香 港 資 優 教 育 學 苑
The Hong Kong Academy for Gifted Education

Exploration on Classical Mechanics and Quantum Mechanics

(E1PHY001W)

Introduction	Classical mechanics and quantum mechanics are two of the four branches of mechanics in theoretical physics, which explains the fundamental nature of the universe by adopting physical abstractions and mathematical models. This workshop will give an overview of classical mechanics and quantum mechanics, with essential concepts introduced in an exploratory approach. Fundamental knowledge such as Newton's laws of motion, energy and momentum, wave-particle duality and atomic model will be discussed. Hence, a number of natural phenomena, such as particle collisions and photoelectric effect, can be explained.
Programme Type / Level	Physics Workshop (Level I) (Token-required)
Instructor(s)	Dr CHAN Man Ho (Assistant Professor, Department of Science and Environmental Studies, The Education University of Hong Kong)
Pre-requisite	➢ Students are recommended to be good at scientific reasoning and mathematical calculation ➢ Students need to bring their calculators to the lesson
Target Participants	➢ S1 – S6 HKAGE student members only in 2020/21 school year ➢ Class Size: 40
Medium of Instruction	English with English handouts
Certificate	**E-Certificate** will be awarded to participants who have: ❖ Attended **all 2 sessions; AND** ❖ Completed all the assignments with **satisfactory performance**
Intended Learning Outcomes	Upon completion of the programme, participants should be able to: 1. apply Newton's laws of motion to solve simple problems in classical kinematics; 2. distinguish the difference and applicable scopes of classical mechanics and quantum mechanics; 3. describe important concepts in quantum physics (e.g. wave-particle duality and atomic model); 4. explain some natural phenomena with quantum mechanics; 5. recognise the beauty of concise formulations in theoretical physics.
Application Procedure	**This programme is Programmes with No Screening** There are no screening questions, written test or other screening methods for this type of programmes. ● Student members can select up to 5 programmes from a list of selection. Applicants have to state the priority when submitting the application. (1st priority, 2nd priority, 3rd priority, etc). 1 token is required for each programme (For programme list, please refer to the issue 22 of Gifted Gateway (click here)); ● The application can only be submitted once. After submission of the application, the programme selection and the priority cannot be changed; ● If a student member removes a programme from the application before the application deadline by withdrawal, the choice priority will remain unchanged. (For example: A student has selected three programmes and removed the programme with the 1st priority from the application. The choices of 2nd and 3rd priority will remain unchanged with no promotion in priority). ● We will select the students based on the student's choice of priorities and a randomly generated selection by the computer system. If there is time clash between the applied programme and other programmes with offer, HKAGE will consider if the application will be accepted; ● Student members should avoid applying programmes with time clash; ● The decision of HKAGE on the result of selection should be final.

Application Deadline **23 Apr 2021 12:00 n.n.** Application Result Release Date **30 Apr 2021**

If student members withdraw from the programme after the Application Deadline, the token will be deducted.

Schedule

Session	Date	Time	Venue (HKAGE)
1	2 Aug	9:30 a.m. – 12:30 p.m.	Room 403
2		2:00 p.m. – 5:00 p.m.	

Sample Notes

A topic in classical mechanics: momentum

- From Newton's third law:

Opposite in direction

$$F_{12} = -F_{21}$$

$$\frac{m_1v_1 - m_1u_1}{t} = -\frac{m_2v_2 - m_2u_2}{t}$$

Same impact time t for two masses

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$$p_{1i} + p_{2i} = p_{1f} + p_{2f}$$

- **Initial total linear momentum before collision = final total linear momentum after collision**
- **Conservation of linear momentum**

A topic in quantum mechanics: emission spectrum of hydrogen

The energy levels of a hydrogen atom can be described by

$$E_n = -\frac{13.6}{n^2} \text{ eV}$$

where 1 eV = 1.6×10^{-19} J and n is the principal quantum number

- The frequency of the photon emitted by a transition from $n = n_i$ to $n = n_f$ can be obtained by:

$$\Delta E = 13.6\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right) \text{ eV} = hf$$

- Conversely, a photon with a right frequency f can excite the hydrogen atom from n_f to n_i

Enquiries

For enquiries, please contact Academic Programme Development Division on 3940 0101 After language selection, press "1".