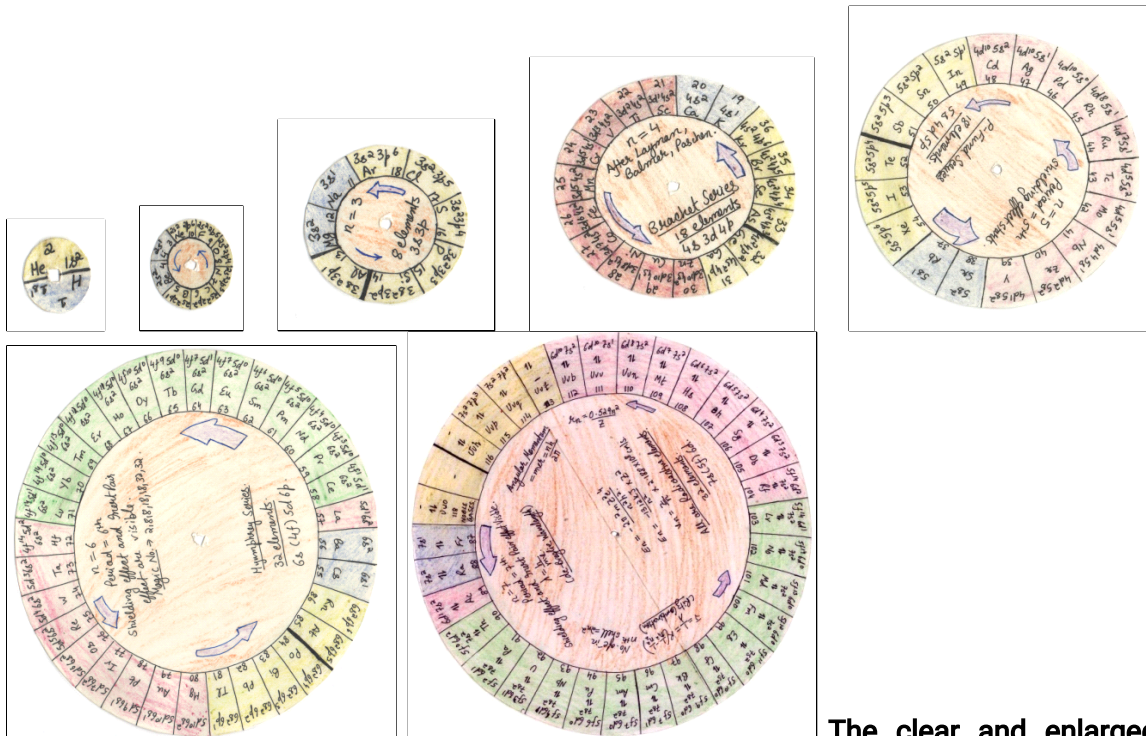


Full representation of the Ato circular periodic table by Ramanpreet Singh Jandu.

Field of Invention

The present invention relates to a device for the understanding of the Periodic table and the Structure of Atom together and in better way. The device consists of seven concentric circular disks rotatable about their centre, wherein the size of the disks increases from the centre to the end like that in the Structure of Atom. Each disk is marked so as to form the sub blocks and each disk in itself represents the periods of the Periodic Table. The disks are divided into sub blocks and labelled with elements at back side as well. Thus the Ato Circular Periodic Table as the name suggests is the combination of Atomic Structure of Atom and that of the Periodic Classification of the Elements.

A pictorial representation of all the seven concentric circles has been shown as follows-



The clear and enlarged pictures of the same have been shown at the end of the presentation and in the respective postulates where ever necessary for reference.

Background of Invention

Periodic Table as we know in Chemistry is the classification of all the atoms or elements found in nature in tabular form which is popularly known as the Modern Periodic Table. We also know that it has two major disadvantages or discarding points namely, the position of the Hydrogen Atom in the Periodic table and the position of the f-block elements kept separately from the whole table. This modern periodic table was formed

by Neils Bohr on the basis of Moseley's concept of atomic number i.e. the periodic trends in the properties are dependent upon the increasing atomic number. It was also a partial replica of the Mendeleev's Periodic Table based upon atomic mass.

Thus there arises a need to develop a device, which is convenient for the student or learner to understand the concepts of periodic table conveniently and in an easy manner. This Ato Circular Periodic Table not only provides the necessary aspects of the periodic table but also does so in an innovative manner which allows the learners not only to understand all the basic concepts of the Periodic classification but also the Structure of Atom which has not been explained like this in the history of the subject. Moreover, it also overcomes the two disadvantages of the Modern Periodic Table.

Complete Description of the Ato Circular Periodic Table

Introduction This invention of the Periodic table as its name suggests is the combination of 3 things in the chemistry namely the Periodic classification of the elements, the Structure of Atom and Measurement of Angles.

This is so as the periodic table gives all the details of the periodic classification namely the atomic number, atomic mass, etc. It superbly represents the Structure of Atom and explains all the theories of Structure of Atom. The measurement of angles has been used in sense that anticlockwise angle is positive whereas the clockwise angle is negative.

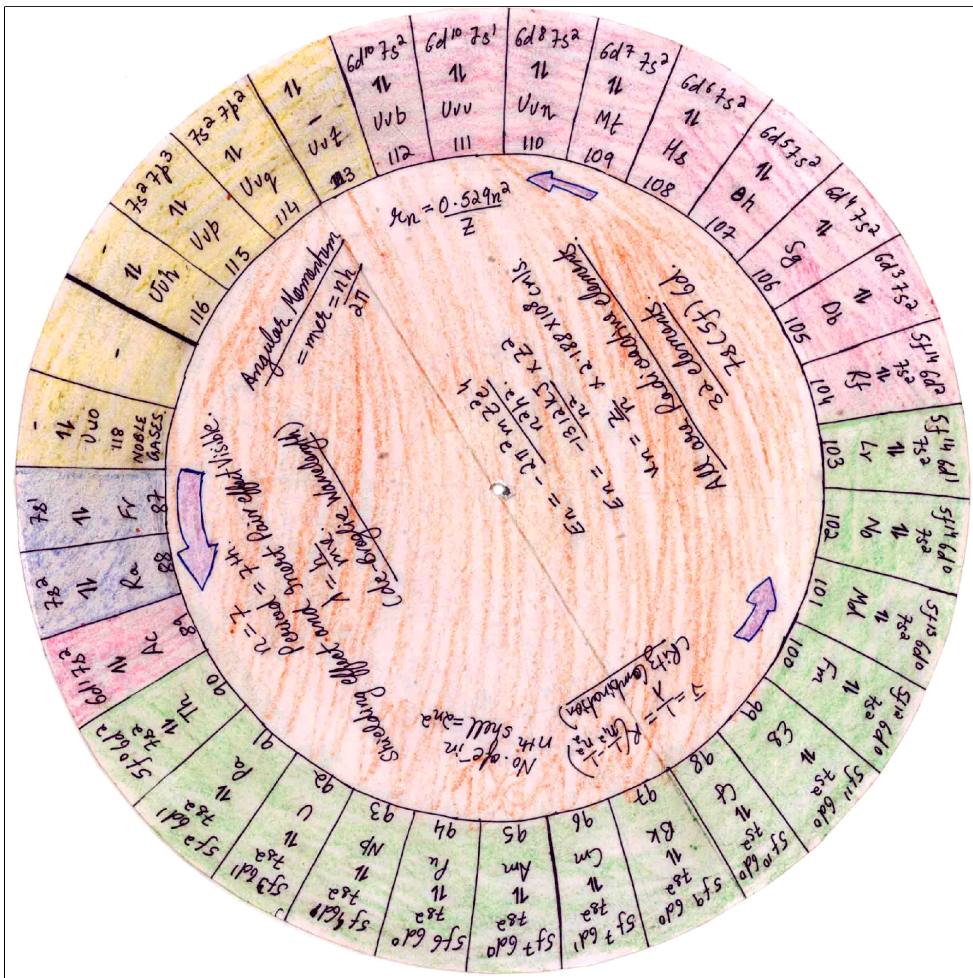
The Theory In the Ato Circular Periodic Table the word Ato stands for the Atomic Structure of Atom whereas the Circular represents its shape and the Periodic Table the periodic trends in the properties of elements found in nature. As in the above pictures it is clear that the colour plays a major role in the explanation of the things. Thus the colour is the essence of this periodic table.

Features or Postulates of the theory In the ACPT all **the basics of the Modern Periodic Table** have been retained. This implies that as the MPT was based on Atomic number, so is this table. The information so provided by the table related to elements is similar and in a circular fashion. The **ACPT gives** the Atomic number, Atomic mass, Element's symbol, Element's name, Element's group number, Element's period number, the four Blocks namely s, p, d, f blocks, Electronic Configuration of every element, Basic formulae of the Neil's Bohr's theory on each concentric circle. But as it is seen all these concepts relate only to the Periodic Classification of elements. Along with this information regarding the elements the **ACPT also gives** full information regarding the Structure of Atom. It gives the Atomic size, Atomic shape, the orbit theory of Rutherford and Neil's Bohr, the orbital concept of Schrodinger or the Quantum Mechanical Model of Atom, the Wave nature of electron, the Bohr's theory, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle, Planck's quantum theory, Photoelectric effect, Emission Spectrum phenomena and the 3-D model of Atom.

