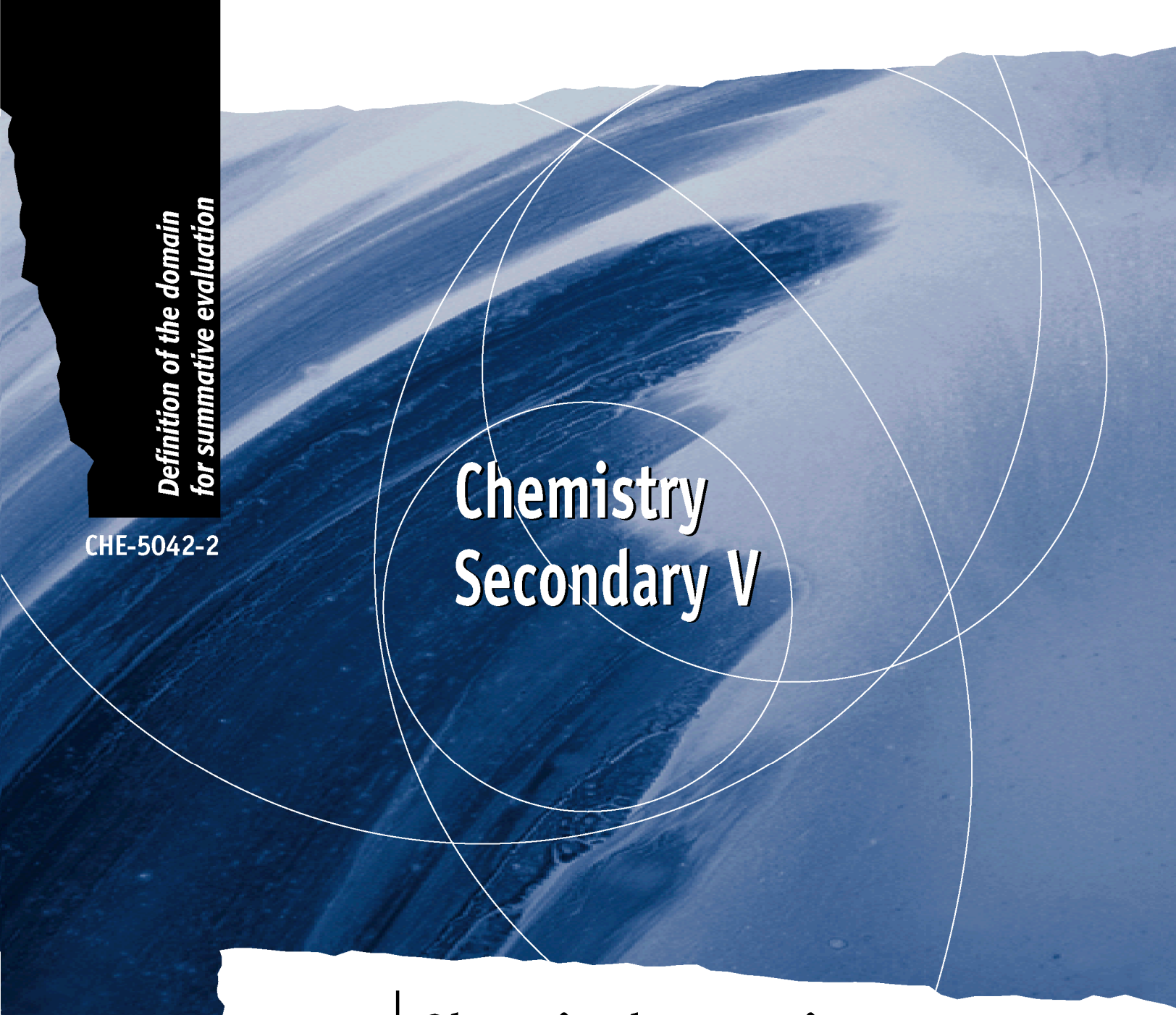


Definition of the domain for summative evaluation

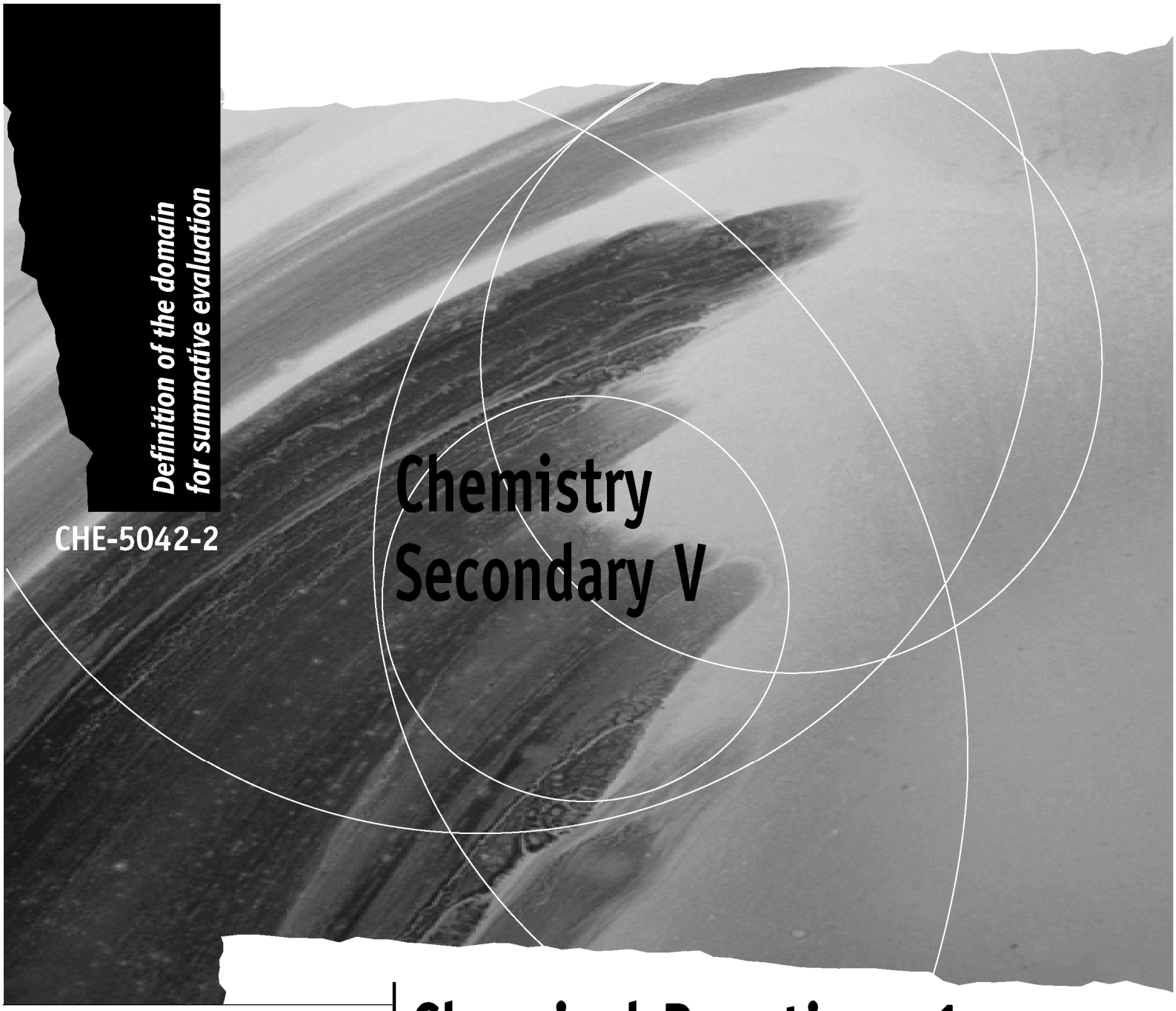
CHE-5042-2

Chemistry Secondary V

Chemical Reactions 1 : Energy and Chemical Dynamics

Reach for your Dreams

Québec



Definition of the domain for summative evaluation

CHE-5042-2

Chemistry Secondary V

Chemical Reactions 1 : Energy and Chemical Dynamics

Formation professionnelle et technique
et formation continue

Direction de la formation générale
des adultes

ISBN 2-550-41887-5

Legal deposit — Bibliothèque nationale du Québec, 2004
CE DOCUMENT REMPLACE LE DOCUMENT 38-8792A PUBLIÉ EN NOVEMBRE 1999.

1. Introduction

This definition of the domain for summative evaluation describes and classifies the essential and representative elements of the *Chemistry* program – specifically, for the course entitled *Chemical Reactions 1: Energy and Chemical Dynamics*. It presents an overview of the program, but should by no means replace the program itself. The purpose of defining the domain is to ensure that all summative evaluation instruments are consistent with the overall program.

The organization of this definition of the domain is the same as that of those of other courses. The content of each section is, however, specific to this course.

The definition of the domain for summative evaluation is used to prepare examinations that are valid from one version to another, from year to year and from one school board to another, taking into account the responsibilities shared by the Ministère de l'Éducation and the school boards.

