

Guidelines and Criteria

Overview

The International Physics Tournament is an annual competition between high-school teams. The tournament aims to **encourage basic understanding of scientific principles in general and of physics in particular and to develop original thinking** in implementing these principles.

The competition is open to pupils in 11th and 12th grade who are studying Physics at a high level in high school. The participants will work in teams of up to five students. Each team will be required to have a local teacher / mentor who will represent them and coordinate with the tournament's Physics counsellor, a Physicist from the Weizmann Institute, who will accompany the teams throughout the safe-building process. The teams need to plan, build and operate the locking mechanism of the safe that will work on the basis of Physics principles. The participants will be required to try to break into other teams' safes. Every team will include no more than five students **and no less than three students**.

The tournament judges meet the teams on the competition day and examine safe quality, complexity and team members' level of understanding.

The tournament fosters creative thinking while exploring the principles of physics. It combines a challenging and continuous learning experience over several months of preparation. At a time when the rates of students choosing to study physics is declining, we attach great importance to promoting the Physics Tournament.

Designing and Building the Safe – Guidelines

1. The physical concept

- The safe opening mechanism may be based on the use of a physical concept from the school's learning material, as indicated in the **list of topics**. Topics not included in the list require the tournament's Physics counsellor's approval at the beginning of the process.
- The concept for building the safe will be submitted through an electronic form only. Forms submitted by hand or manually drawn will not be reviewed, and a notice will not be sent.
- Cracking the safe will be based on the solution to a physics riddle, which can be reached within ten minutes. The mechanism will be based on an understanding of physics rather than on complex calculations or motor skills. The safe builders must ensure that it cannot be opened by any other means than solving the riddle. However, any form of opening the safe without the use of force will be considered legal.

- Each safe box may include up to two physics riddles. All the elements needed by the safe-cracking team to solve the riddles – such as tools they can use, significant components in the safe's structure, electrical circuitry – should be visible or detailed.
- Components which are not needed to solve the riddle and which may mislead (or distract) safe-crackers are prohibited.

2. Reversibility

To allow an unlimited number of safe-cracking attempts, the possibility that the breakers will perform an irreversible operation which will prevent any further breaking must be avoided.

Note: Safe-crackers are allowed to make mistakes in the process; the safes must be able to withstand such errors and be ready for further cracking attempts.

3. Robustness and reliability

The safe must be sturdy and reliable to withstand a large number of hacking attempts and open only upon completing the steps in their planned order.

4. Safety

Safety is a top priority, and the safe itself must not cause any health risk to the user. Any application of high voltage, gas, chemicals, fire, or any other risk factor will require the prior approval of the mentor team.

5. Simple maintenance

Safe maintenance and its return to the locked state after it was cracked must be simple and possible in less than three minutes. A quick opening option, without the need to solve the riddle, should be included for maintenance purposes. It must be ensured that the hacking teams do not have access to the quick opening.

6. Materials required

Box sizes: 60cm x 30cm x 40cm ~ 24" x 12" x 16", consisting of a wooden box with a transparent door that closes with an off-the-shelf electro-mechanical locking device.

Scores in the International Tournament

The final score will be determined on the basis of a four-component weighted average:

1. Scores by senior judges: 45% of the final score

Each group will be tested by a professional team of three judges: Faculty members from the Weizmann Institute of Science, the Davidson Institute for Science Education, and selected teachers. Each judge will examine the team individually and separately.

Judges consider:

- The process of developing the theoretical concept – formulating the idea and organizing and integrating the information.
- Knowledge and understanding – exercising sound judgment in selecting the physics principles, the level of understanding of all the team's members and cooperation among them, their ability to relate to other phenomena or uses.
- Implementation – straightforward, continuous, and elegant safe operation, creating an aesthetic safe, and using materials suitable for the mechanism.

Rubric for judging

The domain	Dimensions	Criteria
Knowledge and understanding	Explanation of the safe	Demonstrating personal and group knowledge while eloquently presenting the physical principles (team expertise is shared)
		Use of language, physical concepts and context
		Introducing knowledge of the physics law in depth and breadth (link to other topics or uses)
		Understanding the technology behind the components
Application	The physics aspect	The principles / laws integrate nicely and support one another
		The safe is challenging
	The technological aspect	The use of components and technology illustrates and brings to light the scientific law / principle
		The visibility of the safe
	The safe has a unique design that integrates with the content	
	The activation of the safe	Safe is simple to operate
		Continuous - There is a sequence of operations that creates a harmonious flow of cracking the safe
		The ability to use the safe and put it back into action
General Impression		

2. *Student evaluation – safe crackers’ feedback: 20% of the final score*

Ranking criteria:

- **Implementation** – the safe presents an original idea and a simple, continuous, and elegant operation.
- **Quality and finish** – the safe is aesthetic, made of materials suitable for the mechanism.
- **Interaction with the safe team** – team members polite and the safe is fair.

Rubric for peers - cracking the safe

The domain	Criteria
Interest	The ideas Integrate and create an interesting concept
Innovation	The safe has innovative components
Using principles	The principles used are familiar, but the way they are implemented is not self-evident
Cracking	The level of difficulty in cracking the safe is reasonable, one that is challenging but possible
	The safe is built on familiar principles
	The use of these components is really required and creates a proper sequence for operation
	Cracking the safe is fun

- **Team’s success in cracking other teams’ safes:**

3. *The team’s success in cracking other teams’ safes: 25% of the final score*

4. *Safe resistance to cracking attempts: 10% of the final score*

Important Notes

- **Submitting the concept for the safe** will be done in electronic form only. Hand-written forms or manual drawings will not be checked and no corresponding notice will be sent.
- Teams must meet all the milestones according to the schedule published on the program’s website. **Continuing to participate in the tournament requires meeting all the goals.** In addition, contact must be continuously maintained with the tournament’s Physics counsellor.
- Prizes will be awarded to the three winners of the international tournament.
- The safe descriptions of each team will be published on the website.

For Further Information: Tournament Director on behalf of the Davidson Institute for Science Education:
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