INVESTIGATION 2

ONE PAGER

high amount of charge:

low amount of charge:

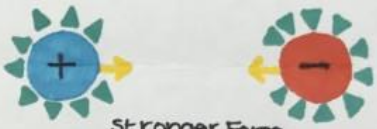
Effects of the amount of charges:

The amount of charge an object has effects the force and field. The greater the amount of protons and electrons, the object will have a stronger force and field. However, the smaller the amount of protons and electrons, the weaker the force and field.

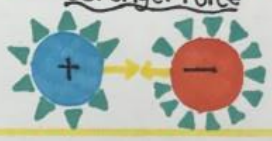
DISTANCE BETWEEN CHARGES:

The distance between the charges changes the force because the greater the distance, the ~~greater~~ weaker the force. The shorter the distance, the stronger the force will be.

Weaker Force



Stronger Force



Stronger Force & Field:

- Distance

- amount of charge

Weaker Force & Field:

- Distance

- amount of charge

ELECTRIC FORCE & FIELD:

The greater the distance and smaller the ~~force~~ amount of charge, the electric force and field will be weaker. The smaller the distance and higher amount of charge, the electric force and field will be stronger.

CONNECTING ELECTRIC CHARGE TO OTHER PHENOMENA:

Electric charges connect to other phenomena like a bee and a flower because the pollen in the flower is negative and the bee is positive. The bee knows to get pollen from the flower since they will attract.

Investigation 2

Act 2.1

= Electric force

Effects of the amount of charges

Two objects of opposite charge will attract each other

Two objects of the same charge will pepel each other

Objects with stronger charges have a stronger force

Objects with weaker charges have a weaker force

Objects can interact without touching because they have an electric field that extends in all directions and exerts force on other objects

Act 2.2

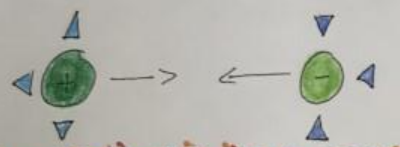
= Electric field

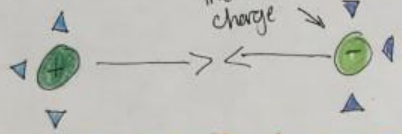
Distance between Charges

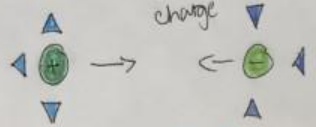
The farther apart two objects become the weaker the strength of force becomes

The closer two objects become the greater the strength of force becomes

When the charge of an object increases the forces on both objects becomes stronger, and when the charge decreases the forces on both objects becomes weaker







Act 2.3

Electric force and field

Electric force is the attraction or repulsion between charged objects

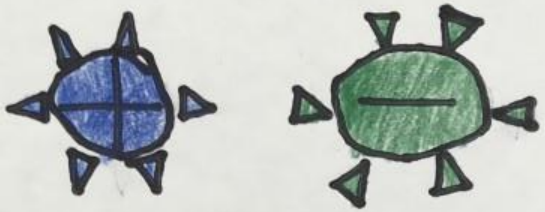
Electric field is the physical space that surrounds an electric charge extends in all directions and gets weaker the farther out it goes

Using models, we are able to see how charges interact in a variety of phenomena

INVESTIGATION 2

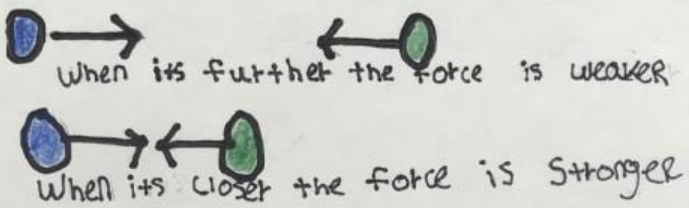
2.1 SUMMARY

2.1 Talks about how there is different ways that the pointers/triangles face different ways depending on the charges for example how when it's a positive charge the triangles point faces away from the positive charge and how when the charge is negative the pointy part of the triangle is faces towards the negative particle.