2. Program Orientations and Consequences for Summative Evaluation

Orientations	Consequences
The purpose of this program is to provide students with rigorous training in the use of the scientific method. Students become familiar with the basic concepts of chemistry and either acquire or improve the skills related to the experimental method.	Evaluation items should test the students' knowledge and understanding of the basic concepts of chemistry and of the experimental method.
Students acquire an understanding of various phenomena that goes beyond the mere ability to apply formulas in solving mathematical problems.	Evaluation should involve problem situations that test the students'understanding of various phenomena. Evaluation should not focus solely on calculations and their results.
The program presents scientific knowledge from a historical, technological and social perspective.	Evaluation should also reflect the relationship between the related content and the history-technology-society perspective (HTS).
In this program, considerable time is devoted to the experimental approach and students are required to perform experiments.	A major part of the evaluation process should focus on the experimental method. In addition to items pertaining to objectives that relate to the experimental method, items that test the students' understanding of the related content may refer to laboratory work.
To help students acquire or improve the skills related to the experimental method, the course entitled *Chemical Reactions 1: Energy and Chemical Dynamics* focuses on having students apply the different aspects of the experimental method.	In the course entitled *Chemical Reactions 1: Energy and Chemical Dynamics*, evaluation relating to the experimental method should involve having the students show their understanding of the instructions in an experimental procedure and their ability to handle experimental equipment, while taking into account safety rules and the possible sources of experimental error.

3. Course Content for Purposes of Summative Evaluation

Themes

- **Related Content**

  – Phase changes and mixture of substances at different temperatures:
    - molecular representation of energy transfers
    - interpretation in terms of kinetic energy and temperature change

  – Dissolution:
    - interpretation
    - energy involved

  – Definition of specific heat capacity and molar heat of solution

  – Energy balance of chemical reactions:
    - equations for heat transferts

  – Enthalpy diagrams for endothermic and exothermic chemical reactions:
    - classification of phenomena as endothermic and exothermic
    - interpretation
    - comparison

  – Hess's law

  – Reaction rate:
    - definition
    - determining factors

  – Collision theory:
    - rate of a reaction
    - energy diagram for a reaction
    - factors affecting the rate of a reaction

  – Problem solving:
    - phase changes: energy transfers
    - specific heat capacity
    - final temperature of a mixture
    - molar heat of solution
    - Hess's law
    - reaction rate and factors affecting it

