HOME PRACTICE 1.7

1. The diagram shows a periodic arrangement for elements 1 to 20.

							He
				B	C	N	O	F	Ne
Li	Be			Al	Si	P	S	Cl	Ar
Na	Mg								
K	Ca								

From this table, name three:

(a) metallic elements. (1)

(b) monatomic elements. (1)

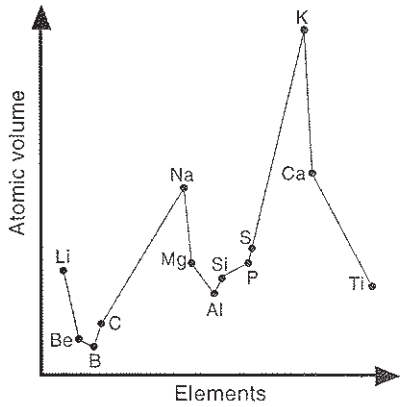
(c) molecular elements which are not diatomic. (1)

(d) diatomic elements. (1)

(e) covalent network elements. (1)

2. In 1869 a scientist called Meyer was trying to show the **periodic** nature of the elements.

He published a graph showing atomic volume.



(a) On what basis did he order the elements along the x-axis? (1)

(b) What is **periodic** about this graph? (1)

3. Also in 1869 a scientist called Mendeleev was thinking along the same lines. He constructed a table to show the periodic nature of the elements.

(a) For what **two** reasons did Mendeleev leave gaps in this table? (1)

(b) Why did he **not** leave a space in his table for the noble gases? (1)

TOTAL **(10)**

Mark your answers by using the Answer Check.

CHALLENGE CHEMISTRY

– Higher –

SECTION 1

ELEMENTS & BONDING

HOME PRACTICE

The "Home Practice" problems are for doing at home. They follow exactly the lesson topics of the section.

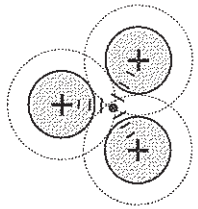
It is good practice to look again at a lesson topic just a short time afterwards, for example – the evening of the same day.

The "Home Practice" problems are designed to help you do that. As each lesson topic is covered in school, then the corresponding "Home Practice" should be done within two days at home.

By doing this consistently, you help to build yourself a memory bridge for the future.

HOME PRACTICE 1.1

1. The diagram illustrates the nature of the metallic bond.



negatively	mobile	electrostatic
positively	ductile	neighbouring

Select the appropriate words to complete the following sentence description.

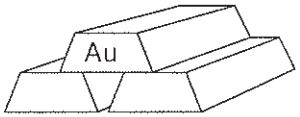
The metallic bond is the ...(a)... attraction between the ...(b)... charged ...(c)... electrons and the ...(d)... charged nuclei of ...(e)... atoms. (5)

2. Trends in boiling points of metals can be related to their bonding and position in the periodic table.

Select the appropriate word from **increases / decreases** to complete the following sentence about alkali metals.

On going down column 1, the boiling point of these metals ...(a)... because the distance of the outermost electron from the nucleus ...(b)... and therefore the strength of the metallic bond ...(c)... . (3)

3. Gold is a good example of a metal which is malleable.



(a) What does malleable mean? (1)

(b) How is it possible for gold atoms to move without them becoming separated? (1)

TOTAL (10)

Mark your answers by using the Answer Check.

HOME PRACTICE 1.6

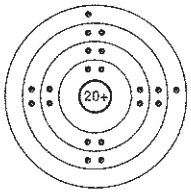
1. Ionisation energies are used by scientists to help understand about the energies of electrons in atoms.

(a) What is meant by the first ionisation energy of nitrogen? (1)

(b) Write the symbol equation for this change. (1)

(c) Write the symbol equation for the second ionisation energy of nitrogen. (1)

2. The diagram shows the target picture for an atom of calcium.



(a) What electron is involved in the first ionisation of calcium? (1)

(b) What is meant by **electron screening** effect? (1)

3. This simplified diagram shows the relative positions of four elements in the periodic table.

Li	Ne
Cs	Rn

(a) From their positions, will the first ionisation energy of neon be higher or lower than that of lithium? (1)

(b) Explain why. (1)

(c) From their positions, will the first ionisation energy of caesium be higher or lower than that of lithium? (1)

(d) Explain why. (1)

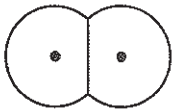
(e) Which of the four elements will have the highest ionisation energy? (1)

TOTAL (10)

Mark your answers by using the Answer Check.

