

Modern Physics Teaching ~ Project Name: _____

Inquiry Question

The true test of understanding is the ability to teach a topic to someone else. Even more challenging – teach a challenging physics concept to an elementary or junior science class.

You are to teach a complex Modern Physics idea to elementary school children. You are to demonstrate your understanding of a given Modern Physics phenomena by generating an interesting lesson that could include demonstrations, props, special effects, solid acting, cartoons etc. to help why the physics you have chosen to examine is so amazing.



Instructions

Using a pencil, answer the following questions. The lab is marked based on clarity of responses, completeness, neatness, and accuracy. Do your best! Please ensure that any data measured (or recorded) includes the appropriate number of significant digits (only one uncertain digit).

This activity is divided into three sections:

- **Core** – this first section explores only the basic “core” ideas involved in understanding. Students must demonstrate a sound understanding with all of their answers in this section BEFORE attempting the next section.
- **Mastery** – Your instructor will NOT review this section if the Core section above shows any misconceptions. In this section students will make predictions and apply the concepts and ideas learned above. For complete mastery it is expected that data collection and scientific procedures will be as accurate as possible. All work shown should be clear with any units included. Answers should be rounded off to the correct number of significant figures based on the data collected.
- **Ace** – Once again, your instructor will only look at this section provided he/she is confident that the above Mastery criteria has been met. In this section students will demonstrate a deeper understanding of the concepts through error analysis, experimental design etc. Physics concepts from other units already covered will often be required here.

This Project will be graded according to this [Marking Rubric](#) (link).

For this project please read the criteria for Core, Mastery, and Ace as you will be choosing the appropriate level BEFORE you begin.

Objectives:

- Choose a Modern Physics topic (suggestions below) of interest
- Research the topic and learn as much about it as possible (remember, your grade is both a reflection of the quality of your final product AND the amount of physics that you learned)
- Design a lesson that could relate this concept to younger students in elementary school
- Teach a class of elementary school children your lesson in Modern Physics.

Rules:

- You must have a pre-approved (by your teacher) lesson of the concept you will be teaching.
- Your lesson must be less than 30 minutes long and contain engaging activities if possible.
- Since your grade is also based on the amount of physics learned, you must somehow document all of the research and learning that was achieved.
- Your target audience must also be surveyed (your design) to check how well your lesson was received (did they understand it? Was it interesting? Were they engaged? Are they more excited about science?)
- You must video tape your lesson
- You are NOT allowed to use any multi-media that pre-exists (no *Youtube* videos unless you made them)
- You must have the class you will be teaching preapproved long before your presented lesson. It will be up to you to make contact with your local elementary school. The teacher of your class must then contact your Physics teacher.

Suggested Topics:

- Einstein's theory of special relativity (can focus on the topic broadly or narrowly by choosing a particular relativistic effect (time dilation, length contraction, mass increase, mass-energy, twin paradox, general relativity, simultaneity, etc)
- Real-world engineering that utilizes special relativity concepts
- Futuristic applications of special relativity
- Black holes, light, space time, wormholes, event horizons
- Quantum entanglement, teleportation
- Double slit experiment and the behaviour of matter when it is observed
- Theories for the age of the universe and the creation of space itself
- Uncertainty principle
- Schrodinger's famous cats
- Bose-Einstein condensate
- Gravitational waves
- Delayed choice quantum eraser
- YOUR CHOICE – must be related to modern physics (requires teacher approval)

Part 1: Core

- Topic is interesting and you have created a lesson that is grade-appropriate
- **Lesson Plan** completed and handed in to both sponsor teacher and physics teacher (see end of this document for sample lesson plan (feel free to modify as needed)
- Your lesson will include some sort of demo or prop to help with your description
- Your students will be engaged and their feedback will be asked for at the end.
- Student feedback will be compiled and given to your physics teacher. YOU will design the student feedback questionnaire – keep it simple!
- Checklist completed (refer to document at the end)

Part 2: Mastery

As above plus...

- The students will be actively involved with something that helps them understand the concept presented.
- The students will be excited and curious about science by the end
- Your lesson will include an analogy that elementary students understand

Part 3: Ace

As above plus...

- You will try your lesson more than once on different days
- Each subsequent lesson will take the student feedback into account and adjustments to the lesson will be made.
- The demonstrations will be amazing and interesting
- The student feedback will be excellent

Science Lesson Planning Template

What's the Big Idea or Main Concept? Write this critical concept of the lesson as a sentence.

Materials required (for demos):

Resources/Materials Required from sponsor school (i.e – projectors, cables, whiteboards etc)

General Outline of lesson (include timeline)

How will your students be activity involved in the learning process?

What should students know and/or be able to do when they have completed this lesson?

Developed by: _____ Revised on: _____

Planning Checklist

Organization

- Does your plan deal with one major topic only?
- Is the topic divided into meaningful subdivisions?
- Can it be delivered by you in the time allowed?
- Is there time for participants to assimilate the material?
- Have you allocated an appropriate amount of time to more difficult sections?
- Have you planned for participant interaction and engagement activities?

Integration

- Is this presentation related to previous experience and knowledge of the participants?
- Is it related to the course of study as a whole, where applicable?
- Have you provided a clear statement of the importance of the presentation?
- Have you planned to capture the initial interest of participants?

Strategies

- Have you chosen suitable methods of teaching?
- Have you planned for participation?
- Have you planned questions or other means of finding out whether the participants have understood the content?
- Have you prepared or booked the resources you will need; e.g. visuals, media, handouts, equipment, etc.

Facilities

- Are you familiar with the room where the presentation will take place?
- Do you know what the seating arrangements are?
- Do you know how to operate the equipment in the room?
- Do you know the person to call if the equipment fails?