IBDP Physics

Labwork and Modeling

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International School of Latvia
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“Teaching Physics in an IB School”

Why do we care about IBDP Physics?

Aims of IBDP Physics

The aims enable students, through the overarching theme of the Nature of science, to:

1. appreciate scientific study and creativity within a global context through stimulating and challenging opportunities
2. acquire a body of knowledge, methods and techniques that characterize science and technology
3. apply and use a body of knowledge, methods and techniques that characterize science and technology
4. develop an ability to analyse, evaluate and synthesize scientific information
5. develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities
6. develop experimental and investigative scientific skills including the use of current technologies
7. develop and apply 21st-century communication skills in the study of science
8. become critically aware, as global citizens, of the ethical implications of using science and technology
9. develop an appreciation of the possibilities and limitations of science and technology
10. develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge.

Aims of IBDP Physics

The aims enable students, through the overarching theme of the Nature of science, to:

1. appreciate science	
2. learn science things	
3. apply and use science things	Internal Assessment
4. critical thinking	
5. communication/collaboration	Group 4 Project
6. science skills	Practical Work
7. technology	Practical Work
8. ethics & internationalism	Group 4 Project
9. limitations of science	
10. relationships with other disciplines	Group 4 Project

Overview

A. Required Practicals

B. Internal Assessment (10 hours)

C. Group 4 Project (10 hours)

(and also the Extended Essay)

D. Modeling?

40 hours (SL)
60 hours (HL)

A. Required Practicals

- “prescribed experiments”
  - must appear on 4/PSOW
- may be assessed on Paper 3, section A
- 8 (SL) or 10 (HL)
- +2 for Option C: Imaging
  - only assessed on Paper 3, section B
- Can be done experimentally or via simulation
  - “Guidance for the use of simulations” in TSM

A. Required Practicals

2.1–Determining the acceleration of free-fall

3.1–Applying the calorimetric techniques of specific heat capacity or specific latent heat

3.2–Investigating at least one gas law

4.2–Investigating the speed of sound

4.4–Determining refractive index

5.2–Investigating one or more of the factors that affect resistance

5.3–Determining internal resistance

7.1–Investigating half-life

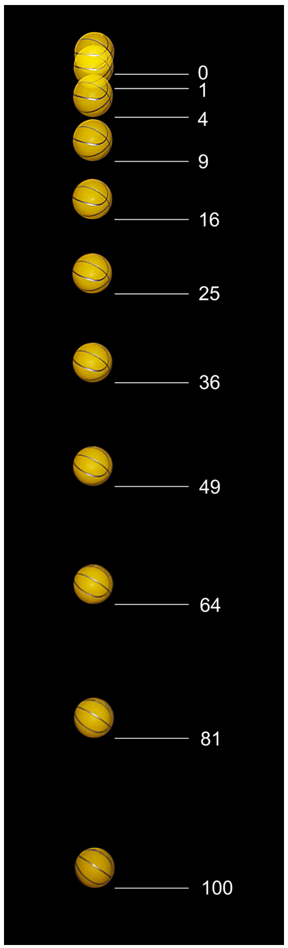
9.3–Investigating Young's double-slit [HL only]

11.2–Investigating a diode bridge rectification circuit [HL only]

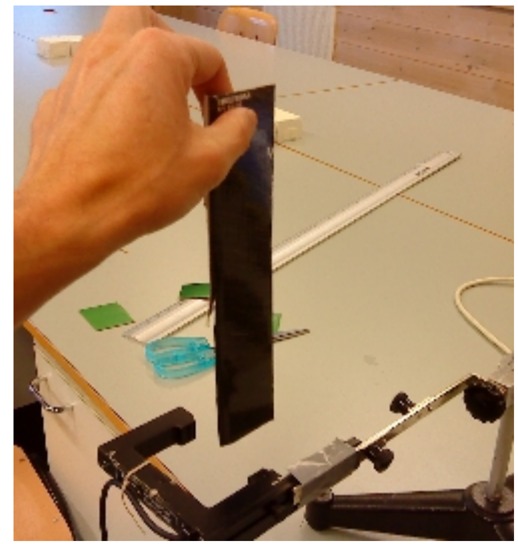
C.2–Investigating the optically compound microscope

