# 4.1 Ionic Bonding & Properties

*Past Exam Questions (Paper 1,2 )*

**1.** *[1 mark]*

What are the correct formulas of the following ions?

| | Ammonium | Hydrogencarbonate | Phosphate |
|---|---|---|---|
| A. | $NH_4^+$ | $HCO_3^{2-}$ | $PO_4^-$ |
| B. | $NH_3^+$ | $HCO_3^-$ | $PO_4^{3-}$ |
| C. | $NH_4^+$ | $HCO_3^{2-}$ | $PO_4^{2-}$ |
| D. | $NH_4^+$ | $HCO_3^-$ | $PO_4^{3-}$ |

**2.** *[1 mark]*

Which is the best description of ionic bonding?

A. The electrostatic attraction between positively charged nuclei and an electron pair

B. The electrostatic attraction between positive ions and delocalized negative ions

C. The electrostatic attraction between positive ions and delocalized electrons

D. The electrostatic attraction between oppositely charged ions

**3.** *[1 mark]*

Metal M has only one oxidation number and forms a compound with the formula $MCO_3$. Which formula is correct?

A. $MNO_3$

B. $MNH_4$

C. $MSO_4$

D. $MPO_4$

**4.** *[1 mark]*

What is the formula of magnesium fluoride?

A. $Mg_2F_3$

B. $Mg_2F$

C. $Mg_3F_2$

D. $MgF_2$

**5.** *[1 mark]*

What are the correct formulas of the following ions?

| | Nitrate | Phosphate | Carbonate | Ammonium |
|---|---|---|---|---|
| A. | $NO_3^-$ | $PO_4^{3-}$ | $CO_3^-$ | $NH_3^+$ |
| B. | $NO_3^{2-}$ | $PO_3^{2-}$ | $CO_3^{2-}$ | $NH_3^+$ |
| C. | $NO_3^-$ | $PO_4^{3-}$ | $CO_3^{2-}$ | $NH_4^+$ |
| D. | $NO_3^{2-}$ | $PO_3^{2-}$ | $CO_3^{2-}$ | $NH_4^+$ |

**6.** *[1 mark]*

Which combination of the characteristics of element X, a metal, and element Y, a non metal, is most likely to lead to ionic bonding?

| | X | Y |
|---|---|---|
| A. | low ionization energy | high electronegativity value |
| B. | low ionization energy | low electronegativity value |
| C. | high ionization energy | high electronegativity value |
| D. | high ionization energy | low electronegativity value |

**7.** *[1 mark]*

What is the formula of calcium phosphide?

A. $Ca_2(PO_3)_3$

B. $Ca_2P_3$

C. $Ca_3(PO_4)_2$

D. $Ca_3P_2$

**8.** *[1 mark]*

Which compound contains both ionic and covalent bonds?

A. $SIH_4$

B. $NaNO_3$

C. $H_2CO$

D. $Na_2S$

**9a.** *[1 mark]*

Ionic bonding and covalent bonding are two types of bonding.

Ionic bonding occurs in sodium chloride. Describe what is meant by the term *ionic bonding*.

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**9b.** *[4 marks]*

Sodium chloride has a lattice structure. Describe the lattice structure of sodium chloride including a suitable representative three-dimensional diagram. On the diagram, label each ion and distinguish between the different types of ions present using different sized spheres.

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**9c.** *[1 mark]*

Ammonium phosphate is also an ionic compound, used in the manufacture of fertilizers. State the chemical formula of ammonium phosphate.

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**9d.** *[2 marks]*

Using electronegativity values from Table 7 of the Data Booklet, state and explain which of the following compounds, IBr, $BaCl_2$, CsI and HBr are ionic and which compounds are covalent.

IBr:

$BaCl_2$:

CsI:

HBr:

**10a.** *[2 marks]*

Across period 3, elements increase in atomic number, decrease in atomic radius and increase in electronegativity.

Describe the bonding and structure of sodium chloride.

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**10b.** *[2 marks]*

State the formula of the compounds formed between the elements below.

Sodium and sulfur:

Magnesium and phosphorus:

**11a.** *[1 mark]*

State the equation for the reaction between potassium and chlorine.

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~~**11b.** *[2 marks]*~~

~~Describe the covalent bond present in the chlorine molecule and how it is formed.~~

**11c.** *[2 marks]*

Describe the ionic bonding present in potassium chloride and how the ions are formed.

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