Table 1.2 Profile of Permanent Stains

STAINS	FINAL COLOUR	SUITABLE FOR
i. Aniline blue	Blue	Fungal hyphae & Spores
ii. Borax carmine	Pink	Nuclei, Obelia colony
iii. Eosin	Pink / Red	Cytoplasm / Cellulose
iv. Feulgen's stain	Red / Purple	DNA (particularly during cell division) i.e. chromosomes
v. Leishman's stain	Red / Pink / Blue	Blood cells
vi. Methylene blue	Blue	Nuclei
vii. Safranin	Red/ Purple	Nuclei, lignin & plant tissues

Table: 1.3Temporary Stains

i. Aniline sulphate	Yellow	Lignin
ii. Iodine solution	Blue-black	Starch
iii. Schultz's solution (Chlor-zinc-iodine)	Yellow / Blue / Blue or Violet	Lignin, Cutin, Protein. / Starch / Cellulose

PHYSICAL QUANTITY	BASE UNIT	DIMENTION
1. Newton (N)	$kg\,m\,s^{-2}$	$[MLT^{-2}]$
2. Joule (J)	Nm / $kg\,m^2s^{-2}$	$[ML^2T^{-2}]$
3. Watt (W)	Js^{-1} / $kg\,m^2s^{-3}$	$[ML^2T^{-3}]$
4. Pascal (Pa)	Nm^{-2} / $kg\,m^{-1}s^{-2}$	$[ML^{-1}T^{-2}]$
5. Columb (C)	As	
6. Angular Velocity (ω)	rad / sec	$[T^{-1}]$
7. Angular Momentum (L)	$kg\,m^2s^{-1}$	$[ML^2T^{-1}]$
8. Moment of Inertia (I)	$kg\,m^2$	$[ML^2]$
9. Torque	$Nm = kg\,m^2s^{-2}$	$[ML^2T^{-2}]$
10. Young's Modulus (Y)	Nm^{-2}	$[ML^{-1}T^{-2}]$
11. Surface Tension (S)	Nm^{-1}	$[MT^{-2}]$
12. Co-efficient of Viscosity (η)	$kg\,m^{-1}s^{-1}$ (Nsm^{-2})	$[ML^{-1}T^{-1}]$
13. Volt	JC^{-1}	$[ML^2T^{-3}A^{-1}]$
14. Magnetic Flux (Wb)		$[ML^2T^{-2}A^{-1}]$
15. Mutual Inductance (M)	Henry (H) → VsA^{-1}	$[ML^2T^{-2}A^{-2}]$
16. Self Inductance (L)	H → VsA^{-1}	$[ML^2T^{-2}A^{-2}]$
17. Volt (V) $\frac{\text{Energy}}{\text{Charge}}$	NmC^{-1}	$ML^2T^{-3}A^{-1}$
18. Rydberg's constant	m^{-1}	$[L^{-1}]$

	0	30	45	60	90
	0	1	2	3	4
Sin (Divide each number by largest and take $\sqrt{}$)	$\sqrt{0/4}$	$\sqrt{\frac{1}{4}}$	$\sqrt{\frac{2}{4}}$	$\sqrt{\frac{3}{4}}$	$\sqrt{\frac{4}{4}}$
	0	$1/2$	$1/\sqrt{2}$ 0.707	$\sqrt{3}/2$ 0.866	1
Cos (For cos the table of sin reverses)	1	$\sqrt{3}/2$	$1/\sqrt{2}$	$1/2$	0
tan ($\tan\theta = \frac{\sin\theta}{\cos\theta}$)	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞

DISTANCE TRAVELLED IN n^{th} SECOND

When a = constant and time interval is equal i.e $t_1 = t_2 = t_3$

1. $S_n = (2n-1) S_1$

2. $S_n = \frac{a}{2}(2n-1)$

3. $S_n = 10t - 5$ → (For Free Fall)

where 'n' is a particular second

DISTANCE TRAVELLED IN n-seconds

1. $S = \frac{a}{2} n^2$ & $S_n = n^2 S_1$

2. $S = 5t^2$ → (For Free Fall)

