

Questions

Q1.

Diamond, graphene and graphite are different forms of carbon.

One way in which diamond differs from graphene and graphite is that only diamond has

(1)

- A a high melting temperature
- B a precise molecular formula
- C poor electrical conductivity
- D a giant structure

(Total for question = 1 mark)

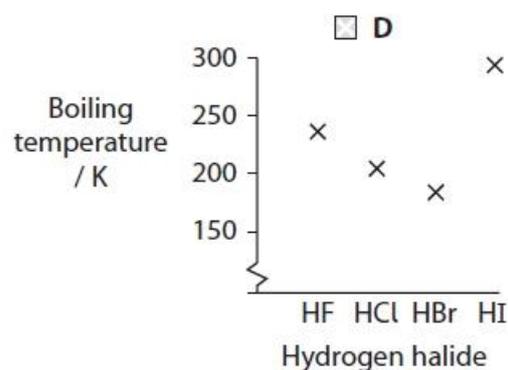
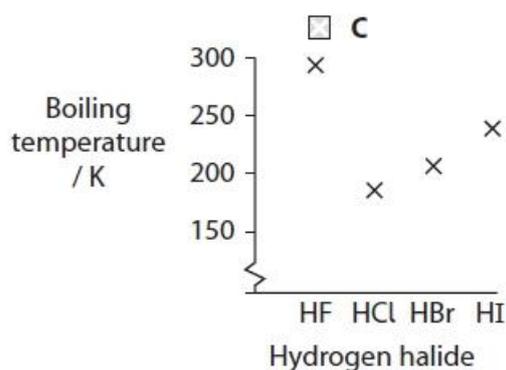
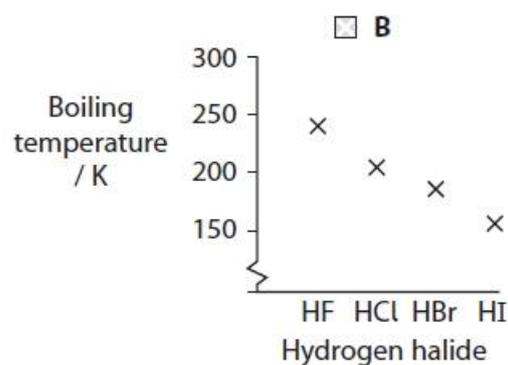
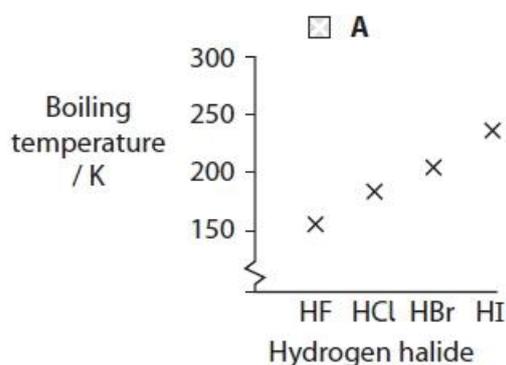
Q2.

This question is about the elements in Group 7 of the Periodic Table and some of their compounds.

The hydrogen halides have the general formula HX, where X represents the symbol of the halogen.

(i) Which diagram shows the trend in the boiling temperatures of the hydrogen halides?

(1)



(ii) What type of reaction occurs when ammonia gas reacts with hydrogen chloride gas?

(1)

- A** acid-base
 B displacement
 C redox
 D substitution

(Total for question = 2 marks)

Q3.

Diamond, graphene and graphite are different forms of carbon.

The structural feature that graphene and graphite have in common is that the carbon atoms are arranged in

(1)

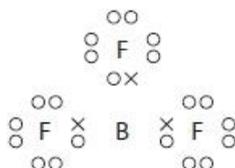
- A layers with each atom bonded to four others
- B hexagonal and pentagonal rings within a layer
- C hexagonal rings within a layer
- D a three-dimensional structure

(Total for question = 1 mark)

Q4.

This question is about covalent bonds.

The dot-and-cross diagram of BF_3 is



What is the bond angle in BF_3 ?

(1)

- A 90°
- B 107°
- C 109.5°
- D 120°

(Total for question = 1 mark)

Q5.

Which compound does **not** have hydrogen bonding between its molecules?

(1)

	Name of compound	Formula of compound
<input type="checkbox"/> A	fluoromethane	CH ₃ F
<input type="checkbox"/> B	hydrogen fluoride	HF
<input type="checkbox"/> C	hydrogen peroxide	H ₂ O ₂
<input checked="" type="checkbox"/> D	methanol	CH ₃ OH

(Total for question = 1 mark)

Q6.

Which molecule has a linear shape?

(1)

- A H₂S
- B SO₂
- C CO₂
- D CH₂=CH₂

(Total for question = 1 mark)

Q7.

Boric acid, H_3BO_3 , is a weak acid with antiseptic properties.

Boric acid is a solid with melting temperature $171\text{ }^\circ\text{C}$.

What are the strongest interactions between the molecules in solid boric acid?

