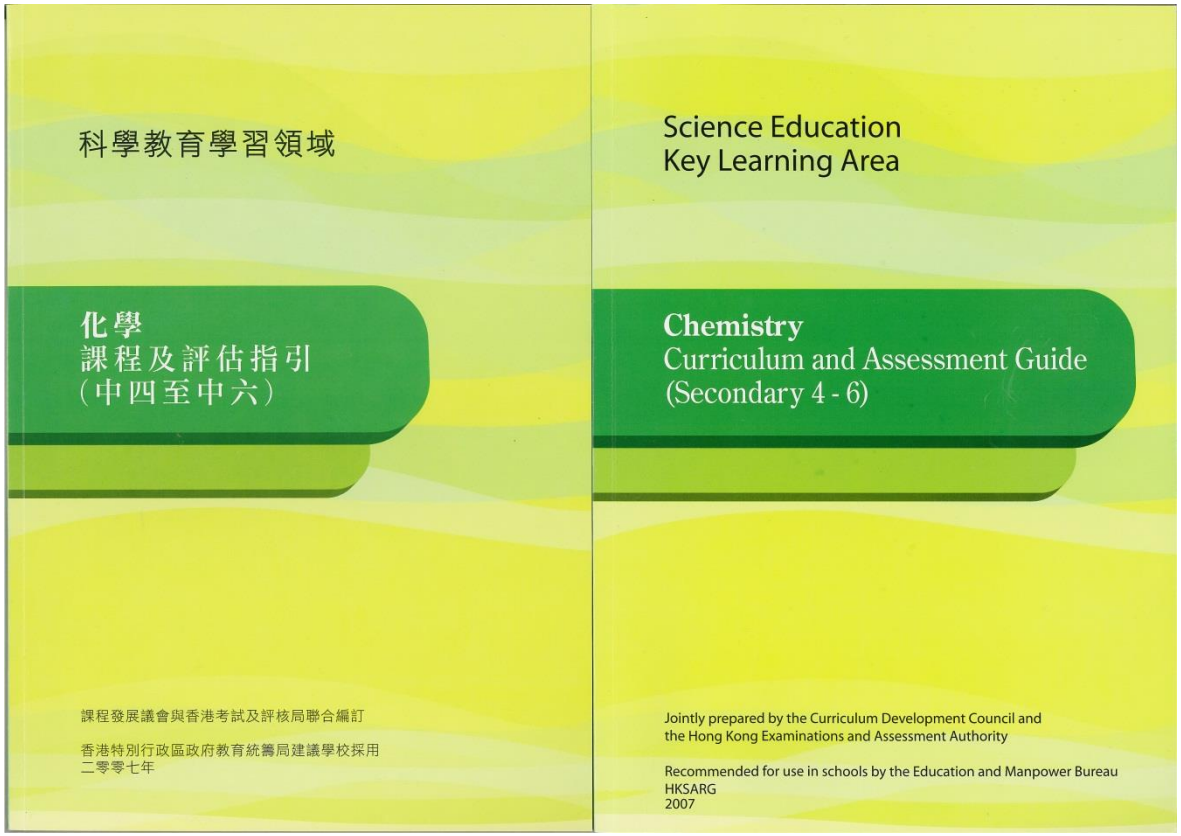
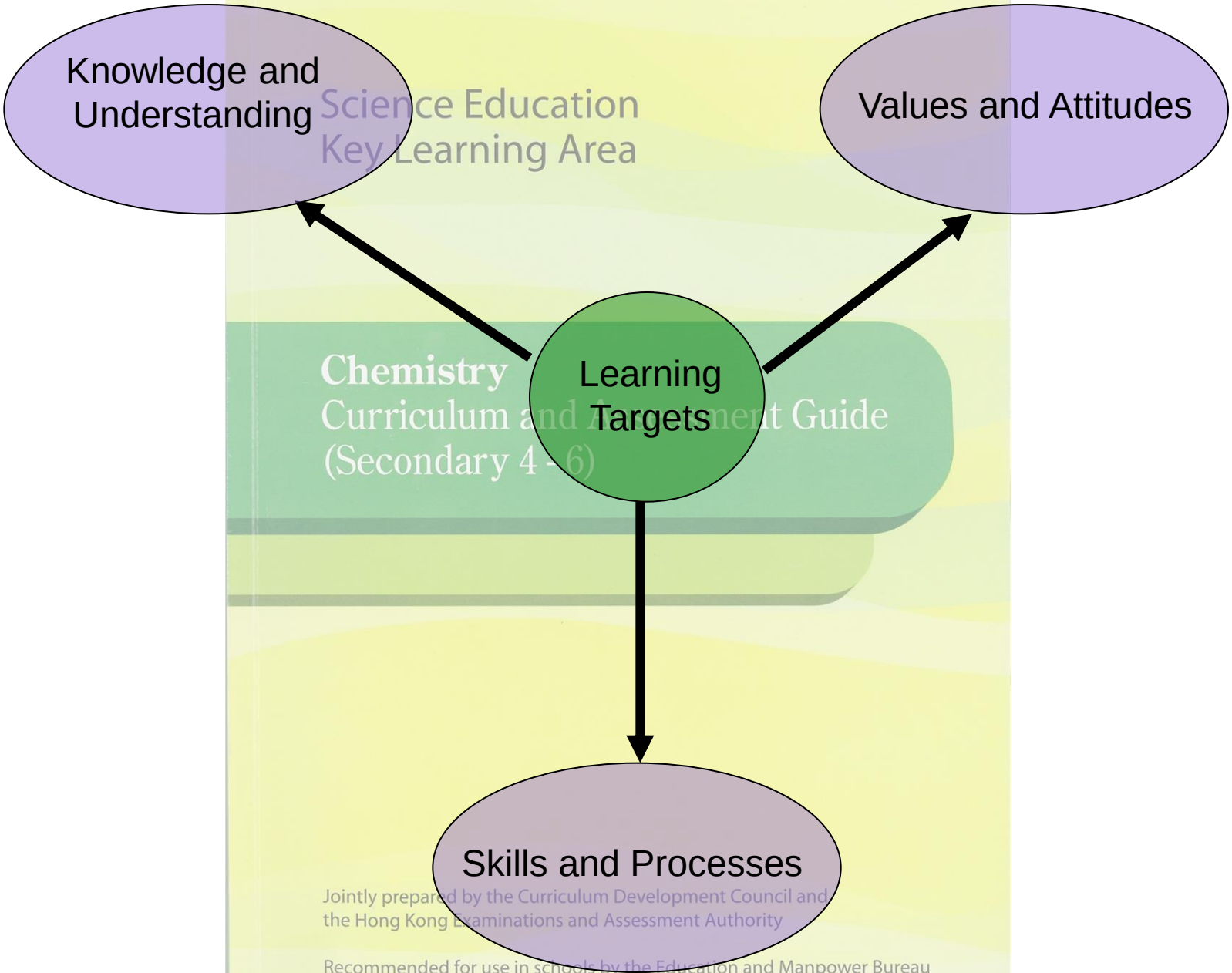
Review of Chemistry and Combined Science (Chemistry Part) Curricula