RATIO OF DISTANCES TRAVELLED IN n^{th} Seconds

$$\frac{S_{n_1}}{S_{n_2}} = \frac{2n_1 - 1}{2n_2 - 1}$$

$$H = \frac{v_i^2 \sin^2\theta}{2g}$$

$$T = \frac{2v_i \sin\theta}{g}$$

$$R = \frac{v_i^2 \sin 2\theta}{g}$$

* At $\theta = 76^\circ$
  or $\theta = \tan^{-1}(4)$

  $R = H$

* At $\theta = 45^\circ$
  $\theta = \tan^{-1}(1)$
  $R = 4H$

* Time of Flight

$$T = \sqrt{\frac{2H}{g}}$$

* For Projectile:

$$T = \sqrt{\frac{8H}{g}}$$

* Combined Velocity after collision:

$$V_c = \frac{m_1 v_1 + m_2 v_2}{m_1 + m_2}$$

* At $\theta = 83^\circ$
  or $\theta = \tan^{-1}(8)$
  $R = \frac{1}{2} H$

Scanned with CamScanner

Underroot Values:

$\sqrt{2} = 1.414$

$\sqrt{3} = 1.73$

$\sqrt{4} = 2$

$\sqrt{5} = 2.2$

$\sqrt{6} = 2.4$

$\sqrt{7} = 2.6$

$\sqrt{8} = 2.8$

$\sqrt{9} = 3$

$\sqrt{10} = 3.16$

$\sqrt{11} = 3.3$

$\sqrt{12} = 3.46$

~~$\sqrt{3}/2 = 0.707$~~

$1/\sqrt{2} = 0.707$

$\sqrt{3}/2 = 0.866$

$$KE = 2\Delta P \pm \frac{\Delta P^2}{100}$$

$$P.E = \sqrt{1 + \frac{K.E}{100}} - 1$$

* Absolute Potential Energy:

$$A.P.E = \frac{-GM_em}{R_e}$$

* Gravitational Potential

$$G.P = \frac{GM_e}{R_e}$$

* Gravitationa Force

$$F = \frac{GM_em}{R_e^2}$$

$$W = \frac{GM_em}{R_e}$$

$$g = \frac{GM_e}{R_e^2}$$

* Escape Velocity

For earth : $V_{esc} = \sqrt{\frac{2GM_e}{R_e}}$

General : $V_{esc} = \sqrt{2gR_e}$

Orbital Velocity : $V_{orbital} = \sqrt{\frac{GM_e}{R_e}}$

Moment Of Inertia Of Different Objects:

1. Ring or thin walled cylinder : $I = mr^2$
2. Disc or solid cylinder : $I = \frac{1}{2} mr^2$
3. Disc ; $I = \frac{1}{2} m (r_2^2 + r_1^2)$
4. Solid sphere : $I = \frac{2}{5} mr^2$ Hollow sphere : $\frac{2}{3} m$
5. Solid rod or meter stick : $I = \frac{1}{12} ml^2$
6. Rectangular plate : $I = \frac{1}{2} m (a^2 + b^2)$

* $a_c = \frac{v^2}{r}$

* $F_c = \frac{mv^2}{r}$

* $a_c = -\omega^2 r$

* $F_c = mr\omega^2$

* $K.E_{rot} = \frac{1}{2} I\omega^2$

* $\theta = n(2\pi)$

  n: no. of revolutions

* $L = \sqrt{2(K.E)(I)}$

* Banking of Road

  $\tan\theta = \frac{v^2}{gr}$

* Speed limit

  $v = \sqrt{\mu Rg}$

* $I = mr^2$

* $\tau = I\alpha$

* $L = I\omega$

* $K.E_{rot} = \frac{1}{2} L\omega$

* $V_{esc} = \sqrt{2}\, V_{orbital}$

* $F_d = 6\pi\eta r v$

At low speed : $F_d \propto v$

At high speed : $F_d \propto v^2$

* $V_t = \dfrac{2\rho g r^2}{9\eta}$

* $r' = n^{1/3} r$

* $V_t' = n^{2/3} V_t$

* $\Delta V = A v \Delta t$

* $A_1 v_1 = A_2 v_2$

* $\dfrac{\Delta m}{\Delta t} = \rho \dfrac{\Delta V}{\Delta t}$

* $d_1^2 v_1 = d_2^2 v_2$

* $r_1^2 v_1 = r_2^2 v_2$

* $P + \frac{1}{2}\rho v^2 + \rho g h = \text{constant}$

* $v = \sqrt{2gh}$

* $F = -kx$

* The acceleration of a body executing SHM leads the velocity by a phase $\pi/2$ radian.

