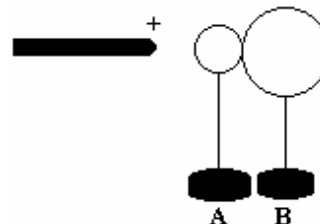


EL FORCE and EL FIELD HW-PRACTICE 2016

1. A difference between electrical forces and gravitational forces is that electrical forces include
 - a. separation distance.
 - b. repulsive interactions.
 - c. the inverse square law.
 - d. infinite range.
 - e. none of the above
2. In a good insulator, electrons are usually
 - a. free to move around.
 - b. free to move around after an impurity has been added.
 - c. semi-free to move around.
 - d. tightly bound in place.
 - e. not moving at all.
3. A conducting sphere has a net charge of $-4.8 \times 10^{-17} \text{ C}$. What is the approximate number of excess electrons on the sphere?
 - a. 100
 - b. 200
 - c. 300
 - d. 400
 - e. 500
4. When a hard rubber rod is given a negative charge by rubbing it with wool:
 - a. positive charges are transferred from rod to wool
 - b. negative charges are transferred from rod to wool
 - c. positive charges are transferred from wool to rod
 - d. negative charges are transferred from wool to rod
 - e. negative charges are created and stored on the rod
5. An electrical insulator is a material:
 - a. containing no electrons
 - b. through which electrons do not flow easily
 - c. which has more electrons than protons on its surface
 - d. cannot be a pure chemical element
 - e. must be a crystal
6. A conductor is distinguished from an insulator with the same number of atoms by the number of:
 - a. nearly free atoms
 - b. electrons
 - c. nearly free electrons
 - d. protons
 - e. molecules

7. Two uncharged, conducting spheres, **A** and **B**, are held at rest on insulating stands and are in contact. A positively charged rod is brought near sphere **A** as suggested in the figure. While the rod is in place, the two spheres are separated. How will the spheres be charged, *if at all*?



- | | <i>Sphere A</i> | <i>Sphere B</i> |
|----|-----------------|-----------------|
| a. | positive | positive |
| b. | positive | negative |
| c. | zero | zero |
| d. | negative | positive |
| e. | negative | negative |

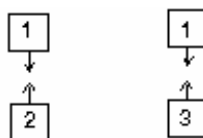
7a. Two uncharged conducting spheres, **A** and **B**, are suspended from insulating threads so that they touch each other. While a negatively charged rod is held *near, but not touching* sphere **A**, the two spheres are separated. How will the spheres be charged, *if at all*?



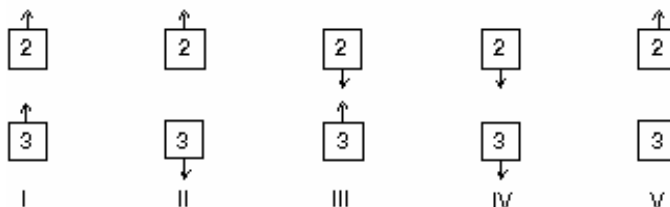
Sphere **A** Sphere **B**

- | | | |
|----|---|---|
| a. | 0 | + |
| b. | - | 0 |
| c. | + | - |
| d. | 0 | 0 |
| e. | - | + |

8. The diagram shows two pairs of heavily charged plastic cubes. Cubes 1 and 2 attract each other and so do cubes 1 and 3.



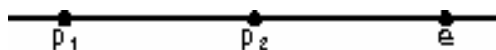
Which of the following illustrates the forces of 2 on 3 and 3 on 2?



9. At what separation will two charges, each of magnitude $6 \mu\text{C}$, exert a force of 1.4 N on each other?
- 0.48 m
 - $5.1 \times 10^{-6} \text{ m}$
 - 0.23 m
 - 40 m
 - 2.0 m
10. Two positive point charges Q and $2Q$ are separated by a distance R . If the charge Q experiences a force of magnitude F when the separation is R , what is the magnitude of the force on the charge $2Q$ when the separation is $2R$?
- F
 - $F/4$
 - $4F$
 - $2F$
 - $F/2$
11. Two small charged objects repel each other with a force F when separated by a distance d . If the charge on each object is reduced to one-fourth of its original value and the distance between them is reduced to $d/2$ the force becomes:
- $F/16$
 - $F/8$
 - $F/4$
 - $F/2$
 - F

