Science Education Key Learning Area: Chemistry
Curriculum Framework of National Security Education (2025)

Introduction

This Curriculum Framework[1] illustrates in tabular form how learning in Chemistry can be connected to related learning elements of national security education, facilitating schools in planning the learning content for national security education. Schools should integrate national security education into the curriculum planning and learning and teaching of this subject through "organic integration", "natural connection", "diversified strategies", "mutual coordination", "learning within and beyond the classroom" and "whole-school participation". In addition to this Curriculum Framework, schools should also refer to the *Curriculum Framework of National Security Education in Hong Kong (2025)* and other relevant curriculum documents to implement national security education more effectively.

1. Overall Teaching Foci

1.1 The chemistry curriculum covers numerous topics related to resource utilisation, environmental protection, and the interrelationships between chemistry, technology, society, and the environment. These topics include the development and use of minerals and fossil fuels, the research and development of new energy, the application of green industries and air quality management. When studying these topics, examples from our country and Hong Kong can be used to help students understand the significant impact of human activities on the environment and how technology promotes the sustainable development of our society. This will help students understand the relationship between the welfare of people and our country and appreciate the necessity of safeguarding ecological security, resource security and science and technology security at the national level.

[1] The content of this framework is set out in the form of examples. Schools should adopt or adapt the relevant suggestions based on students' learning needs and abilities.

1.2 The chemistry curriculum includes content related to the occurrence and extraction of metals, allowing students to understand the limited reserve of metals and realise the need for conserving and using these resources wisely. It also discusses the importance of metal resources (especially critical mineral resources) to emerging industries and technological development, allowing students to understand and recognise the need to formulate a critical mineral development strategy to safeguard resource security and science and technology security.

1.3 The chemistry curriculum discusses the applications and characteristics of chemical cells in daily life, as well as the principles, pros and cons of a hydrogen-oxygen fuel cell. This helps students understand how innovative technologies can be applied in the field of energy to improve our lives and solve environmental problems. It also helps them appreciate that our country is dedicated to conserving resources and technical strategies for developing energy technologies, fostering a deeper understanding of and interest in the latest technological developments and achievements in our country.

1.4 The chemistry curriculum covers topics related to sustainable development, such as fossil fuels and green chemistry. This allows students to evaluate the role of chemistry in society from different perspectives and gain an understanding the policies and actions taken by our country to address climate change, resource shortages and environmental pollution, thereby deepening their understanding of efforts made by our country to ensure sustainable social development.

2. Learning Foci

Science Education Key Learning Area: Chemistry [Key Stage 4 (Senior Secondary)]		**Curriculum Framework of National Security Education in Hong Kong (2025)**
Learning Areas (Examples)	**Learning Elements (Examples)**	**Related Learning Elements / Major Fields of National Security (Examples)**
• Occurrence and extraction of metals	• Recognise the issue of limited metal reserves and thus realise the importance for conserving and using metal resources wisely • Describe the need for the recycling of metals due to limited metal resources ➢ Through understanding the current situation of limited metal reserves and engaging in learning activities related to critical metals, students can understand the great importance of metal resources (especially critical mineral resources) to emerging industries and technological development. They will also appreciate the breakthroughs made by our	• 4.8 Further understand the challenges and opportunities faced by our country in the process of development, thereby strengthening the sense of vigilance against potential danger in times of peace • Related major fields of national security: Ecological Security, Resource Security and Science and Technology Security

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Learning Areas (Examples)	**Learning Elements (Examples)**	**Related Learning Elements / Major Fields of National Security (Examples)**
	country in recent new mineral research and thereby understand and recognise the need to formulate a critical mineral development strategy and develop new mineral resources to safeguard resource security and science and technology security at the national level ➢ Through discussions on the negative impacts of development, extraction and recycling of metal resources on the environment and ecology, students can understand the significant impact of human activities on the environment. This will cultivate a sense of shared responsibility for sustainable development of society and allow them to recognise	

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	the necessity of safeguarding ecological security at the national level	
• Major uses of distilled fractions of petroleum • Consequences of using fossil fuels	• Recognise the major uses of distilled fractions of petroleum and the pollution from the combustion of fossil fuels • Recognise measures for reducing the emission of air pollutants from combustion of fossil fuels ➢ Through understanding and discussing energy structure and related environmental pollution issues and policies in our country, students can apply their chemistry knowledge to understand the social, economic, environmental and technological impacts of fossil fuels. Students can understand the importance of making wise, sustainable, and	• 4.19 Learn about the potential security risks that people in our country and even the world may face in the fields of society, morality, economy, environment, science and technology, etc.; and be able to make wise decisions and judgments on relevant issues that are in line with the national interests • Related major fields of national

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	nationally beneficial decisions and choices in the face of natural resource crises and climate change, as well as appreciate the necessity of safeguarding ecological security, resource security and science and technology security at the national level ➢ Through understanding and discussing the connection between various energy technologies and environmental protection policies and sustainable development, students can enhance their awareness of environmental protection and cultivate a sense of shared responsibility for sustainable social development	security: Ecological Security, Resource Security and Science and Technology Security