(1)

- A covalent bonds
- B hydrogen bonds
- C ionic bonds
- D London forces

(Total for question = 1 mark)

Q8.

Answer the questions with a cross in the boxes you think are correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

This question is about ionisation energies.

(i) Which equation represents the **second** ionisation of bromine?

(1)

- A $\text{Br}(\text{g}) + \text{e}^- \rightarrow \text{Br}^-(\text{g})$
- B $\text{Br}^-(\text{g}) + \text{e}^- \rightarrow \text{Br}^{2-}(\text{g})$
- C $\text{Br}(\text{g}) - 2\text{e}^- \rightarrow \text{Br}^{2+}(\text{g})$
- D $\text{Br}^+(\text{g}) - \text{e}^- \rightarrow \text{Br}^{2+}(\text{g})$

(ii) Which set of successive ionisation energies is most likely to be associated with the element boron?

(1)

- A 738, 1 451, 7 733, 10 541, 13 629
- B 801, 2 427, 3 660, 25 026, 32 828
- C 1 086, 2 353, 4 621, 6 223, 37 832
- D 1 402, 2 856, 4 578, 7 475, 9 445

(Total for question = 2 marks)

Q9.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

This is a question about atoms, isotopes and ions.

Which of the following pairs of ions is isoelectronic?

(1)

- A N^{3-} and Cl^-
- B O^{2-} and S^{2-}
- C Na^+ and K^+
- D Na^+ and Mg^{2+}

(Total for question = 1 mark)

Q10.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

This question is about atoms, molecules and ions.

Which of these isoelectronic ions has the largest ionic radius?

(1)

- A N^{3-}
- B O^{2-}
- C Na^+
- D Al^{3+}

(Total for question = 1 mark)

Q11.

This question is about structure and bonding.

Ionic bonding is the strong electrostatic attraction between

(1)

- A anions and cations
- B atoms and delocalised electrons
- C cations and delocalised electrons
- D two nuclei and a shared pair of electrons

(Total for question = 1 mark)

Q12.

This question is about structure and bonding.

The names of four substances are given.

Substance	Name
P	copper
Q	iodine
R	silicon(IV) oxide
S	sodium chloride

(i) Which of these substances exists at room temperature as a giant lattice of oppositely charged ions?

(1)

- A Substance P
- B Substance Q
- C Substance R
- D Substance S

(ii) Which of these substances has a high melting temperature, **and** conducts electricity when solid and when molten?

(1)

- A Substance P
- B Substance Q
- C Substance R
- D Substance S

(Total for question = 2 marks)

Q13.

Magnesium oxide has a very high melting temperature.

Which of the following is the best description of its structure and bonding?

(1)

- A** giant ionic
- B** giant metallic
- C** giant covalent
- D** simple covalent

(Total for question = 1 mark)

Q14.

Diamond, graphene and graphite are different forms of carbon.

The bond angles within a layer of graphene and a layer of graphite are

(1)

- A** 90° and 109.5°
- B** all 109.5°
- C** 109.5° and 120°
- D** all 120°

(Total for question = 1 mark)

Mark Scheme

Q1.

Question Number	Answer	Mark
	<p>The only correct answer is C (poor electrical conductivity)</p> <p><i>A is not correct because both graphene and graphite are similar to diamond in having a high melting temperature</i></p> <p><i>B is not correct because neither graphene nor graphite nor diamond have a precise molecular formula since they are giant molecular structures</i></p> <p><i>C is not correct because graphene, graphite and diamond are all giant molecular structures</i></p>	(1)

Q2.

Question number	Answer	Mark
(i)	<p>The only correct answer is C (graph C)</p> <p><i>A is incorrect because HF has a much higher boiling temperature than expected due to hydrogen bonding</i></p> <p><i>B is incorrect because there is an increase in boiling temperature from HCl to HI as the number of electrons in the molecules increases so the London forces increase in strength</i></p> <p><i>D is incorrect because HBr has a higher boiling temperature than HCl as there are more electrons in the molecules</i></p>	(1)

Question number	Answer	Mark
(ii)	<p>The only correct answer is A (acid-base)</p> <p><i>B is incorrect there is no displacement taking place</i></p> <p><i>C is incorrect because neither substance is oxidised or reduced</i></p> <p><i>D is incorrect because there is no substitution taking place</i></p>	(1)

Q3.

Question Number	Answer	Mark
	<p>The only correct answer is C (hexagonal rings within a layer)</p> <p><i>A is not correct because in the layers of graphite and graphene the carbon atoms are bonded to three other carbon atoms and not four</i></p> <p><i>B is not correct because graphite and graphene do not have pentagonal rings within their layers</i></p> <p><i>D is not correct because graphene is a two-dimensional structure consisting of a single layer</i></p>	(1)

Q4.

Question Number	Answer	Mark
	<p>The only correct answer is D</p> <p><i>A is not correct because this is approximately the angle given in the diagram</i></p> <p><i>B is not correct because this is the angle for three bonds when there is also a lone pair on the central atom</i></p> <p><i>C is not correct because this is the angle when there are four pairs of bonding electrons around the central atom</i></p>	(1)

Q5.