12. A 5.0-C charge is 10 m from a -2.0 -C charge. The electrostatic force is on the positive charge is:
- 9.0×10^8 N toward the negative charge
 - 9.0×10^8 N away from the negative charge
 - 9.0×10^9 N toward the negative charge
 - 9.0×10^9 N away from the negative charge
 - none of these
13. Two identical charges, 2.0 m apart, exert forces of magnitude 4.0 N on each other. The value of either charge is:
- 1.8×10^{-9} C
 - 2.1×10^{-5} C
 - 4.2×10^{-5} C
 - 1.9×10^5 C
 - 3.8×10^5 C

14. Two protons (p_1 and p_2) and an electron (e) lie on a straight line, as shown. The directions of the force of p_2 on p_1 , the force of e on p_1 , and the total force on p_1 , respectively, are:



- $\rightarrow, \leftarrow, \rightarrow$
 - $\leftarrow, \rightarrow, \rightarrow$
 - $\rightarrow, \leftarrow, \leftarrow$
 - $\leftarrow, \rightarrow, \leftarrow$
 - $\leftarrow, \leftarrow, \leftarrow$
15. Two protons (p_1 and p_2) and an electron (e) lie on a straight line, as shown. The directions of the force of p_1 on e , the force of p_2 on e , and the total force on e , respectively, are:

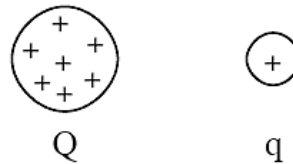


- $\rightarrow, \leftarrow, \rightarrow$
 - $\leftarrow, \rightarrow, \rightarrow$
 - $\rightarrow, \leftarrow, \leftarrow$
 - $\leftarrow, \rightarrow, \leftarrow$
 - $\leftarrow, \leftarrow, \leftarrow$
16. Two particles have charges Q and $-Q$ (equal magnitude and opposite sign). For a net force of zero to be exerted on a third charge it must be placed:
- midway between Q and $-Q$
 - on the perpendicular bisector of the line joining Q and $-Q$, but not on that line itself
 - on the line joining Q and $-Q$, to the side of Q opposite $-Q$
 - on the line joining Q and $-Q$, to the side of $-Q$ opposite Q
 - at none of these places (there is no place)
17. Two point charges, initially 2 cm apart, are moved to a distance of 10 cm apart. By what factor do the resulting electric and gravitational forces between them change?
- 5
 - 25
 - 1/5
 - 1/25
18. If the charge and mass are tripled for two identical charges maintained at a constant separation, the electric and gravitational forces between them will be changed by what factor?
- 9
 - 2/3
 - 1/9
 - 3

19. The electric field around an isolated electron has a certain strength 1 cm from the electron. The electric field strength 2 cm from the electron is
- half as much.
 - the same.
 - twice as much.
 - four times as much.
 - none of the above
20. A beam of electrons accelerates from the back of your TV set to the screen. In order to make the beam hit the top of the screen, oppositely charged parallel plates create a vertical electric field. How will the top plate be charged?
- Positively
 - Negatively
21. Two parallel plates are oppositely charged. The left plate is negative and the right plate is positive. In which direction does the electric field point?
- To the right
 - To the left
22. Which of the following statements is not true?
- Electric charge is quantized.
 - Electric charge is conserved.
 - The force between two point charges is proportional to the sum of the charges.
 - The force between two point charges is proportional to the inverse square of the separation of the charges.

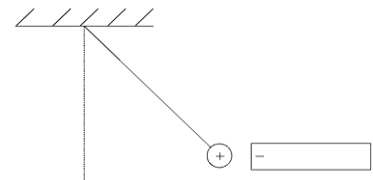
23. A positive test charge q is released near a positive fixed charge Q

As q moves away from Q , it will move with

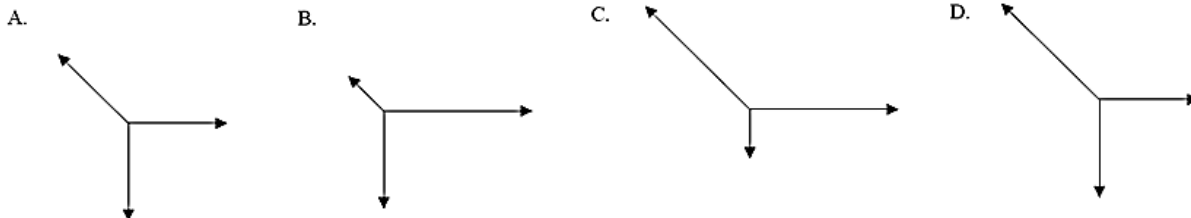


- constant velocity.
- constant acceleration.
- increasing acceleration.
- decreasing acceleration.

