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Sample teaching plan Unit 2:

How do chemical reactions shape the natural world?

This teaching plan is adapted from the *Heinemann Chemistry 1* teacher resources and was supplied by Melissa MacEoin. Royalties from this book fund the Chemistry Education Association.

**Suggested time: 15 teaching weeks**

* 5 weeks: [Unit 2 Area of Study 1](#AOS1): How do chemicals interact with water?
* 8 weeks: [Unit 2 Area of Study 2](#AOS2): How are chemicals measured and analysed?
* 2 weeks: [Unit 2 Area of Study 3](#AOS3): How do quantitative scientific investigations develop our understanding of chemical reactions?
* 1 week: [Units 1 and 2 revision](#revision)

Area of Study 1: How do chemicals interact with water?

**Outcome 1:** On completion of this unit the student should be able to explain the properties of water in terms of structure and bonding, and experimentally investigate and analyse applications of acid-base and redox reactions in society.

| Week | Student book section | Key ideas | *Heinemann Chemistry 1* 6E student book questions | *Heinemann Chemistry 1 Skills and Assessment* | Suggested assessment (can be adapted and used as assessment tasks to meet the requirements of the study design) |
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|  |  | Prior knowledge review |  | Worksheet 23 Knowledge review—identifying and naming types of substances |  |
| 1 | 10.1  10.2  10.3 | Essential water  Heat capacity  Latent heat | Case Study 1-5,  10.1 Key Questions 1-7  Chapter Review 2-9  10.2 Key Questions 1–7  Chapter Review 10, 13, 14, 16, 20-23  10.3 Key Questions 1–6  Chapter Review 1, 11, 12, 15, 17-19 | Worksheet 24 Structure and properties of water  Worksheet 25 Calculations using specific heat capacity  Practical 15 Density of water and ice  Worksheet 26 Calculations using latent heat | Case Study 1-5,  Worksheet 24 Structure and properties of water  Worksheet 25 Calculations using specific heat capacity  Practical 15 Density of  water and ice  Worksheet 26 Calculations using latent heat |
| 2 | 11.1  11.2  11.3 | Acids and bases  Strength of acids and bases  Reactions of acids and bases | 11.1 Key Questions 1–7  Chapter Review 1-9  11.2 Key Questions 1–5  Chapter Review 10, 11  Case Study 1–3,  11.3 Key Questions 1–5  Chapter Review 12, 14-16, | Practical 16 Investigating acids  Worksheet 27 Concentration and strength—picturing acids and bases  Worksheet 28 Predicting products of acid reactions  Practical 17 Reactions of HCl with metals and carbonates | Practical 16 Investigating acids  Worksheet 27 Concentration and strength—picturing acids and bases  Worksheet 28 Predicting products of acid reactions  Practical 17 Reactions of HCl with metals and carbonates  Case Study 1–3, |
| 3 | 11.4  11.5  11.6 | pH: a measure of acidity  Measuring pH  Acid-base reactions in the environment | 11.4 Key Questions 1–9  Chapter Review 17, 18, 20-23, 25  11.5 Key Questions 1–8  Chapter Review 19  Case Study 1–2,  11.6 Key Questions 1–5  Chapter Review 13, 24 | Worksheet 29 Calculating pH  Practical 18 Beetroot—a natural indicator | Worksheet 29 Calculating pH  Practical 18 Beetroot—a natural indicator  Case Study 1–2,  Worksheet 30 Redox reactions and reactivity of metals  Worksheet 31 Literacy review—matching redox key terms |
| 4 | 12.1  12.2 | Introducing redox reactions  Metal displacement reactions | 12.1 Key Questions 1–7  Chapter Review 1, 3-5, 7, 8, 10, 17, 18  12.2 Key Questions 1–6  Chapter Review 2, 6, 12-15, 19, 21 | Worksheet 30 Redox reactions and reactivity of metals  Worksheet 31 Literacy review—matching redox key terms  Practical 19 Reactivity series of metals | Worksheet 30 Redox reactions and reactivity of metals  Practical 19 Reactivity series of metals  Practical 20 Comparing a simple primary cell and a direct reaction  Case Study 1–3, |
| 5 | 12.3 | Redox reactions in society | Case Study 1–3,  12.3 Key Questions 1–6  Chapter Review 9, 11, 16, 20 | Practical 20 Comparing a simple primary cell and a direct reaction | Worksheet 31 Literacy review—matching redox key terms |
|  |  | Review | Unit 2 AoS 1 review | Worksheet 31 Literacy review—matching redox key terms  Worksheet 32 Reflection—How do chemicals interact with water?  Unit 2 AoS 1 EQ |  |

Area of Study 2: How are chemicals measured and analysed?

