1. Refinery Gas	$C_1 - C_4$	Below 20°C
2. Petroleum Ether	$C_5 - C_6$	20°C - 60°C
3. Light Naphtha	$C_6 - C_7$	60°C - 100°C
4. Gasoline	$C_7 - C_{10}$	80°C - 180°C
5. Kerosine	$C_{11} - C_{15}$	160°C - 300°C
6. Heavy Oil	$C_{15} - C_{18}$	300°C - 400°C
7. Lubricating Oil	$C_{18} - C_{20}$	400°C

In A Period

1. Atomic Radius → Decrease
2. Ionization Energy → Increase
3. Electronegativity → Increase
4. Electron affinity → Increase
5. Metallic character → Decrease
6. Melting and boiling point → I-A to IV-A increase
   V to VIII decrease
7. Electrical Conductance → Decrease
8. Hydration Energy → Increase

In A Group

1. Atomic Radius → Increase
2. Ionization Energy → Decrease
   however IIA > IIIA
   VA > VIA
3. Electronegativity → Decrease
4. Electronaffinity → Decrease
   however IA > IIA
   IVA > VA
   VII A > VIII A
5. Metallic character → Increase
6. Electrical Conductance → Decrease
7. Hydration energy → Decrease

REMEMBER:

$$Cl_2O + H_2O \rightarrow 2HOCl$$

$$Cl_2O_7 + H_2O \rightarrow 2HClO_4$$

Normal oxide : O^{-2}

Peroxide : O^{-1}

Superoxide : O_2^-

For Group 1A elements

REACTION OF OXIDES WITH WATER

$X_2O + H_2O \rightarrow 2XOH$

(normal oxide) (Metal Hydroxide)

$X_2O_2 + 2H_2O \rightarrow 2XOH + H_2O_2$

(Peroxide) (Hydrogen Peroxide)

$2XO_2 + 2H_2O \rightarrow 2XOH + H_2O_2 + O_2$

(Super oxide)

FLAME TEST

Li → Red

Na → Yellow

K → Lilac

Rb → Red

Cs → Blue / Violet

Be → No colour

Mg → No colour

Ca → Orange-red

Sr → Red

Ba → Pale Green

* Reactivity of Metals

Period → Decrease

Group → Increase

* Reactivity of Non-metals

Period → Increase

Group → Decrease

1. Brass:

Cu = 60 - 80 %.

Zn = 20 - 40 %.

2) Bronze:

Cu = 75 - 90 %.

Sn = 10 - 25 %.

3. Steel:

Fe = 90 - 95 %.

C = 0.1 - 2 %.

4) Gold: (18 carat)

Au = 70 - 75 %.

Cu = 20 - 25 %.

* Solubility of Mg(OH)2 is enhanced tremendously by addition of NH4Cl
* Al(OH)&#0;3 has the capacity of absorbing various dyes forming coloring matter known as lakes
* Lithium is lightest known metal
* Group 1A elements are very good reducing agents
* The ability of a cation to distort an anion is known as its polarizing power.
* The polarizing power of a cation increase with increasing charge on ion and decreasing radius of ion.
* Thermal stability of Group 1 and Group 2 increase down the group due to decreasing polarizing power.
* Bicarbonates of Group 1 are more stable than Group 2
* Alkaline earth metals donot exist free in nature
* Electron Affinity - Cl >Br>F>I
* Bond Enthalpy - Cl2 > Br2 > F2> I2
* Reactivity of metals increase down the group e.g reactivity of alkali metals
* Reactivity of non metals decrease down the group e.g halogens

EXCEPTIONS TO PERIODIC TRENDS

* IE of Mg is greater than Al
* IE of Phosphorus is greater than Sulphur
* Density of potassium is less than sodium
* IE of radium is higher than Barium
* IE of Nitrogen is greater than Oxygen

NAMING OF COMPLEX COMPOUNDS

* The names of neutral ligands are usually unchanged

Names of negative ligands end in o (chloro)

Names of positive ligands end in ium (hydrazinium)

* Ligands naming order - negative, neutral, positive

* Same type ligands named in alphabetical order

* In positive and neutral complexes name of the metal remians the same

* In negative complexes name of metal is followed by ate. (Ferrate, cobaltate, cuprate, argentate)

