IONIC BONDING

1. a) (i) Na^+ 2,8
(ii) Cl^- 2,8,8
(iii) Mg^{2+} 2,8
(iv) O^{2-} 2,8

b) Strong electrostatic attractions between the positive and negative ions.

c) One of the main factors governing the amount of attraction is the charge on the ions. A crystal where 2+ ions are attracted to 2- ions will have much stronger forces holding it together than where 1+ is attracting 1-. Stronger attractions will need more energy, and so a higher temperature, to break them to melt the salt.

2. a) S^{2-}: 2,8,8 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ or [Ne] $3s^2\ 3p^6$ (You can't just give [Ar] as the structure! You have to show some detail.)

b) F^-: 2,8 $1s^2\ 2s^2\ 2p^6$ or [He] $2s^2\ 2p^6$ (The last form would never be used. It is quicker to write $1s^2$ than [He]

c) Ca^2: 2,8,8 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ or [Ne] $3s^2\ 3p^6$

d) Fe^{2+}: 2,8,14 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$ or [Ar] $3d^6$

e) Cr^{3+}: 2,8,11 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$ or [Ar] $3d^3$

f) Ni^{2+}: 2,8,16 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^8$ or [Ar] $3d^8$

g) I^-: 2,8,18,18,8 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^6$ or [Kr] $4d^{10}\ 5s^2\ 5p^6$

h) Sn^{2+}: 2,8,18,18,2 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2$ or [Kr] $4d^{10}\ 5s^2$

i) Sn^{4+}: 2,8,18,18 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}$ or [Kr] $4d^{10}$

j) Te^{2-}: 2,8,18,18,8 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}\ 5s^2\ 5p^6$ or [Kr] $4d^{10}\ 5s^2\ 5p^6$

k) Ag^+: 2,8,18,18 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^6\ 4d^{10}$ or [Kr] $4d^{10}$

The reason for asking you to do this fairly tedious exercise is partly to give you more practice at writing electronic structures, but also to drive home the point about noble gas structures – they aren't necessarily important. Fewer than half of these ions have noble gas structures (find the ones that have them – noble gases end with $ns^2\ np^6$).

3. a) Na_2S

   b) CsBr

   c) Mg_3N_2

   d) Cr_2O_3

   e) $SnCl_2$

   f) NiSe

   g) Al_2O_3

   h) CuI

   If you got any of these formulae wrong (including the unfamiliar ones), you need to do some work on this. And if it took you ages, because you had to work out what the charge was on all the ions by looking at their electronic structures, you also need to find out how to do this quickly and reliably.

   This is covered in the first few pages of my calculations book. Fortunately, if you look at the book on the Amazon.co.uk site, you can read all of this by clicking on the "Look inside" image in the top left-hand corner of the page.

   You will find a direct link to the Amazon page from http://www.chemguide.co.uk/book.html