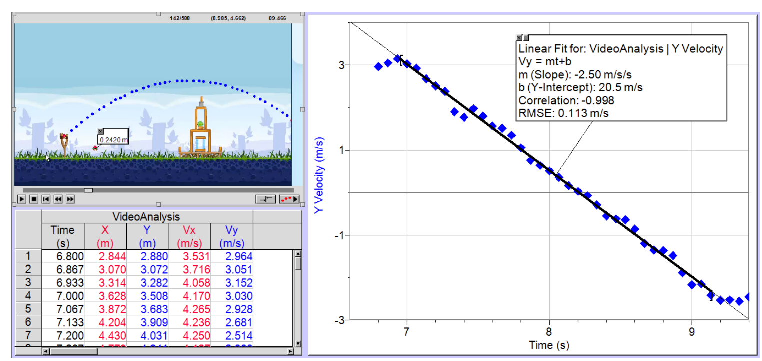
C.2–Investigating the performance of a simple optical astronomical refracting telescope

2.1–Determining the acceleration of free-fall



- Drop a card/picket fence through a photogate
- Video analysis of a dropped ball
- Analyze a video game



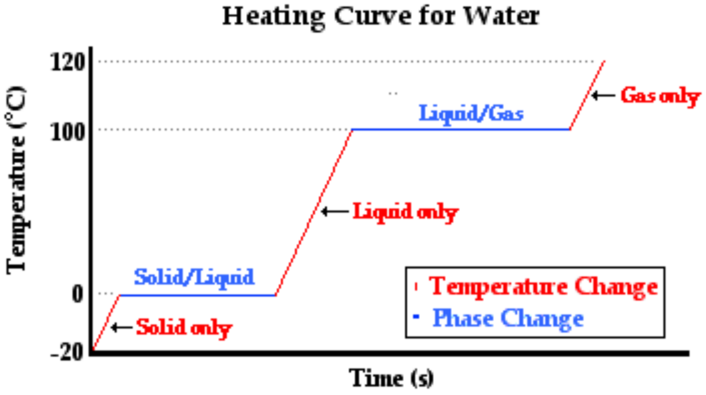


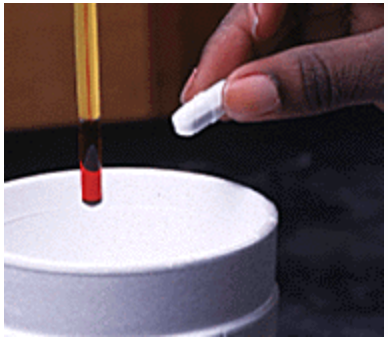
	VideoAnalysis				
	Time (s)	X (m)	Y (m)	Vx (m/s)	Vy (m/s)
1	6.800	2.844	2.880	3.531	2.964
2	6.867	3.070	3.072	3.716	3.051
3	6.933	3.314	3.282	4.058	3.152
4	7.000	3.628	3.508	4.170	3.030
5	7.067	3.872	3.683	4.265	2.928
6	7.133	4.204	3.909	4.236	2.681
7	7.200	4.430	4.031	4.250	2.514

credit: Chris Hamper, Frank Noschese

3.1—...specific heat capacity or specific latent heat

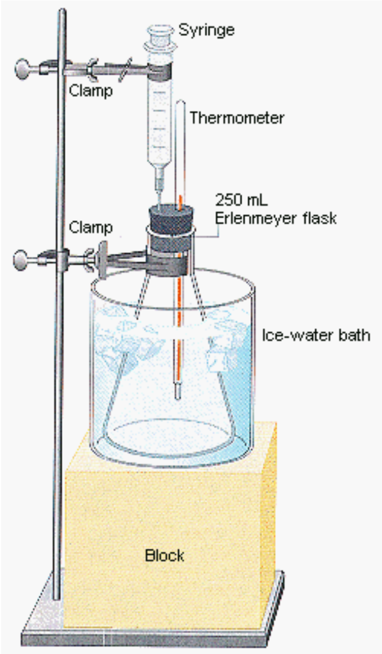
- Use an electric kettle with given power
  - plot T over time, slope is P/mc
- Add metal masses to a water calorimeter
  - identify metal via c
- Heat water from ice to steam