Yellow Orange

$$2\,CrO_4^{2-}{}_{(aq)} + 2H^+{}_{(aq)} \rightleftharpoons Cr_2O_7^{2-}{}_{(aq)} + H_2O_{(l)}$$

This is dynamic equilibrium and sensitive to the acidity and basicity of solution. According to Le-Chatelier's principle, the addition of acid to the

* $2Al + H_2O \rightarrow Al_2O_3 + 3H_2$

* $Si + 2H_2O \rightarrow SiO_2 + 2H_2$

* $SiO_2 + 2H_2O \overset{300^\circ C}{\rightleftharpoons} Si(OH)_4$

* $SiO_2 + NaOH \rightarrow 2Na_2SiO_3 + H_2O$

* $SnO + NaOH + H_2O \rightarrow Na_2Sn(OH)_4$

* $PbO + NaOH + H_2O \rightarrow Na_2Pb(OH)_4$

* $2Al(OH)_3 + 2NaOH \rightarrow 2Na[Al(OH)_4]$
Aluminate

* Hydration of Alkene produce alcohol
* Hydration of Alkyne produce Aldehyde/Ketone
* Epoxidation of Alkene produce Glycol
* Ozonolysis of Alkene produce Carbonyl compounds
* Ozonolysis of Alkyne produce Carboxylic acids.

* $RMgX$ + Formaldehyde → 1° Alcohol
* $RMgX$ + Higher Aldehyde → 2° Alcohol
* $RMgX$ + Ketone → 3° Alcohol

* Reduction of Aldehyde → 1° Alcohol
  Reduction of Ketone → 2° Alcohol

* Oxidation of 1° Alcohol → Formaldehyde
  Oxidation of 2° Alcohol → Ketone
  Oxidation of 3° Alcohol → Not Possible

* Oxidation of Aldehyde produce carboxylic acid
* No oxidation of Ketone

1. No. of isomers in Alkane:

$2^{n-4} + 1$

2. No. of isomers in Alkene:

$2^{n-2} + 1$ [even C]

3. No. of isomers in Alkene:

2^{n-2} [odd C]

4. No. of isomers in Alkyne:

$2^n - 2n$ [odd C]

5. No. of isomers in Alkyne:

$2^n - (2n-1)$ [even C]

6. Total Number of Ring Isomers:

$n-1$

* Halogens - oxidizing agents
* Halide ions - reducing agents
* For detection of carbon, organic compound is mixed with dry copper oxide in ratio 1:3
* Proteins are amphoteric in nature bcz they contain both acidic (carboxyl) and basic (amino) groups.
* Fatty acids are long chain carboxylic acids containing 12-18 carbon atoms per molecule.
* The most common occuring lipids are triglycerides and phospholipids.
* Fat soluble vitamins : A, D, E
* Zinc constituent of enzymes carbonic anhydrase and alkaline phosphatase
* NH_2, NR_2 cause Solubility in acids
* OH, COOH, SO_3H cause solubility in basic solutions
* The azo and anthraquinone nuclei having attached the groups like hydroxyl and carboxyl act as mordant dyes
* First organic chemical made on large scale from a petroleum base was isopropyl alcohol (isopropanol)

* α- Carbon in organic molecule refers to the first carbon atom that attaches to a functional group
The second carbon atom is called the beta carbon

* α- Hydrogen: A hydrogen atom directly attached to α- Carbon

$$F = \frac{k q_1 q_2}{r^2}$$

$$E = \frac{kq}{r^2}$$

$$U = \frac{k q_1 q_2}{r}$$

$$V = \frac{kQ}{r}$$

* Electric Flux

$$\phi = EA \cos\theta$$

* Magnetic Flux

$$\phi = BA \cos\theta$$

$\cos\theta$ max when surface is perpendicular to field bcz in such case normal to the surface will be parallel to field.

