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 1 - Measurements and Uncertainty	**SL or HL / Year 1 or 2**	SL Year 2	**Dates**	August (2-3 weeks)
Unit Description and Texts		**DP Assessment(s) for Unit**			
Students examine taking measurements precisely and report the correct uncertainty. Measurement uncertainties are propagated through data analysis to help determine the trustworthiness of a conclusion. Students also examine how to add and subtract vectors. ● Bowen-Jones, Michael, and David Homer. IB Physics. Oxford: Oxford UP, 2014. Print.		● 1.1 paper 1 quiz, 1.2 paper 1 quiz, 1.3 paper 1 quiz ● Test (paper 1 + paper 3)			

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: A plane can "fly blind" and arrive safely at the correct location by simply using vector coordinates.

Statement of Inquiry: Measurement is a process of detecting an unknown physical quantity by using a standard quantity.

1. Students will derive units for a quantity from SI units.

2. Students will analyze data and propagate uncertainty to fit a scatter plot graph with high and low gradients.
3. Students will add and subtract differing types of vectors to solve problems involving vector components.

ACTION: teaching and learning through inquiry

Content / Skills / Concepts - Essential Understandings	**Learning Process** *Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.*
<u>Students will know the following content:</u> • ***Fundamental and derived SI units*** • ***Scientific notation and metric multipliers*** • ***Significant figures*** • ***Orders of magnitude*** • ***Estimation*** • ***Random and systematic errors*** • ***Absolute, fractional and percentage uncertainties*** • ***Error bars*** • ***Uncertainty of gradient and intercepts*** • ***Solving vector problems graphically and algebraically*** <u>Students will develop the following skills:</u> • **Using SI units in the correct format for all required measurements, final answers to calculations and presentation of raw and processed data** • **Using scientific notation and metric multipliers** • **Quoting and comparing ratios, values and approximations to the nearest order of magnitude** • **Estimating quantities to an appropriate number of significant figures** • **Explaining how random and systematic errors can be identified and reduced** • **Collecting data that include absolute and/or fractional uncertainties and stating these as an**	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,*

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uncertainty range (expressed as: best estimate ± uncertainty range)

- **Propagating uncertainties through calculations involving addition, subtraction, multiplication, division and raising to a power**
- **Determining the uncertainty in gradients and intercepts**
- **Resolution of vectors will be limited to two perpendicular directions**
- **Problems will be limited to addition/subtraction of vectors and multiplication/division of vectors by scalars**

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small group work, practice problems, and lab work.

☒ Other(s): *practice problems, lab work*

Formative assessment(s):

Paper 1 quizzes at the end of each subtopic.

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Summative assessments:

Topic test consisting of questions from P1 and P3

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*

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

Language and Learning *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.*	**TOK Connections** *Check the boxes for any explicit TOK connections made during the unit*	**CAS Connections** *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:	❑ Personal and shared knowledge ✓ Ways of knowing ❑ Areas of knowledge ❑ The knowledge framework Details: *What has influenced the common language*	❑ Creativity ✓ Activity ❑ Service Details: *Students will actively be carrying out experiments involving dropping objects and*

Students will collect data using a concept learned in MYP Physics (free fall) for students to then analyze. Students will discuss their margin of error from calculations. *Students will complete practice problems* *Students will produce a full scatter plot with high and low gradients as demonstration of learning.*	*used in science? To what extent does having a common standard approach to measurement facilitate the sharing of knowledge in physics?*	*free fall.*

Resources

List and attach (if applicable) any resources used in this unit

- Textbooks (see page 1)
- Laboratory resources
- Online notes and videos (Schoology)
- Uncertainty in slope video: https://www.youtube.com/watch?v=Bkp6nHoS_p4&ab_channel=ChrisDoner

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

What worked well	**What didn't work well**	**Notes / Changes / Suggestions**
List the portions of the unit (content, assessment, planning) that were successful	*List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	*List any notes, suggestions, or considerations for the future teaching of this unit*

The uncertainty in slope video and uncertainty/sig fig station were quite successful, and provided students with an opportunity to visualize and reinforce the concepts. Immediately applying the concepts in their next lab was also successful.	My initial attempts at an inquiry based approach to understanding uncertainty propagation were not successful. I had tried to introduce the uncertainty equations by explaining where they came from, and have students figure out what the rules would likely be. I found that they left that lesson confused about what the rules were, and unsure of how/when to apply them. I regrouped, and approached from a more traditional notes, followed by a processing and practice approach, and was much more successful.	In the future, I think that I'll take a more traditional approach to teaching this unit, as it is a very tedious, complicated topic. While inquiry is great for tangible, concrete science topics, the abstract nature of statistics/error propagation, combined with students not having had much exposure to it yet led to a great deal of confusion and wasted instructional time.