ASPIRE
INTERNATIONAL SCHOOL

Science Department

2023/2024

Year 8

Term 1

Model answer of Workbook questions

Unit 2

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Model answer of Workbook questions

Topic 2.1 Atomic structure and the Periodic Table

Exercise 2.1 Atomic structure

1 12

2 14

3 aluminium

4 neon

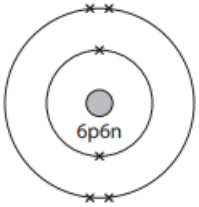
5 Atomic number = 5; Mass number = 11; Number of protons = 5; Number of neutrons = 6; Number of electrons = 5

6 a 6

b 6

c 6

d



7

Element	Atomic number	Mass number	Protons	Neutrons	Electrons	Electronic structure
beryllium	4	9	4	5	4	2,2
phosphorus	15	31	15	16	15	2,8,5
calcium	20	40	20	20	20	2,8,8

8 The atomic number increases by 1 every time you move along to the next element in the Periodic Table.

The mass number increases in most cases (except between argon and potassium where the mass number decreases by 1) but the increase is not by a fixed number each time.

9 calcium and argon

10 Accept helium, nitrogen, oxygen or neon.

11

Element	Potassium
atomic number	19
mass number	39
number of protons	19
number of neutrons	20
number of electrons	19
electronic structure	2, 8, 8, 1

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Topic 2.2 Trends in groups within the Periodic Table

Exercise 2.2A Elements in the same group

1 The number of protons increases.

2 The mass number increases.

3 Atomic number = 11; Mass number = 23; Number of protons = 11; Number of neutrons = 12; Number of electrons = 11

4 2, 8, 1

5 They have the same number of electrons (one) in the outer shell and both have 2 in the inner shell and both have 2 in the inner shell.

6 Atomic number = 19; Mass number = 39; Number of protons = 19; Number of neutrons = 20; Number of electrons = 19

7 2, 8, 8, 1

8 All three atoms have one electron in the outer shell, and two in the inner shell.

9 The atoms get larger / there are more electron shells as you go down the group. The atoms have a larger mass / more protons and neutrons as you go down the group.

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Exercise 2.2B Trends in groups in the Periodic Table

1 A group in the Periodic Table is a column of elements.

2 **a** Watch out for any confusion in understanding that −7 °C is a higher temperature than −220 °C.

The trends are:

- the melting points increase as you go down the group
- the boiling points increase as you go down the group
- the elements become less reactive as you go down the group.

b The melting point of iodine will be higher than that of bromine.

c Iodine is a solid at room temperature. This is because the melting point of iodine is likely to be more greater than room temperature (around 22 °C). The table shows very large changes in melting points between the elements in the group.

The melting point of bromine is −7 °C so the melting point of iodine would be expected to be much higher than that.

d Iodine would have a much lower boiling point than astatine. (The trend in the group is that the further down you go, the more the boiling point increases.)

e Astatine is less reactive than iodine as it is below iodine in Group 7.

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Exercise 2.2C Comparing the trends in Groups 1 and 7

1 The melting point decreases.

2 The melting point increases. This is the opposite of what happens in Group 1. (Watch out for any confusion in understanding that −7 °C is a higher temperature than −220 °C.)

3 In Group 1, the boiling point decreases as the atomic number increases, whereas in Group 7, the boiling point increases as the atomic number increases.

4 In Group 1, the least reactive element is the one with the smallest atom; the most reactive is the one with the largest atom. In Group 7, the least reactive element is the one with the largest atom; the most reactive is the one with the smallest atom.

5 Rubidium, Group 1: Students should predict that:

- it will be more reactive than the other elements shown (as it has a larger atom)
- it will have a lower melting point
- it will have a lower boiling point

Iodine, Group 7: Students should predict that:

- it will be less reactive than the other elements shown (as it has a larger atom)
- it will have a higher melting point
- it will have a higher boiling point.

