POTENTIAL DIFFERENCE

electric potential

the work that must be performed against electric forces to move a charge from a reference point to the point in question, divided by the charge

The concept of electrical potential energy is useful in solving problems, particularly those involving charged particles. But at any point in an electric field, as the magnitude of the charge increases, the magnitude of the associated electrical potential energy increases. It is more convenient to express the potential in a manner independent of the charge at that point, a concept called **electric potential.**

The electric potential at some point is defined as the electrical potential energy associated with a charged particle in an electric field divided by the charge of the particle.

$$V = \frac{PE_{electric}}{q}$$

The potential at a point is the result of the fields due to all *other* charges near enough and large enough to contribute force on a charge at that point. In other words, the electric potential at a point *is independent of the charge at that point.* The force that a test charge at the point in question experiences is proportional to the magnitude of the charge.

Potential difference is a change in electric potential

potential difference

the work that must be performed against electric forces to move a charge between the two points in question, divided by the charge

The **potential difference** between two points can be expressed as follows:

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$$\Delta V = \frac{\Delta PE_{electric}}{q}$$

$$\textbf{potential difference} = \frac{\textbf{change in electrical potential energy}}{\textbf{electric charge}}$$

Figure 3
For a typical car battery, there is a potential difference of 13.2 V between the negative (black) and the positive (red) terminals.

Potential difference is a measure of the difference in the electrical potential energy between two positions in space divided by the charge. The SI unit for potential difference (and for electric potential) is the *volt,* V, and is equivalent to one joule per coulomb. As a 1 C charge moves through a potential difference of 1 V, the charge gains 1 J of energy. The potential difference between the two terminals of a battery can range from about 1.5 V for a small battery to about 13.2 V for a car battery like the one the student is looking at in **Figure 3.**

Because the reference point for measuring electrical potential energy is arbitrary, the reference point for measuring electric potential is also arbitrary. Thus, only changes in electric potential are significant.

Remember that electrical potential energy is a quantity of energy, with units in joules. However, electric potential and potential difference are both measures of energy per