Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Hour \_\_\_\_\_

**Unit 2 – Investigation 2**

**Activity 2.2 -** *Where does the energy that was used to charge the Van de Graaff generator go?*

In this activity, you will investigate how objects can interact without touching, as well as what happens to potential energy when objects interact without touching.

#### **Introduction**

Recall that in the last activity, you noticed that when you pulled or compressed a spring, the force moved the spring from its stable position, so the system had potential energy. What about a system where objects are not in contact? For example, if you use a force to pick up a basketball from the ground and hold it in the air, where is the potential energy in the system? You will be exploring these ideas in this activity.

**Part 1**: Magnets versus springs

**Materials:**

* 2 magnets
* spring

Arrange the magnets so that they **repel** each other, then try to push them together. Then compare pushing the magnets together by pushing on both ends of a spring to compress it.

* 1. How does what you feel when pushing the magnets together compare with what you feel when pushing on the spring?
	2. The force you applied to the spring led to potential energy in the spring system. How are the spring system and the magnet system similar?
	3. How are the spring system and the magnet system different?
	4. When you push repelling magnets together, there is potential energy in the system. Where does the energy come from?

**TEACHER INITIAL:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### **Part 2: COMPUTER SIMULATION:** Go to the Weebly page and find the link to the computer simulation

* 1. Arrange the particles so that there is only a small amount of electric potential energy. What do you observe happening?
	2. Notice that you could have high potential energy when the particles have opposite charge or the same charge. How do the forces (arrows) at the relative positions compare in these two scenarios:
		1. High potential energy with similar charges:
		2. High potential energy with opposite charges:
	3. In addition to having high potential energy, what are some additional **similarities** between the scenarios?
		1. High potential energy with similar charges:
		2. High potential energy with opposite charges:
	4. Describe the following between **gravitational potential energy** and electric **potential energy.**

|  |  |
| --- | --- |
| **Similarities** | **Differences** |
|  |  |

* 1. Describe the following between **magnetic potential energy** and electric **potential energy.**

|  |  |
| --- | --- |
| **Similarities** | **Differences** |
|  |  |

#### **Revisiting the original driving unit question:** How does a small spark trigger a huge explosion?

1. In a previous investigation, you observed in a video that the Van de Graaff generator can be used to create a spark. The light you observed in the spark indicated that energy was transferred from one object to another. Where do you think the energy was stored before the spark was created?
2. Van de Graaff generators are capable of generating strong electric fields. What effect do you think this might have on the amount of electric potential energy that can build up around a Van de Graaff?
3. In this unit, you have been working to answer the question, “How can a small spark start a huge explosion?” Before you can develop a complete answer to this question, you will need to explore additional questions. However, at this point, you do have enough information to start developing an answer to the unit question. How does what you have learned about energy help explain how a spark is formed and why it might start an explosion?

**READING QUESTIONS:** Article for Activity 2.2: [*Potential Energy and Fields*](https://docs.google.com/document/d/1lPuFI3UyC6e1kEN0IVKErDxCxX6vP822pGY4J_6PVc8/edit?usp=sharing)

1. In Figure 2 (from article), 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.

2. 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.

Simulation link: <https://lab.concord.org/embeddable.html#interactives/interactions/electricPE.json>