- **History-Technology-Society perspective (HTS)**

  – Relationships between the study of energy transfers and chemical dynamics, and the evolution of chemistry:
    - Joule's work on the relationship between heat and mechanical energy
    - discoveries resulting from the study of energy transfers and chemical dynamics

  – Technical applications involving energy transfers and chemical dynamics:
    - energy conversions involving heat
    - use of fossil fuels to produce heat
    - use of catalysts and their advantages
    - technical applications of chemical dynamics

  – Environmental consequences and social changes related to the energy produced by chemical reactions:
    - use of fossil fuels and their effects on the environment and our quality of life
    - incomplete combustion of hydrocarbons
    - introduction of chemicals into the environment

- **Experimental method**

  – Appreciation of experimental procedures

  – Handling experimental equipment:
    - instructions
    - safety rules in the laboratory
    - uncertainty and experimental error

Skills

- **Understanding:** Applying acquired knowledge to deduce information.

- **Analyzing:** Examining the components of a phenomenon in order to determine relationships.

4. Table of Dimensions

Themes / Skills	Related Content 60%	HTS Perspective 15%	Experimental Method 25%
Understanding 39%	Phase changes and mixture of substances at different temperatures (4%) Dissolution (4%) Definitions of specific heat capacity and molar heat of solution (4%) Hess's law (4%) Reaction rate (4%) Collision theory (4%) **(1) 24%**	Relationships between the study of energy transfer and chemical dynamics, and the evolution of chemistry (5%) - Joule's work - discoveries resulting from the study of energy transfers and chemical dynamics Technical applications involving energy transfers and chemical dynamics (5%) - energy conversions - use of fossil fuels - catalysts - technical applications of chemical dynamics Environmental consequences and social changes related to the energy produced by chemical reactions (5%) - fossil fuels - incomplete combustion of hydrocarbons - introduction of chemicals into the environment **(3) 15%**	
Analyzing 61%	Energy balance (4%) Enthalpy diagrams for endothermic or exothermic chemical reactions (12%) Problem solving (20%) **(2) 36%**		Appreciation of experimental procedures (10%) Handling experimental equipment (15%) - instructions - safety rules in the laboratory - uncertainty and experimental error **(4) 25%**

5. Observable Behaviours

Dimension 1

- Given molecular representations and statements related to energy transfers that occur during phase changes or mixtures of substances at different temperatures, choose those representations or statements that correctly describe a concrete situation involving a mixture or a phase change. Justify one's choice or correct false statements to make them valid. (4%)

- Given a series of statements, choose those that correctly describe a concrete example of endothermic or exothermic dissolution. Justify one's choice or correct false statements to make them valid. (4%)

- Given a series of statements related to one or more concrete situations, choose those in which the definition of specific heat capacity or molar heat of solution is used correctly to explain the phenomena described. Justify one's choice or correct false statements to make them valid. (4%)

- Given a series of statements related to the application of Hess's law in concrete situations that involve determining the enthalpy of a reaction, choose those that are true. Justify one's choice or correct false statements to make them valid. (4%)

- Given statements related to a reaction rate and to the factors that affect it or given graphs of the concentration of reactants or products as a function of time, choose those statements or graphs that correctly describe or illustrate a given chemical reaction. Justify one's choice or correct false statements to make them valid. (4%)

- Given a series of statements and using collision theory, choose those statements that correctly explain the rate of a chemical reaction, the energy diagram for a chemical reaction and the factors affecting the reaction rate. Justify one's choice or correct false statements to make them valid. (4%)

Dimension 2

- Determine the energy balance of a chemical reaction. A list of appropriate bonding energies is provided with the exam. (4%)

- Given a series of enthalpy diagrams for chemical reactions, indicate the endothermic or exothermic reactions. Indicate the chemical reaction involving the greatest or the least amount of energy absorbed or released. Match each diagram with one of the equations in a list and choose true statements from among a list of statements related to these diagrams. (12%)

– Problem solving:

