### 11.6 CATALYSIS

A catalyst is deined as a substance which alters the rate of a chemical reaction, but remains chemically unchanged at the end of the reaction. A catalyst is often present in a very small proportion. For example, the reaction between H2 and O2 to form water is very slow at ordinary temperature, but proceeds more rapidly in the presence of platinum. Platinum acts as a catalyst. Similarly, KClO3 decomposes much more rapidly in the presence of a small amount of MnO2. HCl is oxidised to Cl2 in the presence of CuCl2.

4HCl+O2 →CuCl2 2H O+2Cl2

2

The process, which takes place in the presence of a catalyst, is called catalysis. A catalyst provides a new reaction path with a low activation energy barrier, Fig.(11.10). A greater number of molecules are now able to get over the new energy barrier and reaction rate increases.

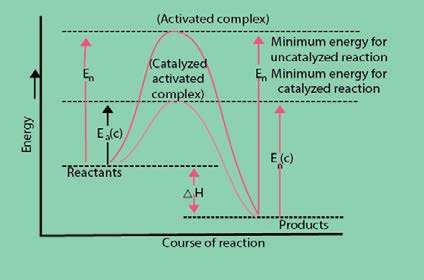
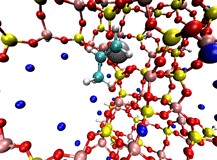


Fig. (11.10) Catalyzed and uncatalyzed reactions.



*Animation 11.22: CATALYSIS*

*Source & Credit :*

[*lsa.umic*](https://sites.lsa.umich.edu/zimmerman-lab/catalysis/)

[*h*](https://sites.lsa.umich.edu/zimmerman-lab/catalysis/)

**Types of Catalysis**

**(a) Homogeneous Catalysis**

#### (b) Heterogeneous Catalysis (a) Homogeneous Catalysis

In this process, the catalyst and the reactants are in the same phase and the reacting system is homogeneous throughout. The catalyst is distributed uniformly throughout the system. For example:

(i). The formation of SO3 (g) from SO2 (g) and O2 (g) in the lead chamber process for the manufacture of sulphuric acid, needs NO (g) as a catalyst. Both the reactants and the catalyst are gases.

2SO (g) + O (g) 2 2 ฀฀฀฀฀฀฀฀฀฀NO(g)  2SO (g)3

(ii). Esters are hydrolysed in the presence of H2SO4. Both the reactants and the catalyst are in the solution state.

CH COOC H (aq) + H O( ) 3 2 5 2 ฀฀฀฀฀฀฀฀฀฀H SOH O23 +4 CH COOH(aq) + C H OH(aq)3 2 5

#### (b) Heterogeneous Catalysis

In such systems, the catalyst and the reactants are in diferent phases. Mostly, the catalysts are in the solid phase, while the reactants are in the gaseous or liquid phasse. For example: (i). Oxidation of ammonia to NO in the presence of platinum gauze helps us to manufacture HNO3.

4NH (g) + 5O (g) 3 2 ฀฀฀฀฀฀฀฀Pt(s)฀ 4NO(g) + 6H O(g)2

(ii) Hydrogenation of unsaturated organic compounds are catalysed by inely divided Ni, Pd or Pt.

CH = CH (g) + H (g) 2 2 2 ฀฀฀฀฀฀฀฀Ni(s)฀ CH - CH (g)3 3

##### 11.6.1 Characteristics of a Catalyst

There are many types of catalysts with varying chemical compositions, but the following features are common to most of them.

1. A catalyst remains unchanged in mass and chemical composition at the end of reaction. It may not remain in the same physical state. MnO2 is added as a catalyst for the decomposition of KClO3 in the form of granules. It is converted to ine powder at the end of reaction. It has been found in many cases that the shining surfaces of the solid catalyst become dull.
2. Sometimes, we need a trace of a metal catalyst to afect very large amount of reactants. For example, 1 mg of ine platinum powder can convert 2.5 dm3 of H2 and 1.25 dm3 of O2 to water. Dry HCl and NH3 don’t combine, but in the presence of trace of moisture, they give dense white fumes of NH4Cl. Thousands of dm3 of H2O2, can be decomposed in the presence of 1 g of colloidal platinum.
3. A catalyst is more afective, when it is present in a inely divided form. For example, a lump of platinum will have much less catalytic activity than colloidal platinum. In the hydrogenation of vegetable oils inely divided nickel is used.
4. A catalyst cannot afect the equilibrium constant of a reaction but it helps the equilibrium to be established earlier. The rates of forward and backward steps are increased equally.
5. A catalyst cannot start a reaction, which is not thermodynamically feasible. It is now considered that a catalyst can initiate a reaction. The mechanism of a catalysed reaction is diferent from that of an uncatalysed reaction.

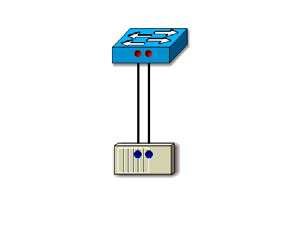
For example:

1. The presence of CO as an impurity with hydrogen decreases the catalytic activity of catalyst in the Haber’s process for the manufacture of NH3.
2. The manufacture of H2SO4 in the contact process needs platinum as a catalyst. The traces of arsenic present as impurities in the reacting gases makes platinum inefective. That’s why arsenic puriier is employed in the contact process.

##### 11.6.2 Activation of Catalyst

Such a substance which promotes the activity of a catalyst is called a promotor or activator. It is also called “catalyst for a catalyst”. For example :

1. Hydrogenation of vegetable oils is accelerated by nickel. The catalytic activity of nickel can be increased by using copper and tellurium.



*Animation 11.23: Characteristics of a Catalyst*

*Source & Credit :*

[*logilen*](http://campus.logilent.com/weblesson/ccna3/icnde/html/lobody33554589.htm)

[*t*](http://campus.logilent.com/weblesson/ccna3/icnde/html/lobody33554589.htm)

1. In Haber’s process for the manufacture of ammonia, iron is used as a catalyst. If small amounts of some high melting oxides like aluminum oxide, chromium oxide or rare earth oxides are added, they increase the eiciency of iron.

#### Negative Catalysis

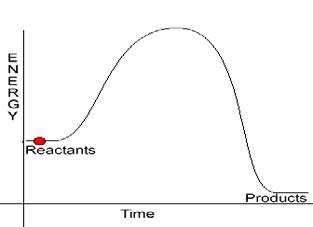
When the rate of reaction is retarded by adding a substance, then it is said to be a negative catalyst or inhibitor. For example, tetraethyl lead is added to petrol, because it saves the petrol from pre-ignition.

#### Autocatalyst

In some of the reactions, a product formed acts as a catalyst. This phenomenon is called auto- catalysis. For example:

1. When copper is allowed to react with nitric acid, the reaction is slow in the beginning. It gains the speed gradually and inally becomes very fast. This is due to the formation of nitrous acid during the reaction, which accelerates the process.
2. The reaction of oxalic acid with acidiied KMnO4 is slow at the beginning, but after sometimes, MnSO4 produced in the reaction makes it faster.

