MINISTRY OF EDUCATION MALAYSIA

Integrated Curriculum for Secondary School

PHYSICS

SYLLABUS

Curriculum Development Centre
Ministry of Education

THE NATIONAL PHILOSOPHY

Our nation, Malaysia, being dedicated to achieving a greater unity of all her peoples; to maintaining a democratic way of life; to creating a just society in which the wealth of the nation shall be equitably shared; to ensuring a liberal approach to her rich and diverse cultural traditions; to building a progressive society which shall be oriented toward modern science and technology;

We, her peoples, pledge our united efforts to attain these ends guided by these principles:

BELIEF IN GOD
LOYALTY TO KING AND COUNTRY
UPHOLDING THE CONSTITUTION
RULE OF LAW
GOOD BEHAVIOUR AND MORALITY

NATIONAL PHILOSOPHY OF EDUCATION

Education in Malaysia is an on-going effort towards further developing the potential of individuals in a holistic and integrated manner, so as to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who possess high moral standards and who are responsible and capable of achieving a high level of personal well-being as well as being able to contribute to the betterment of the family, society and the nation at large.

NATIONAL SCIENCE EDUCATION PHILOSOPHY

In consonance with the National Education Philosophy, science education in Malaysia nurtures a Science and Technology Culture by focusing on the development of individuals who are competitive, dynamic, robust and resilient and able to master scientific knowledge and technological competency

INTRODUCTION

As articulated in the National Education Policy, education in Malaysia is an on-going effort towards further developing the potential of individuals in a holistic and integrated manner to produce individuals who are intellectually, spiritually, emotionally, and physically balanced and harmonious. The primary and secondary school science curriculum is developed with the aim of producing such individuals.

As a nation that is progressing towards a developed nation status, Malaysia needs to create a society that is scientifically oriented, progressive, knowledgeable, having a high capacity for change, forward looking, innovative and a contributor to scientific and technological developments in the future. This society should also have the capability to manage the environment and its resources in a responsible manner. In line with this, there is a need to produce citizens who are creative, critical, inquisitive, open-minded and competent in science and technology.

Science is a discipline comprising knowledge, skills and scientific attitudes and noble values. The integration of these three elements is very important in ensuring a quality science education. As a discipline of knowledge, science provides a conceptual framework that enables students to understand the world around them.

Science is also a process that emphasises inquiry and problem solving. Thus, science develops skills in investigating the environment, which involves thinking skills, thinking strategies and scientific skills. Knowledge is therefore acquired as the product of an investigation. Scientific inquiry also requires and enables students to develop scientific attitudes and noble values.

The science curriculum for the Integrated Curriculum for Primary School and the Integrated Curriculum for Secondary School are designed for students from primary to secondary schools. The curriculum is formulated based on the needs of the nation as well as global scientific requirements. The focus is directed towards thoughtful learning and optimizing learning.

The science curriculum comprises three core science subjects and four elective science subjects. The core subjects are Science at primary school level, Science at lower secondary level and Science at upper secondary level. Elective science subjects are offered at the upper secondary level and consist of Biology, Chemistry, Physics, and Additional Science.

The core science subjects for the primary and lower secondary levels are designed to provide students with basic science knowledge, prepare students to be literate in science, and enable students to continue their science education at the upper secondary level. Core Science at the upper secondary level is designed to produce students who are literate in science, innovative, and able to apply scientific knowledge in decision-making and problem solving

in everyday life. The elective science subjects prepare students who are more scientifically inclined to pursue the study of science at post-secondary level. This group of students would take up careers in the field of science and technology and play a leading role in the field for national development.

For every science subject, the curriculum for the year is articulated in two documents: the syllabus and the curriculum specifications. The syllabus presents the aims, objectives and the outline of the curriculum content for a period of two years for elective science subjects and five years for core science subjects. The curriculum specifications provide the details of the curriculum, which includes the learning objectives, suggested learning activities, the intended learning outcomes, and vocabulary.

AIMS

The aims of the physics curriculum for secondary school are to provide students with the knowledge and skills in physics and technology and enable them to solve problems and make decisions in everyday life based on scientific attitudes and noble values.

Students who have followed the physics curriculum will have a basic foundation in physics to enable them to pursue formal and informal further education in science and technology.

