International Baccalaureate
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Marietta City Schools

2023–2024 District Unit Planner

Teacher(s)	IB Physics PLC	**Subject Group and Course**	Group 4 - Physics		
Course Part and Topic	Topic 5 - Electricity and Magnetism	**SL or HL / Year 1 or 2**	SL Year 2	**Dates**	Late August-Mid October (8 weeks)

Unit Description and Texts	**DP Assessment(s) for Unit**
Students will examine how energy is transferred through the electromagnetic force. ● Bowen-Jones, Michael, and David Homer. IB Physics. Oxford: Oxford UP, 2014. Print.	● 5.1 paper 1 quiz, 5.2 paper 1 quiz, 5.3 paper 1 quiz, 5.4 paper 1 quiz ● Test (paper 1 + paper 2)

INQUIRY: establishing the purpose of the unit

Transfer Goals

List here one to three big, overarching, long-term goals for this unit. Transfer goals are the major goals that ask students to "transfer" or apply their knowledge, skills, and concepts at the end of the unit under new/different circumstances, and on their own without scaffolding from the teacher.

Phenomenon: Energy can be efficiently transferred through the use of moving electrons.

Statement of Inquiry: The various manifestations of electricity are the result of the accumulation or motion of numbers of electrons.

1. Students will calculate the force between two or more charges.
2. Students will examine the effects of electric and magnetic fields.
3. Students will solve for current and electrical potential energy drop across resistors in complex circuits.

ACTION: teaching and learning through inquiry

<table>
<tr><th>Content / Skills / Concepts - Essential Understandings</th><th>Learning Process

Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.</th></tr>
<tr><td rowspan="2"><u>Students will know the following content:</u>
Charge
Electric field
Coulomb's law
Electric current
Direct current (dc)
Potential difference
Circuit diagrams
Kirchhoff's circuit laws
Heating effect of current and its consequences
Resistance expressed as
Ohm's law
Resistivity
Power dissipation
Cells
Internal resistance
Secondary cells
Terminal potential difference
Electromotive force (emf)
Magnetic fields
Magnetic force
<u>Students will develop the following skills:</u>
Identifying two forms of charge and the direction of the forces between them</td><td>Learning experiences and strategies/planning for self-supporting learning:

☒ Lecture

☐ Socratic seminar

☒ Small group/pair work

☒ PowerPoint lecture/notes

☒ Individual presentations

☐ Group presentations

☐ Student lecture/leading

☐ Interdisciplinary learning

Details:

Students will learn through a combination of presentations, small group work, practice problems, and lab work.

☒ Other(s): practice problems, lab work</td></tr>
<tr><td>Formative assessment(s):</td></tr>
</table>

• **Solving problems involving electric fields and Coulomb's law** • **Calculating work done in an electric field in both joules and electron volts** • **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** • **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** • **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** • **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**	*Paper 1 quizzes at the end of each subtopic.*
	Summative assessments: *Topic test consisting of questions from P1, P2, and P3*

Published: September, 2023

Resources, materials, assessments not linked to SGO or unit planner will be reviewed at the local school level.

	partial lab report
	Differentiation: ❏ Affirm identity - build self-esteem ✓ Value prior knowledge ✓ Scaffold learning ✓ Extend learning Details: ● *SWD/504 – Accommodations Provided* ● *ELL – Reading & Vocabulary Support* ● *Intervention Support* ● *Extensions – Enrichment Tasks and Project*

Approaches to Learning (ATL)

Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see the guide.

✓ Thinking
❏ Social
✓ Communication
✓ Self-management
❏ Research

Details:

Students will be continuously challenged to develop higher-order thinking skills as they take prior knowledge, combine it with new content, and analyze the data they collected to reach a conclusion.

Students will begin to prepare for the IA and group 4 project.

Students will communicate their findings to their peers in the form of small-group presentations.

Language and Learning	TOK Connections	CAS Connections
Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see [the guide.]	*Check the boxes for any explicit TOK connections made during the unit*	*Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the "details" section explaining how students engaged in CAS for this unit.*
✓ Activating background knowledge ✓ Scaffolding for new learning ✓ Acquisition of new learning through practice ✓ Demonstrating proficiency Details: *Concepts throughout topic 5 build into understanding final concepts and labs.* *Students will complete practice problems* *Students will produce a full scatter plot to determine emf and resistance of a cell with high and low gradients as demonstration of learning.*	❏ Personal and shared knowledge ❏ Ways of knowing ❏ Areas of knowledge ✓ The knowledge framework Details: Early scientists identified positive charges as the charge carriers in metals; however, the discovery of the electron led to the introduction of "conventional" current direction. Was this a suitable solution to a major shift in thinking? What role do paradigm shifts play in the progression of scientific knowledge?	✓ Creativity ❏ Activity ❏ Service Details: *Students will actively be carrying out experiments involving electrical circuits. Circuit design will be decided on by each student.*
Resources *List and attach (if applicable) any resources used in this unit*		

- Textbooks (see page 1)
- Laboratory resources
- Online notes and videos (Schoology)
- Pith Ball simulation: https://gizmos.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=459
- Electron drift simulation: https://www.asc.ohio-state.edu/orban.14/physics1251_fall2016/conductor/conductor.html
- Electrostatics simulation: http://phet.colorado.edu/sims/html/balloons-and-static-electricity/latest/balloons-and-static-electricity_en.html

REFLECTION: considering the planning, process, and impact of the inquiry

What worked well *List the portions of the unit (content, assessment, planning) that were successful*	**What didn't work well** *List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	**Notes / Changes / Suggestions** *List any notes, suggestions, or considerations for the future teaching of this unit*
Notes sections worked well. Students retained conceptual ideas well, and were able to apply in unfamiliar situations. Summative assessment went well, as I had exposed students to a wide variety of similar questions prior to the exam	Simulation intro to Ohm's Law fell completely flat. We didn't have resistors on hand to physically build the circuits, and the sim didn't get across what I wanted. I also waited too long in this unit to introduce IB style problems. I need to build in problems earlier next year.	As mentioned, build IB style questions earlier in the school year. Though the student did well on the summative assessment, they could have done better if I had started practice earlier. I also need to ensure we have physical resistors on hand to build real circuits. It helps reinforce the visualization of circuits.