Extension Answers

1 Which of the following equations has an enthalpy change equal to the negative lattice enthalpy for potassium chloride?

A $KCl_{(s)} \rightarrow K_{(g)} + \frac{1}{2}Cl_{2(g)}$
B $KCl_{(s)} \rightarrow K^+_{(g)} + Cl^-_{(g)}$
C $KCl_{(g)} \rightarrow K^+_{(g)} + Cl^-_{(g)}$
D $KCl_{(aq)} \rightarrow K^+_{(g)} + Cl^-_{(g)}$

2 The enthalpy change for the process represented by the equation $Na_{(s)} \rightarrow Na^+_{(g)} + e^-$ is equal to

A the first ionisation energy of sodium
B the sum of the electron affinity and the enthalpy change of atomisation of sodium
C the sum of the first ionisation energy and the electron affinity of sodium
D the sum of the first ionisation energy and the enthalpy change of atomisation of sodium.

3 Which one of the reactions listed below represents the electron affinity of chlorine?

A $Cl_{(g)} \rightarrow Cl^+_{(g)} + e^-$
B $Cl^+_{(g)} + e^- \rightarrow Cl_{(g)}$
C $Cl_{(g)} + e^- \rightarrow Cl^-_{(g)}$
D $\frac{1}{2}Cl_{2(g)} + e^- \rightarrow Cl^-_{(g)}$

4 Which of the following equations correctly represents the standard enthalpy change of atomisation of oxygen gas?

A $O_{2(g)} \rightarrow 2O_{(g)}$
B $O_{2(g)} \rightarrow O^+_{(g)} + O^-_{(g)}$
C $\frac{1}{2}O_{2(g)} \rightarrow O_{(g)}$
D $O_3 \rightarrow 3O_{(g)}$

5 For which one of the following is $\Delta H^\ominus$ of the reaction numerically equal to the lattice energy of ammonium chloride?

A $\frac{1}{2}N_{2(g)} + 2H_{2(g)} + \frac{1}{2}Cl_{2(g)} \rightarrow NH_4Cl_{(s)}$
B $NH_4^+{}_{(g)} + Cl^-_{(g)} \rightarrow NH_4Cl_{(s)}$
C $NH_4Cl_{(s)} \rightarrow N^{3-}_{(g)} + 4H^+_{(g)} + Cl^-_{(g)}$
D $NH_4Cl_{(g)} \rightarrow NH_4Cl_{(s)}$

6 Which of the following classes of reaction always have an endothermic enthalpy change?

I atomisation II ionisation III solution

A I only B II only C III only D I and II only

7 Which of the following would lead to more exothermic lattice energies?

I Higher charges on ions II Larger sizes of ion

A I only B II only C Both I and II D Neither I nor II

8 Which one of the following has the most exothermic crystal lattice enthalpy?

A NaF B CsI C MgF_2 D $MgCl_2$

9 The lattice energies (enthalpies) of rubidium fluoride (RbF) and caesium chloride (CsCl) are -760 kJ mol^{-1} and -650 kJ mol^{-1} respectively. What is the lattice energy of caesium fluoride (CsF) likely to be?

A -620 kJ mol^{-1} B -720 kJ mol^{-1} C -760 kJ mol^{-1} D -800 kJ mol^{-1}

10 For which of the following would the difference between the experimental and theoretical lattice energies be greatest?