* Electric Field Intensity

1. Due to an infinite sheet of charge:

$$E = \frac{\sigma}{2\epsilon_0}$$

2. Bw two oppositely charged parallel plates

$$E = \frac{\sigma}{\epsilon_0}$$

* For Capacitor:

$$Q = CV$$

$$E = \frac{V}{d}$$

$$C_{vac} = \frac{\varepsilon_0 A}{d}$$

Day: M T W T F S S

* $C_{med} = \frac{\varepsilon_0 \varepsilon_r A}{d}$

* $\varepsilon_r = \frac{C_{med}}{C_{vac}}$

Energy Stored In A Capacitor:

* $U = \frac{QV}{2}$

$U = \frac{1}{2} \varepsilon_r \varepsilon_0 E^2 \times Ad$

* $U = \frac{CV^2}{2}$

* $U = \frac{Q^2}{2C}$

+ DIAMETER RELATION WITH 'I' AND 'R'

$$I \propto d^2$$

$$R \propto \frac{1}{d^2}$$

* When a wire is stretched n times then new resistance of wire

$$R' = n^2 R$$

* When radius of a wire is decreased n times then new resistance of wire

$$R' = n^4 R$$

* When a wire is bent into circle then new resistance of wire is given by

$$R' = R/4$$

* When three wires are combined to form an equilateral triangle then new resistance

$$R' = 2/3 \times R$$

* Possible combination of conductor of equal resistance is given by:

$$2^{n-1}$$

- If resistance of n conductor different then possible combinations are

$$2^n$$

* $\alpha = \frac{R_T - R_0}{R_0 T}$

* $\alpha = \frac{\rho_T - \rho_0}{\rho_0 T}$

* $R = \frac{\rho^2 l^2}{m}$

* When wire stretched 'n' times

$$R' = n^2 R$$

* $V = \varepsilon - Ir$

* $\varepsilon = IR + Ir$

* $\varepsilon = I(R+r)$

* $I = \frac{\varepsilon}{R+r}$

$$\alpha = \frac{I_C}{I_E}$$

$$\beta = \frac{I_C}{I_B}$$

$$\beta = \frac{\alpha}{1-\alpha}$$

* $1T = NA^{-1}m^{-1}$ or Wbm^{-2}

* $Wb = NmA^{-1}$

* $1G = 10^{-4}T$

FORMULA SHEET

* $F = BIL \sin\theta$

* $\phi = BA\cos\theta$ $\quad$ ϕ : Magnetic Flux

* $B = \frac{\mu_0 I}{2\pi r}$ $\quad$ $\mu_0 = 4\pi \times 10^{-7}\ Wb\ A^{-1} m^{-1}$

* $\Sigma B.\Delta l = \mu_0 I$ $\quad$ → Ampere's Law

* Magnetic Field due to current carrying solenoid:

$$BL = N\mu_0 I$$

$$B = n\mu_0 I \qquad n = N/L$$

* $F = qvB\sin\theta$

* $f = \frac{qB}{2\pi m}$ $\quad$ f: cyclotron frequency

* e/m in terms of Velocity:

$$\frac{e}{m} = \frac{v}{Br}$$

* e/m in terms of voltage:

$$\frac{e}{m} = \frac{2V}{B^2 r^2}$$

* Torque on current carrying loop / coil:

$$\tau = NIAB\cos\theta$$

* For Galvanometer:

$$I = \frac{C\theta}{NAB}$$

* For Ammeter:

$$R_S = \frac{R_g I_g}{I - I_g}$$

* For Voltmeter:

$$R_h = \frac{V}{I_g} - R_g$$

* Lorentz Force $= q[E + (v \times B)]$

* $\mathcal{E} = 2\pi r E$

* RIGHT HAND RULE

When a steady current passes through a conducting wire, it creates a magnetic field around the wire. The direction of such field is determined by Right Hand Rule.

Curl your fingers in direction of magnetic field, thumb indicates direction of current.

* FLEMING'S LEFT HAND RULE

Whenever a current carrying conductor comes under a magnetic field, there will be a force acting on the conductor. The direction of this force can be found using Fleming's Left Hand Rule.

F: Force → Thumb
B: Magnetic Field → First Finger
I: Current → Middle Finger

* FLEMING'S RIGHT HAND RULE

If a conductor is forcefully brought under a magnetic field, there will be induced current in the conductor. The direction of this force can be found using Fleming's Right Hand Rule.