2KMnO + 3H SO + 5(COOH4 2 4 )2 →Mn2+ K SO + 2MnSO + 10CO2 4 4 2 + 8H O2



*Animation 11.24: Activation of Catalyst*

*Source & Credit :*

[*dynamicscienc*](http://www.dynamicscience.com.au/tester/solutions1/chemistry/rates/catalyst.htm)

[*e*](http://www.dynamicscience.com.au/tester/solutions1/chemistry/rates/catalyst.htm)

##### 11.6.3. Enzyme catalysis

Enzymes are the complex protein molecules and catalyze the organic reactions in the living cells. Many enzymes have been identiied and obtained in the pure crystalline state. However, the irst enzyme was prepared in the laboratory in 1969. For example:

1. Urea undergoes hydrolysis into NH3 and CO2 in the presence of enzyme urease present in soyabean.

O

฀

H N2 C NH +H O2 2 →Urease 2NH +CO3  2

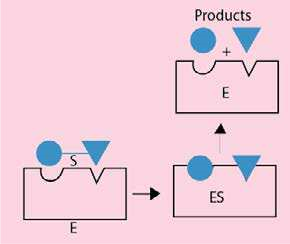
1. Concentrated sugar solution undergoes hydrolysis into glucose and fructose by an enzyme called invertase, present in the yeast.

C H O + H O12 22 11 2 →Inertase C H O + C H O6 12 6 6 12 6

1. Glucose is converted into ethanol by the enzyme zymase present in the yeast.

C H O6 12 6 →Zymase 2C H OH + 2CO2 5 2

Enzymes have active centres on their surfaces. The molecules of a substrate it into-their cavities just as a key its into a lock Fig. (11.11). The substrate molecules enter the cavities, form the complex, reactants and the products get out of the cavity immediately. Michaulis and Menter(1913) proposed the following mechanism for enzyme catalysis

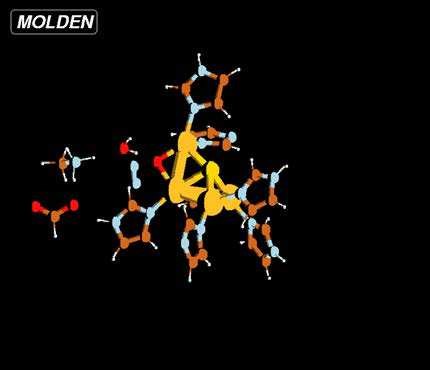
E + S ฀ES → P + E

Where

E = enzyme, S = substrate (reactant)

ES = activated complex, P = product

Fig. (11.11) Lock and key model of enzyme catalysis



*Animation 11.25: Enzyme catalysis*

*Source & Credit :*

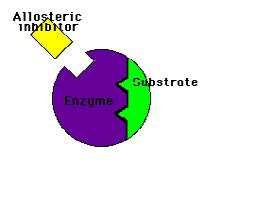
[*kt*](http://www.theochem.kth.se/research/bio/enzyme.html)

[*h*](http://www.theochem.kth.se/research/bio/enzyme.html)

##### 11.6.4 Characteristics of Enzyme Catalysis

The role of enzyme as catalysts is like inorganic heterogeneous catalysts. They are unique in their eiciency and have a high degree of speciicity. For example:

1. Enzymes are the most eicient catalysts known and they lower the energy of activation of a reaction.
2. Enzymes catalysis is highly speciic, for example, urease catalyses the hydrolysis of urea only and it cannot hydrolyse any other amide even methyl urea.
3. Enzyme catalytic reactions have the maximum rates at an optimum temperature.
4. The pH of the system also controls the rates of the enzyme catalysed reaction and the rate passes through a maximum at a particular pH, known as an optimum pH. The activity of enzyme catalyst is inhibited by a poison.
5. The catalytic activity of enzymes is greatly enhanced by the presence of a co-enzyme or activator.



*Animation 11.26: Characteristic of Enzyme*

*Source & Credit :*

[*tdm*](http://intranet.tdmu.edu.ua/data/kafedra/internal/chemistry/classes_stud/en/nurse/BSN/ptn/2/02.%20Investigation%20of%20structure%20and%20physical-chemical%20properties%20of%20proteins-enzymes.%20Mechanism%20of%20enzyme%20action,%20kinetic%20of%20enzymatic%20catalysis.htm)

[*u*](http://intranet.tdmu.edu.ua/data/kafedra/internal/chemistry/classes_stud/en/nurse/BSN/ptn/2/02.%20Investigation%20of%20structure%20and%20physical-chemical%20properties%20of%20proteins-enzymes.%20Mechanism%20of%20enzyme%20action,%20kinetic%20of%20enzymatic%20catalysis.htm)

#### KEY POINTS

1. The studies concerned with rates of chemical reactions and factors that afect the rates of chemical reactions and the mechanism of reactions constitute the subject matter of reaction kinetics.
2. The rate of a reaction is the change in the concentration of a reactant or a product divided by the time taken for the reaction. The rate of reaction between two speciic time intervals is called the average rate of reaction. While the rate at any one instant during the interval is called the instantaneous rate. Rate constant of a chemical reaction is rate of reaction when the concentrations of reactants are unity.
3. Order of reaction is the sum of exponents of the concentation terms in the rate expression of a chemical reaction.The exponents in the expression may or may not be diferent from the coeicients of the chemical equation. Order of a reaction may be zero, whole number or fractional.
4. Half life period of a reaction is the time required to convert 50% of the reactants into products. Half-life period of any reaction is inversely proportional to the initial concentration raised to the power one less than the order of that reaction.
5. The step which limits how fast the overall reaction can proceed, is known as the rate determining step.
6. Determination of the rate of a chemical reaction involves the measurement of the concentration of reactants or products at regular time intervals during the progress of reaction. The change in concentration of reactants and products can be determined by both physical and chemical methods.
7. The efective collisions between the colliding species will take place only when the reactant molecules possess minimum amount of energy, which is called the energy of activation. Moreover, proper orientation is also necessary.

8 . All those factors, which change the number of efective collisions per second, afect the rate of chemical reaction. Some of the important factors are, nature and concentration of reactants, surface area, light, and temperature and catalyst.

1. A catalyst is a substance, which alters the rate of a chemical reaction, but itself remains chemically unchanged at the end of reaction. The process when the catalyst and the reactants are in the same phase is said to be a homogenous catalysis. In case of heterogeneous catalysis, the catalyst and the reactants are in diferent phases. A substance, which promotes the activity of a catalyst, is called promoter or activator. In certain reactions, a product formed acts as a catalyst, the phenomenon is called auto-catalysis.
2. Enzymes are the complex protein molecules, which catalyze the reactions in the living cells.

### EXERCISE

Q.1 Multiple choice questions.

