

P525/ 2

CHEMISTRY

Paper 2

March 2015

2hours

S.6 CHEMISTRY TERM I EXAMINATION

CHEMISTRY

PAPER 2

2 hours

INSTRUCTIONS

Answer **both** questions

Write the answers in the answer booklet provided.

Mathematical tables and graph papers are provided.

Begin each question on a fresh page.

Non- programmable scientific electronic calculators may be used.

1. (a) Define the term **standard enthalpy of formation**. (01mark)
- (b) Some thermochemical data for calcium , calcium chloride and chlorine are given below.

Enthalpy of formation of calcium chloride = -763kJmol^{-1}

Enthalpy of atomisation of chlorine = $+121\text{kJmol}^{-1}$

Enthalpy of atomisation of calcium	= +193kJmol ⁻¹
First ionization energy of calcium	= +590kJmol ⁻¹
Second ionization energy of calcium	= +1145kJmol ⁻¹
Electron affinity for chlorine	= -348kJmol ⁻¹

- (i) Draw an energy level diagram for formation of solid calcium chloride. (04marks)
- (ii) Calculate the lattice energy of calcium chloride. (2½ marks)
- (c) If calcium formed a chloride in which calcium was in the oxidation state of +1, would be more or less stable than calcium chloride? Explain your answer. (03marks)
- (d) (i) Calculate the enthalpy of solution of calcium chloride. The enthalpy of hydration of Ca²⁺ and Cl⁻ are -1689.6kJmol⁻¹ and -383.7kJmol⁻¹ respectively. (2½ marks)
- (ii) Comment on the solubility of calcium chloride. (01mark)
- (e) (i) State **two** factors that can affect the magnitude of hydration energy. (02marks)
- (ii) Explain how the factors you have stated in (e)(i) affect hydration energy. (04marks)

2. (a) Define the following terms:

- (i) Standard enthalpy of combustion (01mark)
- (ii) Standard enthalpy of atomisation (01mark)

(b) Describe an experiment that can be carried out to determine the enthalpy of combustion of hexane. (07marks)

(c) The standard enthalpies of combustion of the first five straight chain alkanes and alcohols are shown in the table below.

Number of carbon atoms (n)	0	1	2	3	4	5
Enthalpy of combustion of alkanes ($-\Delta H^{\circ}_c / \text{kJmol}^{-1}$)	286	890	1560	2220	2877	3509
Enthalpy of combustion of alcohols ($-\Delta H^{\circ}_c / \text{kJmol}^{-1}$)	0	715	1371	2010	2673	3305

- (i) The enthalpy of combustion of alcohols and alkanes when $n = 0$ are 0 and -286 kJmol^{-1} respectively. Explain. (02marks)
- (ii) On the same axes plot a graph of the enthalpies of combustion of both alkanes and alcohols against number of carbon atoms. (05marks)
- (iii) Use the graph to determine the enthalpy of combustion of hexane. (01mark)
- (iv) Explain the shape of the graph. (06marks)
- (d) The standard enthalpies of combustion of carbon and hydrogen are
- 393 and -286 kJmol^{-1} respectively. The standard enthalpies of atomisation of carbon and hydrogen are $+715$ and $+218 \text{ kJmol}^{-1}$ respectively.

Calculate the:

- (i) standard enthalpy of formation of hexane (03½ marks)
- (ii) standard enthalpy of atomisation of hexane.
(03½ marks)

END