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حل أوراق عمل شاملة الوحدة الثالثة Potential Electric الجهد الكهربائي

موقع المناهج ⇐ المناهج الإماراتية ⇐ الصف الثاني عشر المتقدم ⇐ فيزياء ⇐ الفصل الأول ⇐ أوراق عمل ⇐ الملف

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المزيد من مادة فيزياء:	ملفات	كتب للمعلم	كتب للطالب	اختبارات الكترونية	اختبارات	حلول	عروض بوربوينت	أوراق عمل منهج انجليزي	ملخصات وتقارير	مذكرات وبنوك	الامتحان النهائي	للمدرس

التواصل الاجتماعي بحسب الصف الثاني عشر المتقدم

صفحة المناهج الإماراتية على فيسببوك

المواد على تلغرام	التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة فيزياء في الفصل الأول

1	أوراق عمل شاملة الوحدة الثالثة Potential Electric الجهد الكهربائي
2	أوراق عمل الوحدة الثالثة potential Electric الجهد الكهربائي باللغتين العربية والانجليزية
3	أوراق عمل الوحدة الثانية fields Electric المجالات الكهربائية باللغتين العربية والانجليزية
4	أسئلة اختبار الوزارة القسم الكتابي الورقي
5	حل أسئلة اختبار تجريبي ثاني في الوحدة الأولى Electrostatics القوى الالكتروستاتيكية

Practice Questions: Topic 3– Electric Potential

Applied Technology High School

1. Which of the following is the equivalent unit for the unit of electric field, N/C?

A. Vm

√ B. V/m

C. J/m

D. Jm

2. Which of the following quantities are scalar?

I. Electric force
II. Electric field
III. Electric potential
IV. Electric potential Energy

A. I and II

B. II and IV

C. II and III

√ D. III and IV

3. Which of the following gives the correct conversion of eV to joules?

A. $1eV = \frac{1}{1.6 \times 10^{-19}} J$

√ B. $1eV = 1.6 \times 10^{-19} J$

C. $1eV = \frac{1}{8.99 \times 10^{9}} J$

D. $1eV = 8.99 \times 10^{9} J$

4. Electric field lines always point

√ A. from higher potential to lower potential

B. from lower potential to higher potential

C. in the same direction as the equipotential lines

D. in the opposite direction as the equipotential lines

5. A positive charge is released and moves along an electric field line. This charge moves to a position of ____.

√ A. lower potential and lower potential energy

B. lower potential and higher potential energy

C. higher potential and lower potential energy

D. higher potential and higher potential energy

6. A negative charge is released and moves along an electric field line. This negative charge moves to a position of ________.

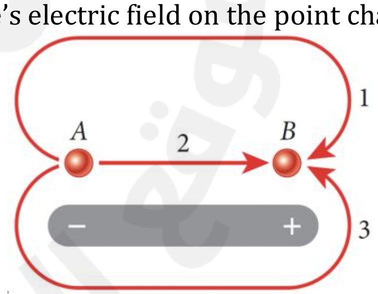
A. lower potential and lower potential energy

B. lower potential and higher potential energy

√ C. higher potential and lower potential energy

D. higher potential and higher potential energy

7. A positive point charge is to be moved from point A to point B in the vicinity of an electric dipole. Which of the three paths shown in the figure will result in the most work being done by the dipole's electric field on the point charge?



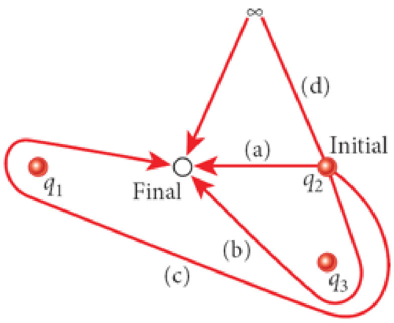
A. path 1

B. path 2

C. path 3

√ D. The work is the same on all three paths

8. Three identical positive point charges are located at fixed points in space. Then charge q_2 is moved from its initial location to a final location as shown in the figure. Four different paths, marked (a) through (d), are shown. Path (a) follows the shortest line; path (b) takes q_2 around q_3; path (c) takes q_2 around q_3 and q_1; path (d) takes q_2 out to infinity and then to the final location.



