Voltage

A charged entity placed in an electromagnetic field will experience a force. The direction of the force depends on the direction of the electromagnetic field and the polarity of the charge (positive or negative). The concept of voltage, or equivalently, electric potential, tells us how much work (in Joules) must be done per unit charge to move between two points in the field.

The voltage between location a and location b is the ratio of dw to dq, where dw is the energy in joules (J) required to move (positive) charge dq from b to a (or negative charge from a to b).

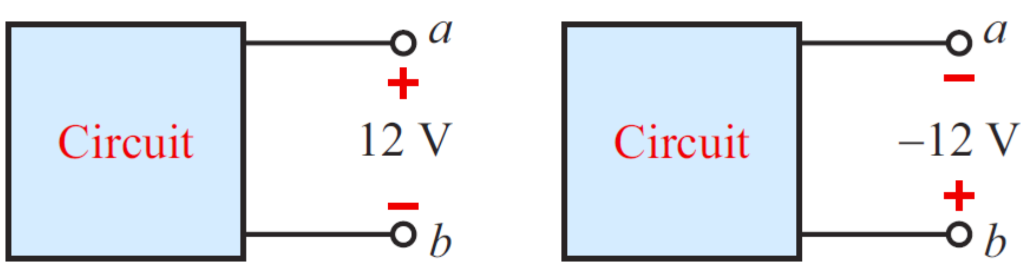
$$v_{ab} = \frac{dw}{dq} \qquad (V)$$

The unit of voltage is volts (V).

Voltage often is denoted v_{ab} to emphasize the fact that it is the voltage difference between points a and b. ***Voltages are always differential (i.e. voltage has no meaning unless both points are defined).***

In terms of that terminology, if v_{ab} has a positive value, it means that point a is at a potential higher than that of point b. Accordingly, points a and b in Fig. 1-10 are denoted with (+) and (−) signs, respectively. If v_{ab} = 5 V, we often use the terminology: “The voltage rise from b to a is 5 V”, or “The voltage drop from a to b is 5 V”.

Consider the circuits below. Just as 5 A of current flowing from a to b in a circuit conveys the same information as −5 A flowing in the opposite direction, a similar analogy applies to voltage. Thus, the two representations below convey the same information with regard to the voltage between terminals a and b.



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