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A' Level Chemistry
Year 1

Unit 3: Bonding

Summer Examination Revision Pack

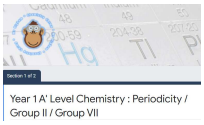
The questions in this pack should be attempted **AFTER** completing all other revision.

Grade Accelerator
Recall Definitions
Drawing Diagrams
Using Equations
Drawing Graphs

Quizlet

Quizlet Classes
Flashcard Based
Games
Tests & Quizzes
Keyword Spell Checker

Condensed Notes
Keywords & Definitions
Key Concepts
Application
Key Skills



Online Forms
Take Time to Answer
Use Paper & Calculator
Work It Out
Review Missed Marks

Use the 3 Wave Process when completing these revision packs.

1. Complete the questions without assistance
(Can't answer a question? Leave it and move on)
2. Use your notes to fill any gaps after step 1
3. Use the mark scheme to fill in any remaining gaps.

1. Having gaps after step 1 is normal, that's why we are doing revision!
2. If your notes don't help during step 2, they are not good enough!
(Change your note taking method and try to understand the problem)
3. If you don't understand why the mark scheme answer is correct, **see Andy.**

If you struggle with the questions in the pack, **STOP!** and complete some more revision.

If you come to a complete dead-end, **STOP!** and speak to **Andy** asap.

4 **Table 2** shows some data about the elements bromine and magnesium.

Table 2

Element	Melting point / K	Boiling point / K
Bromine	266	332
Magnesium	923	1383

0 4 . 1 In terms of structure and bonding explain why the boiling point of bromine is different from that of magnesium. Suggest why magnesium is a liquid over a much greater temperature range compared to bromine.

[5 marks]

Question	Marking Guidance	Mark	Comments
04.1	Structures **M1** Bromine is (simple) molecular / simple molecules **M2** Magnesium is metallic / consists of (positive) ions in a (sea) of delocalised electrons Strength **M3** Br_2 has weak (van der Waals) forces between the molecules / weak IMFs **M4** so more energy is needed to overcome the Stronger (metallic) bonds or converse. The comparison could be direct or implied. Liquid range **M5** Mg has a much greater liquid range because forces of attraction in liquid / molten metal are strong(er) OR converse argument for Br_2	1 1 1 1 1	Chemical Error penalties If Br_2 (covalent) bonds broken lose M3 and M4 If eg Mg molecules or Mg ionic bonds lose M2 and M4 Must refer to liquid range to score M5

Do not write outside the box

Section A

Answer **all** questions in this section.

0 1 This question is about compounds that contain fluorine.

0 1 . 1 Sodium fluoride contains sodium ions (Na^+) and fluoride ions (F^-).
Na^+ and F^- have the same electron configuration.

Explain why a fluoride ion is larger than a sodium ion.

[2 marks]

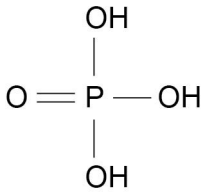
0 1 . 2 Explain, in terms of structure and bonding, why the melting point of sodium fluoride is high.

[2 marks]

Question 1 continues on the next page

Question	Marking guidance	Additional Comments/Guidelines	Mark
01.1	Fluoride ion has (two) fewer protons/lower nuclear charge Weaker attraction between nucleus and (outer) electrons	Do not allow fluorine, but allow fluorine ion Any reference to different numbers of electrons in the ions loses M1 Allow answers in terms of sodium ion but must be explicit. Ignore references to atomic radius	1 1
01.2	(Electrostatic) forces of attraction between oppositely charged ions/Na^+ and F^- Lots of energy needed to overcome/break forces	Mention of IMF, covalent, macromolecular, metallic, electronegativity of ions loses both marks Allow strong ionic bonding Allow strong forces/bonds of attraction (need to be broken)	1 1

0 7 . 5 Cyclohexene is prepared by the dehydration of cyclohexanol using concentrated phosphoric acid as a catalyst. The structure of concentrated phosphoric acid is shown.



Identify the factors that influence the boiling points of each of the compounds in this reaction mixture. State how and explain why cyclohexene can be separated from the reaction mixture.