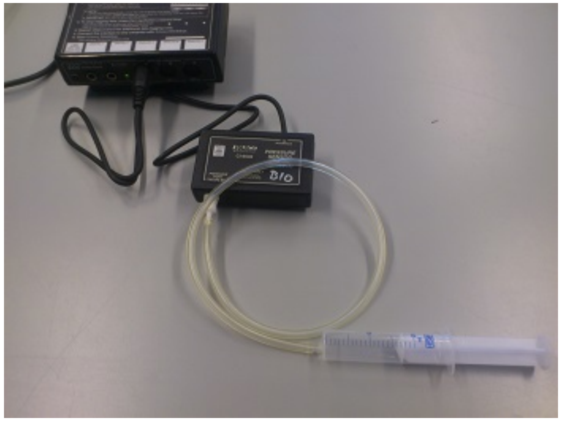


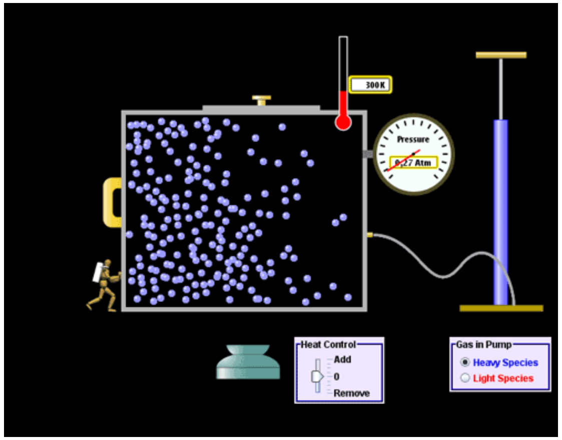


3.2–Investigating at least one gas law

- Boyle's Law with syringe and pressure sensor
- Ideal Gas Law with flask in water bath
- PhET simulation "Gas Properties"



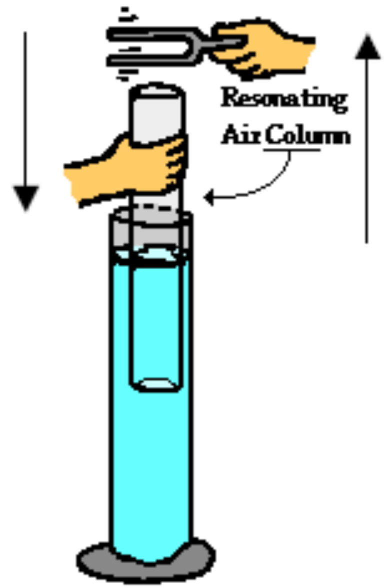




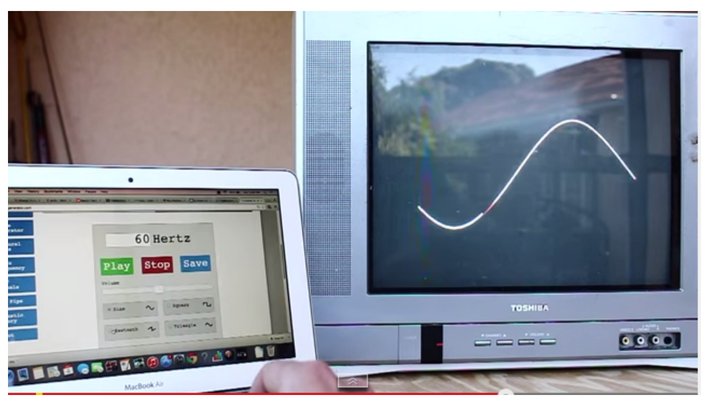
credit: Chris Hamper, PhET

4.2–Investigating the speed of sound

- Standing wave in tube (also CO2)
- Time delay of echo
- Real-size waves on oscilloscope