F: Force / Motion → Thumb
B: Magnetic Field → Fore Finger
I: Current → Middle Finger

* Nucleophility increase as the density of negative charge increase (OH^- > H_2O)
* A highly electronegative atom is a poor nucleophile
* Nucleophility increase with increasing size of anion
* Esters on hydrolysis produce both alcohol as well as carboxylic acid
* Charge on alpha particle : +2e
* When wire is cut in n different pieces then resistance become R/n
* In PN Junction, the potential developed across barrier layer is called barrier potential which is 0.7 volt for silicon diode and 0.3 volt for germanium diode.
* Light Emitting Diode (LED) : operated under forward bias
* Photo diode - operated under reverse bias
* Solar cell - no biasing

* Galvanometer is always connected in series with the circuit component through which we need to detect current.
* For Ammeter : low resistance wire (shunt resistance) connected in parallel to Galvanometer
* For Voltmeter : high resistance connected in series with galvanometer
* Ammeter connected in series with device
* Voltmeter connected in parallel with device

* Self Inductance

$$\mathcal{E} = \frac{L \Delta I}{\Delta t} \qquad L = \frac{\mathcal{E}}{\Delta I / \Delta t}$$

$$L = \frac{N\phi}{I}$$

* Mutual Inductance

$$\mathcal{E} = M \frac{\Delta I}{\Delta t}$$

$$M = \frac{N\phi}{I}$$

For a solenoid:

$$L = \mu_0 n^2 l A$$

where $n = \frac{N}{l}$

* Average Power Dissipated

$$P = \frac{1}{2} I_m^2 R$$

or

$$P = I_{rms}^2 R$$

* Irms

$$I_{rms} = \frac{I_m}{\sqrt{2}}$$

or

$$I_{rms} = 0.707\, I_m$$

* $P = I_{rms} V_{rms} \cos\phi$

* AC Through Resistance

$$V = V_m \sin \omega t$$

$$I = I_m \sin \omega t$$

$$P = \frac{V_m}{\sqrt{2}} \times \frac{I_m}{\sqrt{2}} = V_{rms} I_{rms}$$

* AC Through Pure Inductance

$$I = I_m \sin \omega t$$

$$V = V_m \sin (\omega t + 90^\circ)$$

$$X_L = \omega L = 2\pi f L$$

$$P = 0$$

* AC Through Capacitance

$$I = I_m \sin (\omega t + 90^\circ)$$

$$V = V_m \sin \omega t$$

$$X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C}$$

$$P = 0$$

* Impedence (Z) and Voltage

- For RL Series

$$Z = \sqrt{R^2 + X_L^2} \qquad V = \sqrt{V_R^2 + V_L^2}$$

- For RC Series

$$Z = \sqrt{R^2 + X_C^2} \qquad V = \sqrt{V_R^2 + V_C^2}$$

- For RLC Series

$$Z = \sqrt{R^2 + (X_L - X_C)^2} \qquad V = \sqrt{V_R^2 + (V_L - V_C)^2}$$

	$\tan\theta$	$\cos\theta$
• RL Series	$\frac{X_L}{R}$	$\frac{R}{Z}$
• RC Series	$-\frac{X_C}{R}$	R/Z
• RLC Series	$\frac{X_L - X_C}{R}$	R/Z

POWER FACTOR $\cos\phi$

* For a pure resistive circuit : $\cos\phi = 1$
* For a pure L or C circuit : $\cos\phi = 0$
* For RLC circuit, $\cos\phi$ lies b·w 0 and 1

$$Q\text{-Factor} = \frac{X_L}{R} = \frac{\omega L}{R}$$

$$Q\text{-Factor} = 2\pi \times \frac{\text{Max. Energy stored}}{\text{Energy Dissipated per cycle}}$$

RESONANCE IN AC CIRCUIT

Resonance in an AC circuit refers to that state of the circuit in which the inductive reactance of the circuit is equal to its capacitive reactance.

