

# 都立国際高校 年間授業計画／Tokyo Metropolitan Kokusai High School Course Syllabus

## ○ 科目基礎情報 ( Course information )

開講年度 ( Academic year )	令和7年度 ( 2025 年度 )
開講学科 ( Department )	国際学科国際バカロレアコース／IBDP (International Baccalaureate Diploma Programme)
教科 ( Subject Area )	Science
科目 ( Subject )	Chemistry HL DP1
学年・クラス ( Grade・Class )	DP1
単位数 ( Number of units )	6
使用教科書 ( Text Books )	Chemistry (3rd Edition) For the IB Diploma Programme (Hodder Education)
校外学習 ( Field trip )	No

## ○ 教科の目標 ( Goals of the subject area )

<b>【知識及び技能】 ( Knowledge and Skills )</b> <ul style="list-style-type: none"> <li>acquire a body of knowledge, methods and techniques that characterize science and technology</li> <li>develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge.</li> </ul> <b>【思考力、判断力、表現力等】 ( Ability to think, make judgements, express themselves )</b> <ul style="list-style-type: none"> <li>apply and use a body of knowledge, methods and techniques that characterize science and technology</li> <li>develop an ability to analyse, evaluate and synthesize scientific information</li> <li>develop experimental and investigative scientific skills including the use of current technologies</li> </ul> <b>【学びに向かう力、人間性等】 ( Motivation to learn, Humanity )</b> <ul style="list-style-type: none"> <li>appreciate scientific study and creativity within a global context through stimulating and challenging opportunities</li> <li>develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities</li> </ul>
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## ○ 科目の目標 ( Goals of the subject )

【知識及び技能】 ( Knowledge and Skills )	【思考力、判断力、表現力等】 ( Ability to think, make judgements, express themselves )	【学びに向かう力、人間性等】 ( Motivation to learn, Humanity )
Demonstrate knowledge and understanding of: a. facts, concepts and terminology b. methodologies and techniques c. communicating scientific information	Apply: a. facts, concepts and terminology b. methodologies and techniques c. methods of communicating scientific information.	Demonstrate the appropriate research, experimental, and personal skills necessary to carry out insightful and ethical investigations.

## ○ 授業計画 ( Course schedule )

単元の具体的な指導目標 Unit Objectives	指導項目・内容 Topic / Contents	評価規準 Evaluation Criteria	Alotted hours			
			知 ①	思 ②	態 ③	配当 時数
<b>Structure 1</b> Stoichiometry (Particulate Theory of Matter ) <b>【Knowledge and Skills】</b> <ul style="list-style-type: none"> <li>Students will understand the concept of matter and how it relates to the atomic theory. Also, the modifications to the atomic theory.</li> <li>Students will learn the concept of solubility, construction and interpretation of solubility curves</li> <li>Be able to explain the motion from the perepective of both force and energy</li> </ul> <b>【Ability to think, make judgements, express themselves】</b> <b>Reactivity 1</b> <ul style="list-style-type: none"> <li>Students will learn how to interconvert between various quantities involving mole concept: mass, moles, volumes and concentration.</li> </ul> <b>Reactivity 2</b> <ul style="list-style-type: none"> <li>They will also, investigate and calculate the significance of limiting (excess) reagents on various chemical reactions whilst learning the most economical way to produce a particular reagent.</li> </ul> <b>【Motivation to learn, Humanity】</b> <ul style="list-style-type: none"> <li>Engages actively in the practicals</li> <li>Work collaboratively with other classmates during practicals.</li> </ul> Completion of assignments.	Contents: <b>Structure + Reactivity (1. 1+ 2)</b> <ul style="list-style-type: none"> <li>Particulate Theory of Matter</li> <li>Atomic Theory</li> <li>Molar concept</li> <li>chemical equations</li> <li>Solubility</li> <li>Limiting reagents</li> <li>Atom economy</li> <li>Equipment and uncertainties</li> <li>Standard Deviation</li> <li>Sources of errors</li> </ul> Teaching materials: <ul style="list-style-type: none"> <li>Textbook, PowerPoint slides</li> </ul>	<b>①【Knowledge/Skills】</b> <ul style="list-style-type: none"> <li>Short test, Examination, Lab report</li> </ul> <b>②【Ability to think/make judgements/express themselves】</b> <ul style="list-style-type: none"> <li>Examination, Poster presentation</li> </ul> <b>③【Attitude towards learning proactively】</b> <ul style="list-style-type: none"> <li>Reflection</li> </ul>	○	○	○	29

