Topic 5: Energetics (8 hours)

5.1Exothermic and endothermic reactions
1 hour

	Assessment statement	Obj	Teacher's notes
5.1.1	Define the terms *exothermic reaction*, *endothermic reaction* and *standard enthalpy change of reaction* ($\Delta H°$).	1	Standard enthalpy change is the heat energy transferred under standard conditions—pressure 101.3 kPa, temperature 298 K. Only ΔH can be measured, not H for the initial or final state of a system.
5.1.2	State that combustion and neutralization are exothermic processes.	1	
5.1.3	Apply the relationship between temperature change, enthalpy change and the classification of a reaction as endothermic or exothermic.	2	
5.1.4	Deduce, from an enthalpy level diagram, the relative stabilities of reactants and products, and the sign of the enthalpy change for the reaction.	3	

5.2 Calculation of enthalpy changes
3 hours

	Assessment statement	Obj	Teacher's notes
5.2.1	Calculate the heat energy change when the temperature of a pure substance is changed.	2	Students should be able to calculate the heat energy change for a substance given the mass, specific heat capacity and temperature change using $q = mc\triangle T$.
5.2.2	Design suitable experimental procedures for measuring the heat energy changes of reactions.	3	Students should consider reactions in aqueous solution and combustion reactions. Use of the bomb calorimeter and calibration of calorimeters will not be assessed. **Aim 7:** Data loggers and databases can be used here.
5.2.3	Calculate the enthalpy change for a reaction using experimental data on temperature changes, quantities of	2	

	reactants and mass of water.		
5.2.4	Evaluate the results of experiments to determine enthalpy changes.	3	Students should be aware of the assumptions made and errors due to heat loss. **TOK:** What criteria do we use in judging whether discrepancies between experimental and theoretical values are due to experimental limitations or theoretical assumptions?

5.3 Hess's law

2 hours

	Assessment statement	Obj	Teacher's notes
5.3.1	Determine the enthalpy change of a reaction that is the sum of two or three reactions with known enthalpy changes.	3	Students should be able to use simple enthalpy cycles and enthalpy level diagrams and to manipulate equations. Students will not be required to state Hess's law. **TOK:** As an example of the conservation of energy, this illustrates the unification of ideas from different areas of science.

5.4 Bond enthalpies

2 hours

	Assessment statement	Obj	Teacher's notes
5.4.1	Define the term *average bond enthalpy.*	1	
5.4.2	Explain, in terms of average bond enthalpies, why some reactions are exothermic and others are endothermic.	3	