The value of angular frequency of alternating emf for which resonance is established in the circuit is called resonance frequency

$$f = \frac{1}{2\pi\sqrt{LC}}$$

or

$$\omega = \frac{1}{\sqrt{LC}}$$

$$\mathcal{E} = 2\pi r E$$

$$c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$$

* Elastic Modulus = $\frac{\text{Stress}}{\text{Strain}}$

* Young's Modulus:

$$Y = \frac{FL}{A\Delta L}$$

* Shear or Rigidity Modulus:

$$S = \frac{F}{A\theta}$$

* Bulk Modulus

$$B = \frac{F/A}{(-\Delta V/V)} = \frac{FV}{A(\Delta V)}$$

or $$B = \frac{\Delta P}{(-\Delta V/V)}$$

* Stress = k x strain Hooke's Law

* Strain Energy

$$U = \frac{1}{2} Fe$$

* Strain energy per unit volume

$$u = \frac{1}{2} (\text{stress} \times \text{strain})$$

Day: M T W T F S S

* $B = H \times \mu_0$

H: Magnetic Field Strength

B: Magnetic Flux Density

* $Y = \frac{4FL}{\pi d^2 \Delta L}$

* Relation between ΔL and r^2

$\Delta L \propto \frac{L}{r^2}$ (For same Force and same Y)

* Strain Energy per unit volume

$u = \frac{1}{2} \times Y \times (\text{strain})^2$

1. $E = mc^2$

2. $L = L_0 \sqrt{1 - \frac{v^2}{c^2}}$

3. $t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}}$

4. $m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$

5. $\lambda_{max} T =$ Wein's constant $(0.2898 \times 10^{-2}\ mK)$

6. Stefann - Bolts Mann Law

$E = \sigma T^4$

$\sigma = 5.67 \times 10^{-8}\ Wm^{-2}K^{-4}$

7. $E = hf$

8. $E = \frac{hc}{\lambda}$

9. $K.E = eV$

$K.E = qV$

10 $K.E_{max} = hf - hf_o$

$hf_o = \phi$: Work function

11 $\lambda' - \lambda = \frac{h}{m_o c}(1-\cos\theta)$

12 $\frac{1}{f'} = \frac{1}{f} + \frac{h}{m_o c^2}(1-\cos\theta)$

13 $\lambda = \frac{h}{p}$ $\quad p = \frac{h}{\lambda}$ $\quad p = \frac{hf}{c}$

$\lambda = \frac{h}{mv}$ or $\lambda = \frac{h}{\sqrt{2mqV}}$

14. $(\Delta p)(\Delta x) \approx h$

15 $(\Delta E)(\Delta t) \approx h$

16 $p = \frac{E}{c} = \frac{hf}{c} = \frac{h}{\lambda}$

17 $E_{max} = E_{photon} - \phi$

18 Stopping Potential $= \frac{E_{max}}{e}$

✱ ENERGY REQUIREMENTS

1. For photoelectric effect $E < 0.1\,MeV$
2. For Compton effect $0.1\,MeV < E < 1\,MeV$
3. For Pair production $E > 1\,MeV$

* For electron:

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mE}}$$

* For photon

$$E = \frac{hc}{\lambda}$$

$$\lambda = \frac{hc}{E}$$

For Hydrogen Atom:

First Excitation Potential = 10.2 V

Second Excitation Potential = 12.1 V

* RYDBERG'S CONSTANT:

$$R_H = \frac{E_0}{hc} = 1.0974 \times 10^7 \, m^{-1}$$

$1\ amu = 1.6 \times 10^{-27}\ kg$

$1\ amu = 1.49 \times 10^{-10}\ J$

$1\ u = 931\ MeV$

$1\ eV = 1.6 \times 10^{-19}\ J$

* Mass of electron:

→ $9 \times 10^{-31}\ kg$

→ $5.4 \times 10^{-4}\ u$

→ $0.51\ MeV$

* Mass of Proton:

→ $1.67 \times 10^{-27}\ kg$

→ $1.007\ u$

→ $937\ MeV$

* Mass of Neutron:

→ $1.67 \times 10^{-27}\ kg$

→ $1.008\ u$

→ $938\ MeV$

BINDING FACTOR:

→ Binding energy per nucleon (i-e protons and neutrons) is called binding factor

* Binding Factor, $f = \frac{B.E}{A}$

→ It is used to measure stability of nucleus.

