

Assignment -- Applications of Static Electricity

/25

- Neatness /2
- Full sentences /2
- Meaningful sentences /2
- On time /5
- Answers /14

Part A: Using Static Electricity

1. What is "grounding"?
2. How does touching a small pith ball take away the charge on the pith ball?
3. Why is there very little wasted paint in electrostatic spray painting?
4. How do electrostatic precipitators reduce air pollution?
5. What are three other uses for static electricity?
6. Why does plastic food wrap stick to everything?

Part B: Eliminating Static Electricity

1. What are the two main ways to eliminate static electricity?
2. How does "Static Guard" work?
3. How does a creme rinse prevent "fly-away" hair?
4. How do fabric softener "dryer sheets" prevent "static cling"?
5. How does using a humidifier prevent getting "shocked" in your home?

Part C: The Dangers of Static Electricity

1. During a storm, the bumping together of particles in the sky causes clouds to become negatively charged. How does this negative charge cause lightning?
2. How does a lightning rod protect your home?
3. Why is it dangerous to stand under a tree during a thunderstorm?

Chapter #9 - Static Electricity

E L E E P O S I T I V E C R I
T R I P C N L A R T U E N E N
I T Y O I S O S H O C E K P D
R I N C E G C I Z N Y L O U U
O S D S V S T A T I C E S L C
T P G O I X J D Q C N C U S T
C A R R T G N N D P A T S I I
U R O T A T I P I C E R P O O
D K U C G C H A R G E O T N N
N K N E E B D E B J T S C T I
O R D L N N A D S H D T M R A
C Q U E B W R B W M T A D F A
R O T A L U S N I Q G T X J R
C I R T C E L E H R P I Q R X
G N I N T H G I L W E C H Q M

Circle the letters of the words in the list below. The remaining letters will give you a sentence.

ATTRACTION
ELECTRIC
GROUND
LIGHTNING
POSITIVE
SPARK

CHARGE
ELECTROSCOPE
INDUCTION
NEGATIVE
PRECIPITATOR
STATIC

CONDUCTOR
ELECTROSTATIC
INSULATOR
NEUTRAL
REPULSION

USING STATIC ELECTRICITY

GROUNDING

Our planet is very large compared with any of the objects on it. Because of its size, the earth can gain or lose relatively small numbers of electrons without becoming charged (the electrons seem to get lost among the atoms that make up the earth). When a positively charged object is brought into contact with the ground, it will gain electrons from the earth and become neutral. When a negatively charged object is brought into contact with the ground, it will lose electrons to the earth and become neutral. This process of making an object neutral by placing it in contact with the earth is called GROUNDING. Without grounding, a charged object would remain charged forever, and either attract or repel other objects (and give us "shocks").

When your hand touches a smaller charged object, it has the same effect as a charged object touching the earth. This is why touching a charged object (or holding it in your hand) causes it to become neutral again. The object either gains electrons from you or loses electrons to you. Your body is large compared to the charged object, and so the electrons seem to get lost in your body.

ELECTROSTATIC SPRAY PAINTING

When a spray gun is used to paint a wire mesh fence, a lot of paint is usually wasted. If the fence is given a static charge and the paint is given the opposite charge, the paint will be attracted to the wire mesh. The paint will now be attracted to the wire instead of going through the holes. More paint will stick to the mesh, and less will be wasted.

ELECTROSTATIC SANDPAPER

The paper backing for sandpaper can be coated with glue and then given a strong static charge. The grit particles (which are neutral) will be attracted to the sandpaper (which is charged) and they will stay on the paper longer. This makes the paper last longer, and can be cheaper to use in the long run.

INSECTICIDE POWDERS

Insecticide powders (used to kill insects on plants) can be given a static charge before being sprayed onto plants. Because the powder is charged, it will be attracted to and stick to a plant (which is neutral) much better than if it wasn't charged. This will make it more effective as a bug killer.

ELECTROSTATIC PRECIPITATORS

Tall chimneys in chemical plants, smelters and mills may have statically charged parts inside them. These charged parts are called ELECTROSTATIC PRECIPITATORS. These attract neutral dust particles and polluting droplets before they can escape from the smokestack. As much as 99.5% of the large particles can be removed from the air before they leave the smokestack. This will cut down on air pollution.

Dust particles can prevent sensitive electrical parts from functioning properly. Small electrostatic precipitators are used to remove dust from the air of the factories where electrical parts are being made. This prevents the dust from damaging the parts as they are being made.

Similar devices remove dust from hospital air. This keeps dust out of sterile areas, and away from people with allergies.

It is now possible to buy electrostatic air cleaners that can be hooked up to your furnace. It will remove the dust from the furnace air before it is circulated around the house.

