Translated version

Chemistry (S4 – S6) Curriculum Framework of National Security Education

1. General teaching foci

1.1. The learning of relevant topics such as “Metals”[#], “Fossil Fuels”[#], “Industrial Chemistry” and “Green Chemistry” can enhance students’ concern for and awareness of intelligent use of resources and environmental protection, and enable them to understand the importance of sustainable development and to recognise the necessity of safeguarding the nation's ecological and resource security.

1.2. Topic III “Metals” of the Chemistry Curriculum discusses the occurrence and extraction of metals. The study of the topic can enable students to understand the limited reserve of metals, realise the need for conserving and using these resources wisely, and understand the positive and negative impacts of recycling of metals from social, economic and environmental perspectives.

1.3. Topic V “Fossil Fuels and Carbon Compounds” of the Chemistry Curriculum discusses the use of petroleum fractions as fuel and as a source of hydrocarbons. The study of the topic can enable students to appreciate that the use of fossil fuels has brought us benefits and convenience, but at the same time environmental problems such as air pollution, acid rain, and global warming.

1.4. Topic XIII “Industrial Chemistry” of the Chemistry Curriculum helps students learn to evaluate the role of chemistry in society from different perspectives, develop concepts and understanding of green chemistry, and understand how green chemistry assists in the management and control of the impact of industrial processes on our environment.

1.5. The Chemistry Curriculum involves many topics and issues about the relationship among chemistry, technology, society and the environment, such as the extraction and use of minerals and fossil fuels, applications of green industries, and management of air quality. When studying respective topics, local and national examples can be cited for students to understand that human activities can have a significant impact on our environment. Students should also develop a sense of shared responsibility for the sustainable development of Hong Kong, our country and the world.

Note: In this curriculum framework, topics marked with "#" are also applicable to the chemistry part of Combined Science (Combined Science is to be phased out starting from Secondary 4 in the 2021/22 school year).

2. Learning foci

Chemistry (S4 - S6)		Curriculum Framework of National Security Education in Hong Kong	
Chapter / Topic	**Learning Elements**	**Strand**	**Learning Elements**
Topic III "Metals"# • Occurrence and extraction of metals	• Understand the occurrence of metals in nature in free state and in combined forms, and how metals are extracted • Understand the limited reserve of metals and realise the importance for conserving and using metal resources wisely • Describe metal ores as a finite resource and hence the need to recycle metals • Show concerns for limited reserve of metals and develop a sense of shared responsibility for the sustainable development of our society ➢ When teaching "occurrence and extraction of metals", teachers can briefly introduce the metal reserves of our country and other regions, and then arrange learning activities, such as searching for information, group discussion and presentation, for students to acquire further understanding of the current extraction and recycling of metal resources in our country and other regions. Besides, by applying chemical knowledge, students can understand the impact of chemistry on society, economy, the	7	• Understand the impact of human activities on the ecological environment and our responsibilities, understand the needs of sustainable development, and recognise the necessity of safeguarding ecological security, resource security, nuclear security and new security domains

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Chapter / Topic	**Learning Elements**	**Strand**	**Learning Elements**
	environment and technology, through which they can recognise the necessity of safeguarding ecological and resource security.		
Topic V "Fossil Fuels and Carbon Compounds"# • 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 • Understand measures for reducing the emission of air pollutants from combustion of fossil fuels • Show concern for environmental protection and develop a sense of shared responsibility for the sustainable development of our society ➢ When teaching "major uses of distilled fractions of petroleum" and "consequences of using fossil fuels", learning activities, such as searching for information, group discussion and presentation, can be arranged for students to understand the energy structures of our country and other regions, as well as related issues of and policies on environmental pollution. By applying chemical knowledge, students should understand the impact of chemistry on society, economy, the environment and technology, through which they can recognise the necessity of safeguarding ecological and resource security at the national level.	7	• Understand the impact of human activities on the ecological environment and our responsibilities, understand the needs of sustainable development, and recognise the necessity of safeguarding ecological security, resource security, nuclear security and new security domains

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Chapter / Topic	**Learning Elements**	**Strand**	**Learning Elements**
	➢ Arrange for students to visit energy technology-related facilities and exhibitions in Hong Kong or the Mainland (such as the "CLP Power Low Carbon Energy Education Centre"), so that they can understand how different policies on energy technologies and environmental protection are related to sustainable development, through which they can recognise the necessity of safeguarding ecological and resource security at the national level.		
Topic XIII "Industrial Chemistry" • Importance of industrial processes • Green chemistry	• Discuss the advantages and disadvantages of using industrial processes for manufacturing products from the social, economic and environmental perspectives • Understand the relationship between sustainable development and green chemistry ➢ When teaching "green chemistry", teachers can use some examples of green chemical technologies in our country and other regions to explain the application of green chemistry in the chemical industry. Alternatively, students can conduct learning activities, such as searching for information, group discussion and presentation, to understand how our country and other regions address the environmental impact of the chemical industry by	7	• Understand the impact of human activities on the ecological environment and our responsibilities, understand the needs of sustainable development, and recognise the necessity of safeguarding ecological security, resource security, nuclear security and new security domains

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Chapter / Topic	**Learning Elements**	**Strand**	**Learning Elements**
	means of green chemistry, through which they can have a better understanding of our country and also recognise the necessity of safeguarding ecological security.		

3. Suggested learning and teaching activities (examples)

✧ **Project learning**

- 【Occurrence and extraction of metals】Search for information about metal reserves, extraction and recycling in our country and other regions, and conduct learning activities, such as group discussion and presentation, to facilitate students to better understand the importance of resource security to national sustainable development.
- 【Consequences of using fossil fuels】Search for information about the energy structure in our country and other regions, as well as related issues of and policies on environmental pollution, and conduct project learning for students to apply chemical knowledge to understand the impact of chemistry on society, economy, the environment and technology.
- 【Consequences of using fossil fuels】Search for information about research on and strategies for improving air quality in Hong Kong and our country in recent years and conduct project learning for students to recognise the efforts and the latest developments in environmental protection in Hong Kong and our country.
- 【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 other regions and conduct project learning for students to understand the relationship between green chemistry and sustainable development.
- Design appropriate self-learning activities in line with the curriculum aims and objectives, so that students will understand the attention and importance attached by other countries to such issues as energy security and environmental protection.

✧ **Exchange activities with the Mainland**

- 【Consequences of using fossil fuels】Arrange visits to the Guangdong-Hong Kong-Macao Greater Bay Area for students, so that they can recognise and understand the latest development of the environmental protection policies and related facilities of our country.

✧ **Cross-curricular collaboration**

- 【Consequences of using fossil fuels】 Collaborate with the panel of Design and Technology to design and make air quality monitoring devices.

✧ **Visits and tours**

- 【Consequences of using fossil fuels】 Arrange visits to the “CLP Power Low Carbon Energy Education Centre” for students, so that they can understand how low-carbon energy can be used to address the challenges posed by climate change.