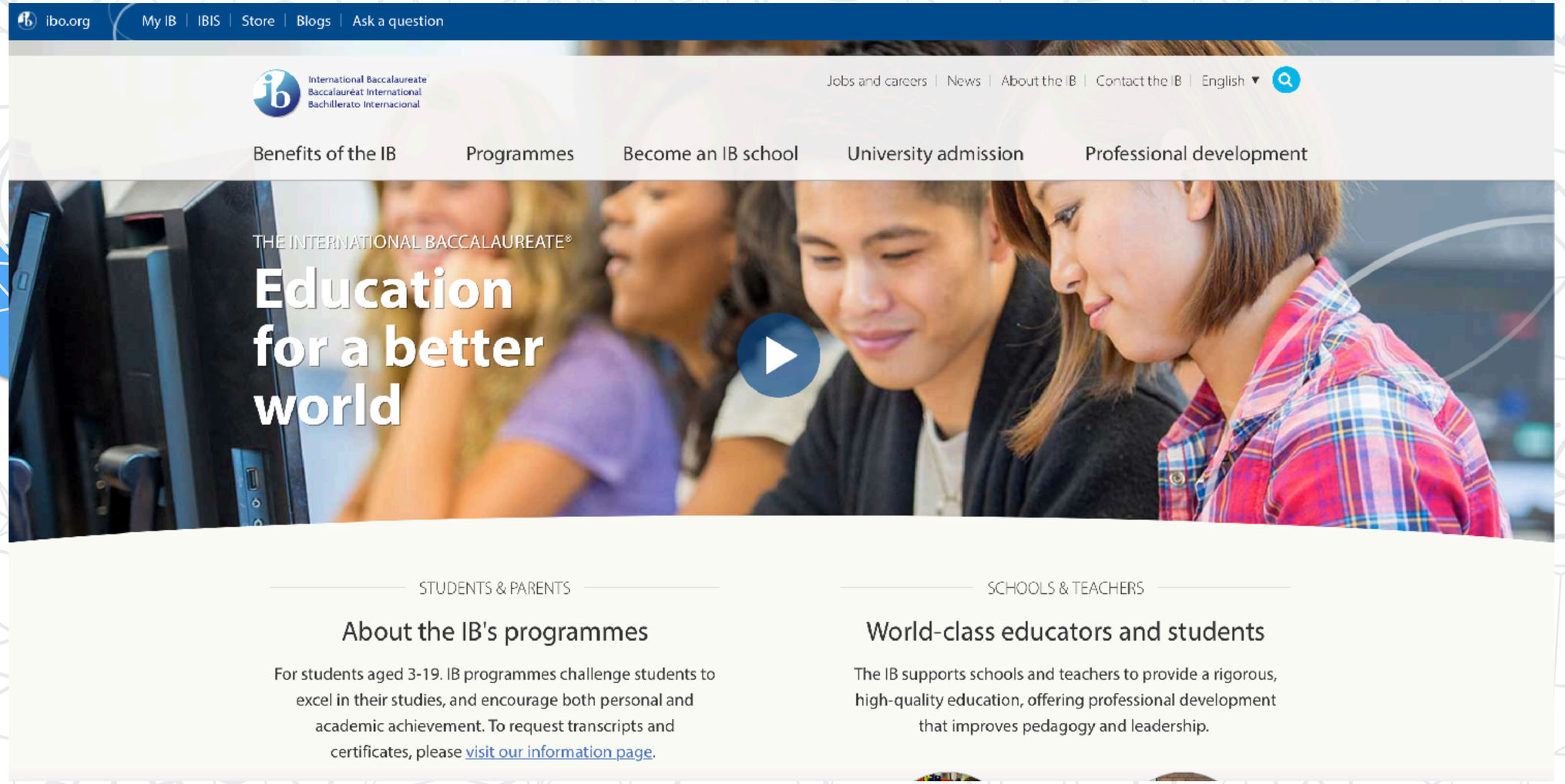
Круглый стол: ”Использование современных информационных технологий в исследовательской работе школьников”

«Оценивание исследовательских работ в программах международного бакалавриата (IBO), использование современных ресурсов для выполнения виртуальных практических работ»

Горелик Михаил Леонидович

ЧОУ - гимназия «Московская экономическая школа»



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Assessment criteria overview

Assessment for science courses in all years of the programme is criterion-related, based on four equally weighted assessment criteria:

Criterion A	Knowing and understanding	**Maximum 8**
Criterion B	Inquiring and designing	**Maximum 8**
Criterion C	Processing and evaluating	**Maximum 8**
Criterion D	Reflecting on the impacts of science	**Maximum 8**

Subject groups **must** assess **all** strands of **all** four assessment criteria **at least twice** in **each year** of the MYP.

A Knowing and understanding

Students develop scientific knowledge (facts, ideas, concepts, processes, laws, principles, models and theories) and apply it to solve problems and express scientifically supported judgments.

Tests or exams must be assessed using this objective. To reach the highest level students must make scientifically supported judgments about the validity and/or quality of the information presented to them. Assessment tasks could include questions dealing with "scientific claims" presented in media articles, or the results and conclusions from experiments carried out by others, or any question that challenges students to analyse and examine the information and allows them to outline arguments about its validity and/or quality using their knowledge and understanding of science.

In order to reach the aims of sciences, students should be able to:

i. explain scientific knowledge

ii. apply scientific knowledge and understanding to solve problems set in familiar and unfamiliar situations

iii. analyse and evaluate information to make scientifically supported judgments.

D Reflecting on the impacts of science

Students gain global understanding of science by evaluating the implications of scientific developments and their applications to a specific problem or issue. Varied scientific language will be applied in order to demonstrate understanding. Students are expected to become aware of the importance of documenting the work of others when communicating in science.

Students must reflect on the implications of using science, interacting with one of the following factors: moral, ethical, social, economic, political, cultural or environmental, as appropriate to the task. The student's chosen factor may be interrelated with other factors.

B Inquiring and designing

Intellectual and practical skills are developed through designing, analysing and performing scientific investigations. Although the scientific method involves a wide variety of approaches, the MYP emphasizes experimental work and scientific inquiry.

When students design a scientific investigation they should develop a method that will allow them to collect sufficient data so that the problem or question can be answered. To enable students to design scientific investigations independently, teachers must provide an open-ended problem to investigate. An open-ended problem is one that has several independent variables appropriate for the investigation and has sufficient scope to identify both independent and controlled variables. In order to achieve the highest level for the strand in which students are asked to design a logical, complete and safe method, the student would include only the relevant information, correctly sequenced.

In order to reach the aims of sciences, students should be able to:

i. explain a problem or question to be tested by a scientific investigation

ii. formulate a testable hypothesis and explain it using scientific reasoning

iii. explain how to manipulate the variables, and explain how data will be collected

iv. design scientific investigations.

C Processing and evaluating

Students collect, process and interpret qualitative and/or quantitative data, and explain conclusions that have been appropriately reached. MYP sciences helps students to develop analytical thinking skills, which they can use to evaluate the method and discuss possible improvements or extensions.

In order to reach the aims of sciences, students should be able to:

