

Biology (S4 - S6) Curriculum Framework of National Security Education**1. General teaching foci**

- 1.1. By studying related topics of “Organisms and Environment” and “Applied Ecology”, students should recognise how organisms interact with each other and with the environment, and understand the impact of human activities on the environment. Students should then recognise the importance of sustainable development, and recognise the necessity of safeguarding ecological security and resource security.
- 1.2. By studying related topics of “Genetics and Evolution”, “Health and Diseases”, “Microorganisms and Humans” and “Biotechnology”, students should recognise the impact of radiation on genetic materials and human health, and the potential hazards of microorganisms and their connection with infectious diseases. Besides, students should recognise the wide application of biotechnology in different areas, and its potential ethical, legal, social, economic and environmental implications, thereby recognising the necessity of safeguarding nuclear security and new security domains (e.g. biosecurity).
- 1.3. The Biology Curriculum includes many topics related to national security, such as “conservation of ecosystem”[#], “human impact on the environment”, “pollution control”, “conservation” and “global issues”, which can be aligned with the learning of ecological security and resource security. When delivering relevant topics, apart from introducing local examples, teachers can introduce our country’s examples in ecological conservation, pollution control and environmental conservation, to enhance students’ understanding of our country.
- 1.4. The Biology Curriculum also includes topics related to nuclear security and new security domains (e.g. biosecurity), such as “causes of mutation”, “prevention of diseases”, “microbiology” and “biotechnology”. When delivering related topics, teachers can introduce our country’s examples in the prevention and control of infectious diseases, management of biological resources and advancement in biotechnology, to enhance students’ understanding of our country's development in these areas.
- 1.5. By studying topics related to ecological and environmental conservation, biological resource management, and disease prevention and control in our country, students can enrich their knowledge of our country and recognise the importance attached by our country to ecological and environmental conservation and to people's health. Students will then develop a sense of belonging to our country and become positive and responsible citizens.

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

2. Learning foci

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Chapter / Topic	Learning Elements	Strand	Learning Elements
II. Genetics and Evolution		7	<ul style="list-style-type: none"> 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 (e.g. biosecurity)
b. Molecular genetics <ul style="list-style-type: none"> Causes of mutation 	<ul style="list-style-type: none"> Recognise the causes of mutation (e.g. radiation and chemical), and understand the effects of radiation on genetic materials and human health <ul style="list-style-type: none"> When teaching “causes of mutation”, teachers can ask students to search for information about the impact of radiation on genetic materials and human health, so as to let them recognise the necessity of safeguarding nuclear security. 		
III. Organisms and Environment		7	<ul style="list-style-type: none"> 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
f. Ecosystems <ul style="list-style-type: none"> Conservation of ecosystem[#] 	<ul style="list-style-type: none"> Recognise the impact of human activities on the ecosystems and the need for conservation <ul style="list-style-type: none"> When teaching “conservation of ecosystem”, teachers can ask students to discuss the impact of human activities on the ecological environment, and how to balance the needs of social development 		

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	and ecological conservation. Students can then understand the responsibility of human kind towards the ecological environment, understand the importance attached by our country to the ecological environment and recognise the necessity of safeguarding ecological security.		security and new security domains (e.g. biosecurity)
IV. Health and Diseases		7	<ul style="list-style-type: none"> 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 (e.g. biosecurity)
b. Diseases <ul style="list-style-type: none"> Infectious diseases[#] — Causes, ways of transmission, treatment Prevention of diseases 	<ul style="list-style-type: none"> Understand the causes of infectious diseases and their ways of transmission Recognise how to reduce the spread of some common infectious diseases <ul style="list-style-type: none"> ➤ When teaching “infectious diseases” and “prevention of diseases”, teachers can ask students to search for information from reliable online sources (e.g. websites of the Centre for Health Protection of the Department of Health, the Chinese Center for Disease Control and Prevention, and the World Health Organisation) about the prevention of infectious diseases. Students can learn about ways of transmission of infectious diseases, ways of infection prevention (such as maintaining personal hygiene and 		

