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**Rathnavali Balika Vidyalaya - Gampaha**

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**First Term Test – 2017 (November) Grade 12**  
*(Enu)*

**Chemistry I**

**Time :- 1 Hour**

- Answer all the questions ,Use of calculators is not allowed
- Write your index number in the space provided in the answer sheet
- In each question 1 to 25 pick one of the alternatives from (1), (2), (3), (4), (5) which is correct or most appropriate and mark your response on the answer sheet with a cross (X)
  - Universal gas constant(R ) = 8.314 NmK<sup>-1</sup>mol<sup>-1</sup>
  - Avogadro's constant(N<sub>A</sub>) = 6.022 x 10<sup>23</sup> mol<sup>-1</sup>
  - Plank constant (h) = 6.626 x 10<sup>-34</sup> Js
  - Speed of light ( C ) = 3 x 10<sup>8</sup> ms<sup>-1</sup>

- 1 The credit of discovering the charge of the electron and discovering neutron respectively goes to the scientists,
 

1. Chadwick and Thomson	2. Rutherford and Chadwick
3. Chadwick and Mulliken	4. Mulliken and Rutherford
5. Mulliken and Chadwick	
  
- 2 Which out of following is not an electromagnetic radiation?
 

1.Radar	2.UV radiation	3.Infra red radiation
4.Cathode rays	5.X rays	
  
3. Which out of following is true regarding the Hydrogen emission spectrum?
  - 1.Paschen series appears in ultra violet region of the electromagnetic spectrum.
  - 2.The first line of balmer series (H<sub>α</sub>) appears in the frequency range of violet .
  - 3.Lyman series appears in the ultra violet region of the electromagnetic spectrum.
  4. Line spacing between spectral lines increases towards the increasing direction of frequencies.
  5. Balmer series contains only 4 spectral lines.
  
- 4 Which out of the given set of quantum numbers represent the electron removed in the second ionization energy of sodium?
 

1. n = 3	l = 0	ml = 0	ms = + ½
2. n = 3	l = 1	ml = 0	ms = + ½
3. n = 2	l = 1	ml = 0	ms = + ½
4. n = 3	l = 2	ml = 1	ms = + ½
5. n = 2	l = 0	ml = 0	ms = + ½

3. The molecule  $\text{AO}_2$  is angular. Which combination given below regarding this molecule is correct?

	Number of valence electrons on A	Number of lone pairs on A	Number of $\sigma$ bonds in $\text{AO}_2$	Number of $\pi$ bonds in $\text{AO}_2$
1.	6	1	1	1
2.	5	1	2	2
3.	5	0	2	2
4.	6	1	2	2
5.	6	2	2	1

6. Which statement is **correct** regarding the ionic compounds?

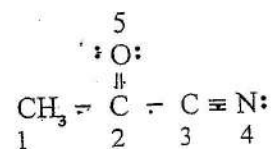
- All ionic compounds are soluble in water.
- All ionic compounds are electrical conductors at solid state.
- When compared with covalent compounds these have high boiling points and melting points.
- Ionic compounds are electrical conductors only at molten state.
- Ionic compounds show covalent properties due to polarization.

7. Which out of following show the **correct** decreasing order of electronegativity of N atom?

- $\text{NH}_3 > \text{NH}_2^- > \text{NH}_4^+ > \text{NO}_2^+$
- $\text{NO}_2^+ > \text{NH}_4^+ > \text{NH}_3 > \text{NH}_2^-$
- $\text{NH}_2^- > \text{NH}_3 > \text{NH}_4^+ > \text{NO}_2^+$
- $\text{NO}_2^+ > \text{NH}_4^+ > \text{NH}_2^- > \text{NH}_3$
- $\text{NH}_2^- > \text{NH}_4^+ > \text{NH}_3 > \text{NO}_2^+$

