

# Physical Science Class X

Bit Bank in New Look

Specially Dedicated to  
My Beloved Parents

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and  
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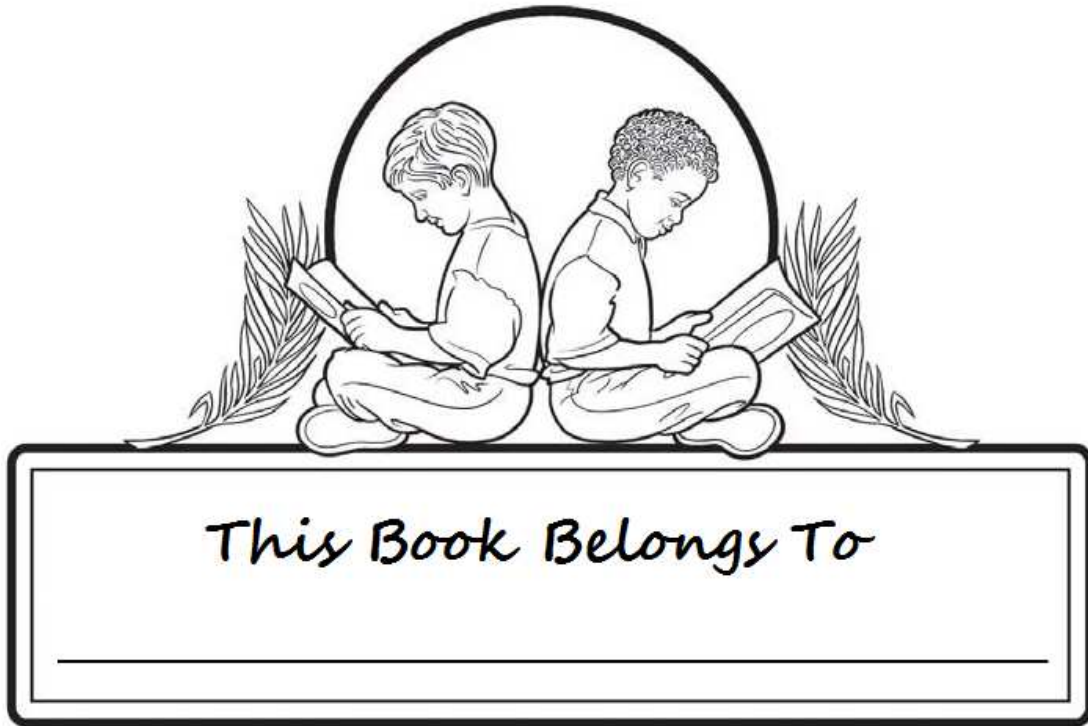
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*Inspite many efforts taken to present the bit bank without errors. Some errors might have been erupts in .We do not take any legal responsibility for such errors and omissions. If they brought to our notice, we will be corrected in the next edition.*

*With Best Wishes,*

*Gali Sree Kar (9700842884, 9440234404)*

## అస్థమించిన వీరుడు-అలుపెరుగని ధీరుడు-నల్ల జాతి సూర్యుడు

**నెల్సన్ రోలిహ్లా మండేలా** (ఆంగ్లం Nelson Rolihlahla Mandela,

జననం 18 జూలై, 1918) దక్షిణాఫ్రికా మాజీ అధ్యక్షుడు. ఆ దేశానికి పూర్తి స్థాయి ప్రజాస్వామ్యంలో ఎన్నికైన మొట్టమొదటి నాయకుడు. అధ్యక్షుడు కాకమునుపు ఇతను జాతి వివక్ష వ్యతిరేఖ ఉద్యమ కారుడు మరియు ఆఫ్రికన్ నేషనల్ కాంగ్రెస్ కు, దానికి సాయుధ విభాగం అయిన "ఉంకోంటో విసిజ్వే"కు అధ్యక్షుడు. జాతి వివక్షకు వ్యతిరేకంగా జరిపిన పోరాటంలో జరిగిన ఒక మారణకాండకు సంబంధించి 27 సంవత్సరాల పాటు "రోబెన్" అనే ద్వీపంలో జైలు శిక్షననుభవించాడు. 20వ శతాబ్దపు అత్యంత ప్రసిద్ధులైన ప్రపంచ నాయకులలో ఒకడు. **నల్లజాతి సూరీడు** అని పలు తెలుగు వ్యాసాలలో ఈయనను గురించి వర్ణించారు. జాతి వివక్షతకు వ్యతిరేకంగా జరిపే పోరాటాలకు, వర్ణ సమానతకు నెల్సన్ మండేలా సంకేతంగా నిలిచాడు.



ఫిబ్రవరి 11, 1990లో జైలునుండి విడుదల అయిన తరువాత నెల్సన్ మండేలా రాజకీయంగా తన లక్ష్యాన్ని సాధించడానికి, దేశంలో నెలకొన్న జాతి వైర్యాన్ని నివారించడానికి, అందరి మధ్య సయోధ్య పెంచడానికి కృషి చేశాడు. తన పూర్వపు ప్రతిస్పర్ధులనుండి కూడా ప్రశంసలు అందుకొన్నాడు. వందకు పైగా అవార్డులు, సత్కారాలతో వివిధ దేశాలు, సంస్థలు మండేలాను గౌరవించాయి. వాటిలో 1993లో లభించిన నోబెల్ శాంతి బహుమతి ముఖ్యమైనది. స్వదేశంలో మండేలాను **మదిబా** అని వారి తెగకు సంబంధించిన గౌరవసూచకంతో మన్నిస్తారు.

మహాత్మాగాంధీ బోధించిన శాంతియుత విధానాలు, అహింస, శత్రువును సంస్కారయుతంగా ఎదుర్కొనే పద్ధతి తనకు ఎంతో స్ఫూర్తినిచ్చాయని మండేలా పెక్కుమార్లు చెప్పాడు. భారత దేశం మండేలాను 1990 లో 'భారత రత్న', జవహర్ లాల్ నెహ్రూ అంతర్జాతీయ సయోధ్య బహుమతితో సత్కరించింది. భారత దేశం నుండి మండేలాకు ఎంతో సమర్థన లభించింది. ప్రపంచవ్యాప్తంగా అణచివేతకు వ్యతిరేకంగా పోరాడే కోట్ల మంది ప్రజలకు మండేలా ఒక ప్రతీకగా మారారు. పశ్చిమ దేశాలు కూడా హక్కుల ఉద్యమ కారులైన అబ్రహం లింకన్, మార్టిన్ లూథర్ కింగ్ లతో సమానంగా ఆయన్ను గౌరవిస్తున్నాయి. హింసా మార్గంలో ప్రారంభించిన ఉద్యమాన్ని గాంధేయ మార్గంలోకి ఆయన మలచుకున్న తీరు ఆయనకు దక్షిణాఫ్రికా గాంధీగా పేరు తెచ్చింది. నోబెల్ శాంతి బహుమతితో అంతర్జాతీయ సమాజం ఆయన్ను గౌరవించుకోగా, 1990లో అత్యున్నత పౌర పురస్కారం భారతరత్న ఇచ్చి భారతీయ సమాజం తనను తాను గౌరవించుకుంది. మండేలా డిసెంబర్ 5, 2013 న మరణించారు. మండేలా మానవతకే స్ఫూర్తి ప్రదాతని రాష్ట్రపతి ప్రణబ్ ముఖర్జీ కొనియాడారు. దక్షిణాఫ్రికా మాజీ అధ్యక్షుడు నెల్సన్ మండేలా మృతికి గౌరవసూచకంగా కేంద్ర ప్రభుత్వం ఐదు రోజుల సంతాపదినాలు ప్రకటించింది.

“ యుగలు తపస్సు చేసినా ఫలించేది క్షణలోనే-జ్ఞానమే ముక్తి! ”

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కోటివిద్యలున్నా కూటికిసరి పోయే

కాటిపాలుచేసికదిలిపోయే

సూటిగన్న వాడుకాటికిబోవునా?

ఏటిబ్రతుకునీదియెరుగుముజీవా...!

పరులను జూచి యసూయతో,

చెరపగ యత్నింపబోకు చెరుపగు నీకే

పరుల సుఖంబును గొరిన,

విధాత నిన్ను గాచు పదిలము జీవా!!

క్షీరంబు గ్రోలి హంసలు

నీరంబులవదిలినట్లునిజగురుబోధల్

సారంబుగోలినిత్యము

నేరంబులఇతరులందునెంచకుజీవా...!

మొమెత్తి పలుకని శిలలకు

వర్ణంబెరుగని విధాత

వెదంబెరిగిన దాసుడా?

వర్ణము గుణమేగదరా సోమారి జీవా!!

## 1. Heat

### Fill in the blanks

1. The SI unit of specific heat is  $\text{J/Kg}^{-1}\text{-K}$ .
2. Heat flows from a body at higher temperature to a body at lower temperature.
3. Evaporation is a cooling process.
4. An object 'A' at  $10^{\circ}\text{C}$  and another object 'B' at  $10\text{K}$  are kept in contact, then heat will flow from A to B.
5. The latent heat of fusion of ice is  $80\text{ Cal/gm}$ .
6. Temperature of a body is directly proportional to average kinetic energy of the molecules of the body.
7. According to the principle of method of mixtures, the net heat lost by the hot bodies is equal to net heat gained by the cold bodies.
8. The sultriness in summer days is due to high evaporation.
9. Water is used as a coolant.
10. Ice floats on water because of its less density.

### Multiple choice questions

1. Which of the following is a warming process [ B ]  
 a) Evaporation      b) condensation      c) boiling      d) all the above
2. Melting is a process in which solid phase changes to [ B ]  
 a) liquid phase      b) liquid phase at constant temperature  
 c) gaseous phase      d) any phase
3. Three bodies A, B and C are in thermal equilibrium. The temperature of B is  $45^{\circ}\text{C}$ . then the temperature of C is [ A ]  
 a)  $45^{\circ}\text{C}$       b)  $50^{\circ}\text{C}$       c)  $40^{\circ}\text{C}$       d) any temperature
4. The temperature of a steel rod is  $330\text{K}$ . Its temperature in  $^{\circ}\text{C}$  is [ B ]  
 a)  $55^{\circ}\text{C}$       b)  $57^{\circ}\text{C}$       c)  $59^{\circ}\text{C}$       d)  $53^{\circ}\text{C}$
5. Specific heat,  $S =$  [ C ]  
 a)  $Q/\Delta t$       b)  $Q\Delta t$       c)  $Q/m\Delta t$       d)  $m\Delta t/Q$
6. Boiling point of water at normal atmospheric pressure is [ B ]  
 a)  $0^{\circ}\text{C}$       b)  $100^{\circ}\text{C}$       c)  $110^{\circ}\text{C}$       d)  $-5^{\circ}\text{C}$
7. When ice melts, its temperature [ A ]  
 a) remains constant      b) increases      c) decreases      d) cannot say

## 2. Chemical Reactions and Equations

- The decomposition of vegetable into compost is an example of oxidation reaction.
- The chemical reactions in which energy is absorbed to form a new compound is called endothermic.
- The reaction  $2\text{N}_2\text{O} \rightarrow 2\text{N}_2 + \text{O}_2$  is an example for decomposition reaction.
- The reaction  $\text{Ca} + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{H}_2\uparrow$  is an example for displacement reaction.
- The substances that are present on left side of a chemical equation are called reactants.
- The arrow mark between the products and reactants of a chemical equation shows direction of the reaction.

### Match the following.

- |  |                                  |
|--|----------------------------------|
| 1) $2\text{AgNO}_3 + \text{Na}_2\text{CrO}_4 \rightarrow \text{Ag}_2\text{CrO}_4 + 2\text{NaNO}_3$ ( D ) | a) combination reactions         |
| 2) $2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$ ( B )   | b) decomposition reactions       |
| 3) $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_6\text{O}$ ( A )            | c) displacement reactions        |
| 4) $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ ( C )                      | d) double displacement Reactions |

### Multiple choice questions

- $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$ . above reaction is an example of. [ C ]  
 a) Combination reaction      b) Decomposition reaction  
 c) Displacement reaction      d) Double decomposition reaction
- What happens when dil. hydrochloric acid is added to iron filings? Choose the correct answer. [ A ]  
 a) Hydrogen gas and iron chloride are produced.  
 b) Chlorine gas and iron hydroxide are produced.  
 c) No reaction takes place.  
 d) Iron salt and water are produced.
- $2\text{PbO}_{(s)} + \text{C}_{(s)} \rightarrow 2\text{Pb}_{(s)} + \text{CO}_{2(g)}$  [ B ]  
 Which of the following statements are correct for the above chemical reaction?  
 a) Lead is reduced                      b) Carbon dioxide is oxidized  
 c) Carbon is oxidized                      d) Lead oxide is reduced.
- The chemical equation  $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$  represents following type of chemical reaction. [ D ]  
 a) displacement      b) combination      c) decomposition      d) double-displacement
- The reaction of formation hydrogen chloride from hydrogen and chloride represents following type of chemical reaction [ C ]  
 a) decomposition      b) displacement      c) combination      d) double-displacement

### 3. Reflection of Light by Different Surfaces

1. The centre of sphere to which a spherical mirror belongs, is called Centre of curvature.
2. The geometric centre of the mirror is pole.
3. The line which passes through the centre of curvature and pole is principle axis or central axis.
4. The rays which are parallel to the principal axis of a concave mirror on reflection, meet at focus or focal point.
5. The distance between pole and centre of curvature is radius of curvature.
6. The distance between pole and focus is focal length.
7. The relation between focal length and radius of curvature is given by  $R = 2f$ .
8. The relation between the angle of incidence and angle of reflection is given by  $i=r$ .
9. Light selects the least time path to travel between two points. This principle was stated by Pierre de Fermat.
10. The equation of mirror formula is  $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ .

#### Multiple Choice Questions:

1. If an object is placed at C on the principal axis in front of a concave mirror, the position of the image is ..... [ **C** ]  
 a) at infinity                      b) between F and C                      c) at C                      d) beyond C
2. We get a diminished image with a concave mirror when the object is placed ..... [ **D** ]  
 a) at F                      b) between the pole and F                      c) at C                      d) beyond C
3. We get a virtual image in a concave mirror when the object is placed ..... [ **B** ]  
 a) at F                      b) between the pole and F                      c) at C                      d) beyond C
4. Magnification  $m =$  ..... [ **D** ]  
 a)  $v/u$                       b)  $u/v$                       c)  $h_o / h_i$                       d)  $h_i / h_o$
5. A ray which seems to be travelling through the focus of a convex mirror passes ..... after reflection [ **A** ]  
 a) parallel to the axis                      b) along the same path in opposite direction  
 c) through F                      d) through C

### 4. Acids, Bases and Salts

1. Sour taste is a characteristic property of all acids in aqueous solution.
2. Acids react with some metals to produce **hydrogen** gas.
3. Because aqueous acid solutions conduct electricity, they are identified as Conductors.

4. Acids react with bases to produce a salt and water.
5. Acids turn indicators different colours.
6. Bases tend to taste bitter and feel soapy.
7. Like acids, aqueous basic solutions conduct electricity, and are identified as conductors.
8. Bases react with acid to produce a salt and water.
9. Bases turn indicators different colours.

**Match the following:**

- |                     |       |   |
|---------------------|-------|---|
| a) Plaster of Paris | ( D ) | A) CaO Cl <sub>2</sub>                    |
| b) Gypsum           | ( E ) | B) NaHCO <sub>3</sub>                     |
| c) Bleaching powder | ( A ) | C) Na <sub>2</sub> CO <sub>3</sub>        |
| d) Baking soda      | ( B ) | D) CaSO <sub>4</sub> . ½ H <sub>2</sub> O |
| e) Washing soda     | ( C ) | E) CaSO <sub>4</sub> . 2 H <sub>2</sub> O |

**Multiple Choice Questions:**

1. The colour of methyl orange indicator in acidic medium is ..... [ D ]  
 a) yellow      b) green      c) orange      d) red
2. The colour of phenolphthalein indicator in basic solution is ..... [ C ]  
 a) yellow      b) green      c) pink      d) orange
3. Colour of methyl orange in alkali conditions? [ B ]  
 a) orange      b) yellow      c) red      d) blue
4. A solution turns red litmus blue, its pH is likely to be ..... [ D ]  
 a) 1      b) 4      c) 5      d) 10
5. A solution reacts with crushed egg-shells to give a gas that turns lime-water milky the solution contains ..... [ B ]  
 a) NaCl      b) HCl      c) LiCl      d) KCl
6. If a base dissolves in water by what name is it better known? [ D ]  
 a) neutralization      b) basic      c) acid      d) alkali
7. Which of the following substances when mixed together will produce table salt? [ B ]  
 a) Sodium thiosulphate and sulphur dioxide  
 b) Hydrochloric acid and sodium hydroxide  
 c) Chlorine and oxygen  
 d) Nitric acid and sodium hydrogen carbonate
8. What colour would hydrochloric acid (p<sup>H</sup>=1) turn universal indicator? [ D ]  
 a) orange      b) purple      c) yellow      d) red



9. Which one of the following types of medicines is used for treating indigestion? [ C ]
  - a) antibiotic
  - b) analgesic
  - c) antacid
  - d) antiseptic
10. What gas is produced when magnesium is made to react with hydrochloric acid? [ A ]
  - a) hydrogen
  - b) oxygen
  - c) carbon dioxide
  - d) no gas is produced
11. Which of the following is the most accurate way of showing neutralization? [ B ]
  - a) Acid + base → acid-base solution
  - b) Acid + base → salt + water
  - c) Acid + base → sodium chloride + hydrogen
  - d) Acid + base → neutral solution

### 5. Refraction of Light at Plane Surfaces

1. At critical angle of incidence, the angle of refraction is 90°
2.  $n_1 \sin i = n_2 \sin r$ , is called Snell's law.
3. Speed of light in vacuum is  $3 \times 10^8$  m/s.
4. Total internal reflection takes place when a light ray propagates from denser to rarer medium.
5. The refractive index of a transparent material is  $3/2$ . The speed of the light in that medium is  $2 \times 10^8$  m/s.
6. Mirage is an example of total internal reflection.

### Multiple Choice Questions:

1. Which of the following is Snell's law. [ B ]
  - a).  $n_1 \sin i = \sin r / n_2$
  - b)  $n_1/n_2 = \sin r / \sin i$
  - c).  $n_2 / n_1 = \sin r / \sin i$
  - d)  $n_2 \sin i = \text{constant}$
2. The refractive index of glass with respect to air is 2. Then the critical angle of glass-air interface is ..... [ C ]
  - a).  $0^\circ$
  - b)  $45^\circ$
  - c)  $30^\circ$
  - d)  $60^\circ$
3. Total internal reflection takes place when the light ray travels from..... [ C ]
  - a. rarer to denser medium
  - b) rarer to rarer medium
  - b. denser to rarer medium
  - d) denser to denser medium
4. The angle of deviation produced by the glass slab is ..... [ D ]
  - a)  $0^\circ$
  - b)  $20^\circ$
  - c)  $90^\circ$
  - d). depends on the angle formed by the light ray and normal to the slab

## 6. Refraction of Light at Curved Surfaces

1. The rays from the distant object, falling on the convex lens pass through focus.
2. The ray passing through the pole of the lens is not deviated.
3. Lens formula is given by  $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ .
4. The focal length of the plano convex lens is  $2R$  where  $R$  is the radius of curvature of the surface.
  - a. Then the refractive index of the material of the lens is  $\frac{3}{2}$
5. The lens which can form real and virtual images is convex.

### Multiple Choice Questions

1. Which one of the following materials cannot be used to make a lens? [ D ]  
 a) water                      b) glass                      c) plastic                      d) clay
2. Which of the following is true? [ B ]  
 a. the distance of virtual image is always greater than the object distance for convex lens  
 b. the distance of virtual image is not greater than the object distance for convex lens  
 c. convex lens always forms a real image  
 d. convex lens always forms a virtual image
3. Focal length of the plano-convex lens is ..... when its radius of curvature of the surface is  $R$  and  $n$  is the refractive index of the lens. [ C ]  
 a)  $f = R$                       b)  $f = R/2$                       c)  $f = R/(n-1)$                       d)  $f = (n-1)/R$
4. The value of the focal length of the lens is equal to the value of the image distance when the rays are [ D ]  
 a) passing through the optic centre                      b) parallel to the principal axis  
 c) passing through the focus                      d) in all the cases
5. Which of the following is the lens maker's formula [ C ]  
 a)  $1/f = (n-1)(1/R_1 + 1/R_2)$                       b)  $1/f = (n+1)(1/R_1 - 1/R_2)$   
 c)  $1/f = (n-1)(1/R_1 - 1/R_2)$                       d)  $1/f = (n+1)(1/R_1 + 1/R_2)$

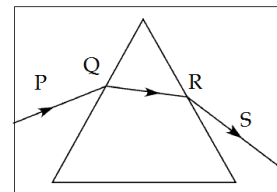
## 7. Human Eye and colourful World

1. The value of least distance of distinct vision is about 25 cm.
2. The distance between the eye lens and retina is about 2.5 cm.
3. The maximum focal length of the eye lens is about 2.5 cm.
4. The eye lens can change its focal length due to working of ciliary muscles.

5. The power of lens is 1D then focal length is 100cm.
6. Myopia can be corrected by using bi-concave lens.
7. Hypermetropia can be corrected by using bi-convex lens.
8. In minimum deviation position of prism, the angle of incidence is equal to angle of emergence.
9. The splitting of white light into different colours (VIBGYOR) is called dispersion.
10. During refraction of light, the character of light which does not change is frequency.

### Multiple Choice Questions

1. The size of an object as perceived by an eye depends primarily on [ B ]
  - a) actual size of the object
  - b) distance of the object from the eye
  - c) aperture of the pupil
  - d) size if the image formed on the retina
2. When objects at different distances are seen by the eye which of the following remain constant? [ D ]
  - a) focal length of eye-lens
  - b) object distance from eye-lens
  - c) the radii of curvature of eye-lens
  - d) image distance from eye-lens
3. During refraction, \_\_\_\_\_ will not change. [ B ]
  - a) wavelength
  - b) frequency
  - c) speed of light
  - d) all the above
4. A ray of light falls on one of the lateral surface of an equilateral glass prism placed on the horizontal surface of a table as shown in figure. For minimum deviation of ray, which of the following is true? [ B ]
  - a) PQ is horizontal
  - b) QR is horizontal
  - c) RS is horizontal
  - d) either PQ or RS is horizontal



5. Far point of a person is 5m. In order that he has normal vision what kind of spectacles should he use? [ A ]
  - a) concave lense with focal length 5m
  - b) concave lense with focal length 10m
  - c) convex lense with focal length 5m
  - d) convex lense with focal length 2.5m
6. The process of re-emission of absorbed light in all directions with different intensities by the atom or molecule is called ..... [ A ]
  - a) scattering of light
  - b) dispersion of light
  - c) reflection of light
  - d) refraction of light

## 8. Structure of Atom

1. If  $n = 1$  then angular momentum quantum number ( $\ell$ ) = 0.
2. If a sub-shell is denoted as  $2p$  then its magnetic quantum number values are -1, 0, +1
3. Maximum number of electrons that an M-shell contain is/are 18.
4. For 'n', the minimum value is 1 and the maximum value is no maximum value.
5. For ' $\ell$ ', the minimum value is 0 and the maximum value is n-1.
6. For ' $m_\ell$ ' the minimum value is - $\ell$  and the maximum value is + $\ell$ .
7. The value of ' $m_s$ ' for an electron spinning in clock-wise direction is  $+\frac{1}{2}$  and for anti-clockwise direction is  $-\frac{1}{2}$ .

### Multiple Choice Questions

1. An emission spectrum consists of bright spectral lines on a dark back ground. Which one of the following does not correspond to the bright spectral lines? [ **D** ]
  - a) Frequency of emitted radiation
  - b) Wave length of emitted radiation
  - c) Energy of emitted radiations
  - d) Velocity of light
2. The maximum number of electrons that can be accommodated in the L – shell of an atom is :
  - a) 2
  - b) 4
  - c) 8
  - d) 16
 [ **C** ]
3. If  $l = 1$  for an atom then the number of orbitals in its sub-shell is [ **C** ]
  - a) 1
  - b) 2
  - c) 3
  - d) 0
4. The quantum number which explains about size and energy of the orbit or shell is: [ **A** ]
  - a) n
  - b)  $\ell$
  - c)  $m_\ell$
  - d)  $m_s$

## 9. The Periodic Table

1. Lithium, Sodium and potassium constitute a Dobereiner's triad.
2. Atomic weight was the basis of the classifications proposed by Dobereiner, Newlands and Mendeleeff.
3. Noble gases belongs to 18<sup>th</sup> group of periodic table.
4. The incomplete period of the periodic table is 7<sup>th</sup> period.
5. The element at the bottom of a group would be expected to show high metallic character than the element at the top.

### Multiple Choice Questions

1. Number of elements present in period – 2 of the long form of periodic table [ B ]  
a) 2                                      b) 8                                      c) 18                                      d) 32
2. Nitrogen ( $Z = 7$ ) is the element of group V of the periodic table. Which of the following is the atomic number of the next element in the group? [ C ]  
a) 9                                      b) 14                                      c) 15                                      d) 17
3. Electron configuration of an atom is 2, 8, 7 to which of the following elements would it be chemically similar? [ B ]  
a) nitrogen( $Z=7$ )                      b) fluorine( $Z=9$ )                      c) phosphorous( $Z=15$ ) d) argon( $Z=18$ )
4. Which of the following is the most active metal? [ D ]  
a) lithium                                      b) sodium                                      c) potassium                                      d) rubidium

## 10. Chemical Bonding

1. Electrons in outer most shell are called valence electrons.
2. Except Helium gas all other noble gases have octet in their valence shell.
3. Covalency of elements explains about member of covalent bond formed by the atom.
4. Valence bond theory was proposed by Sidgwick and Powell
5. In covalent bonding the valence electrons are shared among all the atoms of the metallic elements.

### Multiple Choice Questions

1. Which of the following elements is electronegative? [ B ]  
A) Sodium                      B) Oxygen                      C) Magnesium                      D) Calcium
2. An element  ${}_{11}\text{X}^{23}$  forms an ionic compound with another element 'Y'. Then the charge on the ion formed by X is [ A ]  
A) +1                                      B) +2                                      C) -1                                      D) -2
3. An element 'A' forms a chloride  $\text{ACl}_4$ . The number electrons in the valence shell of 'A' [ D ]  
A) 1                                      B) 2                                      C) 3                                      D) 4

## 11. Electric Current

1. The kilowatt hour is the unit of electrical energy.
2. A thick wire has a less resistance than a thin wire.
3. An unknown circuit draws a current of 2A from a 12V battery its equivalent resistance is 6Ω.

4. The SI unit of potential difference is volt.
5. The SI unit of current is Ampere.
6. Three resistors of values  $2\Omega$ ,  $4\Omega$ ,  $6\Omega$  are connected in series. The equivalent resistance of combination of resistors is  $12\Omega$ .
7. Three resistors of values  $2\Omega$ ,  $4\Omega$ ,  $6\Omega$  are connected in parallel. The equivalent resistance of combination of resistors is  $\frac{11}{12}\Omega$ .
8. The power delivered by a battery of emf, 10V is 10W. Then the current delivered by the battery is 1 Ampere.

### Multiple Choice Questions

1. A uniform wire of resistance  $50\Omega$  is cut into five equal parts. These parts are now connected in parallel. Then the equivalent resistance of the combination is [ A ]  
 a)  $2\Omega$                       b)  $12\Omega$                       c)  $250\Omega$                       d)  $6250\Omega$
2. A charge is moved from a point A to a point B. The work done to move unit charge during this process is called. [ C ]  
 a) potential at A    b) potential at B                      c) potential difference between A and B  
 d) current from A to B
3. Joule/ coulomb is the same as [ B ]  
 a) 1 - watt    b) 1 - volt    c) 1- ampere    d) 1 - ohm
4. The current in the wire depends [ C ]  
 a) only on the potential difference applied                      b) only on the resistance of the wire  
 c) on both of them                      d) none of them
5. Consider the following statements. [ A ]  
 A. In series connection, the same current flows through each element.  
 B. In parallel connection, the same potential difference gets applied across each element.  
 a) both A and B are correct                      b) A is correct but B is wrong  
 c) A is wrong but B is correct                      d) both A and B are wrong

## 12. Electromagnetism

1. The SI unit of magnetic field induction is Weber/m<sup>2</sup> or Tesla.
2. Magnetic flux is the product of magnetic field induction and area.
3. The charge is moving along the direction of magnetic field. Then force acting on it is zero.
4. A current carrying wire of length L is placed perpendicular to a uniform magnetic field B. Then the force acting on the wire with current (*i*) is  $F = Bil$ .
5. Faraday's law of induction is the consequence of conservations of energy.