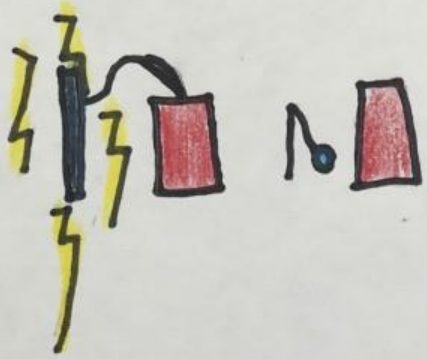
2.2 SUMMARY

In 2.2 we talked about force and how if its closer than it's a stronger force and it attracts more and how if it is further away it is a weaker force and they don't have a strong attraction.



2.3 SUMMARY

In 2.3 we talked about how charges can move from object to object. For example, a lightning rod, a lightning rod takes the charge moves the charge to cause bells that is connected to the lightning rod by wiring ring, so it alerts the person about an incoming storm.



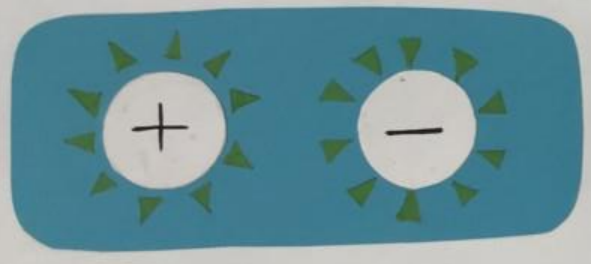
Investigation 2

Repulsion or Attraction?

When two charged objects attract, they have opposite charges. For example a positive object and a negative object will attract. On the other hand, when two objects repel, they have liked charges. A positive and another positive object will repel.

What is electric field?

An electric field is the physical space that surrounds an electric charge. It extends in all directions and gets weaker as it goes further out. Pointers or triangles are used to demonstrate the electric field of a charged particle. When the electric charge is positive the triangles point away. When the triangle points towards the particle it is negative.



A bee becomes positively charged from rubbing against particles in the air. The pollen from the flower is negatively charged and causes the bee to attract to it.

Distance between Charges?

When two particles or objects are closer to eachother they will be more likely to attract or repel stronger. When they are further apart they will attract or repel but weaker than when they are close

Arrows are used to show the forces between two charges.

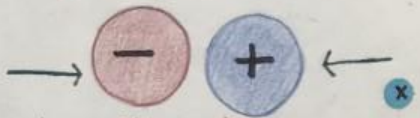
→ Strong force

→ Weak force

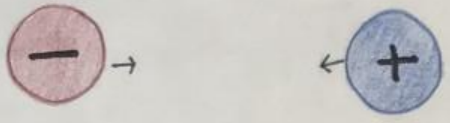
Electric Force:

An electric force is the attraction or repulsion between charged objects.

Strong Attraction:



Weak Attraction:



These pictures show how the distance between two charged objects affects the force between them.

Distance and Amount of Charge affecting interactions between objects

Act. 2.1

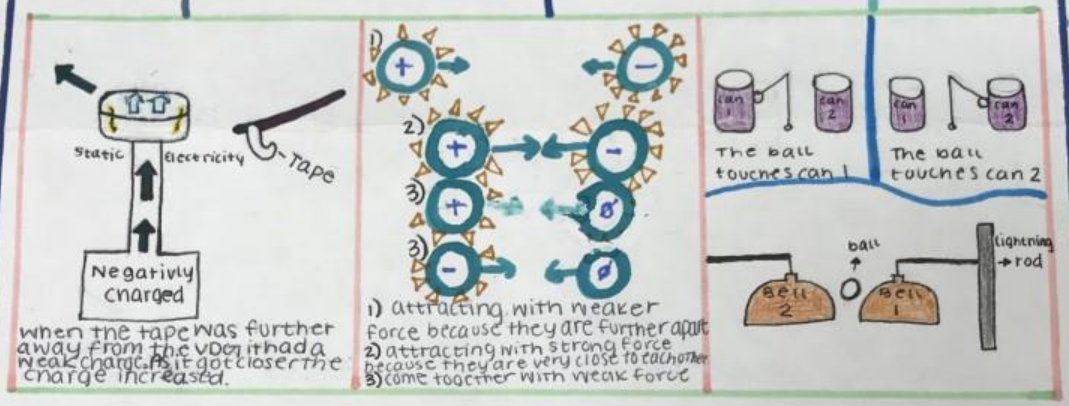
I did a simulation on the computer to see what happens when objects that are further away and closer together interact. I found that when a positive and a negative come together they attract. When they are further apart they have a weak attraction but when they are closer they have a strong force. This is the same for repulsion.