HOME PRACTICE 1.5

1. The diagram shows a Dalton-type picture of a bromine molecule.



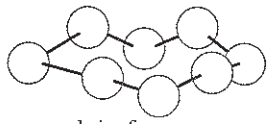
   (a) Why is it not easy to define the size of an atom in a molecule? **(1)**

   (b) What is the covalent radius of an atom defined as? **(1)**

   (c) Illustrate this by drawing a large diagram of a diatomic molecule and clearly marking the covalent radius on it. **(1)**

   (d) What is meant by the van der Waals radius of an atom? **(1)**

2. The covalent radius of sulphur is **104 pm** and the van der Waals radius is **190 pm**.



   (a) What will be the distance between the two nuclei of neighbouring atoms in the ring. **(1)**

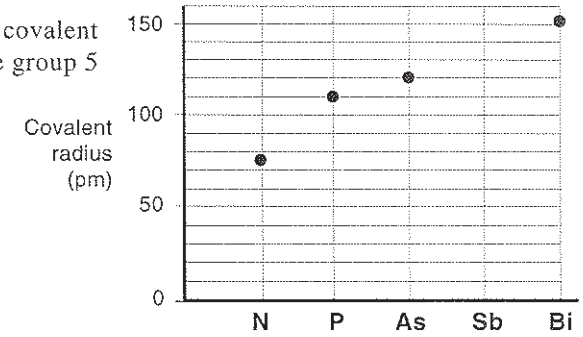
   (b) What will be the closest distance between the centres of sulphur atoms in neighbouring molecules. **(1)**

3. The covalent radii going across a period in the periodic table exhibit a regular trend.

   (a) Describe this trend. **(1)**

   (b) Explain why this occurs. **(1)**

4. This graph plots the covalent radii for some of the group 5 elements.



   (a) From the graph what value would you predict for the covalent radius of antimony (Sb)? **(1)**

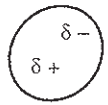
   (b) Explain the trend seen in the graph. **(1)**

TOTAL **(10)**

Mark your answers by using the Answer Check.

HOME PRACTICE 1.2

1. This diagram shows a neutral atom in which a small dipole has arisen.



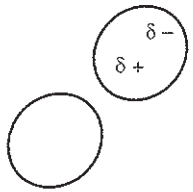
   (a) What do the δ+ and δ– signs stand for? **(1)**

   (b) What does the term **dipole** mean? **(1)**

   (c) What causes the dipole to arise? **(1)**

   (d) Why is this kind of dipole said to be momentary or fleeting? **(1)**

2. A momentary dipole in one atom can induce a momentary dipole in a neighbouring atom.



   (a) What effect does the δ+ side of the first atom have on its neighbour? **(1)**

   (b) Draw the diagram of the two atoms to show the induced dipole. **(1)**

   (c) How does this lead to attraction between the two atoms? **(1)**

   (d) What is this type of attractive force called? **(1)**

3. Of the monatomic elements, radon has the largest atoms.

   How does this explain why radon has the highest melting point of these elements? **(2)**

TOTAL **(10)**

Mark your answers by using the Answer Check.

HOME PRACTICE 1.3

1. Sulphur is an example of a molecular solid.

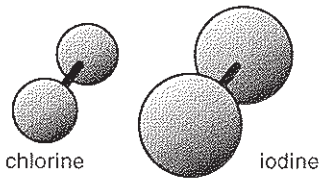
(a) What is the formula of the sulphur molecule? **(1)**

(b) Draw a sketch of the sulphur molecule. **(1)**

(c) What type of bonding holds the **atoms** together within the molecule? **(1)**

(d) What type of bonding holds the **molecules** together within the solid? **(1)**