* If the elevator is accelerated upward the net acceleration is the sum of 'a' and 'g'
  If the elevator is accelerated downward the net acceleration is the difference of a and g

* Time Period during Upward Acceleration

$$T' = 2\pi\sqrt{\frac{l}{g+a}}$$

* Time Period during Downward Acceleration

$$T = 2\pi\sqrt{\frac{l}{g-a}}$$

Scanned with CamScanner

* In S.H.M

$$E_T = \frac{1}{2} k x_0^2$$

$$K.E = \frac{1}{2} k (x_0^2 - x^2)$$

$$P.E = \frac{1}{2} k x^2$$

* If $k' = nk$

$$T' = \frac{T}{\sqrt{n}}$$

* In S.H.M

$$V_{max} = x\omega$$

$$a_{max} = x\omega^2$$

* $\omega = 2\pi f$

* $\omega = \frac{2\pi}{T}$

* $T = 2\pi \sqrt{\frac{l}{g}}$

* $x = x_0 \cos\omega t$

* Spring cut in 'n' parts

$$T' = \frac{T}{\sqrt{n}}$$

$$k' = nk$$

* Velocity of Projection

$$V_p = \omega \sqrt{r^2 - x^2}$$

Scanned with CamScanner

* $V = f\lambda$

* Transverse Wave Speed: in stretched string or spring:

$$V = \sqrt{\frac{T}{m/l}}$$

$$V = \sqrt{\frac{T}{\rho A}}$$

* Longitudenal Wave Speed:

$$V = \sqrt{\frac{E}{\rho}}$$

* Intensity of wave:

$$I = \frac{E}{A \cdot t}$$

$$I = \frac{P}{A}$$

$$I \propto x_0^2$$

* Speed of Sound:

$$V = \sqrt{\frac{E}{\rho}}$$

$$V = \sqrt{\frac{P}{\rho}}$$

$$v = \sqrt{\frac{\rho_m g h}{\rho}}$$

* For air $\gamma = 1.42$

* $V = \sqrt{\frac{\gamma RT}{m}}$

* $V = V_0 + 0.61\ t^\circ C$

$V_0 = 332\ ms^{-1}$

* No. of beats: /Beat Frequency

$n = f_A - f_B$

* Distance b/w two successive nodes or anti nodes:

$\lambda/2$

* Distance b/w adjacent node or antinode:

$\lambda/4$

* For STATIONARY WAVES:

no. of loops formed when plucked at L/n

no. of loops $= \frac{n}{2}$

* FOR STATIONARY WAVES AND OPEN ORGAN PIPE

$$f_1 = \frac{v}{2L}$$

$\lambda_1 = 2L$ $\quad$ n: no. of loops

$$f_n = nf_1$$

$$\lambda_n = \frac{2L}{n}$$

n^{th} harmonic

$(n-1)^{th}$ overtone

Nodes $= n+1$

Antinodes $= n$

* FOR CLOSED ORGAN PIPE:

$$f_1 = \frac{v}{4L}$$

$$\lambda_1 = 4L$$

$$f_n = (2n-1)\frac{v}{4L}$$

$$\lambda_n = \frac{4L}{2n-1}$$

Nodes : n

Antinodes : n

* DOPPLER EFFECT:

1. Source moving towards stationary listener:

$$f' = \frac{v}{v-a} f$$

2. Source moving away from stationary listener

$$f' = \frac{v}{v+a} f$$

3. Listener moving away from stationary source:

$$f' = \frac{v-b}{v} f$$

4. Listener moving towards stationary source:

$$f' = \frac{v+b}{v} f$$

5. Source and listener towards each other:

$$f' = \frac{v+b}{v-a} f$$

6. Source and listener away from each other:

$$f' = \frac{v-b}{v+a} f$$

$$\lambda = 360^\circ$$

$$\lambda = 2\pi$$

* Phase Difference:

$$\delta = \frac{2\pi}{\lambda} \times \text{Path difference}$$

* YOUNG'S DOUBLE SLIT:

* For mth Bright Fringe:

$$y = m\frac{L\lambda}{d}$$

* For mth Dark Fringe

$$y = m + \tfrac{1}{2}\,\frac{L\lambda}{d}$$

* Fringe Spacing

$$\Delta y = \frac{L\lambda}{d}$$

* Order of bright Fringe:

Order = m

* Order of Dark Fringe

Order = m-1

* Michelson's Interferometer:

$$\lambda = \frac{2P}{m}$$

P : distance through which mirror is displaced
m : no. of fringes

* Diffraction of Light

$$s = d\sin\theta$$

s : Path difference
d : distance b.w two slits

→ For Dark Fringe (Minima)

$$\sin\theta = \frac{m\lambda}{d}$$

$m = 1, 2, 3 \cdots$

→ For Bright Fringe (Maxima)

$$\sin\theta = \left(m + \tfrac{1}{2}\right)\frac{\lambda}{d}$$

* Diffraction Grating:

$$d\sin\theta = m\lambda$$

* Bragg's Law

$$2d\sin\theta = m\lambda$$

d : path difference
θ : glancing angle which is complementary angle to angle of incidence