1. In zero order reaction, the rate is independent of
   1. temperature of reaction. (b) concentration of reactants,

c) concentration of products (d) none of these

1. If the rate equation of a reaction 2A + B → products is, rate =k[A]2 [B], and A is present in large excess, then order of reaction is
   1. 1 (b) 2 (c) 3 (d) none of these
2. The rate of reaction
   1. increases as the reaction proceeds.
   2. decreases as the reaction proceeds.
   3. remains the same as the reaction proceeds.
   4. may decrease or increase as the reaction proceeds.
3. With increase of 10°C temperature the rate of reaction doubles. This increase in ate of reaction is due to:
   1. decrease in activation energy of reaction.
   2. decrease in the number of collisions between reactant molecules.
   3. increase in activation energy of reactants.
   4. increase in number of efective collisions.
4. The unit of the rate constant is the same as that of the rate of reaction in (a) irst order reaction. (b) second order reaction. (c) zero order reaction. (d) third order reaction. Q.2 Fill in the blanks with suitable words.

(i) The rate of an endothermic reaction\_\_\_\_\_\_\_ with the increase in temperature. (ii) All radioactive disintegration nuclear reactions are of\_\_\_\_\_\_\_\_ order

1. For a fast reaction the rate constant is relatively and half - life is \_\_\_\_\_\_ .
2. The second order reaction becomes\_\_\_\_\_\_ if one of the reactants is in large excess.
3. Arrhenius equation can be used to ind out\_\_\_\_\_\_\_\_of a reaction.

Q.3 Indicate true or false as the case may be.

1. The half life of a irst order reaction increases with temperature.
2. The reactions having zero activation energies are instantaneous. (iii) A catalyst makes a reaction more exothermic.
3. There is diference between rate law and the law of mass action.
4. The order of reaction is strictly determined by the stoichiometry of the bdanced equation.

Q4. What is chemical kinetics? How do you compare chemical kinetics with clemical equilibrium and thermodynamics.

Q5. The rate of a chemical reaction with respect to products is written with positive sign, but with respect to reactants is written with a negative sign. Explain it with reference to the following hypothetical reaction.

aA + bB → cC + dD

Q6 . What are instantaneous and average rates? Is it true that the instantaneousrate of a reaction at the beginning of the reaction is greater than average rate and beomes far less than the average rate near the completion of reaction?

Q7. Diferentiate between

(i) Rate and rate constant of a reaction

(ii ) Homogeneous and heterogeneous catalyses

1. Fast step and the rate determining step
2. Enthalpy change of reaction and energy of activation of reaction

Q8. Justify the following statements

1. Rate of chemical reaction is an ever changing parameter uner the given conditions.
2. The reaction rate decreases every moment but rate constant ‘k’ of the reation is a constant quantity, under the given conditions.
3. 50% of a hypothetical irst order reaction completes in one hour. The renaming 50% needs more than one hour to complete.

(v) The radioactive decay is always a irst order reaction.

(iv) The unit of rate constant of a second order reaction is dm3 mol-1s-1, but the uit of rate of reaction is mol dm-3s-1S.

(vi) The sum of the coeicients of a balanced chemical equation is not neessarily important to give the order of a reaction.

(vii ) The order of a reaction is obtained from the rate expression of a reaction anthe rate expression is obtained from the experiment.

Q9. Explain that half life method for measurement of the order of a reaction can help us to measure the order of even those reactions which have a fractional order.

Q10. A curve is obtained when a graph is plotted between time on x-axis and concentration on y-axis. The measurement of the slopes of various points give us the instantaneous rates of reaction. Explain with suitable examples.

Q11. The rate determining step of a reaction is found out from the mechanism of that reaction. Explain it with few examples.

Q12. Discuss the factors which inluence the rates of chemical reactions. Q.13. Explain the following facts about the reaction.

2NO(g) + 2H (g2 ) → 2H O(g) + N (g2 2 )

1. The changing concentrations of reactants, change the rates of this reaction.
2. Individual orders with respect to NO and H2 can be measured.
3. The overall order can be evaluated by keeping the concentration of one of the substances constant.

Q14. The collision frequency and the orientation of molecules are necessary conditions for determining the proper rate of reaction. Justify the statement.

Q.15. How does Arrhenius equation help us to calculate the energy of activation of a reaction?

Q16. Deine the following terms and give examples

(i) Homogeneous catalysis (ii) Heterogeneous catalysis

(iii) Activation of a catalyst (iv) Auto-catalysis

(v) Catalytic poisoning (vi) Enzyme catalysis

Q17. Briely describe the following with examples

1. Change of physical state of a catalyst at the end of reaction.
2. A very small amount of a catalyst may prove suicient to carry out a reaction.
3. A inely divided catalyst may prove more efective.
4. Equilibrium constant of a reversible reaction is not changed in the presence of a catalyst.(v) A catalyst is speciic in its action.

Q18. What are enzymes? Give examples in which they act as catalyst. Mention the characteristics of enzyme catalysis.

Q19. In the reaction of NO and H2, it was observed that equimolecular mixture of gases at 340.5 mm Hg pressure was half changed in 102 seconds. In another experiment with an initial pressure of 288 mm of Hg, the reaction was half completed in 140 seconds. Calculate the order of reaction. (Ans:2.88)

Q20. A study of chemical kinetics of a reaction

|  |  |  |
| --- | --- | --- |
| [A] | [B] | Rate |
| 1.00 2.00  1.00 | 0.15  0.15  0.2 | 4.2 x 10-6 8.4 x 10-6  5.6 x 10-6 |

A + B → Products

gave the following data at 25 °C. Calculate the rate law.

(Ans: second order)

Q21. Some reactions taking place around room temperature have activation energies around 50kJ mol-1.

-E

1. What is the value of the factor eRT at 25 Co ?

(Ans: 1.72x10-9)

1. Calculate this factor at 35 °C anat 45 0C and note1 the increase in this factor for every 10 0C rise in temperature.

(Ans:3.31x10-9)

1. Prove that for every 10°C rise in of temperature, the factor doubles and so rate constant also doubles.

(Ans:6.12x10-9)

|  |  |
| --- | --- |
| Temp.  (K) | Rate constant  (cm3 mol-1 s-1) (K) |
| 500  550  600  650  700 | 6.814 x 10-4  2.64 x 10-2  0.56 x 100  7.31 x 100  66.67 x 100 |

Q22. H2 and I2 react to produce HI. Following data for rate constant at various temperatures (K) have been collected.

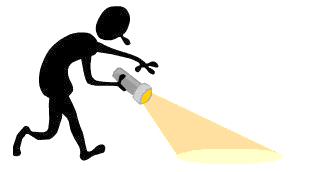
1. Plot a graph between 1 on x-axis and log k on the y-axis.