* Steps of Finding Binding Factor:

(1) Find mass defect of the nucleus (in amu)

Δm = (mass of individual protons + neutrons) − Total mass

(2) Find binding energy E_b (in MeV)

$E_b = 931 \times \Delta m c^2$

As $1u = 931\ MeV$

(3) Find Binding Factor

$f = \frac{E_b}{A}$

* $\frac{1}{\lambda_n} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

$R = 1.097 \times 10^7\ m^{-1}$

* $K.E = \frac{1}{2}\frac{ke^2}{r_n}$

* $P.E = -\frac{ke^2}{r_n}$

* For Continuous X-Rays

$\lambda_{min} = \frac{hc}{eV}$

* Alpha Emission:
  - → Atomic Number reduce by 2
  - → Mass Number reduce by 4

* BETA EMISSION:
  - → Atomic Mass remain same
  - → Atomic Number: increase or decrease by 1
    - +1 for β^-
    - -1 for β^+

Time	Undecayed	Decayed
0 sec	N_0 (100%)	Zero 0%
1 $T_{1/2}$	$N_0/2$ (50%)	$N_0/2$ (50%)
2 $T_{1/2}$	$N_0/4$ (25%)	$N_0 - \frac{N_0}{4} = 3N_0/4$ (75%)
3 $T_{1/2}$	$N_0/8$ (12.5%)	$7N_0/8$ (87.5%)
4 $T_{1/2}$	$N_0/16$ (6.25%)	$15N_0/16$ (93.75%)

* If current in two parallel conductors be flowing in same direction, then the two conductors will repel eachother.
If current flows in opposite direction, they attract
* If motor is overloaded, the back emf decreases and allows the motor to draw more current.
* In RLC AC circuit, voltage across inductor leads current by 90° and voltage across capacitor lags behind the current by 90°. So voltage across LC combination will be zero
* The impedence of the circuit at resonance is only resistive so the current and voltage are in phase. The power factor is 1.
* The type of current which is due to changing electric flux is called displacement current
* The ionization energy of the atom is numerically equal to the ground state energy of the atom
* Neutrino is emitted with beta positive
* Anti neutrino is emitted with beta negative
* Solid state detector - operated under reverse bias

* $\frac{\Delta N}{\Delta t} = -\lambda N$

N: undecayed Nuclei

* $T_{1/2} = \frac{0.693}{\lambda}$

* For Undecayed Nuclei:

$$N = \frac{N_0}{2^n}$$

* For Decayed Nuclei:

$$N = N_0 - \frac{N_0}{2^n}$$

FIELD PARTICLES OR QUANTA

Force	Field Particles
1. Electromagnetic induction (force)	→ Photons
2. Strong Force	→ Gluons
3. Weak Force	→ W and Z bosons
4. Gravitational Force	→ Gravitons

* Moderator slows down neutrons to thermal energies.
Usually graphite and heavy water (water containing deutrium instead of hydrogen) are used as moderator.
* Control rods absorb neutrons e.g cadmium, boron and hafnium
* Co-60 used for treatment of various types of cancer
* I-131 for treatment of cancerous thyroid
* A meson consist of a quark and an antiquark
* Pion is the lightest of known mesons
* Baryons consist of three quarks
* Proton - u, u, d
* Neutron - d, d, u
* In coils, take direction of magnetic field from South to north
* When circuit is in resonance, the amplitude of current is maximum
* DNA replication begins at origin of replication and requires primer
* Transcription begins at promoter region and does not require primer

Codon	Nuclear DNA	Mitochondrial DNA
UGA	Stop codon	Tryptophan
AUA	Iso leucine	Methionine
AGA & AGG	Arginine	Stop Codon

Molar mass of important elements (in g)

1. Carbon = 12g
2. Nitrogen = 14g
3. Oxygen = 16g
4. Fluorine = 19g
5. Sodium (Na) = 23g
6. Aluminium = 27g
7. Phosphorus = 31g
8. Sulphur = 32g
9. Chlorine = 35.5g
10. Potassium (K) = 39g
11. Calcium = 40g
12. Copper = 63g

Molecules and Compounds

1. Water (H_2O) = 18g
2. Glucose ($C_6H_{12}O_6$) = 180g
3. H_2SO_4 = 98g
4. NaCl = 58g
5. $CuSO_4$ = 160g
6. NaOH = 40g
7. C_2H_5OH = 46g

Type of Vectors	Insert DNA Size (In kb)
Plasmid-cloning vectors	0.5 to 8
Bacteriophage cloning vectors	9 to 2.5
Cosmid-cloning vectors (combination of plasmid and phage DNA)	30 to 45
Yeast artificial chromosomes (YACs)	250 to 1000
Bacterial artificial chromosomes (BACs)	50 to 300
Animal and plant vectors (Shuttle vectors)	>1000

