is tripled, the force between them will be \_\_\_\_\_ N.

a. 4.00 b. 9.00 c. 12.0 d. 18.0 e. 36.0

ab. 72.0 ac. 108 ad. 144 ae. 324

**Question 83:**

aa. The electrical force between two objects is 36.0 N. If the charge on one of the objects is doubled, the force between them will be \_\_\_\_\_ N.

a. 4.00 b. 9.00 c. 12.0 d. 18.0 e. 36.0

ab. 72.0 ac. 108 ad. 144 ae. 324

**Question 84:**

aa. The electrical force between two objects is 36.0 N. If the charge on BOTH of the objects is doubled, the force between them will be \_\_\_\_\_ N.

a. 4.00 b. 9.00 c. 12.0 d. 18.0 e. 36.0

ab. 72.0 ac. 108 ad. 144 ae. 324

**Question 85:**

aa. The electrical force between two objects is 36.0 N. If the charge on one of the objects is tripled, the force between them will be \_\_\_\_\_ N.

a. 4.00 b. 9.00 c. 12.0 d. 18.0 e. 36.0

ab. 72.0 ac. 108 ad. 144 ae. 324

**Question 86:**

aa. The electrical force between two objects is 36.0 N. If the charge on one of the objects is cut in half, the force between them will be \_\_\_\_\_ N.

a. 4.00 b. 9.00 c. 12.0 d. 18.0 e. 36.0

ab. 72.0 ac. 108 ad. 144 ae. 324

**Question 87:**

aa. The amount of charge possessed by one electron is \_\_\_\_\_\_ C.

a. 1.00 x 10-6 b. 6.24 x 10+1 c. 1.60 x 10-19 d. 1.0

**Question 88:**

aa. The electrical force between two objects depends on the \_\_\_\_\_.

a. charge on and size of the objects

b. mass of and size of the objects

c. mass of and charge on the objects

d. mass of and distance between the objects

e. charge on and distance between the objects

**Question 89:**

aa. Which of the following would cause the electrical force between two objects to increase? Select all that apply.

a. decrease the charge on one object

b. increase the charge on both objects

c. increase the mass of one object

d. decrease the charge on both objects

e. increase the distance between the objects' centers

**Question 90:**

aa. Which of the following would cause the electrical force between two objects to increase? Select all that apply.

a. increase the charge on one object

b. increase the charge on both objects

c. decrease the mass of one object

d. decrease the charge on both objects

e. decrease the distance between the objects' centers

**Question 91:**

aa. Doubling the distance (i.e., increasing by a factor of two) between two charged objects will cause the electrical force between them to be \_\_\_ the initial force.

a. the same as b. twice c. three times d. four times

e. one-half ab. one-third ac. one-fourth

**Question 92:**

aa. Halving the distance (i.e., decreasing by a factor of two) between two charged objects will cause the electrical force between them to be \_\_\_ the initial force.

a. the same as b. twice c. three times d. four times

e. one-half ab. one-third ac. one-fourth

**Question 93:**

aa. In what ways are gravitational forces and electrical forces similar to each other?

a. Both forces can act from a distance, even when the objects are not touching.

b. The two forces are similar to each other in this manner.

c. This statement does not describe how the two forces are similar.

**Question 94:**

aa. In what ways are gravitational forces and electrical forces similar to each other?

a. Both forces can be attractive or repulsive.

b. The two forces are similar to each other in this manner.

c. This statement does not describe how the two forces are similar.

**Question 95:**

aa. In what ways are gravitational forces and electrical forces similar to each other?

a. The magnitude of each force varies with varying distance of separation.

b. The two forces are similar to each other in this manner.

c. This statement does not describe how the two forces are similar.

**Question 96:**

aa. In what ways are gravitational forces and electrical forces similar to each other?

a. For a unit of charge (1 C) or a unit of mass (1 kg) held a distance of 1-meter apart, the magnitude of the force is very large.

b. The two forces are similar to each other in this manner.

c. This statement does not describe how the two forces are similar.

**Question 97:**

aa. In what ways are gravitational forces and electrical forces similar to each other?

a. Both forces depend upon the size of the object.

b. The two forces are similar to each other in this manner.

c. This statement does not describe how the two forces are similar.

**Question 98:**

aa. In what ways are gravitational forces and electrical forces similar to each other?

a. Both forces vary inversely with the square of the distance of separation.

b. The two forces are similar to each other in this manner.

c. This statement does not describe how the two forces are similar.

**Question 99:**

aa. A positive charge creates an electric field. The direction of the electric field in the space surrounding the positive source charge would be \_\_\_\_.

a. toward the source charge

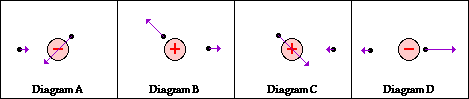
b. away from the source charge

c. dependent upon whether the test charge is positive or negative

d. none of these

**Question 100:**

aa. In the diagrams below, a source charge is shown (the larger objects - looking good in *pink*). The purple arrows represent the direction of the electric field vectors are various locations. Which of the diagrams show the proper direction and relative size of the electric field vectors?