24. A small electrically charged sphere is suspended vertically from a thread. An oppositely charged rod is brought close to the sphere such that the sphere is in equilibrium when displaced from the vertical by an angle of 45° .



Which **one** of the following best represents the free body diagram for the sphere?



25. Three equal point charges X, Y and Z are fixed in the positions shown.



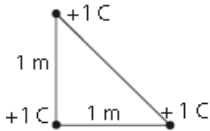
The distance between q_1 and q_2 and the distance between q_2 and q_3 is 1.0 m.
 The electric force between the charges at X and Y is F .
 The electric force between the charges at X and Z is

- A. $F/2$.
- B. $F/\sqrt{2}$.
- C. F .
- D. $2F$.

26. Calculate the force acting between two point charges of $+10.0 \mu\text{C}$ and $-5.0 \mu\text{C}$ separated by a distance of 10.0 cm in a vacuum.

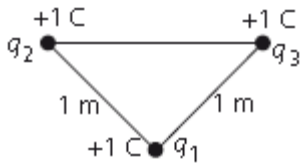
27. The force between two point charges is 20.0 N. If one charge is doubled, the other charge tripled and the distance between them is halved, calculate the resultant force between them.

28. Charges of $+1\text{C}$ are located at the corners of a 45 rightangled triangle as shown in the Figure below.



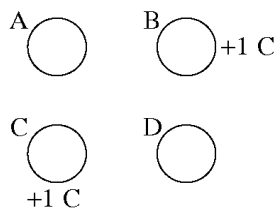
Determine the resultant force on the charge located at the right angle.

29. Charges of $+1\text{C}$ are located at the corners of a 45 rightangled triangle as shown in the Figure below.



Determine the resultant force on the charge located at the right angle.

29.a



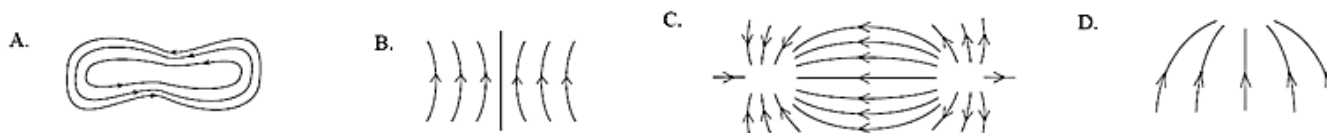
Four charges—A, B, C, and D—are at the corners of a square. Charges A and D, on opposite corners, have equal charge, whereas both B and C have a charge of 1.0 C. If the force on B is zero, what is the charge on A?

- a. -1.0 C b. -0.20 C c. -0.35 C d. -0.71 C

29.b Two charges are located on the positive x -axis of a coordinate system. Charge $q_1 = 2.00 \times 10^{-9}\text{ C}$, and it is 0.02 m from the origin. Charge $q_2 = -3.00 \times 10^{-9}\text{ C}$, and it is 0.04 m from the origin. What is the electric force exerted by these two charges on a third charge, $q_3 = 5.00 \times 10^{-9}$, located at the origin?

- a. $2.2 \times 10^{-4}\text{ N}$ b. $1.4 \times 10^{-4}\text{ N}$ c. $3.1 \times 10^{-4}\text{ N}$ d. $8.4 \times 10^{-4}\text{ N}$

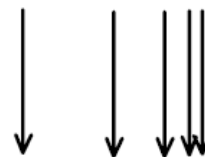
30. Which **one** of the field patterns below could be produced by two point charges?



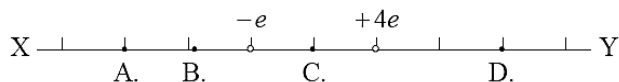
31. The distribution of electric field lines in a certain region of space varies as shown in the figure.

The magnitude of the electric field in this region

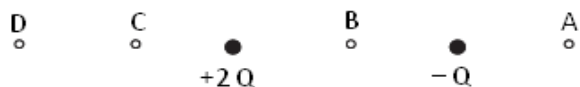
- A. increases to the right.
 B. decreases to the right.
 C. increases in the downward direction.
 D. decreases in the downward direction.



