Priestley's Physics Project

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The Challenge

This Challenge was inspired by a study of an exhibit at the Science museum London. It is expected that you will want to read Priestley's Story and read about his electrostatic machine

Your teacher will set you one or two tasks from the 'static electricity timeline' . A summary of these tasks are given here. The Task pages will give links to websites that will help with the challenge. You will find here a link that is of general use and may be a good starting point.

http://emc2.acu.edu/ptra/ptra_UH_Houston99/program/electrostatics.htm

Task	Title		Practical activity	Written/research	Presentation
1	Thales Challenge	Charge by friction	✓		✓
2	Gilbert Challenge	Build a versorium	✓		✓
3	Guericke Challenge	Electrical sparks	✓		✓
4	Hauksbee Challenge	Fluorescent tubes	✓	✓	✓
5	Grey Challenge	Conductors and insulators			✓
6	Dufay/Franklin	Nature of charge			✓
7	Musschenbroek	Leyden jar	✓		✓
8	Watson Challenge	Drift velocity		✓	✓
9	Volta Challenge	Electrophorus	✓	✓	✓
10	Bennet Challenge	Electroscope	✓		✓
11	Priestley/Coulomb	Inverse square Law		✓	✓

These tasks are designed to be undertaken over the summer vacation. Students are expected to give a presentation to the group early after starting their A/AS study. The practical tasks are not difficult, but you will be expected to give a well prepared presentation of your findings. You may consider producing simple visual aids to get your ideas across and demonstrate any practical activity. Each presentation should not last more than ten to fifteen minutes.

Use Mr. Bunge's Algebra Practice Pages to check out your ability to rearrange simple equations. You should not have too much trouble with the first four lessons. This is the link.

http://www.accessone.com/~bbunge/Algebra/Algebra.html

- **Lesson 1 (Equations: ax + b = c)**
- **Lesson 2 (Equations: ax + b = cx + d)**
- **Lesson 3 (Inequalities: ax + b > c)**
- **Lesson 4 (Inequalities: ax + b < cx + d)**
- **Lesson 5 (Absolute Value: |x| = c)**

You will be able to take things further with the following link. It is expected that you should be able to solve all the linear equations

http://www.sosmath.com/algebra/solve/solve0/solve0.html

. The study of Physics deals with very large and very small numbers. You will need to become familiar with Scientific notation for example

Power	Prefix	Abbreviation
10^{-9}	nano	n
10^{-6}	micro	
10^{-3}	milli	m
10^{-2}	centi	c
10^{-1}	deci	d
10^{3}	kilo	k
10^{6}	mega	M

We challenge you to make some sense of these numbers and ensure you can use scientific notation using a calculator, and without one.

Success in a Physics course at this level can only be achieved with research and independent learning. Physics texts may still the best resource here but the World Wide Web can win out by being interactive, up-to-date, and exciting. Students will be expected to search the web for resources that may be of use to them during their study, and to share them with fellow students.

The Thales Challenge Task1

Rubbed amber will attract small objects. This could not be explained in 6^{th} century B.C.

We now know this has to do with electron transfer.

Practical Investigation.

Some materials get charged by friction more easily than others. Design an experiment to find out which materials charge better than others**.** Electrical insulators work better than conductors. There are now a huge number of different types of plastic. Most people would find it hard to give the scientific name for each material. If you get stuck, you can give the name of the object, for example.

1, Old vinyl record.

2, Expanded polystyrene packaging.

3, Old CD.

4, Clear plastic ruler. etc.

You will need to find a way of comparing the amount of charge on the different objects.

A useful link is given on the website.

Presentation

Prepare a presentation to the class, which explains the Physics behind what you have found out.

How do charged objects attract others? Try to make your presentation interesting by including a demonstration. For example, if a plastic ruler is rubbed with a dry cloth, it will bend a thin stream of water. You may wish to demonstrate and explain this effect.