Which path requires the least work?

A. path (a)

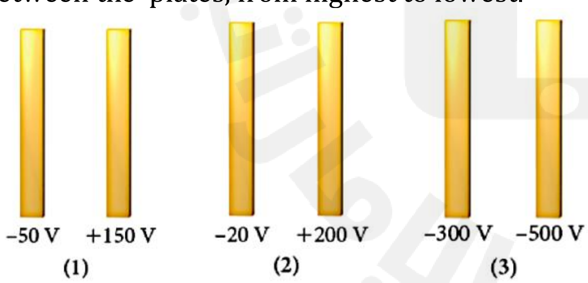
B. path (b)

C. path (c)

D. path (d)

√ E. The work is the same for all the paths

9. Three pairs of parallel plates have the same plate separation and potentials on each plate as indicated in the drawing. The electric field, E, is uniform between each pair of plates and perpendicular to them. Rank the magnitude of E between the plates, from highest to lowest.



A. 1 > 2 > 3

B. 3 > 2 > 1

C. The magnitudes for 3 and 2 are equal and greater than the magnitude for 1

√ D. The magnitude for 2 is greater than that for 1 and 3, which are the same

10. Two parallel plates are held at a potential of + 220 V and + 130 V. If the plates have area of 44 cm² and are separated by a distance of 7.3 mm, what is the magnitude of the electric field between the plates?

A. 54 V/m

B. 132 N/C

√ C. 12 000 N/C

D. 20 000 V/m

11. A proton is placed midway between points A and B. The potential at point A is −20 V, and the potential at point B +20 V. The potential at the midpoint is 0 V. The proton will ______.

A. remain at rest

√ B. accelerate toward point A

C. accelerate toward point B

D. move toward point A with constant velocity

E. move toward point B with constant velocity

12. An electron is accelerated from rest through a potential difference of 450 V. What is its final speed?

A. $0.81 \times 10^7\ m/s$

√ B. $1.3 \times 10^7\ m/s$

C. $2.9 \times 10^7\ m/s$

D. $4.1 \times 10^7\ m/s$

13. A 5.0 V battery is connected to two parallel metal plates placed in a vacuum. An electron is accelerated from rest from the negative plate toward the positive plate. What kinetic energy does the electron have as it just reaches the positive plate?

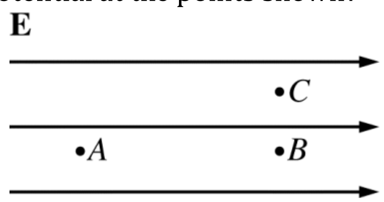
A. $5.6 \times 10^{-19}\ J$

B. $6.1 \times 10^{-19}\ J$

√ C. $8.0 \times 10^{-19}\ J$

D. $8.9 \times 10^{-19}\ J$

14. The diagram below shows a uniform horizontal electric field and three points that lie in the field. Which of the following is true of the electric potential at the points shown?



I. It is lower at point A than at point B
II. It is lower at point A than at point C
III. It is the same at points A and B
IV. It is the same at points B and C

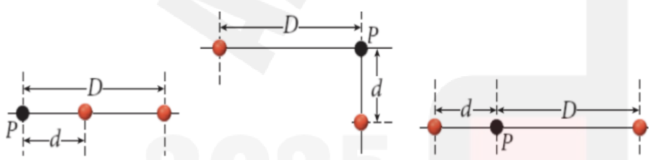
A. I only

B. III only

√ C. IV only

D. II and III only

15. Two protons are located in space in the three ways shown in the figure. Rank the three cases from highest to lowest net electric potential, *V*, produced at point *P*.



