**Year 12 Chemistry Topic Test # 2 (Bonding) - 2012**

Name: **ANSWERS**

# Part 1: Multiple Choice Section 10 marks

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1. **D** 2. **C** 3. **A** 4. **B** 5. **C** 6. **B** 7. **A** 8. **C** 9. **B** 10. **B ✓ each**

# Part 2: Short Answer Section 34 marks

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1. Nitrogen (N2) exists is a gas at room temperature. Nitrogen trichloride (NC3) exists as a

liquid at room temperature.

(a) Name the bonding that would exist in a container of each substance giving

reasons for your answer.

N2 **N-N bonds are covalent ✓**

**Intermolecular bonding is dispersion forces only as N2 molecules**

**are non-polar ✓**

NC3 **N-C bonds are covalent ✓**

**Intermolecular bonding is dipole-dipole and dispersion forces**

**– dipole-dipole because molecule is polar ✓**

**− dispersion forces because they occur between all particles ✓**

(5 marks)

2. Complete the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| *Species* | *Electron dot diagram* | *Name of shape* | *Polarity*  *(polar or non-polar)* |
| SO2 |  | **bent** | **polar** |
| HCN |  | **linear** | **polar** |
| SO42− | http://i1076.photobucket.com/albums/w451/Kr4yk3n/ChemistrySulfateIon.png | **tetrahedral** | N/A |
| PI3 |  | **pyramidal** | **polar** |

(11 marks)

3. The following table gives some information about three elements in the fourth row of the

Periodic Table.

|  |  |  |  |
| --- | --- | --- | --- |
| *Element* | *Electrical conductivity*  *(MS m–1)* | *First ionisation energy*  *(kJ mol−')* | *Melting point*  *(°C)* |
| Potassium | 14 | 425 | 63 |
| Calcium | 29 | 596 | 650 |
| Germanium | 1 x 10−4 | 762 | 938 |

(a) What type of bonding would you expect to occur in germanium?

**covalent network ✓**

(1 mark)

(b) Justify your answer.

**Poor electrical conductor, so can’t be metallic ✓**

**High melting point, so can’t be molecular ✓**

**Obviously not ionic, so ∴ covalent network ✓**

(3 marks)

(c) Explain the trend in ionisation energies of the elements above.

**Increasing nuclear charge (from K to Ca to Ge), with a similar degree of**

**shielding**

**∴ more energy required to remove e− from Ge than Ca than K. ✓**

(1 mark)

(d) Would the value of potassium’s second ionisation energy be larger or smaller than

that for calcium? Explain why.

**Larger ✓**

**The removal of 2nd e− from Ca is from the same (fourth) shell,**

**whereas K is from the third shell – less shielding, ∴ more strongly**

**attracted and more energy required ✓**

(2 marks)

4. Use your understanding of atomic structure and bonding to:

(a) Complete a sketch showing the boiling points of the hydrides of group 14 (———)

and group 17 (- - - - -) on the following graph.

2

3

4

5

Melting

Point

Period Number

**✓ mp of group 14 hydrides increasing**

**✓ mp of group 17 hydrides higher than group 14**

**✓ mp of group 17 hydrides increasing from period 3 to period 5**

**✓ mp of group 17 hydride in period 2 (HF) higher than period 3**

(4 marks)

(b) Explain the overall trend shown on the graph:

**Increasing mp with increasing size of molecules ✓**

**This is due to increasing strength of dispersion forces with increasing**

**size of molecule, as temporary dipoles become larger ✓**

(2 marks)

(c) Give reasons for any exceptions to this trend.

**HF has a particularly strong form of dipole-dipole attraction, called**

**hydrogen bonding.**

**This arises due to the great difference in electronegativity between**

**H and F and the small size of F. ✓**

(1 mark)

5. Using your knowledge of atomic structure and bonding explain the following physical data:

|  |  |
| --- | --- |
| *Substance* | *Solubility in water at 25°C (g L−1)* |
| 1-pentanol  (CH3CH2CH2CH2CH2OH) | 22.0 |
| 1-hexanol  (CH3CH2CH2CH2CH2CH2OH) | 5.9 |

**Water is polar molecule and contains with dispersion forces and hydrogen**

**bonding between molecules. ✓**

**Hydrogen bonding also exists between molecules of each alcohol, but**

**dispersion forces become more significant as the molecule becomes**

**larger (as the carbon chain increases in length). ✓**

**Only dispersion forces form between the carbon chain and water, which**

**are much weaker than hydrogen bonds between water and dispersion**

**forces between alcohols. ✓**

**As the alcohol size increases, solubility in water decreases. ✓**

(4 marks)

**End of Test**