

Summary

Topic 5 - Electricity

Subject	Year	Start date	Duration
Physics	IB1, IB2	Week 2, March	7 weeks 15 hours

Course Part
Core

Curriculum

Aims

- Appreciate scientific study and creativity within a global context through stimulating and challenging opportunities
- Acquire a body of knowledge, methods and techniques that characterize science and technology
- Apply and use a body of knowledge, methods and techniques that characterize science and technology
- Develop an ability to analyse, evaluate and synthesize scientific information
- Develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities
- Develop experimental and investigative scientific skills including the use of current technologies
- Develop and apply 21st century communication skills in the study of science
- Become critically aware, as global citizens, of the ethical implications of using science and technology
- Develop an appreciation of the possibilities and limitations of science and technology
- Develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge

Objectives

Demonstrate knowledge and understanding of

- facts, concepts and terminology
- methodologies and techniques
- communicating scientific information

Apply

- facts, concepts and terminology
- methodologies and techniques
- methods of communicating scientific information

Syllabus Content

Core

5. Electricity and magnetism

5.1 – Electric fields

Nature of science:

Modelling: Electrical theory demonstrates the scientific thought involved in the development of a microscopic model (behaviour of charge carriers) from macroscopic observation. The historical development and refinement of these scientific ideas when the microscopic properties were unknown and unobservable is testament to the deep thinking shown by the scientists of the time.

Understandings:

Charge

Electric field

Coulomb's law

Electric current

Direct current (dc)

Potential difference

Applications and skills:

Identifying two forms of charge and the direction of the forces between them

Solving problems involving electric fields and Coulomb's law

Calculating work done in an electric field in both joules and electronvolts

Identifying sign and nature of charge carriers in a metal

Identifying drift speed of charge carriers

Solving problems using the drift speed equation

Solving problems involving current, potential difference and charge

5.2 – Heating effect of electric currents

Nature of science:

Peer review: Although Ohm and Barlow published their findings on the nature of electric current around the same time, little credence was given to Ohm. Barlow's incorrect law was not initially criticized or investigated further. This is a reflection of the nature of academia of the time with physics in Germany being largely non-mathematical and Barlow held in high respect in England. It indicates the need for the publication and peer review of research findings in recognized scientific journals.

Understandings:

Circuit diagrams

Kirchhoff's circuit laws

Heating effect of current and its consequences

Resistance expressed as $R=VI$

Ohm's law

Resistivity

Power dissipation

Applications and skills:

Drawing and interpreting circuit diagrams

Identifying ohmic and non-ohmic conductors through a consideration of the V/I characteristic graph

Solving problems involving potential difference, current, charge, Kirchhoff's circuit laws, power, resistance and resistivity

Investigating combinations of resistors in parallel and series circuits

Describing ideal and non-ideal ammeters and voltmeters

Describing practical uses of potential divider circuits, including the advantages of a potential divider over a series resistor in controlling a simple circuit

Investigating one or more of the factors that affect resistance experimentally

5.3 – Electric cells

Nature of science:

Long-term risks: Scientists need to balance the research into electric cells that can store energy with greater energy density to provide longer device lifetimes with the long-term risks associated with the disposal of the chemicals involved when batteries are discarded.

Understandings:

Cells

Internal resistance

Secondary cells

Terminal potential difference

Emf

Applications and skills:

Investigating practical electric cells (both primary and secondary)

Describing the discharge characteristic of a simple cell (variation of terminal potential difference with time)

Identifying the direction of current flow required to recharge a cell

Determining internal resistance experimentally

Solving problems involving emf, internal resistance and other electrical quantities

5.4 – Magnetic effects of electric currents

Nature of science:

Models and visualization: Magnetic field lines provide a powerful visualization of a magnetic field. Historically, the field lines helped scientists and engineers to understand a link that begins with the influence of one moving charge on another and leads onto relativity.

Understandings:

Magnetic fields

Magnetic force

Applications and skills:

Determining the direction of force on a charge moving in a magnetic field

Determining the direction of force on a current-carrying conductor in a magnetic field

Sketching and interpreting magnetic field patterns

Determining the direction of the magnetic field based on current direction

Solving problems involving magnetic forces, fields, current and charges

 **ATL Skills**

 **Approaches to Learning**

 **Thinking**

- In this unit, we will

ask students to formulate a reasoned argument to support their opinion or conclusion

give students time to think through their answers before asking them for a response

reward a new personal understanding, solution or approach to an issue

ask open questions

set students a task which required higher-order thinking skills (such as analysis or evaluation)

build on a specific prior task

help students to make their thinking more visible (for example, by using a strategy such as a thinking routine)

require students to take an unfamiliar viewpoint into account when formulating arguments

ask questions that required the use of knowledge from a different subject from the one you are teaching

include a reflection activity

make a link to TOK



Social

- In this unit, we will

have students work in small groups

allocate, or ask students to allocate among themselves, different roles in a classroom discussion or activity

have students peer assess their group performance or process

support students in resolving a conflict in a team

give a group assessment task

give students feedback on how they worked as a group

have students discuss their understanding of a text or idea among themselves and come up with a shared understanding

provide an opportunity for students to analyse the impact of their behaviour on the class or on a group performance

encourage students to consider alternative points of view or to take the perspective of others

provide opportunities for students to make decisions



Developing IB Learners

☆ Learner Profile



Inquirers



Knowledgeable



Thinkers



Reflective



Stream & Resources

☰ Resources



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Topic 5 - Electricity



Topic_5.1_-_Electric_fields.pptx

2 MB PowerPoint Presentation

IB DP 12 PHY 6 HL (IB1)



Topic_5.2_-_Heating_effect_of_electric_currents.pptx
1 MB PowerPoint Presentation



Topic_5.3_-_Electric_cells.pptx
900 KB PowerPoint Presentation



Topic_5.4_-_Magnetic_effects_of_electric_currents.pptx
6 MB PowerPoint Presentation