A. 1 > 2 > 3

B. 2 > 3 > 1

C. 3 > 2 > 1

√ D. All three potentials are the same

16. Suppose an electric potential is described by, $V(x, y, z) = -(5x^2 + y + z)$ in volts. Which of the following expressions describes the associated electric field, in units of volts per meter?

A. $E = 5\hat{x} + 2\hat{y} + 2\hat{z}$

B. $E = 10x\hat{x}$

C. $E = 5\hat{x} + 2\hat{y}$

√ D. $E = 10x\hat{x} + \hat{y} + \hat{z}$

17. Which one of the following statements is not true?

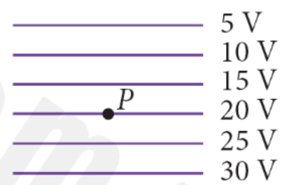
√ A. Equipotential lines are parallel to the electric field lines

B. Equipotential lines for a point charge are circular

C. Equipotential surfaces exist for any charge distribution

D. When a charge moves on an equipotential surface, the work done on the charge is zero

18. In the figure, the lines represent equipotential lines. What is the direction of the electric field at point *P*?



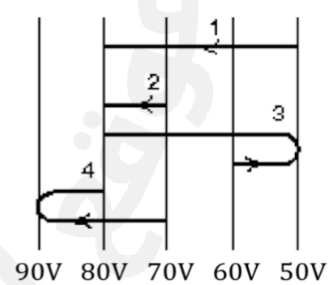
√ A. Up

B. Down

C. Left

D. Right

19. An electron goes from one equipotential surface to another along one of the four paths shown below.



Rank the paths according to the work done by the electric field, from least to greatest.

A. $1 < 2 < 3 < 4$

B. $1 < 3 < 4 = 2$

C. $4 < 3 < 2 < 1$

√ D. $4 = 2 < 3 < 1$

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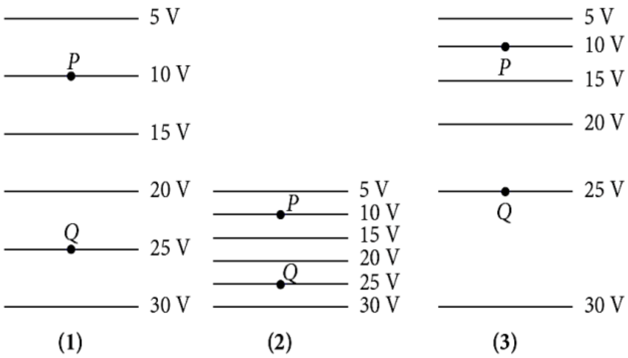
20. In the figure, the lines represent equipotential lines. A charged object is moved from point *P* to point *Q*. How does the amount of work done on the object compare for these three cases?



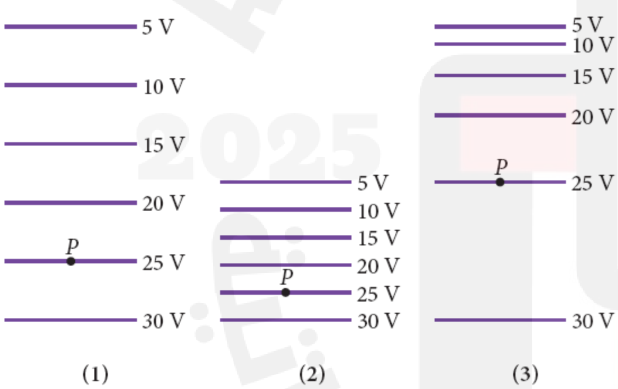
√ A. All three cases involve the same work

B. The most work is done in case 1

C. The most work is done in case 2

D. The most work is done in case 3

21. In the figure, the lines represent equipotential lines. How does the magnitude of the electric field, *E*, at point *P* compare for the three cases?