### Multiple Choice Questions

- Which converts electrical energy into mechanical energy [ A ]  
 a) motor                      b) battery                      c) generator                      d) switch
- Which converts mechanical energy into electrical energy [ C ]  
 a) motor                      b) battery                      c) generator                      d) switch
- The magnetic force on a current carrying wire placed in uniform magnetic field if the wire is oriented perpendicular to magnetic field, is ..... [ B ]  
 a) 0                              b) ILB                              c) 2ILB                              d) ILB/2

### 13. Metallurgy

- The method suitable to enrich the sulphide ores is roasting.
- Arranging metals in the decreasing order of their reactivity is called activity series.
- The method suitable for purification of low boiling metals is distillation.
- Corrosion of iron occurs in the presence of air and water.
- The chemical process in which the ore is heated in the absence of air is called calcinations.

### Multiple Choice Questions

- The impurity present in the ore is called as \_\_\_\_\_ [ A ]  
 a) Gangue                      b) flux                              c) Slag                              d) Mineral
- Which of the following is a carbonate ore? [ A ]  
 a) Magnesite                      b) Bauxite                              c) Gypsum                              d) Galena
- Which of the following is the correct formula of Gypsum [ D ]  
 a)  $\text{CuSO}_4 \cdot 2\text{H}_2\text{O}$                       b)  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$                       c)  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$                       d)  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
- The oil used in the froth floatation process is \_\_\_\_\_ [ B ]  
 a) kerosene oil                      b) pine oil                              c) coconut oil                              d) olive oil.
- Froth floatation is method used for the purification of \_\_\_\_\_ ore. [ A ]  
 a) sulphide                              b) oxide                              c) carbonate                              d) nitrate
- Galena is an ore of \_\_\_\_\_ [ B ]  
 a) Zn                                      b) Pb                                      c) Hg                                      d) Al
- The metal that occurs in the native form is \_\_\_\_\_ [ B ]  
 a) Pb                                      b) Au                                      c) Fe                                      d) Hg
- The most abundant metal in the earth's crust is \_\_\_\_\_ [ B ]  
 a) Silver                                      b) Aluminium                                      c) zinc                                      d) iron

9. The reducing agent in thermite process is \_\_\_\_\_ [ A ]  
 a) Al                      b) Mg                      c) Fe                      d) Si
10. The purpose of smelting an ore is to \_\_\_\_\_ it. [ B ]  
 a) Oxidise                      b) Reduce                      c) Neutralise                      d) none of these

### 14. Carbon and its Compounds

1. Carbon compounds containing double and triple bonds are called unsaturated hydrocarbons.
2. A compound which is basic constituent of many cough syrups ethanol.
3. Very dilute solution of ethanoic acid is vinegar.
4. A sweet odour substance formed by the reaction of an alcohol and a carboxylic acid is ester.
5. When sodium metal is dropped in ethanol, ester gas will be released hydrogen gas(H<sub>2</sub>).
6. The functional group present in methanol is -OH.
7. IUPAC name of alkene containing 3 carbon atoms is propene.
8. The first member of homologous series among alkynes is ethyne.
9. The product that is formed by dehydration of ethanol in conc. sulphuric acid is ethene.
10. Number of single covalent bonds in ammonia are 3(Three).
11. Type of reactions shown by alkanes is substitution.

#### Multiple Choice Questions

1. Which of the four test tubes containing the following chemicals shows the brisk effervescence when dilute acetic acid was added to them? [ B ]  
 i) KOH ii) NaHCO<sub>3</sub> iii) K<sub>2</sub>CO<sub>3</sub> iv) NaCl  
 a) i & ii                      b) ii & iii                      c) i & iv                      d) ii & iii
2. Which of the following solution of acetic acid in water can be used as preservative? [ A ]  
 a) 5-10%                      b) 10-15%                      c) 15-20%                      d) 100%
3. The suffix used for naming an aldehyde is [ B ]  
 a) -ol                      b) -al                      c) -one                      d) -ene
4. Acetic acid, when dissolved in water, it dissociates into ions reversibly because it is a, [ A ]  
 a) Weak acid                      b) strong acid                      c) weak base                      d) strong base
5. Which one of the following hydrocarbon can show isomerism? [ D ]  
 a) C<sub>2</sub>H<sub>4</sub>                      b) C<sub>2</sub>H<sub>6</sub>                      c) C<sub>3</sub>H<sub>8</sub>                      d) C<sub>4</sub>H<sub>10</sub>
6. Combustion of hydrocarbon is generally accompanied by the evolution of [ C ]  
 a) Heat                      b) Light                      c) both heat and light                      d) Electric current.



7. 2ml of ethanoic acid was taken in each of the three test tubes A, B and C and 2ml, 4ml and 8ml water was added to them, respectively. A clear solution is obtained in. [ D ]  
 a) Test tube A only    b) Test tubes A & B only.c) Test tubes B and C only d) All the test tubes.
8. If 2 ml of acetic acid was added slowly in drops to 5ml of water then we will notice [ C ]  
 a) The acid forms a separate layer on the top of water.  
 b) Water forms a separate layer on the top of the acid.  
 c) Formation of a clear and homogenous solution.  
 d) Formation of a pink and clear solution.
9. A few drops of ethanoic acid were added to solid sodium carbonate. The possible results of the reactions are. [ C ]  
 a) A hissing sound was evolved                      b) Brown fumes evolved.  
 c) Brisk effervescence occurred.                      d) A pungent smelling gas evolved.
10. When acetic acid reacts with ethyl alcohol, we add conc.  $H_2SO_4$ , it acts as.....and the process is called..... [ B ]  
 a) Oxidizing agent, Saponification                      b) Dehydrating agent, Esterification  
 c) Reducing agent, Esterification                      d) Acid & Esterification

## 1. Heat

1. Heat is the energy that is transferred from hotter to colder body.
2. 'Hot' and 'cold' are relative terms and that heat was a form of energy.
3. "Temperature and Heat" to describe the hot and cold.
4. When heat energy enters your body you get a feeling of 'hotness'.
5. The 'degree of coldness' of the metal piece is greater than that of the wooden piece.
6. The conventional definition of temperature is "the degree of hotness or coldness".
7. Heat energy will be transferred from the 'hotter' body to the 'colder' body.
8. The transfer of heat energy is continued till both bodies attain same degree of hotness (or) coldness.
9. The state of thermal equilibrium denotes a state of a body where it neither receives nor gives out heat energy.
10. If you are not feeling either hotness or coldness in your surroundings, then your body is said to be in thermal equilibrium with the surrounding atmosphere.
11. The furniture in the room is in thermal equilibrium with air in the room.
12. The steadiness of the mercury column of the thermometer indicates that flow of heat.
13. The thermometer reading at thermal equilibrium state gives the "temperature".
14. The SI unit of heat is Joule (J) and CGS unit is calorie (cal).
15. The amount of heat required to increase the temperature of 1 gram of water by 1°C is called calorie.  
(1cal = 4.186 joules)
16. The SI unit of temperature is Kelvin (K). It can also be expressed as degree Celsius (°C).  
(0°C = 273K)
17. Temperature measured in Kelvin scale is called absolute temperature.
18. The jiggling of the grains of food colour in hot water is more when compared to the jiggling in cold water.
19. Bodies possess kinetic energy when they are in the motion.
20. The average kinetic energy of molecules / particles of the hotter body are larger than that of a colder body.
21. The temperature of a body is an indicator of the average kinetic energy of molecule of that a body.
22. "The average kinetic energy of the molecules is directly proportional to the absolute temperature"
23. Temperature is a quantity that decides which body is hotter and which is colder.
24. Temperature decides direction of heat (energy) flow whereas heat is the energy itself that flow.
25. We know the rise in temperature depends on the nature of the material.
26. The amount of heat absorbed by a body is directly proportional to its mass (m) (i.e. ∝ m).
27. "Specific heat" of substance,  $S = \frac{Q}{m\Delta T}$

28. The same mass (m) of water the change in temperature is proportional to amount of heat (Q) absorbed by it. (i.e.  $Q \propto \Delta T$ )
29. The specific heat of a material is the amount of heat required to raise the temperature of unit mass of the material by a unit.
30. CGS unit of specific heat is cal / g and SI unit of it is J / kg – K.
31.  $1 \text{ Cal/gm} = \underline{4.2 \text{ KJ/kg-K}}$  (Here  $K = 10^3$ ).
32. The rise in temperature depends on nature of the material.
33. The specific heat of the material depends on its nature.
34. Specific heat gives us an idea of degree of 'reluctant' of a material to rise in temperature.
35. The temperature of the body is directly proportional to the average kinetic energy of particle of the body.
36. The molecules of the system (body or material) have different energies such as linear kinetic energy, rotational kinetic energy, vibrational energy and potential (binding) energy between molecules.
37. The total energy of the system (body or material) is called internal energy of the system (body or material).
38. When we supply heat energy to the system (body or material) the heat energy given to it will be shared in various forms.
39. This sharing of heat energy of the system (body or material) also varies with temperature.
40. The specific heat is different for different material.
41. The oceans behave like heat "store houses" for the earth.
42. Oceans can absorb large amounts of heat at the equator without much rise in temperature due to high specific heat capacity of water.
43. Oceans moderate the surrounding temperature near the equator.
44. Ocean water transports the heat away from the equator to areas closer to the north and south poles.
45. Water has greater specific heat value.
46. During the collision of the substances molecules transfer their energy to other molecules.
47. "The process of escaping of molecules from the surface of a liquid at any temperature is called evaporation"
48. Air contains water molecules in the form of vapor.
49. 'Condensation' is a warming process.
50. Evaporation is a cooling process.
51. The amount of water vapor present in air is called the humidity of air.
52. The water droplets condensed on such surface are known as dew.
53. The thick mist is called fog.
54. The boiling point of water is 100°C.

55. Consider a liquid of mass 'm' requires heat energy 'Q' calories to change from its state liquid phase to gas phase. Then Latent heat of vaporization is  $Q/m$ .
56. Latent heat of vaporization is denoted by the letter 'L'.
57. CGS unit and SI unit of latent heat of vaporization is cal/gm and J/kg respectively.
58. The boiling point of water at constant atmospheric pressure (1atm) is 100°C or 373K and Latent heat of vaporization of water is 540 cal/gm.
59. This process of converting solid into a liquid is called "Melting".
60. Ice becomes to water .This process takes place at a constant temperature 0°C or 273K.
61. Ice becomes to water at 0°C. This temperature is called melting point.
62. The Heat energy required to convert 1gm of solid completely into liquid at a constant temperature is called Latent heat of fusion.
63. Latent heat of fusion  $L = Q/m$ .
64. The value of Latent heat of fusion of ice is 80cal/gm.
65. "The process in which the substance in liquid phase changes to solid phase by losing some energy is called freezing."
66. Freezing of water takes place at 0°C or 273 K temperature and at one atmospheric pressure.
67. If two different systems, A and B, (thermal contact) are in thermal equilibrium individually with another system C. then the systems A and B are in thermal equilibrium with each other.
68. The average kinetic energy of the molecules is directly proportional to the absolute temperature.
69. The specific heat capacity of a material is the amount of heat required to raise the temperature of unit mass of the material by or unit.
70. Specific heat,  $S = Q/m\Delta t$
71. Principle is the process of escaping of molecules from the surface of a liquid at any temperature and it is a cooling process.
72. Condensation is the reverse process of evaporation.
73. Boiling is the process in which the liquid phase changes to gaseous phase at a constant temperature.
74. Experimentally we calculate the Specific heat of a solid, by using a formula,  

$$S_l = \frac{[m_1 S_c + (m_2 - m_1) S_w (T_3 - T_1)]}{(m_3 - m_2) (T_2 - T_3)}$$
75. The Specific heat of a Lead is 0.031 cal/g-°C (or) 130 J/kg-K.
76. The Specific heat of a Mercury is 0.033 cal/g-°C 139 J/kg-K.
77. The Specific heat of a Brass is 0.092 cal/g-°C 380 J/kg-K.
78. The Specific heat of a Zinc is 0.093 cal/g-°C 391 J/kg-K.
79. The Specific heat of a Copper is 0.095 cal/g-°C 399 J/kg-K.
80. The Specific heat of a Iron is 0.115 cal/g-°C 483 J/kg-K.
81. The Specific heat of a Glass (flint) is 0.12 cal/g-°C 504 J/kg-K.

82. The Specific heat of a Aluminum is 0.21 cal/g-°C 882J/kg-K.
83. The Specific heat of a Kerosene oil 0.50 cal/g-°C 2100J/kg-K.
84. The Specific heat of a Ice is 0.50 cal/g-°C 2100J/kg-K.
85. The Specific heat of a Water is 1 cal/g-°C 4180J/kg-K.
86. The Specific heat of a Sea water is 0.95 cal/g-°C 3900J/kg-K.

## 2. Chemical Reactions and Equations

1. The changes of substances may be categorized into two types known as physical changes and chemical changes.
2. Examples are chemical changes are, **coal is burnt**.
  - **Food gets digested in our body.**
  - **Iron nail is exposed to humid atmosphere for a longtime.**
  - **We respire.**
  - **Milk is converted into curd.**
  - **Water is added to quicklime.**
  - **Crackers are burnt.**
3. If new substances are formed with properties completely unlike those of the original substances, we say a chemical change has taken place.
4. The calcium oxide (quick lime-CaO) reacts with water and in that process heat energy is released.
5. Calcium oxide dissolves in water producing colorless solution.
6. A red litmus paper turns blue when dipped in the Calcium Hydroxide solution.
7. Chemical name of sodium sulphate is Na<sub>2</sub>SO<sub>4</sub>.
8. Chemical name of barium chloride is BaCl<sub>2</sub>.
9. Chemical name of hydrochloric acid is HCl.
10. When Zink granules are added to hcl Solution Hydrogen gas is evaporated.
11. Bring a burning match stick near the mouth of the conical flask which evaporates hydrogen gas the match stick light off with pop-sound.
12. During a chemical change, the original substances lose their characteristic properties.
13. Chemical changes may be exothermic or endothermic i.e, they may involve heat energy liberation or heat energy absorption.
14. Sometimes during a chemical change may form an insoluble substance known as precipitate.
15. Calcium oxide + water → calcium hydroxide.
16. The substances which undergo chemical change in the reaction are called reactants and the new substances formed are called products.
17. A chemical reaction written in the form of word equation shows the change of reactants to products by an arrow placed between them.
18. The reactants are written on the left side of arrow and the final substances, or products are written on the right side of the arrow.
19. In a chemical equation the arrow head points towards the product shows the direction of the reaction.

20. If there is more than one reactant or product involved in the reaction, they are indicated with a plus (+) sign between them.
21. The reaction of calcium oxide with water can be written as:  $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2$
22. Zinc metal reacts with dilute HCl to yield  $\text{ZnCl}_2$  and liberates Hydrogen gas.
23.  $\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2\uparrow$
24. Sodium sulphate reacts with barium chloride to give white precipitate of barium sulphate.
25.  $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow \text{BaSO}_4 + \text{NaCl}$
26. According to the law of conservation of mass, the total mass of the products formed in chemical reaction must be equal to the mass of reactants consumed.
27. An atom is the smallest particle of an element that takes part in a chemical reaction.
28. The number of atoms of each element before and after reaction must be the same.
29. All the chemical equations must balance, because atoms are neither created nor destroyed in chemical reactions.
30. A chemical equation in which the numbers of atoms of different elements on the reactants side (left side) are same as those on product side (right side) is called a balanced reaction.
31. Balancing a chemical equation involves finding out how many formula units of each substance take part in the reaction.
32. A formula unit, as the name implies, is one unit – whether atom, ion, or molecule – corresponding to a given formula.
33. One formula unit of NaCl for example is one Na<sup>+</sup> ion and one Cl<sup>-</sup> ion.
34. One formula unit of MgBr<sub>2</sub> is one Mg<sup>2+</sup> ion and two Br<sup>-</sup> ions.
35. One formula unit of water is one H<sub>2</sub>O molecule.
36. Chemical formula of Propane is C<sub>3</sub>H<sub>8</sub>
37. Propane is a colorless, odorless gas often used as a heating and cooking fuel.
38. The chemical equation for the combustion reaction of propane is  $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$ .
39. The chemical formula of iron Oxide is Fe<sub>2</sub>O<sub>3</sub>
40. The chemical formula of aluminum trioxide is Al<sub>2</sub>O<sub>3</sub>.
41. The chemical equation for Iron oxide reacts with aluminum to form iron and aluminum trioxide is,  

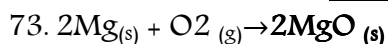
$$\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$$
42. Chemical equations can be made more informative by expressing their Physical state, Heat changes (exothermic or endothermic change), Gas evolved (if any) and Precipitate formed (if any)
43. In some chemical changes heat energy is released. Such chemical reactions are called exothermic chemical reactions.
44. In some chemical changes heat energy is absorbed. Such chemical reactions are called endothermic chemical reactions.

45. The physical states of the substances may be mentioned along with their chemical formulae. The different states ie. gaseous, liquid, and solid states are represented by the notations (g), (l) and (s) respectively.
46. If the substance is present as a solution in water, the word 'aqueous' is written as (aq).
47. In a chemical reaction 'Δ' represents heating.
48. Heat is liberated in exothermic reactions and heat is absorbed in endothermic reactions.
49.  $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)} + Q$  is an example of exothermic reaction.
50.  $N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)} - Q$  is an example of endothermic reaction.
51. In a chemical reactions 'Q' is heat energy which is shown with plus '+' sign on product side for exothermic reactions and minus '-' sign on product side for endothermic reactions.
52. If a gas is evolved in a reaction, it is denoted by an upward arrow ↑ or (g).
53.  $Zn_{(s)} + H_2SO_{4(aq)} \rightarrow ZnSO_{4(aq)} + H_{2(g)} \uparrow$
54. If a precipitate is formed in the reactions it is denoted by a downward arrow.
55.  $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow AgCl_{(s)} \downarrow + NaNO_{3(aq)}$
56. Sometimes the reaction conditions such as temperature, pressure, catalyst, etc are indicated above and/or below the arrow in the equation.
57.  $2AgCl_{(s)} \xrightarrow{\text{Sunlight}} 2Ag_{(s)} + Cl_{2(g)}$
58.  $6CO_{2(g)} + 6H_2O_{(l)} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6_{(s)} + 6O_{2(g)}$
59. A chemical equation gives information about the reactants and products through their symbols and formulae.
60. A chemical equation gives the ratio of molecules of reactants and products.
61. In a chemical equation the molecular masses are expressed in 'Unified Masses' (U).
62. The relative masses of reactants and products are known from the equation.
63. If the masses are expressed in grams then the equation also gives the molar ratios of reactants and products.
64. In a chemical equation using molar mass and Avagadro's number we can calculate the number of molecules and atoms of different substances from the equation.
65. The atomic masses of Al = 27U, Fe = 56U, and O = 16U.
66. If we get 1120 kg of iron we have to use 540 kg of aluminium.
67. The atomic masses of Na = 23U, O = 16U, and H = 1U.
68. 1 gram molar mass of any gas at STP i.e., standard temperature 273K and standard pressure 1 bar, occupies 22.4 liters known as gram molar volume.
69. In a chemical reaction atoms are neither created nor destroyed.
70. A chemical reaction is a process that is usually characterized by a chemical change in which the starting materials (reactants) are different from the products.
71. Chemical reactions occur with the formation and breaking of chemical bonds.



72. Magnesium burns in oxygen by producing dazzling white flame and changes into white powder.

The white powder is magnesium oxide.

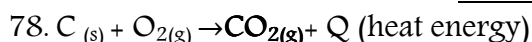


74. Magnesium and oxygen combine to form a new substance magnesium oxide.

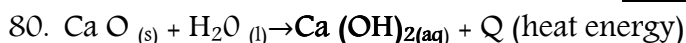
75. A reaction in which single product is formed from two or more reactants are known as chemical combination reaction.

76. When magnesium is burnt in air we noticed that this reaction release of enormous amount of heat energy.

77. When coal is burnt in oxygen, carbon dioxide is produced.



79. Slaked lime is prepared by adding water to quick lime.



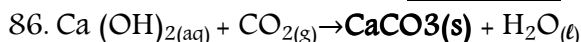
81. Slaked lime means Calcium Hydroxide (Ca(OH)<sub>2</sub>)

82. Quick lime means Calcium oxide (CaO)

83. A solution of slaked lime produced in the reaction is used to white wash the walls.

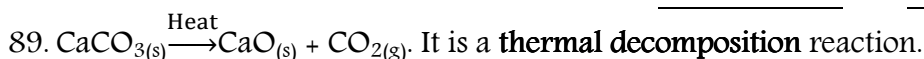
84. Calcium hydroxide reacts slowly with the carbon dioxide in air to form a thin layer of calcium carbonate on the walls.

85. Calcium carbonate gives a shiny finish to the walls.



87. The chemical formula of marble is CaCO<sub>3</sub> (calcium carbonate or lime stone)

88. On heating calcium carbonate decomposes to calcium oxide and carbon dioxide.



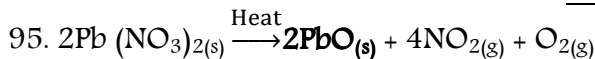
90. When a decomposition reaction is carried out by heating, it is called thermal decomposition reaction.

91. The chemical formula of quick lime or Calcium Oxide is CaO.

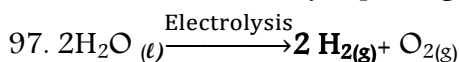
92. The chemical formula of lead nitrate is Pb(NO<sub>3</sub>)<sub>2</sub>

93. Heating of lead nitrate and emission of brown fumes of nitrogen dioxide (NO<sub>2</sub>).

94. On heating lead nitrate decomposes to lead oxide, oxygen and nitrogen dioxide.

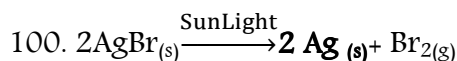


96. When the electricity is passing through the, water dissociates to hydrogen and oxygen.

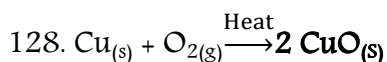


98. Silver bromide decomposes to silver and bromine in the presence of sunlight.

99. Light yellow coloured silver bromide turns to gray due to sunlight.

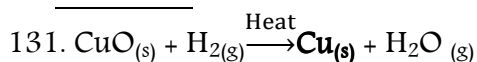


101. Some decomposition reactions are takes place in presence of sunlight and such reactions are called photochemical reactions.
102. All the decomposition reactions require energy in the form of heat, light or electricity for converting the reactants to products.
103. All the decomposition reactions are endothermic.
104. The chemical formula of Silver Chloride is AgCl<sub>2</sub>
105. The chemical formula of ferrous sulphate is Fe So<sub>4</sub>
106. The chemical formula of barium hydroxide is Ba (OH)<sub>2</sub>
107. The chemical formula of ammonium chloride is NH<sub>4</sub>Cl
108. In displacement reaction one element displaces another element from its compound and takes its place there in.
109. When Zink is reacted with Hydro Chloric Acid, the element zinc has displaced hydrogen from Hydrochloric acid. This is displacement reaction.
110. When the iron nail dipped in copper sulphate solution becoming brown.
111.  $\text{Fe}_{(s)} + \text{CuSO}_{4(aq)} \rightarrow \text{FeSO}_{4(aq)} + \text{Cu}_{(s)}$
112. Iron is more reactive than copper, so it displaces copper from copper sulphate.
113.  $\text{Zn}_{(s)} + 2\text{AgNO}_{3(aq)} \rightarrow \text{Zn}(\text{NO}_3)_{2(aq)} + 2\text{Ag}_{(s)}$
114.  $\text{Pb}_{(s)} + \text{CuCl}_{2(aq)} \rightarrow \text{PbCl}_{2(aq)} + \text{Cu}_{(s)}$
115. The chemical formula of potassium iodide is KI.
116. Mix lead nitrate solution with potassium iodide solution. A yellow coloured substance which is insoluble in water, is formed as precipitate. The precipitate is lead iodide.
117.  $\text{Pb}(\text{NO}_3)_{2(aq)} + 2\text{KI}_{(aq)} \rightarrow \text{PbI}_{2(s)} + 2\text{KNO}_{3(aq)}$
118. If two reactants exchange their constituents chemically and form two products, then the reaction is called as double displacement reaction.
119. The chemical formula of Sodium sulphate is Na<sub>2</sub>SO<sub>4</sub>
120. Sodium sulphate solution on mixing with barium chloride solution forms a white precipitate of barium sulphate (BaSO<sub>4</sub>) and soluble sodium chloride.
121.  $\text{Na}_2\text{SO}_4(aq) + \text{BaCl}_2(aq) \rightarrow \text{BaSO}_4(s) + 2\text{NaCl}(aq)$
122. Sodium hydroxide reacts with hydrochloric acid to form sodium chloride and water.
122.  $\text{NaOH}_{(aq)} + \text{HCl}_{(aq)} \rightarrow \text{NaCl}_{(aq)} + \text{H}_2\text{O}_{(l)}$
123. Sodium chloride spontaneously combines with silver nitrate in solution giving silver chloride precipitate.
124.  $\text{NaCl}_{(aq)} + \text{AgNO}_{3(aq)} \rightarrow \text{AgCl}_{(s)} + \text{NaNO}_{3(aq)}$
125. 'Oxidation' is a reaction that involves the addition of oxygen or removal of hydrogen.
126. 'Reduction' is a reaction that involves the addition of hydrogen or removal of oxygen.
127. On heating copper (Blue Colour) it reacts with oxygen present in the atmosphere to form copper Oxide(Block).



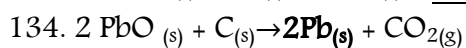
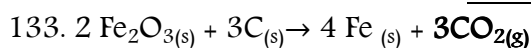
129. Copper combines with oxygen to form copper oxide. Here oxygen is gained and the process is called oxidation.

130. When hydrogen gas over hot copper oxide the black coating on copper turns brown because copper oxide loses oxygen to form copper. In this process oxygen is lost and the process is called Reduction.



132. Generally oxidation and reduction occur in the same reaction. If one reactant gets oxidized, the other gets reduced. Such reactions are called oxidation-reduction reactions or redox reactions.

In the CuO, H<sub>2</sub> reaction CuO is reduced and H<sub>2</sub> is oxidized.



135. Oxidation is the reaction of oxygen molecules with different substances starting from metal to living tissue which may come in contact with it.

136. Apples pears, bananas, potatoes etc., contain enzyme called polyphenol oxidase or tyrosinase, which reacts with oxygen and changes the colour on the cut surface of the fruit.

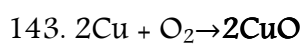
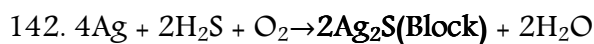
137. The browning of iron, when left for sometime in moist air, is a process commonly known as rusting of iron.

138. Rusting of Iron is basically oxidation reaction which requires both oxygen and water.

139. Rusting does not occur in oxygen free water or dry air.

140. Burning of crackers is also oxidation process of variety of chemicals.

141. When some metals are exposed to moisture, acids etc., they tarnish due to the formation of respective metal oxide on their surface. This process is called corrosion.



144. Corrosion is the oxidative deterioration of a metal.

145. Corrosion causes damage to car bodies, bridges, iron railings, ships etc., and to all other objects that are made of metals.