T

1. Measure the slope of this straight line and calculate the energy for activation of this reaction.

(Ans: 8326.32,160.6kJmol-1)

## APPENDIX



Animation: [Appendix](http://olivergoodwin.com/the-power-of-facebook-broad-interest-targeting/)

Source & Credit: [olivergoodwin](http://olivergoodwin.com/the-power-of-facebook-broad-interest-targeting/)

**Table A.1 The SI System**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Physical Quantity | Name  in Units | Symbol | Physical Quantity | Name  in Units | Symbol |
| Length | meter | m | Volume | cubic meter | m3 |
| Mass | kilogram | kg | Length | angstrom | o  A(0.1nm) |
| Time | second | s | Pressure | atmosphere | atm(101.325kPa) |
| Temperature | Kelvin | K |  | torr | mmHg(133.32Pa) |
| Electrical current | ampere | A | Energy | calorie | cal(4.184J) |
| Luminous intensity | candela | cd |  | electron volt | ev(1.6022x10-19J) |
| Amount of substance | mole | mol | Temperature | degree celsius | o  C (K-273.15) |
|  |  |  | Concentration | molarity | M(mol/L or mol/dm )3 |

**Table A.2 Common Derived Units in SI**

|  |  |  |
| --- | --- | --- |
| Physical Quantity | Name  in Unit | Symbol |
| Energy | joul | J(kg-m /s )2 2 |
| Frequency | hertz | Hz(cycles/s) |
| Force | newton | N(kg-m/s )2 |
| Pressure | pascal | P (N/M )a 2 |
| Power | watt | W(j/s) |
| Electrical charge | coulomb | C(amp-s) |
| Electrical potential | volt | V(j/c) |
| Electrical resistance | ohm | Ù(v/amp) |
| Electrical conductance | siemens | S(amp/V) |
| Electrical capacitance | farad | F(C/V) |

**TableA.3 Fraction and Multiplies for Use in SI**

|  |  |  |  |
| --- | --- | --- | --- |
| Fraction and Multiplies for Use in SI | | | |
| exa, E | 1018 | deci, d | 10-1 |
| peta, P | 1015 | centi, c | 10-2 |
| tera, T | 1012 | milli, m | 10-3 |
| giga, G | 109 | micro, m | 10-6 |
| mega, M | 106 | nano, n | 10-9 |
| kilo, k | 103 | pico, p | 10-12 |
| hecto, h | 102 | femto, f | 10-15 |
| deca, da | 101 | atto, a | 10-18 |

**Table A.4 Values of Selected Fundamental Constants**

|  |  |
| --- | --- |
| Speed of light in vacuum (c) | c = 2.99792458x10 m/s8 |
| Charge on an electron (qe) | q = 1.6021892x10e -19C |
| Rest mass of electron (me) | m = 19.109534x10e -28g  m = 5.4858026x10 amue -4 |
| Rest mass of proton (mp) | m = 1.6726485x10p -24g  m = 1.00727647amup |
| Rest mass of neutron (mn) | m = 1.6749543x10n -24g m = 1.00865012amun |
| Faraday’s constant (F) | F = 96484.56 C/mol |
| Planck’s constant (h) | h = 6.626176x10-34J-s |
| Ideal gas constant (R) | R = 0.0820568 L-atm/mol-K  R = 8.31441 J/mol-K |
| Atomic mass unit (amu) | 1 amu = 1.6605655x10-24g |
| Boltzmann’s constant (k) | k = 1.380662x10−23 J/K |
| Aogadro’s constant (NA) | N = 6.022045x10 mola 23 -1 |
| Rydberg constant (RH) | R = 1.09737318x10 mH 7 -1  = 1.09737318x10 nm-2 -1 |
| Molar Volume of a gas at s.t.p | V = 2.24x10 m molm -2 3 -1 |
| Heat capacity of water | C = 75.276J/mol-K |

**Table A.5 Selected Conversion Factors**

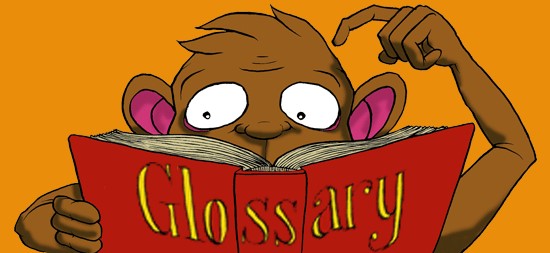
|  |  |
| --- | --- |
| Energy  Temperature  Pressure  Mass  Volume  Length | 1 J = 0.2390 cal = 10 erg7  1 cal = 4.184 J lev/atom = 1.6021892x10-19J/atom = 96.484 kJ/mol |
| K = C + 273.15 0  C = 5/9 (F-32) 0  F = 9/5 (C) + 32 |
| 1am = 760 mmHg = 760 torr = 101.325kPa |
| 1kg = 2.2046 lb  1lb = 453.59 g = 0.45359 kg  1oz = 0.06250 lb = 28.350 g  1ton = 2000 lb = 907.185 kg  1tonne (metric) = 1000 kg = 2204.62 lb |
| 1 mL = 0.001 L = 1 cm3  1 oz (fluid) = 0.031250 qt = 0.029573 L  1 qt = 0.946326 L  1 gal = 0.946 L |
| 1 mile = 1.60934 km  1 in. = 2.45 cm  10mm = 1 cm  1000mm = 1 m  1000m = 1 km  1m = 39.370 in.  o  A = 10-10 m = 10 cm-8 |

### Table A.6 Solubility Table

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | F- | Cl- | Br- | I- | O2- | S2- | OH- | NO3- | CO32- | SO42- | CH3COO- |
| H+ | S | S | S | S | S | s | S | S | s | S | S |
| Na+ | S | S | S | S | S | S | S | S | S | S | S |
| K+ | S | S | S | S | S | S | S | S | S | S | S |
| NH4+ | S | S | S | S | - | S | S | S | S | S | S |
| Ag+ | S | I | I | I | I | I | - | S | I | I | I |
| Mg2+ | I | S | S | S | I | d | I | S | I | S | S |
| Ca2+ | I | S | S | S | I | d | I | S | I | I | S |
| Ba2+ | I | S | S | S | s | d | s | S | I | I | S |
| Fe2+ | s | S | S | S | I | I | I | S | s | S | S |
| Fe3+ | I | S | S | - | I | I | I | S | I | S | I |
| Co2+ | S | S | S | S | I | I | I | S | I | S | S |
| NI2+ | s | S | S | S | I | I | I | S | I | S | S |
| Cu2+ | s | S | S | - | I | I | I | S | I | S | S |
| Zn2+ | s | S | S | S | I | I | I | S | I | S | S |
| Hg2+ | d | S | I | I | I | I | I | S | I | d | S |
| Cd3+ | s | S | S | S | I | I | I | S | I | S | S |
| Sn2+ | S | S | S | s | I | I | I | S | I | S | S |
| Pb2+ | I | I | I | I | I | I | I | S | I | I | S |
| Mn2+ | s | S | S | S | I | I | I | S | I | S | S |
| Al3+ | I | S | S | S | I | d | I | S | - | S |  |

**Key : S = Soluble in water I = Insoluble in water (less than 1g/l00g H2O) s = Slightly soluble in water d = Decompose in water**

## GLOSSARY



Animation: [Glosssary](http://www.speedyromeo.com/glossary/)

Source & Credit: [speedyromeo](http://www.speedyromeo.com/glossary/)

