Electron Arrangement

Chemistry Past Exam Questions

Higher Level

2013

Section B - Question 4 A

(*a*) Write the electron configuration (*s*, *p*, *etc*.) of a zinc atom in its ground state.

2012

Section B - Question 4 A

(*a*) State the number of (*i*) sub-levels (subshells), (*ii*) orbitals, occupied by electrons in an argon atom in its ground state.

Section B - Question 5

5. (*a*) Write the electron configuration (*s*, *p*) of an oxygen atom showing the arrangement of electrons in atomic orbitals. (5)

(*b*) Define *atomic radius* (*covalent radius*).

State and explain the trend in atomic radii (covalent radii) across the second period of the periodic table of the elements. (12)

(*c*) Give **one** reason why electronegativity values exhibit a general increase across the second period of the periodic table. (3)

(*d*) Consider the following hydrides of some of the elements from the second and third periods of the periodic table: **H_2O** **NH_3** **PH_3** **HCl**

(*i*) State how the bonding in **PH_3** differs from the bonding in the other three hydrides.

What is the reason for this difference in bonding?

(*ii*) From these four hydrides, identify the hydride or hydrides in which hydrogen bonding occurs between the molecules.

Give **one** property that is affected by the presence of intermolecular hydrogen bonding in the hydride or hydrides you have identified.

(*iii*) State the shape of the **PH_3** molecule and explain using electron-pair repulsion theory how this shape arises. (21)

(*e*) Boron trichloride (**BCl_3**) is a colourless gas. Would you expect (*i*) the **B–Cl** bonds, (*ii*) the **BCl_3** molecules, to be polar or non-polar? Justify your answers. (9)

2010

Section B - Question 4 A

(*a*) Write the electron configuration (*s, p, etc.*) of the oxygen (oxide) ion (O^{2-}).

Section B - Question 5

5. (*a*) State **two** assumptions of Dalton's atomic theory of 1808. (8)

(*b*) The electron was the first of the sub-atomic particles to be discovered. It was identified in experiments using cathode rays that were carried out in the late nineteenth century.

Name the scientist

(*i*) who, about 1897, measured the ratio of charge to mass of the electron, *e*/*m*,

(*ii*) who, about 1910, proved that the electrons in an atom reside in an electron cloud surrounding a small dense positive central nucleus,

(*iii*) who, about 1911, measured the charge on the electron, *e*. (9)

(*c*) The arrangement of the electrons in the electron cloud proposed in 1913 by Bohr, pictured on the right, was consistent with the hydrogen emission spectrum.

Outline Bohr's atomic theory based on the hydrogen emission spectrum. (15)

(*d*) State **two** limitations of Bohr's theory that led to its modification. (6)

(*e*) Define *atomic orbital*.

Draw the shape of the *p*-orbital.

State the maximum number of electrons that can be accommodated in a *p*-orbital. (12)

2007

Section B - Question 5

5. (*a*) Define *energy level*. (5)

Write the electron configuration (*s*, *p*) for the sulfur atom in its ground state, showing the arrangement in atomic orbitals of the highest energy electrons. (6)

State how many (*i*) energy levels, (*ii*) orbitals, are occupied in a sulfur atom in its ground state. (6)

(*b*) Use electronegativity values (Mathematical Tables p 46) to predict the type of bond expected between hydrogen and sulfur.
Write the chemical formula for hydrogen sulfide.
Use clear dot and cross diagrams to show the bonding in hydrogen sulfide. (15)

Would you expect the hydrogen sulfide molecule to be *linear* or *non-linear* in shape?
Justify your answer. (6)

(*c*) Hydrogen sulfide has a boiling point of 212.3 K and water has a boiling point of 373 K.
Account for the difference in the boiling points of these substances. (6)

Would you expect hydrogen sulfide to be soluble in water? Explain your answer. (6)