32. Two charges of $-e$ and $+4e$ are fixed at the positions shown below. At which position along the line XY is the electric field due to these charges equal to zero?



33. The diagram below shows two stationary point charges $+2Q$ and $-Q$.



At which point is the electric field strength greatest?

- A. A B. B C. C D. D

34. A point charge of $25 \mu\text{C}$ experiences a force of $1.0 \times 10^{-4} \text{ N}$. Calculate the electric field strength producing this force.
35. Calculate the electric field strength 1.5 cm from a point charge of $1.00 \times 10^2 \text{ pC}$ in a vacuum.
37. If an object is given a positive charge, does its mass increase, decrease, or stay the same? Explain.
38. If an object is given a negative charge, does its mass increase, decrease, or stay the same? Explain.
39. Explain why a comb that has been rubbed through your hair attracts small bits of paper, even though the paper is uncharged.
40. Small bits of paper are attracted to an electrically charged comb, but as soon as they touch the comb they are strongly repelled. Explain this behavior.
41. Explain what happens when you vigorously rub your wool socks on a carpeted floor, touch a metal doorknob, and get a shock.
42. A charged rod is brought near a suspended object, which is repelled by the rod. Can we conclude that the suspended object is charged? Explain.

43. A charged rod is brought near a suspended object, which is attracted to the rod. Can we conclude that the suspended object is charged? Explain.
44. An electron (charge $-e$) orbits a helium nucleus (charge $+2e$). Is the force exerted on the helium nucleus by the electron greater than, less than, or the same as the force exerted on the electron by the helium nucleus?
45. An electron and a proton are released from rest in space far from any other objects. The particles move toward each other, due to their mutual electrical attraction. When they meet, are they (a) midway between their initial positions, (b) closer to the initial position of the electron, or (c) closer to the initial position of the proton? Explain.
46. An electron with the velocity v and located infinitely far away moves directly toward another electron that is free and at rest. What will happen to each electron?
47. Given the (comparatively) vast spaces between atoms, why don't we simply fall through the floor?
48. Consider the three electric charges shown. List the charges in order of the magnitude of the force they experience, starting with the smallest.
-
49. In the operating room, technicians and doctors must take care not to create an electric spark, since the presence of oxygen gas used during an operation increases the risk of a deadly fire. Should the operating room personnel wear shoes that are (a) conducting or (b) nonconducting? Explain.
50. Do most or all of the conductors have something in common? If so, what?
51. Do most or all of the insulators have something in common? If so, what?

52. What is the difference between an insulator and a conductor? Which would you guess copper is? Wood? Distilled water?

53. A 2-C charge experiences a force of 20 N when put at a certain location in space. The electric field at that location is

54. The electric field in a certain region of space is 40 N/C. What is the force on a 10-C charge placed in that region?

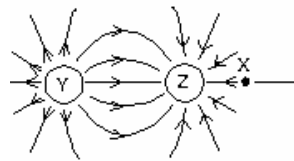
55. The electrical force on a 2-C charge is 60 N. What is the value of the electric field at the location of the charge?

56. 10,000 electrons are removed from a neutral plastic ball. What is its charge?

57. What is the magnitude of the force of an electron in an electric field of 300 N/C?

58. The diagram shows the electric field lines in a region of space containing two small charged spheres (Y and Z). Then:

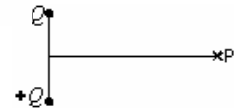
- Y is negative and Z is positive
- the magnitude of the electric field is the same everywhere
- the electric field is strongest midway between Y and Z
- a small negatively charged body placed at X would be pushed to the right
- Y and Z must have the same sign



59. The diagram shows a positive charge Q and a negative charge $-Q$ with the

The electric field at point P on the perpendicular bisector of the line joining them is:

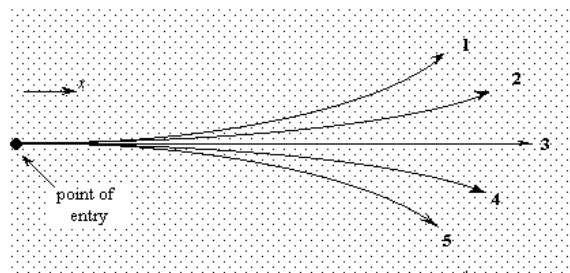
- \uparrow
- \downarrow
- \rightarrow
- \leftarrow
- zero



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

- speeds up
- slows down
- veers east
- veers west
- continues with the same speed in the same direction

61. Five particles are shot from the left into a region that



contains a uniform electric field. The numbered lines show the paths taken by the five particles.
A negatively charged particle with a charge $-3Q$ follows path 2 while it moves through this field.

