Rule Book for the Forty-Sixth UBC Physics Olympics

Version 2

Released, 4 March 2024

(Addendum Included)

The 2024 UBC Physics Olympics will be on Saturday, March 9 at UBC

Announcements related to Physics Olympics will be posted online at https://physoly.phas.ubc.ca/.

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 2024 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

UBC Physics Olympics is held as an in-person competition.

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/about-us/campus-maps

Gold, silver, and bronze medals will be awarded to the top-scoring teams in each event. Only team members who took part in the given event will receive medals. Teams with the overall top six best rankings will receive plaques, and a traveling trophy will be awarded to the overall top team.

Overall team ranking is determined by the sum of their decibel ranks in each event. Scores in each event are used to determine the event ranking, which in turn is used to calculate a corresponding decibel score for that event, set by $10 \log_{10}$ (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 team with the *lowest* total decibel score summed over all events.

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. 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 participation in Physics Olympics activities as being public, with the possibility of being recorded and photographed. Those images and videos may be shared publicly for documenting and advertising the Physics Olympics competition, including through social and traditional media. Efforts will be made to avoid posting or otherwise sharing personal information.

5. 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.

To see a community page where questions about the pre-builds are posted and answered, see our FAQ page here: FAQs: Collected from Teachers & Organizers | UBC Physics Olympics

The pre-builds are as follows:

Pre-Build 1, Cool It Down!

The rules are available at this link:
https://phas-physoly.sites.olt.ubc.ca/files/2024/01/Cool-It-Down-Rules.pdf

An addendum to the rules is here:
https://phas-physoly.sites.olt.ubc.ca/files/2024/01/Cool-It-Down-Addendum.pdf

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

Pre-Build 2, Solar-powered car

The rules are available at this link:
https://phas-physoly.sites.olt.ubc.ca/files/2024/01/Prebuild2_solarpoweredcar_Jan252024KLD.pdf

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

6. 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:

Stay Focused: A hands-on challenge in geometrical optics

The Sound of Science: Exploring waves, interference, and vibration.

7. 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.

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.

8. 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, devices, or calculators are allowed.** 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

ADDENDUM

Added March 4, 2024

This addendum provides additional clarity regarding pre-build check-in expectations, as well as clarification on the use of calculators for Quizzics!

Pre-build check-in

Teams must check in their pre-build devices prior to the first heat of the competition. Delays in doing so may result in disqualification.

Check-in will be in coordination with the Physics Olympics volunteers. Only the minimum number of team members needed to safely transport the device will be allowed into the check-in room.

Once checked in, teams are only allowed to retrieve their pre-builds for their respective heats. To facilitate this, check-out will open approximately 20 minutes prior to each heat.

Upon retrieving a team's pre-build, only the minimum number of team members needed to safely carry the pre-build will be allowed into the check-in room. All persons must be escorted by a Physics Olympics volunteer.

Should a team's pre-build device be damaged during transport to the event, then repairs may be possible, but only with approval by the event judges.

Calculators in Quizzics!

Calculators will be permitted. If the calculator is capable of storing text or equations, the calculator must have its memory cleared if requested by the judge or an event volunteer. Team members are responsible for knowing how to clear their calculator's memory. Not being able to do so may result in the removal of the calculator. Teams may have more than one calculator.

Cell phones or other devices may not be used in lieu of a calculator.