[6 marks]

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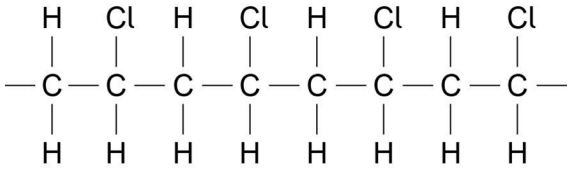
Question	Marking Guidance	Mark	Comments
07.5	**M1** cyclohexene : van der Waals' forces (between molecules) **M2** cyclohexanol : hydrogen bonds (between molecules) **M3** phosphoric acid: hydrogen bonds (between molecules) **M4** idea that cyclohexene has weakest forces **M5** separated by (simple / fractional) distillation **M6** cyclohexene has lowest boiling point / boils off first	1 1 1 1 1 1	Extended response Maximum of 5 marks for answers which do not refer to the van der Waals forces or hydrogen bonds being between molecules in some way **M1** penalise reference to presence of other intermolecular forces **M1** allow vdW forces (on this occasion) **M1/2/3** penalise reference to breaking covalent bonds **M2** & **M3** ignore reference to van der Waals and/or (permanent) dipole-dipole forces **M2** allow use of term H bonds (on this occasion) **M4** allow converse argument **M4** & **M6** – allow correct comparison of cyclohexene forces and boiling point to one of the other two compounds if only one of cyclohexanol or phosphoric acid discussed

0 9 Chloroethene can be polymerised to form poly(chloroethene), commonly known as PVC. This polymer can be used to make pipes, window frames and electrical insulation. Plasticisers can be added to change the properties of PVC

A section of poly(chloroethene) is shown.



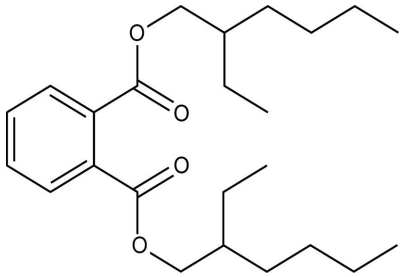
0 9 . 1 Chloroethene has a melting point of −154 ºC

All types of PVC melt at temperatures over 100 ºC

Explain why PVC melts at a higher temperature than chloroethene.

[2 marks]

0 9 . 2 This structure shows a molecule that has been used as a plasticiser in PVC.



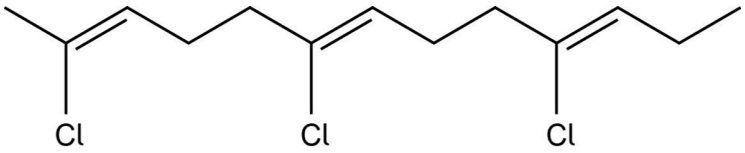
Deduce the number of hydrogen atoms in this molecule.

[1 mark]

0 9 . 3 Use your understanding of the properties of PVC to explain whether you would expect to find a plasticiser in the PVC used to insulate electrical cables.

[1 mark]

0 9 . 4 A section of the polymer poly(chloroprene), a synthetic rubber, is shown.



Draw the **displayed** formula for the repeating unit of poly(chloroprene).

[1 mark]

Turn over for the next question

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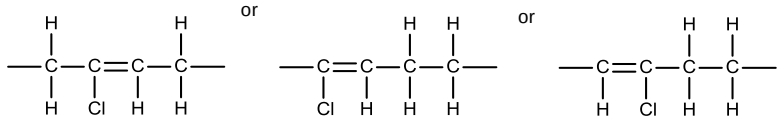
Question	Marking Guidance	Mark	Comments
09.1	**M1** it / PVC is bigger/longer molecule / has more electrons / has bigger surface area / greater M_r **M2** it / PVC has stronger (van der Waals' / dipole-dipole) forces <u>between molecules</u> / <u>intermolecular</u> forces	1 1	**M1** and **M2** independent of each other CE = 0 if reference to hydrogen bonds or breaking of covalent bonds when substances are melted Comparison must be implied in **M1** or **M2** to score 2 marks If there is no comparison at all, then 1 mark could score either for explaining that PVC has strong <u>intermolecular</u> forces due to being a big/long molecule / having many electrons / large surface area / large M_r, or, for explaining that chloroethene has weak <u>intermolecular</u> forces due to being a small/short molecule / having few electrons / low surface area / low M_r,
09.2	38	1	ignore additional words
09.3	Need both ideas that • it is present AND • because PVC needs to be flexible / bendy	1	penalise incorrect properties
09.4	Displayed structure required 	1	ignore any bracket or n

Do not write outside the box

0 4 This question is about pentan-2-ol and pent-1-ene.