Which path would be followed by a helium atom (an electrically neutral particle)?

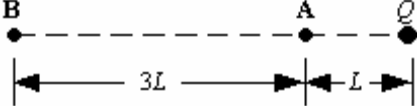
- A) path 5 B) path 2 C) path 3 D) path 1 E) path 4

In which direction does the electric field point?

- A) toward the left of the page
B) toward the right of the page
C) out of the page, toward the reader
D) toward the bottom of the page
E) toward the top of the page

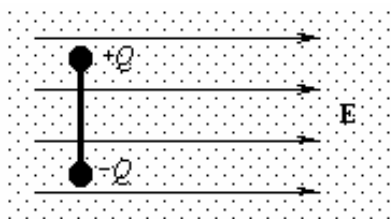
Which path would be followed by a charge $+6Q$?

- a. path 5 b. path 2 c. path 1 d. path 4 e. path 3

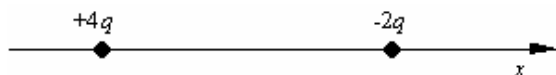
62. An isolated point charge produces an electric field with magnitude E at a point 2 m away from the charge. A point at which the field magnitude is $E/4$ is:
- 1 m away from the charge
 - 0.5 m away from the charge
 - 2 m away from the charge
 - 4 m away from the charge
 - 8 m away from the charge
63. An isolated point charge produces an electric field with magnitude E at a point 2 m away. At a point 1 m from the charge the magnitude of the field is:
- E
 - $2E$
 - $4E$
 - $E/2$
 - $E/4$
64. In the figure, point **A** is a distance L away from a point charge Q . Point **B** is a distance $4L$ away from Q . What is the ratio of the electric field at **B** to that at **A**, E_B/E_A ?
- 
- $1/9$
 - $1/3$
 - This cannot be determined since neither the value of Q nor the length L is specified.
 - $1/4$
 - $1/16$

65. What is the magnitude and direction of the electric force on a $-1.2 \mu\text{C}$ charge at a point where the electric field is 2500 N/C and is directed along the $+y$ axis.
- 0.0030 N , $+y$ direction
 - 0.15 N , $+y$ direction
 - 0.15 N , $-y$ direction
 - 4.3 N , $+x$ direction
 - 0.0030 N , $-y$ direction

66. A electric dipole is released from rest in a uniform electric field with the orientation shown. Which entry in the table below correctly describes the rotation and the net force on the dipole?



- | | <u>rotation</u> | <u>net force</u> |
|----|------------------|------------------|
| a. | clockwise | non-zero |
| b. | zero | zero |
| c. | counterclockwise | non-zero |
| d. | counterclockwise | zero |
| e. | clockwise | zero |
67. At which point (or points) is the electric field zero N/C for the two point charges shown on the x axis?



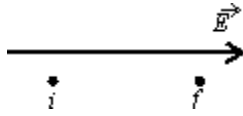
- The electric field is zero somewhere on the x axis to the right of the $-2q$ charge.
 - The electric field is zero somewhere on the x axis between the two charges, but this point is nearer to the $-2q$ charge.
 - The electric field is never zero in the vicinity of these charges.
 - The electric field is zero at two points along the x axis; one such point is to the right of the $-2q$ charge and the other is to the left of the $+4q$ charge.
 - The electric field is zero somewhere on the x axis to the left of the $+4q$ charge.
68. Two point charges, q_1 and q_2 , are placed a distance r apart. The electric field is zero at a point P between the charges on the line segment connecting them. We conclude that:
- q_1 and q_2 must have the same magnitude and sign
 - P must be midway between q_1 and q_2
 - q_1 and q_2 must have the same sign but may have different magnitudes
 - q_1 and q_2 must have equal magnitudes and opposite signs
 - q_1 and q_2 must have opposite signs and may have different magnitudes

POTENTIAL PROBLEMS 1

- A uniform electric field with a magnitude of 500 N/C is directed parallel to the positive x -axis. If the potential at $x = 5$ m is 2500 V, what is the potential at $x = 2$ m? Solutions, detailed in my notes.
 - 1000 V
 - 2000 V
 - 4000 V
 - 4500 V
- A small, positively charged object near a positively charged sphere is moved closer to the sphere. The electric potential energy of the small object
 - increases.
 - decreases.
 - stays the same.