2. Chlorine and iodine are both molecular elements belonging to the halogen family.

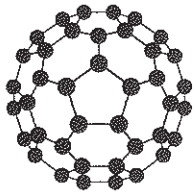


(a) What term is applied to molecules that have only two atoms? **(1)**

(b) Why does chlorine have a lower boiling point than iodine? **(1)**

(c) Why does chlorine also have a much lower boiling point than sulphur? **(1)**

3. Molecular forms of carbon have now been discovered. The diagram shows **part** of a carbon molecule.



(a) What name has been applied to the various molecular forms of carbon? **(1)**

(b) What is the molecular formula of the molecule which is partly illustrated in the diagram? **(1)**

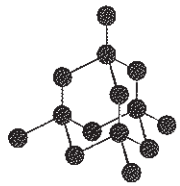
(c) What makes this type of carbon have a low density? **(1)**

TOTAL **(10)**

Mark your answers by using the Answer Check.

HOME PRACTICE 1.4

1. The diagram illustrates the bonding structure in diamond.



(a) What type of bonding holds the atoms together in diamond? **(1)**

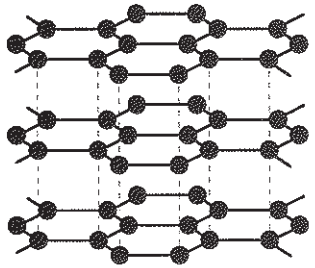
(b) Why is it not possible to identify discrete molecules in the structure of diamond? **(1)**

(c) Why is diamond **not** malleable like metals? **(1)**

(d) Why is diamond **not** able to conduct electricity? **(1)**

(e) What property of diamond makes it useful as a glass cutter? **(1)**

2. The diagram illustrates the bonding structure in graphite.



(a) What element is graphite? **(1)**

(b) What type of bonding holds the layers together in the structure? **(1)**

(c) Why is graphite able to conduct electricity? **(1)**

(d) Why are the layers in graphite able to slide easily? **(1)**

(e) What **two** properties of graphite make it useful for the electric contacts to the rotating parts of electric motors? **(1)**

TOTAL **(10)**

Mark your answers by using the Answer Check.

ANSWER CHECK 1.7

1. **(a)** Any 3 from: lithium, beryllium, sodium, magnesium, aluminium, potassium, and calcium
[3 correct (**1**), 2 correct (½), otherwise (**0**)] (1)

(b) Helium, neon, and argon
[3 correct (**1**), 2 correct (½), otherwise (**0**)] (1)

(c) Phosphorus, sulphur, and fullerene
[3 correct (**1**), 2 correct (½), otherwise (**0**)] (1)

(d) Any 3 from: hydrogen, nitrogen, oxygen, fluorine, and chlorine
[3 correct (**1**), 2 correct (½), otherwise (**0**)] (1)

(e) Boron, silicon, and carbon (diamond or graphite)
[3 correct (**1**), 2 correct (½), otherwise (**0**)] (1)

2. **(a)** Atomic mass (1)

(b) The shape of the graph repeats. (1)

3. **(a)** Because some elements had yet to be discovered. (**1**)
To allow the known elements to match up properly in terms of their properties. (**1**) (2)

(b) Not even one noble gas had been discovered so there was no way at all of telling of their existence. (1)

TOTAL (**10**)

Learn from any mistakes by checking over all wrong answers.
Ask your teacher about anything you still do not understand.

CHALLENGE CHEMISTRY

– Higher –

SECTION 1

ELEMENTS & BONDING

ANSWER CHECK

FOR

HOME PRACTICE

QUESTIONS

Checking your answers is an important part of the learning process.

You should check out every mistake, even if it is just one mark.

If you still do not understand a question, even after studying this answer check, then ask your teacher.

ANSWER CHECK 1.1

1. **(a)** electrostatic (1)

(b) negatively (1)

(c) mobile (1)

(d) positively (1)

(e) neighbouring (1)

2. **(a)** decreases (1)

(b) increases (1)

(c) decreases (1)

3. **(a)** Able to be shaped by beating (or hitting) (1)

(b) The metallic bond can move round in any direction. (1)

TOTAL **(10)**

Learn from any mistakes by checking over all wrong answers.
Ask your teacher about anything you still do not understand.