i. present collected and transformed data

ii. interpret data and explain results using scientific reasoning

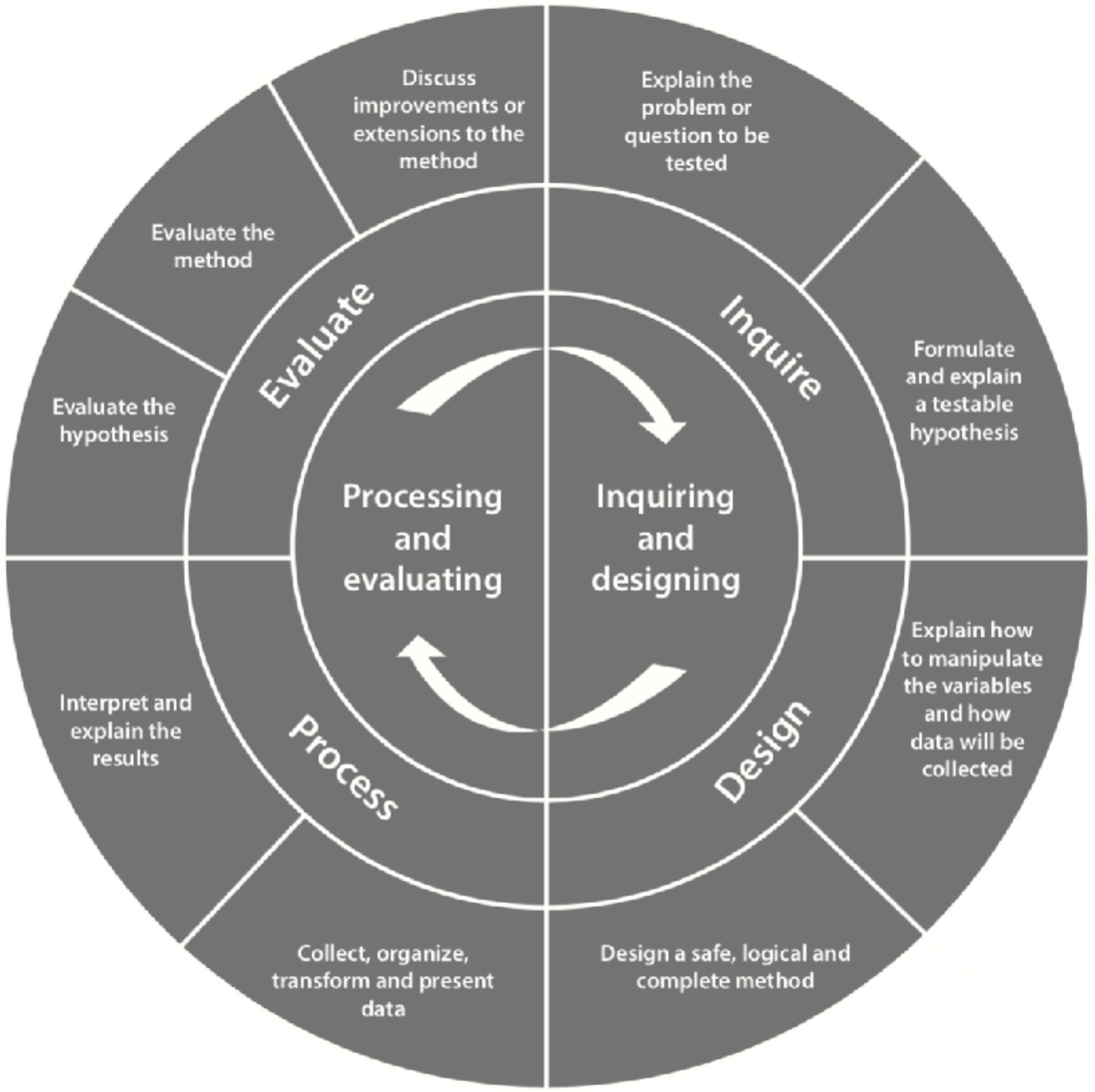
iii. evaluate the validity of a hypothesis based on the outcome of the scientific investigation

iv. evaluate the validity of the method

v. explain improvements or extensions to the method.

Visualizing the scientific process

The scientific process of inquiring, designing, processing and evaluating is represented by MYP sciences objectives B (inquiring and designing) and C (processing and evaluating). The visual representation in figure 4 shows the dynamic relationship between the four areas of experimental design and reporting.

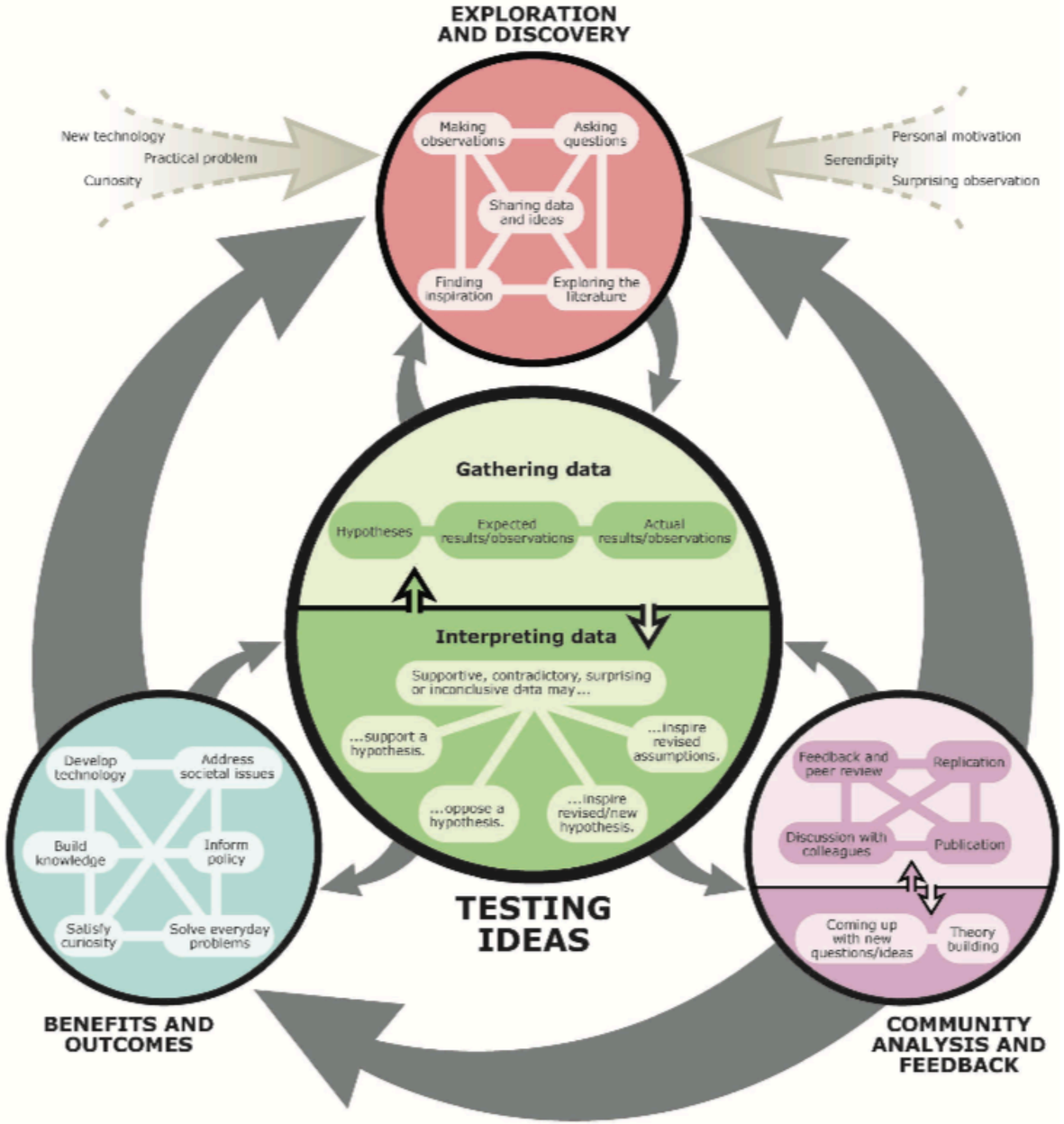


Proposed assessment objectives

The assessment objectives for biology, chemistry and physics reflect those parts of the aims that will be formally assessed either internally or externally. It is the intention of these courses that students are able to fulfil the following assessment objectives:

1. Demonstrate knowledge of
    a. terminology, facts, and concepts
    b. techniques and methodologies
2. Understand and apply knowledge
3. Analyse, evaluate, and synthesize
    a. experimental procedures
    b. primary and secondary data
    c. trends, patterns, and predictions
4. Demonstrate the appropriate ATL skills necessary to carry out insightful and ethical investigations.

How science works



Assessment objectives

The assessment objectives for biology, chemistry and physics reflect those parts of the aims that will be formally assessed either internally or externally. These assessments will centre upon the nature of science. It is the intention of these courses that students are able to fulfill the following assessment objectives:

1. Demonstrate knowledge and understanding of:
    a. facts, concepts and terminology
    b. methodologies and techniques
    c. communicating scientific information.
2. Apply:
    a. facts, concepts and terminology
    b. methodologies and techniques
    c. methods of communicating scientific information.
3. Formulate, analyse and evaluate:
    a. hypotheses, research questions and predictions
    b. methodologies and techniques
    c. primary and secondary data
    d. scientific explanations.
4. Demonstrate the appropriate research, experimental, and personal skills necessary to carry out insightful and ethical investigations.