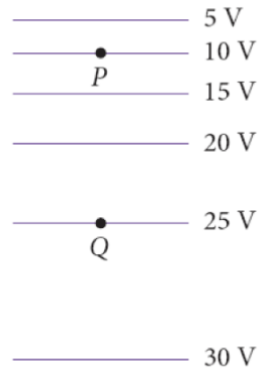
A. $E_1 > E_2 > E_3$

B. $E_1 < E_2 < E_3$

C. $E_3 > E_1 > E_2$

√ D. $E_3 < E_1 < E_2$

22. In the figure, the lines represent equipotential lines. A positive charge is placed at point *P*, and then another positive charge is placed at point *Q*. Which set of vectors best represents the relative magnitudes and directions of the electric field forces exerted on the positive charges at *P* and *Q*?



A. 

√ B. 

C. 

D. 

23. The amount of work done to move a positive point charge q on an equipotential surface of 1000 V relative to that done to move the charge on an equipotential surface of 10 V is ____.

√ A. the same

B. less

C. more

D. dependent on the distance the charge moves

24. The amount of work done to move a positive charge Q on an equipotential surface of 1000 V compared to that on an equipotential surface of 10 V is ____.

√ A. the same

B. less

C. more

D. dependent on distance travelled

25. What is the electric potential 45.5 cm away from a point charge of 12.5 pC?

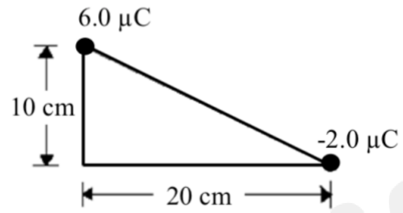
√ A. 0.247 V

B. 1.45 V

C. 4.22 V

D. 10.2 V

26. Two point charges are located at two corners of a triangle as shown. What is the electric potential at the right corner of the triangle?



A. $2.1 \times 10^5\ V$

√ B. $4.5 \times 10^5\ V$

C. $6.3 \times 10^5\ V$

D. $7.2 \times 10^5\ V$

27. At a distance d from a charge, the electric potential is V. What would be the electric potential a distance $d/4$ from the same charge?

A. $V/4$

B. $V/2$

√ C. $2V$

D. $4V$

28. In the opposite corners of a square there are two identical ions. Each has a charge of $+e$. The length of one side of he square is L. What is the net electric potential caused by the two positive ions at both of the empty corners of the square?

A. $ke/2L$

B. ke/L

C. $\sqrt{2}ke/L$

√ D. $2ke/L$

29. The potential energy of a system of three equal charges arranged in an equilateral triangle is 0.54 J If the length of one side of this triangle is 33 cm, what is the charge of one of the three charges?

A. 1.7 μC

B. 2.0 μC

√ C. 2.6 μC

D. 4.3 μC

30. When two charges are separated by a distance d, their electric potential energy is equal to U. What would be their electric potential energy if the separation distance was $d/2$?

A. $U/4$

B. $U/2$

√ C. $2U$

D. $4U$

31. Each of the following pairs of charges are separated by a distance d. Which pair has the highest potential energy?

√ A. +5 C and +3 C

B. +5 C and −3 C

C. −5 C and +3 C

D. All pairs have the same potential energy

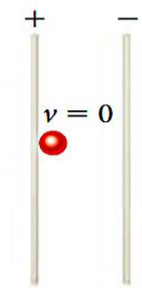
Free Response:

1. How much work would be done by an electric field in moving a proton from a point at a potential of +180 V to a point at a potential of –60.0 V?

$W = -\Delta U = -q\Delta V = -q\left(V_f - V_i\right)$

$W = (-1.6 \times 10^{-19}\ C)(-60.0\ V - 180\ V) = 3.84 \times 10^{-17}\ J$

2. A proton is placed between two parallel conducting plates in a vacuum as shown below. The difference in electric potential between the two plates is 450 V. The proton is released from rest close to the positive plate. What is the kinetic energy of the proton when it reaches the negative plate?