- Short-term recommendations:
  - Applicable to the 2016 HKDSE examination and thereafter
- Medium-term review: 2013/14 to 2014/15

http://334.edb.hkedcity.net/334_review.php


Knowledge and Understanding
Values and Attitudes
Learning Targets
Skills and Processes
Science Education Key Learning Area
Chemistry Curriculum and Assessment Guide (Secondary 4 - 6)
Jointly prepared by the Curriculum Development Council and the Hong Kong Examinations and Assessment Authority
Recommended for use in schools by the Education and Manpower Bureau
HKSARG
2007

Learning targets

- Knowledge and understanding
  - Phenomena, facts, principles, concepts, laws and theories
  - Vocabulary, terminology and conventions
  - Applications of chemistry
  - Scientific investigations

Learning targets

- Skills and processes
  - Scientific thinking, scientific method and problem solving
  - Scientific investigation, practical
  - Decision making, information handling
  - Communication, collaboration
  - Learning and self-learning

Learning targets

- Values and attitudes
  - Curiosity and interest in science
  - Awareness of limitations of science
  - Awareness of the impact of chemistry
  - Commitment to safe practices
  - Appreciation of interrelationship of science and other disciplines
  - Appreciation of importance of life-long learning

Curriculum framework of Chemistry

- Compulsory part
  - 12 topics, compiled with fundamental chemistry knowledge, principles, concepts and scientific process skills

I. Planet earth
II. Microscopic world I
III. Metals
IV. Acids and bases
V. Fossil fuels and carbon compounds
VI. Microscopic world II
VII. Redox reactions, chemical cells and electrolysis
VIII. Chemical reactions and energy
IX. Rate of reaction
X. Chemical equilibrium
XI. Chemistry of carbon compounds
XII. Patterns in the chemical world