**Questions 101-103:**

aa. Charged objects A and B exert forces upon each other. Object B experiences object A's attraction or repulsion \_\_\_\_\_.

a. only when they are touching

b. at all locations surrounding object A

c. only when it is very close

aa. (continued from the previous question) … Therefore, object A is thought to \_\_\_\_\_.

a. be electrically sensitive

b. be an electrically sticky object

c. change the properties of space

aa. (continued from the previous question) … Object A creates an electric\_\_\_\_\_ with which object B interacts and thus experiences the influence.

a. field b. web c. voltage d. circuit

**Question 104:**

aa. When measuring an electric field created by a source charge at a given location in space, it is important that the test charge being used possesses a small amount of charge. This is important because a large test charge could \_\_\_\_\_.

a. create an electric field of its own and interfere with the measurement

b. repel or attract the charge on the source and thus change its location

c. create an action-reaction force which makes the measuremnt impossible

d. be dangerous and possibly result in a potentially hazardous *lightning discharge*

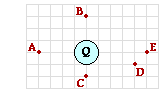
**Question 105:**

aa. A source charge **Q** creates an electric field. A small test charge **q'** experiences a force of **F** when placed a few meters from the source charge. The strength of the electric field at this location is equal to \_\_\_\_\_.

a. **F** / **Q** / **q'** b.Q • **q'** c. **F**

d. **F** / **q'** e. **Q** • **q'** / **F** ab. **F** / **Q**

**Question 106:**

aa. A source charge **Q** creates an electric field; a test charge **q '** is placed at various labeled locations from the charge **q** as shown in the diagram. Rank the five locations in order of increasing electric field strength, beginning with the smallest.

Smallest:

Largest:

**Calculations and Long Answer:**

**Question 107:**

aa. Two point charges of equal magnitude repel each other with a force of 4.07 Newton when separated by 12.1 cm. Find the quantity of charge (in Coulomb).

**Question 108:**

aa. Calculate the net charge (in Coulombs) on an object consisting of 7.39x1025 protons and 3.69x1025 electrons. Use a + or – sign to indicate the type of charge.

**Question 109:**

aa. Calculate the net charge (in Coulombs) on an object consisting of an excess of 3.78x1013 electrons. Include a + or – sign to indicate charge type.

**Question 110:**

aa. Two point charges with 6.98x10-9 C and 6.44x10-9 C of charge are separated by a distance of 0.404 m. Find the electric force (in Newton) with which the two objects interact.

**Question 111:**

aa. Two objects charged with an equal amount of charge each other with a force of 3.62 Newton when separated by a distance of 16.9 cm. Determine the magnitude of the charge (in Coulombs).

**Question 112:**

aa. The strength of the electric field is 4.95x108 N/C at a particular location. The field is directed east to west. Determine the magnitude and direction of the force (in Newton) acting upon a proton when placed at this location. Include the direction (east, west, etc.) in your answer.

**Question 113:**

aa. The magnitude of the electric field at a certain location is 4.95x108 N/C. The field is directed east to west. Calculate the magnitude and identify the direction of the force (in Newton) acting on a proton placed at this point.

**Question 114:**

aa. An electron has a charge and thus creates an electric field. Calculate the magnitude and identify the direction (toward or away from the electron) of the electric field at a location that is 1.24 centimeters from an electron.

**Question 115:**

aa. A 2.5-gram rubber balloon is charged to 1.57x10-6 Coulomb and suspended from the ceiling. A sample of animal fur is charged to 5.62x10-6 Coulomb. Assuming that the fur and the balloon act as *point charges*, determine the distance (in mm) of separation required to produce a force of 5.05 Newton.

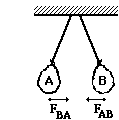
**Question 116:**

aa. The electric field at a location that is 0.648 m from a source charge has a magnitude of 406 N/C. How much charge is on the source?

**Question 117:**

aa. Two point charges with +6.89x10-9 C and +5.75x10-9 C of charge are spaced a distance of 3.01 cm (from their centers). Calculate the strength of the electric field at a location that is midway between their centers.

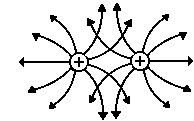
**Question 118:**

aa. The diagram at the right depicts two charged balloons suspended from the ceiling. A student asserts that:

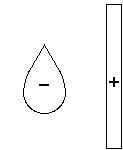
The balloons are hanging motionless because of Newton's third law. Balloon A exerts a repulsive force on balloon B and balloon B exerts an equal and opposite repulsive force on balloon A.

Evaluate the physics behind the student's statement. Be logical and reasonable.

**Question 119:**

aa. Erin Agin drew the following electric field lines for a configuration of two charges. What did Erin do wrong? Explain.

**Question 120:**

aa. Diagram the electric field lines for the following configuration of two objects. Place arrows on your field lines.

**Question 121:**

aa. One of Mr. H's first demonstrations with the Van de Graaff generator involved slowly approaching the dome holding a paper clip stretched towards the device. Explain why Mr. H did not become *toast* when approaching the machine with the pointed object protruding forward.