Questions

Q1.

The nitrates of lithium, rubidium and strontium are all white solids. The compounds are held together by ionic bonds.

State the meaning of the term 'ionic bond'.

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(Total for question = 2 marks)

Q2.

This question is about catalytic converters.

Catalytic converters contain metals such as platinum.

Describe the bonding in platinum.
You may include a diagram in your answer.

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(Total for question = 2 marks)

Q3.

This question is about transition metals and transition metal complexes.

Describe the bonding in the element chromium and use your answer to justify why it has such a high melting temperature.

You may find it helpful to draw a labelled diagram.

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Q4.

This question is about ionic bonding.

The strength of ionic bonding in different compounds can be compared by using the amount of energy required to separate the ions. Some values for this energy are given in the table.

Compound	Amount of energy required to separate the ions / $kJ\,mol^{-1}$
LiF	1031
KF	817
CaF_2	2957

Using the data provided, explain how changes in the cation affect the bond strength in an ionic compound.

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(Total for question = 2 marks)

Q5

(Total for question = 2 marks)

Q5

Magnesium bromide, $MgBr_2$, is an ionic compound.

(i) Draw a dot-and-cross diagram to show the bonding in magnesium bromide.
Only outer shell electrons are required.

(1)

(ii) State all the conditions under which magnesium bromide conducts electricity.

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(Total for question = 2 marks)

Q6.

The table shows some information about a selection of elements and compounds.

	Graphene	Graphite	Diamond	Magnesium oxide	Potassium bromide	Iron
Melting temperature / K	> 4000	3950	3820	3125	1007	1808
Density / $g\,cm^{-3}$	not measured	2.2 to 2.8	3.51	3.58	2.75	7.86
Compressive strength / GPa	not measured	2.3 and 15.3	443	152	15	170

Explain why the electrical conductivity of solid potassium bromide is poor but an aqueous solution of potassium bromide is a good electrical conductor.

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(Total for question = 2 marks)

Q7.

This question is about magnesium.

(i) Complete the electronic structure of a magnesium atom.

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$1s^2$

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(ii) The bonding in magnesium results from

(1)

☐ **A** strong electrostatic attractions between oppositely charged ions

☐ **B** strong electrostatic attractions between the nuclei of magnesium atoms and a shared pair of electrons

☐ **C** strong electrostatic attractions between positively charged ions and a sea of delocalised electrons

☐ **D** weak dispersion forces between magnesium atoms

(Total for question = 2 marks)

Q8.

This question is about ionic bonding.

The elements sodium and fluorine react together to form an ionic compound.

(i) Select the correct equation for this reaction.

(1)

- ☐ **A** $Na(s) + F(g) \rightarrow NaF(s)$
- ☐ **B** $2Na(s) + F_2(g) \rightarrow 2NaF(s)$
- ☐ **C** $Na(s) + F_2(g) \rightarrow NaF_2(s)$
- ☐ **D** $2Na(s) + F(g) \rightarrow Na_2F(s)$

(ii) Draw dot-and-cross diagrams of the ions in sodium fluoride, showing all the electrons.

Use your diagram to explain why the ions are described as isoelectronic.

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(iii) Which diagram shows the trend in ionic radius for the isoelectronic ions N^{3-} to Al^{3+}?