Syllabus component		Recommended teaching hours	
		SL	HL
Core		**95**	
1.	Measurements and uncertainties	5	
2.	Mechanics	22	
3.	Thermal physics	11	
4.	Waves	15	
5.	Electricity and magnetism	15	
6.	Circular motion and gravitation	5	
7.	Atomic, nuclear and particle physics	14	
8.	Energy production	8	
Additional higher level (AHL)			**60**
9.	Wave phenomena		17
10.	Fields		11
11.	Electromagnetic induction		16
12.	Quantum and nuclear physics		16
Option		**15**	**25**
A.	Relativity	15	25
B.	Engineering physics	15	25
C.	Imaging	15	25
D.	Astrophysics	15	25
Practical scheme of work		**40**	**60**
	Practical activities	20	40
	Individual investigation (internal assessment – IA)	10	10
	Group 4 project	10	10
Total teaching hours		**150**	**240**

Component	Overall weighting (%)	Approximate weighting of objectives (%)		Duration (hours)
		1+2	3	
Paper 1	20	10	10	¾
Paper 2	40	20	20	1¼
Paper 3	20	10	10	1
Internal assessment	20	Covers objectives 1, 2, 3 and 4		10

Component	Overall weighting (%)	Approximate weighting of objectives (%)		Duration (hours)
		1+2	3	
Paper 1	20	10	10	1
Paper 2	36	18	18	2¼
Paper 3	24	12	12	1¼
Internal assessment	20	Covers objectives 1, 2, 3 and 4		10

	Nature of the paper	Higher Level		Standard Level	
There will be no choice in the questions to be answered in either paper.		Length/hours	Weighting	Length/hours	Weighting
Paper 1	Section A: Multiple choice paper Section B: Data-analysis or lab-based questions.	2	35%	1½	40%
Paper 2	Short answer questions and one or two multipart questions.	2½	45%	1½	40%
Internal assessment	Individual investigation	10	20%	10	20%

Internal assessment component

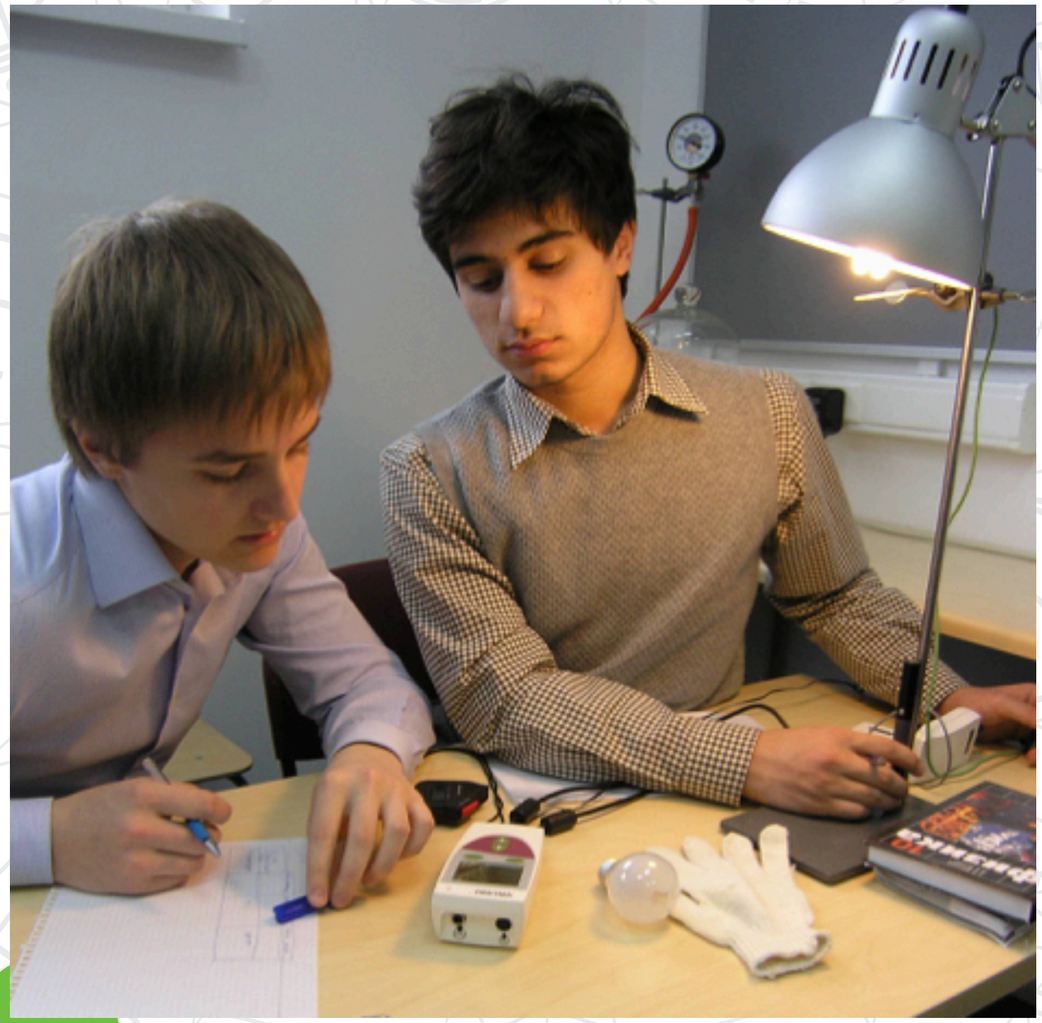
Duration: 10 hours
Weighting: 20%

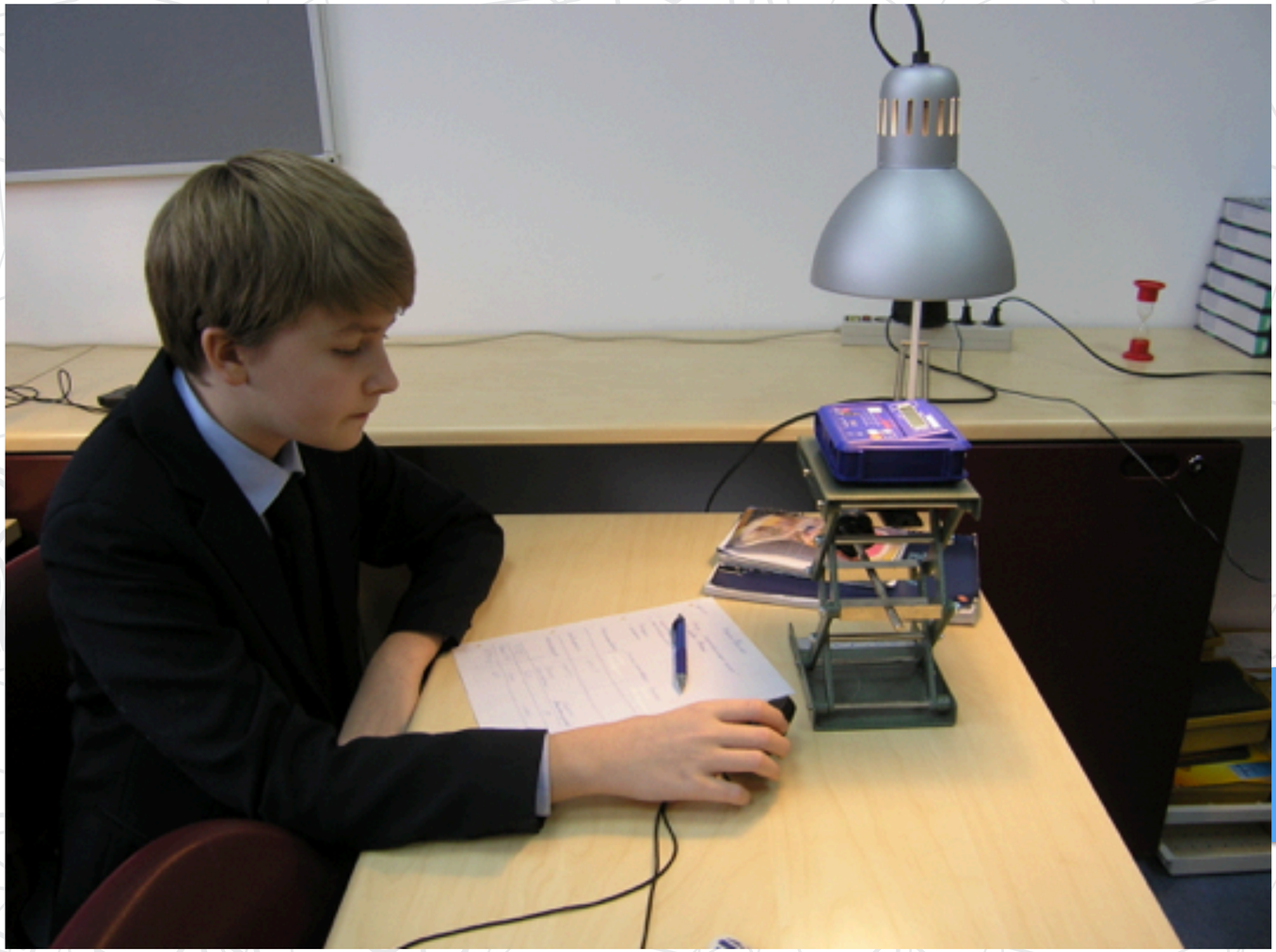
- Individual investigation
- This investigation covers assessment objectives 1, 2, 3 and 4.