From the conservation of energy:

$\Delta K = -\Delta U = -q\Delta V$

$\Delta K = -(1.6 \times 10^{-19}\ C)(0 - 450\ V) = 7.2 \times 10^{-17}\ J$

3. A proton, initially at rest, is accelerated through a potential difference of 500 V. What is its final velocity?

$\frac{1}{2}mv^2 = -q\Delta V$

$v = \sqrt{\frac{-2q\Delta V}{m}} = \sqrt{\frac{-2(1.6 \times 10^{-19}\ C)(-500\ V)}{1.67 \times 10^{-27}}} = 3.1 \times 10^5\ m/s$

4. A 10.0 V battery is connected to two parallel metal plates placed in a vacuum. An electron is accelerated from rest from the negative plate toward the positive plate.

a. What kinetic energy does the electron have just as it reaches the positive plate?

$\Delta k = -\Delta U = -q\Delta V$

$K_f - K_i = -q\Delta V$

Since $K_i = 0$

$K_f = -(-1.6 \times 10^{-19}\ C)(10\ V) = 1.6 \times 10^{-18}\ J$

b. What is the speed of the electron just as it reaches the positive plate?

$\frac{1}{2}m{v_f}^2 = K_f$

$v_f = \sqrt{\frac{2K_f}{m}} = \sqrt{\frac{2(1.6 \times 10^{-18}\ J)}{9.11 \times 10^{-31}\ kg}} = 1.88 \times 10^6\ m/s$

5. A cathode ray tube uses a potential difference of 5.0 kV to accelerate electrons and produce an electron beam that makes images on a phosphor screen. What is the speed of these electrons as a percentage of the speed of light?

$\frac{1}{2}mv^2 = -q\Delta V$

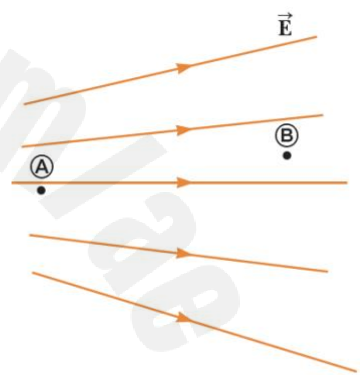
$\frac{1}{2}(9.1 \times 10^{-31}\ kg)v^2 = -(1.6 \times 10^{-19}\ C)(0 - \ 5000\ V)$

$v = 4.2 \times 10^7\ m/s$

$\frac{v}{c} = \frac{4.2 \times 10^7\ m/s}{3.0 \times 10^8\ m/s} = 0.14$

$v = 14\%\ of\ speed\ of\ light$

6. In the figure below, two points A and B are located within a region in which there is an electric field.



a. How would you describe the potential difference $\Delta V = V_B - V_A$? Tick the appropriate box.

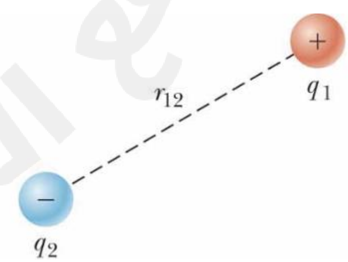
- ❒ It is positive
- ❒ It is negative
- ❒ It is zero

b. A negative charge is placed at A and then moved to B. How would you describe the change in potential energy of the charge-field system for this process? Tick the appropriate box.

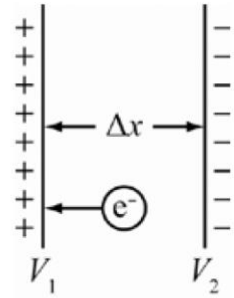
- ❒ It is positive
- ❒ It is negative
- ❒ It is zero

7. In the figure, take q_2 to be a negative source charge and q_1 to be a second charge whose sign can be changed. If q_1 is initially positive and is changed to a charge of the same magnitude but negative, what happens to the potential at the position of q_1 due to q_2?