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| [**Absolute zero:**](https://en.wikipedia.org/wiki/Absolute_zero) | The temperature of -273.16 °C at which the volume of a gas theoretically becomes zero is called absolute zero. It is taken as Zero on the kelvin scale of temperature. |
| [**Actual yield:**](https://en.wikipedia.org/wiki/Yield_(chemistry)) | Actual yield is the amount of the product actually obtained in a chemical reaction. |
| [**Amorphous solids:**](https://en.wikipedia.org/wiki/Amorphous_solid) | Those solids in which the structural units i.e. atoms, ions or molecules are ixed in their positions but are not regularly arranged. |
| [**Anisotropy:**](https://en.wikipedia.org/wiki/Anisotropy) | It is the variation of a certain physical property with direction. |
| [**Atomic absorption spectrum:**](https://en.wikipedia.org/wiki/Atomic_absorption_spectroscopy) | When a beam of white light is passed through the vapours or a gas, the element absorbs certain wavelengths, while rest of the wavelengths are passed through it. The spectrum of this radiation is called atomic absorption spectrum. The missing wavelengths appear as dark lines in the spectrum. |

[**Atomic emission spectrum:**](https://en.wikipedia.org/wiki/Atomic_emission_spectroscopy)It is the spectrum formed by the elements or their compounds when they are heated in a lame. The spectrum consists of a

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|  | series of bright lines with a dark background. |
| [**Atomic radius:**](https://en.wikipedia.org/wiki/Atomic_radius) | If an atom is assumed to be spherical then the atomic size means the average distance between the nucleus of the atom and its outermost shell. This distance is called atomic radius and it can not be measured precisely. |
| [**Auf-bau principle:**](https://en.wikipedia.org/wiki/Aufbau_principle) | The electrons should be illed in energy sub-levels in order of increasing energy values. The electrons are irst placed in Is, then 2s, then 2p and so on. |
| [**Average Rate of Reaction:**](https://en.wikipedia.org/wiki/Reaction_rate) | The rate of reaction between two speciic time intervals is called average rate of reaction. |
| [**Avogadro’s law:**](https://en.wikipedia.org/wiki/Avogadro%27s_law) | Equal volumes of all ideal gases at same temperature and pressure contain equal number of molecules. |
| [**Avogadro’s number:**](https://en.wikipedia.org/wiki/Avogadro_constant) | Avogadro’s number is the number of atoms, molecules or ions in one gram atom of an element, one gram mole of a compound or one gram ion of an ionic substance. |
| [**Azimuthal quantum number:**](https://en.wikipedia.org/wiki/Azimuthal_quantum_number) | The quantum number that deines the shape of the orbital of an electron. |
| [**Balmer series:**](https://en.wikipedia.org/wiki/Balmer_series) | A series of lines present in the visible region of hydrogen spectrum formed when an electron jumps from higher orbits to the 2nd orbit. |

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| [**Boiling point:**](https://en.wikipedia.org/wiki/Boiling_point) | The temperature at which the vapour pressure of a liquid becomes equal to the external pressure, is called boiling point of the liquid. |
| [**Bond energy:**](https://en.wikipedia.org/wiki/Bond_energy) | The average amount of energy required to break all bonds of a particular type in one mole of the substance. |
| [**Bond order:**](https://en.wikipedia.org/wiki/Bond_order) | Half of the diference between the number of bonding electrons and anti-bonding electrons. |
| [**Boyle’s law (1662):**](https://en.wikipedia.org/wiki/Boyle%27s_law) | The volume of the given mass of a gas is inversely proportional to the pressure of that gas when the temperature is kept constant. |
| [**Brackett series:**](https://en.wikipedia.org/wiki/Brackett) | A series of lines in the infra red region of hydrogen spectrum formed when the electron jumps from higher orbits to the fourth orbit. |
| [**Catalyst:**](https://en.wikipedia.org/wiki/Catalysis) | The substance which alters the rate of a chemical reaction but remains chemically unchanged at the end of reaction. |
| [**Cathode rays:**](https://en.wikipedia.org/wiki/Cathode_ray) | Negatively charged rays which originate from the cathode when electricity is passed through a gas at very low pressure. |
| [**Charles’s law (1787):**](https://en.wikipedia.org/wiki/Charles%27s_law) | The volume of a given mass of a gas is directly proportional to absolute temperature when the pressure is kept constant. |
| [**Chromatography:**](https://en.wikipedia.org/wiki/Chromatography) | It is a method used for the separation of components of a mixture. |
| [**Colligative properties:**](https://en.wikipedia.org/wiki/Colligative_properties) | These are the properties of solutions that depend only on the number of solute and solvent molecules or ions. |
| [**Common ion effect:**](https://en.wikipedia.org/wiki/Common-ion_effect) | The decrease in the solubility of an electrolyte in a solution in the presence of a common ion is called common ion efect. |
| [**Conjugate acid of a base:**](https://en.wikipedia.org/wiki/Conjugate_acid) | The positively charged ion produced by the acceptance of a proton by a base is the conjugate acid of the base. |
| [**Conjugate base of the acid:**](https://en.wikipedia.org/wiki/Conjugate_acid)The negatively charged ions or a neutral species produced by the release of proton is the conjugate base of the compound releasing the proton.  [**Covalent crystals:**](https://en.wikipedia.org/wiki/Crystal)Those crystals in which the non-metallic atoms are held together in a network of single covalent bonds.  [**Covalent radius:**](https://en.wikipedia.org/wiki/Covalent_radius)It is half the length of a covalent bond between tw’o atoms.  [**Critical temperature:**](https://en.wikipedia.org/wiki/Lower_critical_solution_temperature)That temperature of a gaseous substance above which it cannot be converted into the liquid state no matter how much the pressure is applied on it.  [**Crystal lattice or space**](https://en.wikipedia.org/wiki/Crystal_structure) A particular three dimensional arrangement of particles i.e.  [**lattice:**](https://en.wikipedia.org/wiki/Crystal_structure)atoms, ions or molecules in a crystal is. called a crystal lattice or  space lattice. | |

