

# Cambridge University Examinations

General Certificate of Education Ordinary Level  
O – LEVEL 5070. Notes, P1, P2 and P4

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Chapter

## Atomic Structure

### Work Sheet Paper 1

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**WORKSHEET**  
**PAPER 2**

Atomic Structure(Questions)

1 An isotope of silicon is represented by the symbol  $^{29}_{14}\text{Si}$ .  
Deduce the number of protons and neutrons in this isotope.  
number of protons .....  
number of neutrons .....[1]

2 (iii) Give the charge of a chloride ion and its electronic configuration.  
charge .....  
electronic configuration .....[2]

3 An isotope of boron is represented by the symbol  $^{11}_5\text{B}$ .  
Deduce the number of protons and neutrons in this isotope of boron.  
number of protons .....  
number of neutrons .....[1]

4 Two isotopes of potassium are  $^{39}_{19}\text{K}$  and  $^{40}_{19}\text{K}$ .  
(a) Complete the table about the number of particles found in one atom of each of these isotopes.

	protons	number of electrons	neutrons
$^{39}_{19}\text{K}$			
$^{40}_{19}\text{K}$			

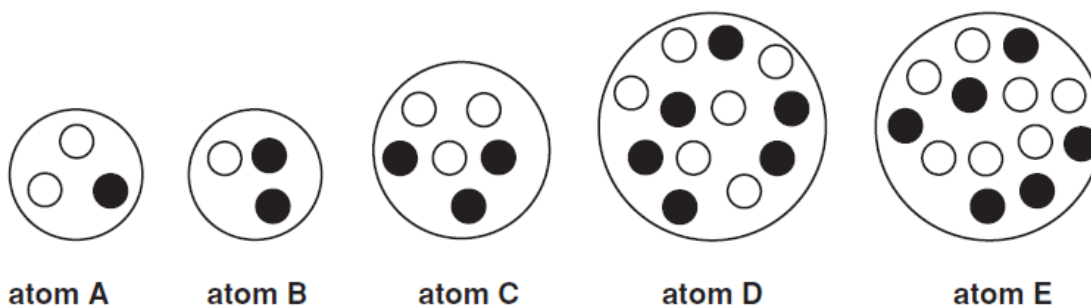
[2]

5 The diagram shows the nuclei of five different atoms.

key

○ neutron

● proton



(a) Which atom has an atomic number of 3?  
 ..... [1]

(b) Which atom has a mass number of 6?  
 ..... [1]

(c) Which **two** atoms are isotopes of the same element?  
 ..... and ..... [1]

(d) Complete the table below to show the number of sub-atomic particles in both an atom and an ion of potassium.

	potassium atom ${}^{39}_{19}\text{K}$	potassium ion ${}^{39}_{19}\text{K}^+$
number of protons		
number of electrons		
number of neutrons		

[2]

6 Complete the table below to show the number of subatomic particles in each of the two ions.

ion	number of protons	number of neutrons	number of electrons
${}^{40}\text{Ca}^{2+}$			
${}^{37}\text{Cl}^-$			

[2]

7 Uranium is a radioactive metal. It has two main isotopes, uranium-235 with a nucleon number of 235 and uranium-238 with a nucleon number of 238.

(a) (i) State one similarity, in terms of sub-atomic particles, between uranium-235 and uranium-238.

.....  
 .....[1]

(ii) State one difference, in terms of sub-atomic particles, between uranium-235 and uranium-238.

.....  
 .....[1]

- 8 A student found a copy of a Periodic Table published in the year 1930. Several elements were missing from this table because they had not yet been discovered. One of these elements was technetium, Tc.

One isotope of technetium has the symbol  ${}_{43}^{98}\text{Tc}$ .

- (a) Complete the table below to show the number of subatomic particles in one atom of this isotope.

number of protons	
number of electrons	
number of neutrons	

[2]

- (b) Suggest the symbol of another isotope of technetium.

..... [1]

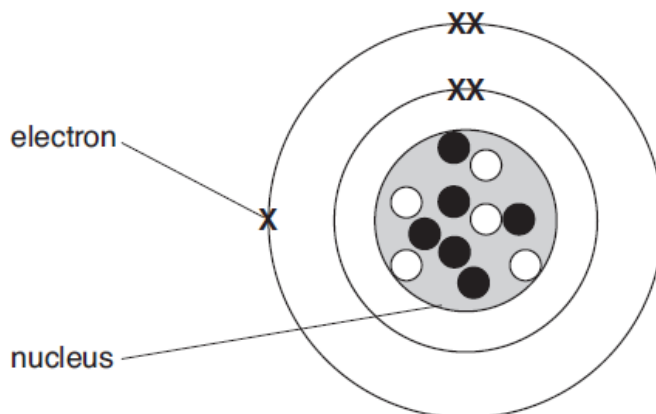
- (c) Explain, in terms of subatomic particles and their charge, why an atom of  ${}_{43}^{98}\text{Tc}$  is electrically neutral.