3. When an electron is brought near a negatively charged sphere, its potential energy increases. The reason this happens is that
- negative charges repel each other.
 - work was done to bring the charges together.
 - two like charges go from a position far apart to a position close together.
 - none of the above
4. Electric potential is defined as
- gravitational potential.
 - electric potential energy.
 - electric potential energy of a charge divided by the quantity of the charge.
 - electric potential energy of a charge multiplied by the quantity of the charge.
 - voltage.
5. If you use 10 J of work to push a 1-C charge into an electric field, its voltage with respect to its starting position is
- less than 10 V.
 - 10 V.
 - more than 10 V.
6. A 2-C charge is located near a positively charged sphere so that it has 40 J of electric potential energy. Its electric potential is
- 80 V.
 - 40 V.
 - 20 V.
 - 10 V.
 - 2 V.
7. When a positive charge moves because of a force, what happens to the electrical potential energy associated with the charge's position in the system?
- It increases.
 - It decreases.
 - It remains the same.
 - It sharply increases, and then decreases.
8. Charge build up between the plates of a capacitor stops when
- there is no net charge on the plates.
 - unequal amounts of charge accumulate on the plate.
 - the potential difference between the plates is equal to the potential difference between the terminals of the battery.
 - the charge on both plates is the same.
9. When comparing the net charge of a charged capacitor with the net charge of the same capacitor when it is uncharged, the net charge is
- greater in the charged capacitor.
 - less in the charged capacitor.
 - equal in both capacitors.
 - greater or less in the charged capacitor, but never equal.

10. An electron moves from point i to point f , in the direction of a uniform electric field. During this placement:



- A) the work done by the field is positive and the potential energy of the electron increases
- B) the work done by the field is negative and the potential energy of the electron increases
- C) the work done by the field is positive and the potential energy of the electron decreases
- D) the work done by the field is negative and the potential energy of the electron decreases
- E) the work done by the field is positive and the potential energy of the electron does not change

11. If 500 J of work are required to carry a 40-C charge from one point to another, the potential difference between these two points is:

- A) 12.5 V
- B) 20,000 V
- C) 0.08 V
- D) depends on the path
- E) none of these

12. The potential difference between two points is 100 V. If 2 C is transported from one of these points to the other, the magnitude of the work done is:

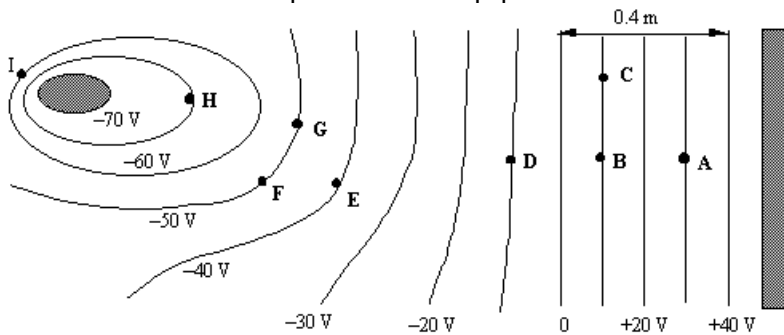
- A) 200 J
- B) 100 J
- C) 50 J
- D) 100 V
- E) 2 J

13. During a lightning discharge, 30 C of charge move through a potential difference of 1.0×10^8 V in 2.0×10^{-2} s. The energy released by this lightning bolt is:

- A) 1.5×10^{11} J
- B) 3.0×10^9 J
- C) 6.0×10^7 J
- D) 3.3×10^6 J
- E) 1500 J

Use the following to answer questions 14-22:

The sketch below shows cross sections of equipotential surfaces between two charged conductors that are shown in solid black. Various points on the equipotential surfaces near the conductors are labeled **A**, **B**, **C**, ..., **I**.