The **Layman, Balmer, Paschen, Bracket, P-fund and Humphrey Series** are explainable via the ACPT. As when the electron will jump from higher concentric circle (here it represents the Principle quantum shells $n=1, 2, 3, 4, 5, 6, 7$) say $n=2, 3, 4, 5, 6, 7$ to $n=1$ it will represent the Layman Series and if from $n=3, 4, 5, 6, 7$ to $n=2$ it will represent the Balmer series and so on. This has been mention in each and every concentric circle of $n= 4, 5, 6, 7$ and on the back of $n= 1, 2, 3$ which is shown as under (see the last page enlarged diagrams).

The ACPT is an **amalgamation of the Modern Periodic Table, the Structure of Atom along with Geometry (Measurement of Angles).**

The ACPT is on the **basis of Mosley's concept of atomic number as well as the Mendeleev's concept of Mass number** (both in increasing order in the anticlockwise direction). This can be **seen as shown below-**



The Atomic Number can be here seen to be increasing in the anticlockwise manner. This is in conformation with the aspect that in geometry in an anticlockwise manner the angle increases.

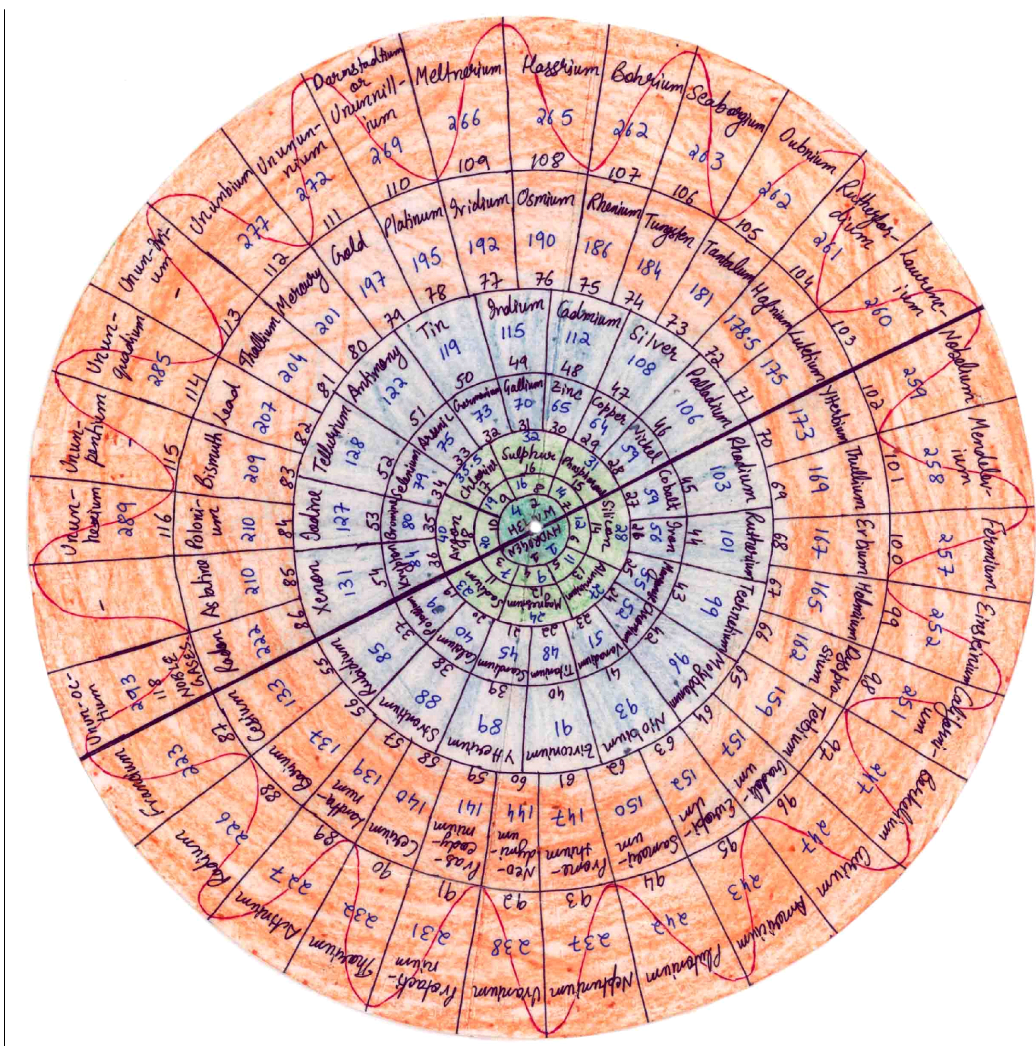
The formula gives the relation.

At the back of this n=7 the atomic masses have been shown in blue ink again increasing in an anticlockwise manner. This has been shown below.

The **Size of the Atom** is also visible via the ACPT. The concentric circles' radii keep on increasing at an irregular value (It is in the consecutive ratio of 1:3:9:16:25:36:49 and so on. This is based on the concept of Quantum Mechanical Model of Atom and Neil's Bohr's theory in which the value of radii is proportional to n^2 as shown in the above picture) such that the successive differences keeps on increasing giving the actual structure of atom. As shown below-

The concentric circles of the ACPT also depict the **number of shells** of an atom called K, L, M, N etc. Or the n=1, 2, 3, 4, 5, 6, 7. These **have been shown** at the start of the presentation.

The ACPT also gives the **Magic Number** 2,8,8,18,18,32,32 which can be easily seen on the back side of **n=7 as shown below** through Dark green, Light green, Blue and orange colours.



In the ACPT the **periodic trends are visible** as well. They can be seen in a group (In MPT the columns were the group, here the groups can be seen going inwards or outwards which will be shown later) going inwards and outwards or in a period (the concentric circles) going anticlockwise or clockwise.

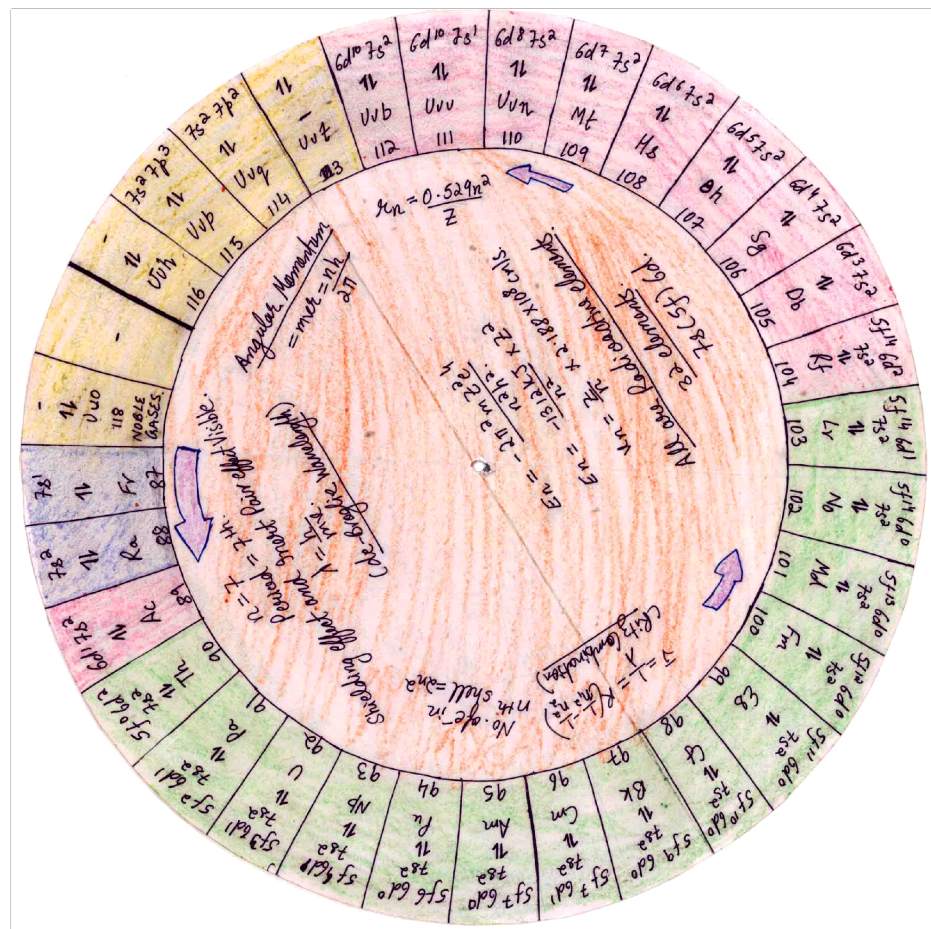
In the ACPT as has been already told that at the back of $n=7$ the **blue ink shows** the atomic masses whereas the **black pen gives atomic number** both in the increasing order in the anticlockwise direction. It has been **shown in the above diagram**.