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	vaccination), and recognise the policies and measures for prevention and control of infectious disease adopted by the local and the Mainland governments. Besides, students should recognise the individual's responsibility in maintaining community health, and the importance attached by our country to people's health, thereby recognising the necessity of safeguarding biosecurity.		
VI. Applied Ecology		7	<ul style="list-style-type: none"> 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 (e.g. biosecurity)
a. Human impact on the environment <ul style="list-style-type: none"> Human population growth Use of resources Effects of urbanisation and industrialisation 	<ul style="list-style-type: none"> Understand the impact and control of rapid human population growth Recognise the impacts of malpractices in using resources Recognise the effects of urbanisation and industrialisation on humans and the environment ➤ When teaching “human impact on the environment”, teachers can ask students to conduct project learning to explore the impact of human population growth, use of resources, urbanisation and industrialisation on the ecological environment and the quality of life. Students can then understand the human responsibility 		

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	towards the ecological environment, recognise the need for sustainable development, and recognise the necessity of safeguarding ecological security and resource security.		
b. Pollution control • Reduce, reuse, recycle and replace • Sewage treatment	<ul style="list-style-type: none"> • Recognise the strategies for pollution control in Hong Kong and the Mainland • Recognise the biological principles of sewage treatment <ul style="list-style-type: none"> ➤ When teaching “pollution control”, teachers can arrange for students to visit a sewage treatment plant, and ask students to analyse the situation of air pollution in Hong Kong with the information provided by the Environmental Protection Department. Students can then recognise the methods and measures of pollution control and they should hence recognise the necessity of safeguarding ecological security and resource security. 		

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c. Conservation <ul style="list-style-type: none"> • Importance of biodiversity • Conservation of species • Conservation of habitats 	<ul style="list-style-type: none"> • Understand the need for conservation • Recognise the importance of preserving biodiversity • Recognise the conservation measures in Hong Kong and the Mainland • Recognise the relationship between economic development and environmental conservation • Recognise individual's responsibility in conservation <ul style="list-style-type: none"> ➤ When teaching “conservation”, teachers can ask students to conduct project learning to compare the policies of environmental conservation between the local and the Mainland governments, so that they will understand the efforts of our country in protecting 		

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	<p>ecological environment and recognise the necessity of safeguarding ecological security.</p> <p>➤ When teaching “conservation of habitats”, teachers can arrange for students to visit an ecological reserve in Hong Kong or the Mainland, so that they can recognise the efforts of Hong Kong / our country in ecological conservation and recognise the importance of safeguarding ecological security.</p>		
<p>d. Global issues</p> <ul style="list-style-type: none"> • Sustainable development • Management of resources: fisheries and agriculture • Global warming • Acid rain 	<ul style="list-style-type: none"> • Recognise the causes and problems of global issues, and recognise the related solutions and measures • Recognise the importance of sustainable development and resource management <p>➤ When teaching “management of resources”, teachers can ask students to search for information about the “South China Sea fishing moratorium”, so that they can recognise the importance of sustainable development and resource management. Besides, students are expected to recognise the efforts of our country in protecting the ecological environment and resources and recognise</p>		

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<ul style="list-style-type: none"> Eutrophication and algal bloom 	<p>the necessity of safeguarding ecological security and resource security.</p> <p>➤ When teaching “global warming”, “acid rain” and “eutrophication and algal bloom”, teachers can ask students to conduct project learning to understand the impact of global warming, acid rain, eutrophication and algal bloom on the ecological environment. Students should also recognise the policies formulated by our country on related issues and recognise the necessity of safeguarding ecological security.</p>		
VII. Microorganisms and Humans		7	<ul style="list-style-type: none"> 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 (e.g. biosecurity)
a. Microbiology <ul style="list-style-type: none"> Viruses 	<ul style="list-style-type: none"> Learn about different viruses Recognise how viruses reproduce by infecting living cells <p>➤ When teaching “viruses”, teachers can ask students to conduct project learning on a viral disease (e.g. COVID-19), so that they can recognise the ways of viral transmission, the impact on our health and the ways of prevention. Students can then understand the necessity of safeguarding biosecurity.</p>		