Act. 2.2

We took a piece of tape and held it close to the VDG. When, the tape was far away there was no attraction or repulsion. As, we moved the tape closer to the VDG the tape started to repel. When, it was very close to the VDG it flipped which means the strength of the repulsion was great. This is because distance affects the strength of the charge.

Act. 2.3

When I did the can simulation I found out that the ball is nuetral to start. When, the ball hits can 1 which is negative because it is connected to the VDG, the ball becomes negative too. After, the ball hits can1 they repel, and the ball hits the neutral can 2, when the can gets hit it turns negative also.



When the tape was further away from the VDG it had a weak charge. As it got closer the charge increased.

1) attracting with weaker force because they are further apart
2) attracting with strong force because they are very close to each other
3) come together with weak force

POSITIVE - when an object has more protons then electrons

NEGATIVE - when an object has more electrons then protons

NUETRAL - when both protons and electrons are the same

Act. 2.3 cont

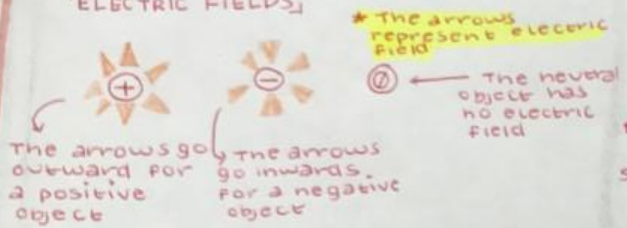
This neutralizes the ball which creates a ringing sound. Franklins bells are used to predict thunderstorms. As you can see Bell 1 is connected to a lightning rod which gets charged when thunderstorms are coming. Negative charges transfer to the bells.

Investigation 2

2.1

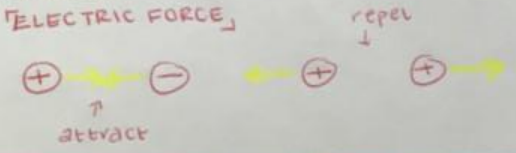
In investigation 2.1 we questioned how can charged objects have an effect on each other without touching. We saw how an aluminum 'pointer' on a string reacted to the Van de Graaff generator. This helped us visualize how the position of the pointer affected its direction. We also tested out a simulation that showed the electric field of a charged object.

「ELECTRIC FIELDS」



Electric fields help explain how electric forces can act on objects without contact. We can't see an objects electric field but we can see its effect on other objects. Electric force, the relationship between to objects, is represented with arrows. Arrows show how strong the attraction or repulsion is. We know that opposites attract while same charges repel. For example, electric charge creates thunderclouds and the thunder released. Repulsion and attraction is present during thunderstorms.

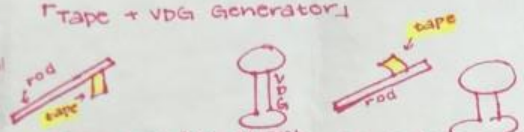
「ELECTRIC FORCE」



2.2

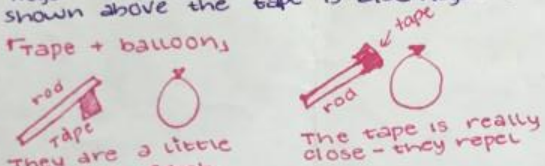
The question for activity 2.2 was: how do factors like distance and amount of charge affect interactions between objects? We observed how tape on a rod reacted to the Van de Graaff generator. As the tape got closer to the VDG it moved farther apart. We concluded that the tape and the VDG generater had the same charge because they repelled.

「Tape + VDG Generator」



In addition we also brought the tape near a balloon, which had been rubbed with wool. We know the balloon had a negative charge and from the expiriment shown above the tape is also negative.