In the **ACPT all the theories of Structure of Atom** are applicable and easily understood. The **Neil's Bohr's theory** gave the concept of orbits which are visible in all the periods. It gave the concept of quantisation of angular momentum in an orbit which can be seen as that until and unless the electron will rotate in a period ($n=1, 2, 3, 4, 5, 6, 7$) the angular momentum will remain constant. The other formula's of the theory relating to energy, radius, etc. are also explainable. As the value of Principle quantum number **n** increases the energy decreases and the radii increases as can be seen above. **Pauli's exclusion**

principle says that in the Quantum Mechanical Model of Atom an electron is excluded to have a same set of all the four quantum numbers. In short it depicted that only 2 electrons will be present in an orbital. Here in the ACPT one box say represents the orbital and the presence of two electrons has been **shown in n=7 as follows** having the three quantum numbers i.e. the Principle Quantum Number, The Azumithal Quantum Number and the Magnetic Moment Quantum Number may be same but the Spin Quantum Number is different (If one moves clockwise the other moves anticlockwise). **Hund's Rule of Maximum Multiplicity** tells us that the electrons are stable by a concept called as Sharing Energy. Here also in ACPT the electrons can make a jump from one box to the other implying that from one orbital to the other thereby giving the concept of the sharing energy. **This is shown below.** The **De-Broglie's concept** relates to the existence of the dual nature of matter i.e. in the case of Atomic Structure an electron has both particle and wave nature. This has been explained by ACPT **in the above diagram** on the back of n=7 and in the last shell where the electron being a particle travels the wave path. The **Aufbau Principle** states that the electrons that are to be filled in an orbital have to be filled in the increasing order of their energy as $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$ and so on. This can be depicted in the ACPT in the way that since in each concentric circles there are boxes depicted and each box is containing two electrons because it represents an orbital and we know that in an orbital a maximum of 2 electrons can be accommodated, and since in this periodic table the boxes or the orbitals are increasing in an anticlockwise manner and in this way each box or orbital is having the higher energy than the previous one, therefore in the table on filling the electrons from the centre (i.e. from Hydrogen) and moving outwards in anticlockwise manner the electrons are being automatically filled in the way the Aufbau principle states. This is **shown as below.** The **Heisenberg's Uncertainty Principle** states that the Position and Momentum of a sub-atomic particle cannot be calculated simultaneously i.e. one is uncertain about the position and momentum of the electron at the same point of time. This can be explained by ACPT as follows. The electron, a sub atomic particle when is seen say in n=2 to check its Position, to do so one has to throw a light of smaller wavelength but by doing so one makes the electron to jump to a higher shell because in this case smaller wavelength implies larger frequency and thus larger energy. But since the energy of the stationary shell (in this case n=2) was smaller the electron had to jump to a higher energy state say n=5 to quantise the angular momentum. Thus the ACPT explains this concept quite overwhelmingly. This has been **shown as follows.** The ACPT also explains the **Planck's Quantum Theory** as follows. The Planck's Quantum theory states that the radiant energy is constantly emitted or absorbed by a body in a discontinuous manner in the form of small packets called Quanta and these quanta in the case of light are called photons. It states that the energy of an electron in the nth shell (here the concentric circles) is directly proportional to the frequency of energy emitted or absorbed i.e. $E = nh\nu$ where ν is the frequency. So when an electron jumps from one shell to another it either loses or gains energy. This is explained by the ACPT

as in it all the shells have different and increasing energies from inwards to the outwards. **This is shown below.** The **Photoelectric Effect** can also be shown by the ACPT. It states that the electrons are emitted by a metallic plate when the photons of frequency greater than the threshold frequency are thrown on it. This can be **shown as follows.** Since the Periodic Table itself represents an atom and contains electrons in orbitals or boxes, so when photons would be thrown on it the electrons would be ejected. Lastly the ACPT also depicts **Schrodinger's theory.** Schrodinger's theory was wholly the platform of the Quantum Mechanical Model of Atom. In it the four quantum numbers were depicted to give an address to an electron as has already been discussed. The four quantum numbers **n, l, m, s** are depicted in the table, as the **n** gives the size, **l** gives the number of orbitals (1, 3, 5, 7 etc.) which means total of 2, 8, 18, 32 electrons, **m** gives the orientation factor i.e. the shape of the electron which has to be imagined here and the **s** gives the spin of the two electrons in the orbital which has already been **depicted below in the boxes** of the table.

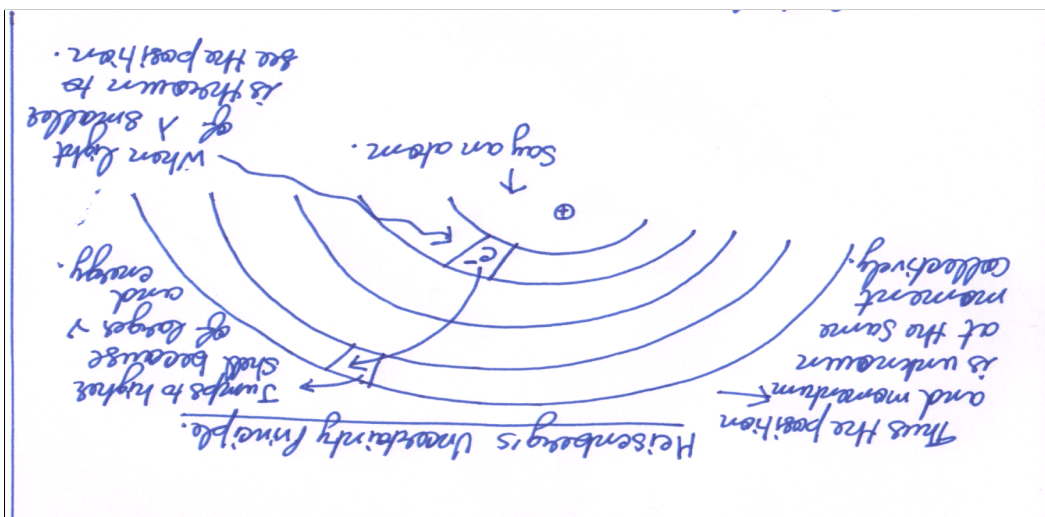
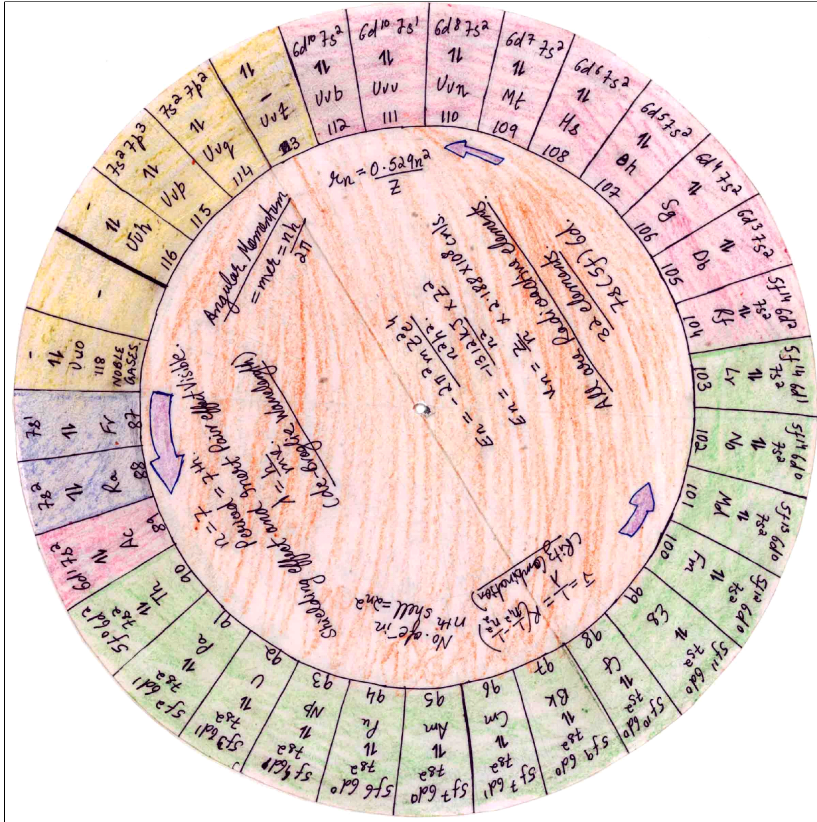
The diagrams are as follows-



They depict Pauli's exclusion principle and Schrodinger's Theory with Electrons having the

opposite spin. Represent the Electrons in an orbital. All the boxes or sub blocks, Represent the orbitals.

The electrons can jump from one orbital to the other thereby giving the concept of Hund's Rule of maximum multiplicity.



This also gives the spiral effect. → can be seen at the back of $n = 7$.

Electrons have been filled in an increasing energy order.

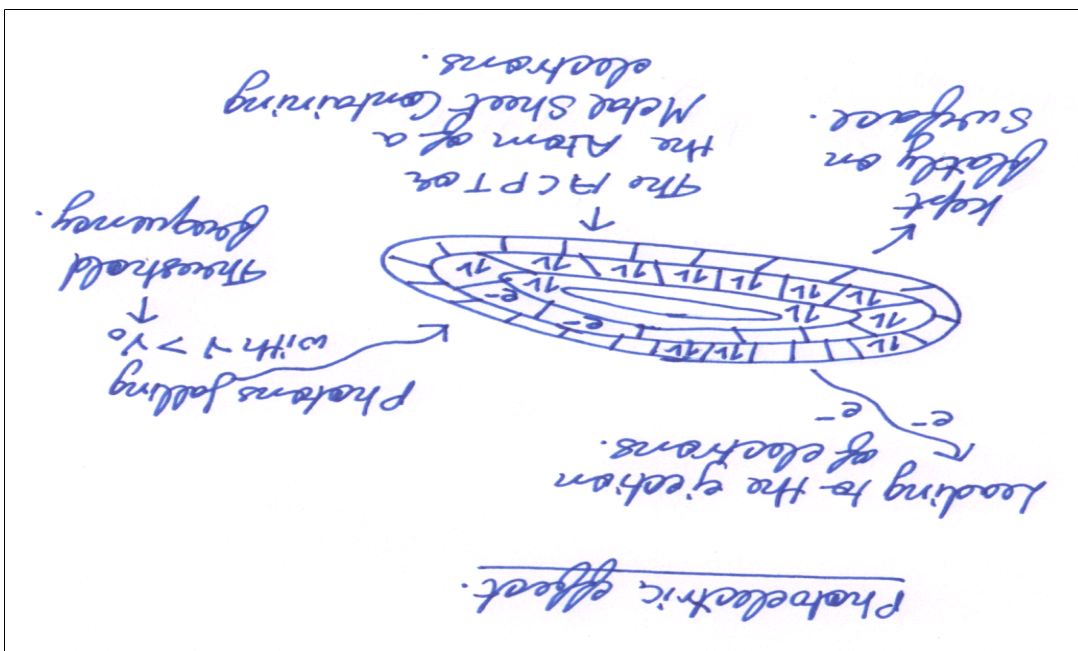
Aufbau principle can be depicted using this both in front and at the back of the Periodic Table.

