

Past-paper walk-through

Valence Electrons and Ionic Compounds ■ 1.8

eXercise

Questions in this set

- 2015 Q6

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 6

2015 ■ Q6

A student learns that ionic compounds have significant covalent character when a cation has a polarizing effect on a large anion. As a result, the student hypothesizes that salts composed of small cations and large anions should have relatively low melting points.

Compound	Melting Point (°C)
LiI	449
KI	686
LiF	845
NaF	993

Question 6

- (a)** Select two compounds from the table and explain how the data support the student's hypothesis.
- (b)** Identify a compound from the table that can be dissolved in water to produce a basic solution. Write the net ionic equation for the reaction that occurs to cause the solution to be basic.

Question 6

Compound	Melting Point (°C)
LiI	449
KI	686
LiF	845
NaF	993

Solution 6

(a) Mark scheme

- Example: choose LiI and KI. LiI has a small cation (Li^+) and a large anion (I^-); KI has a larger cation (K^+) but the same large anion (I^-). LiI's melting point (449 C) is lower than KI's (686 C), so the compound with the smaller, more polarizing cation on the same large anion has the lower melting point, supporting the hypothesis that small-cation/large-anion salts have relatively low melting points. (Equally acceptable pairs: LiI vs. LiF – same small cation, LiI has the larger anion I^- and the lower melting point, $449\text{ C} < 845\text{ C}$; or LiI vs. NaF – LiI, with its small cation and large anion, has a much lower melting point, 449 C, than NaF, 993 C.)
1 point for choosing an appropriate pair of compounds from {LiI/KI, LiI/LiF,

Solution 6

LiI/NaF ; 1 point for an explanation that correctly supports the hypothesis using the melting-point data.

Solution 6

(b)

Mark scheme

- Either LiF or NaF is an acceptable choice: F⁻ is the conjugate base of the weak acid HF, so it hydrolyzes in water to give a basic solution (Li⁺ and Na⁺ are spectator ions and do not affect pH). Net ionic equation: $\text{F}^{-}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HF}(\text{aq}) + \text{OH}^{-}(\text{aq})$. 1 point for choosing one of the two correct compounds (LiF or NaF); 1 point for writing the correct, balanced net-ionic hydrolysis equation.