「Tape + balloon」

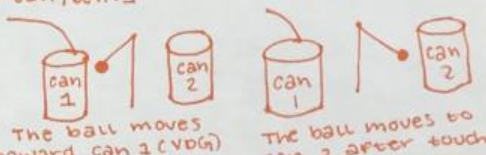


Both of these expiriments show how electric fields are present. The balloon had to be <u>really</u> close to have an affect on the tape. The VDG could be within a larger range and still repel the tape. This represents the bees and the flowers because although electric fields cant be seen we can 'see' it in other ways. The repulsion and how bees find pollen demonstrate how electric fields work.

2.3

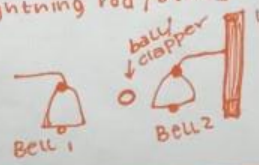
The question asked in activity 2.3 is - how does our model of charge interactions connect with a variety of phenomena? To answer this we watched a video of Franklins bells. The video showed a can connected to the VDG generator, a ball and another soda can. When the VDG generator was turned on the ball began to swing between both cans. This made a bell sound.

「can / bells」



The ball moved toward can 1 because it was charged (by VDG) The charge was transferred to the ball, the ball then moved toward can 2. This process repeated. The amount of charge on can 1 attracted the ball. When the charge is transferred the can (1) repels the ball. The ball moves and gives can 2 the charge, which neutralizes the ball. This process creates a ringing sound. This connects to thunder storms and other phenomena. Franklins bells are used to predict thunderstorms. one bell is conected to a lightning rod, which is charged when thunderstorms are approaching. The same thing happens.

「lightning rod / bells」



Lightning rod — The rod is charged and the bells display the same movement as the cans.

Charges

DISTANCE AND STRENGTH

Negative

Neutral

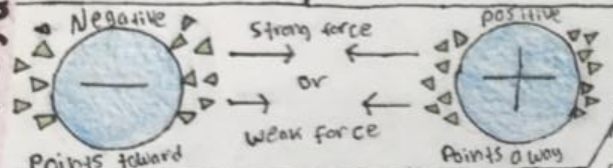
Positive

INV.2~2.1

Electric Field- The physical space that surrounds an electric charge, extends in all directions getting weaker the farther it goes.

Electric force- The attraction or repulsion between charged objects.

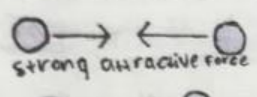
- Electric fields point toward a negative object.
- Electric fields point away from a positive charged object.



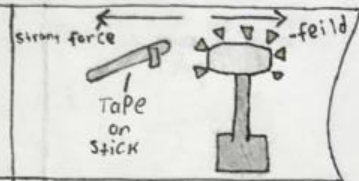
A single charged object generates an electric field but does not experience any forces. When a second charge is placed within that electric field, the two objects will experience a force.

Arrows depict direction of force due to the interaction of electrically charged object, and the field exerts a force on other charged objects. Even though we can't see electric fields, we know they exist because we can see their effects

INV.2~2.2



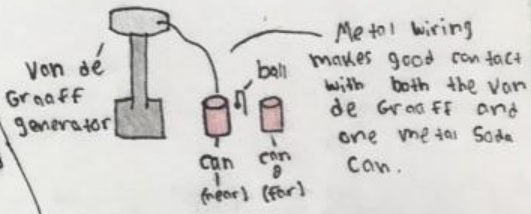
Arrows can represent not only direction of the force but also the strength of the force.



Both the tape and van de Graaff generator are negative, which means they both have a negative field. The balloon also has a negative field. Once you get close to the van de Graaff with the tape it starts to repel, But since its a strong force it starts to repel at a farther distance. The balloon had to be up close to the tape for it to repel because it had a weak force. What I noticed is that they had to be at a certain distance for it to be noticable that they are repeling and thats because the strength of the charge.

INV.2~2.3

Ringing the Bells



- Two soda cans act as bells. One of the cans is connected to the dome of the van de Graaff gen.
- A ball hanging between the cans acts as the clapper that rings the bell

A. Before the van de Graaff is turned on, the ball hangs motionless between the two cans

B. After van de Graaff is turned on it will make the ball move towards can 1.

C. After moving towards can 1, the ball touches it.

D. After touching can 1, the ball moves away and swings toward can 2.

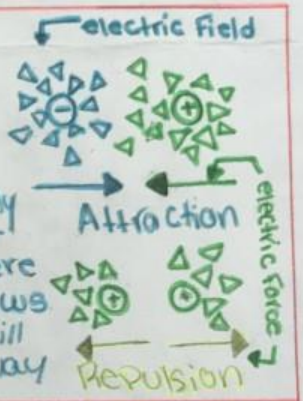
INVESTIGATION 2

2~ How can charged objects effect on each other without touching?