8. Which combination gives the **correct** hybridizations of the atoms marked as 1, 2, 3, 4, and 5 respectively?

- $\text{sp}_3$   $\text{sp}^2$   $\text{sp}$   $\text{sp}$   $\text{sp}$
- $\text{sp}_3$   $\text{sp}^2$   $\text{sp}^2$   $\text{sp}$   $\text{sp}^2$
- $\text{sp}_3$   $\text{sp}_3$   $\text{sp}_2$   $\text{sp}$   $\text{sp}^2$
- $\text{sp}$   $\text{sp}$   $\text{sp}$   $\text{sp}$   $\text{sp}$
- $\text{sp}$   $\text{sp}$   $\text{sp}$   $\text{sp}$   $\text{sp}$



9. Wave length of red light is 700 nm. Calculate the energy of one mole of photons of this radiation.

- 0.152
- 0.119
- 152
- 0.171
- 171

10. What is **incorrect** regarding the atomic orbitals and molecular orbitals?

- $\sigma$  bonds can be formed by the overlapping of hybrid orbitals.
- $\pi$  (pi) bond can be formed by the lateral overlapping of unhybrid p orbitals.
- Each atomic orbital participate for  $\text{CH}_4$  has undergone hybridization.
- Always a multiple bond consists  $\sigma$  and  $\pi$  (pi) bonds.
- Even d orbitals can undergo hybridization.

11. Which out of given ion has the highest polarizing power?  
 1.  $Mg^{++}$       2.  $Na^+$       3.  $F$       4.  $Ba^{++}$       5.  $Cl^-$
12. Which out of given has the highest boiling point?  
 1.  $N_2$       2.  $CH_4$       3.  $F_2$       4.  $Cl_2$       5.  $Ar$
13. Electronic configuration of  $Fe^{2+}$  at ground state is,  
 1.  $[Ar] 4s^2 3d^5$       2.  $[Ar] 4s^1 3d^5$   
 3.  $[Ar] 4s^2 3d^6$       4.  $[Ar] 3d^6$       5.  $[Ar] 4s^1 3d^6$
14. Which out of given is **incorrect** regarding the cathode rays?  
 1. e/m ratio is constant.  
 2. Deflects in magnetic field.  
 3. Green in colour.  
 4. Can do a work.  
 5. Emits perpendicular to the cathode.
15. Which molecule has a closest shape to the shape of  $CH_4$ ?  
 1.  $COCl_2$       2.  $POCl_3$       3.  $BF_3$       4.  $SO_2$       5.  $PCl_3$

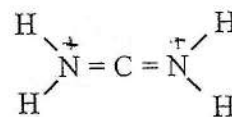
❖ **Summary of instructions for the questions 16 to 20**

(1)	(2)	(3)	(4)	(5)
Only (a) and (b) correct	Only (b) and (c) correct	Only (c) and (d) correct	Only (d) and (a) correct	Another one or more responses are corrected

16. Ionic bond, covalent bond and dative bond present in,  
 a)  $Al_2Cl_6$       b)  $NH_4Cl$       c)  $NaBH_4$       d)  $Na_2CO_3$
17. Which out of given variations is/are **incorrect**?  
 a)  $N^{3-} < O^{2-}$       b)  $Mg^{2+} < Al^{3+}$       c)  $F^- < S^{2-}$       d)  $Na^+ < Ca^{2+}$
18. Which statement /s is/are **correct** regarding the ionization energy?  
 a) Second ionization energy of K is smaller than the first ionization energy of Na.  
 b) The first ionization energy of consecutive elements in a period increases gradually..  
 c) Fourth ionization energy of Al is greater than fifth ionization energy of Si.  
 d) The first ionization energy of N is greater than the first ionization energy of O.
19. Which statement /s is / are **true** regarding cathode rays?  
 a) Always travels on straight lines.  
 b) Have particular nature.  
 c) Have wave nature  
 d) Speed of cathode rays is equal to that of light.

20 Which statement/s is/are correct regarding the given molecule?

- N atoms have undergone  $sp^2$  hybridization.
- All atoms exist in the same plane.
- Oxidation number of N is zero.
- C has undergone  $sp$  hybridization.