- Elective part
  - Select any 2 out of 3 topics
  - In-depth treatment or extension of certain areas of the compulsory part

    XIII. Industrial chemistry

    XIV. Materials chemistry

    XV. Analytical chemistry

- Investigative study
  - Design and conduct a first-hand investigation

Curriculum framework of Combined Science (Chemistry Part)

I. Planet earth
II. Microscopic world
III. Metals
IV. Acids and bases
V. Fossil fuels and carbon compounds
VI. Redox reactions, chemical cells and electrolysis
VII. Chemical reactions and energy

Simple investigations are subsumed in the lesson time suggested for each topic.

In each topic:

Overview	- Main theme and major concepts of the topic
Learning Objectives and Outcomes	- “Students should learn…” & “Students should be able to…”
Suggested Learning and Teaching Activities	- Activities for developing some of the skills to be acquired in the topic
Values and Attitudes	- Intrinsically worthwhile values and positive attitudes related to the topic
STSE (Science-Technology-Society-Environment) connections	- Some issue-based learning activities or subjects related to the topic

Experimental techniques for the Chemistry curriculum (Appendix 2, C&A Guide)

Examples

- Preparing and isolating soluble salt (Topic IV)
  - Filtration; crystallisation; use of volumetric apparatus

- Investigating factors affecting preferential discharge of ions in electrolysis (Topic VII)
  - Handling of simple electrical devices; collection of gases

Topic XI Chemistry of Carbon Compounds

Overview

Organic chemistry is a very important branch of chemistry as judged by the uniqueness of carbon and ubiquitousness of carbon compounds. Together with the basic concepts and knowledge acquired in junior secondary course, Topic V and Topic VI in this curriculum, students build up concepts related to the structural characteristics of some common carbon compounds. Students are also expected to be able to use the systematic and non-systematic names of carbon compounds to communicate knowledge and understandings in study and in daily life.

In this topic, basic concepts of isomerism including structural isomerism, ***Cis-trans*** isomerism and enantiomerism are introduced. Students will also learn about the chemistry of a number of functional groups. They should be able to give systematic names of alkanes, alkenes, haloalkanes, alcohols, aldehydes and ketones, carboxylic acids, esters, unsubstituted amides and primary amines, with not more than eight carbon atoms in their carbon chains. Through studying the reactions of the functional groups (including the reagents, reaction conditions, products and observations), students will be able to make use of some chemical methods to distinguish different functional groups and to identify unknown carbon compounds. They should also be able to predict major product(s) of reactions between alkenes and hydrogen halides using Markovnikov's rule. However, the use of reaction mechanisms to explain how carbon compounds react is not expected at this level of study.

Students should learn

c. Activation energy

- energy profile
- explanation of the effect of temperature change on reaction rate in terms of activation energy
- Arrhenius equation:

$$\log k = \text{constant} - \frac{E_a}{2.3RT}$$

Students should be able to

- draw an energy profile of a reaction
- explain the relationship between temperature and reaction rate using Maxwell-Boltzmann distribution curve
- determine the activation energy of a chemical reaction
  i. by gathering first-hand experimental data
  ii. with a given set of data

Topic VII Redox Reactions, Chemical Cells and Electrolysis

Students are expected to develop the learning outcomes using a variety of learning experiences. Some related examples are:

- making decisions on the choice of chemical cells in daily life based on available information.
- making simple chemical cells and measuring their voltages.
- writing ionic half equations.
- performing experiments to investigate redox reactions with common oxidising and reducing agents.
- determining oxidation numbers of atoms in elements and compounds.
- balancing redox equations by using ionic half equations or by using oxidation numbers.
- investigating redox reactions of concentrated sulphuric acid with metals.
- investigating redox reactions of nitric acid of different concentrations with metals.
- searching for and presenting information about the applications of fuel cells.
- investigating the working principles of a fuel cell car.
- performing experiments to investigate the working principles of a lead-acid accumulator.
- predicting changes in chemical cells based on given information.
- viewing or constructing computer simulations illustrating the reactions in chemical cells.
- performing experiments to investigate changes in electrolysis.
- performing experiments to investigate factors affecting preferential discharge of ions during electrolysis.
- searching for and presenting information about the possible adverse impact of the electroplating industry on the environment.
- designing and performing electroplating experiments.
- reading articles about the industrial processes involved in the extraction of aluminium