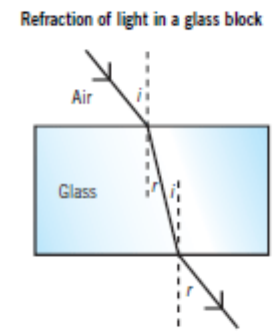
Tuning fork forcing air coumn into resonance

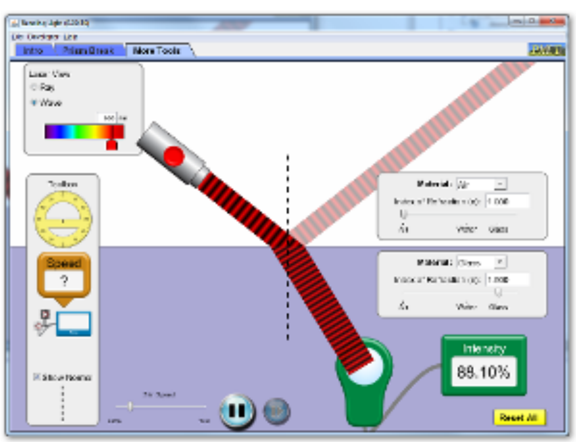


credit: TheBackyardScientist

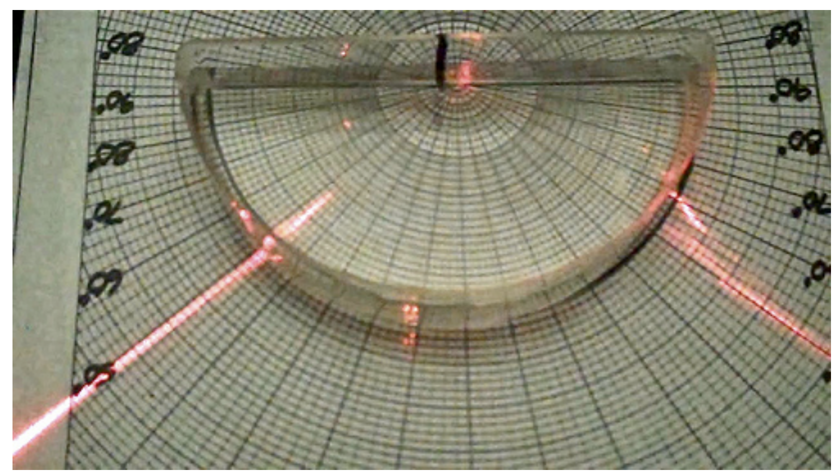
4.4–Determining refractive index

- Glass block
- Total internal reflection with a half-circular dish
- PhET simulation "Bending Light"





