Name:…… ……Index No……

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P525/1
Chemistry
Paper 1
July/August 2024
2 ¾ hours

KAYUNGA SECONDARY SCHOOLS EXAMINATIONS COMMITTEE (KASSEC)
JOINT MOCK EXAMINATIONS 2024
Uganda Advanced Certificate of Education

CHEMISTRY

Paper 1

2 HOURS: 45 MINUTES

INSTRUCTIONS TO CANDIDATES:

- *Answer all questions in section **A** and any **Six** questions in section **B**.*
- *All questions must be answered in the spaces provided*
- *The periodic table has been attached at the end*
- *Mathematical tables (3 figure tables are adequate or non-programmable scientific electronic calculators may be used*
- *Illustrate your answers with equations where applicable.*
- *Where necessary , use the following*
  - *Molar gas constant R = 8.31 JK^{-1} mol^{-1}*
  - *Molar volume of a gas at s.t.p is 22.4 litres.*

For Examiner's Use Only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

Turn Over

SECTION A (46 MARKS)

Answer all question in this section

1. (a) State what is meant by the term first election affinity. ***(01mark)***

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(b) The enthalpy changes for some processes are shown in table **1**.

Atomization of potassium	= 90
Bond dissociation energy of hydrogen	= 436
First ionization energy of potassium	= 418
Lattice energy of potassium hydride	= 710
Formation of potassium hydride	= -62

Use the thermochemical data to calculate electron affinity of hydrogen.

(03marks)

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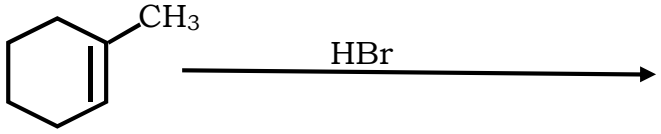
2. Complete the following equations and give the IUPAC name of the main product in each case.

(a) 

(04marks)

Mechanism

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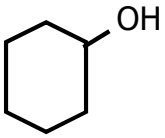
(b) 

$\xrightarrow[\text{Heat}]{KMnO_4/H^+_{(aq)}}$ ..... ***(01 ½ marks)***

Name .....

(c) $(CH_3COO)_2Ca$ $\xrightarrow{\text{heat}}$ ..... ***(01 ½ marks)***

Name .....

3. State the oxidation of the central atom and name the complex ion(s) ***(04 ½ marks)***

Fomula of ion	Oxidation state	Name of ion
$\mathbf{Cu}(CN)_4^{3-}$		
$\mathbf{Zn}(OH)_4^{2-}$		
$\mathbf{Ag}(NH_3)_2^{+}$		

4. (a) Define the term cryoscopic constant ***(1 mark)***

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(b) The melting point of a mixture containing 1g of naphthalene ($\mathbf{C_{10}H_8}$) dissolved in 10g of camphor is 147°c.
Calculate the cryoscopic constant, **K*f***, for camphor. ($C_{10}H_{16}O$)
(The melting point of camphor is 177.5°c) ***(03 marks)***

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(c) State the reason why camphor is preferred as solvent in determining relative molecular mass of non-volatile solutes by the cryoscopic method.
(01mark)

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5. Write equations to show how phenylethanoete can be synthesized from chloroethane.
(03marks)

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6. (a) State what is observed and write equation(s) for the reaction(s) that takes place When;

(i) nickel ethanoate is heated strongly and the gaseous product passed through 'Brady's reagent. ***(04marks)***

Observation

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Equation

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(b) Lead **(IV)** oxide is added to hot concentrated hydrochloric acid. **(02 ½ marks)**

Observation

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Equation

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7. Bond dissociation energies for Group **VII** elements are shown in Table **2**.

Element	Fluorine	Chlorine	Bromine	Iodine
Bond dissociation energy ($KJmol^{-1}$)	33.3	57.8	46.1	36.2

(a) (i) State how bond dissociation energies vary. ***(01mark)***

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(b) Explain your answer in (i) ***(03marks)***

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(b) State what would be observed and write equation for the reaction that takes place when concentrated sulphuric acid is added to solid sodium iodide. ***(02 ½ marks)***

Observation;

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Equation

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8. Complete the following organic reactions and outline the mechanism(s). ***(02 ½ marks)***

(a) $CH_2=C(CH_3)_2 \xrightarrow{HBr}$

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(b) $CH_3COCH_3 \xrightarrow[0-\ 20^oC]{KCN/dilute\ H_2SO_4}$ ***(02 ½ marks)***

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9. Some half cell reactions are given below.

