



Bonding & the Periodic Table Test



Answer ALL Questions. Max 50 marks. To Pass the Bonding & Periodic Table Test you will need to achieve a score of greater than 70%.

1. Iodine and diamond are both crystalline solids at room temperature. Identify one similarity in the bonding, and one difference in the structures, of these two solids.
Explain why these two solids have very different melting points.

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(Total 6 marks)

2. The table below shows the electronegativity values of some elements.

Element	H	C	N	O
Electronegativity	2.1	2.5	3.0	3.5

- (a) State the meaning of the term *electronegativity*.

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(2)

- (b) State the strongest type of intermolecular force in the following compounds.

Methane (CH₄)

Ammonia (NH₃)

(2)

- (c) Use the values in the table to explain how the strongest type of intermolecular force arises between two molecules of ammonia.

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(3)

- (d) Phosphorus is in the same group of the Periodic Table as nitrogen. A molecule of PH₃ reacts with an H⁺ ion to form a PH₄⁺ ion. Name the type of bond formed when PH₃ reacts with H⁺ and explain how this bond is formed.

Type of bond

Explanation

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(3)

- (e) Arsenic is in the same group as nitrogen. It forms the compound AsH₃. Draw the shape of an AsH₃ molecule, including any lone pairs of electrons. Name the shape made by its atoms.

Shape

Name of shape

(2)

- (f) The boiling point of AsH_3 is $-62.5\text{ }^\circ\text{C}$ and the boiling point of NH_3 is $-33.0\text{ }^\circ\text{C}$. Suggest why the boiling point of AsH_3 is lower than that of NH_3

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(1)

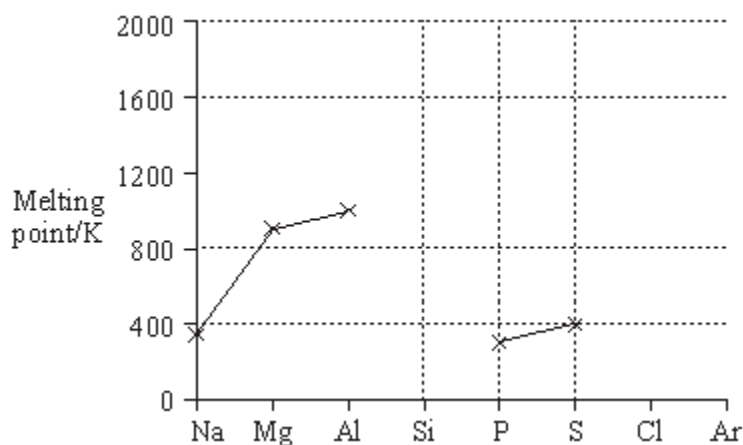
- (g) Balance the following equation which shows how AsH_3 can be made.



(1)

(Total 14 marks)

3. (a) The diagram below shows the melting points of some of the elements in Period 3.



- (i) On the diagram, use crosses to mark the approximate positions of the melting points for the elements silicon, chlorine and argon. Complete the diagram by joining the crosses.
- (ii) By referring to its structure and bonding, explain your choice of position for the melting point of silicon.

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(iii) Explain why the melting point of sulphur, S_8 , is higher than that of phosphorus, P_4

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(8)

(b) State and explain the trend in melting point of the Group II elements Ca–Ba.

Trend

Explanation

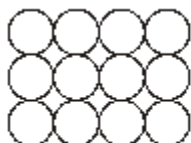
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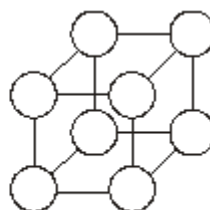
(Total 11 marks)

4. At room temperature, both sodium metal and sodium chloride are crystalline solids which contain ions.

(a) On the diagrams for sodium metal and sodium chloride below, mark the charge for each ion.



Sodium metal



Sodium chloride

(2)

(b) (i) Explain how the ions are held together in solid sodium metal.

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(ii) Explain how the ions are held together in solid sodium chloride.

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(iii) The melting point of sodium chloride is much higher than that of sodium metal. What can be deduced from this information?

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(3)

(c) Compare the electrical conductivity of solid sodium metal with that of solid sodium chloride. Explain your answer.

Comparison

Explanation

(3)

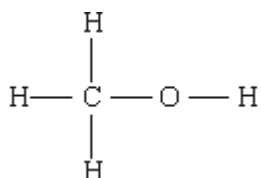
(d) Explain why sodium metal is malleable (can be hammered into shape).

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(1)

(Total 9 marks)

5. (a) Methanol has the structure



Explain why the O–H bond in a methanol molecule is polar.

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(2)

- (b) The boiling point of methanol is +65 °C; the boiling point of oxygen is –183 °C. Methanol and oxygen each have an M_r value of 32. Explain, in terms of the intermolecular forces present in each case, why the boiling point of methanol is much higher than that of oxygen.

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(3)

(Total 5 marks)

6. Predict which one of the following has the highest boiling temperature.

- A** $\text{CH}_3\text{COOCH}_2\text{CH}_3$
B $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
C $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
D $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$

(Total 1 mark)

7. Which one of the following has a shape which is **not** influenced by a lone pair of electrons?

- A** CH_3OH
B H_2F^+
C BF_3
D NF_3

(Total 1 mark)

8. Which one of the following molecules or ions is pyramidal in shape?

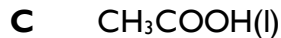
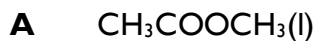


(Total 1 mark)

9. The ester methyl ethanoate is hydrolysed as shown in the following equation.



Which one of the following compounds from the reaction mixture has no hydrogen bonding between its molecules when pure?



(Total 1 mark)

10. Which one of the following molecules is **not** planar?



(Total 1 mark)