	単元の具体的な指導目標 Unit Objectives	指導項目・内容 Topic / Contents	評価規準 Evaluation Criteria	知 ①	思 ②	態 ③	配当 時数
1学期 (1st semester)	<p>Measurement and Data Processing</p> <p>【Knowledge and Skills】</p> <ul style="list-style-type: none"> <li>• Develop understanding of accuracy, precision and distinction of uncertainties.</li> <li>• Develop understanding of how to appropriately apply uncertainty calculations.</li> <li>• Develop understanding on the importance of uncertainties to error calculations.</li> </ul> <p>【Ability to think, make judgements, express themselves】</p> <ul style="list-style-type: none"> <li>• Be able to calculate and correctly use uncertainties in their investigations.</li> <li>• Predict the implications of errors on experimental data</li> <li>• Predict appropriate uncertainty calculations for experimental data provided.</li> </ul> <p>【Motivation to learn, Humanity】</p> <ul style="list-style-type: none"> <li>• Engages actively in experiments</li> <li>• Work collaboratively with other classmates during experiments, discussions and presentations.</li> <li>• Completion of assignments.</li> </ul>	<p>Contents:</p> <ul style="list-style-type: none"> <li>• Particulate Theory of Matter</li> <li>• Atomic Theory</li> <li>• Molar concept</li> <li>• chemical equations</li> <li>• Solubility</li> <li>• Limiting reagents</li> <li>• Atom economy</li> <li>• Equipment and uncertainties</li> <li>• Standard Deviation</li> <li>• Sources of errors</li> </ul> <p>Teaching materials:</p> <ul style="list-style-type: none"> <li>• Textbook, PowerPoint slides</li> </ul>	<p>①【Knowledge/Skills】</p> <ul style="list-style-type: none"> <li>• Short test, Examination, Lab report</li> </ul> <p>②【Ability to think/make judgements/express themselves】</p> <ul style="list-style-type: none"> <li>• Examination, Poster presentation</li> </ul> <p>③【Attitude towards learning proactively】</p> <ul style="list-style-type: none"> <li>• Reflection</li> </ul>	○	○	○	27
	<p><b>Structure 1.3</b></p> <p>Atomic Structure</p> <p>【Knowledge and Skills】</p> <ul style="list-style-type: none"> <li>• Student will use the concept of the atomic structure to predict for the electronic structure of various elements.</li> <li>• Develop understanding of the atomic orbital structure.</li> <li>• Develop an understanding of the various electromagnetic spectrum.</li> </ul> <p>【Ability to think, make judgements, express themselves】</p> <ul style="list-style-type: none"> <li>• Be able to calculate the energy associated with the specific energy levels of electrons in an orbit.</li> <li>• Relate energy, E to the speed of light (c), wavelength and frequency of a wave.</li> <li>• Be able to interpret information from the EMS and apply the</li> <li>• Be able to incorporate Rydberg constant into the determination of energy associated with an electron at a specific orbital.</li> </ul> <p>【Motivation to learn, Humanity】</p> <ul style="list-style-type: none"> <li>• Engages actively in the experiments.</li> <li>• Work collaboratively with other classmates during experiments, discussions and presentations.</li> <li>• Completion of assignments.</li> </ul> <p>Periodicity 【Knowledge and Skills】</p> <ul style="list-style-type: none"> <li>• Develop understanding of the unique properties of transition elements and how they are specifically used in biological systems and industries.</li> <li>• Develop understanding of the trends of alkali metals, alkaline earth metals, transition metals, halogens and nobel gases.</li> <li>• Develop understanding of the motion of a piston</li> <li>• Develop understanding of entropy</li> </ul> <p>【Ability to think, make judgements, express themselves】</p> <ul style="list-style-type: none"> <li>• Students will learn to interpret trends related to Groups and Periods in the Periodic table to be able to predict the reactions of various (unknown) element.</li> </ul> <p>【Motivation to learn, Humanity】</p> <ul style="list-style-type: none"> <li>• Engages actively in the practicals</li> <li>• Work collaboratively with other classmates during experiments, discussions and presentations.</li> <li>• Completion of assignments.</li> </ul>	<p><b>Structure 1.3</b></p> <p>Contents:</p> <ul style="list-style-type: none"> <li>• Atomic orbitals</li> <li>• Principles and Laws associated with Atomic orbitals (Hunds Rule, Heisenberg Uncertainty Principle)</li> <li>• Electromagnetic spectrum</li> <li>• Energy associated with electrons at specific energy levels (Rydberg equation)</li> <li>• Trends related to the periodic table (melting and boiling points, electronegativity, solubility, electron affinity of alkali metals, alkaline earth-metals, transition metals, nobel gases)</li> <li>• Trends associated transition metals.</li> </ul> <p>Teaching materials:</p> <ul style="list-style-type: none"> <li>• Textbook, PowerPoint slides</li> </ul>	<p>①【Knowledge/Skills】</p> <ul style="list-style-type: none"> <li>• Short test, Examination, Lab report</li> </ul> <p>②【Ability to think/make judgements/express themselves】</p> <ul style="list-style-type: none"> <li>• Examination, Poster presentation</li> </ul> <p>③【Attitude towards learning proactively】</p> <ul style="list-style-type: none"> <li>• Reflection</li> </ul>	○	○	○	27
	定期考查 Examination			○	○		1