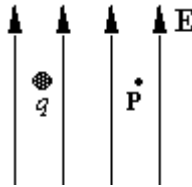


14. At which of the labeled points will the electric field have the greatest magnitude?
A) **D** B) **H** C) **G** D) **A** E) **I**
15. What is the magnitude of the electric field at point **A**?
A) 100 V/m
B) 10 V/m
C) 75 V/m
D) 25 V/m
E) 30 V/m
16. At which of the labeled points will an electron have the greatest potential energy?
A) **H** B) **D** C) **G** D) **I** E) **A**
17. What is the direction of the electric field at **B**?
A) toward **D**
B) up and out of the page
C) into the page
D) toward **A**
E) toward **C**
18. A positive point charge is placed at **F**. Complete the following statement: When it is released,
A) a force will cause it to move toward **E**.
B) it would subsequently lose kinetic energy.
C) a force will cause it to move away from **E**.
D) no force will be exerted on it.
E) a force will cause it to move toward **G**.
19. How much work is required to move a $-1 \mu\text{C}$ charge from **A** to **E**?
A) $-4.0 \times 10^{-5} \text{ J}$
B) $-7.0 \times 10^{-5} \text{ J}$
C) $+7.0 \times 10^{-5} \text{ J}$
D) zero joules
E) $+3.0 \times 10^{-5} \text{ J}$
20. A point charge gains $50 \mu\text{J}$ of electric potential energy when it is moved from point **D** to point **G**. Determine the magnitude of the charge.
A) $50 \mu\text{C}$
B) $1.3 \mu\text{C}$
C) $130 \mu\text{C}$
D) $25 \mu\text{C}$
E) $1.0 \mu\text{C}$

21. What is the potential difference between points **B** and **E**?
- A) 50 V
 B) 30 V
 C) 60 V
 D) 40 V
 E) 10 V
22. How much work is required to move a $-1 \mu\text{C}$ charge from **B** to **D** to **C**?
- A) $-4.0 \times 10^{-5} \text{ J}$
 B) $+2.0 \times 10^{-5} \text{ J}$
 C) $+4.0 \times 10^{-5} \text{ J}$
 D) zero joules
 E) $-2.0 \times 10^{-5} \text{ J}$

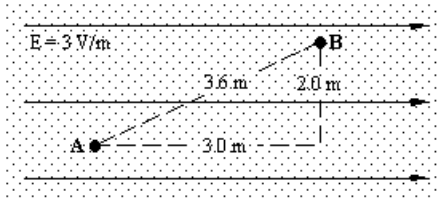
23. A charge $q = -4.0 \mu\text{C}$ is moved 0.25 m horizontally to point **P** in a region where an electric field is 150 V/m and directed vertically as shown. What is the change in the electric potential energy of the charge?

- A) $+2.4 \times 10^{-3} \text{ J}$
 B) $-1.5 \times 10^{-4} \text{ J}$
 C) $-2.4 \times 10^{-3} \text{ J}$
 D) zero joules
 E) $+1.5 \times 10^{-4} \text{ J}$



24. The electric potential at a certain point in space is 12 V. What is the electric potential energy of a $-3.0 \mu\text{C}$ charge placed at that point?
- A) $+4 \mu\text{J}$
 B) $-4 \mu\text{J}$
 C) $-36 \mu\text{J}$
 D) zero μJ
 E) $+36 \mu\text{J}$

25. A $+1.0 \mu\text{C}$ point charge is moved from point **A** to **B** in the uniform electric field as shown. Which one of the following statements is necessarily true concerning the potential energy of the point charge?



- A) It decreases by $6.0 \times 10^{-6} \text{ J}$.
 B) It increases by $6.0 \times 10^{-6} \text{ J}$.
 C) It decreases by $10.8 \times 10^{-6} \text{ J}$.
 D) It decreases by $9.0 \times 10^{-6} \text{ J}$.
 E) It increases by $10.8 \times 10^{-6} \text{ J}$.

**26. A completely ionized beryllium atom (net charge = $+4e$) is accelerated through a potential difference of 6.0 V. What is the increase in kinetic energy of the atom?

- A) 24 eV
 B) 0.67 eV
 C) 4 eV
 D) 6 eV
 E) zero eV

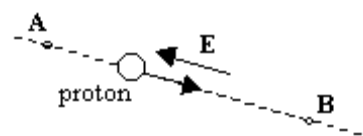
27. A uniform electric field of 8 V/m exists between the plates of a parallel plate capacitor. How much work is required to move a $+20 \mu\text{C}$ point charge from the negative plate to the positive plate if the plate separation is 0.050 m?