146. Especially corrosion of iron is a serious problem.

147. Corrosion can be prevented or at least minimized by shielding the metal surface from oxygen and moisture.

148. Corrosion can be prevented by painting, oiling, greasing, galvanizing, chrome plating or making alloys.

149. Galvanizing is a method of protecting iron from rusting by coating them a thin layer of Zinc.

150. Alloying is also a very good method of improving properties of metal.

151. Generally pure form of iron is very soft and stretches easily when hot.
152. Iron is mixed with carbon, nickel and chromium to get an alloy stainless steel.
153. The stainless steel is hard and does not rust.
154. A metallic substance made by mixing and fusing two or more metals, or a metal and a nonmetal, to obtain desirable qualities such as hardness, lightness, and strength is known as alloy.
155. Examples of Alloys are Brass, bronze and steel.
155. Gold one of the most valuable of elements has been prized since antiquity for its beauty and resistance to corrosion.
156. Combustion is the most common example for oxidation reactions.
157. Burning of wood involves release of carbon dioxide, water vapour along with huge amount of energy.
158. Rising of dough with yeast depends on oxidation of sugars to carbon dioxide and water.
159. Bleaching of coloured objects using moist chlorine
160.  $Cl_2 + H_2O \rightarrow HOCl + HCl$
161.  $HOCl \rightarrow HCl + (O)$
162. Coloured object + (O)  $\rightarrow$  Colourless object.
163. Some times during rainy season the power supply to our home from the electric pole will be interrupted due to formation of the metal oxide layer on the electric wire.
164. The metal oxide is an electrical insulator.
165. On removing the metal oxide layer formed on the wire with a sand paper, supply of electricity can be restored.
166. When fats and oils are oxidized they become rancid. Their smell and taste change.
167. We can say that oxidation reactions in food material that were left for a long period are responsible for spoiling of food.
168. Rancidity is an oxidation reaction.
169. The spoilage of food can be prevented by adding preservatives like Vitamin C and Vitamin E.
170. Usually substances which prevent oxidation (Antioxidants) are added to food containing fats and oil. Keeping food in air tight containers helps to slow down oxidation process.
171. The manufacturers of potato chips flush bags of chips with nitrogen gas to prevent the chips from getting oxidized.
172. Chemical change is permanent change.
173. A Chemical equation represents a chemical reaction.
174. Complete chemical equation represents the reactants, products and their physical state.
175. A Chemical equation is said to be balanced, when the number of atoms of each element is same on both reactants side and products side.
176. A chemical equation must always be balanced.

177. In a **combination** reaction two or more substances combine to form a new single substance.
178. In a **decomposition** reaction a single substance decomposes to give two or more substances.
179. Reactions in which heat energy is absorbed by the reactants are **endothermic** reactions.
180. In **exothermic** reaction heat energy is released by the reactants.
181. A **displacement** reaction occurs, when an element displaces another element from its compound.
182. Two different atoms or ions are exchanged in **double displacement** reactions.
183. **Oxidation** is the gain of Oxygen or loss of Hydrogen.
184. Loss of oxygen or gain of Hydrogen is **Reduction**.
185. **Corrosion** causes damage to iron appliances.
186. When fats and oils are oxidized, they become **rancid**.
187. Precipitate is an **insoluble** substance.

### 3. Reflection of light on different surfaces

1. A source of light, an opaque object and a screen are needed to form a shadow.
2. Light travels in a straight line.
3. When light gets reflected from a surface, the angle of reflection is equal to the angle of incidence.
4. The incident ray, the normal at the point of incidence and the reflected ray lie in the same plane.
5. Light also selects the path which takes the least time to travel. This principle was first given by Pierre de Fermat, a French lawyer and an amateur mathematician.
6. When light gets reflected from a surface, it selects the path that takes the least time.
7. The plane in which the incident ray, reflected ray and normal will lie is the plane of reflection.
8. The angle plays the role in sensing the size of the object. (The size of the object as angular size)
9. A light ray incident at an angle to the normal at the point of incidence will get reflected making the same angle with the normal.
10. In a concave mirror, all normals will converge towards a point. This point is called centre of curvature (C) of the mirror.
11. The midpoint (Geometrical centre) of the mirror is called pole (P) of the mirror.
12. The horizontal line which passes through the centre of curvature and pole is called central axis (Or) principal axis of the mirror.
13. The distance between pole (p) and centre of curvature (C) is radius of curvature (R) of the mirror.
14. The rays coming from sun parallel to the concave mirror are converging at a point. This point is called focus or focal point (F) of the concave mirror.
15. The distance the pole to focal point of the mirror is called the focal length (f) of the mirror.
16. The radius of curvature will be twice of this distance ( $R=2f$ ).
17. This image that we got by extending the rays backwards is called a virtual image.
18. The image that we cannot get this on a screen like a real image.
19. All distances should be measured from the pole (p).
20. The distances measured in the direction of incident light, to be taken positive and measured in the opposite direction of incident light to be taken negative.
21. The mirror formula is  $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ .
22. The image formed by a spherical mirror varies in size we refer to the linear magnification 'm'.
23. Magnification of an image,  $m = \frac{\text{size of image (height)}}{\text{size of object (height)}}$ .
24. In all cases it can be shown that  $m = \frac{\text{image distance from mirror (v)}}{\text{object distance from mirror (u)}}$
25. The story of Archimedes that he burned ships using mirrors.
26. Light chooses the path which takes the least time to travel. It is also applicable to reflection of light.
27. Magnification  $m = \frac{\text{size of the image}}{\text{size of the object}}$  (or)  $m = \frac{\text{object distance}}{\text{image distance}}$

## 4. Acid Basis and Salts

1. Acids are sour to taste and turn blue litmus to red.
2. Bases are bitter to taste, soapy to touch and turn red litmus to blue.
3. There are many natural materials like litmus, extract of red cabbage, turmeric solution are the natural acid- base indicators
4. Methyl orange and phenolphthalein are the examples of synthetic indicators.
5. Litmus solution is a dye extracted from lichen tree.
6. Lichen is a plant belonging to the division of Thallophyta and is used as indicator.
7. In neutral solution litmus colour is purple.
8. Coloured petals of some flowers such as Hydrangea, Petunia and Geranium are also used as indicators.
9. Chemical formula of hydrochloric acid is HCl.
10. Chemical formula of Sulphuric acid is H<sub>2</sub>SO<sub>4</sub>.
11. Chemical formula of nitric acid is HNO<sub>3</sub>.
12. Chemical formula of acetic acid is CH<sub>3</sub>COOH.
13. Chemical formula of sodium hydroxide is NaOH.
14. Chemical formula of calcium hydroxide is Ca (OH)<sub>2</sub>.
15. Chemical formula of magnesium hydroxide is Mg (OH)<sub>2</sub>.
16. Chemical formula of ammonium hydroxide is NH<sub>4</sub>OH.
17. Chemical formula of potassium hydroxide is KOH.
18. There are some substances whose odour changes in acidic or basic media. These are called olfactory indicators.
19. Examples of olfactory indicators are onion, vanilla essence and clove oil.
20. Pickles and sour substances are not stored in brass and copper vessels.
21. Chemical formula of Sodium Zincate is Na<sub>2</sub> ZnO<sub>2</sub>
22.  $2 \text{NaOH} + \text{Zn} \rightarrow \text{Na}_2 \text{ZnO}_2 + \text{H}_2$
23. Chemical formula of sodium hydrogen carbonate NaHCO<sub>3</sub> ( Or Sodium bi Carbonate)
24. Chemical formula of Baking soda is NaHCO<sub>3</sub> ( Or Sodium bi Carbonate)
25.  $\text{Na}_2 \text{CO}_3 (\text{S}) + 2 \text{HCl}(\text{aq}) \rightarrow 2 \text{NaCl}(\text{aq}) + \text{H}_2\text{O} (\ell) + \text{CO}_2 (\text{g})$
26.  $\text{NaHCO}_3 (\text{S}) + \text{HCl}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O} (\ell) + \text{CO}_2 (\text{g})$
27.  $\text{Ca} (\text{OH})_2 (\text{aq}) + \text{CO}_2 (\text{g}) \rightarrow \text{CaCO}_3 \downarrow + \text{H}_2\text{O} (\ell)$
28.  $\text{CaCO}_3 (\text{S}) + \text{H}_2\text{O} (\ell) + \text{CO}_2 (\text{g}) \rightarrow \text{Ca} (\text{HCO}_3)_2 (\text{aq})$
29. Metal carbonate + acid  $\rightarrow$  salt + carbon dioxide + water
30. Metal hydrogen carbonate + acid  $\rightarrow$  salt + carbon dioxide + water
31.  $\text{NaOH} (\text{aq}) + \text{HCl}(\text{aq}) \rightarrow \text{NaCl}(\text{aq}) + \text{H}_2\text{O} (\ell)$

32. The reaction of an acid with a base to give a salt and water is known as a neutralization reaction.
33. In general, a neutralization reaction can be written as: Base + Acid  $\rightarrow$  Salt + Water
34. The copper oxide is dissolves in dilute HCl and the colour of the solution becomes bluish-green.
35. The copper oxide is dissolves in dilute HCl to forms a copper chloride.
36. Metal oxide + Acid  $\rightarrow$  Salt + Water
37.  $\text{Ca O} + 2\text{HCl} \rightarrow \text{Ca Cl}_2 + \text{H}_2\text{O}$
38. Both metallic oxides and metal hydrides give salt and water when they react with an acid.
39. We can conclude that metal oxides are basic in nature like the metal hydroxides.
40. Calcium hydroxide, which is a base, reacts with carbon dioxide to produce a salt and water.
41. Carbon dioxide which is a non metal oxide is acidic in nature.
42. In general all nonmetal oxides are acidic in nature.
43. Acid solutions have ions and the movement of these ions in solution helps for flow of electric current through the solution.
44. The positive ion (cation) present in HCl solution is H<sup>+</sup>.
45. Acids produce hydrogen ions H<sup>+</sup> in solution. Which are responsible for their acidic properties.
46. In glucose there are no H<sup>+</sup> ions in these solutions.
47. The acidity of acids is attributed to the H<sup>+</sup> ions produced by them in solutions.
48.  $2\text{NaCl}(\text{s}) + \text{H}_2\text{SO}_4(\text{l}) \rightarrow 2\text{HCl}(\text{g}) \uparrow + \text{Na}_2\text{SO}_4(\text{s})$
49. Dry HCl gas (Hydrogen chloride) is not an acid because you have noticed that there is no change in colour of dry litmus paper but HCl aqueous solution is an acid because wet blue litmus paper turned into red.
50. The HCl gas evolved at delivery tube dissociates in presence of water to produce hydrogen ions.
51.  $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ (\text{Hydronium ion}) + \text{Cl}^-(\text{aq})$
52.  $\text{H}^+ + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+$
53. We now learnt that acids give H<sub>3</sub>O<sup>+</sup> or H<sup>+</sup> (aq) ion in water.
54.  $\text{NaOH}(\text{s}) \xrightarrow{\text{H}_2\text{O}} \text{Na}^+(\text{aq}) + \text{OH}^-$
55.  $\text{KOH}(\text{s}) \xrightarrow{\text{H}_2\text{O}} \text{K}^+(\text{aq}) + \text{OH}^-(\text{aq})$
56.  $\text{Mg}(\text{OH})_2(\text{s}) \xrightarrow{\text{H}_2\text{O}} \text{Mg}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq})$
57. On dissolving bases in water produces hydroxide (OH<sup>-</sup>) ions.
58. Bases which are soluble in water are called alkalis.
59. All bases do not dissolve in water.
60. Be (OH)<sub>2</sub> is slightly soluble in water.
61. The process of dissolving an acid or a base in water is an exothermic process.
62. The acid must always be added slowly to water with constant stirring.
63. If water is added to a concentrated acid, the heat generated may cause the mixture to splash out and cause burns.



64. The glass container may also break due to excessive local heating.
65. Mixing an acid or base with water result in decrease in the concentration of ions ( $\text{H}_3\text{O}^+/\text{OH}^-$ ) per unit volume. Such a process is called dilution and the acid or the base is said to be diluted.
66. Chemical formula of acetic acid  $\text{CH}_3\text{COOH}$ .
67. More ions in  $\text{HCl}$  solution mean more  $\text{H}_3\text{O}^+$  ions. Therefore it is a strong acid.
68. Whereas acetic acid has fewer  $\text{H}_3\text{O}^+$  ions and hence it is weak acid.
69.  $\text{NaOH}$  (sodium hydroxide) is a strong base and dil.  $\text{NH}_4\text{OH}$  (ammonium hydroxide) is a weak base.
70. The universal indicator can also be used to know the strength of acid or base.
71. Universal indicator is a mixture of several indicators.
72. The universal indicator shows different colours at different concentrations of hydrogen ions in a solution.
73. A scale for measuring hydrogen ion concentration in a solution is called pH scale.
74. The 'p' in pH stands for 'Potenz' German 'Potenz' is power.
75. pH value of a solution is simply a number which indicates the acidic or basic nature of a solution.
76. The pH of neutral solutions is 7.
77. The pH values less than 7 on the pH scale represent an acidic solution.
78. The pH value increases from 7 to 14 is Bases.
79. pH Value represents a decrease in  $\text{H}_3\text{O}^+$  ion concentration or an increase in  $\text{OH}^-$  ion concentration in the solution.
80. pH value of a solution above '7' represents a basic solution.
81. The strength of acid or base depends on the concentration of  $\text{H}_3\text{O}^+$  ions or  $\text{OH}^-$  produced in a solution.
82. If we take hydrochloric acid and acetic acid of the same concentration then they produce different concentration of hydrogen ions.
83. Acids that give more  $\text{H}_3\text{O}^+$  ions are said to be strong acids that give fewer  $\text{H}_3\text{O}^+$  ions are said to be weak acid.
84. To avoid the negative powers of  $\text{H}^+$  concentration in dilute acid and base solutions Sorensen introduced the concept of  $\text{p}^{\text{H}}$ .
85. Plants require a specific pH range for their healthy growth.
86. The  $\text{p}^{\text{H}}$  concept may be restricted for solutions of  $[\text{H}^+]$  less than 1 molar.
87. The  $\text{p}^{\text{H}}$  scale is from 0-14.
88. The  $\text{p}^{\text{H}}$  is an indication of concentration of  $\text{H}^+$ .
89. For example, at a pH of zero the hydronium ion concentration is one molar.
90. Typically the concentrations of  $\text{H}^+$  in water in most solutions fall between a range of 1 M (pH=0) and  $10^{-14}$  M ( $\text{p}^{\text{H}}=14$ ).
91. Living organisms can survive only in a narrow range of pH change.

92. When pH of rain water is less than 5.6, it is called acid rain.
93. When acid rain flows in to the rivers, it lowers the pH of the river water, the survival of aquatic life in such rivers becomes difficult.
94. Tooth decay starts when the pH of the mouth is lower than 5.5.
95. Tooth enamel, made of calcium phosphate is the hardest substance in the body.
96. Tooth enamel does not dissolve in water, but is corroded when the pH in the mouth is below 5.5. Bacteria present in the mouth produce acids by degradation of sugar and food particles remaining in the mouth.
98. The best way to prevent this is to clean the mouth after eating food. Using tooth pastes, which are generally basic neutralize the excess acid and prevent tooth decay.
100. It is very interesting to note that our stomach produces hydrochloric acid.
101. Hydrochloric acid helps in the digestion of food without harming the stomach.
102. During indigestion the stomach produces too much acid and this causes pain and irritation.
103. To get rid of indigestion pain, people use bases called antacids.
104. Antacids neutralize the excess acid in the stomach.
105. Magnesium hydroxide(milk of magnesia), a mild base, is often used for neutralize purpose.
106. Chemical formula of Magnesium hydroxide is Mg (OH)<sub>2</sub>
107. The colour of methyl orange indicator in acidic medium is red.
108. The colour of Phenolphthaline indicator in basic solution is pink.
109. The colour of methyl orange indicator in basic solution is yellow.
110. The colour of phenolphthaline indicator in acidic solution is colourless.
111. A farmer would treat the soil of his fields with quicklime (calcium hydroxide) or calcium carbonate.
112. Bee sting leaves an acid in our body which causes pain and irritation.
113. Use of a mild base like baking soda on the bee stung area gives relief.
114. Stinging hair of leaves of nettle plant, inject methanoic acid causing burning pain.
115. A traditional remedy is rubbing the area with the leaf of the dock plant, which often grows besides the nettle in the wild.
116. Salts having the same positive or negative radicals belong to a family.
117. NaCl and Na<sub>2</sub>SO<sub>4</sub> belong to the family of sodium salts.
118. NaCl, and KCl belong to the family of chloride salts.
119. pH paper is called universal indicator.
120. Salt of a strong acid and a strong base are neutral and the pH value is 7.
121. The salts of a strong acid and weak base are acidic and the pH value is less than 7.
122. The salts of a strong base and weak acid are basic in nature and the pH value is more than 7.
123. You are adding a weak acid and weak base. In such cases the pH depends on the relative strengths of acid and base.

124. Salts are the ionic compounds which are produced by the neutralization of acid with base.
125. Salts are electrically neutral.
126. There are number of salts but sodium chloride is the most common among them.
127. Sodium chloride is also known as table salt or common salt.
128. Sodium chloride is used to enhance the taste of food.
129. Sea water contains many salts dissolved in it.
130. Sodium chloride is the predominant component and it is separated from the sea water.
131. Deposits of solid salt are also found in several parts of the world.
132. These deposits of large crystals are often brown due to impurities. This is called rock salt.
133. Beds of rock salt were formed when seas of bygone ages dried up.
134. Rock salt is mined like coal.
135. The common salt is an important raw material for various materials of daily use, such as sodium hydroxide, baking soda, washing soda, bleaching powder and many more.
136. When electricity is passed through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide.
137. We get NaOH from NaCl by passing of electricity. The process is called the chlor-alkali process.  
Because of the products formed chlor for chlorine and alkali for sodium hydroxide.
138.  $2 \text{NaCl}_{(aq)} + 2\text{H}_2\text{O}_{(l)} \rightarrow 2 \text{NaOH}_{(aq)} + \text{Cl}_{2(g)} + \text{H}_{2(g)}$
139. The chlorine gas is used for the manufacture of bleaching powder.
140. Bleaching powder is produced by the action of chlorine on dry slaked lime [ $\text{Ca}(\text{OH})_2$ ].
141. Bleaching powder is represented by formula  $\text{CaOCl}_2$
142.  $\text{Ca}(\text{OH})_2 + \text{Cl}_2 \rightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$
143. Bleaching Powder is used for bleaching cotton and linen in the textile industry for bleaching wood pulp in paper industry and for bleaching washed clothes in laundry.
144. Bleaching Powder is used as an oxidizing agent in many chemical industries.
145. Bleaching Powder is used for disinfecting drinking water to make it free of germs.
146. Bleaching Powder is used as a reagent in the preparation of chloroform.
147. The chemical formula of chloroform is CHCl<sub>3</sub>
148. Baking soda is sometimes added for faster cooking.
149. The chemical name of the compound is sodium hydrogen carbonate (NaHCO<sub>3</sub>).
150.  $\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2 + \text{NH}_3 \rightarrow \text{NH}_4\text{Cl} + \text{NaHCO}_3$
151. Baking soda is a mild non-corrosive base.
152.  $2\text{NaHCO}_3 \xrightarrow{\text{Heat}} \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$
153. Baking powder is a mixture of baking soda and a mild edible acid such as tartaric acid.
154.  $\text{NaHCO}_3 + \text{H}^+ \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{sodium salt of acid}$ .
155. Sodium hydrogen carbonate is an ingredient in antacids.

156. Sodium hydrogen carbonate is being alkaline, it neutralizes excess acid in the stomach and provides relief.
157. Sodium hydrogen carbonate is also used in soda-acid fire extinguishers.
158. Sodium hydrogen carbonate acts as mild antiseptic.
159. Washing soda (sodium carbonate) chemical formula is  $\text{Na}_2\text{CO}_3$ .
160. Recrystallisation of sodium carbonate gives washing soda. It is also a basic salt.
161.  $\text{Na}_2\text{CO}_3 + 10\text{H}_2\text{O} \rightarrow \underline{\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}}$
162. Sodium carbonate and sodium hydrogen carbonate are useful chemicals for many industrial processes.
163. Sodium carbonate (washing soda) is used in glass, soap and paper industries.
164. Sodium carbonate is used in the manufacture of sodium compounds such as borax.
165. Sodium carbonate can be used as a cleaning agent for domestic purposes.
166. Sodium carbonate is used for removing permanent hardness of water.
167. When Copper sulphate is heated blue colour turns to white.
168. When the crystals of Copper are moistened with water, the blue colour reappears.
169. Water of crystallization is the fixed number of water molecules present in one formula unit of a salt. Five water molecules are present in one formula unit of copper sulphate.
170. Chemical formula for hydrated copper sulphate is  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ .
171. The salt which possesses water of crystallization is gypsum. It has two water molecules in its crystals and the formula is  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ .
172. On careful heating of gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) at 373 K it loses water molecules partially to become calcium sulphate hemihydrates ( $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ ).
173. Calcium sulphate hemihydrates ( $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ ) is called plaster of Paris.
174. Plaster of Paris is used for supporting fractured bones in the right position.
175. Plaster of Paris is a white powder and on mixing with water, it sets into hard solid mass due to the formation of gypsum.
176.  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O} + 1\frac{1}{2}\text{H}_2\text{O} \rightarrow \underline{\text{CaSO}_4 \cdot 2\text{H}_2\text{O}}$
177. The chemical formula of Gypsum is  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ .
178. Plaster of Paris is used for making toys, materials for decoration and for making surfaces smooth.
179. Acid – base indicators are dyes or mixtures of dyes which are used to indicate the presence of acids and bases.
180. Acidic nature of a substance is due to the formation of  $\text{H}^+$  (aq) ions in solution. Formation of  $\text{OH}^-$  (aq) ions in solution is responsible for the basic nature of a substance.
181. When a base reacts with a metal with the evolution of hydrogen gas, a salt is formed.
182. When an acid reacts with a metal carbonate or metal hydrogen carbonate gives the corresponding salt, carbon dioxide gas and water.
183. Acidic and basic solutions in water conduct electricity because they produce hydrogen ions and hydroxide ions respectively.

185. The strength of an acid or an alkali can be tested by using a scale called the pH scale (0-14), which gives the measure of hydrogen ion concentration in a solution.
186. A neutral solution has a pH of 7, while an acidic solution has a pH less than 7 and a basic solution has a pH more than 7.
187. Living beings carry out their metabolic activities within an optimal pH range.
188. Mixing concentrated acids or bases with water is a highly exothermic process.
189. Acids and bases neutralize each other to form corresponding salts and water.
190. Water of crystallization is the fixed number of water molecules chemically attached to each formula unit of a salt in its crystalline form.
191. Salts have various uses in everyday life and in industries.
192. The chemical formula of Tartaric acid is  $C_4H_6O_6$ .

## 5. Refraction of Light at Plane Surfaces

1. Beauty of the nature is made apparent with light.
2. We observed that a coin kept at the bottom of a vessel filled with water appears to be raised.
3. A lemon kept in a glass of water appears to be bigger than its size.
4. When a thick glass slab is placed over some printed letters, the letters appear raised when viewed through the glass slab.
5. The speed of the light changes when light propagates from one medium to another medium.
6. "The process of changing speed at an interface when a light travel from one medium to another resulting in a change in direction is refraction of light.
7. The process of refraction involves bending of light ray except when it is incident normally".
8. If light ray enters from rarer medium to denser medium then refracted ray moves towards the normal drawn at the interface of separation of two media.
9. When light travels from denser medium to rarer medium it bends away from normal.
10. When a light ray propagates through one medium to another medium is expressed in terms of refractive index (n).
11. Light travels in vacuum with a speed nearly equal to  $3 \times 10^8$  m/s (denoted by letter 'c').
12. The speed of light is smaller than 'c' in other transparent media.
13. Absolute refractive index,  $n = \frac{\text{Speed of light in vacuum (C)}}{\text{Speed of light in medium (v)}}$
14. Refractive index gives us an idea of how fast or how slow light travels in a medium.
15. The speed of light in a medium is low when refractive index of the medium is high and vice versa.
16. Refractive index depends on nature of material and wavelength of light used.
17. The refractive index of a medium with respect to another medium is defined as the ratio of speed of light in the first medium to the speed of light in the second medium.
18. Refractive index of second medium with respect to first medium is given by,  

$$n_{21} = \frac{\text{speed of light in medium - 1}}{\text{speed of light in medium - 2}}$$
19. Relative refractive index,  $(n_{21}) = \frac{\text{Refractive index of second medium (n2)}}{\text{Refractive index of first medium (n1)}}$
20. Snell's law is,  $n_1 \sin i = n_2 \sin r$ .
21. The incident ray, the refracted ray and the normal to interface of two transparent media at the point of incidence all lie in the same plane.
22. During refraction, light follows Snell's law  $n_1 \sin i = n_2 \sin r$  (or)  $\frac{\sin i}{\sin r} = \text{constant}$ .
23. We observe that at a certain angle of incidence the refracted ray does not come out but grazes the interface separating air and glass. This angle of incidence is known as critical angle (c).
24. The formula for critical angle is,  $\sin c = \frac{1}{n_{12}}$  (Or)  $\frac{1}{\sin c} = \frac{n_2}{n_1}$ .

25. When the angle of the incidence is greater than critical angle, the light ray gets reflected into the denser medium at the interface i.e., light never enters the rarer medium. This phenomenon is called total internal reflection.
26. Mirage is an optical illusion where it appears that water has collected on the road at a distant place but when we get there, we don't find any water.
27. Formation of a mirage is the best example where refractive index of a medium varies throughout the medium.
28. If the temperature is decreases then the result density of air increases.
29. We know that refractive index of air increases with density.
30. The cooler air at the top has greater refractive index than hotter air just above the road.
31. Light travels faster through the thinner hot air than through the denser cool air.
32. When the light from a tall object such as tree or from the sky passes through a medium just above the road, whose refractive index decreases towards ground, it suffers refraction and takes a curved path because of total internal reflection.
33. Total internal reflection is the main reason for brilliance of diamonds.
34. The critical angle of a diamond is very low (24.4°).
35. Total internal reflection is the basic principle behind working of optical fiber.
36. An optical fiber is very thin fiber made of glass (or) plastic having radius about a micrometer.
37. One Micrometer is equal to  $10^{-6}$  m.
38. A bunch of optical thin fibers form a light pipe.
39. When light is entered into optical fiber, the angle of incidence is greater than the critical angle and hence total internal reflection takes place.
40. The other important application of fiber optics is to transmit communication signals through light pipes.
41. 2000 telephone signals, appropriately mixed with light waves, may be simultaneously transmitted through a typical optical fiber.
42. The clarity of the signals transmitted in the light pipe is much better than other conventional methods.
43. A thin glass slab is formed when a medium is isolated from its surroundings by two plane surfaces parallel to each other.
44. The distance between the parallel rays in a glass slab is called lateral shift.
45. The refractive index of a glass slab is calculated by using the formula, 
$$\frac{\text{Thickness of the slab}}{\text{thickness of slab} - \text{vertical shift}}$$
46. When the angle of incidence is greater than the critical angle, the light ray is reflected into denser medium at interface. This phenomenon is called total internal reflection.
47. The refractive index of air is 1.0003
48. The refractive index of Canada balsam is 1.53

49. The refractive index of Ice is 1.31
50. The refractive index of Rock salt is 1.54
51. The refractive index of Water is 1.33
52. The refractive index of Carbon Diasulphide is 1.63
53. The refractive index of Kerosene is 1.44
54. The refractive index of Dense flint glass is 1.65
55. The refractive index of Fused quartz is 1.46
56. The refractive index of Ruby is 1.71
57. The refractive index of Turpentine oil is 1.47
58. The refractive index of Sapphire is 1.77
59. The refractive index of Crown glass is 1.52
60. The refractive index of Diamond is 2.42



## 6. Refraction of Light at Curved Surfaces

1. The line that joins the centre of curvature and the pole is called 'principal axis'.
2. The centre of the sphere, of which curved surface is a part, is called as centre of curvature. It is denoted by letter 'C'
3. In the case of plane surfaces, a ray will bend towards the normal if it travels from a rarer to denser medium and it bends away from the normal if it travels from a denser to a rarer medium.
4. According to Snell's law the ray which travels along the normal drawn to the surface does not deviate from its path.
5. The ray that travels along the principal axis is undeviated.
6. The ray that travels along the pole is undeviated.
7. The point where refracted ray intersects the axis in all the above cases is called the focal point.
8. If the rays move very close to the principal axis, the rays can be treated as parallel and are called paraxial rays.
9. In the paraxial rays, the angles  $\alpha$ ,  $\beta$  and  $\gamma$  become very small. This approximation is called paraxial approximation.
10. All distances are measured from the pole (or optic centre).
11. Distances measured along the direction of the incident light ray are taken as positive.
12. Distances measured opposite to the direction of the incident light ray are taken as negative.
13. The heights measured vertically above from the points on axis are taken as positive.
14. The heights measured vertically down from points on axis are taken as negative.
15. The formula for formation of image in the case of a curved surfaces is  $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$
16. The formula for formation of image in the case of a plane mirror is  $\frac{n_2}{v} - \frac{n_1}{u} = 0$ .
17. A lens is formed when a transparent material is bounded by two surfaces of which one (or) both surfaces are spherical.
18. The lens is bounded by at least one curved surface.
19. A lens may have two spherical surfaces bulging outwards. Such a lens is called double convex lens (Biconvex lens)
20. Biconvex lens is thick at the middle as compared to edges.
21. A double concave lens (Biconcave lens) is bounded by two spherical surfaces curved inwards.
22. Biconcave lens is thin at the middle and thicker at the edges.
23. We are concerned only with thin lenses i.e. the thickness of the lens is negligible.
24. The centre of the sphere which contains the part of the curved surface is called centre of curvature.
25. The distance between the centre of curvature and curved surface is called radius of curvature (R).
26. The midpoint of a thin lens is called optic centre (P) of lens.