  Solve a problem related to specific heat capacity in a situation involving a phase change or the mixture of substances at different temperatures. (5%)

  Solve a problem involving the molar heat of solution. (5%)

  Solve a problem involving Hess's law. (5%)

  Suggest one or more ways of increasing or decreasing the rate of a given chemical reaction or predict the effect of one or more proposed changes on the reaction rate. Justify one's answer. As much as possible, the situations will be experimental. (5%)

Dimension 3

– Explain the relationships between the study of energy transfers or chemical dynamics, and the evolution of chemistry. This involves using the information provided with the exam and knowledge acquired during the course. (5%)

– Explain technical applications involving the use of energy transfers or chemical dynamics. This involves using the information provided with the exam and knowledge acquired during the course. (5%)

– Briefly describe the situation that prevailed before the advent of a technical application involving the use of energy transfers or chemical dynamics as well as the new possibilities resulting from its implementation. This involves using the information provided with the exam and knowledge acquired during the course. (5%)

Dimension 4

– Critically examine one or more experimental procedures using the following criteria: appropriateness of variables chosen and of safety rules, the clarity of the instructions, their relationship to the given problem, etc. (10%)

– In a laboratory, demonstrate one's ability to use chemistry laboratory materials appropriately, to recognize possible sources of experimental error and to exercise judgement in following safety rules. Given tasks are not necessary part of a complete experimental procedure. (15%)

6. Explanation of the Content and Weighting

In accordance with the objectives of the Secondary V *Chemistry* program, students should acquire a theoretical knowledge of chemistry, while examining the historical, technological and social aspects of this discipline. Students should also acquire or improve the skills related to the experimental method. Summative evaluation instruments will reflect this principle.

Two factors were considered in determining the relative importance of the dimensions pertaining to the experimental method: the progress made in acquiring or improving the skills related to the experimental method and the relative importance of the experimental method in the evaluation scheme used in the youth sector. As in the youth sector, the experimental method accounts for 25% of the overall mark for the three courses in the program. However, the relative importance of this theme varies from one course to another. It accounts for 25% of the mark obtained in the present course.

The dimensions related to the history-technology-society perspective account for 15% of the mark obtained in each of the three courses.

Given the relative importance of the previously mentioned dimensions, evaluation pertaining to the related content accounts for 60% of this course mark.

The relative importance of any skill to be developed in this course is determined by adding up the weightings given to the observable behaviours pertaining to that skill. In the present course, the relative importance of each skill is as follows:

UNDERSTANDING	39%
ANALYZING	61%

7. Description of the Examination

A. Type of Examination

The examination for purposes of summative evaluation will be administered at the end of the course. It consists of two parts:

– One part is a written examination covering dimensions 1 to 3, inclusive, and is worth 75% of the course mark. It consists of restricted-response, short-answer or extended-response items.

– The other part is a laboratory examination covering dimension 4 and is worth 25% of the course mark.

Both parts of the examination are compulsory. All the observable behaviours for each dimension must be taken into account.

