Bonding Practice Test

Mr Cole Chemistry

Name ..... Class: .....

Start Time ..... End Time ..... Time Taken .....

Time allowed: 50 minutes

INSTRUCTIONS TO CANDIDATES

Write your name in the space above.
Fill in the time you start and the time you finish the test.
Answer all the questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part of a question.
The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.

Success Criteria	Questions in Paper	Mark	Out of	%	Rank Order
Predict the charge on a simple ion and construct formulas for ionic compounds	1		1		
Understand the formation of bonds and how single bonds, double bonds and lone pairs can arise	N/A				
Understand the formation of co-ordinate bonds in molecules and be able to draw them using an arrow.	2, 4b, 5d		6		
Relate the properties of materials to the type of structure and the bonding present	3aii, 3bii, 3biii, 5f		4		
Explain the properties of metals including melting and boiling points of metals and their conductivity	3ai, 3bi, 3c, 3d		6		
Explain the shapes of molecules, including bond angles	4a, 4c, 5e, 5a		8		
Use partial charges to show that a bond is polar	5a		2		
Explain why some molecules with polar bonds do not have a permanent dipole.	(7)				
Explain how Van Der Waals forces arise and the factors that affect their strength	5bi, 6c		3		
Explain how permanent dipole-dipole interactions arise and the factors that affect their strength	7		6		
Explain how permanent hydrogen bonds arise and the factors that affect their strength	5bii, 5c, 5bi, 5bii		8		
Other topics	3ei, 3eii, 5g		4		
Total			48		

Q1.

What is the formula of calcium nitrate(V)?

A $CaNO_3$ ⬭

B $Ca(NO_3)_2$ ⬭

C Ca_2NO_2 ⬭

D $Ca(NO_2)_2$ ⬭

(Total 1 mark)

Q2.

Which molecule is **not** able to form a co-ordinate bond with another species?

A BH_3 ⬭

B CH_4 ⬭

C NH_3 ⬭

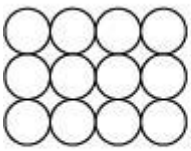
D H_2O ⬭

(Total 1 mark)

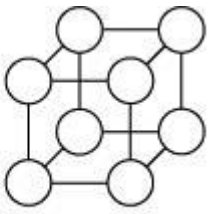
Q3.

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.

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(3)

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

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(1)

(e) Sodium chlorate(V), $NaClO_3$, contains 21.6% by mass of sodium, 33.3% by mass of chlorine and 45.1% by mass of oxygen.

(i) Use the above data to show that the empirical formula of sodium chlorate(V) is $NaClO_3$

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(ii) Sodium chlorate(V) may be prepared by passing chlorine into hot aqueous sodium hydroxide. Balance the equation for this reaction below.

..... Cl_2 + ... NaOH → ..... NaCl + $NaClO_3$ + 3H_2O

(3)

(Total 12 marks)

Q4.

Ammonia reacts with aluminium chloride as shown by the equation:

$$NH_3 + AlCl_3 \longrightarrow H_3NAlCl_3$$

(a) Draw diagrams to illustrate the shapes of NH_3 molecules and of $AlCl_3$ molecules.

Include in your diagrams any lone pairs of electrons that influence the shape.

Indicate the values of the bond angles.

(3)

(b) Name the type of bond formed between N and Al in H_3NAlCl_3 and explain how this bond is formed.

(2)

(c) Explain how the value of the Cl-Al-Cl bond angle in $AlCl_3$ changes, if at all, on formation of the compound H_3NAlCl_3

(2)
(Total 7 marks)

Q5.

The table below shows the electronegativity values of some elements.

	H	C	N	O
Electronegativity	2.1	2.5	3.0	3.5

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

(2)

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

Methane (CH_4) .....

Ammonia (NH_3) .....

(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 PH_3 reacts with an H^+ ion to form a PH_4^+ ion.
Name the type of bond formed when PH_3 reacts with H^+ and explain how this bond is formed.

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(3)

(e) Arsenic is in the same group as nitrogen. It forms the compound AsH_3
Draw the shape of an AsH_3 molecule, including any lone pairs of electrons. Name the shape made by its atoms.

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(2)

(f) The boiling point of AsH_3 is –62.5 °C and the boiling point of NH_3 is –33.0 °C.
Suggest why the boiling point of AsH_3 is lower than that of NH_3

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(1)

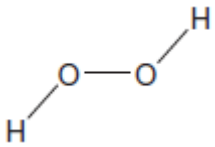
(g) Balance the following equation which shows how AsH_3 can be made.

..... $AsCl_3$ + ... $NaBH_4$ → ..... AsH_3 + ... NaCl + ... BCl_3

(1)
(Total 14 marks)

Q6.

A hydrogen peroxide molecule can be represented by the structure shown.



(a) Suggest a value for the H–O–O bond angle.

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(1)

(b) Hydrogen peroxide dissolves in water.

(i) State the strongest type of interaction that occurs between molecules of hydrogen peroxide and water.

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(1)

(ii) Draw a diagram to show how one molecule of hydrogen peroxide interacts with one molecule of water.
Include all lone pairs and partial charges in your diagram.

(3)

(c) Explain, in terms of electronegativity, why the boiling point of H_2S_2 is lower than H_2O_2.

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(2)
(Total 7 marks)

Q7.

The melting point of XeF_4 is higher than the melting point of PF_3

Explain why the melting points of these two compounds are different.

In your answer you should give the shape of each molecule, explain why each molecule has that shape and how the shape influences the forces that affect the melting point.

(Total 6 marks)