❖ Summary of instructions for the questions 21 to 25

Answer	First statement	Second statement
1.	True	True , and correctly explain the first statement
2.	True	True, but it does not explain the first statement correctly .
3.	True	False
4.	False	True
5.	False	False

First statement	Second statement
21. Polarizing power of cation and the polarizability of anion is important in determining the covalent nature of a compound.	When polarizability increases covalent property also increases.
22. Silica is a heteroatomic molecular lattice.	Silica exists as $SiO_2$ molecules. ?
23. Diamond does not contain free electrons. $sp^2$ hybridized carbon atoms bond strongly to form the lattice.	Graphite lattice contains carbon atoms bonded tetrahedrally and each carbon has an unpaired electron. so it conducts electricity.
24. Out of positive rays proton has the highest $e/m$ ratio.	In cathode ray experiment when hydrogen is in the tube protons travel from anode to cathode.
25. Anion formed by any atom contains 6 electrons in the outermost subenergy level.	Electrons in the outer most subenergy level of an anion formed by any atom can have only 0 and 1 for $l$ (Azimuthal quantum number)

Name : ..... Index Number: ..... Class: .....

**Important :**

- ❖ *This question paper consists of 09 pages*
- ❖ *This question paper comprises Part A .*
- ❖ *The time allotted for part A is 1  $\frac{1}{2}$  hours*

**Part A – Structured Essay:**

*Answer all the questions on this paper itself.*

*Write your answers in the space provided for each question. Please not that the space provided is sufficient for your answers and that extensive answers are not expected*

**For Examiner's use only**

Part	Q. No.	Marks
A	1	
	2	
	3	
	Total	

**Final Marks**

I	II	Final marks

Marking Examiner	
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2

## Part – A - Structural essay

answer the all questions in this paper

a) Arrange the following species according to the given property in parenthesis .

(i) Rb ,Na, Li, K, Cs (melting point )

.....

(ii) Al ,O,P,Ca ,C (atomic radius )

.....

(iii) H<sub>2</sub>S ,H<sub>2</sub>O, H<sub>2</sub>Se (bond angle )

.....

(iv) HClO<sub>2</sub> ,HClO<sub>4</sub> ,HClO<sub>3</sub> ,HOCl (oxidation number of Cl)

.....

(v) Al ,F ,N ,O ,Na (Frist ionization energy)

.....

b) put (✓) sign for correct statements and (×) sign for wrong statements (Marks will be deducted for wrong answers)

(i) electron affinities of for F ,Cl , Br varies as  $F < Cl > Br$  .....

(ii) Metallic property of the elements in the second period of the periodic table decreases across the period and that increases down a group.....

(iii) Modern periodic table is based on the atomic masses of the elements.....

(iv) Electronegativity is a property of an isolated atom .....

(v) Third period of the periodic table has 18 elements because third energy level has 3s 3p and 3d sub energy levels.....

(vi) Frist and the second ionization energies of Nitrogen are greater than that of oxygen.....

(vii) Covalent radius of an atom is smaller than the vanderwaals radius of it.....

(viii) Nuclear charge feels by the valence electron of Na is less than 11 .....

(ix) Group 1 elements are strong oxidizing agents.....

(x) Fe<sup>3+</sup> ion contains 5 unpaired electrons.....

c) A, B, C, D and E are five consecutive non transitional elements in the periodic table with atomic numbers  $z$ ,  $z+1$ ,  $z+2$ ,  $z+3$ , and  $z+4$ . D has the highest first ionization energy. Several successive ionization energies of D are given below,

1011  $\text{kJmol}^{-1}$ , 1907  $\text{kJmol}^{-1}$ , 2914  $\text{kJmol}^{-1}$ , 4923  $\text{kJmol}^{-1}$ , 6273  $\text{kJmol}^{-1}$ , 21267  $\text{kJmol}^{-1}$ , 25431  $\text{kJmol}^{-1}$

i) Identify the group of D in the periodic table .....

ii) Atomic number of D is less than 16 Write the chemical symbols of the elements from A to E.