Planck's Q.T

$E_n = -\frac{13.12 Z^2}{n^2}$

→ e^- jumps from one shell to other the energy emitted is observed, $E = h\nu$.

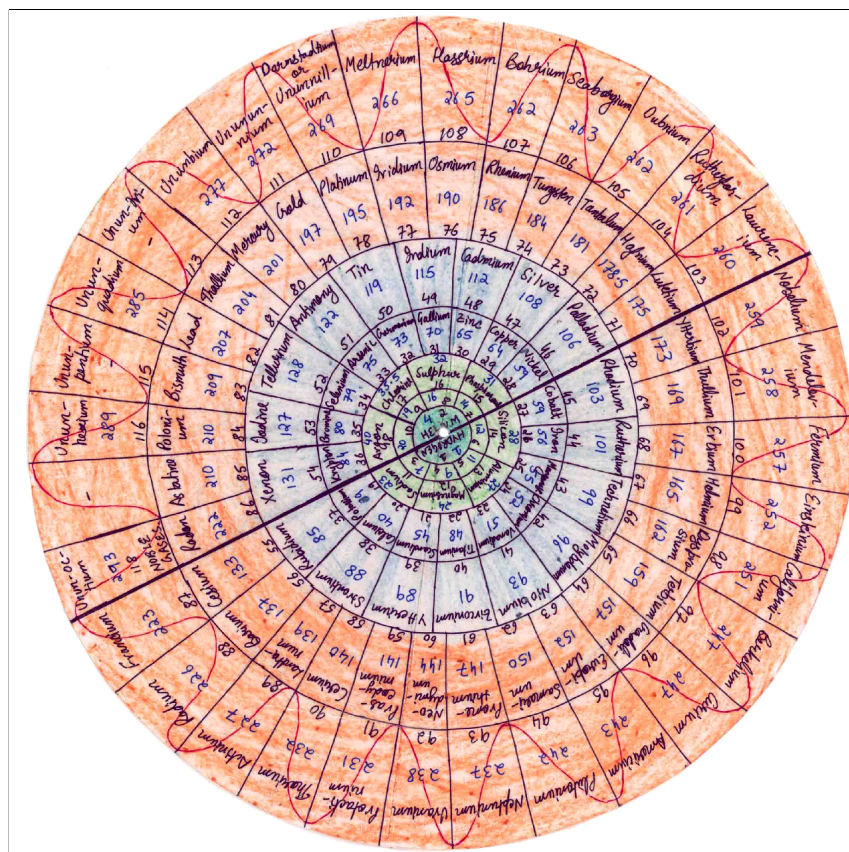
as $E = n h \nu$.



The ACPT depicts the 7 periods and 18 groups similar to those depicted in the Modern Periodic Table. Each shell or the concentric circle depicts a new period. Here it is from $n=1$ to $n=7$ which can be further extended unobjectionably. The 18 groups can be seen anti clock wisely in a period i.e. the shell or the concentric circle and inwards and outwards (if blocks are to be seen i.e. **s, p, d, f blocks**) respectively i.e. the blue colour depicts the s-block, the yellow colour depicts the p-block, the red colour depicts the d-block and the green colour depicts the f-block. This can be seen as follows in the enlarged pictures of the table. For Group Numbers moving anticlockwise the Blue colour gives the Group Numbers 1 and 2, the yellow colour gives the Group Numbers 13, 14, 15, 16, 17, 18, the red colour gives the Group Numbers 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and the green colour gives the Group Number 3 (f block).

The **s, p, d, f blocks** are also depicted by the ACPT as explained above.

The major asset of the ACPT is that its concentric circles can be rotated about its common centre. Moreover the stationary aspect has also been kept in which the ACPT can be seen to be not rotatable i.e. at the back of $n=7$ where the same whole periodic table can be seen not rotating.



This is the back of $n=7$ which is not rotatable and is fixed. Therefore if periodic table has to be seen as fixed one can see this and for the rotatable form one can see the front of the table.

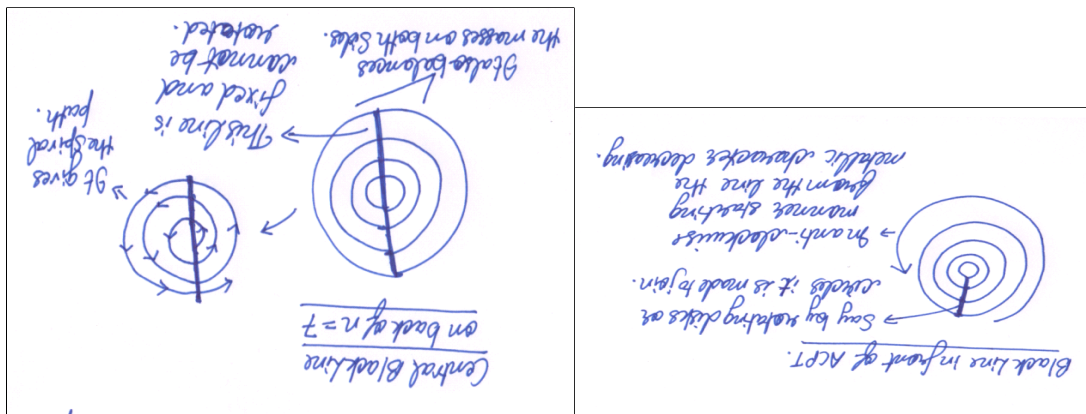
Since the ACPT is movable therefore the **relationships between any elements** can be found. But the relationship has to be positive one. For Example Hydrogen having one proton and one electron can be related to all because all the elements have electron and protons as their fundamental particles. But if outer shell elements are radioactive one cannot expect even Hydrogen to behave radioactively. Here we can have a positive relationship that Hydrogen's isotope Tritium is radioactive. Therefore if a relation has to be maintained one should think of a positive relation.

The ACPT also helps us understand the **Binding Energy Concept of Nuclear Fission and Nuclear Fusion**. In the table it is easily clear that elements with lesser mass number lie near the nucleus (**as seen on $n=7$ back**) and are thus stable. In the theory of Binding Energy Concept the element Iron (atomic number 26) is the most stable having energy equal to 8.8 Mega electron volts. And Iron lies in $n=4$. Therefore the higher or Transuranic elements and even the lower elements try to come nearer to $n=4$ and thus try to undergo Nuclear fission or nuclear fusion respectively. Therefore if $n>4$ or $n<4$ the elements' nuclei are unstable and want to reach in the region of $n=4$ thus giving the

nuclear concept.

The ACPT also brings out the **Spiral Effect**. We all are quite familiar with Maxwell's question (Electron should follow a spiral path and fall into the nucleus). Leaving it, if we accurately focus on back of $n=7$ it is visible that where the previous atomic number ends in lower shell or concentric circle in the anticlockwise manner the next starts in a higher shell giving the spiral effect. This can be seen in the enlarged pictures at the end.

The ACPT **has two black lines** both in the front and in the back. The front one black line is breakable because of the rotation of the circles. However, the **central black line** at the back on $n=7$ is fixed as that side is fixed. The central black line at the back of $n=7$ depicts the middle of the Periodic table and it helps to easily visualize the spiral effect and the volume the electrons or the elements occupy. Since the size of the orbitals or boxes and the respective half circles on both the sides on the central line increases this implies that the electrons as they start moving out from the middle of the periodic table they start getting more space or volume to move as depicted by Schrodinger's theory. Now if the black line on the front of the periodic table is joined then it is seen that moving anticlockwise starting from the line gives a decrease in the metallic nature of the elements and vice versa. Also the elements near the black line in the front tend to behave as metalloids.

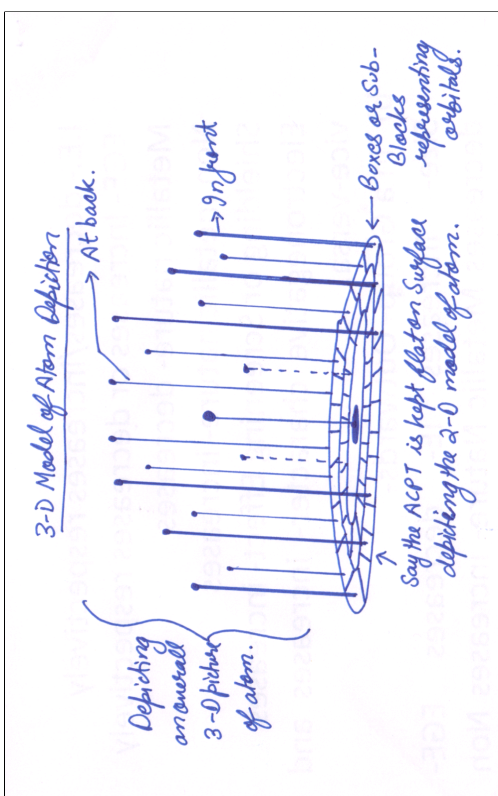


The Crux of the ACPT is its **Anticlockwise Depiction**. In geometry under the measurement of angles the anticlockwise angle is positive whereas clockwise it is negative. Now since the spiral goes inside out it means we are heading anticlockwise towards positive end. Thanks to the Neil's Bohr's theory, that at the centre energy is negative. Therefore moving positively at infinity the energy will be equal to zero. This is clearly depicted in this table. Similarly, from infinity if we reach to the nucleus clockwise (and not anticlockwise to help the Bohr's Concept) the energy decreases. And moreover this periodic table **can be extended till infinity**. And the energy based electronic concept can be understood on the same basis.