credit: PhET



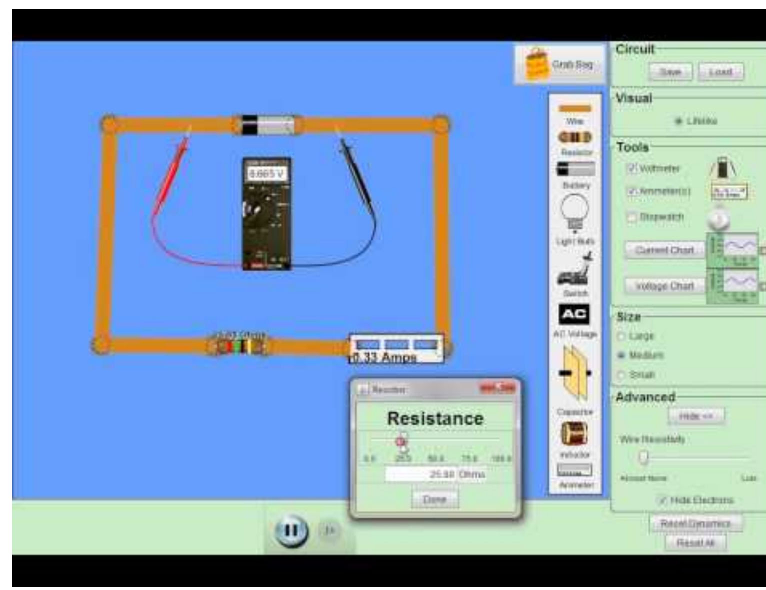
5.2–...factors that affect resistance

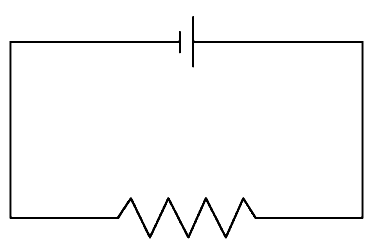
- Pencil marking (graphite) on paper
- Conductive paper
- Nichrome wire (different gauges)
- Double-ended pencil
- Bare conductive paint

credit: Chris Hamper

5.3–Determining internal resistance

- Connect an old battery to a variable resistor (< 20 Ohm) and measure V & I as R changes
- Can also be done using PhET DC circuit construction kit



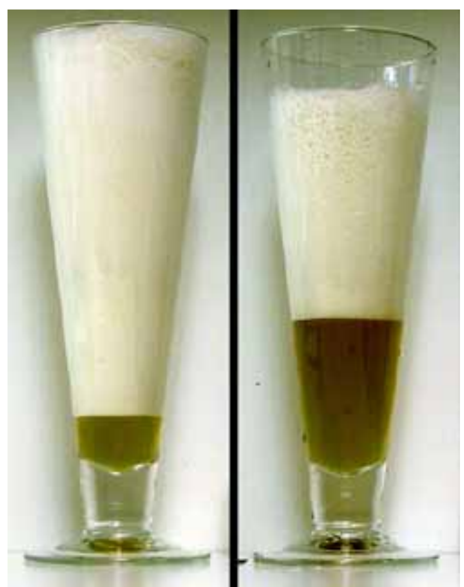


credit: PhET, Art Knoflick

7.1–Investigating half-life

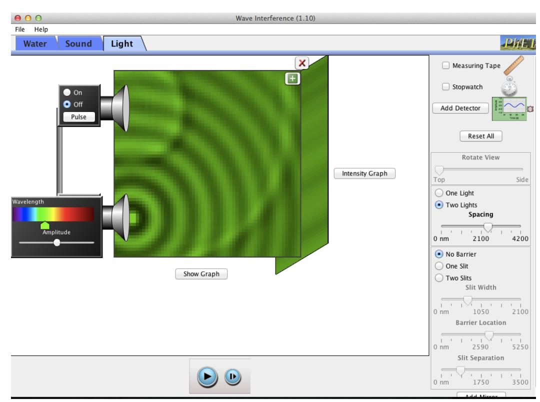
- Simulation with coins/dice/etc
- Beer foam
- Cs-137/Ba-137m (half-life ~3 minutes)

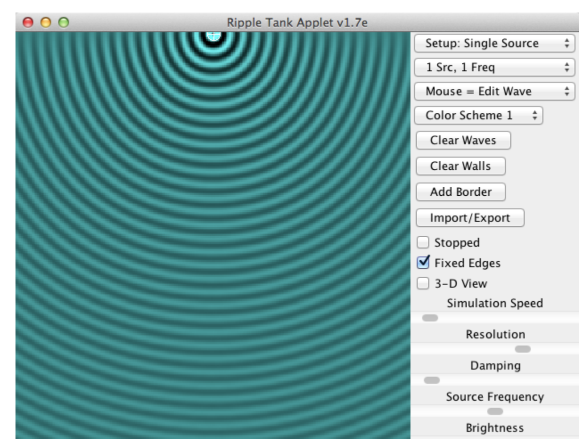
credit: Mark Headlee



9.3–Investigating Young's double-slit

- double-source with sound waves
- ripple tank
- laser and double-slit
- simulation (Falstad, PhET)

