Reading for Activity 2.2
Potential Energy and Fields

Recall the discussion from class about dropping the basketball. When the basketball is held above the ground and then let go, it falls. How can we explain this? Also, as it falls, the ball goes from having no kinetic energy (because it was still) to having kinetic energy (because it is now moving). Where does this energy come from? When the ball is lifted from the ground, it gains the potential to fall, which means potential energy is stored somewhere.

Many people would say that the potential energy is stored in the basketball. But remember, if Earth disappeared, the ball would not fall. Therefore, the potential energy must not only be related to the ball. It must be related to both of the interacting objects: the basketball and Earth. In other words, potential energy is not stored in just one object, but the system of interacting objects. Also, recall that when objects interact without touching, they interact through a field. Therefore, the basketball, earth and field are all part of the system. Therefore, both potential energy and the field are both relate to the interaction between objects. Rather than suggesting that potential energy is stored in objects, it is more accurate to say that potential energy is stored in the field. Saying that potential energy is stored in the field emphasizes that potential energy results from an interaction between more than one object.

Figure 1: Basketball

The basketball and Earth are attracted to each other. Therefore, in order to separate the ball and Earth, you have to apply a force. When you separate the ball and Earth by picking up the ball, you are applying a force. Since your force is being used to pull apart two attracted objects, you are increasing the amount of potential energy stored in the gravitational field generated by those objects. Forces and energy are two different ideas, but they are related. In order to change the amount of potential energy stored in a field, a force is needed to change the positions of the interacting objects.

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Electric forces also interact through a field, so when electric force is used to move charged particles, the amount of potential energy stored in the electric field changes. Electric fields are a bit more complicated than gravitational fields, though. When objects interact through a gravitational field, they are always attracted to each other. For example, when a basketball and Earth interact through a gravitational field, they always attract each other. However, charged objects can attract or repel, depending on the charges. Figure 2 shows two negatively charged balloons.

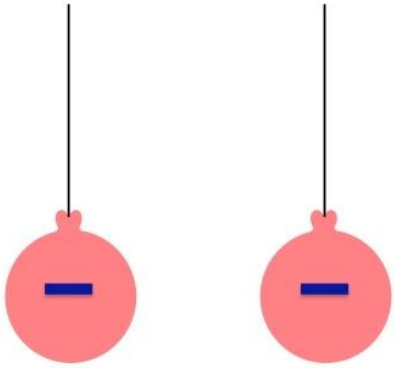

Figure 2: Negatively charged balloons

In Figure 2, to increase the amount of potential energy stored in the field between the two balloons, which way would a force need to move the balloons—toward each other or apart? Justify your answer.

In Figure 2, which way would the two charged balloons naturally move? What would that do to the amount of potential energy stored in the field? Justify your answer.

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