Objects have an effect on others without touching because of electric field. Electric field extends in all directions around a charged object. In this figure, it shows a piece of tape repelling from a VDG from a far distance. Because of the electric force and electric field around the VDG, it is effecting the piece of tape

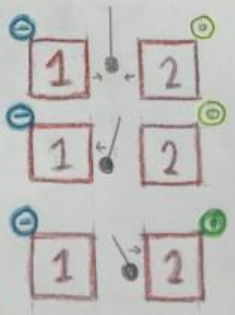
1~

Electric field cannot be seen but we know it exists because on it's effect on objects around it. The electric field points toward a negatively charged object and away from a positive object with an electric field there is an electric force shown with arrows when objects attract the arrows will face toward eachother and point away when objects repel.



3~ How does our model of charge interactions connect with phenomena?

The model connects with a variety of phenomena because of like charges and unlike charges, such as posative with posative or negative with posative. It also connects because of Electric field and electric force of a object. Objects will also attract to neutral.



— E·L·E·C·T·R·I·S·I·T·Y —

UNIT 1. INV. 2 ONE-PAGER

What are factors that affect the interactions between objects?

ELECTRIC CHARGE

Electric force is a property of matter that is determined by the amount of electrons and protons a particle has.

The three types of electric charge are negative (−), positive (+) and neutral.

A positively charged (object) has more protons, while a negatively charged has more electrons, and a neutral charged (object) has either = amount or none

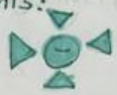
ELECTRIC FIELD

An electric field is the space surrounding an electric charge that extends in all directions.

It gets weaker the farther it goes; the interaction between the objects within the electric field weakens.

It is represented by triangles/arrows since it cannot be seen directly. The direction in which the arrows point will be based on the charge.

The electric field of a negatively charged particle looks like this:



The electric field of a positively charged particle looks like this:

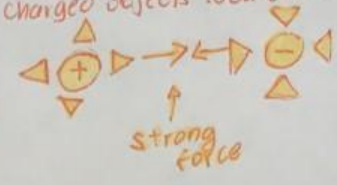
Neutral particles do not have an electric field, however.

ELECTRIC FORCE

This is the attraction/repulsion between two charged objects.

It can be represented by large or short arrows, depending on the strength of force.

This is how it would look like on opposite charged objects located near each other:



INTERACTIONS

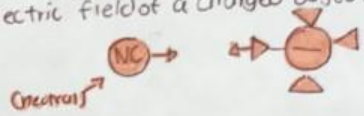
There are 3 interactions that could occur between two charged and/or neutral objects if located within their electric field:

- ATTRACTION

This type of interaction is the process when two objects move towards each other; are attracted.

Attraction can occur when:

- Two opposite charged objects are brought close to each other/into each other's electric field (− & +).
- A neutral object is brought in the electric field of a charged object.



- REPULSION

This type of interaction occurs when two similar charged objects (like − & − or + & +) are brought near each other's electric fied and move away from each other; repel.

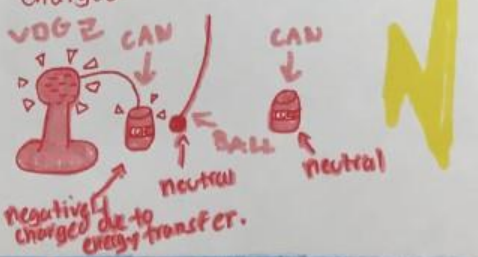
- NONE

This is when two neutral (charged) particles are brought near each other; nothing happens.

TRANSFER OF CHARGE

Positive and positive charge can be transfered to other objects, especially to neutral objects by direct contact.

For example, the Van de Graaf generator, that has/produces negative charge, can transfer some of its charge to a neutral charged can to make the can negatively charged



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