Date:
Day:

* Brewster's Law:

$$\frac{n_2}{n_1} = \tan i_p$$

i_p : polarizing angle (angle of incidence)

* Grating Element (d)

$$d = \frac{\text{Unit Length of Grating}}{\text{Total No. of lines ruled on it}}$$

* Refractive Index: (n)

$$n = \frac{\lambda_0}{\lambda}$$

$$n = \frac{c}{v}$$

$$n = \frac{\sin \angle i}{\sin \angle r}$$

* $\Delta H = \Delta E + p\Delta V$

* $\Delta U = \Delta Q - \Delta W$

* $C_p = C_v + R$

$R = 8.315\ J mol^{-1} K^{-1}$

* Co-efficient of Performance of Refrigerator:

$$E_{cooling} = \frac{Q_2}{W}$$

$$E_{cooling} = \frac{Q_2}{Q_1 - Q_2}$$

$$E_{cooling} = \frac{T_2}{T_1 - T_2}$$

* Efficiency of Heat Engine:

$$\eta = \frac{\Delta W}{Q_1}$$

$$\eta = \frac{Q_1 - Q_2}{Q_1}$$

$$\eta = \frac{T_1 - T_2}{T_1}$$

* ENTROPY:

$$\Delta S = \frac{\Delta Q}{T}$$

* $\gamma = \frac{C_p}{C_v}$

* ADDITION AND SUBTRACTION

In adding or subtracting numbers, the numbers of decimal places retained in the answer should equal the smallest number of decimal places in any of the quantities being added or subtracted. In this case, the number of significant figures is not important.

9.725 km
− 4.04 km
5.685 → Rounds off to 5.68 km

* MULTIPLICATION AND DIVISION

Final result is limited to least number of significant figures.

* Weight of object in a Stationary or constantly moving lift is :

$$W' = mg$$

Weight of object in an elevator accelerating upward is :

$$W' = (g+a)m$$

Weight of object in an elevator accelerating downward is :

$$W' = (g-a)m$$

* For a Satellite:

(i) Orbital velocity : $v \propto \frac{1}{\sqrt{r}}$

(ii) Time Period : $T \propto r^{3/2}$

(iii) Linear Momentum : $p \propto \frac{1}{\sqrt{r}}$

(iv) Angular Momentum : $L \propto \sqrt{r}$

(v) $K.E \propto \frac{1}{r}$

* SIMPLE PENDULUM

$T = 1\,sec$

$f = 1\,Hz$

$l = 0.248\,cm$

* 2nd Pendulum:

$T = 2\,sec$

$f = 0.5\,Hz$

$l = 0.99\,cm$

* In SHM

$K.E = P.E$

at $x = x_0/\sqrt{2}$

* For Carnot Engine :

$$\frac{Q_2}{Q_1} = \frac{T_2}{T_1}$$

* Spring Constant and radius

$k \propto r^2$

Molar Mass of Important Elements (in g)

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

Molar Mass of Molecules and Compounds

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

VALUES:

* e/m for electron = 1.7588×10^{11} C/kg
* Charge on electron = 1.6022×10^{-19} C or 4.8×10^{-10} e.s.u
* Mass of electron = 9.11×10^{-31} kg
* Max. e/m Ratio of canal Rays = 9.54×10^{7} C/kg
  (when H_2 gas is used in discharge tube)
* Mass of proton = 1.6726×10^{-27} kg
* Mass of neutron = 1.6749×10^{-27} kg
* Planck's constant = 6.6262×10^{-34} Js
* Speed of light, c = 3×10^{8} ms^{-1}
* Vacuum Permitivity, ϵ_0 = 8.85×10^{-12} $C^2 J^{-1} m^{-1}$
* Rydberg's constant, R = 1.0974×10^{7} m^{-1}
* General Gas constant, R = 0.0821 dm^3 atm mol^{-1} K^{-1}
* SI Value of General Gas constant, R = 8.314 Nm mol^{-1} K^{-1}

RYDBERG'S CONSTANT

$$R = \frac{me^4}{8\epsilon_0^2 h^3 c}$$

$$R = 1.0974 \times 10^7 \, m^{-1}$$

* To Find Number Of Spectral Lines

$$\text{Number of Spectral lines} = \frac{n(n-1)}{2}$$

Size → n

Shape → l

x, y, z orientation → m

spin → s

* Values of $n = 1, 2, 3 \ldots$
* Values of $l = 0$ to $n-1$
* Values of $m = -l$ through 0 to $+l$
* Values of $s = +1/2, -1/2$