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| [**Crystal:**](https://en.wikipedia.org/wiki/Crystal) | A three dimensional shape bounded by plane surfaces which intersect at deinite angles with each other. |
| [**Crystallization:**](https://en.wikipedia.org/wiki/Crystallization) | A process in which a crude product is puriied and obtained in the form of crystals. |
| [**Dalton’s law of partial pressures:**](https://en.wikipedia.org/wiki/Dalton%27s_law) | Total pressure of a mixture of gases is equal to the sum of the partial pressures of all the gases in the mixture. |
| [**Diffusion of gases:**](https://en.wikipedia.org/wiki/Diffusion) | The spontaneous mixing of the molecules of diferent gases by random motion and collisions to form homogeneous mixture is called gaseous difusion. |
| [**Dipole moment:**](https://en.wikipedia.org/wiki/Dipole_moment) | It is a product of charge and the distance between the positive and negative centers present in a compound. |
| [**Dipole:**](https://en.wikipedia.org/wiki/Dipole) | Partial separation of charges on a bond between two atoms. |
| [**Dipole-Dipole forces:**](https://en.wikipedia.org/wiki/Intermolecular_force) | The attractive forces between the positive end of one molecule and the negative end of the another polar molecule are called dipole-dipole forces. |
| [**Discharge tube:**](https://en.wikipedia.org/wiki/Gas-discharge_lamp) | A glass tube containing a gas at low pressure and is provided with electrodes for the passage of electricity through the gas. |
| [**Effusion of gases:**](https://en.wikipedia.org/wiki/Effusion) | With the passage of the gas molecules one by one without collisions through a pin hole in their container into an evacuated space is called efusion. |
| [**Electrochemical Cell:**](https://en.wikipedia.org/wiki/Electrochemical_cell) | It is a system consisting of electrodes that dip into an electrolyte and in which a chemical reaction either uses or generates electric current. |
| [**Electrode potential:**](https://en.wikipedia.org/wiki/Electrode_potential) | It is the tendency of a metal to form its ions or to get deposited on the metal when a metal is dipped into the solution of its own ions. |
| [**Electrolysis:**](https://en.wikipedia.org/wiki/Electrolysis) | It is the decomposition of ionic compounds by the passage of electric current. |
| [**Electrolytic conduction:**](https://en.wikipedia.org/wiki/Conductivity_(electrolytic)) | It is the passage of electric current through electrolytes present in the fused state or in the solution form. |
| [**Electron afinity:**](https://en.wikipedia.org/wiki/Electron_affinity) | Attraction of nucleus of an atom for an extra electron. |
| [**Electronegativity:**](https://en.wikipedia.org/wiki/Electronegativity) | Tendency of a bonded atom to attract the shared electron pair towards itself. |
| [**Empirical formula:**](https://en.wikipedia.org/wiki/Empirical_formula) | That formula of a compound which is based on the formula unit and gives the simple whole number ratio of the atoms in the molecule is called empirical formula. |

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| [**Endothermic reactions:**](https://en.wikipedia.org/wiki/Endothermic_process) | The chemical reactions, which are accompanied by absorption of heat, are called endothermic reactions. |
| [**Enthalpy or heat of solution:**](https://en.wikipedia.org/wiki/Enthalpy_change_of_solution) | It is deined as the heat change when one mole of a substance is dissolved in a speciied number of moles of solvent at a given temperature. |
| [**Enthalpy:**](https://en.wikipedia.org/wiki/Enthalpy) | The total heat content of a system is termed as enthalpy of a system. |
| [**Equilibrium constant:**](https://en.wikipedia.org/wiki/Equilibrium_constant) | Equilibrium constant is the ratio of forward rate constant and backward rate constant for a reaction at given condition. |
| [**Evaporation:**](https://en.wikipedia.org/wiki/Evaporation) | The spontaneous change of a liquid into its vapours at the surface of liquid at a given temperature is called evaporation. |
| [**Exothermic reaction:**](https://en.wikipedia.org/wiki/Exothermic_reaction) | The chemical reactions, which are accompanied by the evolution of heat, are called exothermic reactions. |
| [**First law of thermodynamics:**](https://en.wikipedia.org/wiki/First_law_of_thermodynamics) | It states that energy can neither be created nor be destroyed but can be changed from one form to another. |
| [**Graham ‘s law of diffusion:**](https://en.wikipedia.org/wiki/Graham%27s_law) | The rate of difusion of a gas is inversely proportional to the square root of the density of the gas or the molar mass of gas under the given conditions of temperature and pressure. |
| [**Half-life period:**](https://en.wikipedia.org/wiki/Half-life) | Half-life period of a reaction is the time required to convert 50% of the reactants into products. |
| [**Heisenberg’s uncertainty principle:**](https://simple.wikipedia.org/wiki/Heisenberg%27s_uncertainty_principle) | It is not possible to measure simultaneously the exact position and momentum of an electron in an atom. |
| [**Hess’s law of constant heat summation:**](https://en.wikipedia.org/wiki/Hess%27s_law) | If a chemical change takes place by several diferent routes, the overall energy change is the same, regardless of the route by which the chemical change occurs, provided the initial and inal conditions are the same. |
| [**Hund’s rule:**](https://en.wikipedia.org/wiki/Hund%27s_rules) | If degenerate orbitals are available and more than one electrons are to be placed in them, they should be placed in separate orbitals with the same spin rather than putting them in the same orbital with opposite spins. |
| [**Hybridization:**](https://en.wikipedia.org/wiki/Hybridisation) | Mixing of orbitals to form new orbitals with speciic orientations. |
| [**Hydration:**](https://en.wikipedia.org/wiki/Hydration) | The process in which water molecules surround and interact with solute molecules or ions is called hydration. |
| [**Hydrogen bonding:**](https://en.wikipedia.org/wiki/Hydrogen_bond) | Hydrogen bondingis the electrostatic force of attraction between hydrogen atom (bonded to a small highly electronegative atom) and the electronegative atom of another molecule. |
| [**Ideal gas:**](https://en.wikipedia.org/wiki/Ideal_gas) | A gas which obeys the gas laws at all temperatures and pressures. |
| [**Ideal solutions:**](https://en.wikipedia.org/wiki/Ideal_solution) | Those solutions which obey Raoult’s law. |

[**Instantaneous Rate of Reaction:**](https://en.wikipedia.org/wiki/Reaction_rate)The rate of reaction at any one instant during the interval.

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| [**Intermolecular forces:**](https://en.wikipedia.org/wiki/Intramolecular_force) | The attractive forces which exist between individual particles i.e. atoms, ions and molecules. |
| [**Ion dipole interactions:**](https://en.wikipedia.org/wiki/Intermolecular_force) | The electrostatic forces of attraction between an ion (positive or negative) and the polar molecules of the solvent. |
| [**Ionic crystals:**](https://en.wikipedia.org/wiki/Ionic_compound) | Those crystals in which the oppositely charged ions are held together by an ionic bond. |
| [**Ionic radius:**](https://en.wikipedia.org/wiki/Ionic_radius) | It is the radius of an ion considered spherical in shape. |
| [**Ionization Energy:**](https://en.wikipedia.org/wiki/Ionization_energy) | It is the minimum amount of energy required to remove the most loosely bound electron from an isolated gaseous atom. |
| [**Irreversible reaction:**](https://en.wikipedia.org/wiki/Irreversible_process) | An irreversible reaction is that in which products of the reaction do not react to form the original reactants under the same set of conditions. |
| [**Kinetic molecular theory of gases:**](https://en.wikipedia.org/wiki/Kinetic_theory_of_gases) | A model of gases which explains the physical behaviour of gases. |
| [**Law of mass action:**](https://en.wikipedia.org/wiki/Law_of_mass_action) | The rate at which a substance reacts is proportional to its active mass and the rate of a chemical reaction is proportional to the product of the active masses of the reacting substances. |
| [**Le-Chatelier’s principle:**](https://en.wikipedia.org/wiki/Le_Chatelier%27s_principle) | If a system at equilibrium is disturbed, it behaves in such a way as to nullify the efect of that disturbance. |
| [**Limiting reactant:**](https://en.wikipedia.org/wiki/Limiting_reagent) | Limiting reactant is that reactant which is present in lesser amount and controls the amount of the products in a chemical reaction. |
| [**Liquid crystal:**](https://en.wikipedia.org/wiki/Liquid_crystal) | That crystalline state of a substance which exists between two temperatures i.e. the melting temperature and the clearing temperature. |

[**London dispersion forces:**](https://en.wikipedia.org/wiki/London_dispersion_force)The attractive forces between the temporary dipole in one molecule and temporary induced dipole in an adjacent molecule are called London dispersion forces, adjacent molecule are called London dispersion forces.