27. The point of convergence (or) the point from which rays seem to emanate is called focal point or focus (F).
28. Every lens has two focal points.
29. The distance between the focal point and optic centre is called the focal length of lens denoted by 'f'.
30. For drawing ray diagrams related to lenses we represent convex lens with a symbol  $\lrcorner$  and concave lens with  $\llcorner$
31. Any ray passing along the principal axis and the optic centre is undeviated.
32. The rays passing parallel to the principal axis converge at the focus in the case of convex lens.
33. The rays passing parallel to the principal axis diverge from the focus in the case of concave lens.
34. The ray passing through the focus will take a path parallel to principal axis after refraction.
35. Focal plane is the plane perpendicular to the principal axis at the focus.
36. When object is placed beyond the centre of curvature ( $C_2$ ), a real, inverted and diminished image is formed on the principal axis between the points  $F_1$  and  $C_1$ .
37. When an object is placed at the centre of curvature ( $C_2$ ) on the principal axis, you will get an image at  $C_1$  which is real, inverted and the same size as that of object.
38. When an object is placed between centre of curvature ( $C_2$ ) and focus ( $F_2$ ), you will get an image which is real, inverted and magnified. The image will form beyond  $C_1$ .
39. When an object is placed at focus ( $F_2$ ), the image will be at infinity.
40. When the image is formed at an infinite distance away we cannot discuss the size and nature of the image.
41. If we place an object between focus and optic centre, we will get an image which is virtual, erect and magnified.
42. As the image formed is virtual, we can see it with our eyes.
43. The image is real which we can't see with our eyes but can be viewed if the image is captured on a screen.
44. A magnified virtual image is formed on the same side of the lens where the object is placed.
45. The particular behaviour of convex lens helps to construct a microscope, which gives a magnified image.
46. You might remember that the magnification of the virtual image is possible only when the object is at the distance less than the focal length of the lens.
47. Lens formula is  $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ . Lens maker's formula is,  $\frac{1}{f} = (n-1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$ .
48. The convex lens behaves as a converging lens, if it is kept in a medium with refractive index less than the refractive index of the lens.
49. The convex lens behaves like a diverging lens when it is kept in a transparent medium with greater refractive index than that of the lens.
50. An air bubble in water behaves like a diverging lens.

## 7. Human Eye and Colourful world

1. The human eye functions on the principle of sensation of vision.
2. We see objects because the light scattered from them falls on the eye.
3. The eye has a lens in its structure.
4. If we see an object comfortably and distinctly, you must hold it at a distance about 25 cm from your eyes.
5. We see an object clearly at a distance of about 25cm. This distance is called least distance of distinct vision.
6. The maximum angle, at which we are able to see the whole object is called angle of vision.
7. The angle of vision for a healthy human being is about 60°.
8. The human eye is one of the most important sense organs.
9. The eye ball is nearly spherical in shape.
10. The front portion of the eye is more sharply curved and is covered by a transparent protective membrane called the 'cornea'.
11. The portion which is visible from outside of the eye is Cornea.
12. Behind the cornea, there is place filled with a liquid called aqueous humour.
13. Behind the cornea aqueous humour and a crystalline lens which is responsible for the image formation.
14. Between the aqueous humour and the lens, we have a muscular diaphragm called 'iris'.
15. Iris has a small hole in it called pupil.
16. Iris is the coloured part that we see in an eye.
17. The pupil appears black because any light falling on it goes into the eye and there is almost no chance of light coming back to the outside.
18. Iris helps in controlling the amount of light entering the eye through 'pupil'.
19. In low light condition, the iris makes the pupil to expand so that more light is allowed to eye.
20. In the case of bright (or) excess light condition, iris makes the pupil contract and thereby prevent the excess light not to go into eye.
21. 'Iris' enables pupil to act as a "variable aperture" for entry of light into the eye.
22. The eye lens is hard in the middle and gradually becomes soft towards the outer edge.
23. The light that enters the eye forms an image on the retina. (It covers the rear part of eyeball).
24. The distance between the lens and retina is about 2.5 cm.
25. The ciliary muscle to which eye lens is attached helps the eye lens to change its focal length by changing the radii of curvature of the eye lens.
26. When the eye is focused on a distant object, the ciliary muscles are relaxed so that the focal length of eye lens has its maximum value which is equal to its distance from the retina.

27. When the eye is focused on a closer object, the ciliary muscles are strained and focal length of eye-lens decreases.
28. The ciliary muscles adjust the focal length in such a way that the image is formed on retina and we see the object clearly.
29. The process of adjusting focal length is called "accommodation".
30. The eye-lens forms a real and inverted image of an object on the retina.
31. The retina is a delicate membrane, which contains about 125 million receptors called 'rods' and 'cones' which receive the light signal.
32. In a receptors of eye rods identify the colour and cones-identify the intensity of light.
33. The signals of receptors are transmitted to the brain through about 1 million optic-nerve fibers.
34. The brain interprets these signals and finally processes the information so that we perceive the object in terms of its shape, size and colour.
35. The maximum focal length of the eye lens is 2.5 Cm.
36. The minimum focal length of the eye lens is 2.27 Cm.
37. The ability of eye-lens to change its focal length is called "accommodation of lens".
38. Sometimes the eye may gradually lose its ability for accommodation. In such conditions the person cannot see an object clearly and comfortably.
39. There are mainly three common defects of vision. They are Myopia, Hypermetropia and Presbyopia.
40. Some people cannot see objects at long distances but can see nearby objects clearly. This type of defect in vision is called 'Myopia'.
41. The defect, in which people cannot see objects beyond far point, is called 'Myopia'.
42. Myopia is also called 'nearsightednesses.
43. The least distance of distinct vision, the eye lens can form an image on the retina. This distance is called 'far point'.
44. The point of maximum distance at which the eye lens can form an image on the retina is called 'far point'.
45. If we can correct myopia then we need to select bi-concave lens.
46. Hypermetropia is also known as "far sightedness".
47. A person with hypermetropia can see distant objects clearly but cannot see objects at near distances.
48. The minimum focal length of eye lens for the person of hypermetropia is greater than 2.27 cm.
49. The point of minimum distance at which the eye lens can form an image on the retina is called near point (d).
50. To correct the defect of hypermetropia, we need to use a double convex lens.
51. Presbyopia is vision defect when the ability of accommodation of the eye usually decreases with ageing.

52. Presbyopia happens due to gradual weakening of ciliary muscles and diminishing flexibility of the eye lens.
53. Sometimes a person may suffer from both myopia and hypermetropia with ageing.
54. To correct this type of defect of vision we need bi-focal lenses which are formed using both concave and convex lenses.
55. In bi-focal lenses the upper portion consists of the concave lens and lower portion consists of the convex lens.
56. The degree of convergence or divergence of light rays that can be achieved by a lens is expressed in terms of its power.
57. A prism is a transparent medium separated from the surrounding medium.
58. Prism has at least two plane surfaces which are inclined at a certain angle in such a way that, light incident on one of the plane surfaces emerges from the other plane surface.
59. A triangular glass prism has two triangular bases and three rectangular plane lateral surfaces.
60. The angle between the incident ray and normal is called angle of incidence ( $i_1$ ).
61. The ray which comes out of the outer surface of the prism is called emergent ray.
62. The angle between the plane surfaces any two sides are called the angle of the prism or refracting angle of prism (A).
63. The angle between the incident ray and emergent ray is called angle of deviation (d).
64. A graph between angle of incidence and angle of deviation, take angle of incidence along X- axis and the angle of deviation along Y- axis.
65. In an angle of incident and angle of deviation graph is a Curved line.
66. Draw a tangent line to the curve, parallel to X- axis, at the lowest point of the graph. The point where this line cuts the Y- axis gives the angle of minimum deviation.
67. Angle of minimum deviation is denoted by the letter "D".
68. The refractive index of a prism by using the formula,  $n = \frac{\sin(\frac{A+D}{2})}{\sin(\frac{A}{2})}$
69. The splitting of white light into different colours (VIBGYOR) is called dispersion.
70. We can consider that white light is a collection of waves with different wavelengths.
71. Violet colour is known to have the shortest wavelength while red is of the longest wavelength.
72. According to wave theory, light can be thought of a wave propagating in all directions. Light is an electromagnetic wave.
73. The oscillating electric and magnetic fields propagate in all directions with the speed of light.
74. We know that refractive index is the ratio of speeds in vacuum and in the medium.
75. The refractive index of a medium depends on wavelength of light.
76. When white light passes through a medium, each colour selects its least time path and we have refraction of different colours to different extents.
77. It has been experimentally found that refractive index decreases with an increase in wavelength.

78. Red colour has longest wavelength and violet colour has shortest wavelength.
79. The relation between the speed of wave ( $v$ ), wavelength ( $\lambda$ ) and frequency ( $f$ ) is,  $v = f\lambda$ .  
(Frequency ( $f$ ) may be denoted by  $\nu$ )
80. Speed of the wave increases with increase in wavelength of light.
81. The rays of sunlight enter the drop near its top surface. At this first refraction, the white light is dispersed into its spectrum of colours.
82. The angle between the incoming and outgoing rays can be anything between  $0^\circ$  and about  $42^\circ$ .
83. An observer is in a position to see only a single colour from any one drop depending upon its position.
84. The refractive index of red is low hence it suffers low deviation.
85. The frequency of the light wave remains unaltered while its wavelength changes depending on the medium through which it passes.
86. The beautiful colours of the rainbow are due to dispersion of the sunlight by millions of tiny water droplets.
87. The rays of sunlight enter the drop near its top surface. At this first refraction, the white light is dispersed into its spectrum of colours, violet being deviated the most and red the least.
88. The light rays reaching the opposite side of the drop, each colour is reflected back into the drop because of total internal reflection.
89. We observe bright rainbow when the angle between incoming and outgoing rays is near the maximum angle of  $42^\circ$ .
90. If violet light from a single drop reaches the eye of an observer, red light from the same drop can't reach his eye.
91. The colour red will be seen when the angle between a beam of sunlight and light sent back by a drop is  $42^\circ$ .
92. The colour violet is seen when the angle between a sunbeam and light sent back by a drop is  $40^\circ$ .
93. If you look at an angle between  $40^\circ$  and  $42^\circ$ , you will observe the remaining colours of VIBGYOR.
94. A rainbow is not the flat two dimensional arc as it appears to us.
95. The rainbow you see is actually a three dimensional cone with the tip at your eyes.
96. All the drops that disperse the light towards you lie in the shape of the cone – a cone of different layers.
97. The drops that disperse red colour to your eye are on the outer most layer of the cone.
98. The drops that disperse orange colour to your eye are on the layer of the cone beneath the red colour cone.
100. Atoms or molecules which are exposed to light absorb light energy and emit some part of the light energy in different directions.
101. If the size of the particle (atom or molecule) is small, it will be affected by higher frequency (lower wave length) light and vice versa.

102. **The intensity** of light is the energy of light passing through unit area of plane, taken normal to the direction of propagation of light, in one second.
103. If the atom vibrates, the atom re-emits a certain fraction of absorbed energy in all directions with **different intensities**.
104. The re-emitted light is called **scattered light** and the process of re-emission of light in all directions with different intensity is called **scattering of light**.
105. The atoms or molecules are called **scattering centre**.
106. The intensity of scattered light varies with angle of **scattering**.
107. The intensity is maximum at **90°** angle of scattering.
108. The reason for blue sky is due to the molecules **N<sub>2</sub>** and **O<sub>2</sub>**.
109. The sizes of N<sub>2</sub> and O<sub>2</sub> molecules are comparable to the wavelength of **blue** light.
110. N<sub>2</sub> and O<sub>2</sub> molecules act as **scattering centers** for scattering of blue light.
111. Our atmosphere contains atoms and molecules of **different sizes**.
112. The atmosphere contains **free molecules** and atoms with different sizes.
113. **C.V Raman** found experimentally that the frequency of scattered light by the liquids is greater than the frequency of incident light.
114. Raman introduced the **Raman Effect**.
115. Raman effect is helpful to determine the shapes of the **molecules**.
116. The least distance of distinct vision is about **25cm** and the angle of vision is about **60°**.
117. The ability of eye lens to change its focal length is called **accommodation of lens**.
118. The defect in which people cannot see objects beyond far point is called **Myopia**.
119. The defect in which people cannot see objects situated before near point is called **Hypermetropia**.
120. **Presbyopia** is a vision defect indicating that the power of accommodation of the eye usually decreases with ageing.
121. The reciprocal of focal length is called **power of the lens**.
122. The refractive index of prism is given by  $n = \frac{\sin(\frac{A+D}{2})}{\sin(\frac{A}{2})}$
- Where A is **angle of prism** and D is **angle of minimum deviation**.
123. The splitting of white light into colours (VIBGYOR) is called **dispersion**.
124. The process of re-emission of absorbed light in all directions with different intensities by atoms or molecules is called **scattering of light**.

## 8. Structure of Atom

1. The smallest unit of substances is called atom.
2. The central part of an atom is called nucleus.
3. Nucleus is made up of sub atomic particles like electron,proton and neutron.
4. An atom consists of sub-atomic particles like negatively charged electrons, positively charged protons and electrically neutral neutrons.
5. Some fundamental ideas about atomic models suggested by JJ Thomson, Ernest Rutherford and Niels Bohr.
6. There are seven colours namely violet, indigo, blue, green, yellow, orange and red (VIBGYOR) in a rainbow.
7. Electromagnetic waves are produced when an electric charge vibrates (moves back and forth).
8. Sound waves are produced when something vibrates, like a drum.
9. A vibrating electric charge creates a change in the electric field. The changing electric field creates a changing magnetic field.
10. Visible light is an electromagnetic wave and the speed of light (c) is  $3 \times 10^8 \text{ m s}^{-1}$ .
11. Electromagnetic energy travelling through a vacuum behaves in some way like ocean waves travelling through water.
12. Like ocean waves, electromagnetic energy is characterized by wavelength ( $\lambda$ ) and frequency ( $\nu$ ).
13. Electromagnetic waves can have a wide variety of frequencies.
14. The entire range of electromagnetic wave frequencies is known as the electromagnetic spectrum.
15. A group of wave length or frequencies is called a spectrum.
16. The familiar example of the visible spectrum in nature is the formation of a rainbow.
17. Each colour in a rainbow is characterized by a specified wavelength from red (higher wavelength) to violet (shorter wavelength).
18. The range of wavelengths covering red colour to violet colour is called the visible spectrum.
19. Electromagnetic waves can have a wide variety of wavelengths.
20. The entire range of wavelengths is known as the electromagnetic spectrum.
21. The electromagnetic spectrum consists of a continuous range of wavelengths of gamma rays at the shorter wavelength to radio waves at the longer wavelength.
22. Our eyes are sensitive only to visible light.
23. When you heat an iron rod, some of the heat energy is emitted as light.
24. When you heat an iron rod, first it turns red (lower energy corresponding to higher wavelength) and as the temperature rises it glows orange, yellow, blue (higher energy and of lower wavelength) or even white (all visible wavelengths) if the temperature is high enough.



25. Max Planck broke with the 'continuous energy' tradition of electromagnetic energy by assuming that the energy is always emitted in multiples of  $h\nu$ .
26. In the equation  $E = h\nu$ , where 'h' is Planck's constant and ' $\nu$ ' is the frequency of light.
27. The value of h is  $6.626 \times 10^{-34} \text{ Js}$  (Or)  $6.625 \times 10^{-27} \text{ erg.Sec}$
28. The energy (E) for the red colour (higher wavelength or lower frequency) is lower compared to the energy of blue colour (lower wavelength or higher frequency).
29. The energy emitted from a material body increases with increase in heat energy.
30. The significance of Planck's proposal is that, electromagnetic energy can be gained or lost in discrete values and not in a continuous manner.
31. Cupric chloride produces a green colour flame while strontium chloride produces a crimson red flame.
32. Niels Henrik David Bohr was a Danish physicist who made foundational contributions to understanding atomic structure and quantum theory.
33. Niels Henrik David Bohr received the Nobel Prize in Physics in 1922.
34. Bohr was also a philosopher and a promoter.
35. Sodium vapors produce yellow light in street lamps.
36. Scientists found that each element emits its own characteristic colour. These colours correspond to certain discrete wavelengths of light and are called line spectra.
37. The lines in atomic spectra can be used to identify unknown atoms, just like fingerprints are used to identify people.
38. Niels Bohr proposed that electrons in an atom occupy 'stationary' orbits (states) of fixed energy at different distances from the nucleus.
39. When an electron 'jumps' from a lower energy state (ground state) to higher energy states (excited state) it absorbs energy or emits energy when such a jump occurs from a higher energy state to a lower energy state.
40. The energies of an electron in an atom can have only certain values  $E_1, E_2, E_3, \dots$ ; that is, the energy is quantized.
41. The states corresponding to these energies are called stationary states and the possible values of the energy is called energy levels.
42. The electron loses the energy and comes back to its ground state.
43. The energy emitted by the electron is seen in the form of electromagnetic energy and when the wavelength is in the visible region it is visible as an emission line.
44. Bohr's model explains all the line spectra observed in the case of hydrogen atom.
45. Bohr's model is a successful model as far as line spectra of hydrogen atom is concerned.
46. The line spectrum of hydrogen atom when observed through a high resolution spectroscope appears as groups of finer lines.

47. Bohr's model failed to account for splitting of line spectra.
48. In an attempt to account for the structure (splitting) of line spectra known as fine spectra, Sommerfeld modified Bohr's atomic model by adding elliptical orbits.
49. While retaining the first of Bohr's circular orbit as such, he added one elliptical orbit to Bohr's second orbit, two elliptical orbits to Bohr's third orbit, etc.
50. The nucleus of the atom is one of the principal foci of these elliptical orbits.
51. Sommerfeld was guided by the fact that, in general, periodic motion under the influence of a central force will lead to elliptical orbits with the force situated at one of the foci.
52. Bohr-Sommerfeld model, though successful in accounting for the fine line structure of hydrogen atomic spectra, does not provide a satisfactory picture of the structure of atom in general.
53. Bohr's model failed to account for the atomic spectra of atoms of more than one electron.
54. Max Karl Ernst Ludwig Planck was a German theoretical physicist who originated quantum theory, which won him the Nobel Prize in Physics in 1918.
55. Planck made many contributions to theoretical physics, but his fame rests primarily on his role as originator of the quantum theory.
56. This theory revolutionized human understanding of atomic and subatomic processes.
57. Electron revolves around the nucleus in defined paths called orbits or shells.
58. This short wavelength light interacts with the electron and disturbs the motion of the electron.
59. It is clear that electrons do not follow definite paths in an atom.
60. If the electrons are not distributed in orbits around the nucleus this means that an atom does not have a definite boundary.
61. It is not possible to pinpoint an electron in an atom.
62. Under these circumstances in order to understand the properties of electrons in an atom, a quantum mechanical model of atom was developed by Erwin Schrodinger.
63. The region of space around the nucleus where the probability of finding the electron is maximum is called an orbital.
64. Each electron in an atom is described by a set of three numbers  $n$ ,  $\ell$ , and  $m_\ell$ . These numbers are called quantum numbers.
65. Quantum numbers indicate the probability of finding the electron in the space around the nucleus.
66. The quantum numbers describe the space around the nucleus where the electrons are found and also their energies. These are called atomic orbital's.
67. Principal quantum number was introduced by Neil's Bohr.
68. Principle quantum number was denoted by the letter 'n'
69. The principal quantum number is related to the size and energy of the main shell.
70. 'n' has positive integer values of 1, 2, 3,...

71. As 'n' increases, the shells become larger and the electrons in those shells are farther from the nucleus.
72. An increase in 'n' also means higher energy. n = 1, 2, 3, ... are often represented by the letters K, L, M... For each 'n' value there is one main shell.
73. Each shell or orbit has definite energy. These orbits are called Stationary orbit.
74. Stationary orbits are denoted by the letters K, L, M, N, O, P....etc.
75. The angular-momentum quantum number ( $\ell$ ) was proposed by Sommerfield.
76. ' $\ell$ ' has integer values from 0 to n-1 for each value of 'n'. Each ' $\ell$ ' value represents one sub-shell.
77. Each value of ' $\ell$ ' is related to the shape of a particular sub-shell in the space around the nucleus.
78. The value of ' $\ell$ ' for a particular sub-shell is generally designated by the letters s, p, d...
79. When n = 1, there is only one sub-shell with  $\ell = 0$ . This is designated as '1s' orbital.
80. When n = 2, there are two sub-shells, with  $\ell = 0$ , the '2s' sub-shell and with  $\ell = 1$ , the '2p' sub-shell.
81. The magnetic quantum number ( $m_\ell$ ) quantum number was proposed by Lande.
82. The magnetic quantum number ( $m_\ell$ ) has integer values between -l and l, including zero.
83. For a certain value of l, there are  $(2l + 1)$  integer values of  $m_l$  as follows:  

$$-l, (-l+1) \dots, -1, 0, 1, \dots, (l-1), +l$$
84. Magnetic quantum number gives the orientation of the orbital in the presence of applied magnetic field.
85. When  $\ell = 0$ ,  $(2\ell + 1) = 1$  and there is only one value of  $m_\ell$ , thus we have only one orbital i.e., 1s.
86. When  $\ell = 1$ ,  $(2\ell + 1) = 3$ , that means  $m_l$  has three values, namely, -1, 0, and 1 or three p orbital's, with different orientations along x, y, z axes. These are labeled as  $p_x$ ,  $p_y$ , and  $p_z$ .
87. Orbital's in the sub-shell belonging to the same shell possess same energy.
88. S-orbital is spherical in shape, p-orbital is dumbbell-shaped and d-orbital are double dumbbell-shape.
89. Each sub-shell holds a maximum of twice as many electrons as the number of orbital's in the sub-shell.
90. The maximum number of electrons that can occupy various sub-shells is given by the formula  $2n$ .
91. The total number of electrons that can occupy various shell or orbit was given by the formula  $2n^2$ .
92. Spin Quantum Number ( $m_s$ ) was introduced by Uhlen beck and Goudsmith.
93. The three quantum numbers n,  $\ell$ , and  $m_\ell$  describe the size (energy), shape, and orientation, respectively, of an atomic orbital in space.
94. To account for orientation behavior of electron an additional spin quantum number is introduced.
95. Spin quantum number is denoted by ' $m_s$ '.
96. The arrangement of electrons in shells, sub-shells and orbital's in an atom is called the electronic configuration.

97. According to Pauli Exclusion Principle no two electrons of the same atom can have the entire four quantum numbers same.
98. According to Aufbau principle, the electron enter into lowest-energy orbital's first.
99. According to Hund's rule, the electron pairing takes place all the available degenerate orbital's are completely filled by one electron in each.
100. This quantum number refers to the two possible orientations of the spin of an electron, one clockwise and the other anticlockwise spin.
101. The clock wise and anti-clock wise spin of the electron was represented by +1/2 and -1/2.
102. The importance of the spin quantum number is seen when electrons occupy specific orbital's in multi-electron atoms.
103. The distribution of electrons in shells, sub-shells and orbital in an atom is known as electronic configuration.
104. The shorthand notation consists of the principal energy level (n value), the letter representing sub-level (l value), and the number of electrons (x) in the sub-shell is written as a superscript as shown  $n\ell^x$ .
105. In the short hand notation ' $n\ell^x$ ', n-represent the principle quantum number, x- Denotes the number of electrons in orbital and ' $\ell$ ' Denotes the angular momentum quantum number.
107. For the electron in H, as you have seen, the set of quantum numbers is:  $n = 1, \ell = 0, m_\ell = 0, m_s = +\frac{1}{2}$  or  $-\frac{1}{2}$ .
108. The distribution of electrons in various atomic orbital's provides an understanding of the electronic behavior of the atom and, in turn, its reactivity.
109. To describe the electronic configuration for more than one electron in the atom, we need to know three principles. Those are the Pauli Exclusion Principle, Aufbau principle and Hund's Rule.
110. According to Pauli Exclusion Principle no two electrons of the same atom can have all four quantum numbers the same.
111. Electrons with paired spins are denoted by ' $\uparrow\downarrow$ '.
112. One electron has  $m_s = +\frac{1}{2}$ , the other has  $m_s = -\frac{1}{2}$ .
113. The maximum number of electrons in any shell is ' $2n^2$ ', where 'n' is the principal quantum number.
114. The maximum number of electrons in a sub-shell (s, p, d or f) is equal to  $2(2\ell+1)$ .
115. The German word "Aufbau" means "building up."
116. In the ground state the electronic configuration can be built up by placing electrons in the lowest available orbital's until the total number of electrons added is equal to the atomic number. This is called the Aufbau principle.
117. Electrons are assigned to orbital's in order of increasing value of (n+l).

118. According to Aufbau principle the electron occupies the orbital having the lowest energy.
119. The energy of the orbital represented by the formula (n+1).
120. According to Hund's rule electron pairing in orbitals starts only when all available empty orbital's of the same energy (degenerate orbitals) are singly occupied.
121. Light can be characterized by its wavelength ( $\lambda$ ) and frequency ( $\nu$ ), and these quantities are related to the speed of light (c) as:  $c = \nu\lambda$ .
122. Spin is an intrinsic property of an electron.
123. Spectrum is a group of wavelengths or frequencies.
124. Electromagnetic energy (Light) can have only certain discrete energy values which is given by the equation,  $E=h\nu$ .
125. Electrons in an atom can gain energy by absorbing a particular frequency of light and can lose energy by emitting a particular frequency.
126. Bohr's model of atom, Electrons are present in stationary states.
127. The electron moves to higher energy level if it absorbs energy in the form of electromagnetic energy or moves to a lower energy state by emitting energy in the form of electromagnetic energy of appropriate frequency.
128. Atomic line spectra arise because of absorption /emission of certain frequencies of light energy.
129. It is not possible to measure accurately the position and velocity of an electron simultaneously.
130. The space around the nucleus where the probability of finding the electron is maximum is called orbital.
131. The three quantum numbers n, l, m<sub>l</sub> describes the energy, shape and orientation respectively, of an atomic orbital.