- A) $8 \times 10^{-4} \text{ J}$
- B) $8 \times 10^{-6} \text{ J}$
- C) $8 \times 10^{-5} \text{ J}$
- D) 1.6 J
- E) 0.4 J

28. If the work required to move a $+0.35 \text{ C}$ charge from point A to point B is $+125 \text{ J}$, what is the potential difference between the two points?

- A) 180 V
- B) 88 V
- C) zero volts
- D) 360 V
- E) 44 V

29. A proton moves in a constant electric field \mathbf{E} from point A to point B. The magnitude of the electric field is $4.2 \times 10^4 \text{ N/C}$; and it is directed as shown in the drawing, the direction opposite to that of the proton. If the distance from point A to point B is 0.18 m, what is the change in the proton's electric potential energy, $U_A - U_B$?



- A) $+1.2 \times 10^{-15} \text{ J}$
- B) $-2.4 \times 10^{-15} \text{ J}$
- C) $-1.8 \times 10^{-15} \text{ J}$
- D) $+2.4 \times 10^{-15} \text{ J}$
- E) $-1.2 \times 10^{-15} \text{ J}$

POTENTIAL PROBLEMS 2

1. 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

2. Electric potential energy is the energy a charged object has because of its

- a. location.
- b. size.
- c. motion.
- d. momentum.
- e. electric charge.

5. After you rub a balloon on your hair, the balloon will likely be charged

- a. to several thousand volts.
- b. to several hundred volts.
- c. to less than 10 volts.
- d. not at all.

8. Which of the following is NOT a characteristic of electrical potential energy?

- a. It is a form of mechanical energy.
- b. It results from a single charge.
- c. It results from the interaction between charges.
- d. It is associated with a charge in an electric field.

12. A capacitor consists of two metal plates; ____ is stored on one plate and ____ is stored on the other.

- a. negative charge; positive charge
- b. potential energy; kinetic energy
- c. potential difference; internal resistance
- d. residual charge; induced charge

15. A proton of mass m and charge e is accelerated from rest through a potential difference V . The final speed of the proton is

- A. $\sqrt{\frac{2Ve}{m}}$
- B. $\frac{2Ve}{m}$
- C. $\sqrt{\frac{Ve}{m}}$
- D. $\frac{Ve}{m}$

16. Which of the following correctly describes the nature of electric potential and electric field strength?

	Potential	Electric field
A.	Scalar	Scalar
B.	Scalar	Vector
C.	Vector	Scalar
D.	Vector	Vector

17. The electric field required to suspend a proton against the force of gravity is:

- A 102 nanovolts/m directed upward
- B 102 nanovolts/m directed downward
- C 557 picovolts/m directed upward
- D 557 picovolts/m directed downward

18. An alpha particle (nucleus of helium with 2 protons and 2 neutrons) and an electron are each accelerated from rest through a potential difference of 2500 volts. Their resultant kinetic energies, in electron volts will be, respectively:

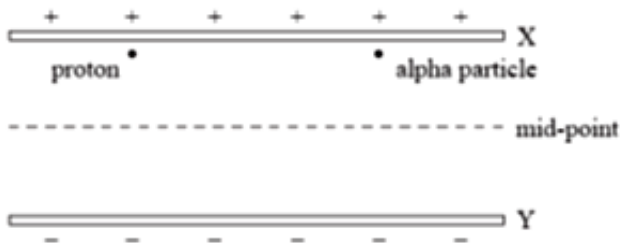
- A. none of these
- B. 2500, 1.36
- C. 10000, 2500
- D. 2500, 1250
- E. 5000, 2500

19. Two large, parallel, conducting plates are 1.2 mm apart and have equal and opposite charges on their facing surfaces. An electrostatic force of 6×10^{-13} N acts on an electron placed anywhere between the two plates. What is the potential difference in volts between the plates?

- A. 4500
- B. 720
- C. 3.76×10^6
- D. 2250

20. A proton and an alpha particle (nucleus of helium atom = 2 neutrons +

2 protons) are accelerated from rest from the positively charged plate X to the negatively charged plate Y.



At the mid-point between the plates, the proton has a kinetic energy E_k . At this point, the alpha particle has a kinetic energy

- A. $E_k/2$.
- B. E_k .
- C. $2 E_k$.
- D. $4 E_k$.