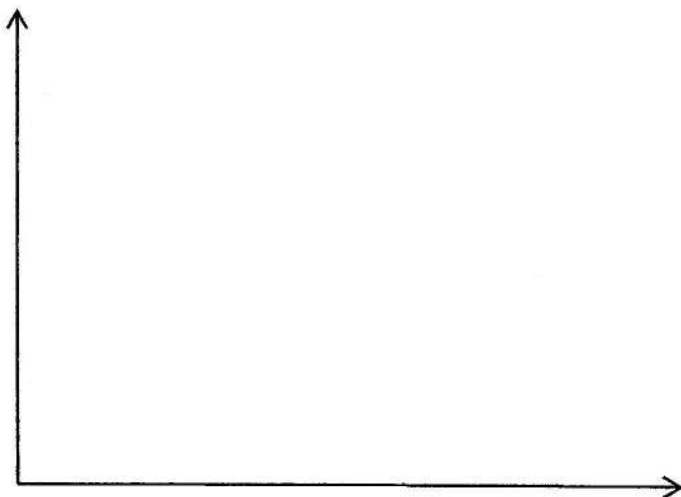
A..... B.....

C..... D.....

E.....

iii) Draw the variation of the second ionization energies of the elements from A to E.

second ionization energy  
 $\text{kJmol}^{-1}$

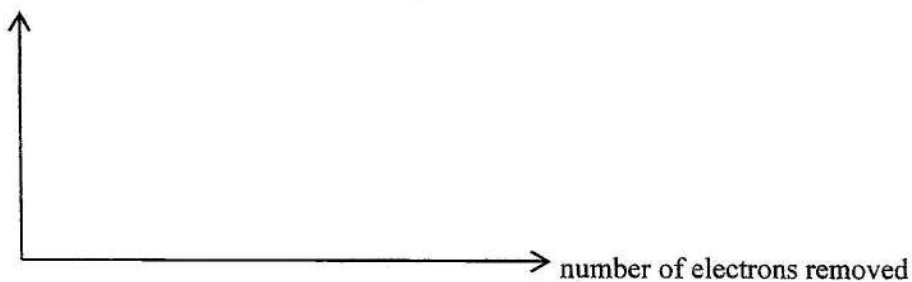


iv) Mention whether the first ionization energy of A is greater or less than that of B Explain the reason briefly

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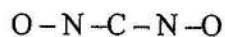
v) Draw the variation of five successive ionization energies of B.

ionization energy  
 $\text{kJmol}^{-1}$



4

- 2 • a)  $\text{CN}_2\text{O}_2\text{H}_2$  is a dibasic weak acid. It forms an anion with -2 charge in basic medium. Skeleton of the negative ion is given below •



(i) Draw a stable Lewis Structure for  $\text{CN}_2\text{O}_2^{2-}$  ion.

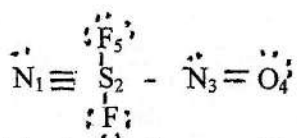
(ii) Draw 3 resonance structures for  $\text{CN}_2\text{O}_2^{2-}$  ion .

(iii) Draw a rough sketch of  $\text{H}_2\text{CN}_2\text{O}_2$  showing approximate bond angles.

(iv) State the atomic / hybrid orbitals participate for following bonds in the acid in (iii) above •

- a) O-H ..... b.) N-O .....  
c) C-N .....

(b)(i) Lewis structure of the molecule  $\text{SF}_2\text{N}_2\text{O}$  is given below. Complete the table below using this molecule



(ii) complete the table given below considering the Lewis structure in (i) above

property	$\text{N}_1$	$\text{S}_2$	$\text{N}_3$	$\text{O}_4$	$\text{F}_5$
Electron pair geometry					
shape					
valency					
Oxidation number					
hybridization					



(c) Complete the table below

	Number of VSEPR pairs	Number of lone pairs	Shape	Bond angle	Example
1	5				AsCl <sub>5</sub>
2	4	1			
3	5		T		
4					H <sub>2</sub> O
5	3			120°	

(d) consider the three steps given below

Step I - water at -5C° was allowed to reach room temperature.

Step II - NaCl is prepared by passing Cl<sub>2</sub> (g) on cleaned Na which was stored in liquid paraffin (C<sub>12</sub>H<sub>26</sub>)

Step III - Solid NaCl is dissolved in water in step I and aqueous solution of NaCl was prepared.

