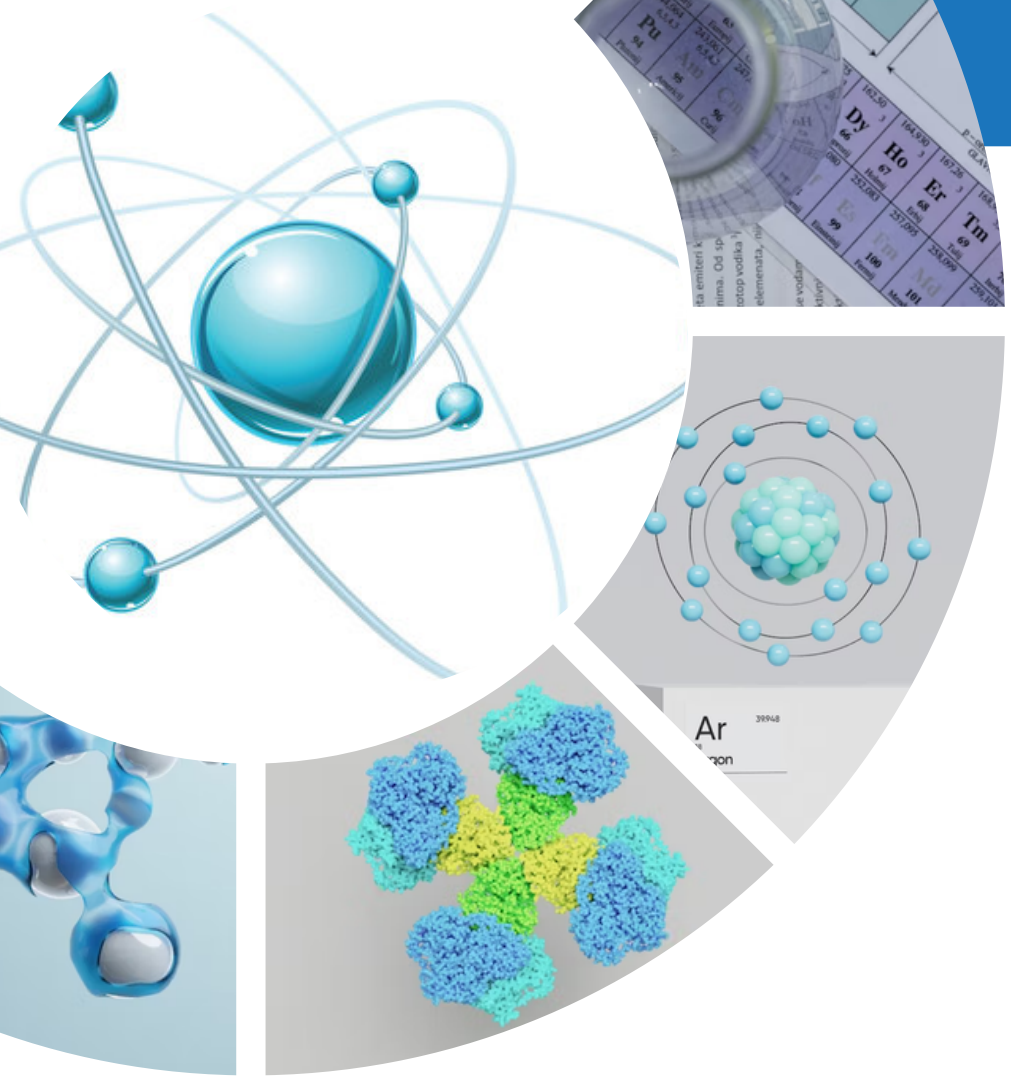
STUDY PACK 1.C



Pearson Edexcel

ATOMIC STRUCTURE

Since 2005
Chembase
School of Chemistry

First Edition Jan 2006
Second Edition Jun 2009
Third Edition Jun 2011
Fourth Edition Jun 2021 (Revised New Syllabus)

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UNIVERSITY OF CAMBRIDGE

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Atomic Structure

1. Describe the simple model of an atom

The atom is mostly empty space. It has a solid core known as nucleus in the center, which consists of protons and neutrons. The electrons circulate around the nucleus in specific orbitals or shells.

2. What are sub atomic particles? Describe each of them

Protons – Has a unit positive charge and a mass of 1 RAM, found in the nucleus.

Neutrons – Has a mass of 1 RAM and no charge found in the nucleus.

Electrons – Negligible mass, negatively charged, rotates around the nucleus.

3. State the masses & electric charges of sub atomic particles

Particle	Relative mass	Relative Charge

4. Describe the behavior of beams of protons, neutrons & electrons in electric fields

5. Define the terms "**Mass number**" & "**Atomic number**" of an atom & state their Inter relationship

Mass number (nucleon number) : The total of protons & neutrons of an atom

Atomic number (proton number) : Number of protons of an atom

The mass number is roughly double the atomic number

6. How do you calculate the number of neutrons in a given atom?

7. What is the relationship between the no. of protons & the no. of electrons of an atom?

8. What are Isotopes? Name some examples for isotopes

Isotopes are different atomic forms of the same element which has the same atomic number but different mass number.

(Definition in terms of sub atomic particles) Isotopes are different atomic forms of the same element which has the same number of protons but different number of neutrons.

Eg:

9. What you can comment on the chemical behavior of isotopes? Are they same or different? Explain your answer

The chemical behavior depends on the number of electrons in the outermost shell / same electronic configuration. The isotopes contain the same number of electrons, but different number of neutrons. Therefore, the isotopes exhibit similar chemical properties.