Internal assessment criteria

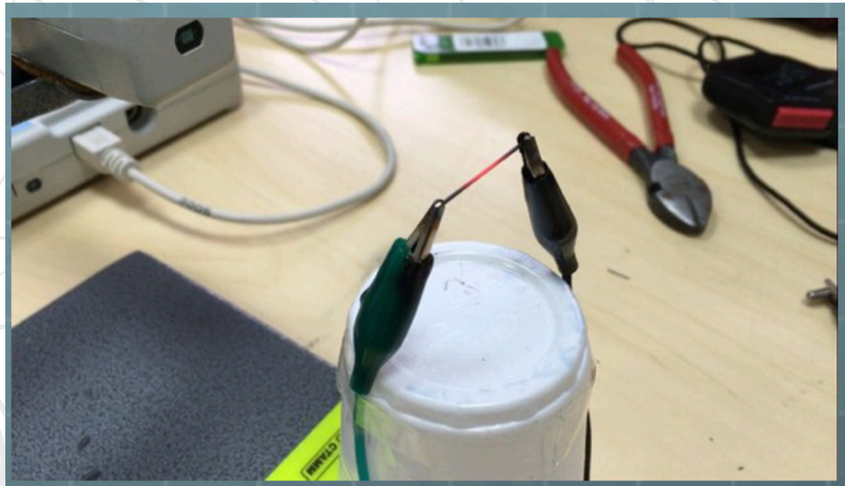
The new assessment model uses five criteria to assess the final report of the individual investigation with the following raw marks and weightings assigned:

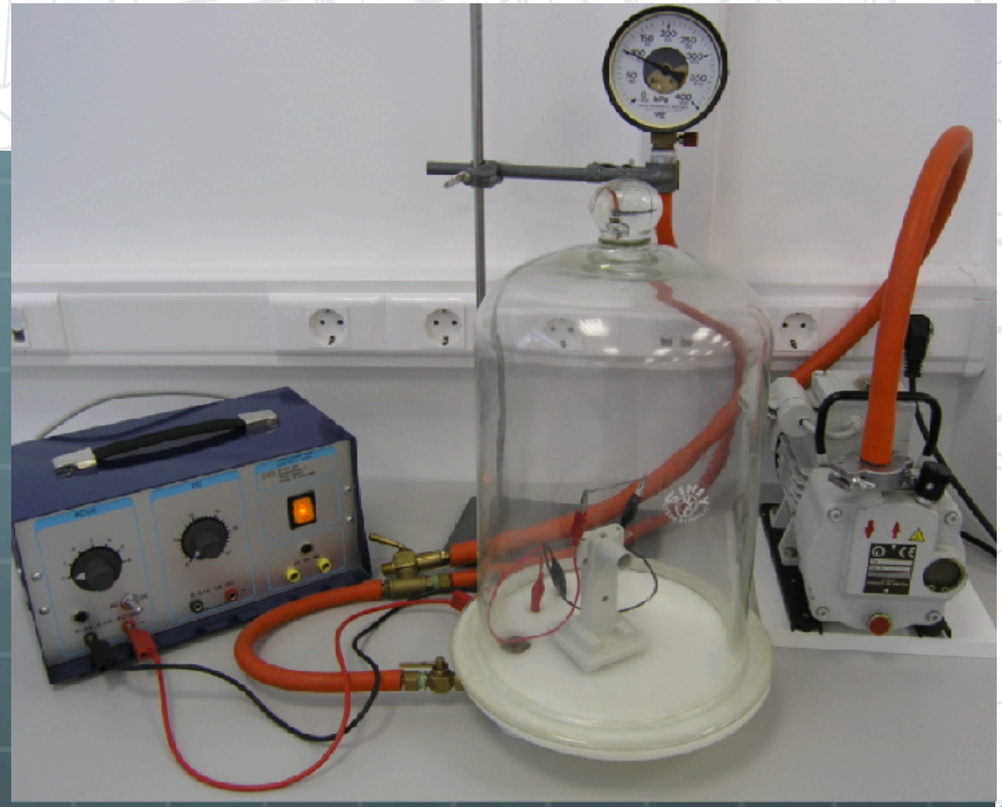
Personal engagement	Exploration	Analysis	Evaluation	Communication	Total
2 (8%)	6 (25%)	6 (25%)	6 (25%)	4 (17%)	24 (100%)