## 9. Classification of Elements– The Periodic Table

1. Robert Boyle (1661) defined an element as any substance that cannot be decomposed into a further simple substance by a physical or chemical change.
2. At the time of Boyle about thirteen elements were known.
3. At the end of the eighteenth century, by the time of Lavoisier another eleven elements were discovered.
4. In 1865 about sixty three elements were known and by 1940, a total of ninety one elements from natural sources and another seventeen elements synthetically were obtained.
5. Now, including synthetic elements, there are more than 115 elements.
6. We know elements were classified into metals and non-metals.
7. In the beginning of the 18<sup>th</sup> century Joseph Louis Proust stated that hydrogen atom is the building material and atoms of all other elements are simply due to the combination of number of hydrogen atoms.
8. The first classifications of the elements were attempt by Dobereiner in 1817.
9. A German chemist Johann Wolfgang Döbereiner (1829) noted that there were groups of elements with three elements known as triads in each group with similar chemical properties.
10. Dobereiner tried to give a relationship between the properties of elements and their atomic weights.
11. Döbereiner arranged the three elements in the ascending order of their atomic weights.
12. The atomic weight of the middle element is the average of the atomic weights of the first and third elements. This statement is called the Dobereiner's law of triads.
13. 1. Lithium (Li), Sodium (Na), Potassium (K) 2. Calcium (Ca) Strontium (Sr) Barium (Ba) 3. Chlorine (Cl) Bromine (Br) Iodine (I) 4. Sulphur (S) Selenium (Se) Tellurium (Te) 5. Manganese (Mn) Chromium (Cr) Iron (Fe) are examples of Dobereiner triad.
14. Döbereiner's attempts gave a clue that atomic weights could be correlated with properties of elements.
15. The densities of calcium (Ca) and barium (Ba) are 1.55 and 3.51 gcm<sup>-3</sup> respectively.
16. John Newlands was a British chemist.
17. Newlands (1865) found that when elements were arranged in the ascending order of their atomic weights they appeared to fall into seven groups.
18. Each group of Newland contained elements with similar chemical properties. This is called Newland concept of octaves.
19. According to Newland concept of Octaves every eight element having the similar properties of the first element.
20. Newlands was the first to assign atomic numbers to the elements.

21. It was found that the law of octaves holds good only for the elements up to calcium.
22. The Octave law was not valid for elements that had atomic masses higher than calcium.
23. Newlands periodic table was restricted to only 56 elements and did not leave any room for new elements.
24. Mendeleeff arranged the elements known at that time in a chart in a systematic order in the increasing order of their atomic weights.
25. Mendeleeff divided the chart into 8 vertical columns known as groups.
26. According Mendeleeff each group is divided into A, B sub groups. Each column contained elements of similar chemical properties.
27. The elements in the first column, for example, react with oxygen to form compounds with the general formula  $R_2O$ .
28. When Li, Na and K, react with oxygen and form compounds  $Li_2O, Na_2O$  and  $K_2O$  respectively.
29. Elements of the second column react with oxygen to form compounds with the general formula RO.
30. When Be, Mg and Ca when react with oxygen form BeO, MgO and CaO.
31. Mendeleeff tried to explain the similarities of elements in the same group in terms of their common valence.
32. Mandeleeff periodic table based on atomic weight.
33. There are eight vertical columns in Mendeleeff's periodic table called as groups.
34. Groups are represented by Roman numerals I to VIII.
35. Elements present in a given vertical column (group) have similar properties.
36. Each group is divided into two sub-groups 'A' and 'B'.
37. The elements within any sub-group resemble one another to great an extent.
38. In a periodic table sub-group IA elements called 'alkali metals' (Li, Na, K, Rb, Cs, Fr)
39. The horizontal rows in Mendeleeff's periodic table are called periods.
40. There are seven periods in the table, which are denoted by Arabic numerals 1 to 7.
41. Elements in a period differ in their properties from one another.
42. A period comprises the entire range of elements after which properties repeat themselves.
43. Mendeleeff believed that some new elements would be discovered definitely.
44. Mendeleeff named those elements tentatively by adding the prefix 'eka'
45. Eka is a Sanskrit word for numeral one.
46. The predicted properties of elements namely eka-boron,eka-aluminium and eka-silicon were close to the observed properties of scandium, gallium and germanium respectively which were discovered later.
47. In his honour of Mendeleeff the 101<sup>th</sup> element was named Mendelevium.
48. All alkali metals are solids but hydrogen is a gas with diatomic molecules.

49. **H.J. Moseley (1913)** found that each element emits a characteristic pattern of X-rays when subjected to bombardment by high energy electrons.
50. By analyzing the X-ray patterns, Moseley was able to calculate the number of **positive charges** in the atoms of respective elements.
51. The number of positive charges (protons) in the atom of an element is called the **atomic number** of the element.
52. Moseley realized that the **atomic number** is more fundamental characteristic of an element than its atomic weight.
53. After knowing the atomic numbers of elements, it was recognized that a better way of arranging the elements in the periodic table is according to the increasing **atomic number**.
54. The periodic law is changed from atomic weight concept to atomic number concept and now it is called the **modern periodic law**.
55. **Mendeleeff's** periodic law is stated as "The properties of elements are the periodic functions of their atomic weights".
56. The **modern periodic law** may state as "the properties of the elements are periodic function of their atomic numbers."
57. The physical and chemical properties of atoms of the elements depend not on the **number of protons** but on the number of electrons and their arrangements (electronic configurations) in atoms.
58. The **modern periodic law** may be stated as "The physical and chemical properties of elements are the periodic function of the electronic configurations of their atoms."
59. The modern periodic table has eighteen vertical columns known as groups and seven horizontal rows known as **periods**.
60. The elements with similar outer shell (valence shell) electronic configurations in their atoms are in the same column called **group**.
61. Elements listed in a group down to it are in the order of their increasing **principal quantum number**.
62. In a '**Structure of atom**' 's' sub-shell with one orbital contains a maximum of two electrons. Each 'p' sub-shell contains 3 orbital's and accommodates a maximum of six electrons.
63. The 'd' sub-shell contains 5 orbital's and accommodates a maximum of **10** electrons.
64. The 'f' sub-shell contains 7 orbital's with **14** electrons maximum.
65. The vertical columns in the periodic table are known as **groups**.
66. There are eighteen groups in long form of **periodic table**.
67. They are represented by using Roman numeral **I** through **VIII** with letters **A** and **B** in traditional notation.
68. According to latest recommendation of the IUPAC, these groups are represented by Arabic numerals 1 through 18 with no **A** and **B designations**.



69. Group of elements is also called element family or chemical family.
70. Group 1 (IA) elements are Alkali metal family.
71. Group 2 (IIA) elements are Alkali earth metal family.
72. Group 13 (IIIA) elements are Boron family.
73. Group 14 (IVA) elements are Carbon family.
74. Group 15 (VA) elements are Nitrogen family.
75. Group 16 (VIA) elements are Oxygen family or (Chalcogen family).
76. Group 17 (VIIA) elements are Halogen family.
77. Group 18 (VIIIA) elements are Noble gas family.
78. The horizontal rows in the periodic table are called periods.
79. There are seven periods in the modern periodic table.
80. The periods are represented by Arabic numerals 1 through 7.
81. Hydrogen (H) and Helium (He) atoms contain only one main shell (K). Therefore they belong to period-1.
82. Similarly, the elements Li, Be, B, C, N, O, F and Ne contain two main shells (K and L) in their atoms. Therefore they belong to period-2.
83. Alkali metal family: (aliquili = plant ashes) Na, K etc.... were obtained from plant ash, group IA elements are called alkali metals family.
84. Chalcogen family: chalcogenous = ore product, as the elements in group 16 (VIA) form ores with metals. They are called as chalcogenous family.
85. Halogen family: halos = sea salt, genus = produced. As most of the elements in group 17 (VIIA) are obtained from nature as sea salt. They are called as halogen family.
86. Noble gases: As the elements of group 18 (VIIIA) are chemically least active. They are called as noble gases.
87. The outer shell electronic configurations are basis for octet rule.
88. The number of elements in period depends on how electrons are filled into various shells.
89. The first period starts with K-shell. The first main shell (K) contains only one sub-shell, the (1s).
90. The first period contains only two elements.
91. Second period starts with the 2nd main shell (L). L-shell has two sub shells, namely, 2s and 2p.
92. Eight types of configurations are possible in this shell (L) like 2s<sup>1</sup> and 2s<sup>2</sup> and 2p<sup>1</sup> to 2p<sup>6</sup>.
93. The second period contains 8 elements Li, Be, B, C, N, O, F and Ne in the order given.
94. The 2nd period consists two s-block elements (Li, Be) and six p-block elements (B to Ne).
95. Third period starts with third main shell (M).
96. This shell (M) has 3 sub shells, namely, 3s, 3p and 3d, but while electrons are being filled into the shell '3d' gets electrons only after '4s' is filled.
97. The 3<sup>rd</sup> period contains again 8 elements, which includes two s-block elements (Na, Mg) and six p-block elements (Al to Ar).

98. Fourth main shell is 'N'. This shell (N) has four sub-shells namely 4s, 4p, 4d and 4f, but while electrons are being filled into the shell, electrons enter the atoms in the order 4s, 3d and 4p.
100. Fourth period contains 18 elements which includes two s-block (K, Ca), 10 elements from d-block (Sc to Zn) and six elements from p-block (31Ga to 36 Kr).
101. There are altogether eighteen elements in the fourth period.
102. On the same lines, we can explain why there are 18 elements in the fifth period (37Rb to 54Xe).
103. There are thirty two elements in the Sixth period from 55Cs to 86 Rn which includes 2 elements from s-block (6s) and 14 elements from f-block (4f).
104. In Sixth period, 10 elements from d-block (5d) and 6 elements from p-block (6p).
105. '4f' elements are called Lanthanoids or lanthanides.
106. 7th period is incomplete and contains 2 elements from s-block (7s) and 14 elements from f-block (5f), 10 elements from d-block (6d) and some elements from p-block (7p).
107. The 5f elements are called Actinides or as Actinides. They are from 90Th to 103Lr .
108. The f-block elements known as lanthanides and actinides are shown separately at the bottom of the periodic table.
109. 'Ide' means 'heir' and it is used generally for a change like Cl to Cl<sup>-</sup>. 'Cl' is chlorine atom and Cl<sup>-</sup> is chloride ion. 'Oid' means 'the same'.
110. The elements with three or less electrons in the outer shell are considered to be metals and those with five or more electrons in the outer shell are considered to be non metals.
111. 'd' block elements (3rd group to 12th group) are metals and they are also known as transition metals and the metallic character of d-block elements decreases gradually from left to right in periodic table.
112. Lanthanides and actinides actually belong to 3<sup>rd</sup> group (III B) which is within the transition elements: hence they are called the inner transition elements.
113. Metalloids or semi-metals are elements which have properties that are intermediate between the properties of metals and non metals.
114. Metalloids or semi-metals possess properties like metals but brittle like non metals. They are generally semi conductors. 9(Eg: B, Si, Ge.)
115. All elements in s-block are metals, whereas in p-block (except 18<sup>th</sup> group) there are metals, non metals and metalloids.
116. The elements on staircase (or) very near to it like B, Si, As, Ge etc., are metalloids.
117. The modern periodic table is organized on the basis of the electronic configuration of the atoms of elements.
118. Now a days the valence of an element is generally taken as the number of valence shell (outer most shell) electrons in its atom.
119. Oxidation number concept almost is the latest substitute to the valence concept in the modern literatura.

120. Atomic radius of an element may be defined as the distance from the centre of the nucleus of the atom to its outermost shell.
121. Atomic radius of an element is not possible to measure in its isolated state.
122. More than 75 percent of the elements are metals and atomic radii of metals are called metallic radii. Another way of estimating the size of an atom is to measure the distance between the two atoms incovalent molecules.
123. Atomic radius is measured in 'pm' (pico meter) units. (1 pm = 10<sup>-12</sup>m)
124. Atomic radii increase from top to bottom in a group (column) of the periodic table.
125. As we go down in a group, the atomic number of the element increases.
126. The atomic number increases the distance between the nucleus and the outer shell of the atom increases.
127. As we go down the group in spite of increase in nuclear charge.
128. Atomic radii of elements decrease across a period from left to right.
129. As we go to right, electrons enter into the same main shell or even inner shell in case of 'd' block and 'f' block elements.
130. The nuclear charge increases from left to right in a period. Because of the increase in the atomic number of elements in period.
131. In a period the nuclear attraction on the outer shell electrons increases. As a result the size of the atom decreases.
132. In general the positive ions are called cation and negative charged ions are called anions.
133. The energy required removing an electron from the outer most orbits or shell of a neutral gaseous atom is called ionization energy.
134. The energy required removing the first electron from the outer most orbits or shell of a neutral gaseous atom of the element is called its first ionization energy.
135. The energy required to remove an electron from uni- positive ion of the element is called the 2<sup>nd</sup> ionization energy of that element and so on.
136.  $M_{(g)} + IE_1 \rightarrow M^+_{(g)} + e^-$  (IE<sub>1</sub> = first ionization energy)
137.  $M^+_{(g)} + IE_2 \rightarrow M^{+2}_{(g)} + e^-$  (IE<sub>2</sub> = second ionization energy)
138. If the nuclear charge increases then ionization energy is increases.
139. More the shells with electrons between the nucleus and the valence shell, they act as screens and decrease nuclear attraction over valence electron. This is called the screening effect.
140. If more the screening effect, less is the ionization energy.
141. If more the atomic radius, less is the ionization energy.
142. Ionization energy of 'F' is greater than that of 'I' and the ionization energy of 'Na' is more than that of 'Cs'.
143. Ionization energy decreases as we go down in a group and generally increases from left to right in a period.

144. Ionization energy is expressed in  $\text{kJ mol}^{-1}$
145. Ionization energy is also called the ionization potential but when we use the term the ionization potential, it is better to write the unit ev.
146. The electron affinity of an element is defined as the energy liberated when an electron is added to its neutral gaseous atom.
147. Electron affinity of an element is also called electron gain enthalpy of that element.
148.  $M_{(g)} + e^- \rightarrow M^-_{(g)} + EA$  (**EA = Electron affinity**).
149. The energy liberated when an electron is added to a uni-negative ion of the element is called the 2<sup>nd</sup> electron affinity of that element.
150. Electron affinity values of halogens are (in  $\text{kJ mol}^{-1}$ ); F(-328); Cl(-349); Br (-325); I(-295).
151. Similarly for group 16 elements, the electron gain enthalpies are O(-141); S(-200); Ge(-195) and Te(-190)  $\text{kJ mol}^{-1}$ .
152. Electron gain enthalpy values decrease as we go down in a group, but increase along a period from left to right.
153. Metals have very low electron gain enthalpy values and alkaline earth metals have even positive values.
154. The calculated electron gain enthalpy values for alkaline earth metals and noble gases are positive.
155. The second period element for example 'F' has less electron gain enthalpy than the third period element of the same group for example 'Cl'.
156. The ionization energy and the electron gain enthalpy are properties of isolated atoms of elements.
157. The electro negativity of an element is defined as the relative tendency of its atom to attract electrons towards it when it is bonded to the atom of another element.
158. Milliken proposed that the electro negativity of an element is the average value of its ionization energy and electron affinity.
159. Electro negativity =  $\frac{\text{ionization energy} + \text{electron affinity}}{2}$
160. Milliken assumed that the electro negativity of hydrogen is 2.20 and calculated the values of other elements with respect to hydrogen.
161. Electro negativity values of elements decrease as we go down in a group and increase along a period from left to right.
162. The most electronegative element is 'F' and the least electronegative stable element is 'Cs'.
163. Metals generally show less electronegative character.
164. Metals are electropositive elements.
165. Non metals are generally more electronegative due to their smaller atomic radii.
166. We know that Na and Mg are metals, Al and Si are semi metals(metalloids), P, S and Cl are non metals.

167. We find metals on left side and non metals on right side of the periodic table.
168. The metallic character decreases while non metallic character increases as we move along a period (from left to right).
169. Here also we know that carbon is nonmetal. Si and Ge are metalloids. Sn and Pb are metals.
170. We find nonmetals particularly at the right hand side top and metals at the left and right hand side bottom of the periodic table.
171. Metallic character increases while non metallic character decreases in a group as we move from top to bottom.
172. Elements are classified on the basis of similarities in their Properties.
173. Dobereiner grouped the elements into Triads and Newlands gave the law of Octaves.
174. Mendeleeff's Periodic law: The physical and chemical Properties of the elements are the periodic functions of their Atomic Masses.
175. Moseley's Periodic law: The physical and chemical properties of the elements are the periodic functions of their Atomic numbers.
176. Modern Periodic Law: The Physical and chemical Properties of the elements are the periodic functions of their Electronic Configurations.
177. Anomalies in arrangement of elements based on increasing atomic mass could be removed when the elements were arranged in order of increasing atomic number, a fundamental property of the element discovered by Moseley.
178. Elements in the Modern Periodic table are arranged in 18 groups and 7 periods.
179. Elements are classified into s, p, d, f blocks, depending upon to which sub shell the differentiating electron enters in the atom of the given element.
160. All the d- block elements (except Zn group) are known as transition elements and all the f-block elements (both Lanthanides, Actinides) are known as inner transition elements.
161. Periodic properties of elements and their trends in groups and in periods.
162. In a group from top to bottom the metallic nature is increases and in a period from left to right side decreases.
163. In a group from top to bottom the non- metallic nature is decreases and in a period from left to right side increases.

## 10. Chemical Bonding

1. Oxygen, nitrogen and Hydrogen are the examples of diatomic molecules.
2. A chemical bond is an attractive force between two atoms in a molecule.
3. By the late 19<sup>th</sup> century and early twentieth century, scientists knew about three types of forces. They are gravitational, magnetic and electrostatic.
4. It was believed that electrostatic forces were the cause of attraction between atoms in a molecule.
5. When two atoms come sufficiently close together, the electrons of each atom experience the attractive force of the nucleus of the other atom.
6. The strength of attraction or repulsion will decide bondformation.
7. If attraction is more than the repulsion then atoms combine.
8. If repulsion is more than attraction then the atoms do not combine.
9. The nucleus and the electrons in the inner shell remain unaffected when atoms come close together.
10. In the bond formation the electrons in the outermost shell (valence shell) of atoms get affected.
11. Humphry Davy (1778-1819), a professor of chemistry at the Royal Institution in London, constructed a battery of over 250 metallic plates.
12. In 1807, using electricity from this battery, Humphry Davy was able to extract highly reactive metals like potassium and sodium by electrolysis of fused salts.
13. Humphry Davy seen that the metal part of the compound migrated towards the negative electrode and the non-metal part towards the positive electrode.
14. It was proposed that metals are responsible for positively charged particles and non-metals are responsible for negatively charged particles.
15. The oppositely charged particles are held together by electrostatic forces in a compound.
16. Electrons in valence shell (valence electrons) are responsible for the formation of bonds between atoms.
17. Noble gases are more stable. Because they have octant configuration.
18. The valence electronic configuration of Inert gases (or noble gases or "O" group elements or 18<sup>th</sup> group elements) is  $ns^2 np^6$  except helium (1s<sup>2</sup>)
19. All the noble gases have eight electrons in the outermost shell, except Helium (He).
20. The valence electron in the atom of an element is depicted in a short form by Lewis symbol electron dot structure.
21. The number of valence electrons in Group 1 has one outer electron, group 2 has two, and group 13 has three and so on.
22. It was found that the elements which participate in chemical reactions try to get octet or  $ns^2 np^6$  configuration similar to that of noble gas elements.

23. Electronic theory of valence was given by Lewis and Kosselin 1916.
24. Lewis and Kossel provided logical explanation of valence on the basis of the lack of chemical activity of noble gases which led to the proposal of octet rule.
25. Group IA elements (Li to Cs) try to lose one valence shell electron from their atoms to form corresponding uni-positive ions which get octet in their outer shells.
26. Group IIA elements (Mg to Ba) try to lose two valence electrons from their atoms during chemical changes and form di-positive ions with the octet in the outer shells.
27. Group IIIA elements try to lose three valence electrons from their atoms and form corresponding tri positive ions with octets in the outer shells.
28. Group VIA elements try to gain two electrons into the valence shells of their atoms during the chemical changes and form corresponding di negative anions which get octet in their outer shells.
29. Group VIIA elements try to gain one electron into the valence shells of their atoms during the chemical changes and form corresponding uni- anions which get octet in their outer shells.
30. Atoms combine to form a molecule.
31. Noble gases with eight electrons in the valence shell in their atoms are highly stable and rarely participate in chemical changes.
32. Eight electrons in the outermost shell definitely give stability to the ion or atom.
33. The valence shell fill with eight electrons is called octant configuration.
34. The atoms of elements tend to undergo chemical changes that help to leave their atoms with eight outer-shell electrons.
35. Chemically active elements do not have an octet of electrons in the valence shell of their atoms.
36. The force of attraction between any two atoms or a group of atoms that results a stable entity is called a 'chemical bond'.
37. There are many types of chemical bonds, but here we discuss only about ionic bond and covalent bond.
38. Transfer of electrons from one atom to another atom leads to ionic bond.
39. Sometimes based on the forces being electrostatic, the bond is also called the electrostatic bond.
40. As the valence concept has been explained in terms of electrons, it is also called the electrovalent bond.
41. The electrostatic attractive force that keeps cation and anion together to form a new electrically neutral compound is called 'ionic bond'.
42. Sodium chloride is formed from the elements sodium and chlorine.
43. When sodium (Na) atom loses one electron to get octet electron configuration it forms a cation (Na<sup>+</sup>) and gets electron configuration that of Neon (Ne) atom.
44. Chlorine has shortage of one electron to get octet in its valence shell.
45. Chlorine gains the electron from Na atom to form anion and gets electron configuration as that of argon (Ar).

46. Transfer of electrons between 'Na' and 'Cl' atoms, results in the formation of 'Na<sup>+</sup>' and 'Cl<sup>-</sup>' ions.
47. Magnesium chloride is formed from the elements magnesium and chlorine.
48. Mg<sup>2+</sup> gets 'Ne' configuration and each Cl<sup>-</sup> gets 'Ar' configuration.
49. One 'Mg' atom transfers two electrons one each to two 'Cl' atoms and so formed Mg<sup>2+</sup> and 2Cl<sup>-</sup> attract to form MgCl<sub>2</sub>.
50.  $2\text{Na}_{(g)} \rightarrow 2\text{Na}^+_{(g)} + 2e^-$
51.  $\text{O}_{(g)} + 2e^- \rightarrow \text{O}^{2-}_{(g)}$
52.  $2\text{Na}^+_{(g)} + \text{O}^{2-}_{(g)} \rightarrow \text{Na}_2\text{O}_{(s)}$
53. Chemical formula of di sodium monoxide is Na<sub>2</sub>O.
54. Each Na<sup>+</sup> gets 'Ne' configuration and O<sub>2</sub><sup>-</sup> gets 'Ne' configuration. These ions (2Na<sup>+</sup> and O<sub>2</sub><sup>-</sup>) attract to form Na<sub>2</sub>O.
55.  $13\text{Al}_{(g)} \rightarrow \text{Al}^{3+}_{(g)} + 3e^-$
56.  $3\text{Cl}_{(g)} + 3e^- \rightarrow 3\text{Cl}^-_{(g)}$
57. Each aluminium atom loses three electrons and three chlorine atoms gain them, one electron each in the formation of Aluminium Chloride.
58. The compound AlCl<sub>3</sub> is formed from its component ions by the electrostatic forces of attractions.
59.  $\text{Al}^{3+}_{(g)} + 3\text{Cl}^-_{(g)} \rightarrow \text{AlCl}_3_{(s)}$
60. Chemical formula of aluminium chloride is AlCl<sub>3</sub>.
61.  $3\text{Al}_{(g)} \rightarrow \text{Al}^{3+}_{(g)} + 3e^-$
62.  $3\text{Cl}_{(g)} + 3e^- \rightarrow 3\text{Cl}^-_{(g)}$
63. The compound AlCl<sub>3</sub> is formed from its component ions by the electrostatic forces of attractions.
64.  $\text{Al}^{3+}_{(g)} + 3\text{Cl}^-_{(g)} \rightarrow \text{AlCl}_3_{(s)}$
65. The electrostatic forces are non directional.
66. Ionic compounds in the crystalline state consist of orderly arranged cations and anions held together by electrostatic forces of attractions in three dimensions.
67. Generally elements of metals have tendency of losing electron to attain the octet in their valence shell. This property is called as the metallic character or electro positivity.
68. Elements with more electropositive character form cations.
69. Non metals like oxygen (<sub>8</sub>O), fluorine (<sub>9</sub>F) and chlorine (<sub>17</sub>Cl) acquire electron configuration of elements of inert gases by gaining electrons this property is called the non-metallic character or electro negativity of the element.
70. Elements with more electronegative character form anions.
71. Ionic bond is formed between atoms of elements with electro negativity difference equal to or greater than 1.9.
72. In ionic bond formation, you have noticed that atoms either lose electrons or gain electrons to attain octet in valence shell.



73. The tendency of losing electrons to form cations (or) gaining electron to form anions depends on Atomic size, Ionization potential, Electron affinity and Electro negativity.
74. The atoms of elements with low ionization energy, low electron affinity high atomic size and low electro negativity form cations.
75. The atoms of elements with high ionization potential, high electron affinity, small atomic size and highelectro negativity form anions.
76. G.N. Lewis (1916) proposed that atoms of some elements could achieve an octet in their valence shells without transfer of electrons between them.
77. The electrons shared between two atoms belong to both the atoms and the sharing of electrons between them leads to the formation of a chemical bond known as covalent bond.
78. The dot around fluorine atom shows the valence electrons of respective atoms.
79. The chemical bond formed between two atoms by mutual sharing of a pair of valence shell electrons so that both of them can attain octet or duplet in their valence shell is called the covalent bond.
80. Oxygen atom has six electrons in its valence shell. Oxygen atom requires two more electrons to get octet in its valence shell.
81. Oxygen atoms come close and each oxygen atom contributes **two electrons** for bonding.
82. We can say that a **double bond** is formed between two oxygen atoms in O<sub>2</sub> molecule.
83. Double bond is formed in **O<sub>2</sub> molecule**.
84. The valence electronic configuration of 'N' atom is 2, 5 and to have octet in the valence shell it requires three more electrons.
85. When two nitrogen atoms approach each other, each atom contributes 3 electrons for bonding.
86. There are six electrons shared between two nitrogen atoms in the form of three pairs.
87. Triple bond is formed in N<sub>2</sub> molecule.
88. Chemical formula of Methane is CH<sub>4</sub>
89. In CH<sub>4</sub> molecule, there are four C – H covalent bonds are formed.
90. In ammonia molecule, three N – H single covalent bonds are present.
91. Electron configuration of <sub>7</sub>N is 2, 5 and <sub>1</sub>H is 1.
92. In ammonia, Nitrogen atom contributes three electrons for bonding.
93. In water molecule (H<sub>2</sub>O), there are two O – H single covalent bonds.
94. Electron configuration of <sub>8</sub>O is 2, 6 and <sub>1</sub>H is 1.
95. The total number of covalent bonds that an atom of an element forms is called its 'covalence'.
96. Bond length or bond distance is the equilibrium distance between the nuclei of two atoms which form a covalent bond.
97. Bond length or bond distance is generally given in nm (nanometer) or Å (Angstrom unit).
98. Bond energy or Bond dissociation energy is the energy needed to break a covalent bond between two atoms of a diatomic covalent compound in its gaseous state.

99. An angstrom ( $\text{\AA}$ ) is a unit of length equal to  $10^{-10}$  meter, or 0.1 nanometer, or 100 picometre.
100. 1 nanometer =  $10^{-9}$  meter (Or)  $1\text{\AA} = 10^{-8}$  cm.
101. Valence – shell – electron – pair repulsion – theory (VSEPR) was proposed by Sedgwick and Powell (1940).
102. Valence – shell – electron – pair repulsion – theory (VSEPR) was further improved by Gillespie and Nyholm (1957).
103. If two bond pairs are present in two covalent bonds around the nucleus of the central atom without any lone pairs in the valence shell, they must be separated by  $180^\circ$  to have minimum repulsion between them.
104. The valence shell separated by the angle  $180^\circ$ . Thus, the molecule would be linear.
105. If three bond pairs are there in three covalent bonds around the nucleus of the central atom, without any lone pairs they get separated by  $120^\circ$  along three corners of a triangle.
106. The valence shell separated by the angle  $120^\circ$ . Therefore, the shape of the molecule is trigonal-planar.
107. If there are four bond pairs in the valence shell of the central atom, the four bond pairs will orient along the four corners of a tetrahedron and the bond angle expected is  $109^\circ 28'$
108. The shape of the  $\text{NH}_3$  molecule is triangular pyramidal with N at the apex of the pyramid.
109. Water molecules have V-Shape.
110. To describe covalent bonding, a quantum mechanical model called valence bond theory has been suggested by Linus Pauling (1954).
111. Carbon dioxide has linear shape.
112. The greater the overlapping of the orbital's that form the bond, the stronger will be the bond.
113. In end-on-end overlap Sigma bond ( $\sigma$ ) is formed.
114. In side-on overlap pi ( $\pi$ ) bond is formed.
115. Sigma bond is stronger than pi-bond
116. In chlorine molecule one sigma bond is formed.
117. In nitrogen molecule one sigma and two pi-bonds are formed.
118. In oxygen molecule one sigma-bond and one pi-bond is formed.
119. Hybridization of atomic orbital's' was proposed by Linus Pauling (1931).
120. Hybridization is a phenomenon of intermixing of atomic orbital's of almost equal energy which are present in the outer shells of the atom and their reshuffling or redistribution into the same number of orbital's but with equal properties like energy and shape.
121. Borontrifluoride ( $\text{BF}_3$ ) has planar triangular shape.
122. Ammonia ( $\text{NH}_3$ ) has pyramidal shape.
123. Shape of water ( $\text{H}_2\text{O}$ ) molecule is v-shape.
124.  $\text{sp}$  hybridization is formed in Beryllium chloride.