10. How many electrons, neutrons and protons are present in the following nuclides?

$^{1}_{1}H$ $^{16}_{8}O$ $^{14}_{6}C$ $^{37}_{17}Cl$ $^{23}_{11}Na$ $^{31}_{15}P$ $^{35.5}_{17}Cl$ $^{32}_{16}S$

e :

p :

n :

$^{24}_{12}Mg^{2+}$ $^{27}_{13}Al^{3+}$ $^{14}_{7}N^{3-}$ $^{81}_{35}Br^{-}$ $^{28}_{14}Si^{4+}$

e :

p :

n :

11. Explain the term **'electronic configuration of elements'**

……
……

12. Write the maximum number of electrons present in each of the following periods?

Period 1	**Period 2**	**Period 3**	**Period 4**
……	……	……	……

13. Write the electronic configuration of the elements & thereby predict their group number.

Atomic number	**Element**	**Shell Number** 1 2 3 4	**Group Number**
1	**H**		
2	**He**		
3	**Li**		
4	**Be**		
5	**B**		
6	**C**		
7	**N**		

8	**O**		
9	**F**		
10	**Ne**		
11	**Na**		
12	**Mg**		
13	**Al**		
14	**Si**		
15	**P**		
16	**S**		
17	**Cl**		
18	**Ar**		
19	**K**		
20	**Ca**		

14. The pattern for the distribution of electrons in the outer most energy level seems to repeat from time to time. What is the significance of this in relation to the periodic table?

15. Draw the structure of the atoms indicating the nucleus, shells (energy levels), number of electrons, protons & neutrons.

^{3} **Li**	^{6} **C**	^{8} **O**

^{13} **Al**	^{17} **Cl**	^{15} **P**
^{18} **Ar**	^{20} **Ca**	^{11} **Na**
^{16} **S**	^{12} **Mg**	^{19}**K**

15. What are the factors on which chemical reactivity depends?

……

……

16. What can be said about the elements, which have the same number of electrons in the outermost shell?

17. What can be said about the elements which have the same number of shells, (energy levels) but different number of electrons, in relation to the periodic table?

18. Explain the chemical reactivity of elements across the period. Are they the same?

19. Explain the reactivity of noble gases based on their electronic configuration?

Noble gases are unreactive as their atoms do not easily lose or gain electrons. It is difficult to gain as incoming electrons are strongly repelled by the electrons in the shells. Also difficult to lose due to greater nuclear attraction. (do not relate the stability to stable configurations / having completely filled outermost shell ect.)

20. Describe the valency of Group I & Group VII elements based on their electronic configurations. Thereby show how the cations & anions are formed?

21. Write the ionic charges of the given elements.

Atomic Number	Element	Electronic configuration	Ionic charge
11	Na		
12	Mg		
13	Al		
14	Si		
15	P		
16	S		
17	Cl		
18	Ar		

Electronic Configurations of ions

22. What are '**Cations**' & '**Anions**'?

……

……

23. Describe the formation of 'Cations' & 'Anions'

Cations :- ……..

……

eg : ……

Anions :- ……..

……

eg : ……

24. Write the electronic configuration of below ions.

Atomic number	**Ion**	**Shell Number** 1 2 3 4
3	Li^+	
5	B^{3+}	
7	N^{3-}	
8	O^{2-}	
9	F^-	
11	Na^+	
12	Mg^+	
13	Al^{2+}	
16	S^{2-}	
17	Cl^-	
19	K^+	
20	Ca^{2+}	

1. Explain why the mass of an atom is measured in relative masses?

The mass of an individual atom is very small therefore it is only possible to measure the atomic masses in relative masses. Since SI units cannot be used, we use an atom itself to measure the mass of another atom

2. Define "**Relative atomic mass**"? Write its units.

Average mass of an atom of an element compared to $1/12^{th}$ the mass of an atom of $^{12}_{6}C$ isotope. No units.

$$\text{R.A.M} = \frac{\text{The average mass of an atom of an element}}{1/12^{th} \text{ the mass of an atom of } ^{12}_{6}C \text{ isotope}}$$

3. Define "**Relative molecular mass**"? Write its units.

Average mass of all atoms / ions in a molecule /formula compared to $1/12^{th}$ the mass of an atom of $^{12}_{6}C$ isotope. No units.

4. Calculate the Relative molecular mass of these molecules:

H_2SO_4

$CaCO_3$

$Mg(OH)_2$

Li_2CO_3

K_2CrO_4

$(NH_4)_2SO_4$

$Pb(NO_3)_2$

$Ca(HCO_3)_2$

C_2H_5OH

$Na_2SO_3.5H_2O$

$CuSO_4.5H_2O$

$(COOH)_2.2H_2O$

$Cu(NH_3)_4SO_4.2H_2O$

5. Define "**molar mass**"? Write its units.

Molar mass is the mass of one mole of the of a substance. (Mole is defined as $6x10^{23}$ particles, thus molar mass is the mass of $6x10^{23}$ particles)
Unit : $g\ mol^{-1}$

6. Calculate the **molar mass** of the molecules of the above question (4)?

7. Define "**Relative isotopic mass**"?

The mass of an atom of an isotope compared to 1/12th the mass of an atom of $^{12}_{6}C$ isotope. No units.

$$R.I.M = \frac{\text{The mass of an atom of an isotope}}{1/12^{th} \text{ the mass of an atom of } ^{12}_{6}C \text{ isotope}}$$

8. i) The relative abundance of "Cl" isotopes are ^{35}Cl - 75% & ^{37}Cl - 25%. Calculate the relative atomic mass (RAM)of "Cl"?

ii) Two isotopes of "X" exists in nature as ^{16}X & ^{18}X, the relative abundance of ^{16}X is 70%, find the relative atomic mass of "X"?

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.