The curriculum also aims to develop a dynamic and progressive society with a science and technology culture that values nature and works towards the preservation and conservation of the environment.

OBJECTIVES

The physics curriculum for secondary school enables students to:

1. Acquire knowledge in physics and technology in the context of natural phenomena and everyday life experiences.

2. Understand developments in the field of physics and technology.

3. Acquire scientific and thinking skills.

4. Apply knowledge and skills in a creative and critical manner to solve problems and make decisions.

5. Face challenges in the scientific and technological world and be willing to contribute towards the development of science and technology.

6. Evaluate science and technology related information wisely and effectively.

7. Practise and internalise scientific attitudes and good moral values.

8. Appreciate the contributions of science and technology towards national development and the well-being of mankind.

9. Realise that scientific discoveries are the result of human endeavour to the best of his or her intellectual and mental capabilities to understand natural phenomena for the betterment of mankind.

10. Be aware of the need to love and care for the environment and play an active role in its preservation and conservation.

CONTENTS ORGANISATION

The Physics curriculum is organised by topics. Each topic consists of various learning areas, each of which consists of a number of learning objectives. A learning objective has one or more learning outcomes. Learning outcomes are written based on the hierarchy of the cognitive and affective domains. Levels in the cognitive domain are: knowledge, understanding, application, analysis, synthesis and evaluation. Levels in the affective domain are: to be aware of, to be in awe, to be appreciative, to be thankful, to love, to practise, and to internalise. Where possible, learning outcomes relating to the affective domain are explicitly stated. The inculcation of scientific attitudes and noble values should be integrated into every learning activity. This ensures a more spontaneous and natural inculcation of attitudes and values. Learning outcomes in the psychomotor domain are achieved implicitly through the learning activities.

The Suggested Learning Activities in the supporting document entitled 'Curriculum Specifications' provides information on the scope and dimension of learning outcomes. The suggested learning activities aim at providing some guidance as to how learning outcomes can be achieved. A suggested activity may cover one or more learning outcomes. At the same time, more than one activity may be suggested for a particular learning outcome. Teachers may modify the suggested activities to suit the ability and style of learning of their students. At the same time, teachers are encouraged to design other innovative and effective learning activities to enhance the learning of science.

Teaching and learning strategies in the science curriculum emphasise thoughtful learning. Thoughtful learning is a process that helps students acquire knowledge and master skills that will help them develop their mind to an optimum level. Thoughtful learning can occur through various learning approaches such as inquiry, constructivism, contextual learning, and mastery learning. These learning approaches encompass learning methods such as experiments, discussions, simulations, projects, visits and future studies. Learning activities should therefore be geared towards activating students'

critical and creative thinking skills and not be confined to routine or rote learning.

Students should be made aware of the thinking skills and thinking strategies that they use in their learning. They should be challenged with higher order questions and problems and be required to solve problems utilising their creativity and critical thinking. The teaching and learning process should enable students to acquire knowledge, master skills and develop scientific attitudes and noble values in an integrated manner.

The learning of science is not limited to activities carried out in the school compound. The latest trend in science education is to encourage smart partnership between the Ministry of Education and various organisations such as institutions of higher learning, other governmental agencies, non-governmental agencies and private corporations to provide new ideas, opportunities, strategies and skills. Learning of science can also be enhanced through the use of external resources such as zoos, animal sanctuaries, museums, science centres, research institutes, mangrove swamps, and factories. Visits to these places make the learning of science more interesting, meaningful and effective. To optimise learning opportunities, visits need to be carefully planned. Students may be involved in the planning process and specific educational tasks should be assigned during the visit. No educational visit is complete without a post-visit discussion.

The skills to select, analyse and evaluate information from various sources are also developed. Through the use of technology such as television, radio, video, computer, and Internet, the teaching and learning of science can be made more interesting and effective. Computer simulation and animation are effective tools for the teaching and learning of abstract or difficult science concepts. Computer simulation and animation can be presented through courseware or Web page. The use of technology will enhance the effectiveness of teaching and learning of science besides optimising the intended learning outcomes.

SCIENTIFIC SKILLS

Scientific skills encompass science process skills and manipulative skills. Science process skills promote thinking in a critical, creative, analytical and systematic manner. The mastering of science process skills together with scientific attitudes and knowledge will enable the students to think, formulate questions and find out answers systematically.