B. Characteristics of the Examination

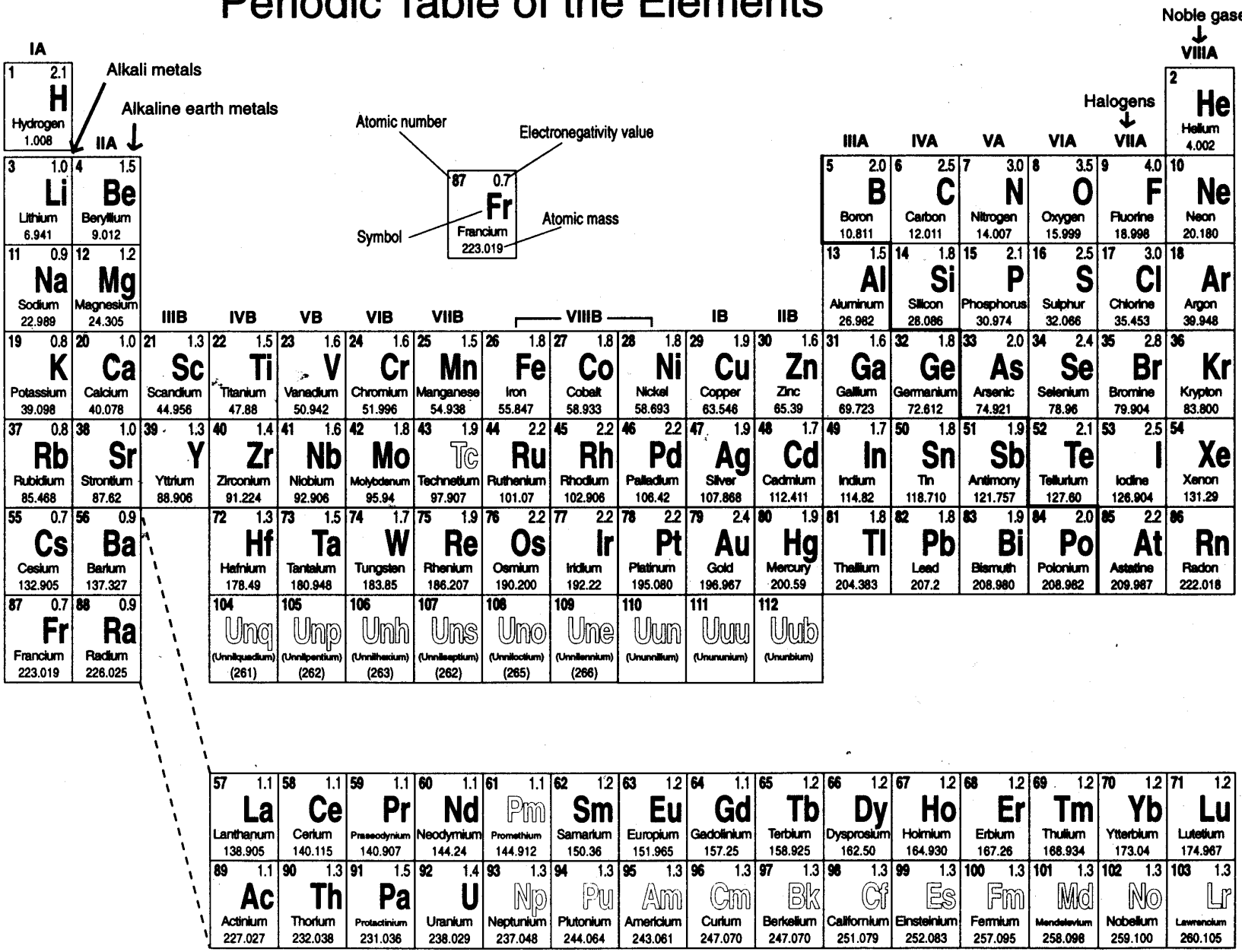
The part covering dimensions 1 to 3 is written in a single session lasting no more than 180 minutes. Students are permitted to use a calculator and must be provided with a periodic table, formulas and appropriate information required by dimensions 2 and 3. Examples of this material are included in Appendix 1 and 2.

The part covering dimension 4 is administered in the laboratory in a single session lasting no more than 90 minutes. The appropriate information must be incorporated into each related item or group of items.

C. Pass Mark

The pass mark for the entire examination is 60%.