(i) Name the species in steps I/II/III respectively and write the primary and secondary interaction in front of them.

steps	Primary interactions	Secondary interactions
Step I		
Step II		
Step III		

(e) Explain the statements given below.

(1)Boiling point of  $CH_3Br$  is  $365C^0$  but boiling point of  $CBR_4$  is  $189.5C^0$

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(2)Thermal decomposition temperatures of  $BeCl_2$  , $MgCl_2$  , $CaCl_2$  ,and  $SrCl_2$  are  $415^0C$  , $714^0C$  ,  $772^0C$  ,  $874^0C$  .

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(a)Atomic spectrum is important in finding information of atoms. Atomic emission spectrum of Hydrogen is a line spectrum. Spectral lines occur as several series of lines.

(I)Write two information that can be obtained by studying the atomic spectrum of Hydrogen.

.....

.....

(II)When gaseous hydrogen atom absorbs electrical energy electrons go to excited state. Explain how a spectral line occur by this process.

.....

.....

(III)Answer the following questions using the line series that is visible to human eye .

- a. Name of the line series.....
- b. Region of the electromagnetic spectrum.....
- c. Electronic transition.....

(IV)Name two other species which produce a line spectrum equal to that of the above spectrum

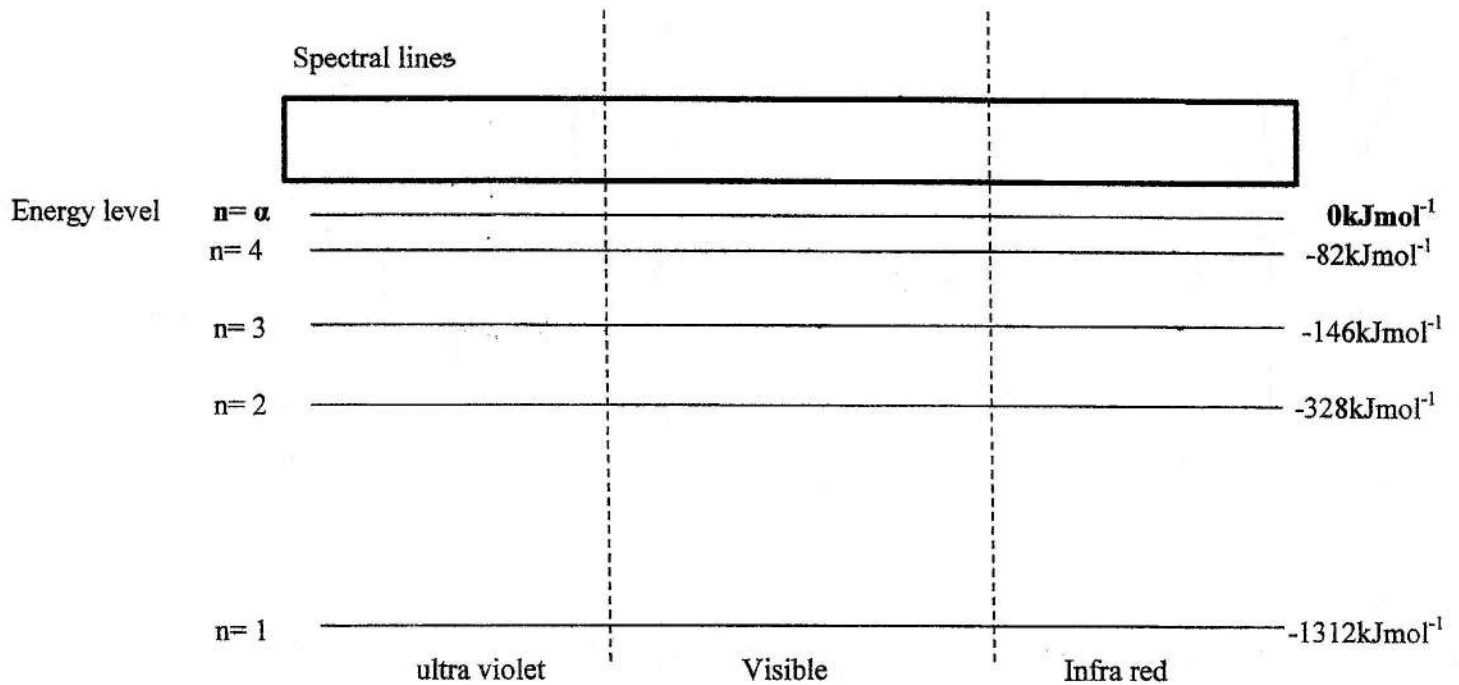
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.....