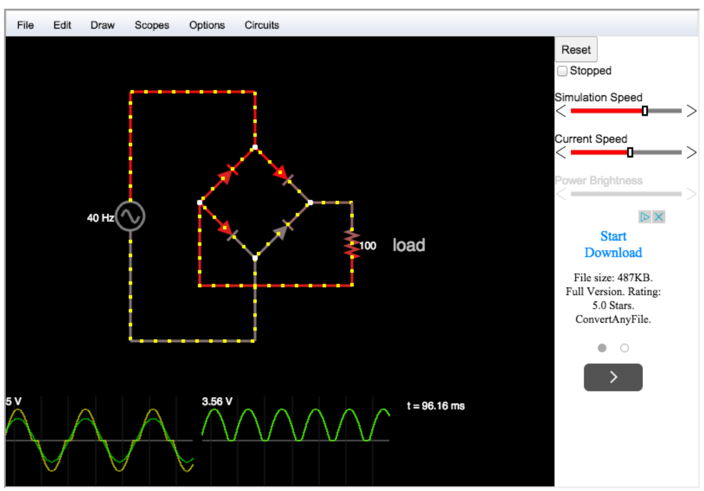




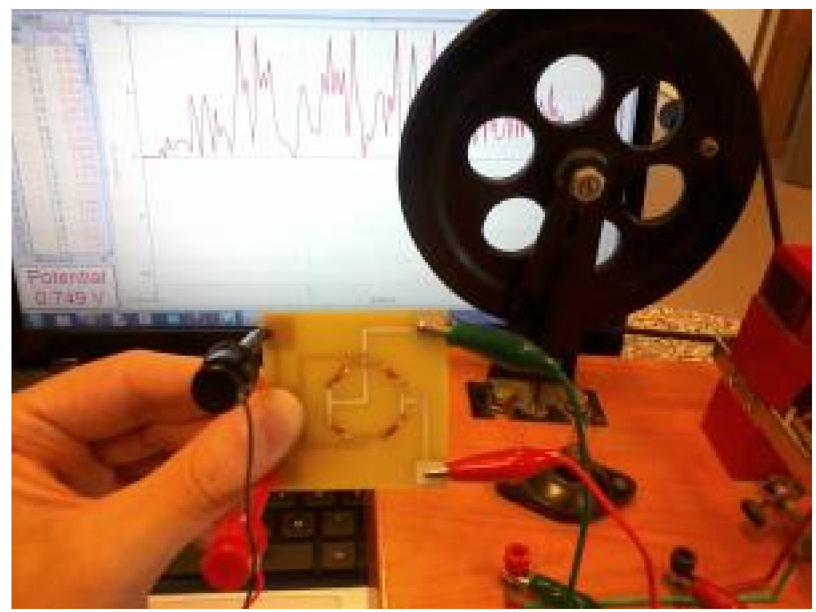
credit: Paul Falstad, PhET

11.2–Investigating a diode bridge rectification circuit

- Hand-crank or DC motor as generator
  - students solder the diodes together
  - could use LEDs
- Falstad simulation



credit: Paul Falstad



For first use in 2016 assessment

4/PSOW

Group 4: Practical scheme of work (biology, chemistry and physics)

Session:

School number: School name:

- *Complete this form in the working language of your school (English, French, Spanish).*
- ***One form must be completed for each class and level offered.***
- *A completed copy should be retained by the school.*

Subject: Level: Total time (hrs):

Outline of all experiments/investigations/projects	PP *	ICT	Topic/ option	Time (hrs)
Individual investigation [redacted]				10
Group 4 project [redacted]				10

* Check the box to indicate which experiments/investigations/projects are the prescribed practicals.

Please fill in the ICT column using the numbers below to show where the students experienced each of these applications:
1 - Data logging
2 - Graph plotting software
3 - Spreadsheet
4 - Database
5 - Computer model/simulation

Teacher's name:

Signature: Date:

Please turn over

ICT in the PSOW

Please fill in the ICT column using the numbers below to show where the students experienced each of these applications:

1 - Data logging
2 - Graph plotting software
3 - Spreadsheet
4 - Database
5 - Computer model/simulation

B. Internal Assessment

- 10 hours of class-time
  - write-up at home
- individual project, supervised at school
- need not be experimental
  - ie: simulation, database, spreadsheet, hybrid
- criteria - 24
  - engagement - 2
  - exploration (aka design) - 6
  - analysis - 6
  - evaluation - 6
  - communication - 4