Science Process Skills

Science process skills that need to be developed in the science curriculum are as follows:

- Observing
- Classifying
- Measuring and Using Numbers
- Inferring
- Predicting
- Communicating
- Using Space-Time Relationship
- Interpreting Data
- Defining Operationally
- Controlling Variables
- Hypothesising
- Experimenting.

Manipulative Skills

Manipulative skills are psychomotor skills in scientific investigation which enable students to:

- Use and handle science apparatus and laboratory substances correctly,
- Store science apparatus correctly and safely,
- Clean science apparatus correctly,
- Handle specimens correctly and carefully,
- Observe, record and measure accurately.

Thinking Skills

Teaching and learning of science provides a good opportunity to develop students' thinking skills. Strategies in teaching and learning science require the mastering of thinking skills and thinking strategies which will be the foundation for thoughtful learning. Thinking strategies can be categorised into critical thinking skills and creative thinking skills.

Scientific Attitudes and Noble Values

Science learning experiences can be used as a means to inculcate positive scientific attitudes and noble values in students. The inculcation of scientific attitudes and noble values can be done through proper planning or spontaneously. In this curriculum, the learning objectives for the affective domain are articulated as specific learning outcomes. The specific activities to achieve the learning objectives have also been suggested.

Knowledge Contents

The curriculum content is organised based on the following topics:

1. Introduction to Physics
2. Forces and Motion
3. Forces and Pressure
4. Heat
5. Light
6. Waves
7. Electricity
8. Electronics
9. Radioactivity

The following are the learning areas and content of each topic:

1. Introduction to Physics

This topic aims to provide an understanding of Physics as a field of study. Students are also introduced to the method of acquiring science knowledge in a scientific manner using scientific investigation. The topic also discusses physical quantities and measurements.

The content of this topic are as follows:

- Understanding Physics
- Base Quantities and Derived Quantities
- Scalar Quantities and Vector Quantities
- Measurements
- Scientific Investigation

2. Forces and Motion

This theme aims to provide an understanding of forces, movement, momentum, and energy as well as the laws of conservation. Students also learn about its applications.

The content of this topic is as follows:
? Linear Motion
? Motion Graphs
? Inertia
? Momentum
? Effects of a Force
? Impulse and Impulsive Force
? Gravity
? Forces in Equilibrium
? Work, Energy, Power and Efficiency
? Elasticity

3. Forces and Pressure

This topic aims to provide understanding of the concepts and principles of pressure and its applications.

The content of this topic is as follows:
? Pressure
? Pressure in Liquids
? Gas Pressure and Atmospheric Pressure
? Pascal's principle
? Archimedes principle
? Bernoulli's principle

4. Heat

This topic aims to provide understanding of the concepts and principles of heat and its applications.

The content of this topic is as follows:
? Thermal Equilibrium
? Specific Heat Capacity
? Specific Latent Heat
? Gas laws

5. Light

This topic aims to provide understanding of concepts and principle of optics and its applications.

The content of this topic is as follows:
? Reflection of Light
? Refraction of Light
? Total Internal Reflection of Light
? Lenses

6. Waves

This topic aims to provide understanding of the characteristics and properties of waves and its applications.

The content of this topic is as follows:

- Waves
- Reflection of Waves
- Refraction of Waves
- Diffraction of Waves
- Interference of Waves
- Light Waves
- Electromagnetic Waves
- Waves in Telecommunications

7. Electricity and Electromagnetism

This topic aims to provide understanding of electromagnetism and its applications.

The content of this topic is as follows:

a. Electricity

- Charge and Current
- Electric Field
- Potential Difference
- Series and Parallel Circuits
- Electromotive Force and Internal Resistance
- Electrical Energy, Power and Efficiency

b. Electromagnetism

- Magnetic Effect of a Current-Carrying Conductor
- Electromagnetic Induction
- Direct Current and Alternating Current
- Transformers
- Generation and Transmission of Electricity

8. Electronics

This topic aims to provide a basic understanding of the principles of electronics and their applications.

The content of this topic is as follows:
? Cathode Rays
? Semiconductor Diodes
? Transistors
? Logic Gates

9. Radioactivity

This topic aims to provide an understanding of radioactivity and its applications.

The content of this topic is as follows:
? Radioactive Decay
? Half-life
? Uses of Radioactivity