Nitrogen Fixing bacteria :

1. Free Living

Azotobacter (aerobic)

Clostridium (anaerobic)

2. Symbiotic with leguminous plants

Rhizobium

3. Symbiotic with non leguminous plants

Frankia

Anabaena azolla (cyanobacteria)

* Nitrogenase

~ an enzyme complex in nitrogen fixing bacteria

~ sensitive to oxygen (inactivates when exposed to oxygen)

Rh + : Rh antigen present, Antibody absent DD/Dd
Rh- : Rh antigen absent, Antibody present (dd)

Donors for Rh+ : both Rh+ and Rh-
Donors for Rh- : only Rh-

Maternal foetal incompatibility :
Mother Rh-
Foetus Rh+

$K_2CrO_4 + H_2O \rightarrow$ Yellow Solution

$K_2Cr_2O_7 + H_2O \rightarrow$ Orange Solution

$$2CrO_4^{-2} + 2H^+ \rightleftharpoons Cr_2O_7^{-2} + H_2O$$

Yellow — Orange

Immine → $R-\overset{\overset{NH}{\|}}{C}-H$

Oxime → $R-\overset{\overset{NOH}{\|}}{C}-H$

Hydrazine → NH_2NH_2

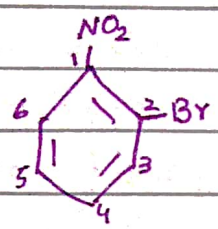
Hydrazone → $R-\overset{\overset{NNH_2}{\|}}{C}-H$

* In SiO2 every silicon atom is tetrahedrally attached with four oxygen atoms and every oxygen atom is attached to two silicon atoms.
* Monoclonal antibodies are typically made by fusing myeloma cells (cancerous B-lymphocytes) with the spleen cells from a mouse that has been immunized with the desired antigen. The technique is called somatic cell hybridization.
* 2nd Ionization Energy - greatest for Group 1A elements
* 3rd Ionization Energy - greatest for Group 2A elements
* Potassium chromate forms yellow while dichromaye forms orange solution in water. Addition if acid promote dichromate yield (orange) while addition of base promote chromate yield (yellow)
* Tertiary amines donot react with acid chloride.
* Cleavage of 1,2 diols (glycols) in the presence of strong oxidizing agent produce formic acid while in presence of weak oxidizing agent produce formaldehyde

* Ether react with sulphuric acid to form oxonium salts
Ether react with halogen acids to form alcohol and alkyl halide
Ether react with acetyl chloride to form alkyl chloride (RCl) and ester
* Cyanohydrins are compounds with hydroxyl and cyano group attached to same carbon
* Aldehydes and ketones react with HCN to form Cyanohydrins.
* Oxidation of alkyl benzene (toluene) produce carboxylic acid.
* Esters can be prepared by reacting alcohol with carboxylic acid, acid halide or acid anhydride.
* Decarboxylation of carboxylic acids is also known as Kolbe's electrolysis which produce alkane.
* Nitriles react with Grignard reagent to produce ketones.

* BENZENE NOMENCLATURE

If the substituents are different, they are named in alphabetical order. The last named substituent is understood to be at position 1 e.g



2-Bronitrobenzene

MCQ: When benzene is substituted by halogens only, which one of the following halogens is given the number one position in the ring while writing the name of compound

(a) Bromine (b) Fluorine

(c) Chlorine (d) Iodine ✓

Gene Locations

* Gene I (Blood Group) - Chromosome 9
* Se (Secreter Gene) - Chromosome 19
* H Gene - Chromosome 19

H Substance is prexursor to chromosome A and B antigens

* Insulin Gene - Chromosome 11

* STRUCTURE OF TASTE RECEPTORS

1. Filiform Papillae - cone shaped and found all over the tongue (which is why tongue look rough)
2. Fungiform Papillae - mushroom shaped and found at the tip and sides of the tongue
3. Foliate Papillae - a series of folds along the sides of the tongue
4. Circumvalate Papillae - shaped like flat mounds surrounded by a trench and found at the back of the tongue

Pain receptors are the most numerous types of receptors.