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c. Microbial genetics • Genetically modified microorganisms	<ul style="list-style-type: none"> • Be aware of the significance and potential hazards of the application of genetically modified microorganisms <ul style="list-style-type: none"> ➤ When teaching “genetically modified microorganisms”, teachers can discuss with students on the use of such microorganisms and the potential risks of related technologies, so that students can recognise the necessity of safeguarding biosecurity. 		
d. Harmful effects of microorganisms • Diseases caused by microorganisms	<ul style="list-style-type: none"> • Understand how viruses and microorganisms cause diseases in humans <ul style="list-style-type: none"> ➤ When teaching “diseases caused by microorganisms”, teachers can ask students to collect information from reliable online sources (e.g. websites of the Centre for Health Protection of the Department of Health, the Chinese Center for Disease Control and Prevention, and the World Health Organisation) about the prevention of infectious diseases. Students can learn about ways of transmission of infectious diseases, understand the ways of infection prevention (such as maintaining personal hygiene and vaccination), and recognise the policies and measures adopted by the local and the Mainland governments in infectious disease 		

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	prevention and control. Besides, students can recognise the individual's responsibility in maintaining community health, and the importance attached by our country to people's health, thereby recognising the necessity of safeguarding biosecurity.		
VIII. Biotechnology		7	<ul style="list-style-type: none"> 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 (e.g. biosecurity)
b. Applications in biotechnology <ul style="list-style-type: none"> Production of pharmaceutical products (e.g. Insulin, human growth hormone, vaccines and monoclonal antibodies) Gene therapy Stem cell therapy 	<ul style="list-style-type: none"> Understand the role of bacteria in the production of pharmaceutical products Recognise the possible benefits and hazards of gene therapy Recognise the potential application of stem cells in medicine Recognise the use of transgenic animals and plants in scientific research, food industry and agriculture <p>➤ When teaching “applications in biotechnology”, teachers can ask students to search for information about the development of related areas (e.g. the production of pharmaceutical products, transgenic animals and plants) and hence let the students recognise the development of these areas and the relevant regulations in our country. Students can then recognise the necessity of safeguarding</p>		

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<ul style="list-style-type: none"> Transgenic animals and plants 	<p>new security domains (e.g. biosecurity) and develop a sense of belonging to the country.</p>		
<p>c. Bioethics</p> <p>Ethical, legal, social, economic and environmental issues</p>	<ul style="list-style-type: none"> Be aware of the potential impact of biotechnology on society and the environment <ul style="list-style-type: none"> ➤ When teaching “bioethics”, teachers can ask students to discuss the benefits, potential risks as well as moral and ethical issues arising from the use of biotechnology. Students can then recognise the necessity of safeguarding biosecurity. 		

3. Suggested learning and teaching activities (examples)

✧ Project learning

- ◆ **【Human impacts on the environment】** Study the impacts of human population growth on the environment and quality of life.
- ◆ **【Conservation】** Study the current policies of the local and the Mainland governments on environmental conservation.
- ◆ **【Conservation】** Study the approaches of conservation of endangered species in Hong Kong and the mainland of China.
- ◆ **【Pollution control】** Study the approaches of pollution control in Hong Kong and the mainland of China.
- ◆ **【Global issues】** Study related issues such as global warming and acid rain, and understand that other countries also pay much attention to these issues.
- ◆ **【Applications in biotechnology】** Study the application of biotechnology in different areas.
- ◆ **【Bioethics】** Study the benefits, potential risks as well as the moral and ethical issues arising from biotechnology.

✧ Exchange activities with the Mainland

- ◆ **【Conservation】** Visit ecological reserves in the Mainland (e.g. nature reserves in Guangdong Province) to recognise the efforts of our country in ecological conservation.

✧ Cross-curricular collaboration

- ◆ **【Human impact on the environment, pollution control, conservation】** Collaborate with the panel of Geography to arrange a field study to the Guangdong-Hong Kong-Macao Greater Bay Area, so that students can learn about the impact of population growth and economic development on the environment, as well as the efforts of our country in ecological conservation, pollution control and sustainable development.

✧ Visits

- ◆ **【Pollution control】** Visit a sewage treatment plant.
- ◆ **【Conservation】** Visit ecological reserves in Hong Kong (e.g. Sites of Special Scientific Interest, country parks, marine parks and the Ramsar site).

✧ Online and self-directed learning activities

- ◆ **【Pollution control】** With reference to information provided by the Environmental Protection Department, find out areas with more serious air pollution in Hong Kong and discuss the possible causes.
- ◆ Design appropriate self-learning activities in line with the curriculum aims and objectives, so that students will learn about the attention and importance attached by other countries to biological issues and ecological protection.