B. Internal Assessment

- Need to practice design, experimental, writing skills
- Minimal feedback on the IA work is allowed
  - “oral or written advice on how the work could be improved” is permitted on one draft only
- Might be difficult to ensure all students have correct equipment, know how to use it
- Funding for new equipment, supplies?
- Design is harder than expected for students
- Assessment - more flexible than in the past

B. Internal Assessment

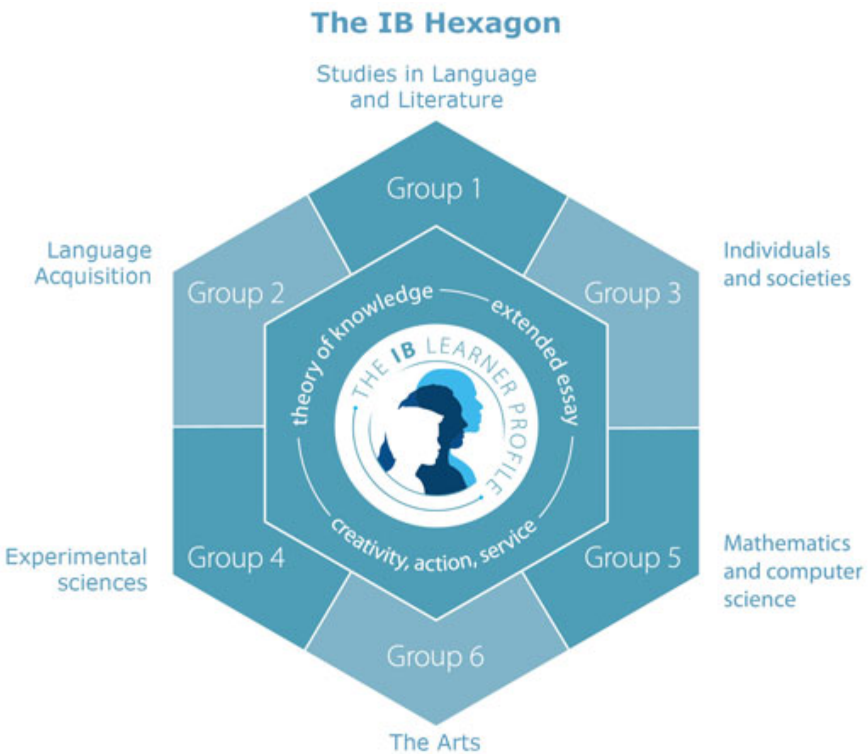
- Models for implementation:
  - Group 4 Project in Year 1; IA-style report grading; IA done at start of Year 2
  - Use old syllabus labs to practice exploration/ analysis/evaluation; IA design due at end of Year 1
  - Students work after-school or during breaks, one student per week, starting midway through Year 1
  - Multiple attempts, only keep best submission
  - Two whole-day sessions

C. Group 4 Project

- Collaborative project with students in other science disciplines; 10 hours
  - ideally, also, other schools/countries
- Required: 50-word summary (ungraded)
  - appears on 4/PSOW
- Models for implementation
  - 2 weeks of class-time to design/conduct/report
  - 1 full day, trip to a place of ecological significance
  - Combination with community/environmental project
  - Easily done in Year 1 (Year 2 usually busier)

C. Extended Essay

- EE in any subject
- EE != IA
  - longer
  - extension of learning
  - context, relevance more important
  - more points for formatting



D. Modeling

- IBDP Physics = broad
  Modeling = deep
- Philosophies align (active learning)

D. Modeling

1. Measurement & Uncertainty (5)
2. Mechanics (22) Modeling Mechanics (rushed)
3. Thermal Physics (11)
4. Waves (15+17) Modeling Mech Waves (add more)
5. Electromagnetism (15+16) Modeling E&M (add more)
6. Gravitation, Fields (5+11) Start with Modeling CFPM
7. Modern (14+16) Modeling Light (lots more)
8. Energy Production (8)

Relativity/Engineering/Astro/Imaging Pieces