**Electric Potential Energy, Electric Potential, Electric Potential Difference with Point Charges**

Can’t see it, can’t touch it, can’t smell it, can’t hear it, can’t taste it but believe you me, it’s there!

**1**. Find the electric potential energy of a 2.00nC charge and a 3.00nC charge separated by 1.20x10-5m.

**2**. Find the electric potential energy of a -2.00nC charge and a 3.00nC charge separated by 1.20x10-5m.

**3**. Find the electric potential energy of a -2.00nC charge and a -3.00nC charge separated by 1.20x10-5m.

**4**. Find the electric potential energy of a 2.00nC charge and a -3.00nC charge separated by 1.20x10-5m.

**5.** Find the electric potential 2.0m from a -4.0µC point charge.

**6.** Find the electric potential 25.0cm from a 5.00µC point charge.

**7. a.** Find the potential difference between point A, 1.00mm from an electron, and point B, 2.00mm from an electron.

 **b.** Which point is at higher potential?

**8.** The potential at point X is 15.0V, the potential at point Y is -25.0V.

a. What is the change in potential as you move from X to Y.

b. A proton is released from rest midway between X and Y, toward which point will it accelerate?

c. An electron is released from rest midway between X and Y, toward which point will it accelerate?

**9.** Three charges are arranged as shown below. The rectangle measures 3.00cm by 4.00cm.

 +2.50µC P

+3.00µC -2.00µC

**a.** Find the electric potential energy of this arrangement.

**b.** Find the electric potential at point P.

**c.** If an electron were placed at point P, how much electric potential energy would it have?

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**a.** Find the electric potential energy of this arrangement.

**b.** Find the electric potential at point P.

**c.** If an electron were placed at point P, how much electric potential energy would it have?

**10.** Point A has a potential of 240V. Point B has a potential of 190V. Charge 1 is a charged sphere with a charge of +2.0µC and a mass of 10.0g. Charge 2 is a charged sphere with a charge of -4.0µC and a mass of 30.0g.

 **a.** What is the potential difference ΔVBA?

 **b.** What is the potential difference ΔVAB?

 **c.** In which direction will Charge 1 accelerate, A to B or B to A?

 **d.** In which direction will Charge 2 accelerate, A to B or B to A?

 **e.** Charge 1 is released from rest at either A or B (see part c.) and accelerates to B or A. What is the final speed?

 **f.** Charge 2 is released from rest at either A or B (see part c.) and accelerates to B or A. What is the final speed?

**11.** Two protons are separated by 1.00nm and are at rest. The protons are released. How far apart are they when they reach a speed of 10.0km/s

**12.** Two electrons are separated by 1.00nm and are at rest. The electrons are released. How far apart are they when they reach a speed of 10.0km/s

**13.** A small charge has a mass of 2.0x10-12kg and a charge of +4.0μC. A second small charge has a mass of 4.0x10-12kg and a charge of -3.0μC. The two charges are initially at rest and separated by 6.0x10-2m. The charges are then simultaneously released from rest. What is the distance between them when the +4.0μC charge has a speed of 5.0x105m/s?

**14.** Two point charges are arranged on a straight line as shown below:

 **+4.0nC -6.0nC**

 **2.00mm**

Consider the position of the 4.0nC charge to be zero. Locate any points on the line (if any exist) at which the potential due to these 2 charges is zero.

**15.** Two point charges are arranged on a straight line as shown below:

 **-4.0nC -6.0nC**

 **2.00mm**

Consider the position of the -4.0nC charge to be zero. Locate any points on the line (if any exist) at which the potential due to these 2 charges is zero.

**10.** Point A has a potential of 240V. Point B has a potential of 190V. Charge 1 is a charged sphere with a charge of +2.0µC and a mass of 10.0g. Charge 2 is a charged sphere with a charge of -4.0µC and a mass of 30.0g.

 **a.** What is the potential difference ΔVBA?

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 **c.** In which direction will Charge 1 accelerate, A to B or B to A?

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 **f.** Charge 2 is released from rest at either A or B (see part c.) and accelerates to B or A. What is the final speed?

**11.** Two protons are separated by 1.00nm and are at rest. The protons are released. How far apart are they when they reach a speed of 3.0 km/s?

**12.** Two electrons are separated by 1.00nm and are at rest. The electrons are released. How far apart are they when they reach a speed of 3.0 km/s?

**13.** A small charge has a mass of 2.0x10-12kg and a charge of +4.0μC. A second small charge has a mass of 4.0x10-12kg and a charge of -3.0μC. The two charges are initially at rest and separated by 6.0x10-2m. The charges are then simultaneously released from rest. What is the distance between them when the +4.0μC charge has a speed of 5.0x105m/s?

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 **-4.0nC -6.0nC**

 **2.00mm**

Consider the position of the -4.0nC charge to be zero. Locate any points on the line (if any exist) at which the potential due to these 2 charges is zero.