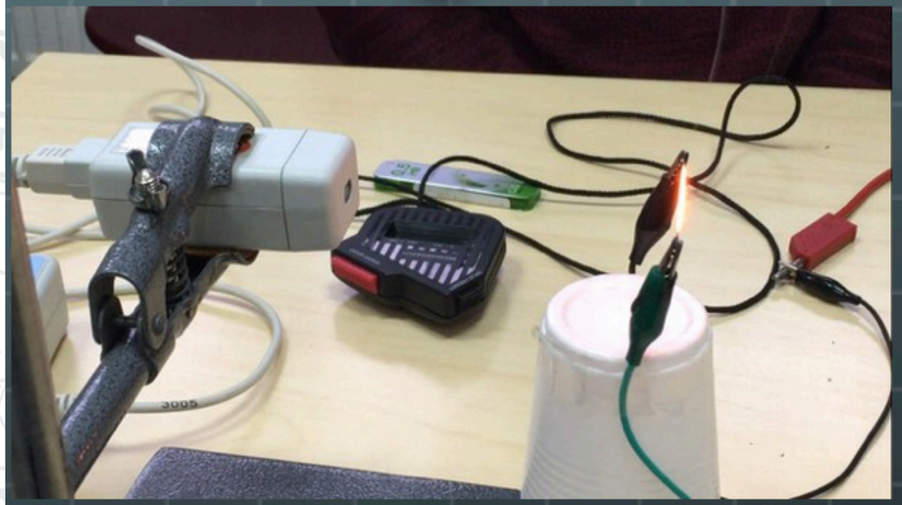




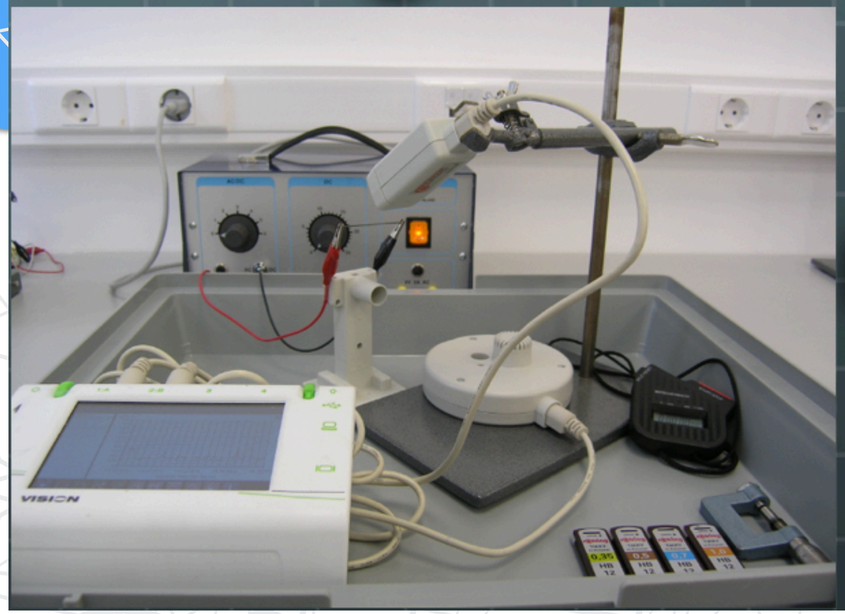

Lampe Lodiguine 1874

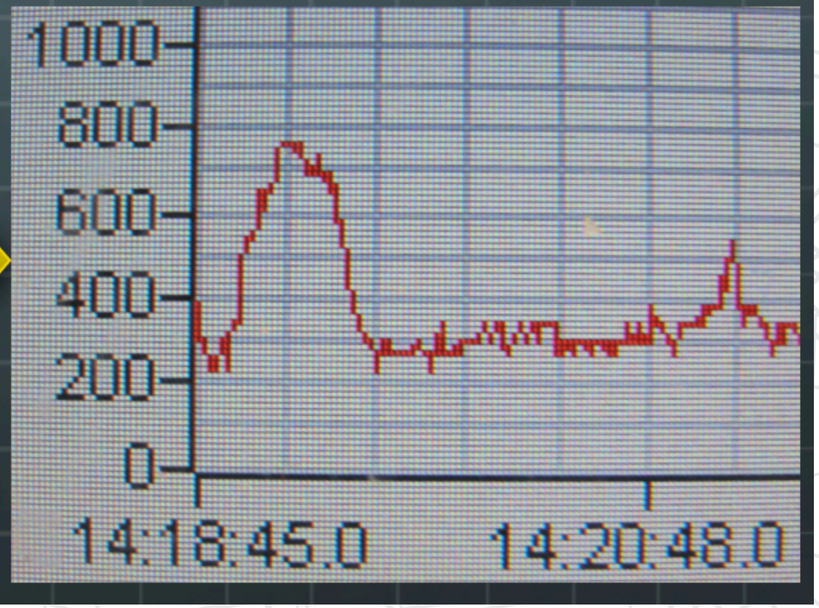


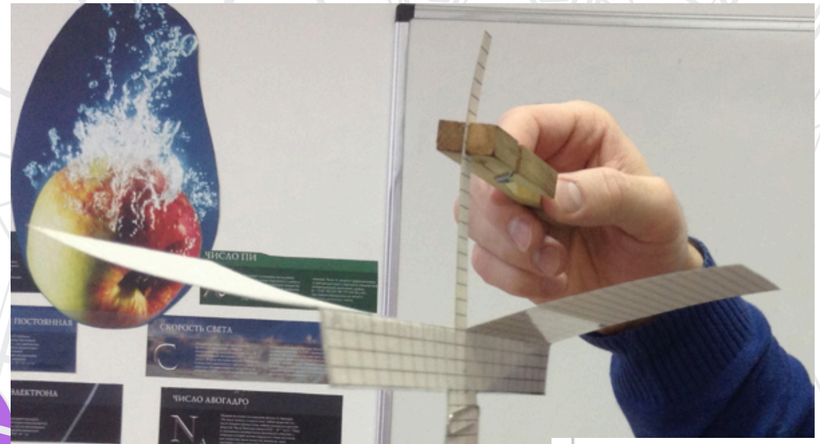


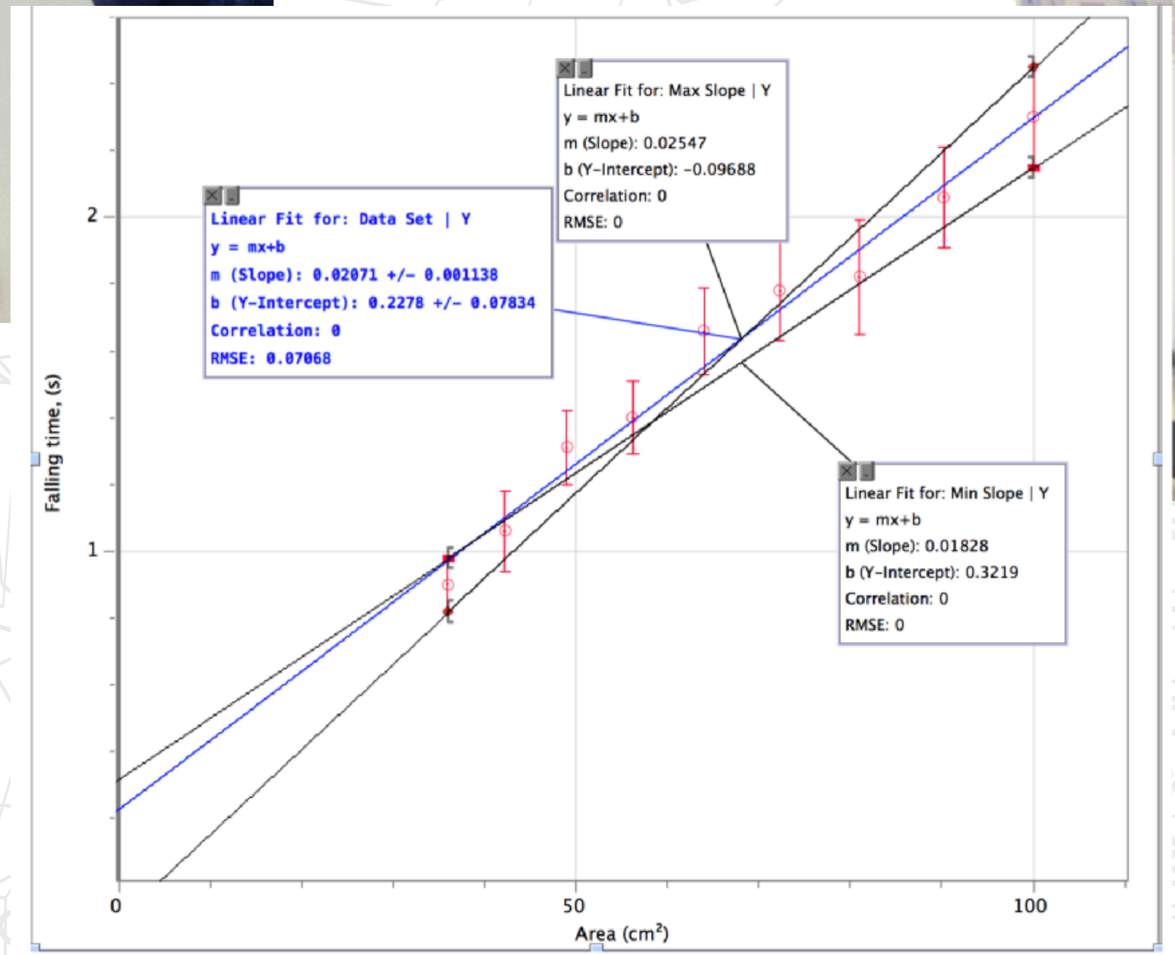


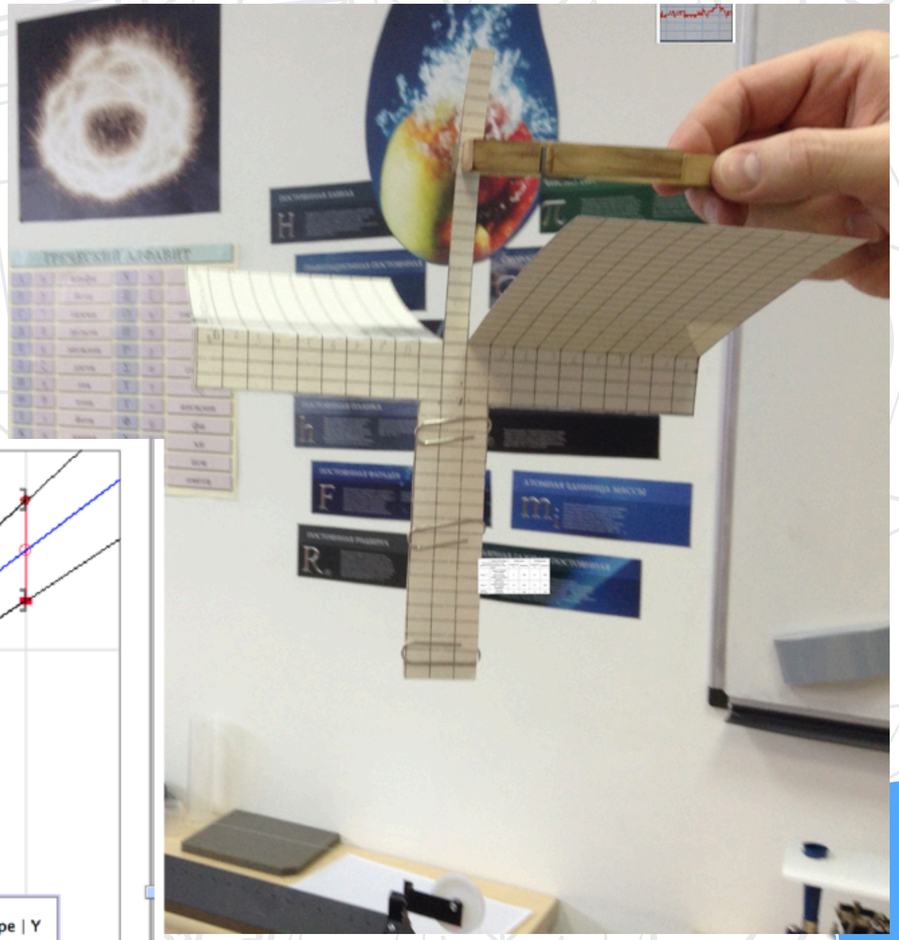
Diameter (cm) ±0.05 cm	Time (seconds)	Max. lighting (lx) ±20 lx	Max. level of formation of carbon dioxide (ppm) ±30 ppm
0.35	18±3	306	1004
0.50	29±5	613	1109
0.70	39±5	766	1163
1.00	60±8	804	1274