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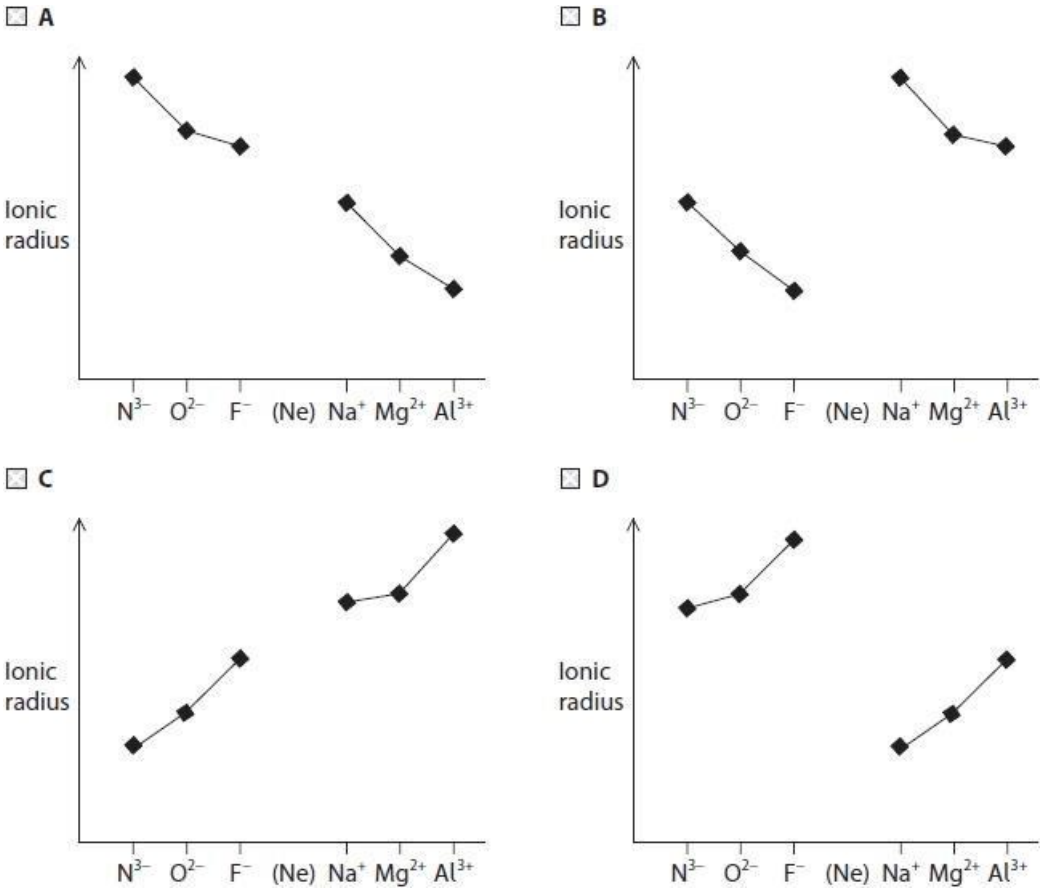

(iv) Explain your answer to (iii) in terms of the structure of the ions.

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(Total for question = 7 marks)

Q9.

Give the formula of a stable **ion** that is isoelectronic with the magnesium ion, Mg^{2+}.

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(Total for question = 1 mark)

Q10.

The table shows some information about a selection of elements and compounds.

	Graphene	Graphite	Diamond	Magnesium oxide	Potassium bromide	Iron
Melting temperature / K	> 4000	3950	3820	3125	1007	1808
Density / $g\,cm^{-3}$	not measured	2.2 to 2.8	3.51	3.58	2.75	7.86
Compressive strength / GPa	not measured	2.3 and 15.3	443	152	15	170

Explain the difference in the melting temperatures of magnesium oxide and potassium bromide.

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(Total for question = 3 marks)

Q11.

The properties of elements and their compounds are determined by their structure and bonding.

Element **X** has the typical appearance of a metal.

Predict **two** other distinct physical properties that element **X** would exhibit if it is a metal. Explain your choices in terms of structure and bonding.

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(Total for question = 4 marks)

Q12.

This question is about the thermal stability of Group 1 and Group 2 nitrates and carbonates.

Calcium carbonate is thermally decomposed during the manufacture of cement.

(i) Write an equation, including state symbols, for the thermal decomposition of calcium carbonate.

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(ii) Name all the types of bond present in calcium carbonate.

(1)

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(iii) Give a reason, in terms of the bonding, why a high decomposition temperature is required.

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(Total for question = 3 marks)