PLASTIC FOOD WRAP

The thin plastic used for wrapping food clings to itself because of static electricity. The film is charged when it is made. It clings to almost any neutral object it comes in contact with and makes an airtight seal.

ELIMINATING STATIC ELECTRICITY

Many things we come in contact with have a static charge, and will attract to neutral objects. This can be annoying, and can cause problems for us. How can we eliminate these problems?

The way to eliminate a static charge on an object so that it will not attract to neutral objects is to:

1. Get rid of the static charge on the object, and/or
2. Prevent an object from becoming statically charged

1. Getting Rid of Static Charge

Products like "Static Guard" spray get rid of the opposite charges found on the two objects clinging together, by neutralizing them. This makes them both neutral, and as we know, two neutral objects do not attract each other.

2. Preventing Objects From Becoming Statically Charged

Two objects become statically charged when they are rubbed together because electrons "jump" from the weaker object to the stronger object. To prevent objects from becoming charged in the first place, we must somehow stop the electrons from being transferred from one object to another. This is usually done by coating one object with a film of some sort that stops the electrons from being transferred. If the electrons can't leave one object or enter another, then the objects will remain neutral.

Creme rinse coats the hair with a film that prevents electrons from leaving the hair and moving onto the comb. The hair and the comb don't become charged when rubbed together, and so "fly-away" hair does not happen.

Fabric softener (or "dryer sheets") work in the same way. They coat the clothing with a film that stops electrons from being transferred from one piece of clothing to another as they rub against each other in the dryer. Since the clothes remain neutral, they won't stick together and "static cling" does not happen.

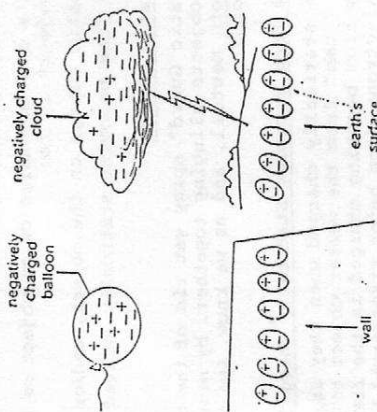
You are less likely to get "shocks" from metal objects in your home after you walk across a rug if the air in your home is humid than if it is dry. In a humid home, the water vapour in the air coats objects with a film and stops the electrons from being transferred to other objects that rub against them. This stops the objects from becoming statically charged, which stops you from getting "shocked".

THE DANGERS OF STATIC ELECTRICITY

LIGHTNING

Do you remember how the negatively charged balloon brought about a positive charge on the surface of the neutral wall near it? The same thing can occur on a larger scale in nature. The motion of the particles in the clouds high above the earth may result in the clouds becoming negatively charged. This may induce a positive charge on the surface of the earth, just as a negatively charged balloon may induce a positive charge on the surface of a wall.

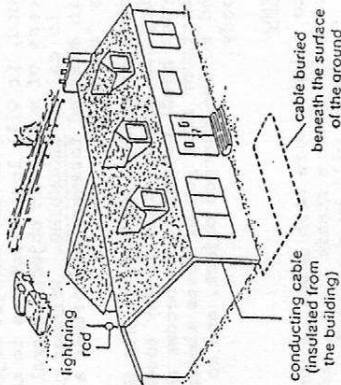
If the difference between the size of the negative charge in the cloud and the induced positive charge on the earth is large, negative electrons are attracted to the earth's surface and may "jump" from the cloud to the earth. If this happens, you will see a giant spark. This spark is lightning!



The balloon induces a positive charge on the surface of the wall. The cloud induces a positive charge on the surface of the earth.

A bolt of lightning may be up to 3 km in length and 30 cm in width. The heat generated from the electron movement may reach 30 000°C.

Lightning will usually strike the highest point on the earth below (the closest object to it). For this reason, lightning rods may be attached to the top of houses and tall buildings. An insulated conductor connects the lightning rod to a cable buried in the ground. Lightning will strike the rod before striking anything else nearby, and the charge (electrons from the cloud) is carried along the conductor to the earth. Since the earth is so large, it "absorbs" the excess electrons safely, just as it does in "grounding".



How a lightning rod protects buildings

It is important to know about the dangers of lightning and how to react to them. If you are caught outside during a thunderstorm, seek shelter in a building or a car. Do not go boating or swimming and avoid being the tallest object in the area. In fact, do not stand near a tall object such as a tree. When lightning strikes, it often hits tall or exposed ungrounded structures. It can spread along the ground and electrocute you. Perhaps the safest thing to do if you are caught without shelter is to squat or lie flat on the ground, far from tall structures.