ЧИСЛО ПИ
СКОРОСТЬ СВЕТА
ЧИСЛО АВОГАДРО
РАДИУС ПЕРВОЙ БОРОВСКОЙ ОРБИТЫ
АТОМНАЯ ЕДИНИЦА МАССЫ
МОЛЯРНАЯ ГАЗОВАЯ ПОСТОЯННАЯ

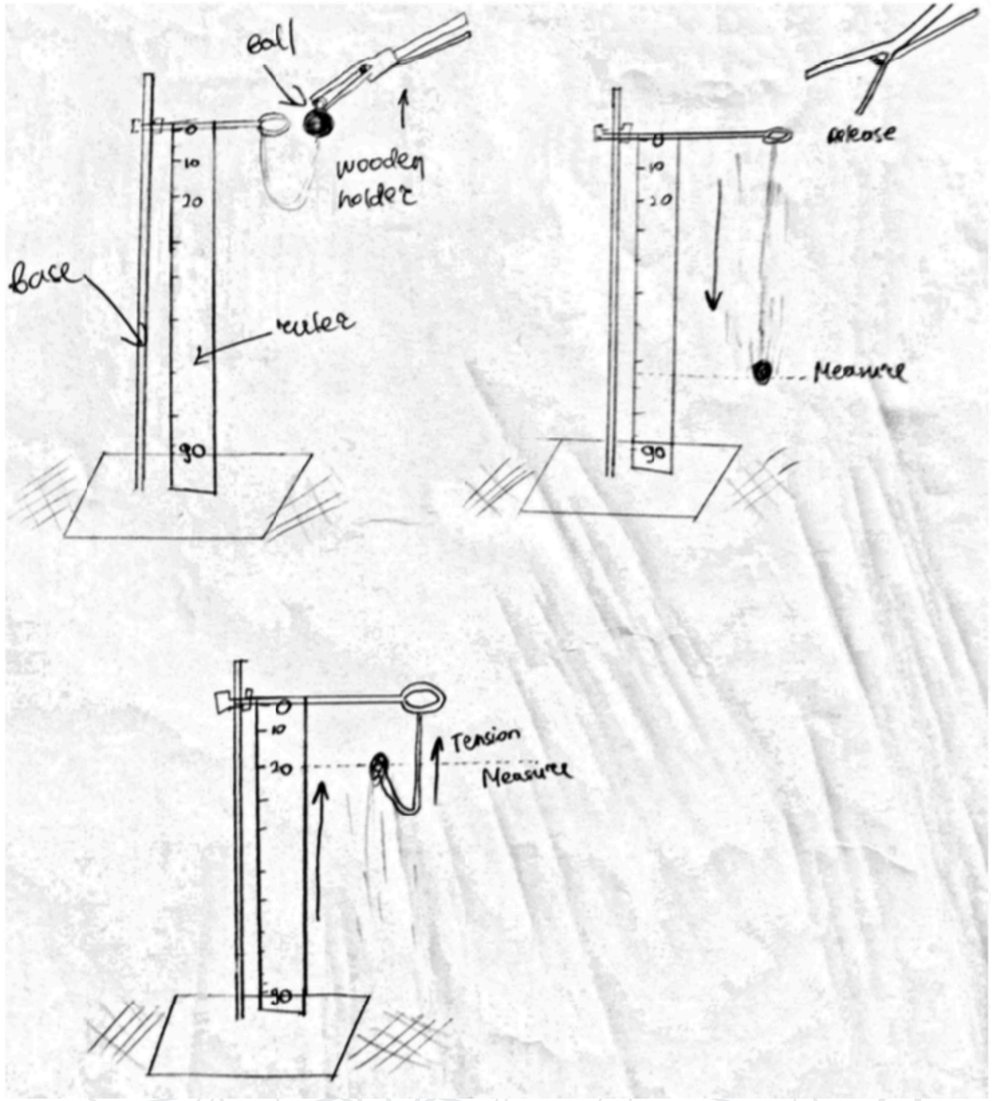

Linear Fit for: Max Slope | Y
y = mx+b
m (Slope): 0.02547
b (Y-Intercept): -0.09688
Correlation: 0
RMSE: 0
Linear Fit for: Data Set | Y
y = mx+b
m (Slope): 0.02071 +/- 0.001138
b (Y-Intercept): 0.2278 +/- 0.07834
Correlation: 0
RMSE: 0.07068
Linear Fit for: Min Slope | Y
y = mx+b
m (Slope): 0.01828
b (Y-Intercept): 0.3219
Correlation: 0
RMSE: 0
Falling time, (s)
2
1
0
50
100
Area (cm²)



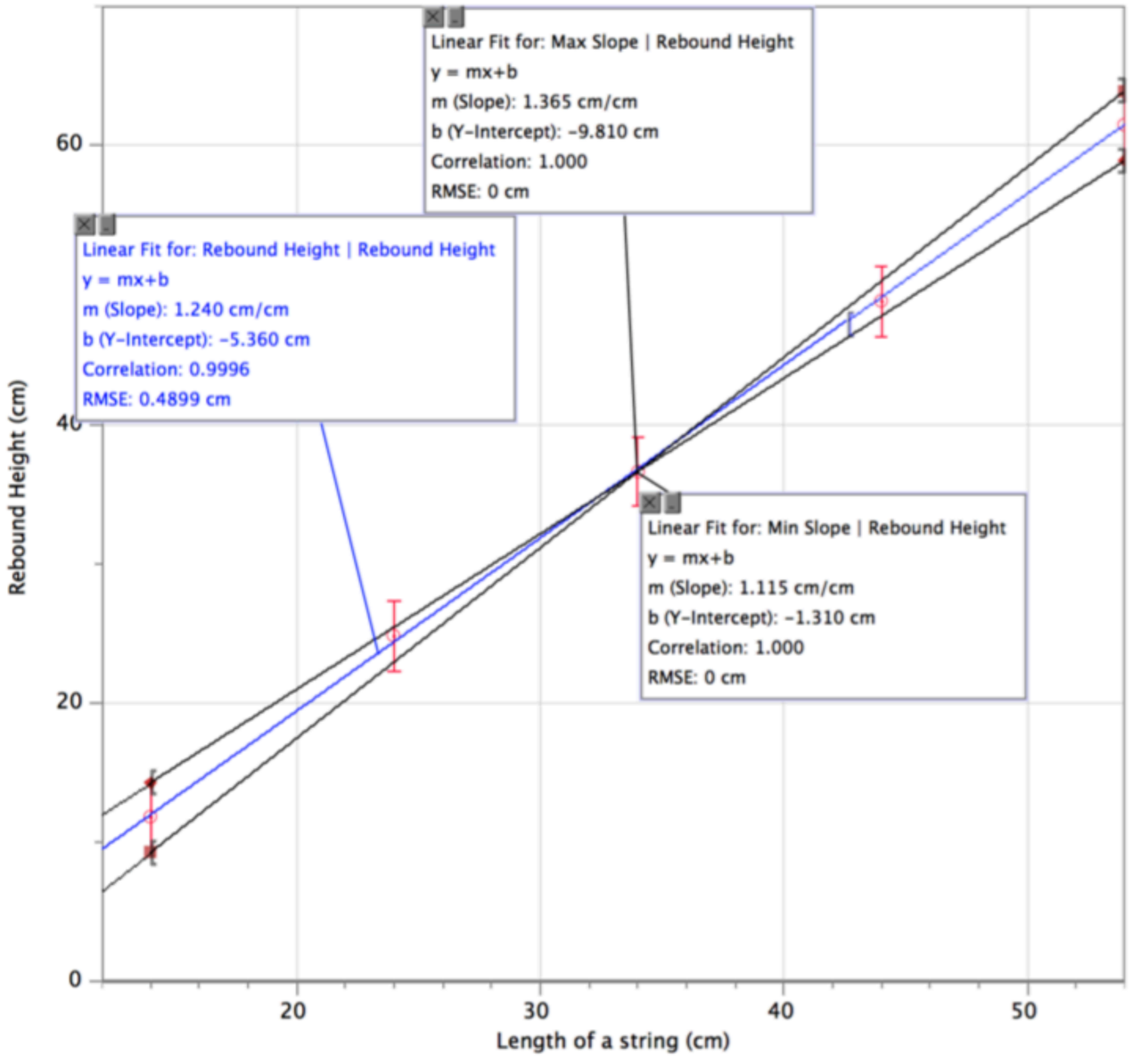
Method

1. Attach big protractor to stand
2. Make a hole in the ball and attach a paper clip to it through that hole
3. Tie a long piece of string to the paper clip
4. Tie the other side of the string to the stand in front of the protractor
5. Tie scotch tape in front of and behind the side of the string tied to the stand to prevent the string from moving too much, thus ensuring a more accurate experiment
6. Fill the syringe with 5 ml (equivalent to 5g) of water and inject it into the ball
7. Weigh the ball and record the result
8. Start video on camera
9. Tilt the ball to the right 45 degrees and hold a ruler in front of it to keep it in place
10. Pull the ruler down to drop the ball (this is done with a ruler to ensure that the initial force acting upon the ball is equal to 0)
11. Wait for 5 oscillations
12. Stop camera
13. Repeat steps 8-12 5 times for several trials
14. Repeat steps 6-13 until the ball weighs about 100g
15. Analyze the results of the video on a computer in slow motion for maximum accuracy

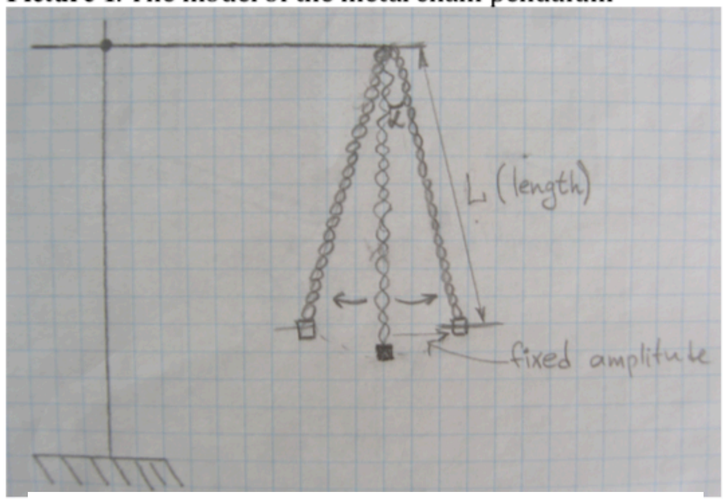
Visual representation of the experiment



The graph shows the relationship between the length of a string and the rebound height. It also shows maximum and minimum slopes of the graph.