0 4 . 1 The boiling point of pentan-2-ol is 119 °C
The boiling point of pent-1-ene is 30 °C

Explain why pentan-2-ol has a higher boiling point than pent-1-ene.

[3 marks]

Question	Marking guidance	Additional Comments/Guidelines	Mark
04.1	**M1** idea that pentan-2-ol has stronger intermolecular forces **M2** pent-1-ene has van der Waals' forces (only) **M3** pentan-2-ol (also) has hydrogen bonds	**M1** idea that hydrogen bonds are stronger than van der Waals' forces Penalise **M1** for any reference to idea of breaking covalent bonds **M2** allow London forces or temporary/induced dipole forces or vdW forces for van der Waals' forces **M3** Ignore reference to dipole-dipole forces in pentan-2-ol	1 1 1

Do not write outside the box

0 4 This question is about intermolecular forces.

0 4 . 1 Complete the diagram to show how one molecule of ammonia can form a hydrogen bond with one molecule of ethanol.
Include all lone pairs of electrons and partial charges on atoms involved in the hydrogen bond.

[3 marks]

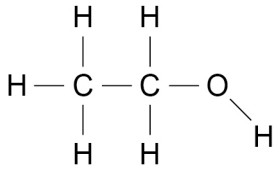


Table 3 shows the electronegativity values of atoms of some elements.

Table 3

Atom	H	C	N	O	Br
Electronegativity	2.1	2.5	3.0	3.5	2.8

0 4 . 2 Define the term electronegativity.

[1 mark]

0 4 . 3 Deduce the **two** atoms from **Table 3** that will form the most polar bond.

[1 mark]

Do not write outside the box

0 4 . 4 The C–Br bond is polar.

Explain why CBr_4 is **not** a polar molecule.

[2 marks]

0 4 . 5 Suggest, in terms of the intermolecular forces for each compound, why CBr_4 has a higher boiling point than $CHBr_3$

[3 marks]

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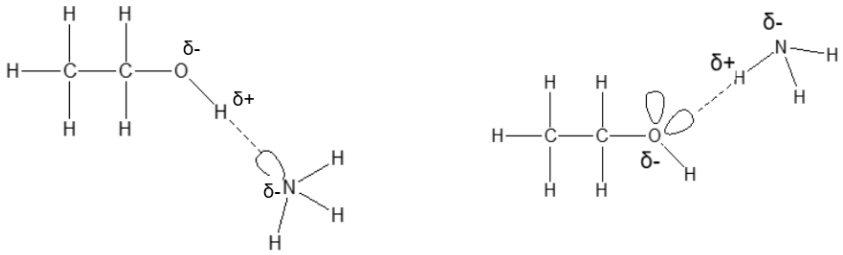
Turn over for the next question

Question	Marking guidance	Additional Comments/Guidelines	Mark
04.1	 M1 –lone pairs and partial charges (δ–, δ+, δ–) on atoms involved in the hydrogen bond M2 – dotted line between lone pair on N/O to correct H M3 – linear O–H···N / linear N–H···O	Ignore partial charges on C-H	1 1 1 (3 x AO2)

Question	Marking guidance	Additional Comments/Guidelines	Mark
04.2	The (relative) tendency of an atom to attract a pair of electrons/ the electrons/ electron density in a covlent bond	Allow Nucleus instead of atom Power of an atom to attract a bonding/shared pair of electrons Power of an atom to withdraw electron density from a covalent bond Not lone pair / element	1 (AO1)

Question	Marking guidance	Additional Comments/Guidelines	Mark
04.3	H and O	O–H	1 (AO2)

Question	Marking guidance	Additional Comments/Guidelines	Mark
04.4	M1 the molecule is completely symmetrical / the molecule is tetrahedral / there is an even distribution of electron density M2 the dipoles cancel out	 Do not allow The polar bonds cancel out / no dipole moment / partial charges cancel	1 1 (2 x AO2)

Question	Marking guidance	Additional Comments/Guidelines	Mark
04.5	M1 CBr_4 has van der Waals' forces between molecules M2 $CHBr_3$ has van der Waals' forces and dipole-dipole intermolecular forces M3 The van der Waals' between CBr_4 molecules are stronger than the dipole-dipole and van der Waals' forces between $CHBr_3$ (because it has a larger mass/more electrons/larger electron cloud) OR The intermolecular forces between CBr_4 molecules are stronger than the intermolecular forces between $CHBr_3$	M3 cannot be awarded if mention of breaking bonds	1 1 1 (3 x AO2)