Worksheet 18.1

Lattice energies

1 The table below contains the values of some standard enthalpy changes in kJ mol^{-1}.

Enthalpy change	**Na_2S**	**FeS**	**$ZnCl_2$**
$H^{\ominus}_{f}$	–375	–95	
$H^{\ominus}_{at}$ (metal)	+109	+418	+130
$H^{\ominus}_{at}$ (non-metal)	+223	+223	+121
$H^{\ominus}_{i1}$ (metal)	+494	+762	+908
$H^{\ominus}_{i2}$ (metal)	n/a	+1560	+1730
$H^{\ominus}_{ea1}$ (non-metal)	–200	–200	–362
$H^{\ominus}_{ea2}$ (non-metal)	+532	+532	n/a
$H^{\ominus}_{latt}$			–2698

Use the data to calculate:

a the lattice energy of sodium sulfide (Na_2S) [4]

b the lattice energy of iron(II) sulfide (FeS) [4]

c the enthalpy of formation of zinc chloride ($ZnCl_2$). [4]

2 The table below contains some standard lattice energy values.

Substance	**$H^{\ominus}_{latt}$ / kJ mol^{-1}**	**Substance**	**$H^{\ominus}_{latt}$ / kJ mol^{-1}**
CaF_2	–2602	KBr	–670
MgO	–3889	$SrCl_2$	–2112
CaO	–3513	LiF	–1022
NaCl	–771	SrO	–3310
CaS	–2966	$MgCl_2$	–2492
RbI	–609		

a Rank the compounds in order of lattice energy, starting with the most negative (MgO). [1]

b What do the first four compounds in your list have in common? [1]

c What do the next three compounds in your list have in common? [1]

d What do the last four compounds in your list have in common? [1]

e Use your answers to parts **b**, **c** and **d** to suggest a general rule for one factor that affects how negative the lattice energy is. [2]

f The last four compounds in your list should be made up of elements from Groups I and VII of the Periodic Table. By considering where within the groups these elements appear, suggest another general rule for a second factor that affects how negative the lattice energy is. [2]