Question Number	Answer	Mark
	<p>The only correct answer is A</p> <p><i>B is not correct because fluorine is very electronegative and has a suitable lone pair of electrons for hydrogen bonding.</i></p> <p><i>C is not correct because has hydrogen bonding; compare with water.</i></p> <p><i>D is not correct because alcohols can hydrogen bond; compare with water.</i></p>	(1)

Q6.

Question Number	Answer	Mark
	<p>The only correct answer is C</p> <p><i>A is not correct because it has a similar shape to water.</i></p> <p><i>B is not correct because it has a trigonal planar shape; resulting from the lone pair and two groups of electrons in the two double bonds.</i></p> <p><i>D is not correct because it is planar but not linear.</i></p>	(1)

Q7.

Question Number	Answer	Mark
	<p>The only correct answer is B</p> <p><i>A is incorrect because covalent bonds are within molecules not between molecules</i></p> <p><i>C is incorrect because there are no ionic bonds</i></p> <p><i>D is incorrect because London forces are not the strongest force</i></p>	(1)

Q8.

Question Number	Answer	Mark
(i)	<p>The only correct answer is D ($\text{Br}^+(\text{g}) - \text{e}^- \rightarrow \text{Br}^{2+}(\text{g})$)</p> <p><i>A is not correct because $\text{Br}(\text{g}) + \text{e}^- \rightarrow \text{Br}^-(\text{g})$ is an equation for first electron affinity</i></p> <p><i>B is not correct because $\text{Br}^-(\text{g}) + \text{e}^- \rightarrow \text{Br}^{2-}(\text{g})$ is an equation for second electron affinity</i></p> <p><i>C is not correct because $\text{Br}(\text{g}) - 2\text{e}^- \rightarrow \text{Br}^{2+}(\text{g})$ is an equation that combines first and second ionisations</i></p>	(1)

Question Number	Answer	Mark
(ii)	<p>The only correct answer is B (801, 2 427, 3 660, 25 026, 32 828)</p> <p><i>A is not correct because 738, 1 451, 7 733, 10 541, 13 629 is typical of Group 2 elements</i></p> <p><i>C is not correct because 1 086, 2 353, 4 621, 6 223, 37 832 is typical of Group 4 elements</i></p> <p><i>D is not correct because 1 402, 2 856, 4 578, 7 475, 9 445 could be for Group 5, 6, 7, 8 or transition elements</i></p>	(1)

Q9.

Question Number	Answer	Mark
	<p>The only correct answer is D (Na^+ and Mg^{2+})</p> <p><i>A is not correct because the chloride ion has an extra shell of electrons compared to the nitride ion</i></p> <p><i>B is not correct because the sulfide ion has an extra shell of electrons compared to the oxide ion</i></p> <p><i>C is not correct because the potassium ion has an extra shell of electrons compared to the sodium ion</i></p>	(1)

Q10.

Question Number	Answer	Mark
	<p>The only correct answer is A</p> <p><i>B is not correct because oxygen has more protons to exert an attractive force to reduce the ionic radius</i></p> <p><i>C is not correct because sodium has more protons to exert an attractive force to reduce the ionic radius</i></p> <p><i>D is not correct because aluminium has more protons to exert an attractive force to reduce the ionic radius</i></p>	(1)

Q11.

Question number	Answer	Mark
	<p>The only correct answer is A (anions and cations)</p> <p><i>B is incorrect because ionic bonding involves positive ions and negative ions</i></p> <p><i>C is incorrect because there are no delocalised electrons in ionic bonding</i></p> <p><i>D is incorrect because this is a description of covalent bonding</i></p>	(1)

Q12.

Question number	Answer	Mark
(i)	<p>The only correct answer is D (Substance S)</p> <p><i>A is incorrect because copper exists as a giant metallic lattice</i></p> <p><i>B is incorrect because iodine exists as a simple molecular lattice</i></p> <p><i>C is incorrect because silicon(IV) oxide exists as a giant covalent lattice</i></p>	(1)

Question number	Answer	Mark
(ii)	<p>The only correct answer is A (Substance P)</p> <p><i>B is incorrect because iodine has a low melting temperature and does not conduct electricity</i></p> <p><i>C is incorrect because silicon(IV) oxide does not conduct electricity</i></p> <p><i>D is incorrect because sodium chloride does not conduct electricity when solid</i></p>	(1)

Q13.

Question Number	Answer	Mark
	A (giant ionic)	(1)

Q14.

Question Number	Answer	Mark
	<p>The only correct answer is D (all 120°)</p> <p><i>A is not correct because the angles within a layer of graphite and graphene are neither 90° nor 109.5° but are all 120°</i></p> <p><i>B is not correct because the angles within a layer of graphite and graphene are not 109.5° but are all 120°</i></p> <p><i>C is not correct because there are no angles within a layer of graphite and graphene that are 109.5° but they are all 120°</i></p>	(1)