(V) Fill in the blanks.

The scientist ..... explained the occurrence of lines in the hydrogen emission spectrum. He used ..... theory to explain this.

(b) Excited electrons at 4<sup>th</sup> energy level of Hydrogen atom reach ground state due to the nuclear attraction by the electronic transition only between the consecutive energy levels.



(I) Draw the relevant spectral lines in the box given above. Name them as A, B and C respectively in increasing order of the wave length.

(II) Draw the electronic transition for the spectral line you drew in (I) above. Name them as A<sub>0</sub> B<sub>0</sub> C<sub>0</sub> accordingly.

(III) State to which line series in emission spectrum of hydrogen do the line you drew belong.

line	Line series

8

(IV) Identify coloured spectral lines if any and state their colour .

(V) Prove using a calculation that the spectral line / (s) you identified is / are coloured (wave length of visible Region between 400nm - 700nm )

(VI) Draw a relevant spectral line and an electronic transition for the change



(VII) Give information about above spectral line / electronic transition.

(a) Spectrum ( emission / absorption )

(b) spectral line series

(c) Energy change

(c) 3d series elements are placed in 4<sup>th</sup> period in the periodic table.

(I) Name the principal related to the above placement of elements.

(II) Write the principal.

(III) Explain the reason for the above phenomena using the principal you mentioned.

(IV) To which sub energy levels does the last electron of the elements in the 4<sup>th</sup> period fill.

(V) Arrange those sub energy levels according to the increasing order of their energies before and after the filling of electrons.

a) before filling the electrons.....

b) after filling the electrons .....

(VI) Fill the table given below.

sub energy level	Principal quantum number	Azimuthal quantum number	Magnetic number	Number of orbitals	Number of electrons
1					
2					
3					

(d) Dual nature of subatomic particles is an important concept revealed recently. De Broglie equation is used to study dual nature.

(l) Write de Broglie's equation and identify the terms.

(III) Mass of an electron is  $9.1 \times 10^{-31}$  kg. Calculate de Broglie's wave length of an electron which travels  $1 \times 10^8$  ms<sup>-1</sup> speed.

(IV) Calculated wave length for a proton which travels with the same speed is  $4 \times 10^{-8}$  nm. Compare the dual nature of electron and proton.

hydrogen 1 H 1.0079																	helium 2 He 4.0026				
lithium 3 Li 6.941	beryllium 4 Be 9.0122															boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305															aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 36.960
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.63	arsenic 33 As 74.922	selecnium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80				
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc 98	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29				
cesium 55 Cs 132.91	barium 56 Ba 137.33	* 57-70 *	lanthanum 57 Lu 175.07	hafnium 72 Hf 178.50	tantalum 73 Ta 180.95	wolfram 74 W 183.84	reuterium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po 209	astatine 85 At 210	radon 86 Rn 222			
francium 87 Fr 223	radium 88 Ra 226	* *	actinium 89 Lr 227	rutherfordium 104 Rf 261	bohrium 105 Db 262	seaborgium 106 Sg 266	hassium 107 Bh 264	meitnerium 108 Hs 265	darmstadtium 109 Mt 268	roentgenium 110 Uun 271	copernicium 111 Uuu 273	nihonium 112 Uub 277									

\* Lanthanide series

lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm 145	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.05
actinium 89 Ac 227	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np 237	plutonium 94 Pu 244	americium 95 Am 243	curium 96 Cm 247	berkelium 97 Bk 247	californium 98 Cf 251	einsteinium 99 Es 252	fermium 100 Fm 257	mendeleevium 101 Md 258	nobelium 102 No 259

\*\* Actinide series