単元の具体的な指導目標 Unit Objectives	指導項目・内容 Topic / Contents	評価規準 Evaluation Criteria	知 ①	思 ②	態 ③	配当 時数
<b>Structure 2</b> Chemical Bonding <b>【Knowledge and Skills】</b> <ul style="list-style-type: none"> <li>Students will learn to appreciate and recall the various types of bonding and how they will associate with various reactions amongst elements.</li> <li>Students should be able to provide alternatives to VSEPR in the determination of the shapes of molecules</li> <li>Develop an understanding of hybridization</li> </ul> <b>【Ability to think, make judgements, express themselves】</b> <ul style="list-style-type: none"> <li>Also, the students should be able to construct and predict the shapes of molecules</li> <li>Students should be able to produce hybridized molecules.</li> </ul> <b>【Motivation to learn, Humanity】</b> <ul style="list-style-type: none"> <li>Engages actively in experiments</li> <li>Work collaboratively with other classmates during experiments, discussions and presentations.</li> <li>Completion of assignments.</li> </ul> Organic chemistry <b>【Knowledge and Skills】</b> <ul style="list-style-type: none"> <li>Students will learn about the synthetic pathways in organic reactions.</li> <li>Develop an understanding for the different reagents and catalysts required in the reaction pathway.</li> <li>Students will learn how to connect various aspects of chemical bonding such as shapes of the molecules and how they relate to the mechanism of reaction. As well as the connection made amongst all organic molecules.</li> </ul> <b>【Ability to think, make judgements, express themselves】</b> <ul style="list-style-type: none"> <li>Be able to interpret pathways with unknown chemicals</li> <li>Interconvert amongst the different functional groups.</li> </ul> <b>【Motivation to learn, Humanity】</b> <ul style="list-style-type: none"> <li>Engages actively in the experiments.</li> <li>Work collaboratively with other classmates during experiments, discussions and presentations.</li> <li>Completion of assignments.</li> </ul>	<b>Structure 2</b> Contents: <ul style="list-style-type: none"> <li>Types of Bonding</li> <li>Shapes of Molecule wave</li> <li>Quantum Chemistry and the shapes of molecules</li> <li>Intermolecular Forces and Hybridization</li> <li>Organic Chemistry</li> <li>Nomenclature and Classifications</li> <li>Mechanisms of reactions</li> <li>Applications of Chemical Bonding in organic chemistry</li> </ul> Teaching materials: <ul style="list-style-type: none"> <li>Textbook, PowerPoint slides, computer simulation</li> </ul>	<b>①【Knowledge/Skills】</b> <ul style="list-style-type: none"> <li>Short test, Examination, Lab report</li> </ul> <b>②【Ability to think/make judgements/express themselves】</b> <ul style="list-style-type: none"> <li>Examination, Poster presentation</li> </ul> <b>③【Attitude towards learning proactively】</b> <ul style="list-style-type: none"> <li>Reflection</li> </ul>	○	○	○	30