- ❒ It increases
- ❒ It decreases
- ❒ It remains the same



8. Two parallel plates are held at potentials of +200.0 V and −100.0 V. The plates are separated by 1.00 cm.



a. Find the electric field between the plates.

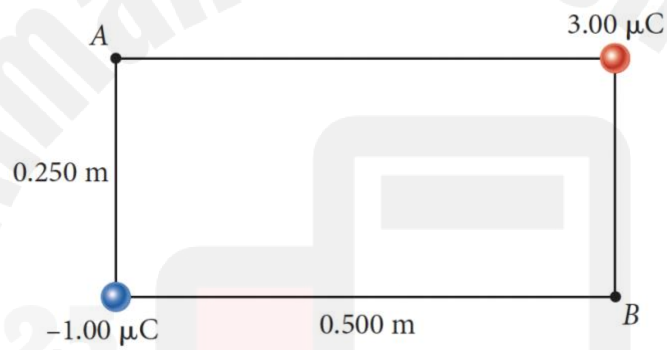
$$E = \left|\frac{dV}{dx}\right| = \frac{\Delta V}{\Delta x} = \frac{300\ V}{0.0100\ m} = 3.00 \times 10^4\ V/m$$

b. An electron is initially placed halfway between the plates. Find its kinetic energy when it hits the positive plate.
If the electron only travels $d = \Delta x/2$, the change in electric potential is $\Delta V' = Ed = E\Delta x/2$. Since all its initial potential energy becomes kinetic energy:

$$K = U_i = e\Delta V' = \frac{1}{2}eE\Delta x$$

$$K = \frac{1}{2}(1.6 \times 10^{-19}\ C)(3.00 \times 10^4\ V/m)(0.0100\ m) = 2.40 \times 10^{-17}\ J$$

9. Two point charges are located at two corners of a rectangle, as shown in the figure.



a. What is the electric potential at point A?

$$V_A = \frac{kq_1}{r_1} + \frac{kq_2}{r_2} = k\left(\frac{q_1}{r_1} + \frac{q_2}{r_2}\right)$$

$$V_A = (9.0 \times 10^9\ Nm^2/C^2)\left(\frac{-1.00 \times 10^{-6}\ C}{0.250\ m} + \frac{3.00 \times 10^{-6}\ C}{0.500\ m}\right) = 1.8 \times 10^4\ V$$

b. What is the potential difference between points A and B?

$$V_{AB} = V_A - V_B = k\left(\frac{q_1}{r_1} + \frac{q_2}{r_2}\right) - k\left(\frac{q_1}{r_2} + \frac{q_2}{r_1}\right) = k(q_1 - q_2)\left(\frac{1}{r_1} - \frac{1}{r_2}\right)$$

$$V_{AB} = (9.0 \times 10^9\ )(-1.00 \times 10^{-6}\ C - 3.00 \times 10^{-6}\ C)\left(\frac{1}{0.250} - \frac{1}{0.500}\right)$$

$$V_{AB} = 7.2 \times 10^4\ V$$

10. A 2.50 μg dust particle with a charge of 1.00 μC falls at a point $x = 2.00\ m$ in a region where the electric potential varies according to:

$$V(x) = (2.00\ V/m^2)x^2 - (3.00\ V/m^3)x^3$$

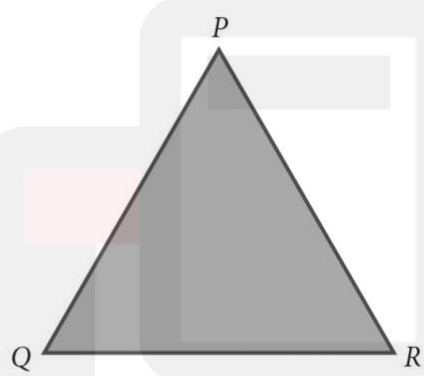
a. What is the electric field at $x = 2.00\ m$?