Every sqare cm of our skin contain around :

200 pain receptors

15 pressure receptors

6 receptors for cold

1 receptor for warmth

$$\frac{h}{m_0 c} = 0.00243\ m$$

* Ortho/para directing groups increase the reactivity of benzene ring (except halogens)
Meta directing groups decrease the reactivity of benzene
* Moment of inertia is inversely proportional to angular speed
* Shear Modulus and Young's modulus is a characteristic of solids only while Bulk Modulus is maximum for solids and minimum for gases.
* Lines of force always flow from north to south outside a magnet and from south to north within a magnet.

Laws Based on :

1. Law of conservation of momentum - Newton's Thurd law of motion
2. Equation of continuity - Law of conservation of mass
3. Bernoulli's Equation - Law of conservation of energy
4. Young's Double Slit Experiment - Division of wavefront (or wavelength)
5. Interference in a thin film - Division of amplitude
6. Diffraction Grating - Interference and diffraction
7. Michelson's Interferometer - Division of amplitude
8. First Law of Thermodynamics - Law of conservation of energy
9. Lenz Law - Law of conservation of energy
10. KCL - Law of conservation of charge
11. KVL - Law of conservation of energy

* Aristotle - Scala Naturae or ladder of nature
* George Cuvier - Theory of catastrophism
* James Hutton and Charles Lyell - Uniformitarianism (earth is eternal ie no vestige of a beginning, no prospect of an end)
* Lamark - organisms evolved through the Inheritance of acquired characters
* Charles Darwin and Alfred Russell - Driving force behind evolutionary change was natural selection
* Jean Baptiste De Lamark - Lamarckism
* Darwin - Natural Selection
* Herbert Spencer - Survival of the fittest
* Von Baer - Recapitulation theory

Pnemonic For Remembering Nature of Cranial Nerves

Some →	Sensory	I
Say →	Sensory	II
Marry →	Motor	III
Money →	Motor	IV
But →	Both (Mixed)	V
My →	Motor	VI
Brother →	Both (Mixed)	VII
Says →	Sensory	VIII
Big →	Both (Mixed)	IX
Brains →	Both (Mixed)	X
Matter →	Motor	XI
More →	Motor	XII

Sensory → 1, 2, 8

Motor → 3, 4, 6, 11, 12

Mixed → 5, 7, 9, 10

* aldehyde/ketone react with alcohol to produce hemiacetal
* hemiacetal react with alcohol to produce acetal
* Oxidation of alkyl benzene produce carboxylic acids.
* Nitriles react with RMgX to produce ketone
* Nucleophility is directly proportional to size of anion
* As electronegativity increase, Nucleophility decrease
* the bulkier a nucleophile is, the weaker the nucleophile becomes
* Hemiacetals are formed by the reaction between alcohol and aldehyde

* Thickness
  - DNA → 2nm
  - Nucleosome string → 10nm
  - Chromatin fiber or solenoid → 30nm
  - Super coil → 200nm
  - chromatid → 700nm

* DNA → negatively charged bcz of phosphate groups

* Histone proteins → Positively charged bcz of basic amino acids such as arginine and lysine

* DNA Gyrase (tropoisomerase) → opens the turns of DNA duplex

* DNA helicase → breaks down base pairs of DNA so the two strands gradually separate from eachother

* Single stranded Binding (SSB) proteins → Prevent pairing up of base pairs

DNA Polymerase Enzymes:
- I → important role in termination phase
- II → involved in repairing processes of DNA damages
- III → Synthesize daughter strands + proofreading

* Fragments of Lagging strands
  In Prokaryotes → 100 to 200 nucleotides
  In eukaryotes → 1000-2000 nucleotides

* Binding Sites In Promotor :
  1. In Prokaryotes :
     TATAAT → 10 sequence
     TTGACA → 35 sequence

  2. In Eukaryotes :
     TATA → 25 sequence
     CAAT → 70 sequence

* RNA polymerase :
  I → synthesize rRNA
  II → synthesize mRNA
  III → synthesize tRNA

* Coding or Sense Strand → 5' to 3' end
* Antisense strand → 3' to 5' end

* Start Codon : AUG (Methionine)

* Stop Codon : UGA , UAG , UAA