R; $PbO_{2(s)} + 4H^{+}_{(aq)} + 2e^{-} \longrightarrow Pb^{24}_{(aq)} + 2H_2O$ $+1.46\ E^{o}/_{v}$.

Q; $Fe^{3+}_{(aq)} + e^{-} \longrightarrow Fe^{2+}_{(aq)}$ + 0.77

(a) Write the cell notation for the cell formed by combining half cells R and Q. . ***(01mark)***

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(b) State what is observed and write equations for the reaction (s) that take place at the ;

(i) Positive electrode. ***(01 ½ mark)***
Observation.

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Equation;

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(ii) Negative electrode ***(01 ½ marks)***
Observation

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Equation

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(c) Write the overall equation for the cell reaction. ***(1 ½ mark)***

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(d) Calculate the e.m.f of the cell. ***(01 ½ mark)***

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SECTION B (54 MARKS)

*Attempt any **six** questions in this section)*
Additional questions answered will not be marked.

10. Explain the following observation (s)

(a) When dilute ammonia solution is added to a solution containing aluminum ions, a white precipitate forms. However similar treatment of solution of aluminium ions in the presence of ammonium chloride no precipitate forms. ***(04 marks)***

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(b) Lead (IV) iodide does not exist whereas lead (IV) chloride exists***.(02 marks)***

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(c) The melting points of group(II) elements are higher than those of group(i) elements. ***(03 marks)***

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11. (a) During the extraction of iron from hematite the ore is mixed with coke, limestone and then heated strongly in a blast furnace.
Write equations for the reactions that lead to formation of iron. ***(03 marks)***

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(b) Acidified solution of hydrogen peroxide was added to iron (II)sulphate solution
. State what is observed and write equation for the reaction that takes place.
(02 ½ marks)

Observation.

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Equation:

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(c) 3g of a sample of hematite were dissolved in concentrated hydrochloric acid and the solution dilute to 250cm^3. 25cm^3 of this solution after reduction with tin(II) chloride, required 26.6cm^3 of potassium dichromate for complete oxidation. ***(03 ½ marks)***

Calculate the percentage of iron (III) oxide in the ore.

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12. (a) Name two major sources of sulphur dioxide for use in the manufacture of sulphuric acid. ***(01mark)***

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(b) Sulphur dioxide reacts with oxygen to form sulphur trioxide according to the equation,

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$, $\Delta H = -197KJmol^{-1}$ at 298K

State what happens to the position of equilibrium and in each case give a reason if

(i) The pressure of the system is increased. ***(01 ½ marks)***

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(ii) Vanaduim(v) oxide powder is added to the system. ***(01 ½ marks)***

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(iii) The temperature of the system is increased. ***(01 ½ marks)***

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(c) When 1.4 moles of sulphur dioxide and 0.8 moles of oxygen where placed in a 2 litres vessel and heated at 700^{o}c, 1 mole of sulphur trioxide was formed at equilibrium calculate the;

(i) The amount of oxygen and sulphur dioxide at equilibrium in moles per litre.

(1 ½ mark)

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(ii) Equilibrium constant ,Kc, for the reaction at this temperature and state its units.

(02marks)

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13. A compound **G** contains carbon 61.02%, hydrogen 15.25% and rest nitrogen.

(a) (i) Calculate the empirical formula of **G**. ***(02 marks)***

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(b) Determine the molecular formula of **G** (density of G at S.t.p = 2.63g dm^{-3})
(***02marks)***

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(c) Write the structural formulae of the possible isomers of **G** and Give the IUPAC names
(03marks)

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(d) G forms a yellow oil when reacted with aqueous sodium nitrate solution and concentrates hydrochloric acid at O^oc.