125.  $sp^2$  hybridization is formed in Boron trifluoride.
126.  $sp^3$  hybridisation is formed in ammonia and water molecules.
127. Ionic compounds like NaCl are solids at room temperature.
128. Location of elements in the periodic table helps in predicting the type of bonding that will take place between the elements.
129. Ions are positively or negatively charged particles formed by the loss or gain of electrons.
130. The force between any two atoms or a group of atoms that results in the formation of a stable entity is called chemical bond.
131. The outer most shell is called valence shell and electrons in this are called valence electrons.
132. The gases belongs to 'O' group are called noble gases because they reluctant to combine other atoms.
133. Except helium all other noble gases have an octet of electron configuration in their valence shell.
134. The reason why atoms bond can be explained on the basis of the octet rule.
135. Chemically active elements have an incomplete octet in their valence shell of the atoms.
136. The number of valence electrons available in the atoms decides the type of bond.
137. Elements which have tendency to gain electrons for attaining octet in their valence shell called electro negative character elements. They form anions.
138. In the formation of ionic bond the atoms of electro positive elements lose their valence electrons to atoms of electro negative elements so that both of them can attain octet in their valence shell.
139. The electrostatic attractive force that keeps cation and anion together to form a new electrically neutral entity is called an ionic bond.
140. Ionic compounds are often crystalline solids with high melting points.
141. A chemical bond that formed by sharing of valence-shell electrons between the atoms so that both of them can attain octet or duplet in their valence shell is called covalent bond.
142. A single covalent bond is formed when two atoms share a pair of electrons
143. Each shared pair of electron is equivalent to a covalent bond.
144. Electrons are not always shared equally between the atoms in a covalent bond. This leads to bond polarity.
145. Bond lengths and bond energies in covalent compounds.
146. The H – H bond length is  $0.74\text{\AA}$  and Bond (dissociation) energy is  $436\text{ KJmol}^{-1}$
147. The F – F bond length is  $1.44\text{\AA}$  and Bond (dissociation) energy is  $159\text{ KJmol}^{-1}$
148. The C – C bond length is  $1.95\text{\AA}$  and Bond (dissociation) energy is  $243\text{ KJmol}^{-1}$
149. The Br – Br bond length is  $2.28\text{\AA}$  and Bond (dissociation) energy is  $193\text{ KJmol}^{-1}$

150. The I – I bond length is 2.68Å and Bond (dissociation) energy is 151 KJmol<sup>-1</sup>
151. The H – F bond length is 0.918Å and Bond (dissociation) energy is 570 KJmol<sup>-1</sup>
152. The H – C bond length is 1.27Å and Bond (dissociation) energy is 432 KJmol<sup>-1</sup>
153. The H – Br bond length is 1.42Å and Bond (dissociation) energy is 366 KJmol<sup>-1</sup>
154. The H – I bond length is 1.61Å and Bond (dissociation) energy is 298 KJmol<sup>-1</sup>
155. The H – O (of H<sub>2</sub>O) bond length is 0.96Å and Bond (dissociation) energy is 460 KJmol<sup>-1</sup>
156. The H – N (of NH<sub>3</sub>) bond length is 1.01Å and Bond (dissociation) energy is 390 KJmol<sup>-1</sup>
157. The H – C (of CH<sub>4</sub>) bond length is 1.10Å and Bond (dissociation) energy is 410 KJmol<sup>-1</sup>

## 11. Electric Current

1. AC stands for Alternative current.
2. DC stands for Direct current.
3. Lightning is an electric discharge between two clouds or between cloud and earth.
4. The electric discharge through air appears to us as an electric spark or lightning.
5. Lightning is a live example which provides evidence for the motion of charge in the atmosphere.
6. In a battery the chemical energy is converted into electrical energy.
7. The nature of the substance plays an important role in the transfer of energy from battery to bulb.
8. The material which transfers energy from battery (source) to the bulb is called a conductor.
9. The material which cannot transfer energy from battery (source) to the bulb is called a non-conductor.
10. The Conductors contain a large number of free electrons was proposed by Drude and Lorentz scientists of the 19<sup>th</sup> century.
11. Metals contain a large number of free electrons while the positive ions are fixed in their locations.
12. The arrangement of the positive ions is called lattice.
13. The net charge moving along a conductor through any cross section is zero when the conductor is in open circuit.
14. The electrons are responsible for this transfer of energy.
15. If the electrons are responsible for transfer of energy from battery to bulb, they must have an ordered motion.
16. When the electrons are in ordered motion, there will be a net charge crossing through any cross section of the conductor.
17. The ordered motion of electrons is called electric current.
18. We can say that electric current is ordered motion of charges.
19. Electric current is defined as the amount of charge crossing any cross section of the conductor in one second.
20. The amount of charge crossing through that cross section in one second is  $\frac{Q}{t}$ .
21. Electric current =  $\frac{\text{electric charge}}{\text{time interval}}$  ( $i = Q/t$ ).
22. The SI unit of electric current is ampere denoted by A.
23. 1 Ampere = 1 Coloumb/1 Second ( $1 A = 1 C/s$ ).
24. When the conductor is not connected to the circuit through a battery, the electrons inside the conductor are in random motion.
25. When the conductor is connected to a battery, the electrons move in a specified direction.
26. The free electrons in the conductor are accelerated by the electric field and move in a direction opposite to the direction of the field.

27. When electrons are in motion under the influence of the field, they collide with lattice ions, lose energy and may even come to a halt at every collision.
28. The electrons in the conductor move with a constant average speed. We call this speed as drift speed or drift velocity.
29. The number of charges present in the conductor in a unit volume is called charge density.
30. The charge carriers in a conductor are electrons.
31. The magnitude of electric charge 'e' is  $1.602 \times 10^{-19} \text{C}$ .
32. The drift speed of electron in a copper wire carrying a current of 1A and cross sectional area,  $A = 10^{-6} \text{m}^2$ .
33. The electron density of copper that was found experimentally is  $n = 8.5 \times 10^{28} \text{m}^{-3}$ .
34. The electric field makes all the electrons to move in a specified direction simultaneously.
35. The work done by the electric force on a free charge q is given by,  $W = Fe\ell$
36. Work done by the electric force on unit charge =  $W/q = Fe \ell/q$
37. This potential difference is also called voltage.
38. The SI unit of potential difference is "Volt" and it is denoted by V.
39. 1 Volt = 1 Joule/1 Coulomb (1V = 1J/C).
40. When electric current is allowed to pass through fluids, the positive ions (cations) and negative ions (anions) move in opposite directions.
41. The direction of the motion of positive charges in an electrolyte is always in the direction of the electric field while negative charges move in a direction opposite to that of positive charges.
42. The conduction in fluids there exists motion of both positive and negative charges.
43. As negative charges always move in a direction opposite to the electric field we consider that electrons move from low potential to high potential.
44. A battery consists of two metal plates called electrodes and a chemical (electrolyte).
45. The electrolyte (chemical) between the two metal plates consists of positive and negative ions which move in opposite directions.
46. The electrolyte exerts a certain force on these ions and makes them move in a specified direction.
47. Depending upon the nature of the chemical, positive ions move towards one of the plates and accumulate on that plate.
48. The direction of this force is opposite to the direction of chemical force  $F_c$  and the magnitude of this force depends on the amount of charge accumulated on the plates.
49. This potential difference sets up an electric field throughout the conductor.
50. The direction of electric field is from positive terminal to negative terminal in the conductor.
51. The conductor contains large number of electrons.
52. The work done on negative charge 'q' by the chemical force,  $W = F_c d$ , where 'd' is the distance between the terminals.

53. The work done by the chemical force to move 1 Columb charge from positive terminal to negative terminal is given by,  $W/q = Fcd/q$ .
54.  $W/q$  is the work done by the chemical force on unit negative charge to move it from positive terminal to negative terminal. This is called emf ( $\epsilon$ ).
55. Generally, emf is defined as the work done by the chemical force to move unit positive charge from negative terminal to positive terminal of the battery.
56. Generally a volt meter is used to measure potential difference or emf across an electric device like battery.
57. Current is measured in Amperes.
58. The device used to measure the current in the circuit is Ammeter.
59. Ohm's law was introduced by German Physicist, George Simon Ohm.
60. The SI unit of resistance is ohm. The symbol of ohm is  $\Omega$ .
61.  $1 \text{ Ohm} = 1 \text{ Volt}/1 \text{ Ampere}$  ( $1 \Omega = 1V/A$ )
62. The conductors which obey the Ohm's law are called ohmic conductors.
63. All the metals are examples of Ohmic conductors.
64. The conductors which do not obey the ohms law are called non-ohmic conductors.
65. LEDs are the examples of non-ohmic materials.
66. Ohm's law is valid for metal conductors provided the temperature and other physical conditions remain constant.
67. The resistance of the material changes with temperature.
68. Ohm's law is not applicable to gaseous conductors.
69. Ohm's law is not applicable semiconductors such as germanium and silicon.
70. When a conductor is connected to a battery the free electrons start moving with a drift speed in a specified direction.
71. During the motion of the electrons collide with positive ions (fixed) of the lattice and come to halt.
72. The electrons collide with positive ions (fixed) of the lattice. This means that they lose mechanical energy in the form of heat.
73. The resistance of a conductor is defined as the obstruction to the motion of the electrons in a conductor.
74. The material which offers resistance to the motion of electrons is called resistor.
75. The resistance of the human body generally varies from  $100 \Omega$  (if body is wet with salt water) to  $5,00,000 \Omega$  (if the skin is very dry).
76. Our body resistance be  $1,00,000 \Omega$ .
77. The current flowing through your body is given by  $I = \frac{24}{100000} = 0.00024A$ .
78. The current passing through our body when we touch a live wire of 240V is given by  $I = \frac{240}{100000} = 0.0024A$ .
79. The disturbance inside the body is felt as electric shock.

80. If the current passing through the body reaches 0.07A, it effects the functioning of the heart and if this much current passes through the heart for more than one second it could be fatal.
81. When current flows through human body, it chooses the path which offers low resistance.
82. The electric shock is a combined effect of potential difference, electric current and resistance of the human body.
83. When the bird stands on a high voltage wire, there is no potential difference between the legs of the bird because it stands on a single wire.
84. When the bird stands on a high voltage wire, no current passes through the bird. Hence, it doesn't feel any electric shock.
85. A multi meter is an electronic measuring instrument that combines several measurement functions in one unit.
86. Digital multi meter displays the measured value in numerals.
87. If the multi meter reads 1, or displays OL, means it's overloaded.
88. If the multi meter reads 0.00 or nearly 0, then you need to lower the mode to 2K  $\Omega$  or 200 $\Omega$ .
89. The filament in a bulb acts as a resistance.
90. The bulb filament made up of tungsten.
91. The value of resistance of a conductor depends on temperature for constant potential difference between the ends of the conductor.
92. The resistance of a conductor depends on the material of the conductor.
93. The resistance (R) of a conductor is directly proportional to its length ( $l$ ) for a constant potential difference. (i.e.  $R \propto l$ ).
94. The resistance of a conductor is inversely proportional to its cross section area. (i.e.  $R \propto 1/A$ ).
95. In the equation  $R = \rho \frac{l}{A}$ . Here 'p' is called specific resistance or resistivity.
96. Specific resistance depends on the temperature and nature of the material.
97. The resistance of the conductor depends on nature of material, temperature and geometrical factors like length and cross section area of the conductor.
98. The SI unit of resistivity is  $\Omega - m$ .
99. The unit of resistance is Ohm ( $\Omega$ ).
100. The reciprocal of resistivity is called conductivity ( $\sigma$ ).
101. The values of resistivity of material determine their conductivity.
102. Metals with low resistivity behave as good conductors.
103. The filament of an electric bulb is usually made of tungsten, because of its higher resistivity values and melting point ( $3422^{\circ}C$ ).
104. The values of resistivity of insulators are very high of the order of  $10^{14}$  to  $10^{16} \Omega - m$ .
105. Alloys like Nichrome (Nickel, chromium and iron) and Manganese (86% copper, 12% manganese, 2% nickel) have 30-100 times larger values of resistivity than those of metals.



106. The resistivity of materials such as silicon and germanium are  $10^5$  to  $10^{10}$  times more than that of metals, but  $10^{15}$  to  $10^{16}$  times less than that of insulators.
107. ICs are used in all sorts of electronic devices, including computer, TV, mobile phones etc.
108. Silicon and Germanium are the examples of semiconductors.
109. A closed path created by the connecting wires through a battery along which electrons can flow is called a circuit.
110. When the components of the circuit are connected in series, there will be a single path for flow of electrons between the terminals of the battery, generator or wall socket.
111. When these components are connected in parallel, they form branches and each branch provides a separate path for the flow of electrons.
112. The equivalent resistance of a parallel combination is less than the resistance of each of the resistors.
113. The resistors are connected in series combination the resultant resistance is equal to sum of individual resistances. ( $R=R_1+R_2+R_3$ ).
114. The resistors are connected in parallel combination the resultant resistance is equal to sum of reciprocals of individual resistances. ( $R = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$  or  $R = \frac{R_1 R_2 R_3}{R_1+R_2+R_3}$ ).
115. Alloys like Nichrome is made from Nickel, chromium and iron.
116. Alloys like Manganese is made from 86% copper, 12% manganese and 2% nickel.
117. The resistivity of materials such as silicon and germanium are 105 to 1010 times more than that of metals, but 1015 to 1016 times less than that of insulators.
118. The electric appliances that we use in our daily life are heater, cooker, fan, and refrigerator etc.
119. The work done by electric field in time 't' is given by W = QV.
120. 1 KW = 1000 W = 1000 J/S.
121. The unit of electric power consumption is equal to 1 KWH (one Kilo Watt Hour).
122. 1 KWH = (1000 J/S) (60 x 60 S) = 3600 x 1000 J = 3.6 x 10<sup>6</sup> J
123. Electricity enters our homes through two wires called lines.
124. The line wires have low resistance and the potential difference between the wires is usually about 240V.
125. The electric appliances at our home are in parallel connection.
126. The potential drop across each house hold device is 240V.
127. Total current drawn from the mains is equal to the sum of the currents passing through each device is called Junction law.
128. The minimum and maximum limit of current that can be drawn from the mains is 5 – 20A.
129. The maximum current that we can draw from the mains is 20A.
130. When the current drawn from the mains is more than 20A. This is called over loading.

131. All the electric devices are saved from damage that could be caused by overload. We can save the house holding wiring and devices by using fuses.
132. Electric potential difference between points in an electric circuit is the work done to move a unit positive charge from one point to another.
133. Electric current is expressed as the amount of charge flowing through a particular cross section area in unit time.
134. A multi-meter is an electronic measuring instrument that combines several measuring functions (electric potential difference, electric current and electric resistance) in one unit.
135. Ohms law: The current through a conductor element is proportional to the potential difference applied between its ends, provided the temperature remains constant. Mathematically  $V=IR$ .
136. Ohm's law is valid for metal conductors at constant temperature. It is not applicable for gaseous conductors and semiconductors.
137. Resistance is the opposition that a substance offers to the motion of electrons.
138. Resistance of a wire depends on the material of the wire, its length and its area of cross section
139. The resistivity of a material is the resistance per unit length of a unit cross section of the material.
140. Two or more resistors are said to be connected in series if the same current flows through them.
141. Two or more resistors are said to be connected in parallel if the same potential difference exist across them.
142. The junction law: At any junction point in a circuit where the current can divide, the sum of the currents into the junction must equal the sum of the currents leaving the junction.
143. The loop law: The algebraic sum of the increases and decreases in potential difference across various components of a closed circuit loop must be zero.
144. Electric power is the product of potential difference and the current. SI unit of power is watt (W).
145. Electrical energy is the product of power and time. Units of electrical energy W-s and KWH.
146. Metals contain a large number of free electrons while the positive ions are fixed in their locations.
147. The Resistivity of Silver is  $1.59 \times 10^{-8} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
148. The Resistivity of Copper is  $1.68 \times 10^{-8} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
149. The Resistivity of Gold is  $2.44 \times 10^{-8} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
150. The Resistivity of Aluminium is  $2.82 \times 10^{-8} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
151. The Resistivity of Calcium is  $3.36 \times 10^{-8} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
152. The Resistivity of Tungsten is  $5.60 \times 10^{-8} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
153. The Resistivity of Zinc is  $5.90 \times 10^{-8} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
154. The Resistivity of Nickel is  $6.99 \times 10^{-8} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
155. The Resistivity of Iron is  $1.00 \times 10^{-7} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
156. The Resistivity of Lead is  $2.20 \times 10^{-7} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
157. The Resistivity of Nichrome is  $1.10 \times 10^{-6} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
158. The Resistivity of Carbon (Graphite) is  $2.50 \times 10^{-6} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .

159. The Resistivity of Germanium is  $4.60 \times 10^{-1} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
160. The Resistivity of Drinking water is  $2.00 \times 10^{-1} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
161. The Resistivity of Silicon is  $6.40 \times 10^2 \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
162. The Resistivity of Wet wood is  $1.00 \times 10^3 \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
163. The Resistivity of Glass is  $10.0 \times 10^{10} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
164. The Resistivity of Rubber is  $1.00 \times 10^{13} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .
165. The Resistivity of Air is  $1.30 \times 10^{16} \rho(\Omega\text{-m})$  at  $20^\circ\text{C}$ .

## 12. Electromagnetism

1. The unit of magnetic field strength is named Oersted in his honour.
2. Oersted was made a foreign member of the Royal Swedish Academy of Sciences in 1822.
3. We say that the magnetic field is three dimensional i.e., magnetic field surrounds its source such as bar magnet.
4. The magnetic lines are formed around the magnet is technically called "magnetic field lines".
5. The number of lines passing through the plane of area 'A' perpendicular to the field is called magnetic flux. It is denoted by 'Φ'.
6. Magnetic flux represents the number of lines passing through the imagined plane in the field. Flux depends on the orientation of the plane in the field.
7. The S.I unit of magnetic flux is Weber.
8. The strength of the field is technically called magnetic flux density (B).
9. Magnetic flux density is defined as the magnetic flux passing through unit area taken perpendicular to the field.
10. B is also known as magnetic field induction.
11. The ratio of magnetic flux passing through a plane perpendicular to the field and the area of the plane is called the magnetic flux density.
12. So magnetic flux density = magnetic flux/ area. ( $B = \Phi/A. \Rightarrow \Phi = BA$ )
13. A unit of magnetic flux density is Weber/ (meter)<sup>2</sup>. It is also called Tesla.
14.  $B = \text{magnetic flux /effective area}$ .
15. When the current in the coil is in clock-wise direction, the direction of magnetic field due to the coil points away from you.
16. When you curl your right hand fingers in the direction of current, thumb gives the direction of magnetic field.
17. A solenoid is a long wire wound in a close packed helix.
18. The magnetic field lines set up by solenoid resemble those of a bar magnet indicating that a solenoid behaves like a bar magnet.
19. The direction of the field due to solenoid is determined by using right hand rule.
20. One end of the solenoid behaves like a north pole and other behaves like a south pole.
21. The field lines outside the solenoid are continuous with those inside.
22. Outside the solenoid the direction of the field lines is from north to south while inside the direction is from south to north.
23. The magnetic field lines are closed loops.
24. The current carrying wires produce magnetic field.
25. The electric charges in motion produce magnetic fields.

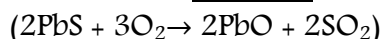
26. The value of magnetic force on the moving charge can be found experimentally and it is given by,  $\underline{F = q v B}$ .
27. Magnetic force on the charge is the product of three quantities charge, speed and magnetic flux density.
28. When charge moves parallel to the magnetic field the value of  $\theta$  becomes zero.
29. The direction of magnetic force is always perpendicular to the direction of both velocity and magnetic field.
30. According to right hand rule "If the fore-finger points towards the direction of velocity of charge or current, middle finger points to the direction of field (B), then thumb gives direction of force.
31. Electric current is charges in motion.
32. To understand the working of an electric motor we need to understand the behaviour of a current carrying coil kept in a uniform magnetic field.
33. Apply right hand rule to get the direction of magnetic force.
34. In electric motors, electrical energy is converted into mechanical energy.
35. When a bar magnet is pushed towards a coil with its north pole facing the coil an induced current is set up in the coil.
36. Whenever there is a continuous change of magnetic flux linked with a closed coil, a current is generated in the coil.
37. The current generated is called induced current and is set up by an induced electromotive force (induced EMF).
38. The phenomenon of getting induced current is called electromagnetic induction.
39. Faraday observed that the changes in the magnetic flux through the coil are responsible for the generation of current in the coil.
40. Faraday observed that the rapid changes in flux through coil generate greater induced current or induced EMF.
41. The induced EMF generated in a closed loop is equal to the rate of change of magnetic flux passing through it.
42. Induced EMF = change in flux/ time ( $\epsilon = \Delta\Phi/\Delta t$ ).
43. Lenz's law states that "the induced current will appear in such a direction that it opposes the changes in the flux in the coil."
44. The tape recorder which we use to listen to songs (or) record voices works on the principle of electromagnetic induction.
45. The tape recorder tape consists of a piece of plastic tape coated with iron oxide.
46. The principle of electromagnetic induction in the case of using ATM card.

47. An induction stove works on the principle of electromagnetic induction.
48. In an AC motor commutator is not necessary.
49. In a DC motor commutator is necessary to reversing the current.
50. In generators, mechanical energy is converted into the electrical energy.
51. Magnetic flux density (B) is defined as the ratio of flux passing through a plane perpendicular to field and the area of the plane.
52. In electric motor, electrical energy is converted into mechanical energy.
53. Faraday's law: The induced EMF generated in a closed loop is equal to the rate of change of magnetic flux passing through it.
54. Lenz's law: the induced current set up in the coil is in such a direction that it opposes the changes in the flux.
55. When a conductor of length ' $l$ ' moves perpendicular to field B with a speed  $v$  then potential difference (voltage) developed between the ends of conductor is  $Bv$ . This EMF is called motional EMF.

## 13. Principles of Metallurgy

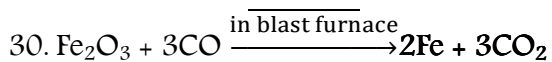
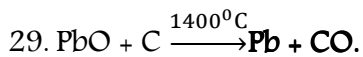
1. The properties of metals like, malleability, ductility, sonority etc.
2. Metals play an important role in our daily life.
3. We use various metals for various purposes like gold and silver as jewelers. Copper, iron, aluminium for making conducting wires and for making utensils etc.
4. We use many house hold articles made up of metals and their alloys at our home.
5. Metallurgy is the process of extraction of metals from their ores.
6. Bronze is an alloy of copper and tin.
7. The earth's crust is the major source of metals.
8. Sea water also contains some soluble salts such as sodium chloride and magnesium chloride etc.
9. Some metals like gold (Au), silver (Ag) and copper (Cu) are available in nature in free state (native) as they are least reactive.
10. The elements or compounds of the metals which occur in nature in the earth crust are called minerals.
11. The minerals from which the metals are extracted without economical loss are called ores.
12. Aluminium is the most common metal in the Earth's crust, occurring in most of minerals.
13. 50 – 70 % of aluminium oxide is extracted from Bauxite.
14. You will notice that the ores of many metals are oxides and sulphides.
15. 16<sup>th</sup> group is called chalcogen family (chalco = ore; genus = produce.)
16. The metals like K, Na, Ca, Mg and Al are more reactive that they are never found in nature in free state.
17. The metals like Zn, Fe, Pb etc., are moderately reactive. They are found in the earth crust mainly as oxides, sulphides and carbonates.
18. Metals like Au, Ag are least reactive and they are found even in free state in nature.
19. Concentration or Dressing means, simply getting rid of as much of the unwanted rocky material as possible from the ore.
20. The impurities like clay are called gangue.
21. Froth floatation method is mainly useful for sulphide ores which have no wetting property whereas the impurities get wetted.
22. If the ore or impurity, one of them is magnetic substance and the other non-magnetic substance they are separated using electromagnets.
23. Extraction of the metal from its ores depends on the reactivity of the metal.
24. Arrangement of the metals in decreasing order of their reactivity is known as activity series.
25. Sulphide ores are converted into oxides by heating them strongly in excess of air. This process is known as roasting.

26. Generally the sulphide ores are roasted to convert them into oxides before reducing them to metal.

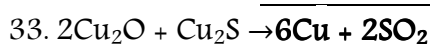
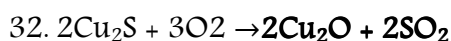


27. The metal oxides are then reduced to the corresponding metal by using suitable reducing agent such as carbon.

28. The oxides are reduced by coke in a closed furnace which gives the metal and carbon monoxide(CO).



31. In the extraction of Cu from its sulphide ore, the ore is subjected partial roasting in air to give its oxide.

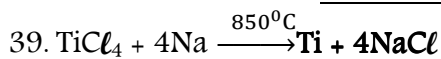
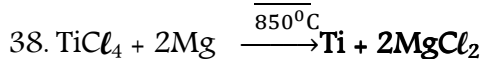


34. Thermite process involves the reaction of metal oxides with aluminium.

35. Sodium, calcium, aluminium etc are highly reactive metals and are used as reducing agents.

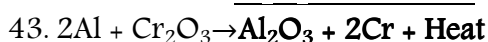
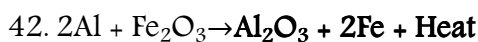
36. The displacement reactions are highly exothermic.

37. The amount of heat evolved is so large that the metals produced are in molten state.



40. Chemical formula of Iron oxide is Fe<sub>2</sub>O<sub>3</sub>.

41. The reaction of Iron oxide (Fe<sub>2</sub>O<sub>3</sub>), with aluminium is used to join railings of railway tracks or cracked machine parts. This reaction is known as the thermite reaction.

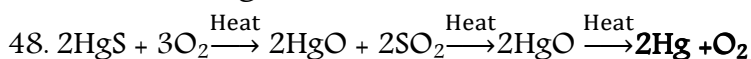


44. Metals at the bottom of the activity series are often found in free state.

45. The chemical formula of cinnabar is HgS.

46. When cinnabar (HgS) which is an ore of mercury.

47. Cinnabar (HgS) is heated in air; it is first converted into HgO and then reduced to mercury on further heating.



49. Ag<sub>2</sub>S is dissolved in say KCN solution to get dicyanoargentate (I) ions.

50. Ag is precipitated by treating with Zn dust powder.

51. The chemical formula of copper iron pyrites is CuFeS<sub>2</sub>, contains some copper sulphide, iron and sulphur.

52. The process of obtaining the pure metal from the impure metal is called refining of the metal.

53. Distillation method is very useful for purification of low boiling metals like zinc and mercury containing high boiling metals as impurities.