The ACPT depicts **Metals, Non Metals**, and gases as well. It has been discussed earlier in the case of black line concept. However, one can use any other colour sense if required for the depiction of the same.

The **Pictorial Reason for the Increasing Energy** in the ACPT can be depicted as follows. We know that electron shows both particle and wave nature. Since after each principle quantum number n the size of the shell and space for the movement of electron increases therefore its wavelength increases. Now since frequency is inversely proportional to wavelength therefore if wavelength increases frequency decreases and by Planck's quantum theory $E=nh\nu$. Therefore the mod value of energy falls or become less. But by Bohr's theory energy in the n^{th} shell is negative of this mod value E . Therefore it becomes more or goes towards the positive.

The ACPT depicts the **Wave Nature** as well. By Schrodinger's theory we know Ψ^2 gives the area or volume probability to find an electron. If area increases and the sub blocks i.e. the boxes are diagonally joined one can imagine the electron showing a wave nature of larger wavelength and larger amplitude in successive shells. This has been **shown while discussing the De-Broglie Theory** above.



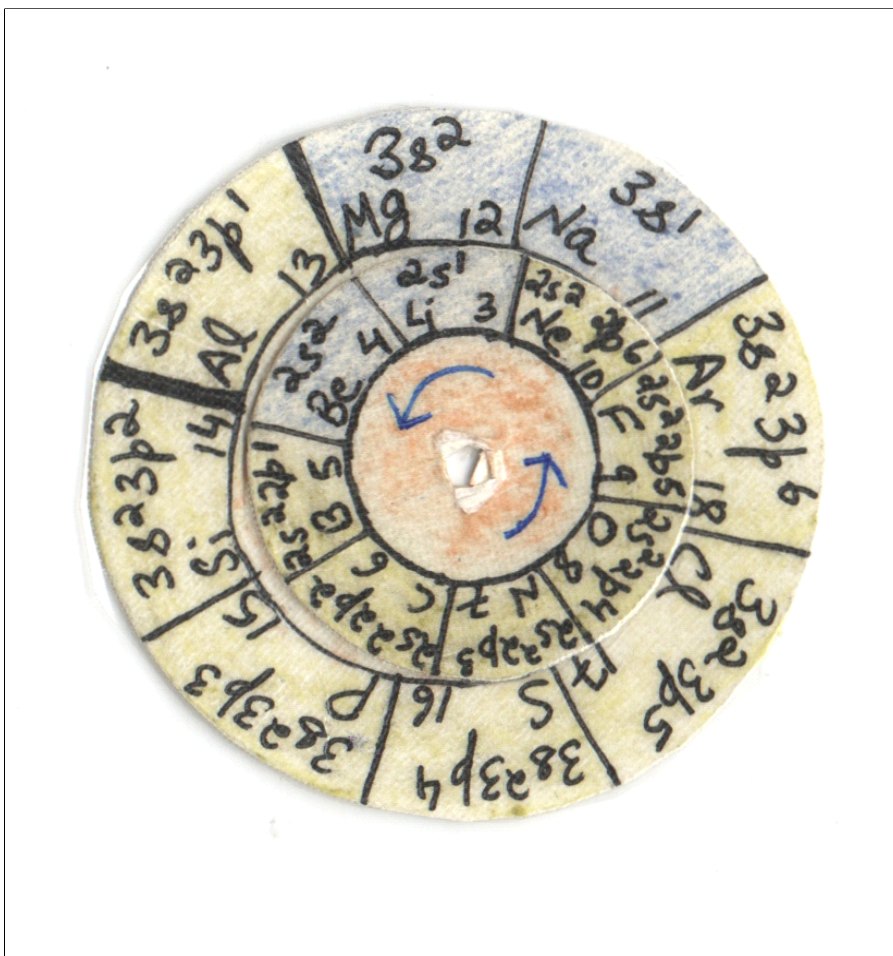
The **Orbital Concept and $2n^2$ (2, 8, 18, 32) rule** is also depicted by ACPT. The boxes or the sub blocks on each concentric circle represent the orbitals. Whereas the rule has been depicted while discussing the magic number above.

The ACPT can be used to depict the **3-D Model of Atom** as well. This can be done as

follows. If in the sub blocks or the boxes and at the centre holes are made and wires having beads at one end signifying the moving electrons are joined to it having different lengths then the electron moving (flexible wires), size of atom and nucleus can be wonderfully seen.

The ACPT depicts the **Extent of d and f block elements** as well. Through the table it can be easily seen that d and f block elements don't even dart near the nucleus. They exist from $n=4$. This gives an idea of **Penetration effect** of s and p orbitals and explains the **Penetration effect**. For example the Representative elements (s block) start early from group 1 ($n=1$) but others don't.

The **Diagonal Relationship** in the ACPT has been converted into the **Pseudo Group**. In the Modern Periodic Table the Diagonal relationship was visible between Period 2 and 3 elements. In the ACPT since it is rotatable this converts into the formation of the Pseudo Group or Pseudo Block i.e. a block which doesn't actually exist.



From inwards to outwards as it can be seen that Mg is related to Li, Be to Al, B to Si, C to P, N to S and O to Cl. This is the Diagonal Relationship. This leads to the formation Of a Pseudo Group.

The ACPT **overcomes the Defects of the Modern Periodic Table**. The two major defects of the Modern Periodic Table have been overcome in this table i.e. the Hydrogen's anomalous position and f block elements. Hydrogen being the first element (n=1 or in first period) has to be kept at the centre of the ACPT. Therefore no question of second position arises as was in the case of Modern Periodic Table. Moreover as has been earlier said it can be compared with group 17 if the need arises. F block hasn't been kept outside the ACPT because there is no outside or inside in this table. It has been made an integral part of the table which not done so in the Modern Periodic Table and the block was kept outside the major table. The F-block has been shown as follows.

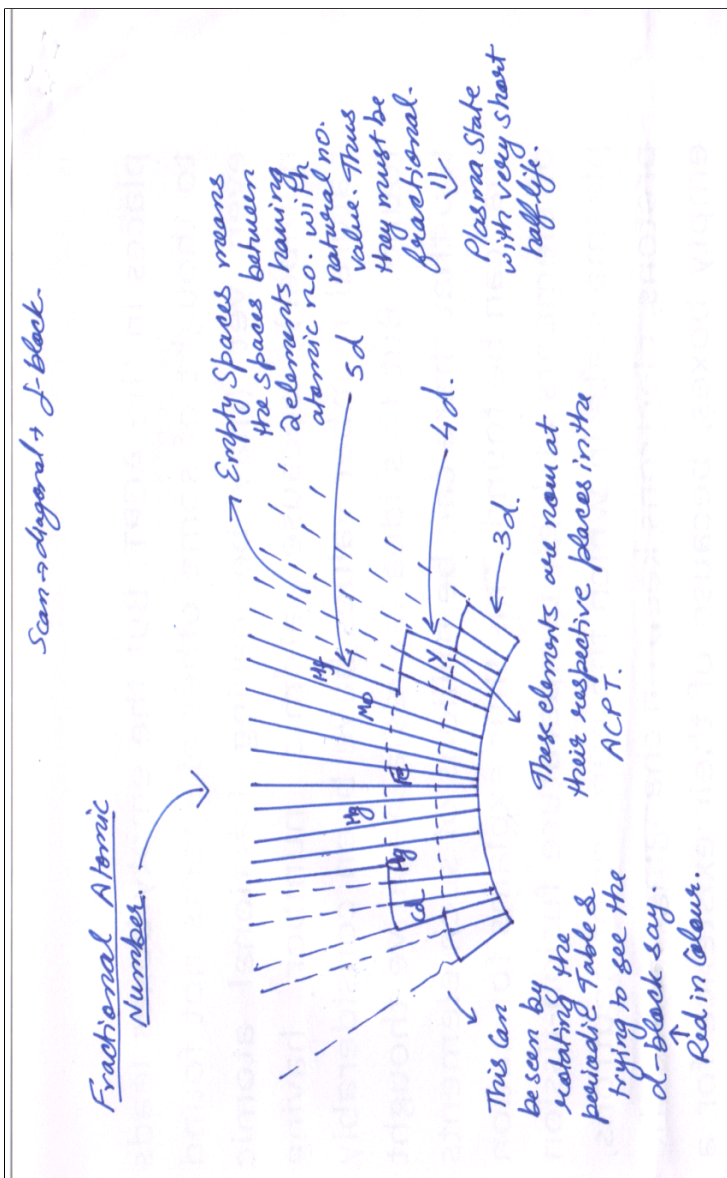
Group number 3, Period number 6 and 7 And the F-block

The ACPT can become a very helpful device for the **Future Explorations** as well. In future say any other element is created or found then its position can be put to question in the Modern Periodic Table but not in ACPT. For example say an f block element is found then it would be difficult to have a new box. But not in the case of ACPT. This is thus a limitation of Modern Periodic Table but not in this table.