[**Lowry-Bronsted Concepts**](https://en.wikipedia.org/wiki/Br%C3%B8nsted%E2%80%93Lowry_acid%E2%80%93base_theory)Acids are those species which give proton or have a tendency [**of acids and bases:**](https://en.wikipedia.org/wiki/Br%C3%B8nsted%E2%80%93Lowry_acid%E2%80%93base_theory)to give proton. Bases are those species which accept proton or have a tendency to accept proton.

[**Lyman series:**](https://en.wikipedia.org/wiki/Lyman_series)A series of lines in the ultraviolet region of hydrogen spectrum which are obtained when electron jumps from higher orbits to the irst orbit of hydrogen atom.

[**Magnetic quantum number:**](https://en.wikipedia.org/wiki/Magnetic_quantum_number)The quantum number that deines the orientation of an orbital in a magnetic ield.

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| [**Mass spectrometer:**](https://en.wikipedia.org/wiki/Mass_spectrometry) | It is the instrument employed to separate positively charged particles on the basis of their m/e values and get the record on the photographic plate or electrometer. |
| [**Metallic crystals:**](https://en.wikipedia.org/wiki/Metal) | Those crystals in which the metal atoms are held together by metallic bonds. |
| [**Molality (m):**](https://en.wikipedia.org/wiki/Molality) | It is the number of moles of the solute dissolved in 1000 grams (1 kg) of the solvent. |
| [**Molar volume:**](https://en.wikipedia.org/wiki/Molar_volume) | The volume occupied by one mole of an ideal gas at standard temperature and pressure - 22.414 dm3 is called the molar volume. |
| [**Molarity (M):**](https://en.wikipedia.org/wiki/Molarity_(comic_strip)) | It is the number of moles of the solute dissolved per dm3 of the solution. |
| [**Mole fraction:**](https://en.wikipedia.org/wiki/Mole_fraction) | Mole fraction of any component in a mixture is the ratio of the number of moles of it to the total number of moles of all the components present in the solution. |
| [**Mole:**](https://en.wikipedia.org/wiki/Mole) | A quantity which contains Avogadro’s number of units i.e. atoms, molecules, ions or whatever under consideration is called a mole. |
| [**Molecular crystals:**](https://en.wikipedia.org/wiki/Molecular_solid) | Those crystals in which the molecules are held together by van der Waal’s forces. |
| [**Molecular formula:**](https://en.wikipedia.org/wiki/Category:Molecular_formulas) | A chemical formula which gives the total number of atoms present in a molecule of a substance. |

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| [**Molecular ions:**](https://en.wikipedia.org/wiki/Polyatomic_ion) | Those ions which are produced by the removal of one or more electron or electrons from the molecule of a substance are called molecular ions. They are mostly positive and rarely negative. |
| [**Non-ideal solution:**](https://en.wikipedia.org/wiki/Raoult%27s_law) | Those solutions which do not obey Raoult’s law. |
| [**Non-spontaneous Process:**](https://en.wikipedia.org/wiki/Endergonic_reaction) | It is the reverse of the spontaneous process. It does not take place on its own and does not occur in nature. |
| [**Orbit:**](https://en.wikipedia.org/wiki/Orbit) | An orbit is a deinite path at a deinite distance from the nucleus in which the electron revolves around the nucleus; actually an orbit indicates an exact position or location of an electron in an atom. |
| [**Orbital:**](https://en.wikipedia.org/wiki/Orbital) | A region around the nucleus where the probability of inding the electron is maximum, s, p, d and f are diferent types of orbitals which exist in an atom. |
| [**Order of Reaction:**](https://en.wikipedia.org/wiki/Order_of_reaction) | It is the sum of the exponents of the concentration terms in the rate expression of a chemical reaction. |
| [**Oxidation Number:**](https://en.wikipedia.org/wiki/Oxidation_state) | It is the apparent charge on an atom of an element in a compound or a radical. |
| [**Paper Chromatography:**](https://en.wikipedia.org/wiki/Paper_chromatography) | It is a technique of partition chromatography in which the stationary phase is water adsorbed on paper and mobile phase is usually an organic liquid. |
| [**Partial pressure:**](https://en.wikipedia.org/wiki/Partial_pressure) | The pressure exerted by an individual gas in a gaseous mixture is called the partial pressure of that gas. |
| [**Parts per million:**](https://en.wikipedia.org/wiki/PPM) | It is deined as the number of the parts (by weight or volume) of a solute per million parts (by weight or volume) of the solution. |
| [**Paschen series:**](https://en.wikipedia.org/wiki/Hydrogen_spectral_series#Paschen_series_.28Bohr_series_n.27_.3D_3.29) | A series of lines in the infra red region of hydrogen spectrum which results from the transitions of electron from higher orbits to the third orbit. |
| [**Pauli’s exclusion principle:**](https://en.wikipedia.org/wiki/Pauli_exclusion_principle) | According to this principle, it is impossible for two electrons residing in the same orbital of a poly electron atom, to have the same values of four quantum numbers. Thus two electrons in the same orbital should have opposite spins. |
| [**Percentage yield:**](https://en.wikipedia.org/wiki/Annual_percentage_yield) | Actual yield  %yield= x100  Theoretical yield |
| [**Pfund series:**](https://en.wikipedia.org/wiki/Talk%3APfund_series) | A series of lines in the infra red region of hydrogen spectrum which results from the transition of electron from higher orbits to the ifth orbit. |

