Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Physical

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Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Q1.

Comparison of lattice enthalpies from Born-Haber cycles with lattice enthalpies from calculations based on a perfect ionic model are used to provide information about bonding in crystals.

(a) Define the terms *enthalpy of atomisation* and *lattice dissociation enthalpy*.

Enthalpy of atomisation _____

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Lattice dissociation enthalpy _____

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(4)

(b) Use the following data to calculate a value for the lattice dissociation enthalpy of sodium chloride.

	$\Delta H^{\ominus}$/kJ mol^{-1}
$Na(s) \longrightarrow Na(g)$	+109
$Na(g) \longrightarrow Na^+(g) + e^-$	+494
$Cl_2(g) \longrightarrow 2Cl(g)$	+242
$Cl(g) + e^- \longrightarrow Cl^-(g)$	−364
$Na(s) + \frac{1}{2}Cl_2(g) \longrightarrow NaCl(s)$	−411

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(3)

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(c) Consider the following lattice dissociation enthalpy (ΔH_L^o) data.

	NaBr	AgBr
ΔH_L^o(experimental)/kJ mol^{-1}	+733	+890
ΔH_L^o(theoretical)/kJ mol^{-1}	+732	+758

The values of ΔH_L^o (experimental) have been determined from Born–Haber cycles.

The values of ΔH_L^o (theoretical) have been determined by calculation using a perfect ionic model.

(i) Explain the meaning of the term *perfect ionic model*.

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(2)

(ii) State what you can deduce about the bonding in NaBr from the data in the table.

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(1)

(iii) State what you can deduce about the bonding in AgBr from the data in the table.

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(1)

(Total 11 marks)

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Q2.

Ammonia can be manufactured by the Haber Process.

The equation for the reaction that occurs is shown below.

$$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$$

(a) The table below contains some bond enthalpy data.

	N ≡ N	H–H	N–H
Mean bond enthalpy / kJ mol^{-1}	944	436	388

(i) Use data from the table to calculate a value for the enthalpy of formation for one mole of ammonia.

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(3)

(ii) A more accurate value for the enthalpy of formation of ammonia is –46 kJ mol^{-1}.
Suggest why your answer to part (a) (i) is different from this value.

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(1)

(b) The table below contains some entropy data.

	$H_2(g)$	$N_2(g)$	$NH_3(g)$
$S\ominus$ / J K^{-1} mol^{-1}	131	192	193

Use these data to calculate a value for the entropy change, with units, for the formation of one mole of ammonia from its elements.

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(3)

(c) The synthesis of ammonia is usually carried out at about 800 K.

(i) Use the Δ*H* value of –46 kJ mol^{-1} and your answer from part (b) to calculate a value for Δ*G*, with units, for the synthesis at this temperature.
(If you have been unable to obtain an answer to part (b), you may assume that the entropy change is –112 J K^{-1} mol^{-1}. This is not the correct answer.)

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(3)

(ii) Use the value of Δ*G* that you have obtained to comment on the feasibility of the reaction at 800 K.

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(1)

(Total 11 marks)

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