Periodic Table of the Elements



Formulas

$Q = mc\Delta T$

$m_1c_1\Delta T_1 = m_2c_2\Delta T_2$

Q quantity of heat

m mass

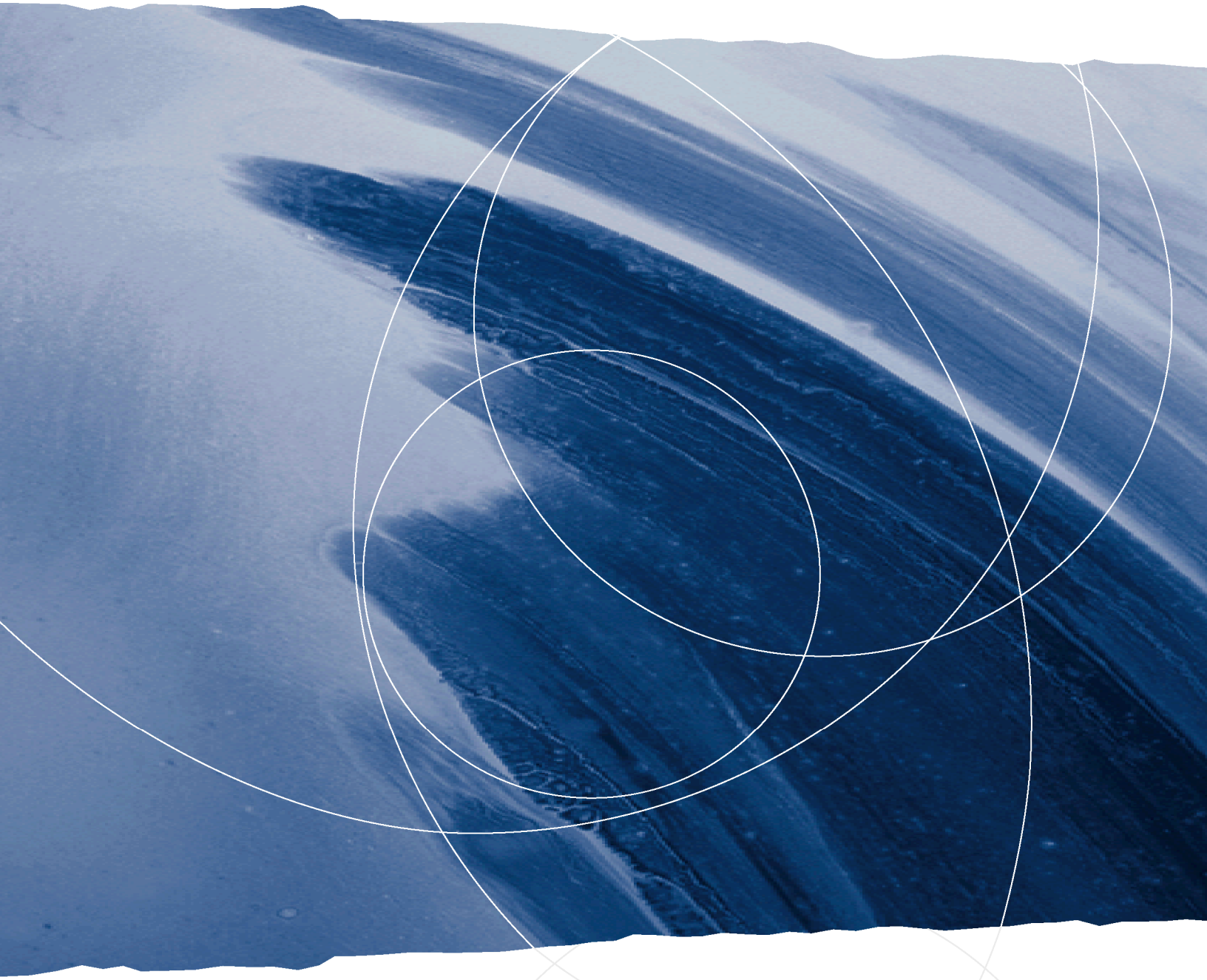
c specific heat capacity

ΔT change in temperature

Constants

Specific heat capacity of water (c) = 4190 J/kg•ºC or 4.19 J/g•ºC

Density or water (ρ) = 1.00 g/mL



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