(i) Identify **G** ***(01 mark)***

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(ii) Write equation the reaction leading to the formation of a yellow oil. ***(01 mark)***

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14. (a) Differentiate between a thermosetting plastic and a them softening plastic. Give one example of each type of plastic ***(03 marks)***

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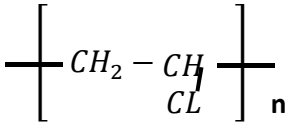
(b) A polymer **J** has the structure.



(i) Write the structural formula and give the IUPAC name of the monomer. ***(01 mark)***

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(ii) Name the type of polymerization reaction leading to the formation of the polymer. ***(0 ½ mark)***

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(c) When 71.76g of the monomer in a(i) was polymerized 2.67×10^{-2} moles of polymer was formed.
Calculate the ;

(i) Molecular mass of polymer. ***(02 marks)***

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(ii) Value of **n** ***(02 marks)***

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(d) State one use of polymer **J**. ***(0 ½ Mark)***

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15. (a) (i) Write the general electronic configuration of group(IV) elements. ***(01mark)***

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(ii) State the common oxidation states exhibited by the elements in their compounds. ***(01 mark)***

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(b) Explain the trend in stability of the oxidation states in a(ii) down the group. ***(04 marks)***

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(c) Write equation for the reaction of the following chlorides with water.

(i) Tin(II) chloride. ***(01 ½ mark)***

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(ii) Tin (IV) chloride ***(01 ½ marks)***

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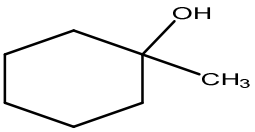
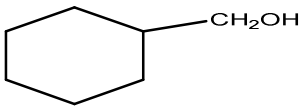
16. Name the reagent(s) that can be used to distinguish between the following compounds. In each case state what is observed when the reagent is reacted separately with each compound.

(a)  and  ***(03 marks)***

Reagent

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Observation

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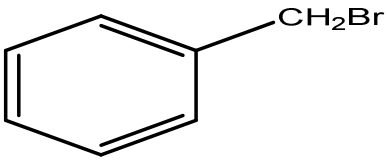
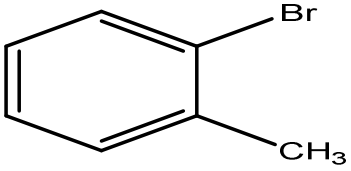
(b)  and  ***(03marks)***

Reagent

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Observation

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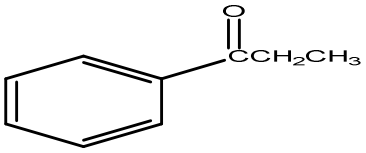
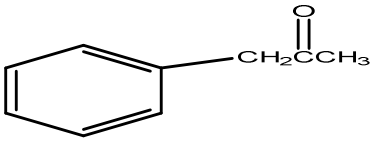
(c)  and 

(03marks)

Reagent

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Observation

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17. (a) Define the term eutectic mixture. ***(01 mark)***

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(b) State one difference and one similarity between the ***eutectic mixture*** and ***a pure compound***.

(i) Difference ***(0 ½ mark)***

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(ii) Similarity ***(0 ½ mark)***