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• Chemical cells in daily life • Fuel cell	• Recognise the principles, pros and cons of a hydrogen-oxygen fuel cell • Understand how the application of innovative technologies can improve our lives and solve environmental problems ➢ Through studying the principles, pros and cons of a hydrogen-oxygen fuel cell and engaging in learning activities related to hydrogen energy development and achievements in our country, students can understand how our country is dedicated to developing energy technologies to address environmental pollution, improve people's quality of life and promote sustainable development. They can also understand and care about our country's achievements in related	• 4.5 Further understand and care about the achievements of our country in various aspects (e.g. society, economy, national defence, environment, diplomacy, technology, healthcare, transportation and infrastructure), and have pride in our country's achievements • 4.9 Have a deeper understanding of the importance of the science and innovation and technology industries in our country and Hong

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	technologies. This allows them to appreciate the necessity of safeguarding ecological security, resource security and science and technology security at the national level	Kong in safeguarding national security and promoting sustainable development • Related major fields of national security: Ecological Security, Resource Security and Science and Technology Security

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• Industrial chemistry and green chemistry	• Discuss the advantages and disadvantages of using industrial processes for manufacturing products from social, economic and environmental perspectives • Understand the relationship between sustainable development and green chemistry ➢ Through discussions on the examples of green chemical technologies in our country, students can understand the application of green chemistry in the chemical industry and explore how these technologies can help address global challenges such as environmental pollution and climate change. They will also learn how our country leverages science and innovative technologies to promote green	• 4.9 Have a deeper understanding of the importance of the science and innovation and technology industries in our country and Hong Kong in safeguarding national security and promoting sustainable development • 4.19 Learn about the potential security risks that people in our country and even the world may face in the fields of society, morality, economy, environment, science and technology, etc.; and

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	development and international sustainable development cooperation. This will help students recognise the necessity of safeguarding ecological security and science and technology security at the national level and cultivate their ability to make wise judgments that are align with national interests when facing technological development and environmental risks	be able to make wise decisions and judgments on relevant issues that are in line with the national interests • Related major fields of national security: Ecological Security and Science and Technology Security

3. Suggested Learning and Teaching Activities (Examples) (Senior Secondary)

The following are merely examples. Teachers can design appropriate activities based on their school context and subject characteristics to promote national security education.

✧ **Project learning**

- [Occurrence and extraction of metals] Search for information about metal resource reserves, extraction and recycling in our country, and conduct learning activities such as group discussions and presentations, to facilitate students to understand the importance of resource security and science and technology security to national sustainable development
- [Fossil fuels] Search for information on recent research and strategies for improving air quality in our country and Hong Kong. Conduct project learning for students to recognise the efforts and the latest developments in environmental protection in our country and Hong Kong, as well as their importance to the people
- [Hydrogen-oxygen fuel cell] Search for information about the development of hydrogen energy industry and the research, development and application of fuel cell technology in our country. Conduct project learning for students to recognise the latest developments and achievements in promoting low-carbon energy in our country and recognise the importance of science and innovative technology of our country in safeguarding national security and sustainable development
- [Industrial chemistry and green chemistry] On the topic of the application of green chemistry in the chemical industry, search for information about green chemical technologies in our country and conduct project learning for students to recognise the developments in the field of green chemistry and its emphasis on sustainable development in our country

✧ **Extended learning activities**

- [Fossil fuels] Design and make a device to measure nitrogen dioxide in the air and analyse and compare the data collected by this device with the air quality data provided by the Environmental Protection Department. This allows students to understand the connection between chemistry, the environment and technology, developing their environmental awareness and sense of responsibility for sustainable social development

✧ **Competitions**

- [Hydrogen-oxygen fuel cell] Arrange for students to participate in competitions related to energy technologies to facilitate students' understanding of the development of energy technologies (e.g. hydrogen energy) as a strategy for achieving carbon neutrality and the importance of developing low-carbon emission new energy sources for safeguarding ecological security and sustainable development

✧ **Visits**

- [Fossil fuels] Arrange visits to the "CLP Power Low Carbon Energy Education Centre" for students to learn how to use low-carbon energy to address the challenges of climate change
- [Occurrence and extraction of metals] Arrange visits to the "WEEE·PARK" for students to learn about the recycling and treatment processes of waste electrical and electronic equipment and understand the importance of "turning wastes into resources" in safeguarding resource security and ecological security

✧ **Exchanges with the Mainland**

- [Fossil fuels] Arrange study tours to environmental protection facilities in the Guangdong-Hong Kong-Macao Greater Bay Area (e.g. visiting the resources thermal power plant science education base in Guangzhou) for students to understand the latest developments of environmental protection policies and related facilities in our country, thereby deepening their understanding of the promotion of sustainable development in our country

Disclaimer:

- *In case of any discrepancy in the meaning of wording between the English text and the Chinese text, the Chinese text shall prevail.*