54. The extracted metal in the molten state is distilled to obtain the pure metal as distillate.
55. Blister copper is purified by Poling method.
56. In an electrolytic refining method, the impure metal is made to act as anode.
57. The rusting of iron (iron oxide), tarnishing of silver (silver sulphide), development of green coating on copper (copper carbonate) and bronze are some of the examples of corrosion.
58. In metallic corrosion, a metal is oxidized by loss of electrons generally to oxygen and results in the formation of oxides.
59. Corrosion of iron (commonly known as rusting) occurs in presence of water and air.
60. To prevent corrosion of metals by covering the surface with paint or by some chemicals like bisphenol.
61. Alloying is a method of improving the properties of a metal.
62. When iron is mixed with nickel and chromium we get stainless steel which will not rust.
63. Pure gold, known as 24 carat gold, is very soft.
64. Pure gold is not suitable for making jewellery.
65. Pure gold is alloyed with either silver or copper to make it hard.
66. Generally in India 22carat gold is used for making ornaments. It means that 22 parts of pure gold is alloyed with 2 parts of either silver or copper.
67. Smelting is a pyrochemical (pyre = heat) process, in which the ore is mixed with flux and fuel and strongly heated.
68. During smelting the impurities (gangue) in the ore react with flux to form slag which is removed.
69. For hematite ( $\text{Fe}_2\text{O}_3$ ) ore, coke is used as fuel and lime stone ( $\text{CaCO}_3$ ) is used as flux.
70. The smelting is carried out in a specially built furnace known as blast furnace.
71.  $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{CO}(\text{g}) \rightarrow 2\text{Fe}(\text{l}) + 3\text{CO}_2(\text{g})$
72.  $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
73.  $\text{CaO}(\text{s}) + \text{SiO}_2(\text{s}) \rightarrow \text{CaSiO}_3(\text{l})$
74. Roasting is a pyrochemical process in which the ore is heated in the presence of oxygen or air below its melting point.
75.  $2\text{ZnS}(\text{s}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{ZnO}(\text{s}) + 2\text{SO}_2(\text{g})$
76. Calcinations are a pyrochemical process in which the ore is heated in the absence of air.
77.  $\text{MgCO}_3(\text{s}) \rightarrow \text{MgO}(\text{s}) + \text{CO}_2(\text{g})$
78.  $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
79. Flux is a substance added to the ore to remove the gangue from it by reacting with the gangue.
80. If the impurity (gangue) is acidic substance like  $\text{SiO}_2$ , basic substance like CaO is used as flux and if the impurity is of basic nature like FeO acidic flux like SiO<sub>2</sub> is added to the gangue.
81.  $\text{CaO}(\text{s}) + \text{SiO}_2(\text{s}) \rightarrow \text{CaSiO}_3(\text{l})$
82.  $\text{FeO}(\text{s}) + \text{SiO}_2(\text{s}) \rightarrow \text{FeSiO}_3(\text{l})$

83. Furnace is the one which is used to carry out pyrochemical processes in metallurgy.
84. Chimney is the outlet through which flue (waste) gases go out of the furnace.
85. A metallic compound occurring in the earth crust along with impurities is called mineral.
86. A mineral from which a metal can be extracted economically and conveniently is called ore.
87. The impurity present in the ore is called gangue.
88. The substance added to the ore to remove gangue from it is called flux.
89. The extraction of metal from its ore involves mainly three stages: Concentration, Extraction of crude metal, and Refining of the metal.
90. Physical methods adopted in dressing the ore are: hand picking, washing, froth flotation, Magnetic separation etc.
91. The methods used for Extracting of Crude metal are Calcinations, Roasting, Chemical reduction, Auto reduction, Displacement method, Electrolytic reduction.
92. Calcinations are a process of heating the ore strongly in the absence of air or oxygen.
93. During calcinations, carbonate is converted to its oxide.
94. Roasting is a process of heating the ore strongly in a free supply of air or oxygen.
95. Calcinations and Roasting are carried out in a reverberatory furnace.

## 14. Carbon and its Compounds

1. The food you eat, the clothes you wear, the cosmetics you use, the fuels you use to run automobiles are all the compounds of carbon.
2. Carbon was discovered in prehistory and it was known to the ancients.
3. Carbon used to manufacture charcoal by burning organic material.
4. Carbon is a non-metal.
5. It belongs to the fourteenth group or IV A group in the modern periodical table.
6. Carbon has four electrons in the valence shell.
7. Atomic number of carbon is 6.
8. Electronic configuration of carbon (ground state)  ${}_6\text{C}$  is  $1s^2 2s^2 2p^2$ .
9. The electro negativity of carbon is only 2.5 and its nucleus has only six protons.
10. If carbon loses four electrons from the outer shell, it has to form  $\text{C}_4^+$  ions.
11. Carbon atom may form one single bond and a triple bond ( $\text{H}-\text{C}\equiv\text{C}-\text{H}$  or  $\text{CH}_3-\text{C}\equiv\text{N}$ ) or carbon atoms may also form two double bonds as in  $\text{CH}_2 = \text{C} = \text{CH}_2$ .
12. The Electronic configuration of carbon at excited state is  $1s^2 2s^1 2p^1_x 2p^1_y 2p^1_z$ .
13. Each carbon atom has four unpaired electrons when excited and tends to form four covalent bonds.
14. The bond angle in methane ( $\text{CH}_4$ ) is  $109^\circ 28'$ .
15. When bonds are formed, energy is released and the system becomes more stable.
16. If carbon forms four bonds rather than two, still more energy is released and so the resulting molecule becomes even more stable.
17. The energy difference between the 2s and 2p orbital's is very small.
18. The concept of hybridization was introduced by Linus Pauling (1931).
19. The redistribution of orbital's of almost equal energy in individual atoms to give equal number of new orbitals with identical properties like energy and shape is called "hybridization".
20. In the hybridization the newly formed orbital's are called as 'hybrid orbital's.'
21. In the excited carbon atom its one s-orbital (2s) and three p-orbital's ( $2p_x$ ,  $2p_y$ ,  $2p_z$ ) intermix and reshuffle into four identical orbital's known as  $sp^3$ orbital's. Thus, carbon atom undergoes  $sp^3$  hybridization.
22. General name of ethane is ethylene and its chemical formula is  $\text{CH}_2 = \text{CH}_2$ .
23. In the formation of  $\text{CH}_2=\text{CH}_2$  each carbon atom in its excited state undergoes  $sp^2$  hybridization by intermixing one s-orbital (2s) and two p-orbital's (say  $2p_x$ ,  $2p_y$ ) and reshuffling to form three  $sp^2$  orbital's.
24. The three  $sp^2$  orbital's having one electron each get separated around the nucleus of carbon atoms at an angle of  $120^\circ$ .

25. S-orbital's overlap with another S-orbital in end-on-end overlap to form Sigma bond ( $\sigma$ ).
26. P-Orbital's overlap with another P-Orbital in sideways to form Pi-bond ( $\Pi$ ).
27. Carbon use the 's' orbital (2s) and one of the 2p orbital's, but leave the other 2p orbital's unchanged. The new hybrid orbital's formed are called sp hybrid orbital's.
28. To know the ability of 'C' to form one single bond and one triple bond, let us consider ethyne (acetylene,  $C_2H_2$ ) molecule as our example.
29. In acetylene molecule there exists a triple bond between two carbon atoms and the fourth valence of each carbon atom is satisfied by hydrogen atoms ( $H-C\equiv C-H$ ).
30. One sp-orbital of a carbon overlaps the sp-orbital of other carbon to give sp-sp sigma bond.
31. The other sp-orbital of each carbon atom overlaps 's' orbital of a hydrogen atom to form an s-sp sigma bond.
32. The unhybridised 'p' orbitals of one carbon atom laterally overlap the unhybridised 'p' orbitals of other carbon atom to give two  $\Pi$  bonds between two carbon atoms.
33. The property of an element to exist in two or more physical forms having more or less similar chemical properties but different physical properties is called allotropy.
34. The different forms of the element are called allotropes.
35. The occurrence of same element in two or more different forms is known as allotropy.
36. The allotropes of carbon are classified into two types. They are 1. Amorphous forms  
2. Crystalline forms.
37. Different amorphous allotropes of carbon are: Coal; Coke; Wood Charcoal; Animal charcoal; Lamp black; Gas carbon; Petroleum coke; Sugar charcoal.
38. Carbon atoms can arrange themselves into different hybridized chemical bonds.
39. Carbon in solid phase can exist in three crystalline allotropic forms: diamond, graphite and buckminsterfullerene.
40. Buckminsterfullerene has a molecular solid structure with discrete  $C_{60}$  molecules.
41. In diamond each carbon atom undergoes in its excited state sp<sup>3</sup> hybridization.
42. In a diamond carbon atoms are in tetrahedral arrangement.
43. Due to the hardness of the diamond, it is used as glass cutter.
44. The density of a diamond is 3.51 gm/cc<sup>3</sup>.
45. The refractive index of a diamond is 2.41.
46. Diamond is a bad conductor of Electricity.
47. Bond length in a diamond is 1.54 Å.
48. The bond angle in a diamond is 109° 28'.
49. Graphite forms a two dimensional layer structure with C-C bonds within the layers.
50. In the layer structure of graphite, the carbon atoms are in a trigonal planar environment.
51. In the graphite carbon atoms are sp<sup>2</sup> hybridization.
52. Graphite is good conductor of electricity and insoluble in any solvent.

53. The density of graphite is 2.25 gm/cc<sup>3</sup>.
54. In graphite the carbon atoms are in hexagonal arrangement.
55. The distance between the two carbon atoms in graphite is 3.35 Å.
56. In graphite, the distance between the two carbon atoms is 1.42 Å and its bond angle 120°.
57. The buckminsterfullerene was discovered in 1985 by a team of scientists, Robert F. Curl, Harold W. Kroto and Richard E. Smalley from Rice University and they awarded the 1996 Nobel Prize in Chemistry.
58. They are named so for the resemblance of their structure to the geodesic structures devised by the scientist and architect Richard Buckminster "Bucky" Fuller.
59. Spherical fullerenes are also called buckyballs.
60. Number of carbon atoms in a buckminsterfullerene is 60.
61. Fullerene,  $C_{60}$  molecule contains 12 pentagonal and 20 hexagonal faces on its soccer ball shape, and each carbon atom has  $sp^2$  hybridized orbitals.
62. Fullerenes are under study for potential medicinal use – such as specific antibiotics to target resistant bacteria and even target certain cancer cells such as melanoma.
63. Nanotubes are another allotropic form of carbon discovered in 1991 by Sumio Iijima.
64. Nano tubes consist of hexagonal arrays of covalently bonded carbon atoms, similar to the sheets in graphite.
65. Unlike the flat graphite sheets, in nanotubes the sheets are rolled into cylinders.
66. Nanotubes sheets are rolled into cylinders. Due to this reason they are called nanotubes. Nanotubes like graphite are electrical conductors and can be used as molecular wires.
67. In integrated circuits nanotubes are used instead of copper to connect the components together.
68. Scientists inserted biomolecules into nanotubes to inject them into a single cell.
69. Graphene is extracted from graphite, the material used in pencils.
70. For a thickness of 1mm graphite contains some 3 million layers of graphene.
71. The carbons are perfectly distributed in a hexagonal honeycomb formation only in 0.3 nanometers thickness.
72. Graphene conducts electricity better than copper.
73. Graphene is 200 times stronger than steel but six times lighter. It is almost perfectly transparent to light.
74. J. J. Berzelius (1807) named the compounds that derived from living organism as organic compounds and those from non-living materials as inorganic compounds.
75. F. Wohler (1828) produced an organic compound Urea in the laboratory by heating an inorganic salt ammonium cyanate.
76. Chemical formula of Ammonium cyanate is  $NH_4CNO$ .
77. The chemical formula of urea is  $CO(NH_2)_2$ .
78. An atom of same element join to form a long chain is known as catenation.

79. The compounds containing only carbon and hydrogen in their molecules are called hydrocarbons.
80. Hydrocarbons are classified into two categories known as open chain hydrocarbons and closed chain hydrocarbons.
81. Open chain hydrocarbons are also called aliphatic hydrocarbons or acyclic hydrocarbons.
82. All hydrocarbons (both Aliphatic and cyclic hydrocarbons) are again classified as Alkanes, Alkenes and Alkynes.
83. Hydrocarbons containing only single bonds between carbon atoms are called Alkanes.
84. Hydrocarbons containing at least one double bond between carbon atoms are called Alkenes.
85. Hydrocarbons containing at least one triple bond between carbon atoms are called Alkynes.
86. The hydrocarbons containing only C–C single bonds are known as saturated hydrocarbons.
87. All alkanes are saturated hydrocarbons.
88. The hydrocarbons that contain at least one double bond (C=C) or contain at least one triple bond (C≡C) between the two carbon atoms are called unsaturated hydrocarbons.
89. Alkenes and Alkynes are the examples for unsaturated hydrocarbons.
90. Straight chain, branched chain and closed chain hydrocarbon compounds may be saturated or unsaturated.
91. If a hydrogen atom of H<sub>2</sub>O molecule is replaced by 'R' we get alcohols R-OH.
92. The hydrocarbons that contain –OH group are called alcohols.
93. General formula of alcohols is R – OH where 'R' is alkyl group, C<sub>n</sub>H<sub>2n+1</sub>.
94. The hydrocarbons with functional group –CHO are called aldehydes.
95. General formula of aldehydes is R – CHO, where R = alkyl group or hydrogen and –CHO is functional group.
96. The hydrocarbons with functional group C=O are called ketones.
97. The general molecular formula of carboxylic acid is R – COOH, where R is an alkyl group or H atom.
98. Ethers are carbon compounds contain functional group is C-O-C.
99. These compounds are derivatives of carboxylic acids. If the hydrogen atom of –COOH gets replaced by 'R', the alkyl group esters are obtained.
100. –NH<sub>2</sub> group is called amine group. We may compare amines to NH<sub>3</sub> as we have done ROH and R – O – R/ to H<sub>2</sub>O.
101. If one hydrogen atom is replaced from NH<sub>3</sub> by an alkyl group we get the so called primary amines.
102. If two hydrogen atoms of NH<sub>3</sub> are replaced by two alkyl groups (same or different) we get secondary amines.
103. If all the three hydrogen atoms are replaced by the same or different alkyl groups we get tertiary amines.

104. The characteristic properties of an organic compound depend mainly on an atom or group of atoms in its molecule known as the functional group.
105. The common system of the Butane is n-butane.
106. The common system 2-methyl propane is iso-butane.
107. The compounds which are having same molecular formula but different structures are called isomers.
108. The phenomenon of possessing same molecular formula but different properties by the compounds is known as isomerism.
109. The compounds that exhibit isomerism are called isomers.
110. Isomerism is due to the difference in the structures. Therefore, it is called the structural isomerism.
111. The series of carbon compounds in which two successive compounds differ by  $-\text{CH}_2$  unit is called homologous series.
112. The formula of alkanes is  $\text{C}_n\text{H}_{2n+2}$ ; alkynes is  $\text{C}_n\text{H}_{2n-2}$ ; alcohols is  $(\text{C}_n\text{H}_{2n+1})\text{OH}$  etc.
113. Expand IUPAC International Union of Pure and Applied Chemistry.
114. The number of carbon atoms present in the molecules we call this part of the name as word root.
115. The substituent in the molecule; which are shown as the prefix
116. The functional group in the molecule; which is shown as the suffix.
117. Prefix again has several parts known as primary prefix secondary prefix, numerical prefix and number prefix etc.
118. Primary prefix is 'cyclo' and it is useful only for cyclic compounds which have properties similar to aliphatic compounds.
119. Secondary prefix tells about the second grade functional groups known as substituents.
120. 'Halogens' which are written as halo; alkyl groups(R), alkoxy groups (-OR) etc. which are written as alkyl, alkoxy.
121. Halogens also contain several parts known as primary suffix, secondary suffix, numerical suffix and number suffix etc.
122. Primary suffix tells about the saturation of the compound.
123. For saturated (C-C) it is 'an' and carbon atoms are attached to one another only through single bonds in the compounds.
124. For unsaturated (C-C) double bonded compounds it is 'en' and for unsaturated triple bonded ( $\text{C}\equiv\text{C}$ ) compounds it is 'yn'.
125. X (halo), R (alkyl), -OR (alkoxy),  $-\text{NO}_2$  (nitro), NO (nitroso) etc. are Substituent's.
126. Carbon, and its compounds burn in presence of oxygen or air to give  $\text{CO}_2$ , heat and light.
127. The process of burning of carbon or carbon compound in excess of oxygen to give heat and light is called the combustion reaction.
128.  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2 + \text{Energy}$ .

129.  $2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O} + \text{Energy}$ .
130.  $\text{CH}_3\text{CH}_2\text{OH} + 3\text{O}_2 \rightarrow \text{CO}_2 + 3\text{H}_2\text{O} + \text{Energy}$ .
131. Generally, saturated hydrocarbons burn with a clear light blue flame, whereas unsaturated hydrocarbons burn with yellow flame with soot.
132. Oxidation reactions may be carried out using oxidizing agents.
133. Oxidizing agents or Oxidants are substances that oxidize other substances. They themselves undergo reduction.
134. Ethyl alcohol undergoes oxidation to form the product Acetaldehyde and finally Acetic acid.
135. A catalyst is a substance which regulates (increase/decrease) the rate of a given reaction without itself finally undergoing any chemical change.
136. Fats and oils are both of fatty acids.
137. A reaction in which an atom or a group of atoms in a given compound is replaced by other atom or group of atoms is called a substitution reaction.
138. Alkanes, the saturated hydrocarbons are chemically least reactive. Therefore they are also called paraffins (parum = little; affins = affinity, i.e., no affinity towards chemical changes).
139. The chemical formula of Methyl Chloride is  $\text{CH}_3\text{Cl}$ .
140. The chemical formula of Methylene Chloride is  $\text{CH}_2\text{Cl}_2$ .
141. The chemical formula of Chloroform is  $\text{CHCl}_3$ .
142. The chemical formula of Chloride Tetrachloride is  $\text{CCl}_4$ .
143. The process of conversion of starches and sugars to  $\text{C}_2\text{H}_5\text{OH}$  is called fermentation process.
144. Ethanol is a colourless liquid with characteristic sweet odour.
145. Pure ethanol boils at  $78.3^\circ\text{C}$ . Pure ethanol is called absolute (100 %) alcohol.
146. Denatured alcohol is ethanol that contains impurities that make it undrinkable.
147. Methanol, methyl isobutyl ketone, aviation gasoline etc are impurities.
148. Solution of about 10% ethanol in gasoline (gasohol) is a good motor fuel.
149. Ethanol is commonly called alcohol and is active ingredient of all alcoholic drinks.
150. Consumption of small quantity of dilute ethanol causes drunkenness.
151. In addition, as it is a good solvent it is also used in medicines such as tincture iodine, cough syrups and many tonics.
152. The chemical formula of potassium-di-chromate is  $\text{K}_2\text{Cr}_2\text{O}_7$ .
153.  $\text{K}_2\text{Cr}_2\text{O}_7$  is a good oxidizing agent.
154. Now a day's police are using even an electronic instrument containing small fuel cell that measures the electrical signal produced when ethanol in the breath is oxidized.
155. The police even use the IR Spectra to detect the bonds C – OH and C – H of  $\text{CH}_3 - \text{CH}_2\text{OH}$ .
156. Ethanol reacts with metallic sodium to liberate hydrogen and forms sodium ethoxide.
156.  $2\text{C}_2\text{H}_5\text{OH} + 2\text{Na} \rightarrow 2\text{C}_2\text{H}_5\text{ONa} + \text{H}_2$



157. Ethanol reacts with conc.  $\text{H}_2\text{SO}_4$  at about  $170^\circ\text{C}$  (443 K) to give ethene. It is a dehydration reaction.
158.  $\text{H}_2\text{SO}_4$  is a dehydrating agent and removes  $\text{H}_2\text{O}$ .
159.  $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{170^\circ\text{C}} \text{CH}_2 = \text{CH}_2 + \text{H}_2\text{O}$
160. The chemical formula of Ethanoic acid (Acetic acid) is  $\text{CH}_3\text{COOH}$ .
161. Ethanoic acid is a colourless liquid with characteristic unpleasant odour.
162. Ethanoic acid is commonly called as acetic acid. 5–8% solution of acetic acid in water is called Vinegar.
163. Vinegar is used widely as a preservative in pickles.
164. Ethanoic acid reacts with active metals like Na to liberate hydrogen.
165.  $2\text{CH}_3\text{COOH} + 2\text{Na} \rightarrow \text{2CH}_3\text{COONa} + \text{H}_2$
166. Ethanoic acid reacts with NaOH to form salt and water.
167.  $\text{CH}_3\text{COOH} + \text{NaOH} \rightarrow \text{2CH}_3\text{COONa} + \text{H}_2\text{O}$
168. Ethanoic acid reacts with sodium carbonate and sodium hydrogen carbonate which are weaker bases and liberates  $\text{CO}_2$ .
169.  $2\text{CH}_3\text{COONa} + \text{Na}_2\text{CO}_3 \rightarrow \text{2CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$
170.  $\text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$
171. The strength of acids may be expressed in terms of their pKa values.
172. pKa is the negative value of logarithm of dissociation constant of an acid.
173. pKa is a measure of how much an acid dissociates in a solution.
174.  $\text{pKa} = -\log_{10}\text{Ka}$
175. The lower the pKa value, the stronger is the acid.
176. The pKa of 1.0M HCl is zero but pKa of  $\text{CH}_3\text{COOH}$  is 4.76.
177. pKavalues are useful to tell about acid strength.
178. Strong acids have  $\text{pKa} < 1$ , acids with pKa between 1 and 5 are moderately strong and weak acids have pKa between 5 and 15. The weakest acids have  $\text{pKa} > 15$ .
179. The reaction between carboxylic acid and an alcohol in the presence of conc.  $\text{H}_2\text{SO}_4$  to form a sweet odoured substance is called esterification.
180. The esterification reaction is slow and reversible.
181. Soap is a sodium or potassium salt of a higher fatty acid like palmitic acid ( $\text{C}_{15}\text{H}_{31}\text{COOH}$ ), stearic acid ( $\text{C}_{17}\text{H}_{35}\text{COOH}$ ), oleic acid ( $\text{C}_{17}\text{H}_{33}\text{COOH}$ ) etc.
182. The formula of a soap in general is  $\text{RCOONa}$  or  $\text{RCOOK}$ , where  $\text{R} = \text{C}_{15}\text{H}_{31}$  ;  $\text{C}_{17}\text{H}_{35}$  etc.
183. Fats are esters of higher fatty acids and the trihydroxy alcohol known as glycerol.
184. When fats are treated with sodium hydroxide, sodium salts the fatty acids and glycerol is formed.
185. The sodium salts of these higher fatty acids being soaps the reaction is the soap formation reaction which is generally called as 'saponification reaction'.

186. Alkaline hydrolysis of tristers of higher fatty acids producing soaps is called saponification.
187. A true solution is that in which the solute particles dispersed in the solvent are less than 1nm in diameter.
188. A colloidal solution contains the solute known as 'dispersed phase' with its particles with diameters greater than 1nm but lesser than 1000 nm in the solvent known as 'dispersion medium'.
189. A spherical aggregate of soap molecules in water is called micelle.
190. Soaps give a true solution at particular concentration known as critical micelle concentration (CMC).
191. When soap is dissolved in water, it forms a colloidal suspension in which the soap molecules cluster together to form spherical micelles.
192. Soap has one polar end and one non-polar end.
193. The non-polar end in soaps is hydrophobic, in nature and it is attracted towards grease or oil on the cloth, but not attracted towards water.
194. Hydrocarbons are the compounds of carbon and hydrogen.
195. Carbon forms covalent bonds with its own atoms and atoms of other elements such as hydrogen, oxygen, sulphur, nitrogen and chlorine.
196. Hydrocarbons are of two types – saturated hydrocarbons (alkanes) and unsaturated hydrocarbons (alkenes and alkynes).
197. Carbon chains may be in the form of straight chains, branched chains or rings.
198. Carbon compounds with identical molecular formula but different structures are called structural isomers.
199. Saturated hydrocarbons on combustion give carbon dioxide and water with the liberation of heat.
200. Unsaturated hydrocarbons undergo addition reactions while saturated hydrocarbons undergo substitution reactions.
201. Ethanol and Ethanoic acid (glacial acetic acid) are carbon compounds of importance in our daily life.
202. The molecules of soap are sodium or potassium salts of long chain carboxylic acids.
203. Detergents are ammonium or sulphonate salts of long chain carboxylic acids.
204. The action of soaps and detergents is based on the presence of both hydrophobic and hydrophilic groups in the molecule and this helps to emulsify the oily dirt and hence its removal.
205. The chemical formula of soap is C<sub>17</sub> H<sub>35</sub> COONa.

## Chemical Compounds–Formulae

The lists of Chemical Compound Formulas are given below.