**Outcome 2:** On completion of this unit the student should be able to calculate solution concentrations and predict solubilities, use volumetric analysis and instrumental techniques to analyse for acids, bases and salts, and apply stoichiometry to calculate chemical quantities.

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| Week |  | Key knowledge | *Heinemann Chemistry 1* 6E student book chapter/section | *Heinemann Chemistry 1 Skills and Assessment* | Suggested assessment (can be adapted and used as assessment tasks to meet the requirements of the study design) |
|  |  | Prior knowledge review |  | Worksheet 33 Knowledge review—elements, compounds and molar mass |  |
| 6 | 13.1 | Measuring solubility | Case Study 1-2,  13.1 Key Questions 1-8  Chapter Review 1-3, 5, 6, 13-19 | Practical 21 Determination of solubility of a salt in water Worksheet 36 Purification of water using precipitation reactions | Case Study 1-2,  Practical 21 Determination of solubility of a salt in water  Worksheet 36 Purification of water using precipitation reactions |
| 7 | 13.2 | Calculating concentration | Case Study 1-2  13.2 Key Questions 1–8  Chapter Review 4, 7-12, 20- 26 | Worksheet 34 Molarity—measuring moles in solution  Worksheet 35 Converting between concentration units | Worksheet 34 Molarity—measuring moles in solution  Worksheet 35 Converting between concentration units |
| 8 | 14.1 | Principles of volumetric analysis | Case Study 1–7,  14.1 Key Questions 1–9  Chapter Review 1-6, 11-13, 16 | Worksheet 37 Standard solutions  Worksheet 38 Acid–base titrations  Practical 22 Preparation of a standard solution  Practical 23 Determination of HCl content in brick cleaner | Case Study 1–7,  Worksheet 37 Standard solutions  Worksheet 38 Acid–base titrations  Practical 22 Preparation of a standard solution  Practical 23 Determination of HCl content in brick cleaner |
| 9 | 14.2 | Stoichiometry | 14.2 Key Questions 1–8  Chapter Review 7-10, 14, 15, 17-22 |  |  |
| 10 | 15.1  15.2 | Greenhouse gases  Introducing properties of gases | 15.1 Key Questions 1–5  Chapter Review 1-3  Case Study 1-2,  15.2 Key Questions 1-7  Chapter Review 1, | Worksheet 39 Mass–volume stoichiometry for gases  Worksheet 40 Solving complex calculations—using more than one formula  Practical 24 Investigating the volume–pressure relationship in gases  Practical 25 Determining the molar volume of hydrogen | Case Study 1-2,  Worksheet 39 Mass–volume stoichiometry for gases  Worksheet 40 Solving complex calculations—using more than one formula  Practical 24 Investigating the volume–pressure relationship in gases  Practical 25 Determining the molar volume of hydrogen |
| 11 | 15.3 | Calculations involving gases | 15.3 Key Questions 1–6  Chapter Review 14-19 | Worksheet 39 Mass–volume stoichiometry for gases | Worksheet 39 Mass–volume stoichiometry for gases |
| 12 | 16.1  16.2 | Testing for salts in water  Quantitative analysis of salts | 16.1 Key Questions 1–7  Chapter Review 2, 5, 6, 9, 10, 13  16.2 Key Questions 1–8  Chapter Review 1, 3, 14, 15, 17-19, 21 | Practical 26 Gravimetric determination of sulfur as sulfate in fertiliser | :  Case Study 1–5,  Practical 26 Gravimetric determination of sulfur as sulfate in fertiliser |
| 13 | 16.3 | Instrumental analysis for salts | Case Study 1–5,  16.3 Key Questions 1–9  Chapter Review 4, 7, 8, 11, 12, 16, 20, 22 | Worksheet 41 Analysis with light—colorimetry and UV–visible spectroscopy  Practical 27 Colorimetric determination of phosphorus content | :  Worksheet 41 Analysis with light—colorimetry and UV–visible spectroscopy  Practical 27 Colorimetric determination of phosphorus content |
|  |  | Review | Unit 2 AoS 2 review | Worksheet 42 Literacy review—key terms and formulas  Worksheet 43 Reflection— How are chemicals measured and analysed?  Unit 2 AoS 2 EQ | :  Worksheet 42 Literacy review—key terms and formulas |

