



Rule Book for the Forty-Fifth UBC Physics Olympics

Version 1

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The 2023 UBC Physics Olympics will be on Saturday, March 4, 2023, at UBC

Announcements related to Physics Olympics will be posted on Canvas; please make sure to check regularly for updates.

**Department of Curriculum and Pedagogy (Science Education Group)
Department of Physics and Astronomy**

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Objective: UBC Physics Olympics strives to establish an intellectually challenging, exciting, positive, fun, and safe environment, wherein all participants feel engaged, respected, and capable of doing physics.

1. UBC Physics Olympics Code of Conduct

By participating in the 2023 UBC Physics Olympics, participants agree to the Physics Olympics Code of Conduct. Any participant unable to adhere to the code of conduct will be dismissed from the event immediately; we reserve the right to limit that individual's participation in future events.

We ask all participants to:

- Follow activity rules and instructions from the UBC Physics Olympics team.
- Treat each other with respect – be respectful of the rights and opinions of others, even if you don't agree with each other.
- Stay on topic – remember the objective of UBC Physics Olympics.
- Remember everything you share on online platforms could become public – avoid sharing private and personal information (e.g., email address, home address or phone number for yourself or others).
- Review all rules and guidelines, and acknowledge that there are some risks involved in your participation.
- Take steps to protect your own safety during the participation of any UBC Physics Olympics activities.

We will not tolerate any of the following:

- Cheating or other forms of academic misconduct.
- Speech that promotes discrimination based on race, sex, religion, nationality, disability, sexual orientation, gender, class, or age.
- Defamatory, indecent, hateful, deceitful, threatening, abusive, obscene, inflammatory, or inappropriate comments.
- Messages that encourage or suggest illegal activity, contain sexually explicit material, contain advertising or promote any services, or are off-topic, unintelligible or irrelevant.

If you have any questions regarding the community guidelines or are experiencing harmful behaviours, please contact

- Kirsty Dickson: communications@phas.ubc.ca
- Marina Milner-Bolotin: marina.milner-bolotin@ubc.ca

2. General Rules

This year, UBC Physics Olympics will be held as an in-person competition. Some elements will be facilitated through online platforms, such as Canvas and possibly a virtual “buzzer” system. Teams may also participate in some events remotely as an exhibition only.

Each registered organization (hereafter simply “school”) enters students as a team. Up to five students from a team may participate in any given event. A school may request to have two teams, but each must have at least four students on the day of the competition. Two teams with fewer than four students on the competition day will be combined into one team. Events are designed so small team numbers are not penalized. Each event is run in six heats lasting about one hour each.

There is a break for lunch. Lunch itself is not provided, but the Student “Nest” building is across the street from the Hennings Building, which has many food options. You can find the location of the Nest here:

<https://planning.ubc.ca/sites/default/files/2019-11/UBCMap-Portrait.pdf>

The event members of the top teams from each event will be awarded gold, silver, and bronze medals. Schools with the top six combined scores will receive plaques, and a travelling trophy will be awarded to the overall top school. Awards are only given for in-person participation. However, online participants will be recognized through the Physics Olympics website.

The combined score of a team is the sum of their decibel scores in the six events. For each event, schools are ranked by their event score, and the corresponding decibel score for that event is given by $10 \log_{10}(\text{rank})$ dB. Thus, a rank of first place in an event is 0 dB, second is 3.01 dB, fifth is 6.99 dB, tenth is 10 dB, and twentieth is 13.01 dB. The overall winner is the school with the *lowest* total decibel score.

Online teams are not ranked. They may participate in Pre-build 1, Pre-build 2, and Fermi Questions only. Their participation will be acknowledged through Canvas and the UBC Physics Olympics website.

3. Interpretation of Rules

Normal physics interpretations will be applied to all the terminology used in defining the challenges. Those solutions that, in the opinion of the event judges, do not comply with the spirit and intent of the rules will be disqualified from the event (and thus ranked last for the event). The ruling of the event judges is final.

4. Use of Third-party Applications

The following applications may be used to support the Physics Olympics activities. This list will be updated as needed. If you have any concerns or questions about the collection of your information and the applications used during UBC Physics Olympics, please contact Kirsty Dickson, Communications Coordinator, UBC Physics & Astronomy at communications@phas.ubc.ca.

The following applications might not be hosted in Canada:

- [Cosmic Buzzer](#) (Links to an external site): Online buzzer system, which may be used in lieu of physical buzzers
- [PhyPhox](#) (Links to an external site): physical phone experiment application (Pre-build)
- [YouTube](#) (Links to an external site): video sharing and streaming platform (used within Canvas)

Some applications may ask participants to create an account in the tool; by doing so, you will be required to provide personally identifying information including but not limited to your name and email address. Because these tools might be hosted on servers outside of Canada, by creating an account you will also be consenting to the storage of your information outside of Canada. Please know you are not required to consent to sharing this personal information with the tool, if you are uncomfortable doing so. If you choose not to provide consent, you may create an account using a nickname and a non-identifying email address, or use tools that will provide disposable email addresses. You may also choose not to participate in activities that require the use of these applications.

