

Dr Clays A-level Chemistry

UNIT 1 TOPIC 3

STRUCTURE & BONDING

Dr Chris Clay
http://drclays-alevelchemistry.com/

Unit 1 Topic 3 – Structure & Bonding

EXERCISE 1 – dot-cross diagrams

Draw dot-cross diagrams for the following compounds:

1. $NaCl$
2. $MgCl_2$
3. Na_2O
4. MgO

Draw dot-cross diagrams for the following compounds:

5. Cl_2
6. NH_3
7. CH_4
8. $AlCl_3$
9. CO_2
10. H_2O

Draw dot-cross diagrams for the following compounds:

11. H_2SO_4
12. HNO_3
13. $NaNO_3$
14. NH_4Cl
15. NH_3AlCl_3

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EXERCISE 2 - prediction of bond type

Predict the type of bond formed between the following atoms, using electronegativity differences to explain your answers:

1. Cs and Cl
2. N and Al
3. Cl and Cl
4. Al and Al
5. Al and Cl
6. Al and F
7. Cu and Zn
8. Mg and N
9. C and O
10. C and H

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EXERCISE 3 - molecular shapes

Predict the shape of the following molecules, and suggest bond angles:

1. $BeCl_2$
2. BF_3
3. CH_4
4. PCl_3
5. H_2S
6. $SnCl_2$

Predict the shapes of the following molecules, and suggest bond angles:

7. CO_2
8. SO_2
9. SO_3
10. SF_6
11. XeF_4
12. PCl_5

Predict the shapes of the following ions, and suggest bond angles:

13. PCl_4^+
14. PCl_6^-
15. SO_4^{2-}
16. NO_3^-
17. NO_2^-
18. NH_4^+
19. SO_3^{2-}
20. CH_3^+
21. CH_3^-

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Exercise 4 – molecular shapes, polarity and intermolecular forces

1. Explain the meaning of the term electronegativity.

2. Draw the correct dipoles on the following covalent bonds:

   a) Cl – Cl

   b) H – O

   c) B – F

   d) N – F

   e) N – O

   f) H – Cl

   g) H – N

   h) B – H

3. Draw the following molecules, add dipoles to all the bonds and predict whether or not they have an overall dipole:

   a) CO_2

   b) SO_2

   c) BF_3

   d) NF_3

   e) Cl_2

   f) HCl

   g) H_2O

   h) H_2S

   i) $SiCl_4$

   j) PCl_3

   k) NH_3

   l) SO_3

4. Hence deduce the types of intermolecular force that can exist between the molecules

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EXERCISE 5 – Structure and bonding summary 1

Predict which of the following pairs of substances is likely to have the higher melting point, giving reasons for your choice:

1. Na and Mg
2. Na and K
3. NaCl and NaBr
4. NaCl and MgO
5. C and Si
6. Ne and Ar
7. F_2 and Cl_2
8. NH_3 and PH_3
9. NaCl and HCl
10. SiO_2 and CO_2

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EXERCISE 6 – Structure and bonding summary II

Describe the bonding in the following compounds, and briefly describe their main physical properties, limited to:

a) melting point
b) electrical conductivity

1. magnesium

2. diamond

3. silicon dioxide

4. magnesium oxide

5. carbon dioxide

6. graphite

7. sodium nitrate

8. water

9. sulphur dioxide

10. helium