$$E(x) = -\frac{dV}{dx} = -\frac{d(2.00x^2 - 3.00x^3)}{dx}$$
$$E(x) = -4.00x + 9.00x^2$$
$$E(2.00) = -4.00(2.00) + 9.00(2.00)^2 = 28\ V/m$$

b. With what acceleration will the particle start moving after it touches down?

$$a = \frac{F}{m} = \frac{qE}{m}$$
$$a = \frac{(1.00 \times 10^{-6}\ C)(28\ V/m)}{2.50 \times 10^{-6}\ kg} = 11.2\ m/s^2$$

11. Three charges, q_1, q_2, q_3, are located at the corners of an equilateral triangle with side length of 1.20 m.



Find the work done in each of the following cases:

a. to bring the first particle, $q_1 = 1.00\ pC$, to P from infinity.
Since there is no particle for q_1 to interact with, $U_1 = W_1 = 0\ J$

b. to bring the second particle, $q_2 = 2.00\ pC$, to Q from infinity.
Charge q_1 is present as q_2 is moved to its corner, so:

$$U_2 = W_2 = \frac{kq_1q_2}{l}$$

$$W_2 = \frac{(9 \times 10^9\ Nm^2/C^2)(1.0 \times 10^{-12}\ C)(2.0 \times 10^{-12}\ C)}{1.20\ m} = 1.5 \times 10^{-14}\ J$$

c. to bring the last particle, $q_3 = 3.00\ pC$, to R from infinity.
Charges q_1 and q_2 is present as q_3 is moved to its corner, so:

$$U_3 = W_3 = \frac{kq_1q_3}{l} + \frac{kq_2q_3}{l} = \frac{k}{l}(q_1q_3 + q_2q_3)$$

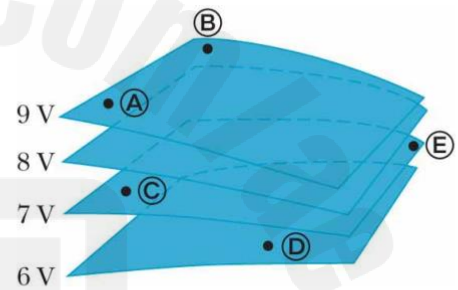
$$W_3 = \frac{(9 \times 10^9\ Nm^2/C^2)}{1.20\ m}[(1.0 \times 10^{-12}\ C)(3.0 \times 10^{-12}\ C) + (2.0 \times 10^{-12}\ C)(3.0 \times 10^{-12}\ C)]$$

$$W_3 = 6.7 \times 10^{-14}\ J$$

d. Find the total potential energy stored in the final configuration of q_1, q_2, and q_3.
The total energy is $U_{Total} = U_1 + U_2 + U_3$

$$U_{Total} = (0\ J) + (1.5 \times 10^{-14}\ J) + (6.7 \times 10^{-14}\ J) = 8.2 \times 10^{-14}\ J$$

12. The labeled points in the figure are on a series of equipotential surfaces associated with an electric field. Rank (from greatest to least) the work done by the electric field on a positively charged particle that moves from A to B, from B to C, from C to D, and from D to E.



B to C,
C to D,
A to B,
D to E

13. Can two equipotential lines cross? Why or why not?
An equipotential line is defined as a line connecting points of the same potential. This means that if two equipotential lines were to cross, at the cross point, the potential would have two values at the same point. The equipotential lines are also always perpendicular to the electric field. If they were to cross, then there would have to be two different electric fields acting at the same point. If a point charge were put at this point where the electric fields crossed, there would be two separate forces acting from the two different electric fields. Both of these situations are not possible. Therefore two equipotential lines cannot cross.