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| [**pH of the solution:**](https://en.wikipedia.org/wiki/PH) | The negative log of [H+] is called pH of the solution. |
| [**Phase:**](https://en.wikipedia.org/wiki/Phase) | Every sample of matter with uniform properties and a ixed composition is called a phase. |
| [**pi (**p**) bond**](https://en.wikipedia.org/wiki/Pi_bond) | A bond formed by the parallel overlap of the two planar p-orbitals present on the adjacent atoms which are already bonded with a ct bond. |
| [**pKw:**](https://en.wikipedia.org/wiki/Einheits-PKW_der_Wehrmacht) | It is the negative log of dissociation constant of water. |
| [**pOH of the solution:**](https://en.wikipedia.org/wiki/Poh_(disambiguation)) | The negative log of [OH-] is called pOH of the solution. |
| [**Polarizability:**](https://en.wikipedia.org/wiki/Polarizability) | Polarizability is the quantitative measurement of the extent to which the electronic cloud can be polarized. |
| [**Positive rays or canal rays:**](https://en.wikipedia.org/wiki/Anode_ray) | Rays travelling in a direction opposite to the cathode rays in a discharge tube. They consist of positively charged ions formed by the ionization of gas molecules with the passage of cathode rays. |
| **Principal quantum number:** | The quantum number that deines the shell of an electron in an atom. Its symbol is n. |
| [**Quantum Numbers:**](https://en.wikipedia.org/wiki/Quantum_number) | These are the sets of numerical values which give the acceptable solutions. |
| [**Raoult’s law:**](https://en.wikipedia.org/wiki/Raoult%27s_law) | The lowering of the vapour pressure of a solvent by a solute, at a given temperature, is directly proportional to the mole fraction of solute. |
| [**Rate Constant:**](https://en.wikipedia.org/wiki/Reaction_rate_constant) | It is the rate of reaction when the concentrations of the reactants are unity. |
| [**Rate of Reaction:**](https://en.wikipedia.org/wiki/Reaction_rate) | It is deined as the change in concentration of a reactant or a product divided by the time taken for the change. |
| [**Real gas:**](https://en.wikipedia.org/wiki/Real_gas) | A gas which does not obey the gas laws at all temperatures and pressures. |
| [**Redox Reaction:**](https://en.wikipedia.org/wiki/Redox) | A chemical reaction in which oxidation and reduction take place. |
| [**Relative abundance of isotope:**](https://en.wikipedia.org/wiki/Relative_abundance) | The percentage of isotope of an element in comparison to other isotopes of the same element is called relative abundance of isotope. |
| [**Relative atomic mass:**](https://en.wikipedia.org/wiki/Relative_atomic_mass) | Relative atomic mass of an atom of an element is the mass as compared with the mass of one atom of carbon taken as twelve. It is expressed in a.m.u. |

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| [**Retardation Factor (Rf):**](https://en.wikipedia.org/wiki/Retardation_factor) | A component of a mixture may be identiied by a speciic retardation factor called R, value. It is related to the partition coeicient by the following relationship,  Distance travelled by a component from the original spot  R =f  Distance travelled by a solvent from the original spot |
| [**Reversible reaction:**](https://en.wikipedia.org/wiki/Reversible_reaction) | A reversible reaction is that one in which products of a reaction can react to form the original reactants. |
| [**Sigma (**s**)-bond:**](https://en.wikipedia.org/wiki/Sigma_bond) | A bond formed by the linear overlap of atomic orbitals. |
| [**Solubility:**](https://en.wikipedia.org/wiki/Solubility) | It is the number of grams of a solute that can be dissolved in 100 grams of the solvent to prepare a saturated solution at a particular temperature. |
| [**Solvent Extraction:**](https://simple.wikipedia.org/wiki/Solvent_extraction) | It is a technique in which a solute can be separated from a solution by shaking the solution with a solvent in which the solute is more soluble and the added solvent does not mix with the solution. |
| [**Spectrum:**](https://en.wikipedia.org/wiki/Spectrum) | A band of seven colours formed by the dispersion of the components of white light, when it is passed through a prism. |
| [**Spontaneous Process:**](https://en.wikipedia.org/wiki/Spontaneous_process) | Process, which takes place on its own without any outside assistance and moves from a non-equilibrium state towards an equilibrium state, is termed as spontaneous process. |

[**Standard Electrode Potential:**](https://en.wikipedia.org/wiki/Standard_electrode_potential)When a metal is dipped into the solution of its own ions

[**Standard Enthalpy of Atomization:**](https://en.wikipedia.org/wiki/Standard_enthalpy_of_formation)

[**Standard Enthalpy of Combustion:**](https://en.wikipedia.org/wiki/Enthalpy_of_atomization)

[**Standard Enthalpy of Formation:**](https://en.wikipedia.org/wiki/Standard_enthalpy_of_formation)

having concentration 1.0 mol per dm3 or a gas is passed at a pressure of one atmosphere through a solution of 1.00 mol per dm3 strength of its ions having an inert electrode, the potential developed is called standard electrode potential. The temperature of the system is maintained at 250 C. It is the change of enthalpy when one mole of gaseous atoms is formed form the element under standard conditions.

It is the amount of heat produced when one mole of the substance is completely burnt in excess of oxygen under standard conditions.

It is the change of enthalpy when one mole of a compound is formed from its elements under standard conditions.

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| [**Standard Enthalpy of**](https://en.wikipedia.org/wiki/Enthalpy_of_neutralization) It is the amount of heat evolved when one mole of hydrogen ions H+  [**Neutralization:**](https://en.wikipedia.org/wiki/Enthalpy_of_neutralization)from an acid react with one mole of hydroxide ion OH- from an alkali under standard conditions.  [**Standard temperature**](https://en.wikipedia.org/wiki/Standard_conditions_for_temperature_and_pressure) The standard temperature is 00C (273 K) and the standard pressure is [**and pressure:**](https://en.wikipedia.org/wiki/Standard_conditions_for_temperature_and_pressure)1 atm or 760 mm of Hg or 760 torr or 101325 Nm-2. | |
| [**State Function:**](https://en.wikipedia.org/wiki/State_function) | It is a macroscopic property of a system which has some deinite value for each state and which is independent of path in which the state is reached. |
| [**Stoichiometry:**](https://en.wikipedia.org/wiki/Stoichiometry) | Stoichiometry is the branch of chemistry which deals with the quantitative relationship between reactants and products in a balanced chemical equation. |
| [**Sublimation:**](https://en.wikipedia.org/wiki/Sublimation) | It is a process in which a solid, when heated, vapourizes directly without passing through the liquid state. |
| [**Surroundings:**](https://en.wikipedia.org/wiki/Surroundings) | The remaining portions around a system are called surroundings. |
| [**System:**](https://en.wikipedia.org/wiki/System) | Anything (materials) under test or under consideration, is termed as a system. |
| [**Theoretical yield:**](https://simple.wikipedia.org/wiki/Yield_(chemistry)) | The oretical yield is the amount of the products calculated from the balanced chemical equation. |
| [**Thermochemistry:**](https://en.wikipedia.org/wiki/Thermochemistry) | The study of heat changes during a chemical reaction is known as thermochemistry. |
| [**Unit cell:**](https://en.wikipedia.org/wiki/Unit_cell) | The smallest unit of the volume of a crystal which when repeated in three dimensions can generate the structure of the entire crystal. |
| [**Vacuum distillation:**](https://en.wikipedia.org/wiki/Vacuum_distillation) | The process of heating a liquid under reduced pressure to change it into vapours at a lower temperature and then condensing the vapours to a liquid. |
| [**van der Waal’s equation:**](https://en.wikipedia.org/wiki/Van_der_Waals_equation) | It is an equation of state of gases that modiies the ideal gas equation to represent more accurately the behaviour of real gases. |
| [**Vapour pressure:**](https://en.wikipedia.org/wiki/Vapor_pressure) | The pressure exerted by the vapours of a liquid in equilibrium with the liquid at a given temperature. |
| [**Water of crystallization:**](https://en.wikipedia.org/wiki/Water_of_crystallization) | Those water molecules, which have combined with some compounds as they are crystallized from aqueous solutions is called water of crystallization or water of hydration. |