The ACPT is a supreme example of conversion of a **Microcosm thing into a Macrocosm** one. The Atomic Structure is a microscopic phenomenon which is being depicted at a macroscopic level in the ACPT.

The ACPT helps us understand the **Accommodation of Electrons and Mass of Atom**. In the formula $R = R_0 A^{1/3}$ where R is the radius of the nuclei, R_0 is the Radius constant and A is the Atomic mass, here if A is taken to be average atomic mass of elements of respective principal quantum numbers (Periods) then it would be more easier to know that by how

much amount the size of the shells increase and how their ability to accommodate more electrons and mass depends on the radius R. Thus it helps us to understand the accommodation of Atom.

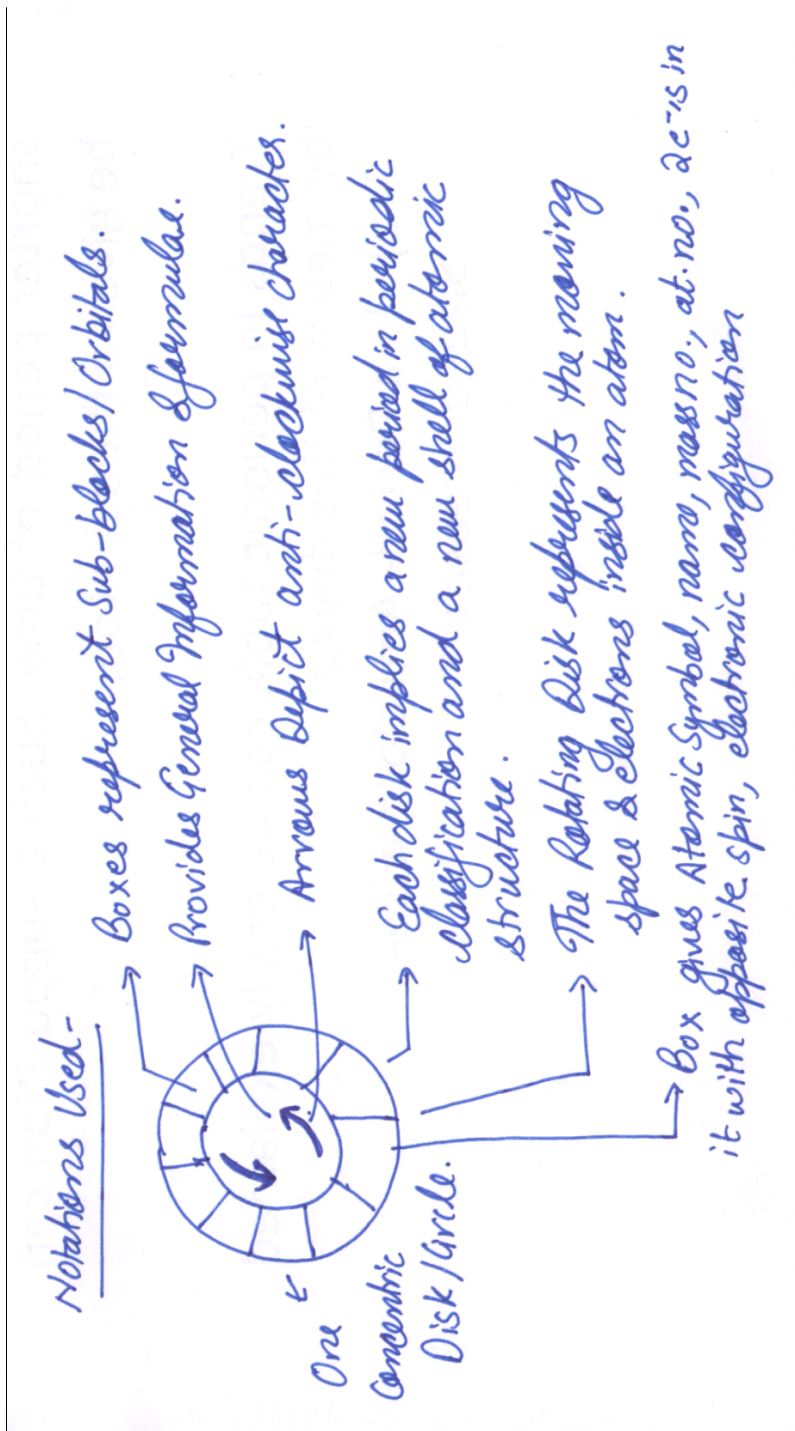


The most mindboggling concept

of ACPT is that of **Fractional Atomic Number**. Since geometry has been used the angles are limited i.e. 360 degrees. Thus while seeing s, p, d blocks (not f-block) a problem of symmetry arises. If the greatest angle i.e. the lowest quantum number (shell) is taken into consideration and the divisions done accordingly, not only does it give an idea of sub groups (as done by Mendeleev) but also gives an idea of some elements which may be found from centuries now onwards having fractional atomic number. i.e. say d block is considered as follows. The empty boxes leads to thought of some other elements not found even yet (may be having fractional atomic number) because atomic number having natural values have been considerably found. But this idea leaves a negative

thought too that there can be millions of such elements that can be found. This thus explains the formation of elements at high temperature fusion-fission Plasma state in which the number of neutrons, protons, and electrons keeps on changing. Hence the empty boxes because of their existence for a shorter period of time.

The **Trends in the Periodic Properties of elements** in the ACPT is as follows. In a period in the anticlockwise manner- the size decreases, Ionization enthalpy decreases or increases respectively, Electron Gain Enthalpy Increases or decreases respectively, Metallic nature decreases, Non metallic nature increases, Shielding effect or Screening effect increases, electronegative character increases AND VICE VERSA. In a group in the outwards direction- the size increases, Ionization enthalpy decreases, Electron Gain Enthalpy decreases, Metallic nature increases, Non metallic nature decreases, Shielding effect or Screening effect increases, electropositive character increases AND VICE VERSA.



Finally, the ACPT doesn't

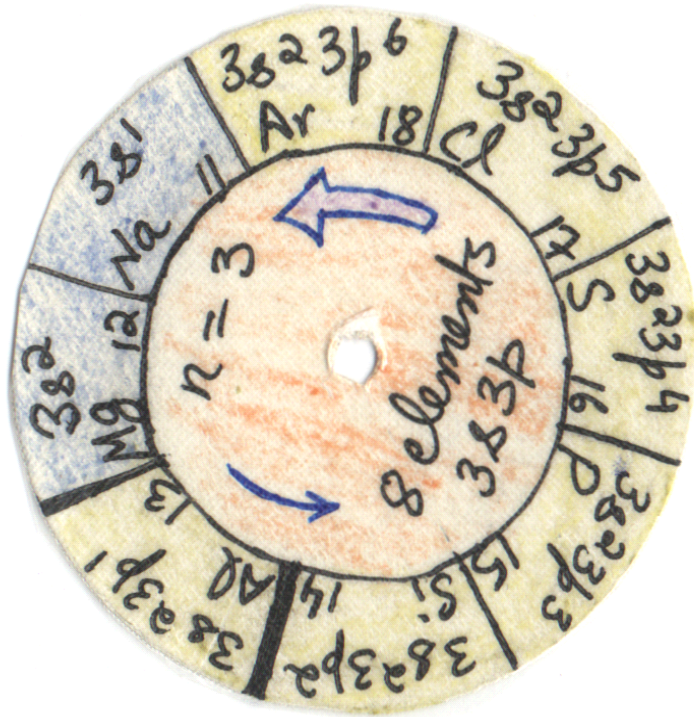
discard any kind of theory, opens up better prospects of thinking which may not be thought or explainable logically presently, gives better information in innovative manner than the Modern Periodic Table, is easy to use and understand and can be put forward for various practical interpretation of concepts which was not possible earlier.