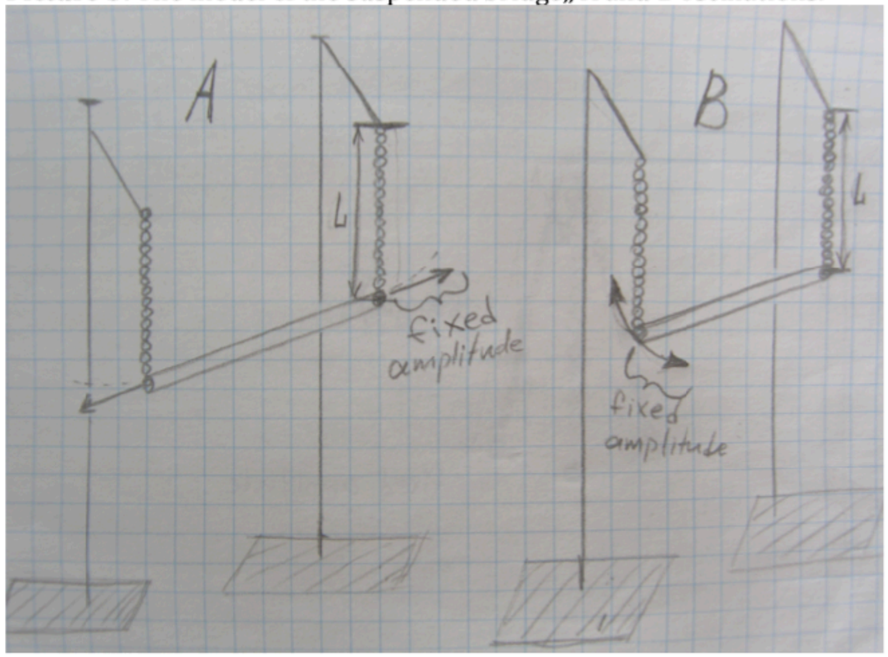


Picture 1. The model of the metal chain pendulum



Picture 2. The photo of the metal chain pendulum

Picture 3. The model of the suspended bridge„ A and B oscillations.



Picture 4. The photo of the model of the suspended bridge.

Picture 5. The photo of the model of the suspended brid

Fig. 1. Graph of the dependence of T^2 from the length L for metal chain pendulum.

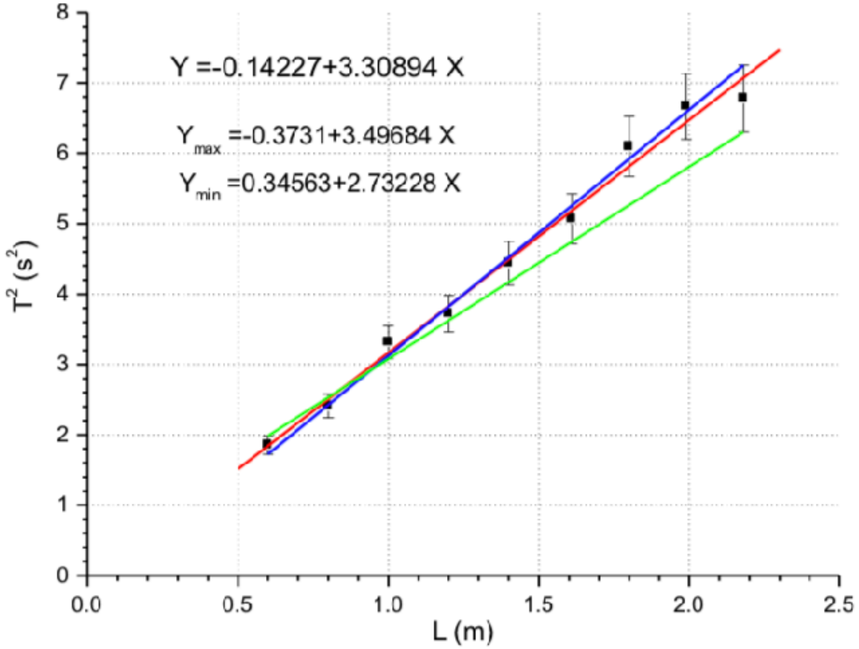
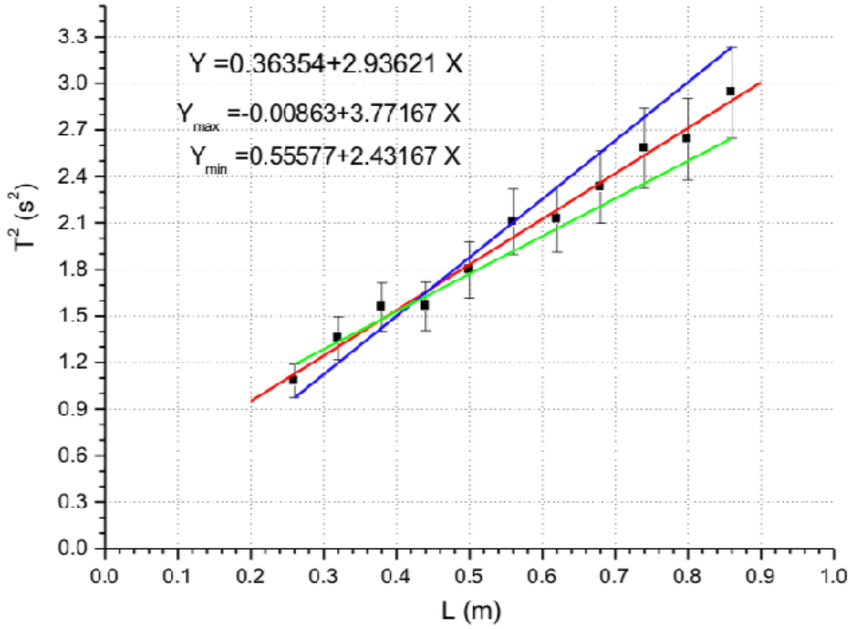


Fig. 3. Graph of the dependence of T^2 from the length L for the oscillations perpendicular to the direction of the iron rod for the model of the suspended bridge pendulum. (B oscillations)



Conclusion

As can be seen from the graph 1 obtained in the first part of the study, the dependency of the squared period of the oscillation of the metal chain on the chain length is linear: $T^2 = (3.31 \pm 0.38)L + (-0.14 \pm 0.36)$. This is consistent with the known dependences for a simple pendulum and rod oscillations. If we write the relation in the general form $T = 2\pi\sqrt{x\frac{L}{g}}$, where for the simple pendulum $x = 1$, for the rod $x = 2/3$, and for the chain pendulum we obtained $x = 0.82 \pm 0.09$. The last value is apparently related to the characteristics of the chain, for example, with the geometric characteristics of the individual link and material of the chain.