	単元の具体的な指導目標 Unit Objectives	指導項目・内容 Topic / Contents	評価規準 Evaluation Criteria	知 ①	思 ②	態 ③	配当 時数
2学期 (2nd semester)	<b>Reactivity 2.3</b> Equilibrium <b>【Knowledge and Skills】</b> ・ Develop an understanding and become familiar with Le ' Chateliers Principle. ・ Develop understanding of magnetic field around current <b>【Ability to think, make judgements, express themselves】</b> ・ Be able to use Le ' Chateliers Principle to predict the favoured direction of chemical reactions. ・ Students will also learn to calculate the equilibrium constant, Kc. <b>【Motivation to learn, Humanity】</b> ・ Engages actively in the experiments. ・ Work collaboratively with other classmates during experiments, discussions and presentations. ・ Completion of assignments.  Acids and Bases <b>【Knowledge and Skills】</b> ・ Develop understanding of the concepts related to pH ・ Students should associate equilibrium to that of acids and bases. ・ Students will become familiar and appreciate the derivation of the pH curve and the importance of indicators to determine the equivalence points of various acid-base reactions involving the use of buffers. <b>【Ability to think, make judgements, express themselves】</b> ・ Be able to calculate pH, concentrations of acids and bases using the Henderson–Hasselbalch equation. They will also learn to interpret and calculate the pKw, pKa and pKb of various reversible reactions. <b>【Motivation to learn, Humanity】</b> ・ Engages actively in the experiments ・ Work collaboratively with other classmates during experiments, discussions and presentations. ・ Completion of assignments. Chemical Kinetics <b>【Knowledge and Skills】</b> ・ Students will learn and appreciate the concept of chemical kinetics and how it relates to equilibrium ・ Develop an understanding of rate orders and the connection to reaction rate. <b>【Ability to think, make judgements, express themselves】</b> ・ Students will also learn to calculate the rate equation and its connection to the equilibrium constant. ・ Students are to be able to predict the reaction rate based on data from the rate equation. <b>【Motivation to learn, Humanity】</b> ・ Engages actively in the experiments ・ Work collaboratively with other classmates during experiments, discussions and presentations. ・ Completion of assignments.	<b>Reactivity 2.3</b> Contents: ・ Le ' Chateliers Principle ・ Equilibrium constant Kc and Position of equilibrium, Q ・ Factors that affect Kc and Q to include Catalyst, SA, concentration, pressure and temperature (Kc only) ・ pH, pH curve, indicators ・ Henderson-Hasselbalch equation ・ Chemical kinetics (rates), factors that affect chemical kinetics ・ Molecularity ・ Reaction rates Teaching materials: ・ Textbook, PowerPoint slides, computer simulation.	<b>①【Knowledge/Skills】</b> ・ Short test, Examination, Lab report <b>②【Ability to think/make judgements/express themselves】</b> ・ Examination, Poster presentation <b>③【Attitude towards learning proactively】</b> ・ Reflection	○	○	○	25