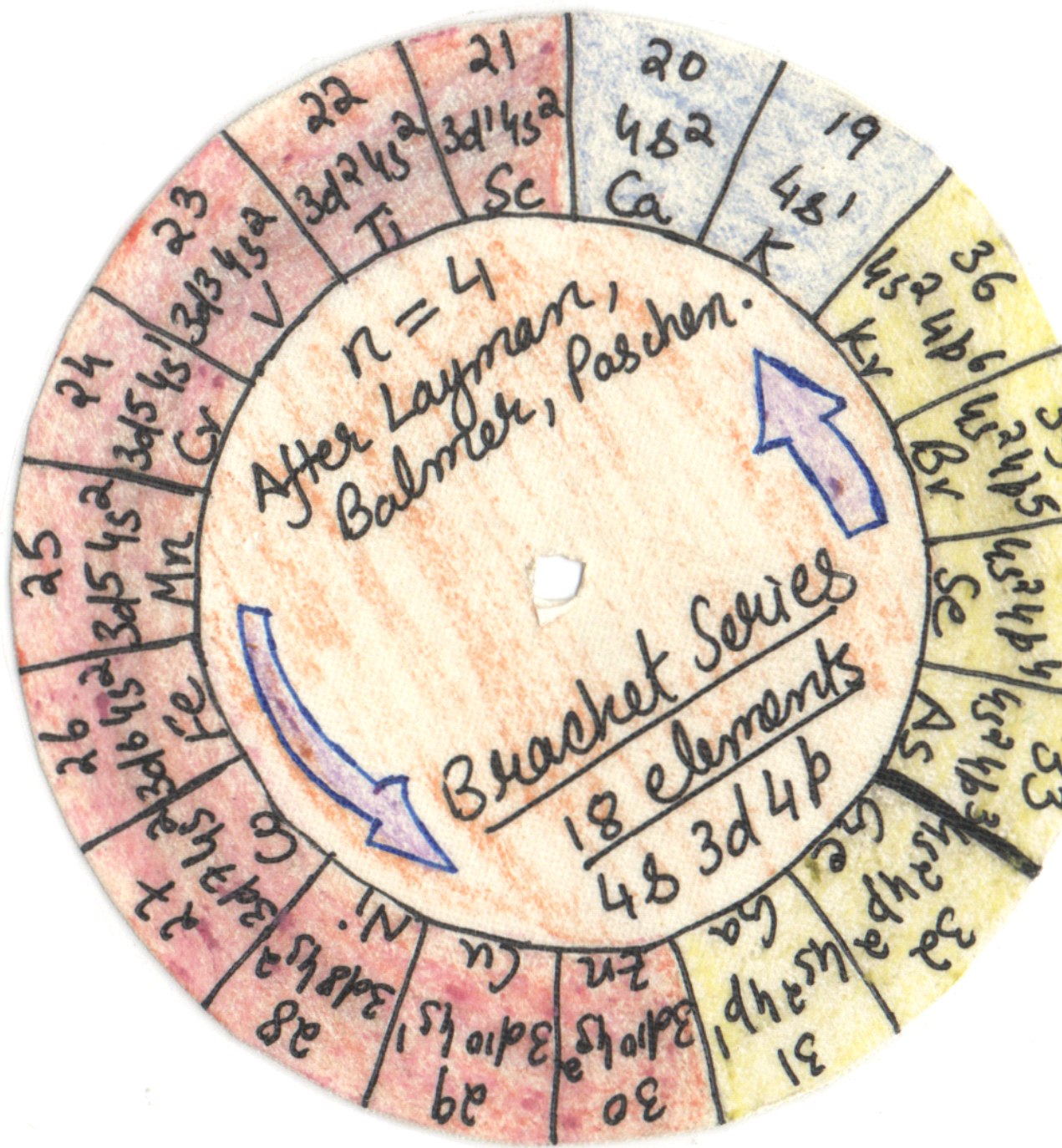
Enlarged

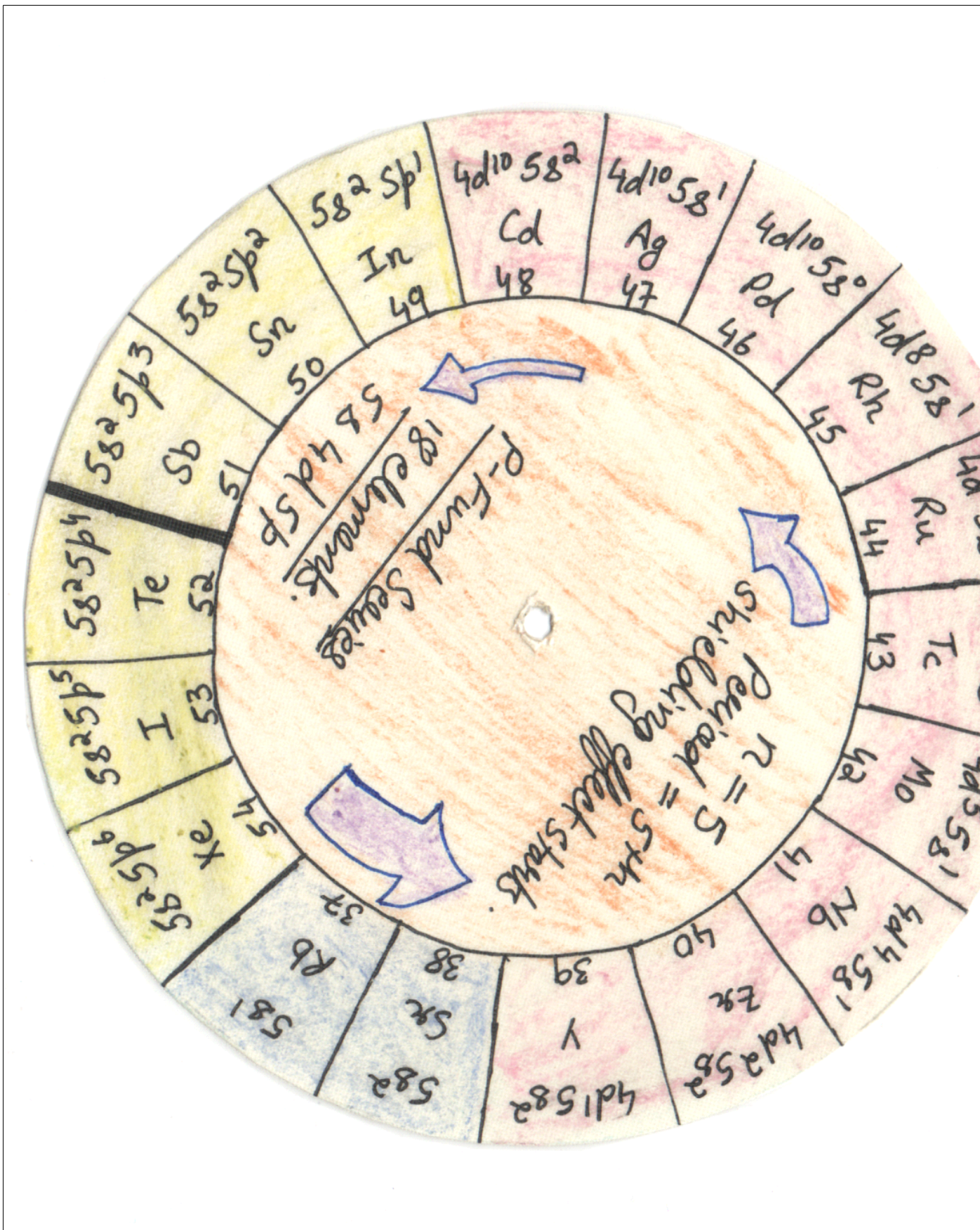
Pictures of the Periodic Table – These are the various concentric circles showing the front of $n=1, 2, 3, 4, 5, 6, 7$ and the back of $n=1, 2, 3$ and 7 .