Area of Study 3: How do quantitative scientific investigations develop our understanding of chemical reactions?

**Outcome 3:** On completion of this unit the student should be able to draw an evidence-based conclusion from primary data generated from a student-adapted or student-designed scientific investigation related to the production of gases, acid-base or redox reactions or the analysis of substances in water.

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| Week | Key knowledge | *Heinemann Chemistry 1* 6E student book chapter/section | *Heinemann Chemistry 1 Skills and Assessment* | *Heinemann Chemistry 6E 1 eBook* resources with online assessment (student-access resources in blue) | Suggested assessment (can be adapted and used as assessment tasks to meet the requirements of the study design) |
| 14 | Investigation design  • chemical science concepts specific to the selected scientific investigation and their significance, including the definition of key terms | n/a | AoS 3: Investigating the concentration of ethanoic acid in different types of vinegar | Unit 2 AoS 3 sample logbook  Unit 2 AoS 3 logbook template  Unit 2 AoS 3 sample poster  Unit 2 AoS 3 poster template  Unit 2 AoS 3 teacher notes  Unit 2 AoS 3 assessment rubric  Unit 2 AoS 3 student checklist  Unit 2 AoS 3 sample marking scheme | Unit 2 AoS 3 sample logbook  Unit 2 AoS 3 logbook template  Unit 2 AoS 3 sample poster  Unit 2 AoS 3 poster template  Unit 2 AoS 3 teacher notes  Unit 2 AoS 3 assessment rubric  Unit 2 AoS 3 student checklist  Unit 2 AoS 3 sample marking scheme |
| 14 | • scientific methodology relevant to the selected scientific investigation, selected from the following: classification and identification; controlled experiment; fieldwork; modelling; product, process or system development; or simulation |
| 14 | • techniques of primary qualitative and quantitative data generation relevant to the investigation |
| 14 | • accuracy, precision, repeatability, reproducibility, resolution, and validity of measurements in relation to the investigation |
| 14 | • health, safety and ethical guidelines relevant to the selected scientific investigation |
| 15 | Scientific evidence  • the distinction between an aim, a hypothesis, a model, a theory and a law |
| • observations and investigations that are consistent with, or challenge, current scientific models or theories |
| • the characteristics of primary data |
| • ways of organising, analysing and evaluating generated primary data collected to identify patterns and relationships, and to identify sources of error |
| • the use of a logbook to authenticate generated primary data |
| • the limitations of investigation methodologies and methods, and of data generation and/or analysis |
| 15 | Science communication  • the conventions of scientific report writing, including scientific terminology and representations, standard abbreviations and units of measurement |
| 15 | • ways of presenting key findings and implications of the selected scientific investigation |

Units 1 and 2 revision

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| **Week** | **Key knowledge** | ***Heinemann Chemistry 1* 6E student book chapter/section** | ***Heinemann Chemistry 1 Skills and Assessment*** | *Heinemann Chemistry 1 6E eBook* resources with online assessment | **Suggested assessment** |
| 16 | All | All | All | **Whole book/unit:**  Units 3 and 4 exam readiness guide  Units 1 and 2 practice exam  Units 1 and 2 practice exam MC answer sheet  Units 1 and 2 practice exam suggested answers  Units 1 and 2 practice exam mapping document | **Whole book:**  Practice exam |