	単元の具体的な指導目標 Unit Objectives	指導項目・内容 Topic / Contents	評価規準 Evaluation Criteria	知 ①	思 ②	態 ③	配当 時数
3学期 (3rd semester)	<b>Reactivity 1-2.2</b> Energetics and Thermochemistry <b>【Knowledge and Skills】</b> • Students will develop an understanding of the various enthalpies and how they associate with entropy and Gibbs Free energy and the molar concept. • Develop an understanding of Hess's Law • Develop understanding on relationship between entropy and enthalpy. • Connection with redox processes through the Gibbs Free energy. <b>【Ability to think, make judgements, express themselves】</b> • Students will be able to calculate the various enthalpies and how they associate with entropy and Gibbs Free energy and the molar concept. • Students will be able to associate the various enthalpies to the calculation of overall energy or enthalpy in the Born-Haber cycle. <b>【Motivation to learn, Humanity】</b> • Engages actively in experiments. • Work collaboratively with other classmates experiments, discussions and presentations. • Completion of assignments.	<b>Reactivity 1- 2.2</b> Contents: • Enthalpies • Bond Enthalpies • Hess's Law • Gibbs Free Energy • Born Haber Cycle • Electrochemistry • Electrochemical cells Teaching materials: • Textbook, PowerPoint slides	<b>①【Knowledge/Skills】</b> • Short test, Examination, Lab report <b>②【Ability to think/make judgements/express themselves】</b> • Examination, Poster presentation <b>③【Attitude towards learning proactively】</b> • Reflection	○	○	○	25
	<b>Reactivity 1.3+ 3.2</b> Redox Processing <b>【Knowledge and Skills】</b> • Students will learn about the electrochemical reactions involving the Daniel/ Voltaic cells and the relative oxidizing an reducing powers of various species. • Develop an understanding about the concept of the electrolysis. <b>【Ability to think, make judgements, express themselves】</b> • Students will be able to calculate quantity of electricity and associate calculations with Faradays constant. • Students should be able to predict the ions that will be preferentially discharged. <b>【Motivation to learn, Humanity】</b> • Engages actively in experiments • Work collaboratively with other classmates during experiments, discussions and presentations. • Completion of assignments.	<b>Reactivity 1.3 + 3.2</b> Contents: • Redox Processes • Daniele Cell • Electrolytic Cells Teaching materials: • Textbook, PowerPoint slides	<b>①【Knowledge/Skills】</b> • Short test, Examination, Lab report <b>②【Ability to think/make judgements/express themselves】</b> • Examination, Poster presentation <b>③【Attitude towards learning proactively】</b> • Reflection	○	○	○	15
	定期考查 Examination			○	○		1
	<b>Structure 3.2 + Reactivity 2-3</b> Organic Chemistry <b>【Knowledge and Skills】</b> • Functional Groups • Polymers • Addition + Condensation Polymers <b>【Ability to think, make judgements, express themselves】</b> • Be able to determine and identify the properties of different funtional groups • Be able to predict the reactivities of these organic compounds. • Predict the various macromolecules based on their monomers. <b>【Motivation to learn, Humanity】</b> • Engages actively in the experiments • Work collaboratively with other classmates during experiments . • Completion of assignments.	<b>Structure 3.2 + Reactivity 2-3</b> Contents: • Organic Chemistry (Functional groups) • HNMR, IR, Mass spectroscopy, Crystallography Teaching materials: • Textbook, PowerPoint slides	<b>①【Knowledge/Skills】</b> • Short test, Examination, Lab report <b>②【Ability to think/make judgements/express themselves】</b> • Examination, Poster presentation <b>③【Attitude towards learning proactively】</b> • Reflection	○	○	○	27
		Contents: • Past paper revision Teaching materials:	<b>①【Knowledge/Skills】</b> • Short test, Examination, Lab report <b>②【Ability to think/make judgements/express</b>				

	単元の具体的な指導目標 Unit Objectives	指導項目・内容 Topic / Contents	評価規準 Evaluation Criteria	知 ①	思 ②	態 ③	配当 時数
		・ Textbook, PowerPoint slides	themselves】 ・ Examination, Poster presentation ⑤【Attitude towards learning proactively】 ・ Reflection	○	○	○	26
	定期考査 Examination			○	○		1

総授業時数 Total hours	234
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