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# Global Quantum Mechanics Challenge

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Vision and Mission



## ● Vision and Mission



Quantum mechanics is the branch of physics that describes the behaviour of matter and energy at the most fundamental level: governing the motion of electrons, photons, and atomic nuclei according to principles that have no counterpart in everyday experience. Its insights underpin technologies as diverse as semiconductors, lasers, MRI scanners, and quantum computers, and it connects fields ranging from chemistry and materials science to information theory and cosmology. Our society urgently needs talented physicists, researchers, and innovators to address global challenges including quantum computing, sustainable energy, advanced materials, medical diagnostics, and secure communications.

The Global Quantum Mechanics Challenge offers students a platform to challenge their analytical and problem-solving skills, explore diverse quantum mechanics concepts, and delve deeper into this fascinating discipline beyond the standard school curriculum. We believe that blending education with friendly competition can inspire students to develop a lasting passion for quantum mechanics, potentially leading to fulfilling careers in research, industry, education, and scientific innovation.

The Global Quantum Mechanics Challenge aims to be accessible to all students from all countries, regardless of their background, school, or institution: all you need is a pen, paper, and an internet connection to join!

## ● What makes GQMC unique?



While competition is part of GQMC, our core mission is to foster genuine engagement with quantum mechanics, sparking curiosity and encouraging further exploration in this and related scientific fields. GQMC is a learning journey, enabled by diverse problem formats that enhance a student's understanding through practical application. Key aspects that distinguish GQMC include:

- ▶ **Internationality:** From the very first round, GQMC is a truly global event. All participants tackle the same challenges, ensuring fair assessment and fostering international connections.
- ▶ **Digital Accessibility:** We utilise the power of the internet to open participation to students everywhere, regardless of geographic location or school affiliation. While teacher guidance is beneficial, motivated individuals can participate independently from anywhere.
- ▶ **Exploration of Theory and Practice:** GQMC embraces the full scope of quantum mechanics. The competition covers a broad range of topics, including wave mechanics, quantum states and operators, angular momentum and spin, perturbation theory, atomic and molecular quantum mechanics, quantum statistical mechanics, quantum optics, solid-state physics,

and quantum information and computing. These topics are presented through diverse problem formats that combine theoretical understanding with practical application, requiring students to apply quantum principles, perform calculations, and analyse physical systems.

- ▶ **Real-World Research:** Bridging the gap between academic learning and cutting-edge research is vital, especially in a rapidly evolving field like quantum mechanics. GQMC problems typically incorporate concepts from recently published research papers. This unique feature provides many participants with their first exposure to actual quantum mechanics research: a field where groundbreaking work is published daily, sometimes even by students like you!
- ▶ **Scaling Difficulty Levels:** Our problems are designed to engage both experienced quantum mechanics enthusiasts and those beginning to explore the subject beyond the classroom. The difficulty ranges from approachable exercises that reinforce foundational concepts to advanced challenges that introduce novel formats and require deeper analytical thinking. This ensures a rewarding and intellectually stimulating experience for all participants.
- ▶ **Online Tools for Educators:** We equip teachers and schools with resources and support. A dedicated teacher interface allows for streamlined management of student submissions, results tracking, certificate access, and supervision of the Final Round exam.
- ▶ **Local Communities & Ambassadors:** GQMC encourages the formation of local student groups focused on quantum mechanics. Our Ambassador Program empowers motivated students to inspire peers, organise local events, and build vibrant communities centred around shared interests in quantum mechanics.