ANSWER CHECK 1.6

1. **(a)** The energy to remove one electron from every atom in a mole of free nitrogen atoms (1)

(b) $N(g) \rightarrow N^+(g) + e^-$ (1)

(c) $N^+(g) \rightarrow N2^+(g) + e^-$ (1)

2. **(a)** One of the two **outermost** electrons (1)

(b) The inner electrons screen (or shield) the outermost electrons from the full attractive force of the nucleus. (1)

3. **(a)** Higher (1)

(b) Because of the greater attraction of the more positive nucleus (1)

(c) Lower (1)

(d) Because the outermost electron is further from the nucleus (½) and screened from it by more layers (or shells) of electrons (½). (1)

(e) Neon (1)

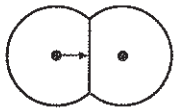
TOTAL **(10)**

Learn from any mistakes by checking over all wrong answers.
Ask your teacher about anything you still do not understand.

ANSWER CHECK 1.5

1. **(a)** There is no clear-cut edge to an atom. **(1)**

(b) Half the distance between the nuclei of covalently bonded atoms **(1)**

(c)  **(1)**

(b) Half the distance between the nuclei of "touching" atoms which are not bonded **(1)**

2. **(a)** 208 pm **(1)**

(b) 380 pm **(1)**

3. **(a)** Decreasing from left to right **(1)**

(b) The increasing nuclear charge pulls the outermost electrons in more strongly. **(1)**

4. **(a)** 135 (± 5) pm **(1)**

(b) Each atom has one more energy level (or shell of electrons) making the outermost electron further from the nucleus. **(1)**

TOTAL **(10)**

Learn from any mistakes by checking over all wrong answers.
Ask your teacher about anything you still do not understand.

ANSWER CHECK 1.2

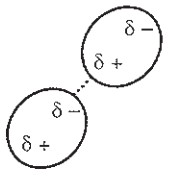
1. **(a)** Slightly positive (½) and slightly negative (½) **(1)**

(b) Two electric poles (or sides) **(1)**

(c) The electron cloud wobbling (or vibrating) **(1)**

(d) Because the wobble keeps changing (so the dipole keeps changing too). **(1)**

2. **(a)** It attracts the electron cloud. **(1)**

(b) 

(1)

(c) The opposite charges of the δ+ on one atom is attracted to the δ– of the other. **(1)**

(d) It is called van der Waals force. **(1)**

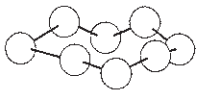
3. The larger the atom the greater the wobble of the electron cloud (½) giving a greater dipole effect (½) resulting in stronger attraction between the atoms (½) so more heat energy is needed to overcome these forces when melting the solid (½). **(2)**

TOTAL **(10)**

Learn from any mistakes by checking over all wrong answers.
Ask your teacher about anything you still do not understand.

ANSWER CHECK 1.3

1. **(a)** S_8 **(1)**

(b)  **(1)**

(c) Covalent **(1)**

(d) Van der Waals **(1)**

2. **(a)** Diatomic **(1)**

(b) The atoms are smaller (½) so the van der Waals attractions are weaker (½). **(1)**

(c) It has fewer atoms (½) so there are fewer van der Waals attractions (½). **(1)**

3. **(a)** Fullerenes **(1)**

(b) C_{60} **(1)**

(c) The large space inside each molecule **(1)**

TOTAL **(10)**

Learn from any mistakes by checking over all wrong answers.
Ask your teacher about anything you still do not understand.

ANSWER CHECK 1.4

1. **(a)** Covalent **(1)**

(b) The covalent bonding extends throughout the entire structure. **(1)**

(c) The covalent bonds are fixed in position (or the covalent bonding cannot move like metallic bonding). **(1)**

(d) It does not have any delocalised electrons.
(OR It has no free-moving electrons.) **(1)**

(e) It is very hard. **(1)**

2. **(a)** Carbon **(1)**

(b) Van der Waals forces **(1)**

(c) It has delocalised electrons.
(OR There are free-moving electrons in the structure.) **(1)**

(d) The bonding **between** the layers is weak. **(1)**

(e) Conduction **and** slipperiness (ability to slide). **(1)**

TOTAL **(10)**

Learn from any mistakes by checking over all wrong answers.
Ask your teacher about anything you still do not understand.