.....  
 .....  
 ..... [2]

- (d) From its position in the modern Periodic Table predict two properties of technetium.

1 .....  
 2 ..... [2]

- 9 The diagram shows the atomic structure of an atom of element X.



○ = a proton

● = a neutron

(a) Complete the table.

sub-atomic particle	relative charge	relative mass
electron	-1	
neutron		
proton		1

[2]

(b) Carbon-12 has the symbol  ${}^{12}_6\text{C}$ .  
Write the symbol for an atom of element X.

.....[2]

(c) Draw a diagram to show the atomic structure of **another** isotope of element X.

[2]

10 Magnesium bromide and sodium oxide are both ionic compounds.

(a) Complete the following table.

ion	number of			atomic number	mass number
	protons	neutrons	electrons		
$\text{Mg}^{2+}$	12	12			
$\text{Br}^-$				35	81

[3]

(b) Draw diagrams to show the electronic configurations and charges of the ions present in sodium oxide.

- 11 Complete the table to show the number of electrons and number of neutrons in the sulfur atom and in the magnesium ion.

	number of electrons	number of neutrons
${}^{33}_{16}\text{S}$		
${}^{25}_{12}\text{Mg}^{2+}$		

[4]

- 12 The table shows some information about six particles.

(a) Complete the table.

particle	proton (atomic) number	number of neutrons in particle	number of electrons in particle
${}^{35}\text{Cl}$	17	18	.....
.....	17	20	17
${}^{39}\text{K}^+$	19	.....	18
${}^{79}\text{Br}^-$	.....	44	36
${}^{81}\text{Br}$	35	.....	35
.....	37	48	36

[6]

(b) (i) What is meant by the term *isotopes*?

.....  
 .....  
 ..... [1]

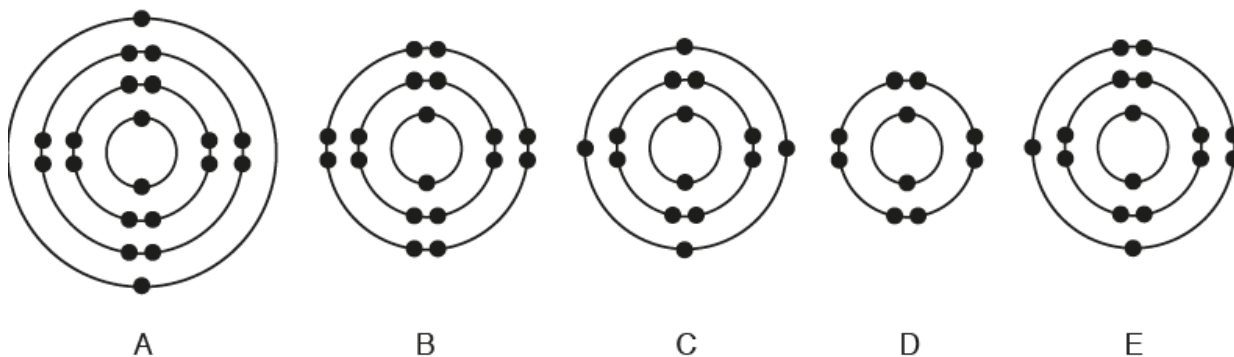
(ii) Identify two **atoms** which are isotopes of the same element.

..... and ..... [1]

[Total: 8]

13

The electronic configurations of five atoms are shown.



(a) Which electronic configuration represents each of the following descriptions?

Each electronic configuration may be used once, more than once or not at all.

(i) a sulfur atom

.....[1]

(ii) a metal atom

.....[1]

(iii) an atom with a proton number of 14

.....[1]

(iv) an atom of a noble gas with three occupied electron shells

.....[1]

(v) an atom which forms a noble gas electronic configuration when it loses two electrons

.....[1]

(b) The element germanium has five naturally occurring isotopes.

An isotope of germanium is represented by the symbol shown.



(i) What is the meaning of the term *isotopes*?

.....  
 .....[1]

(ii) Deduce the number of neutrons in one atom of this isotope of germanium.

.....[1]

[Total: 7]

14

The Periodic Table of Elements

		Group															
I	II	III	IV	V	VI	VII	VIII					VIII					
3 Li lithium 7	4 Be beryllium 9	1 H hydrogen 1	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20					18 Ar argon 40				
11 Na sodium 23	12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40					36 Kr krypton 84					
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —	118 Og oganesson —	119 Ts tennessine —	120 Nh nihonium —	121 Lr lawrencium —

**Key**

atomic number  
name  
atomic symbol  
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).