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Topic 2.3 Why elements react to form compounds

Exercise 2.3A Atoms and ions

1 The outer shell of the atom should be labelled as the highest energy level.

2 Diagram should have a nucleus, and one shell with two electrons.

3 Li^+

4 Diagram should have two shells, with electron structure 2,8 and a nucleus.

5 F^-

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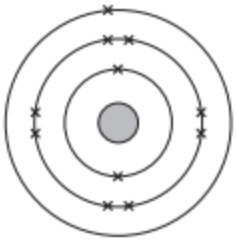
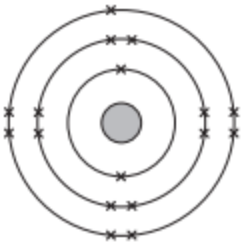
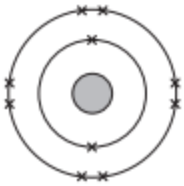
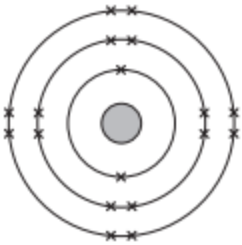
1

sodium: atomic number 11 mass number 23	chlorine: atomic number 17 mass number 35
sodium atom:  The learners must place the electron crosses in the correct shells but they can be anywhere in those shells.	chlorine atom:  The learners must place the electron crosses in the correct shells but they can be anywhere in those shells.
sodium ion:  The learners must place the electron crosses in the correct shells but they can be anywhere in those shells.	chlorine ion:  The learners must place the electron crosses in the correct shells but they can be anywhere in those shells.

2 The electrons are held in place by the electrostatic forces between the protons and the electrons.

3 Ions are formed because the outer shells of the atoms are not full and that makes the atom less stable. The atoms can form full shells by losing or gaining electrons.

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Exercise 2.3C Forming ionic compounds

1 a Calcium **atom** diagram should have a nucleus, **four** shells, with electron structure **2,8,8,2**.

Chlorine **atom** diagram should have a nucleus, **three** shells, with electron structure **2,8,7**.

Diagrams must be labelled.

b Calcium **ion** diagram should have a nucleus, **three** shells, with electron structure **2,8,8**.

Chlorine **ion** diagram should have a nucleus, **three** shells, with electron structure **2,8,8**.

Diagrams must be labelled; learners may mark the chlorine ion as negatively charged and the calcium ion as positively charged.

c The calcium atom has two electrons in its highest energy shell. For the calcium atom to become more stable these two electrons must be lost. Chlorine has seven electrons in its highest energy level so only needs one electron to fill this shell. Two atoms of chlorine are needed to use the two electrons lost from the calcium atom so the formula for calcium chloride is $CaCl_2$ because two atoms of chlorine are needed for every one atom of calcium.

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Topic 2.4 Simple and giant structures

Exercise 2.4A Ionic or covalent bonds

1 Ionic bonding, because the particles are packed closely together in a lattice pattern.

2 Arrows should indicate the points where the large atom and the four small atoms in each molecule join. The label should read 'strong forces within each molecule'.

3 Substance B

4 Substance A

5 Ionic

6 covalent

7 Any correct example, such as graphite or silicon dioxide.

Exercise 2.4B Properties of ionic and covalent substances

1 Its melting and boiling points are high.

2 a gas

3 potassium chloride, calcium chloride and magnesium oxide

4 ammonia and bromine

5 Water; because it has a boiling point of 100 °C and a melting point of 0 °C.

6 bromine

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7 Magnesium oxide has high melting and boiling points because it is an ionic compound. The ions have strong forces holding them together in a lattice pattern. This means that a lot of energy is needed to overcome these forces and make the magnesium oxide melt or boil.

8 Ammonia has low melting and boiling points because, although the forces inside the molecules are strong, the forces between the molecules are weak and less energy is needed to overcome these intermolecular forces and make the ammonia melt or boil.

Exercise 2.4C Giant structures of carbon

1 diamond (left) and graphite (right)

2 The atoms of carbon in graphite are arranged in layers. The bonds between the carbon atoms in the layers are strong (each carbon atom bonds with three other atoms) but the bonds between the layers are weak. This means that the layers can slide over one another and the surface is soft and comes away. For example, when you write with a graphite pencil.

3 The atoms of carbon in diamond are arranged in a rigid, giant three-dimensional structure or lattice. This means that there are strong bonds throughout the whole structure and this is what makes diamond so hard.