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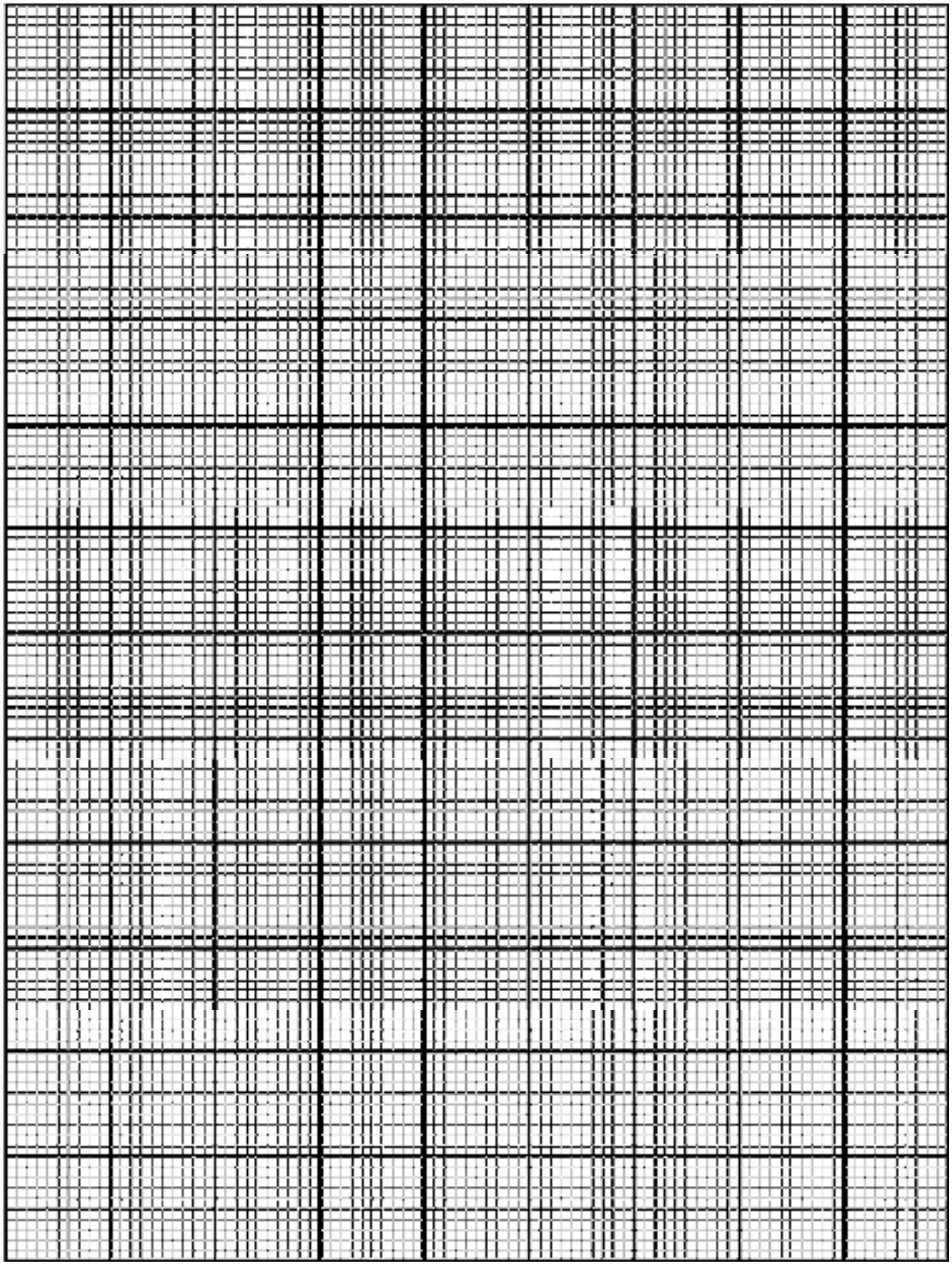
(c) The freezing points of molten mixtures of bismuth(Bi) and cadmium (Cd) are shown in the table 3 below.

%Cd	90	70	50	40	30	10	0
Temperature (^{o}c)	300	255	195	145	175	235	270

(i) Plot the freezing point – composition labelled phase diagram for the Bismuth- cadmium system. ***(03 marks)***



(ii) Use the phase diagram you have plotted to determine the composition of eutectic mixture and eutectic temperature. ***(01mark)***

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(d) Describe and explain what happened when a liquid mixture containing 60% Bismuth is cooled from 400^{o}c to 100^{o}c. ***(03marks)***

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END

Periodic table

1	2											3	4	5	6	7	8
1 H 1.0																1 H 1.0	2 He 4.0
3 Li 6.9	4 Be 9.0											5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
11 Na 23.0	12 Mg 24.3											13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.4	18 Ar 40.0
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc 98.9	44 Ru 101	45 Rh 103	46 Pd 103	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 Hf 178	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Ti 204	82 Pb 207	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)															
			57 La 139	58 Ce 140	59 Fr 141	60 Nd 144	61 Pm (145)	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 162	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
			89 Ac (227)	90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf 251	99 Ea (254)	100 Fm (257)	101 Mv (256)	102 No (254)	103 Lw 260