The following applications are hosted in Canada:

- [Canvas](#) (Links to an external site): online teaching and learning platform
- [Kaltura](#) (Links to an external site): online video hosting platform
- [Qualtrics](#) (Links to an external site.): online survey application and post-event survey

When using these applications, your personal information is collected under the authority of section 26(c) of the [Freedom of Information and Protection of Privacy Act \(FIPPA\)](#) ([Links to an external site.](#))

Collected data will be used for the purpose of sending you information regarding the 2024 UBC Physics Olympics, and evaluating your participation in the UBC Physics Olympics competition.

5. Privacy and Recording

While the competition is not open to the general public and some safeguards will be in place to protect teams' privacy, teams should consider their usage of the Canvas platform, other applications, and their participation in Physics Olympics activities as being public, with the possibility of being recorded. Efforts should be made to avoid posting/sharing personal information including but not limited to text, video, and audio.

The Final Quizzics! event may be streamed within Canvas through YouTube. A video recording may be made by UBC Physics & Astronomy for internal use, which will be kept confidential and private.

6. Pre-Build Events

There are two pre-build events. For each event, teams are required to design and build devices in advance of the competition. At the start of the day, pre-built devices will be checked into a storage room until required for a heat. Modifications are not allowed after arrival. Exceptions are made at the discretion of the judges for the purpose of repairing damage sustained during transit.

The pre-build events are intended to be learning experiences for the students, so we ask that team coaches do not overly involve themselves in the device design and construction.

We strongly encourage creativity, but violating the rules will result in disqualification. To avoid this disappointment, teams are encouraged to contact the Physics Olympics organizers for a preliminary evaluation whether their design is within the rules. However, the ruling of the event judge about the legality of a pre-built device at the time of the competition is final, and overrides any preliminary evaluation.

Please direct general inquiries about the pre-build rules to Prof. Aaron Boley, preferably by email (acboley@phas.ubc.ca) or by telephone (604.822.3853), Monday-Friday 11 AM to 4 PM.

Pre-Build 1, Vacuum Pump

The rules are available at this link:

<https://phas-physoly.sites.olt.ubc.ca/files/2023/01/Vacuum-Pump-Rules-Final-1.pdf>

Contact event judge Prof. Valery Milner at vmilner@phas.ubc.ca for questions.

Pre-Build 2, Marine Ambulance

The rules are available at this link:

https://phas-physoly.sites.olt.ubc.ca/files/2023/02/Pre-build-2-Boat_AB_Feb12023.pdf

Contact the event team at prebuild2@phas.ubc.ca for questions.

7. Labs

Heats (except the last) will be closed to all persons except the heat participants. Coaches will be allowed to view heats upon request. No more than five participants per team will be allowed in the lab. Teams are encouraged to bring a calculator.

The labs this year are:

Centre of Mass Lab: The lab will explore the concept of the centre of mass and how mass distributions affect its location.

Air Resistance Lab: The lab will explore concepts of aerodynamic drag.

8. Quizzics!

Team members will work together to answer questions about physics and astronomy. Questions may involve mechanics, waves, electricity and magnetism, optics, fluids, modern physics, famous scientists, or the history of science. Some questions may involve short calculations. Use of cellphones or other wireless devices for looking up information will result in disqualification. However, one device per team will be necessary for submitted responses.

All teams will participate in the preliminary Quizzics! heats. Questions are in a multiple-choice format. Consultation between team members is allowed. The same questions will be used in each preliminary heat, so these heats are closed to all except the participants.

The teams with the highest scores in the preliminary heats will meet in the public round of Final Quizzics! using a buzzer system. Each question will be answered by the first team to buzz. For approximately the first third of the questions, the correct answer is worth 1 point, while each incorrect answer (or failing to give an answer within 5 seconds) loses 1 point. For the next third, a correct answer is worth 2 points, and an incorrect -2 points. For the final third, a correct answer is worth 3 points, and an incorrect answer is -3 points. The winner is the team with the maximum number of Final Quizzics! points. Teams cannot go below zero points.

9. Fermi Questions

The great twentieth century physicist Enrico Fermi was famous for being able to estimate anything to within a factor of ten. Examples of "Fermi Questions" are:

- What is the total mass of the students competing in the Physics Olympics today?
- How many litres of gasoline are consumed in Greater Vancouver each year?
- How many molecules of air are there in this room?

For more examples, look on the web. These were taken from http://www.physics.uwo.ca/science_olympics/events/puzzles/fermi_questions.html (Links to an external site).

Answering a Fermi question in physics requires common sense understanding, knowing the order of magnitude of key constants of nature and physical parameters, and the ability to do approximate calculations quickly.

Your team will be given a number of Fermi Questions to answer using only pencil and paper and your own knowledge. **No notes, tables, books, or calculators are allowed. Cellphones, tablets or computers are only allowed to access the Canvas site.** Since there will be a substantial number of questions to answer and only a limited time to answer them, speed and teamwork will be important. Your written answers will be graded for accuracy appropriate to the questions. Your answers must include appropriate units, in the SI (MKS) system.

Many physicists pride themselves on knowing various constants of nature and physical parameters to at least one decimal place. Parameters that may be needed, to this accuracy, include but are not limited to:

- the speed of light
- Planck's constant
- Boltzmann's constant
- Avogadro's number
- the mass of the electron
- the mass of the proton
- the charge of the electron
- the constant in Coulomb's Law
- the constant in Newton's Law of Universal Gravitation
- the acceleration of gravity on Earth
- the radius of the Earth, and
- the distance from Earth to the Sun