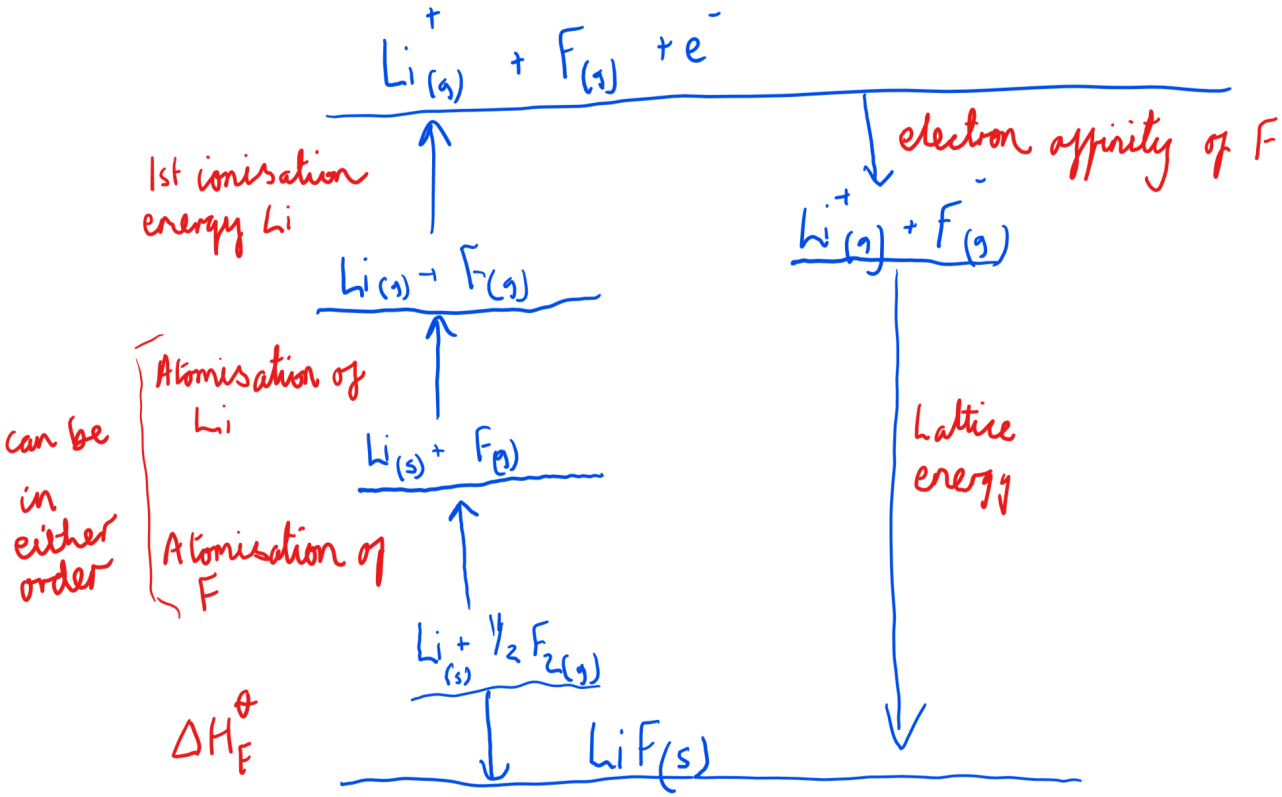
A CaO B CaS C NaF D NaCl

11 Which reaction has the most negative ΔH value?

A $LiF_{(s)} \rightarrow Li^+_{(g)} + F^-_{(g)}$
B $Li^+_{(g)} + F^-_{(g)} \rightarrow LiF_{(s)}$
C $NaCl_{(s)} \rightarrow Na^+_{(g)} + Cl^-_{(g)}$
D $Na^+_{(g)} + Cl^-_{(g)} \rightarrow NaCl_{(s)}$

12 (a) The lattice enthalpy of an ionic compound can be calculated using a Born-Haber cycle.

Using lithium fluoride as the example, construct a Born-Haber cycle, labelling the cycle with the formulas and state symbols of the species present at each stage. [6]



(b) Given the following data (all in kJ mol^{-1}) calculate the lattice enthalpy of lithium fluoride. [2]

$\Delta H^e_{formation}$	lithium fluoride	-612
$\Delta H^e_{atomisation}$	lithium	+161
$\Delta H^e_{atomisation}$	fluorine	+79
1st ionisation energy	lithium	+519
1st electron affinity	fluorine	-348

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- (-348) - (519) – (161) – (79) + (-612) = **-1023KJmol^{-1}**

The signs between the brackets indicate if you are following the arrow in the diagram (in which case +) or going the opposite way to the arrow (in which case -)