

“Teaching Physics in English”

1. Introduction

In our school, important technical terms and phrases had been taught both in Japanese and English during regular Physics classes. Our school was designated as SSH (Super Science High School) in 2012. Since then, one fourth of “SS Physics 1” has been taught in the English language, even though in most schools in Japan, it is taught only in Japanese. The class “Physics in English” has been conducted with an ALT (Assistant Language Teacher) ever since.

Online classes were conducted using Zoom while schools were closed in April and May 2020.

2. Objective

By providing English Physics instruction, this class aims to give the students an incentive and basic knowledge to work in the science field all over the world in the future.

3. Students

The target students are in the second year of senior high school.

4. Teaching Materials

4.1 [APlusPhysics: Your Guide to Regents Physics Essentials](#) (Material for high school students in New York, USA.) Texts, Videos, Interactive Quizzes, Supplemental Problems and so on can be downloaded from the site "[APlusPhysics.com](#)."

4.2 YouTube videos about the most advanced physics topics, technological innovations, etc.

4.3 Others

5. Outline

5.1 Firstly, basic expressions in Physics and Mathematics are introduced by teaching basic mechanics.

5.2 Next, the students study the most advanced physics topics and technological innovations as well as review what they learned through English discussions on the experiments (as part of input exercises).

5.3 The students give presentations about electricity and magnetism in English in order to experience how to present scientific topics in English (as part of output exercises).

5.4 In the latter half of the year, Physics classes conducted only in English are given several times.

5.5 The students should submit assignments or worksheets like “Vocabulary to Know” for every class to check their level of focus and understanding.

6. Contents

6.1 INPUT

6.1.1 Mechanics (**Basic Learning**)

Mechanics about the following topics is taught using PowerPoint presentations and worksheets based on "APlusPhysics.com".

- [Introduction \(Worksheet\)](#)
- [Math Review \(Worksheet\)](#)
- [Defining and Graphing Motion \(Worksheet\)](#)
- [Kinematic Equations \(Worksheet\)](#)
- [Free Fall and Projectile Motion \(Worksheet\)](#)
- [Newton's 1st Law \(Worksheet\)](#)
- [Newton's 2nd Law \(Worksheet\)](#)
- [Newton's 3rd Law \(Worksheet\)](#)
- [Work and Power \(Worksheet\)](#)
- [Energy \(Worksheet\)](#)

6.1.2 Most Advanced Physics and Technologies (**Learning Physics in English**)

The videos on the following topics are shown and explained to them using PowerPoint slides.

- ILC (International Linear Collider) [\(Worksheet\)](#)
- The Apollo 15 Hammer and Feather Drop on the moon [\(Worksheet\)](#)
- Redefinition of SI Units [\(Worksheet\)](#)
- First Image of a Black Hole [\(Worksheet\)](#)
- Space Elevator [\(Worksheet\)](#)
- Life and work of Stephen Hawking [\(Worksheet\)](#)
- Nobel Prize in Physics 2014, 2015, 2016, 2017, 2018, 2019, 2020

- Standard Model of Elementary Particles ([Worksheet](#))
- Hayabusa-2 capsule returns to Earth
- ITER (World's Largest Fusion Reactor Experiment) ([Worksheet\(1\)](#)) ([Worksheet\(2\)](#))
- Gravitational Waves ([Worksheet](#))
- Radio Astronomy ([Worksheet](#))
- Cavendish Laboratory ([Worksheet](#))

6.2 OUTPUT

6.2.1 [Electricity and Magnetism](#) (Presenting Physics in English)

The students learn about the basic terminologies through a worksheet prior to their presentation in Electricity and Magnetism. Students make a presentation in English with the website, "APlusPhysics.com", as reference

- Topics include Electrostatics, Current Electricity, Magnetism, and Electromagnetic Waves.
- Spectators evaluate the presenters.

6.3 [Classes by the special Lecturers](#)

6.4 [Others \(Some Experiments and Review\)](#)

7. References:

7.1 Text: "APlusPhysics: Your Guide to Regents Physics Essentials"

<https://www.aplusphysics.com/index.html>

7.2 Basic expressions in Physics and Mathematics:

- Lawrence Chang's book Handbook for Spoken Mathematics: Larry's Speakeasy (1983)
- Website of Project Math Access Handbook for Spoken Mathematics hosted by the Texas School for the Blind and Visually Impaired http://www.tsbvi.edu/mathproject/appB_sec1.asp#main

7.3 Special Topics:

- ILC (International Linear Collider) (ILC Kitakami)
 - https://youtu.be/gaMRQvRxiE?list=PL4iuZmcYR41gvd_nJ8wg_7MzALbTe_6dfX
 - https://www.youtube.com/watch?v=fq3PSjU_WA0&feature=emb_logo
 - https://www.youtube.com/watch?v=7OyAFvp1QU&feature=emb_logo
 - "ILC comic" https://www2.kek.jp/ilc/en/docs/ILC_comic_e.pdf
- The Apollo 15 Hammer and Feather Drop on the moon
 - <https://www.youtube.com/watch?v=4mTsrRZEMwA>
- Redefinition of SI Units "The kg is dead, long live the kg"
 - https://www.youtube.com/watch?v=c_e1wITe_ig
- First Image of a Black Hole
 - <https://www.youtube.com/watch?v=qpYcCl9uzKo>
- Space Elevator
 - T. Uematsu et al. 総合物理2, Keirinkan., pp. 226-227 (2019)
 - <https://youtu.be/33guUBZFxYQ>
- Life and work of Stephen Hawking
 - "Physicist Stephen Hawking has died" https://youtu.be/uA8GdJJqz_s
 - "Hawking explains Black Holes" <https://youtu.be/D6lFGJdwRyo>
- Nobel Prize in Physics 2014, 2015, 2016, 2017, 2018, 2019, 2020
 - "Nobel Prize Rewards Crucial Blue LED Invention"
 - <https://www.youtube.com/watch?v=vR6RaZPD8c>
 - "Neutrino Discovery Leads to Nobel Prize in Physics"
 - <https://www.youtube.com/watch?v=swlbZ7d7o50>
 - "Announcement of the 2017 Nobel Prize in Physics"
 - <https://www.youtube.com/watch?v=DdeOwXjA6xc>
 - "EXPLAINED: Physics Nobel Prize 2019"
 - <https://www.youtube.com/watch?v=IO98TfeT-XY>
 - "Announcement of the 2020 Nobel Prize in Physics"
 - <https://www.youtube.com/watch?v=5JFKNDVmx6k>

- Standard Model of Elementary Particles "What's the smallest thing in the universe?"
https://www.youtube.com/watch?v=ehHoOYqAT_U
- Hayabusa2 capsule returns to Earth
https://www.youtube.com/watch?v=WasAorPfQ3E&feature=emb_logo
- ITER (World's Largest Fusion Reactor Experiment) "ITER: The \$65 Billion Power Plant of the Future"
<https://www.youtube.com/watch?v=JCpWPJrH7TA>
- Gravitational Waves
<https://www.youtube.com/watch?v=4GbWfNHtHRg>
<http://phdcomics.com/comics.php?f=1853>
- "Radio Astronomy"
<http://www.jodcast.net/archive/video/radioastronomy/>
- Cavendish Laboratory
<https://www.phy.cam.ac.uk/outreach/museum>

7.4 Electricity and Magnetism:

“ステップアップノート物理基礎”, Keirinkan. pp. 74-91 (2019)

(translated to English) [Electricity STEP UP NOTE Basic Physics \(example\).pdf](#)