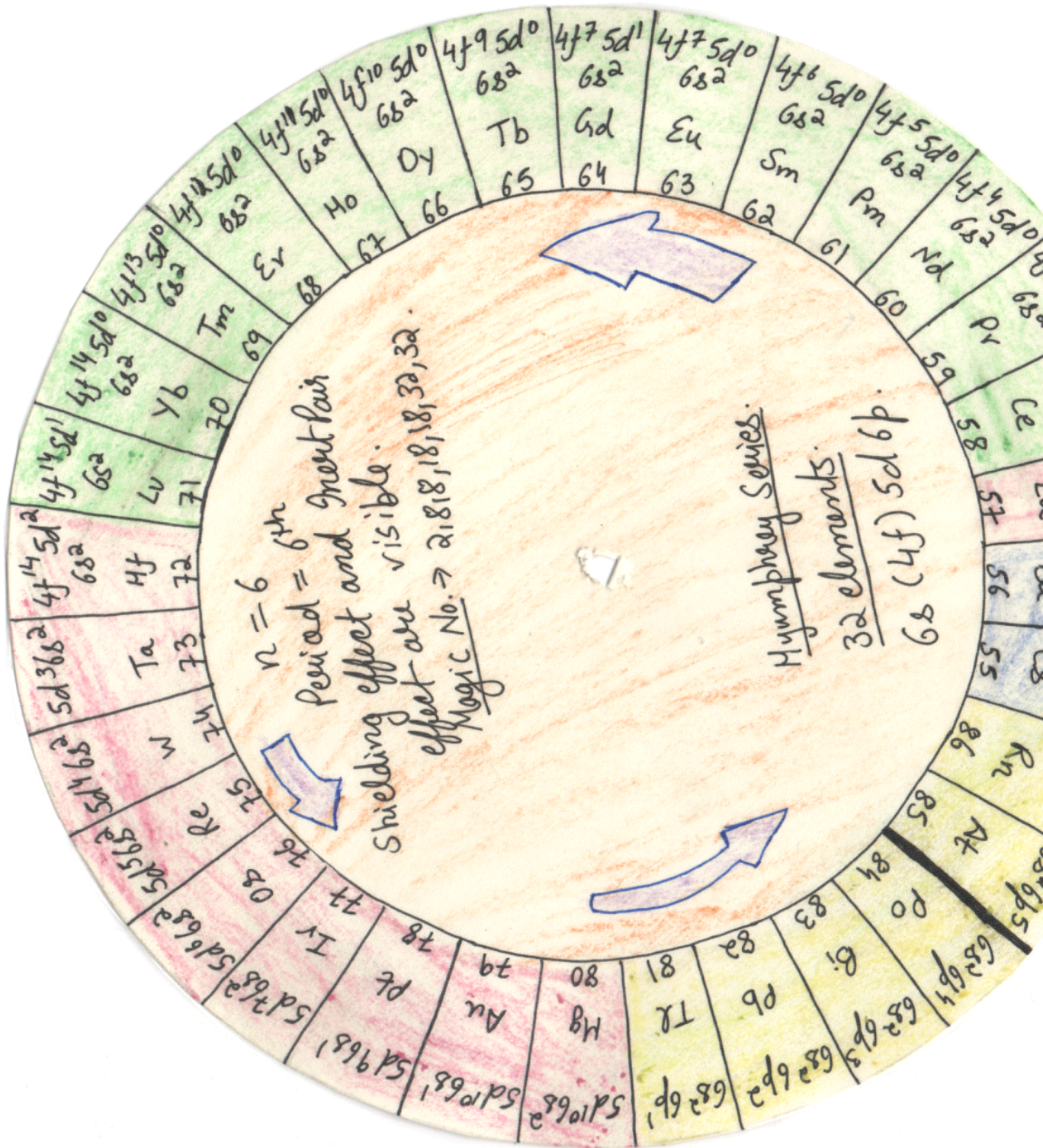




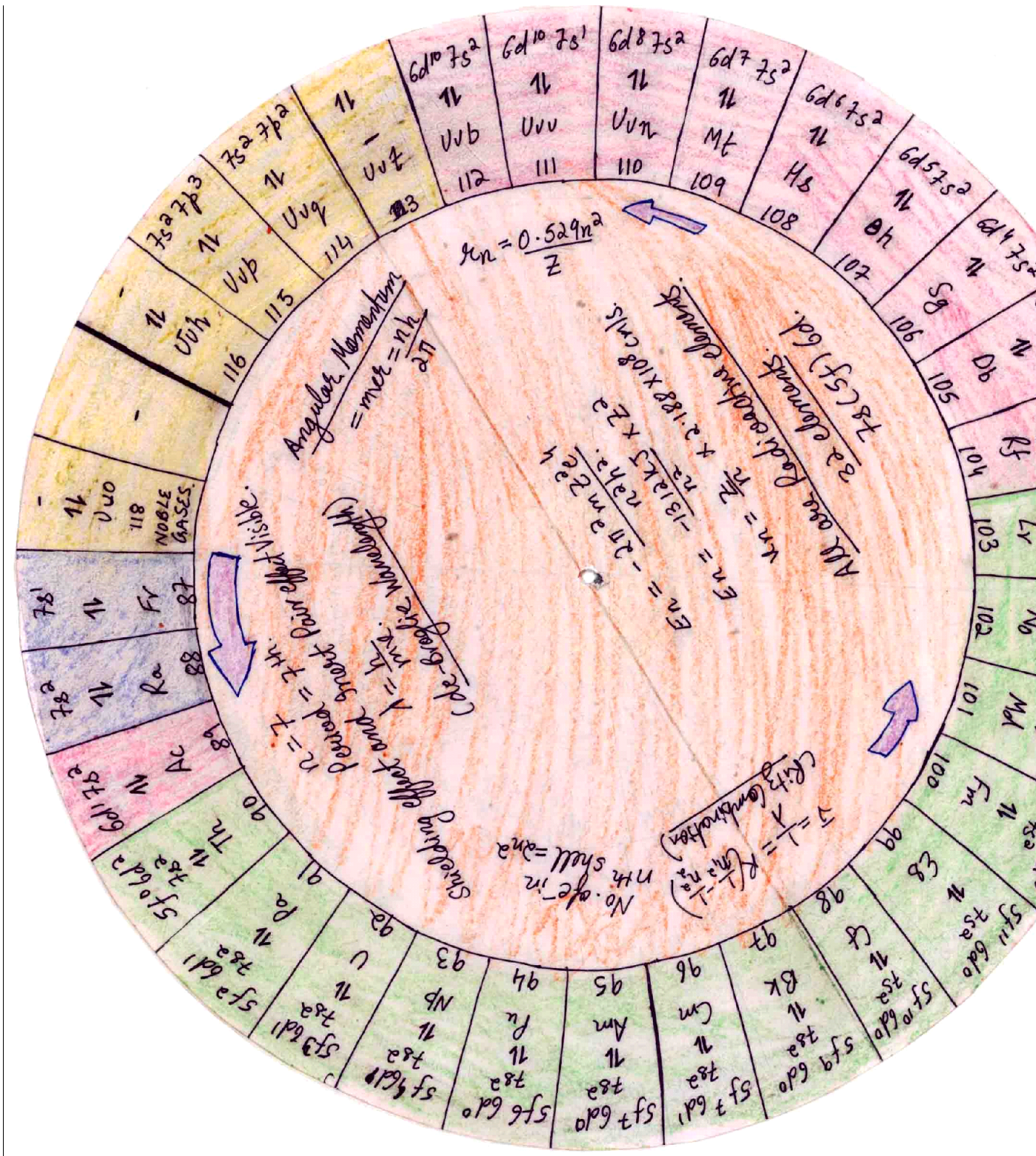


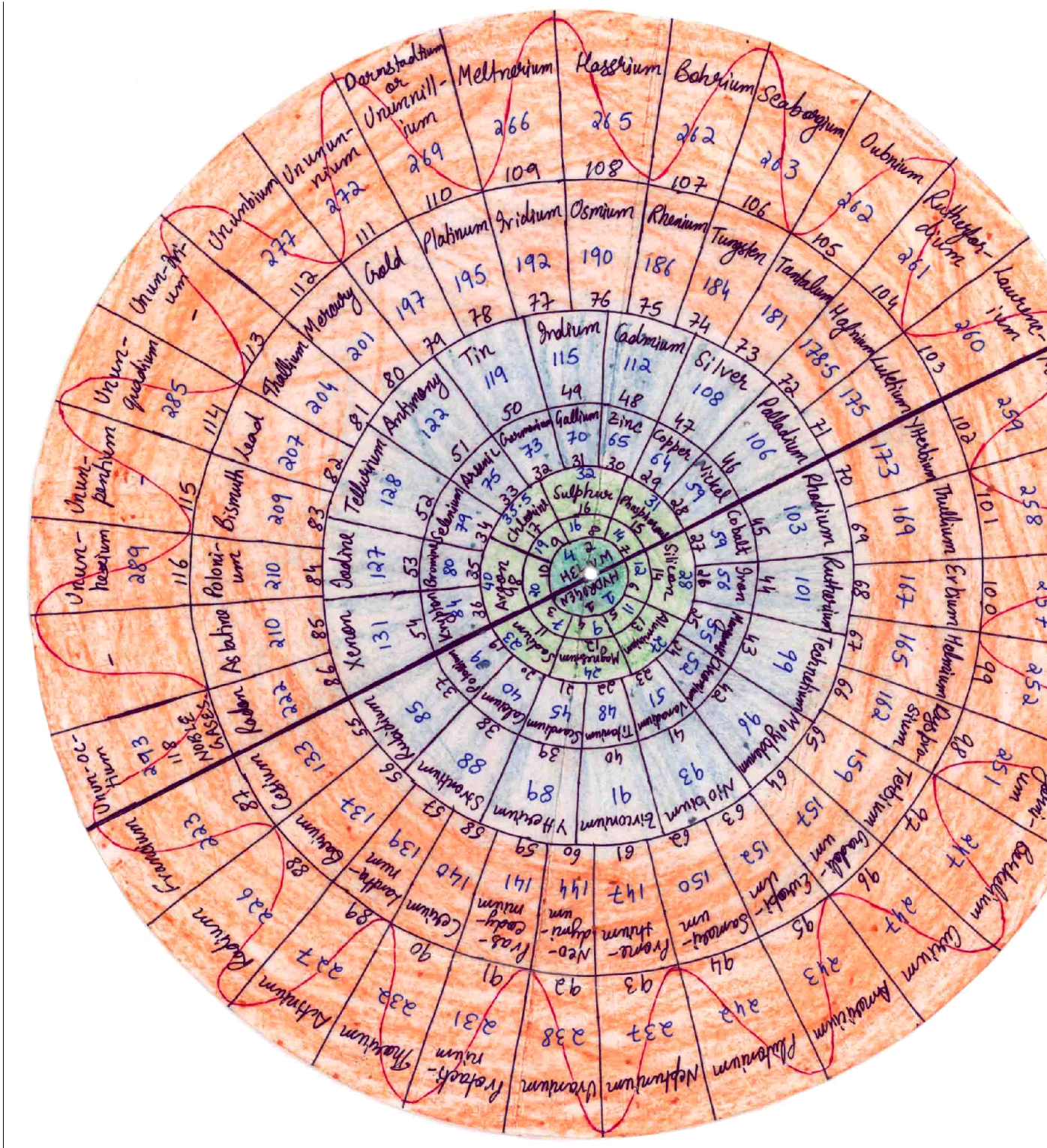






4f ¹⁴ 5d ¹ Lu 71	4f ¹⁴ 5d ⁰ Yb 70	4f ¹⁴ 5d ⁰ Tm 69	4f ¹⁴ 5d ⁰ Er 68	4f ¹⁴ 5d ⁰ Ho 67	4f ¹⁴ 5d ⁰ Dy 66	4f ¹⁴ 5d ⁰ Tb 65	4f ¹⁴ 5d ¹ Gd 64	4f ¹⁴ 5d ⁰ Eu 63	4f ¹⁴ 5d ⁰ Sm 62	4f ¹⁴ 5d ⁰ Pm 61	4f ¹⁴ 5d ⁰ Nd 60	4f ¹⁴ 5d ⁰ Pr 59	4f ¹⁴ 5d ⁰ Ce 58	4f ¹⁴ 5d ⁰ La 57
5d ³ 6s ² Ta 73	5d ³ 6s ² W 74	5d ⁴ 6s ² Re 75	5d ⁵ 6s ² Os 76	5d ⁶ 6s ² Ir 77	5d ⁷ 6s ² Pt 78	5d ⁸ 6s ¹ Au 79	5d ¹⁰ 6s ¹ Hg 80	5d ¹⁰ 6s ¹ Tl 81	5d ¹⁰ 6s ² Pb 82	5d ¹⁰ 6s ² Bi 83	5d ¹⁰ 6s ² Po 84	5d ¹⁰ 6s ² At 85	5d ¹⁰ 6s ² Rn 86	5d ¹⁰ 6s ² Fr 87





Back of n=7