

Core Worksheet – Chapter 5

- 1 The equation shows the combustion of hydrogen:



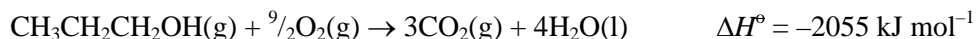
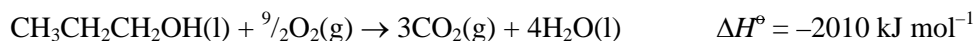
- a State the meaning of ' $\Delta H = -286 \text{ kJ mol}^{-1}$ '. [3]
- b Draw an energy level diagram for this reaction. [3]

- 2 The specific heat capacities of some metals are shown in the table:

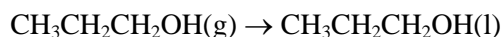
Metal	Specific heat capacity / $\text{J g}^{-1} \text{K}^{-1}$
aluminium	0.900
cobalt	0.435
gold	0.130
magnesium	1.03
titanium	0.523

- a 100 J of heat energy is supplied to 10.0 g of cobalt. Calculate by how much the temperature (in $^{\circ}\text{C}$) of the cobalt will rise. [1]
- b 1.00 kJ of heat energy is supplied to 5.00 g of each of the metals in the table. For which metal will this result in the greatest temperature rise? [1]
- c A piece of titanium of mass 100.0 g and at a temperature of 75.0°C is placed in a beaker containing 200.0 g of water (specific heat capacity $4.18 \text{ J g}^{-1} \text{K}^{-1}$) at a temperature of 16.0°C . When the titanium is removed after a short time it has cooled to 51.0°C . Calculate the temperature of the water in the beaker. [4]
- d 50.0 g of gold at a temperature of 85.0°C is put into a beaker containing 100.0 g of water (specific heat capacity $4.18 \text{ J g}^{-1} \text{K}^{-1}$) initially at a temperature of 20.0°C . The two eventually come to a common temperature; calculate that common temperature. (Assume no heat loss to the surroundings.) [4]
- 3 Use the data given to calculate the enthalpy change (in kJ mol^{-1}) when 1.00 mol of each of the following is burnt. (Specific heat capacity of water is $4.18 \text{ J g}^{-1} \text{K}^{-1}$.)
- a Ethene; when 0.21 g of ethene is burnt the temperature of 100.0 g of water is raised by 19.0°C . [4]
- b Benzene; when 1.20 g of benzene is burnt the temperature of 1.00 kg of water increases from 19.1°C to 30.0°C . [4]
- 4 50.0 cm^3 of 1.50 mol dm^{-3} sodium hydroxide is mixed with 100.0 cm^3 of 1.00 mol dm^{-3} hydrochloric acid. Both solutions were initially at 19.3°C and when they were mixed the temperature rose to a maximum of 28.3°C .
- a Write an equation for the reaction that occurs. [1]
- b Calculate the number of moles of sodium hydroxide and of hydrochloric acid. [2]
- c Calculate the enthalpy change of neutralisation. [3]

- 5 Given these enthalpy changes:



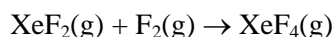
calculate the enthalpy change for the following process: [2]



- 6 Given these enthalpy changes:



calculate the enthalpy change for the following process: [2]



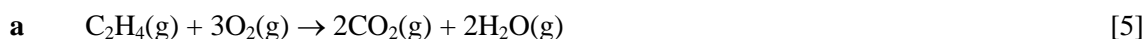
- 7 Define, using an equation, the bond energy of H–Br. [1]

- 8 Use the bond energies given in the table to calculate enthalpy changes for reactions below.

Bond	Bond enthalpy / kJ mol ⁻¹
C–C	348
C=C	612
C≡C	837
N–N	163
N=N	409
N≡N	944

Bond	Bond enthalpy / kJ mol ⁻¹
C–H	412
N–H	388
O–H	463
O–O	146
O=O	496
H–H	436

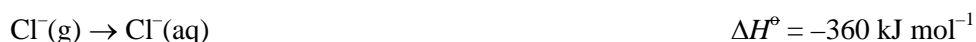
Bond	Bond enthalpy / kJ mol ⁻¹
C–O	360
C=O	743
C≡O	1070
Cl–H	431



- 9 Use the data given below and the bond energies in question 8 to calculate the Cl–Cl bond energy. [5]



- 10 Given these enthalpy changes:



calculate the enthalpy change for the following process: [4]