The Gilbert Challenge Task2

William Gilbert explained some of the similarities and differences between electrostatic effects and magnetism, he also made the first 'versorium'. You have two tasks in this challenge. Practical Investigation

Design and build a simple Versorium. Test out your design, evaluate and make improvements. Your design should be small, portable and easy to construct. You will be asked to demonstrate your design in the group. A useful link is given on the website.

Presentation

Devise a presentation to explain the similarities and differences between magnetism and static electricity.

The von Guerrick Challenge. Task 3

Otto von Guerrick made a machine that could make electrical sparks. Now that must be fun. Your challenge has two parts.

Practical Investigation

Try to make a 'machine' or simple method of making a large electrical charge. You must consider safety in this activity very carefully. A large charge without a spark will be considered a success.

A useful link is given on the website.

You may wish to work with the student(s) doing the Volta Challenge and use their link as well.

Presentation.

Give a simple but accurate explanation of the Physics of sparks and prepare to explain this to the group.

The Hauksbee Challenge Task4

Francis Hauksbee observed and investigated glowing gases in the 18th century. Now that's what I call 'ahead of your time'.

Practical Investigation

Your practical activity can only be carried out at school and you will need the help of your teacher.

Your task is to demonstrate that a fluorescent tube held near to a charged Van de Graff generator will start to glow in your hand.

In the mean time you have a written research task.

Research/written task.

Fluorescent tubes work on a completely different principle to ordinary filament lamps.

Produce a written report which answers some or all of these questions:

1) How do fluorescent lamps work?

2) How does an ordinary lamp work?

3) Is there any difference in the light these produce?

4) Which is the most efficient to use? What does this mean?

5) Do fluorescent lamps and ordinary lamps produce a different type of shadow?

Presentation

Present your findings to the group.

The Grey Challenge Task 5

Stephen Grey investigated how electricity traveled along materials.

Presentation

Give a presentation to explain the difference between conductors and insulators. Your presentation should include an explanation about how electrons travel through a conductor.

The Dufay/Franklin Challenge Task 6

Charles Dufay and Benjamin Franklin had different ideas on the nature of electricity, both contributed to our present understanding of electricity.

Presentation

Give a presentation which describes in detail how objects become charged by friction and by induction.

A useful link is given on the website.

The Mussenbroek challenge Task 7

Pieter von Mussenbroek was interested in storing electricity in a bottle. He made a simple device called a Leyden jar.

Practical Investigation

Your challenge is to make a simple Leyden jar. A useful link is given on the website. Do not get over ambitious with this activity. The link given above is quite suitable, but larger jars like the one pictured above in the London Science Museum can give a really nasty kick.

Presentation.

Present your findings to the group

The Watson Challenge Task 8

William Watson wrongly thought that electrical impulses were instantaneous

Investigation/written task

Find out what is meant by the drift velocity of electrons and what is the approximate speed of electrical impulses or messages. why are these to speeds so different.

Presentation

Present your findings to the group.

The Volta Challenge Task 9

Volta was interested in the fact that the electrophorus produces almost endless amounts of electricity

Practical activity

Try to make your own electrophorus. A useful link is given on the website.

Research/written task

Find out how the electrophorus works, and also investigate the principle of conservation of energy. Explain why it might appear that the electrophorus defies this principle, and why it does not. A useful link is given on the website.

Presentation

Present your findings to the group.

The Bennet Challenge Task 10

Practical Investigation

Construct a simple electroscope. Use it to investigate the charge on objects.

A useful link is given on the website.

Presentation

Demonstrate your electroscope to the group. explain how it works. For a real challenge explain how an electroscope can be used to find if the charge on an object is positive or negative.

A useful link is given on the website.

Priestley/Coulomb Challenge. Task 11

Priestley suggested and Coulomb proved that the force caused by static electricity obeys an 'inverse-square law'.

Research task.

What is the 'inverse square law'. What sort of situations can it be applied to. A useful link is given on the website.

Presentation.

You will be expected to present your findings to the group.

A PowerPoint presentation may be of some use. There is one you can download from the website (Remember to left click to advance the show).