For the second part of the experiment, we investigated a more complex construction, consisting of two connected pendulums from the chain. For oscillations of a rod fixed to a chain, we also obtained linear dependencies of the squared period of oscillations from the length of the chain: for A series $T^2 = (2.65 \pm 0.66)L + (0.46 \pm 0.29)$ and for B series $T^2 = (2.94 \pm 0.67)L + (0.36 \pm 0.28)$. The oscillation period in the direction perpendicular to the rod slightly exceeded the oscillation period of such a system along the rod. The coefficient of proportionality for the oscillations in series B is somewhat larger than the coefficient for series A, but the difference in


КОЛЕБАНИЯ МЕТАЛЛИЧЕСКОЙ ЦЕПИ
Ильина Алиса, Томащук Савелий
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Video Overview

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Physics

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20 to 22 September 2019
more info

Physics: A focus on internal assessment

IBDP Category 3

Berlin, Germany
18 to 20 October 2019
more info

Physics

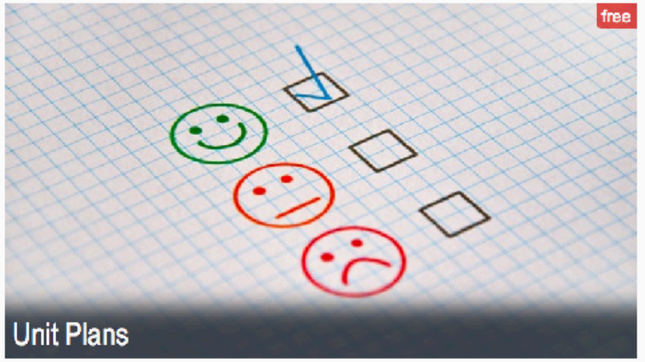
Latest updates

see all

Getting started

The whole course can be delivered through the activities on this website, Chris has been doing it this way for some years. Here is his teaching order.MechanicsActivity: Measurement and uncertaintyIn this practical the mass and diameter of different balls of Plasticine will be measured in order to verify that the mass of a

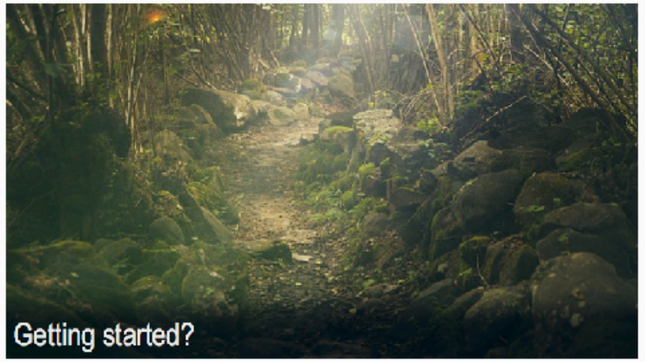
more



Blog

Whitgift has spent this academic year gearing up for our five-year review. In the Physics department, this means ensuring that our Unit Plans are up-to-date and live. We have several IB teachers so, to reflect our different styles and resources, our documentation is in-house and produced collaboratively. The 'How To' guide on Unit

more



Blog

It's always humbling to welcome new users to ThinkIB Physics, and to know that we're serving the needs and wants of our experienced subscribers too. As we near the end of Emma's 'vlog series' (two

Blog

May Papers 1 and 2 have been and gone and now it's the turn of Paper 3. As well as revising the theoretical content of Measurements and uncertainties we should also remind our

Тема: ”Использование мотивирующих подходов в обучении - Естественные науки”

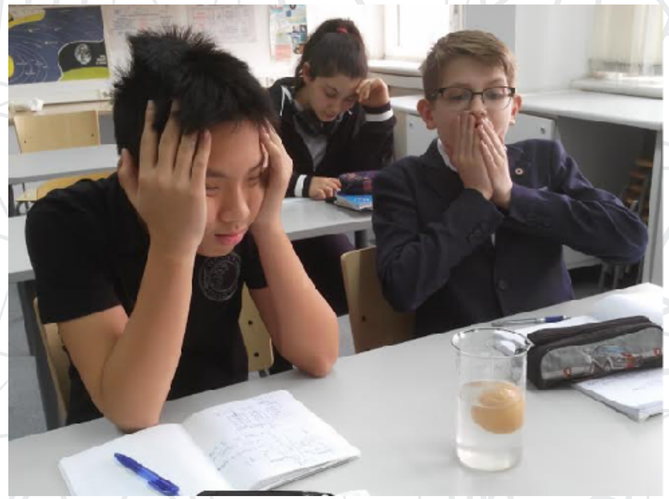
1. Motivation
- internal
- external

2. **Problem solving technology. Hooking question.**

3. Real experiments

4. Interactive models, virtual lab, games

5. Activities: meetings with scientists, expeditions, tours, projects, competitions



Тема: ”Использование мотивирующих подходов в обучении - Естественные науки”

1. **Motivation**
- **internal**
- **external**

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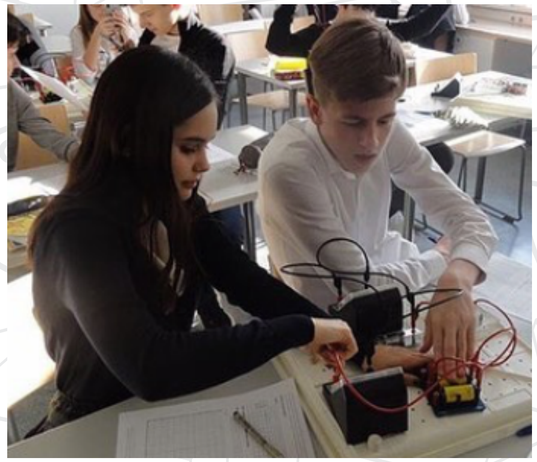
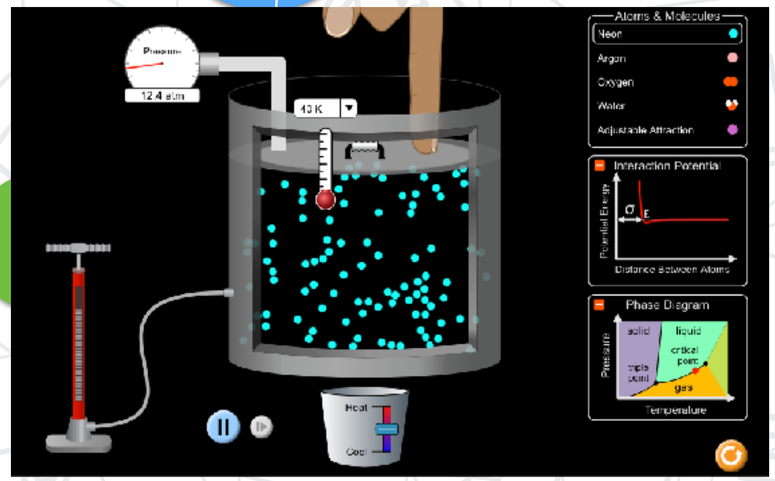
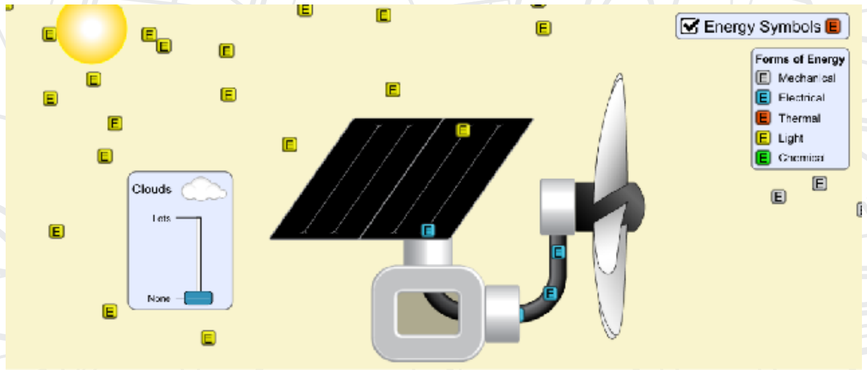
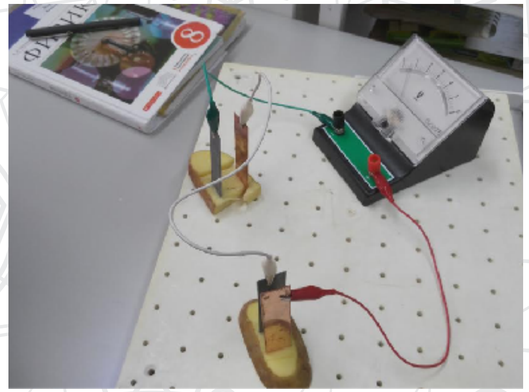
5. **Activities: meetings with scientists, expeditions, tours, projects, competitions**









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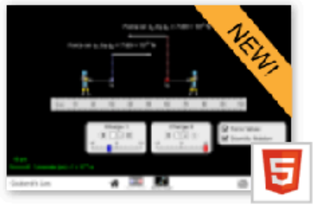
New Sims

Masses and Springs: Basics

Energy Forms and Changes

Wave Interference

Build a Fraction



Coulomb's Law

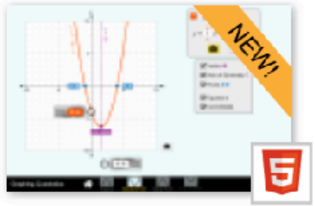
Equality Explorer: Basics

Equality Explorer: Two Variables

Fractions: Equality

Fractions: Intro

Fractions: Mixed Numbers



Graphing Quadratics

Masses and Springs

Тема: ”Использование мотивирующих подходов в обучении - Естественные науки”

1. Motivation
- **internal**
- **external**

2. Problem solving technology.
Hooking question.

3. Real experiments

4. Interactive models

5. Activities:
meetings with scientists,
expeditions,
tours, projects,
competitions …

Конкурс «Мы и биосфера»

Международная конференция «Сахаровские чтения»

THANK YOU for ATTENTION !