S.No	Name of the chemical compound	Formula
1	Acetic acid formula	$\text{CH}_3\text{COOH}$
2	Hydrochloric acid formula	$\text{HCl}$
3	Sulphuric acid formula	$\text{H}_2\text{SO}_4$
4	Acetate formula	$\text{CH}_3\text{COO}^-$
5	Ammonia formula	$\text{NH}_3$
6	Nitric acid formula	$\text{HNO}_3$
7	Phosphoric acid formula	$\text{H}_3\text{PO}_4$
8	Sodium phosphate formula	$\text{Na}_3\text{PO}_4$
9	Calcium carbonate formula	$\text{CaCO}_3$
10	Ammonium sulphate formula	$(\text{NH}_4)_2\text{SO}_4$
11	Carbonic acid formula	$\text{H}_2\text{CO}_3$
12	Sodium bicarbonate formula	$\text{NaHCO}_3$
13	Sodium hydroxide formula	$\text{NaOH}$
14	Calcium hydroxide formula	$\text{Ca}(\text{OH})_2$
15	Ethanol formula	$\text{C}_2\text{H}_5\text{OH}$
16	Hydrobromic acid formula	$\text{HBr}$
17	Hydrosulfuric acid formula	$\text{H}_2\text{SO}_4$
18	Nitrous acid formula	$\text{HNO}_2$
19	Potassium phosphate formula	$\text{KH}_2\text{PO}_4$
20	Silver nitrate formula	$\text{AgNO}_3$
21	Sodium carbonate formula	$\text{Na}_2\text{CO}_3$
22	Sodium chloride formula	$\text{NaCl}$
23	Aluminum hydroxide formula	$\text{Al}(\text{OH})_3$
24	Magnesium hydroxide formula	$\text{Mg}(\text{OH})_2$
25	Methane formula	$\text{CH}_4$
26	Nitrogen monoxide formula	$\text{NO}$

27	Potassium hydroxide formula	KOH
28	Sodium nitrate formula	NaNO <sub>3</sub>
29	Sulfurous acid formula	H <sub>2</sub> SO <sub>3</sub>
30	Phosphate formula	PO <sub>4</sub> <sup>-</sup>
31	Aluminum oxide formula	Al <sub>2</sub> O <sub>3</sub>
32	Ammonia chemical formula	NH <sub>4</sub>
33	Ammonium nitrate formula	NH <sub>4</sub> NO <sub>3</sub>
34	Ammonium phosphate formula	(NH <sub>4</sub> ) <sub>3</sub> PO <sub>4</sub>
35	Barium hydroxide formula	Ba(OH) <sub>2</sub>
36	Carbon tetrachloride formula	CCl <sub>4</sub>
37	Citric acid formula	C <sub>6</sub> H <sub>8</sub> O <sub>7</sub>
38	Hydrocyanic acid formula	HCN
39	Hydrofluoric acid formula	HF
40	Hydroiodic acid formula	HI
41	Hypochlorous acid formula	HClO
42	Iron iii oxide formula	Fe <sub>2</sub> O <sub>3</sub>
43	Magnesium phosphate formula	Mg <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>
44	Sodium acetate formula	C <sub>2</sub> H <sub>3</sub> NaO <sub>2</sub>
45	Sodium sulphate formula	Na <sub>2</sub> SO <sub>4</sub>
46	Sucrose formula	C <sub>12</sub> H <sub>22</sub> O <sub>11</sub>
47	Potassium nitrate formula	KNO <sub>3</sub>
48	Ammonium carbonate formula	(NH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub>
49	Ammonium chloride formula	NH <sub>4</sub> Cl
50	Ammonium hydroxide formula	NH <sub>4</sub> OH
51	Calcium nitrate formula	Ca(NO <sub>3</sub> ) <sub>2</sub>
52	Calcium oxide formula	CaO
53	Carbon monoxide formula	CO
54	Chlorine gas formula	Cl <sub>2</sub>
55	Hydrogen gas formula	H <sub>2</sub>
56	Hydrogen peroxide formula	H <sub>2</sub> O <sub>2</sub>

57	Hydroxide formula	$\text{OH}^-$
58	Magnesium chloride formula	$\text{MgCl}_2$
59	Magnesium oxide formula	$\text{MgO}$
60	Potassium chloride formula	$\text{KCl}$
61	Potassium iodide formula	$\text{KI}$
62	Sulphur dioxide formula	$\text{SO}_2$
63	Vinegar chemical formula	$\text{C}_2\text{H}_4\text{O}_2$
64	Ammonium sulphide formula	$(\text{NH}_4)_2\text{S}$
65	Barium nitrate formula	$\text{Ba}(\text{NO}_3)_2$
66	Calcium acetate formula	$\text{Ca}(\text{COO}^-)_2$
67	Chlorous acid formula	$\text{HClO}_2$
68	Iron oxide formula	$\text{Fe}_2\text{O}_3$
69	Potassium carbonate formula	$\text{K}_2\text{CO}_3$
70	Silver chloride formula	$\text{AgCl}$
71	Sodium iodide formula	$\text{NaI}$
72	Sodium oxide formula	$\text{Na}_2\text{O}$
73	Sodium sulphide formula	$\text{Na}_2\text{S}$
74	Sugar chemical formula	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$
75	Zinc nitrate formula	$\text{Zn}(\text{NO}_3)_2$
76	Aluminum chloride formula	$\text{AlCl}_3$
77	Barium chloride formula	$\text{BaCl}_2$
78	Magnesium nitrate formula	$\text{Mg}(\text{NO}_3)_2$
79	Silicon dioxide formula	$\text{SiO}_2$
80	Acetone formula	$\text{C}_3\text{H}_6\text{O}$
81	Aluminum acetate formula	$\text{Al}_2\text{O}(\text{C}_2\text{H}_3\text{O}_2)_4$
82	Aluminum bromide formula	$\text{AlBr}_3$
83	Ammonium acetate formula	$\text{C}_2\text{H}_3\text{O}_2\text{NH}_4$
84	Barium phosphate formula	$\text{Ba}_3\text{O}_8\text{P}_2$
85	Barium sulphate formula	$\text{BaSO}_4$
86	Benzene formula	$\text{C}_6\text{H}_6$

87	Bicarbonate formula	$\text{CHO}_3^-$
88	Chromate formula	$\text{CrO}_4^{2-}$
89	Copper ii nitrate formula	$\text{Cu}(\text{NO}_3)_2$
90	Cyanide formula	$\text{CN}^-$
91	Iron iii hydroxide formula	$\text{HFeO}_2$
92	Magnesium sulphate formula	$\text{MgSO}_4$
93	Methanol formula	$\text{CH}_3\text{OH}$
94	Nitrogen dioxide formula	$\text{NO}_2$
95	Oxygen gas formula	$\text{O}_2$
96	Barium acetate formula	$\text{Ba}(\text{C}_2\text{H}_3\text{O}_2)_2$
97	Sodium sulphite formula	$\text{Na}_2\text{SO}_3$
98	Sulphur trioxide formula	$\text{SO}_3$
99	Aluminum phosphate formula	$\text{AlPO}_4$
100	Bromic acid formula	$\text{HBrO}_3$
101	Dinitrogen monoxide formula	$\text{N}_2\text{O}$
102	Formula for carbon monoxide	$\text{CO}$
103	Formula for carbonic acid	$\text{H}_2\text{CO}_3$
104	Formula for sodium carbonate	$\text{Na}_2\text{CO}_3$
105	Iron ii oxide formula	$\text{FeO}$
106	Lithium phosphate formula	$\text{Li}_3\text{PO}_4$
107	Oxalic acid formula	$\text{H}_2\text{C}_2\text{O}_4$
108	Potassium dichromate formula	$\text{K}_2\text{Cr}_2\text{O}_7$
109	Salicylic acid formula	$\text{C}_7\text{H}_6\text{O}_3$
110	Sodium bromide formula	$\text{NaBr}$
111	Sodium hypochlorite formula	$\text{NaClO}$
112	Zinc acetate formula	$\text{Zn}(\text{O}_2\text{CCH}_3)_2$
113	Zinc chloride formula	$\text{ZnCl}_2$
114	Zinc hydroxide formula	$\text{Zn}(\text{OH})_2$
115	Magnesium bicarbonate formula	$\text{MgCO}_3$
116	Potassium chlorate formula	$\text{KClO}_3$

117	Aluminum carbonate formula	$\text{Al}_2(\text{CO}_3)_3$
118	Ascorbic acid formula	$\text{C}_6\text{H}_8\text{O}_6$
119	Benzoic acid formula	$\text{C}_7\text{H}_6\text{O}_2$
120	Butane formula	$\text{C}_4\text{H}_{10}$
121	Chlorine formula	$\text{Cl}_2$
122	Formula for ammonium nitrate	$(\text{NH}_4)(\text{NO}_3)$
123	Formula for ammonium phosphate	$(\text{NH}_4)_3\text{PO}_4$
124	Formula for carbon tetrachloride	$\text{CCl}_4$
125	Formula for nitrous acid	$\text{HNO}_2$
126	Formula for potassium phosphate	$\text{KH}_2\text{PO}_4$
129	Hydrogen carbonate formula	$\text{CHO}_3^-$
130	Hypochlorite formula	$\text{NaClO}$
131	Lead nitrate formula	$\text{Pb}(\text{NO}_3)_2$
132	Magnesium carbonate formula	$\text{MgCO}_3$
133	Magnesium nitride formula	$\text{Mg}_3\text{N}_2$
134	Nitrite formula	$\text{NO}_2^-$
135	Per bromic acid formula	$\text{HBrO}_4$
136	Phosphate chemical formula	$\text{PO}_4^{3-}$
137	Phosphorus trichloride formula	$\text{PCl}_3$
138	Potassium acetate formula	$\text{CH}_3\text{CO}_2\text{K}$
139	Potassium chromate formula	$\text{CrK}_2\text{O}_4$
140	Zinc sulphate formula	$\text{ZnSO}_4$
141	Iodine formula	$\text{I}_2$
142	Permanganate ion formula	$\text{MnO}_4^-$
143	Aluminum formula	$\text{Al}$
144	Aluminum iodide formula	$\text{AlI}_3$
145	Calcium bromide formula	$\text{CaBr}_2$
146	Chemical formula for citric acid	$\text{C}_6\text{H}_8\text{O}_7$
147	Chlorate formula	$\text{ClO}^{-3}$
148	Chromic acid formula	$\text{H}_2\text{CrO}_4$

149	Di hydrogen monoxide formula	$H_2O$
150	Dinitrogen pent oxide formula	$N_2O_5$
151	Formula for hydrofluoric acid	$HF$
152	Hexane formula	$C_6H_{14}$
153	Hydrogen phosphate formula	$H_3PO_4$
154	Iodic acid formula	$HIO_3$
155	Iron ii nitrate formula	$Fe(NO_3)_3$
156	Iron iii carbonate formula	$Fe_2(CO_3)_3$
157	Lactic acid formula	$C_3H_6O_3$
158	Lead acetate formula	$Pb(C_2H_3O_2)_2$
159	Lead iv oxide formula	$PbO_2$
160	Lithium hydroxide formula	$LiOH$
161	Magnesium acetate formula	$Mg(CH_3COO)_2$
162	Phosphorus pentachloride formula	$PCl_5$
163	Potassium oxide formula	$K_2O$
164	Potassium phosphate chemical formula	$KH_2PO_4$
165	Silver acetate formula	$AgC_2H_3O_2$
166	Sodium citrate formula	$Na_3C_6H_5O_7$
167	Sodium fluoride formula	$NaF$
168	Sodium nitrite formula	$NaNO_2$
169	Sulphate ion formula	$SO_4^{2-}$
170	Barium oxide formula	$BaO$
171	Calcium iodide formula	$CaI_2$
172	Hydrogen sulphate formula	$HSO_4^-$
173	Lithium oxide formula	$Li_2O$
174	Nitride formula	$N_3$
175	Permanganate formula	$KMnO_4$
176	Silver phosphate formula	$Ag_3PO_4$
177	Sodium carbonate chemical formula	$Na_2CO_3$
178	Ammonium bromide formula	$NH_4Br$



179	Chemical formula for calcium phosphate	$\text{Ca}_3(\text{PO}_4)_2$
180	Dichromate formula	$\text{K}_2\text{Cr}_2\text{O}_7$
181	Formula for aluminium sulphide	$\text{Al}_2\text{S}_3$
182	Formula for ammonium carbonate	$(\text{NH}_4)_2\text{CO}_3$
183	Formula for barium chloride	$\text{BaCl}_2$
184	Formula for calcium nitrate	$\text{Ca}(\text{NO}_3)_2$
185	Formula for hydroiodic acid	$\text{HI}$
186	Formula for nitrogen monoxide	$\text{NO}$
187	Formula for potassium carbonate	$\text{K}_2\text{CO}_3$
188	Formula for potassium iodide	$\text{KI}$
189	Formula for potassium nitrate	$\text{KNO}_3$
190	Formula for sodium oxide	$\text{Na}_2\text{O}$
191	Fructose chemical formula	$\text{C}_6\text{H}_{12}\text{O}_6$
192	Magnesium iodide formula	$\text{MgI}_2$
193	Magnesium sulphide formula	$\text{MgS}$
194	Ozone formula	$\text{O}_3$
195	Potassium cyanide formula	$\text{KCN}$
196	Silver oxide formula	$\text{Ag}_2\text{O}$
197	Sodium chromate formula	$\text{Na}_2\text{CrO}_4$
198	Sodium peroxide formula	$\text{Na}_2\text{O}_2$
199	Toluene formula	$\text{C}_7\text{H}_8$
200	Zinc carbonate formula	$\text{ZnCO}_3$
201	Zinc phosphate formula	$\text{Zn}_3(\text{PO}_4)_2$
202	Zinc sulphide formula	$\text{ZnS}$
203	Amino acid formula	$\text{R}(\text{NH}_2)\text{-COOH}$
204	Boric acid formula	$\text{H}_3\text{BO}_3$
206	Formula for magnesium phosphate	$\text{Mg}_3(\text{PO}_4)_2$
207	Oxalate formula	$\text{C}_2\text{O}_4^{2-}$
208	Potassium bicarbonate formula	$\text{KHCO}_3$
209	Potassium hypochlorite formula	$\text{KClO}_3$

210	Potassium nitrite formula	$\text{KNO}_2$
211	Ammonium bicarbonate formula	$\text{NH}_4\text{HCO}_3$
212	Ammonium iodide formula	$\text{NH}_4\text{I}$
213	Ammonium nitrate chemical formula	$(\text{NH}_4)(\text{NO}_3)$
214	Ammonium nitrite formula	$\text{NH}_4\text{NO}_2$
215	Ammonium oxide formula	$(\text{NH}_4)_2\text{O}$
216	Argon gas formula	Ar
217	Barium bromide formula	$\text{BaBr}_2$
218	Barium iodide formula	$\text{BaI}_2$
219	Bromate formula	Br
220	Dinitrogen trioxide formula	$\text{N}_2\text{O}_3$
221	Ethylene glycol formula	$\text{C}_2\text{H}_6\text{O}_2$
222	Formula for hypochlorous acid	HClO
223	Formula for magnesium nitrate	$\text{MgNO}_3$
224	Helium gas formula	He
225	Iodide formula	$\text{I}_2$
226	Lead ii acetate formula	$\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$
227	Lithium chloride formula	$\text{LiCl}_2$
228	Phosphate ion formula	$\text{PO}_4^{3-}$
229	Potassium fluoride formula	KF
230	Potassium sulphite formula	$\text{K}_2\text{SO}_3$
231	Silver carbonate formula	$\text{Ag}_2\text{CO}_3$
232	Sodium cyanide formula	NaCN
233	Sodium nitride formula	$\text{Na}_3\text{N}$
234	Strontium chloride formula	$\text{SrCl}_2$
235	Strontium nitrate formula	$\text{Sr}(\text{NO}_3)_2$
236	Urea formula	$\text{CH}_4\text{N}_2\text{O}$
237	Bleach formula	NaClO
238	Chemical formula for carbonic acid	$\text{H}_2\text{CO}_3$
239	Lithium bromide formula	LiBr

240	Aluminum fluoride formula	$\text{AlF}_3$
241	Barium fluoride formula	$\text{BaF}_2$
242	Butanoic acid formula	$\text{C}_4\text{H}_8\text{O}_2$
243	Calcium hydride formula	$\text{CaH}_2$
245	Copper ii carbonate formula	$\text{CuCO}_3$
246	Ethanol structural formula	$\text{CH}_3\text{CH}_2\text{OH}$
247	Fluorine gas formula	$\text{F}_2$
248	Formula for lithium phosphate	$\text{Li}_3\text{PO}_4$
249	Glycerol formula	$\text{C}_3\text{H}_8\text{O}_3$
250	Hypobromous acid formula	$\text{HBrO}$
251	Hypoiodous acid formula	$\text{HIO}$
252	Lead iodide formula	$\text{PbI}_2$
253	Lithium iodide formula	$\text{LiI}_2$
254	Magnesium oxide chemical formula	$\text{MgO}$
255	Magnesium phosphate chemical formula	$\text{Mg}_3\text{PO}_4$
256	Nickel nitrate formula	$\text{Ni}(\text{NO}_3)_2$
257	Potassium chloride chemical formula	$\text{KCl}$
258	Potassium nitrate chemical formula	$\text{KNO}_3$
259	Sodium dichromate formula	$\text{Na}_2\text{Cr}_2\text{O}_7$
260	Sodium nitrate chemical formula	$\text{NaNO}_3$
261	Tartaric acid formula	$\text{C}_4\text{H}_6\text{O}_6$
262	Zinc iodide formula	$\text{ZnI}_2$
263	Bromine gas formula	$\text{Br}_2$
264	Formula for aluminum bromide	$\text{AlBr}_3$
265	Formula for barium sulphate	$\text{BaSO}_4$
267	Nickel acetate formula	$\text{Ni}(\text{C}_2\text{H}_3\text{O}_2)_2$

## Electronic configurations of the elements

The ground electronic configurations of the elements H through U and their first cations are given below. The notation [X] indicates that all subshells associated with the noble gas X are fully occupied.

<b>Electronic Configuration</b>			
Z	Symbol	Neutral	Positive ion
1	H	$1s^1$	-
2	He	$1s^2$	$1s^1$
3	Li	[He] $2s^1$	$1s^2$
4	Be	[He] $2s^2$	[He] $2s^1$
5	B	[He] $2s^2 2p^1$	[He] $2s^2$
6	C	[He] $2s^2 2p^2$	[He] $2s^2 2p^1$
7	N	[He] $2s^2 2p^3$	[He] $2s^2 2p^2$
8	O	[He] $2s^2 2p^4$	[He] $2s^2 2p^3$
9	F	[He] $2s^2 2p^5$	[He] $2s^2 2p^4$
10	Ne	[He] $2s^2 2p^6$	[He] $2s^2 2p^5$
11	Na	[Ne] $3s^1$	[He] $2s^2 2p^6$
12	Mg	[Ne] $3s^2$	[Ne] $3s^1$
13	Al	[Ne] $3s^2 3p^1$	[Ne] $3s^2$
14	Si	[Ne] $3s^2 3p^2$	[Ne] $3s^2 3p^1$
15	P	[Ne] $3s^2 3p^3$	[Ne] $3s^2 3p^2$
16	S	[Ne] $3s^2 3p^4$	[Ne] $3s^2 3p^3$
17	Cl	[Ne] $3s^2 3p^5$	[Ne] $3s^2 3p^4$
18	Ar	[Ne] $3s^2 3p^6$	[Ne] $3s^2 3p^5$
19	K	[Ar] $4s^1$	[Ne] $3s^2 3p^6$
20	Ca	[Ar] $4s^2$	[Ar] $4s^1$
21	Sc	[Ar] $3d^1 4s^2$	[Ar] $3d^1 4s^1$
22	Ti	[Ar] $3d^2 4s^2$	[Ar] $3d^2 4s^1$

23	V	[Ar] 3d <sup>3</sup> 4s <sup>2</sup>	[Ar] 3d <sup>4</sup>
24	Cr	[Ar] 3d <sup>5</sup> 4s <sup>1</sup>	[Ar] 3d <sup>5</sup>
25	Mn	[Ar] 3d <sup>5</sup> 4s <sup>2</sup>	[Ar] 3d <sup>5</sup> 4s <sup>1</sup>
26	Fe	[Ar] 3d <sup>6</sup> 4s <sup>2</sup>	[Ar] 3d <sup>6</sup> 4s <sup>1</sup>
27	Co	[Ar] 3d <sup>7</sup> 4s <sup>2</sup>	[Ar] 3d <sup>8</sup>
28	Ni	[Ar] 3d <sup>8</sup> 4s <sup>2</sup>	[Ar] 3d <sup>9</sup>
29	Cu	[Ar] 3d <sup>10</sup> 4s <sup>1</sup>	[Ar] 3d <sup>10</sup>
30	Zn	[Ar] 3d <sup>10</sup> 4s <sup>2</sup>	[Ar] 3d <sup>10</sup> 4s <sup>1</sup>
31	Ga	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>1</sup>	[Ar] 3d <sup>10</sup> 4s <sup>2</sup>
32	Ge	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>2</sup>	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>1</sup>
33	As	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>3</sup>	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>2</sup>
34	Se	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>4</sup>	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>3</sup>
35	Br	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>5</sup>	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>4</sup>
36	Kr	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>6</sup>	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>5</sup>
37	Rb	[Kr] 5s <sup>1</sup>	[Ar] 3d <sup>10</sup> 4s <sup>2</sup> 4p <sup>6</sup>
38	Sr	[Kr] 5s <sup>2</sup>	[Kr] 5s <sup>1</sup>
39	Y	[Kr] 4d <sup>1</sup> 5s <sup>2</sup>	[Kr] 5s <sup>2</sup>
40	Zr	[Kr] 4d <sup>2</sup> 5s <sup>2</sup>	[Kr] 4d <sup>2</sup> 5s <sup>1</sup>
41	Nb	[Kr] 4d <sup>4</sup> 5s <sup>1</sup>	[Kr] 4d <sup>4</sup>
42	Mo	[Kr] 4d <sup>5</sup> 5s <sup>1</sup>	[Kr] 4d <sup>5</sup>
43	Tc	[Kr] 4d <sup>5</sup> 5s <sup>2</sup>	[Kr] 4d <sup>5</sup> 5s <sup>1</sup>
44	Ru	[Kr] 4d <sup>7</sup> 5s <sup>1</sup>	[Kr] 4d <sup>7</sup>
45	Rh	[Kr] 4d <sup>8</sup> 5s <sup>1</sup>	[Kr] 4d <sup>8</sup>
46	Pd	[Kr] 4d <sup>10</sup>	[Kr] 4d <sup>9</sup>
47	Ag	[Kr] 4d <sup>10</sup> 5s <sup>1</sup>	[Kr] 4d <sup>10</sup>
48	Cd	[Kr] 4d <sup>10</sup> 5s <sup>2</sup>	[Kr] 4d <sup>10</sup> 5s <sup>1</sup>
49	In	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>1</sup>	[Kr] 4d <sup>10</sup> 5s <sup>2</sup>
50	Sn	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>2</sup>	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>1</sup>
51	Sb	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>3</sup>	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>2</sup>

52	Te	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>4</sup>	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>3</sup>
53	I	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>5</sup>	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>4</sup>
54	Xe	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>6</sup>	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>5</sup>
55	Cs	[Xe] 6s <sup>1</sup>	[Kr] 4d <sup>10</sup> 5s <sup>2</sup> 5p <sup>6</sup>
56	Ba	[Xe] 6s <sup>2</sup>	[Xe] 6s <sup>1</sup>
57	La	[Xe] 5d <sup>1</sup> 6s <sup>2</sup>	[Xe] 5d <sup>2</sup>
58	Ce	[Xe] 4f <sup>1</sup> 5d <sup>1</sup> 6s <sup>2</sup>	[Xe] 4f <sup>1</sup> 5d <sup>2</sup>
59	Pr	[Xe] 4f <sup>3</sup> 6s <sup>2</sup>	[Xe] 4f <sup>3</sup> 6s <sup>1</sup>
60	Nd	[Xe] 4f <sup>4</sup> 6s <sup>2</sup>	[Xe] 4f <sup>4</sup> 6s <sup>1</sup>
61	Pm	[Xe] 4f <sup>5</sup> 6s <sup>2</sup>	[Xe] 4f <sup>5</sup> 6s <sup>1</sup>
62	Sm	[Xe] 4f <sup>6</sup> 6s <sup>2</sup>	[Xe] 4f <sup>6</sup> 6s <sup>1</sup>
63	Eu	[Xe] 4f <sup>7</sup> 6s <sup>2</sup>	[Xe] 4f <sup>7</sup> 6s <sup>1</sup>
64	Gd	[Xe] 4f <sup>7</sup> 5d <sup>1</sup> 6s <sup>2</sup>	[Xe] 4f <sup>7</sup> 5d <sup>1</sup> 6s <sup>1</sup>
65	Tb	[Xe] 4f <sup>9</sup> 6s <sup>2</sup>	[Xe] 4f <sup>9</sup> 6s <sup>1</sup>
66	Dy	[Xe] 4f <sup>10</sup> 6s <sup>2</sup>	[Xe] 4f <sup>10</sup> 6s <sup>1</sup>
67	Ho	[Xe] 4f <sup>11</sup> 6s <sup>2</sup>	[Xe] 4f <sup>11</sup> 6s <sup>1</sup>
68	Er	[Xe] 4f <sup>12</sup> 6s <sup>2</sup>	[Xe] 4f <sup>12</sup> 6s <sup>1</sup>
69	Tm	[Xe] 4f <sup>13</sup> 6s <sup>2</sup>	[Xe] 4f <sup>13</sup> 6s <sup>1</sup>
70	Yb	[Xe] 4f <sup>14</sup> 6s <sup>2</sup>	[Xe] 4f <sup>14</sup> 6s <sup>1</sup>
71	Lu	[Xe] 4f <sup>14</sup> 5d <sup>1</sup> 6s <sup>2</sup>	[Xe] 4f <sup>14</sup> 6s <sup>2</sup>
72	Hf	[Xe] 4f <sup>14</sup> 5d <sup>2</sup> 6s <sup>2</sup>	[Xe] 4f <sup>14</sup> 5d <sup>1</sup> 6s <sup>2</sup>
73	Ta	[Xe] 4f <sup>14</sup> 5d <sup>3</sup> 6s <sup>2</sup>	[Xe] 4f <sup>14</sup> 5d <sup>3</sup> 6s <sup>1</sup>
74	W	[Xe] 4f <sup>14</sup> 5d <sup>4</sup> 6s <sup>2</sup>	[Xe] 4f <sup>14</sup> 5d <sup>4</sup> 6s <sup>1</sup>
75	Re	[Xe] 4f <sup>14</sup> 5d <sup>5</sup> 6s <sup>2</sup>	[Xe] 4f <sup>14</sup> 5d <sup>5</sup> 6s <sup>1</sup>
76	Os	[Xe] 4f <sup>14</sup> 5d <sup>6</sup> 6s <sup>2</sup>	[Xe] 4f <sup>14</sup> 5d <sup>6</sup> 6s <sup>1</sup>
77	Ir	[Xe] 4f <sup>14</sup> 5d <sup>7</sup> 6s <sup>2</sup>	[Xe] 4f <sup>14</sup> 5d <sup>7</sup> 6s <sup>1</sup>
78	Pt	[Xe] 4f <sup>14</sup> 5d <sup>9</sup> 6s <sup>1</sup>	[Xe] 4f <sup>14</sup> 5d <sup>9</sup>
79	Au	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>1</sup>	[Xe] 4f <sup>14</sup> 5d <sup>10</sup>
80	Hg	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup>	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>1</sup>

81	Tl	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>1</sup>	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup>
82	Pb	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>2</sup>	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>1</sup>
83	Bi	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>3</sup>	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>2</sup>
84	Po	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>4</sup>	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>3</sup>
85	At	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>5</sup>	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>4</sup>
86	Rn	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>6</sup>	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>5</sup>
87	Fr	[Rn] 7s <sup>1</sup>	[Xe] 4f <sup>14</sup> 5d <sup>10</sup> 6s <sup>2</sup> 6p <sup>6</sup>
88	Ra	[Rn] 7s <sup>2</sup>	[Rn] 7s <sup>1</sup>
89	Ac	[Rn] 6d <sup>1</sup> 7s <sup>2</sup>	[Rn] 7s <sup>2</sup>
90	Th	[Rn] 6d <sup>2</sup> 7s <sup>2</sup>	[Rn] 6d <sup>2</sup> 7s <sup>1</sup>
91	Pa	[Rn] 5f <sup>2</sup> 6d <sup>1</sup> 7s <sup>2</sup>	[Rn] 5f <sup>2</sup> 7s <sup>2</sup>
92	U	[Rn] 5f <sup>3</sup> 6d <sup>1</sup> 7s <sup>2</sup>	[Rn] 5f <sup>3</sup> 7s <sup>2</sup>

The simple technique to find out the Periodic Properties is as follows.

The simple technique was **READ P**-ysics.

Here,

**R**  $\Rightarrow$  Stands for Reducing Nature.

**E**  $\Rightarrow$  Stands for Electro positivity.

**A**  $\Rightarrow$  Stands for Atomic size.

**D**  $\Rightarrow$  Stands for Decreases. (In)

**P**  $\Rightarrow$  Stands for Periods.

It means the three periodic properties like Reducing nature, Electro positivity and size are decreases in periods, increases in groups.

The remaining periodic properties are opposite to the above properties. I.e. Ionization energy, Electron affinity, Electro negativity and oxidising nature are increases in periods and decreases in groups.

**READ P**-ysics.

Atomic property	Periods (left to right)	Groups (top to bottom)
Reducing nature	Decreases	Increases
Electro positivity	Decreases	Increases
Atomic size	Decreases	Increases
Ionization energy	Do not follow any regular trend.	Decreases
Electron affinity	Increases	Decreases
Electro negativity	Increases	Decreases
Oxidising nature	Increases	Decreases

**NOTE:** - Don't confuse E-stands for Electro positivity but not Electro negativity or Electron affinity.



## జాబిలి పై మువన్నెల జెండా

దాదాపు మూడు లక్షల ఎనభై వేల కిలో మీటర్ల దూరం లో వుండి మనలను కనువిందు చేసే జాబిలిని భారత్ ఒడిసిపట్టుకుంది. జాబిలి పై తన మువన్నెల పతకాన్ని ఎగుర వేసింది. యదృఢికమో ఏమో భారతీయులకు ఎంతో ప్రశస్తమైన కార్తీక మాసం లో అందునా జవహర్ లాల్ నెహ్రూ గారి జయంతి రోజున ఈ విజయం సాధించారు. బాలల ధినోత్సవం రోజున .....చిన్నారులకు చందమామను కానుకగా ఇస్తున్నాం అని, అప్పటి ఇస్రో చైర్మన్ మాధవన్ నాయర్ సగర్వం గా ప్రకటించారు. చంద్రుని రహస్యాలు శోధించే లక్ష్యం తో 2008 అక్టోబర్ 22 న పి.సి.యల్. సి-11 ద్వారా ప్రయోగించిన చంద్రయాన్-1 తిరుగులేని విజయాన్ని నమోదు చేసింది. చంద్రుని కక్ష లో పరిభ్రమిస్తున్న చంద్రయాన్-1 వ్యామనౌక నుండి విడివడిన ప్రయోగ పరికరం నవంబర్ 14 రాత్రి 8:31 గంటలకు చంద్రుని దక్షిణ ద్వవానికి సమీపంలో షాకిల్టోస్ లోయకు దగ్గరగా అనుకున్నట్టుగానే సాఫీ గా తాకింది. దీనితో చంద్రుని ఉపరితలంపై యంత్రాలను పంపించిన అమెరికా, సోవియట్ రష్యా, యురోపియన్ యూనియన్ తర్వాత ఈ ఘనత సాధించిన దేశంగా భారత్ చరిత్ర పుటల కెక్కింది.



Methyl orange	Red	Yellow	
Methyl red	Red	Yellow	
Bromothymol blue	Yellow	Blue	
Litmus	Red	Blue	
Phenolphthalein	Colourless	Pink	
Indigo carmine	Blue	Yellow	
	Acids	Neutral	Bases

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