* Max no. of electrons in a shell = $2n^2$
* Max no. of electrons in a subshell = $2(2l+1)$
* Max no. of orbitals in an orbit = n^2
* Max no. of orbitals in a subshell = $2l+1$

* Total nodes = $n - 1$

* Angular nodes = l

* Radial nodes = $(n-1) - l$

FORMULA FOR HYBRIDIZATION

$$H = \frac{1}{2}(V + M - C + A)$$

V : Number of valence electrons

M : Monovalent atoms bonded to central atom

C : cationic charge (+)

A : Anionic charge (-)

For

$H = 2 \rightarrow sp$

$H = 3 \rightarrow sp^2$

$H = 4 \rightarrow sp^3$

$H = 5 \rightarrow sp^3d$

$H = 6 \rightarrow sp^3d^2$

$H = 7 \rightarrow sp^3d^3$

$$\text{Bond Order} = \frac{N_B - N_A}{2}$$

N_B : No. of electrons present in bonding molecular orbital
N_A : No. of electrons present in anti bonding molecular orbitals

* Bond order is zero if :
$N_B = N_A$

* Bond Order > Zero if :
$N_B > N_A$

→ All even electron species have bond order in whole number.
→ All odd electron species have bond order in fractions and paramagnetic

→ All even electron Species are diamagnetic except :
$16e^-$, $10e^-$
O_2 B_2

→ All iso-electron species have same bond order, magnetic behaviour.

→ $14e^-$ species N_2, O_2^{+2}, NO^+, CN^{-1} have bond order = 3 and are diamagnetic

→ $16e^-$ species : O_2, N_2^{-2}, NO^{-1} have bond order = 2 and are paramagnetic.

* Electrons : 1 - 2

$$B.O = \frac{n}{2}$$

* Electrons : 3 - 6

$$B.O = \frac{|14 - n|}{2}$$

* Electrons : 7 - 14

$$B.O = \frac{|18 - n|}{2}$$

* Electrons : 15 - 20

$$B.O = \frac{|20 - n|}{2}$$

* FOR POLAR GASES

T_c, V_c, P_c $\propto$ Intermolecular Forces

* FOR NON POLAR GASES

T_c, V_c, P_c $\propto$ Molar mass of gas

MCQ: Gas having highest T_c

a) H_2 b) He c) O_2 ✓d) Cl_2

* 1 Debye = 3.34×10^{-30} Cm

* Dipole Moment of water = 1.84 Debye

* NH_3 and HF → Form one H-bond

* H_2O → form 2 H-bonds

* Order of Strength of H-bonding:
  HF > H_2O > NH_3

* Order of Boiling Points:
  H_2O > HF > NH_3

* Vapour Pressure of Ether at 25°C:
  537 mm Hg

* V.P of H_2O:
  At 25°C → 24mm Hg
  At 100°C → 760mm Hg

* Liquid Crystal Properties :

1. show optical properties
2. surface tension
3. viscosity
4. Fluidity

* Examples :

1. Stearin
2. Cholestryl Benzoate

* Allotropes → Elements existing in more than one crystalline form

* Isotopes → same atomic number, different atomic mass

* $K_w = [H^+][OH^-]$ → Ionic Product of water

* $K_a = \frac{[H^+][A^-]}{[HA]}$ → Acid Ionization constant

* $K_b = \frac{[HA][OH^-]}{[A^-]}$ → Base Ionization constant

* $K_a = \frac{K_w}{K_b}$

* $pK_w = -\log K_w$
* $pH = -\log [H^+]$
* $pOH = -\log [OH^-]$
* $pK_a = -\log K_a$
* $pK_b = -\log K_b$

* $K_w = 10^{-14}$ at $25^\circ C$

* $pK_w = 14$
* K_a of $H_2O = 1.8 \times 10^{-5}$ at $25^\circ C$
** pK_a of $H_2O = 15.7$ at $25^\circ C$

* $pH + pOH = pK_w = 14$

* $pK_w = pK_a + pK_b = 14$
* $[H^+] = 10^{-pH}$

CALCULATING pH OF BUFFER SOLUTION

Henderson - Hesselbalch Equation:

$$pH = pK_a + \log \frac{[Salt]}{[Acid]}$$

$$pH = pK_a - \log \frac{[Acid]}{[salt]}$$

$$pOH = pK_b + \log \frac{[salt]}{[Base]}$$

If [salt] = [acid] then pH = pKa
If [salt] > [acid] then pH > pKa
If [salt] < [acid] then pH < pKa

* Hydrolysis of salt obtained from weak acid and strong base :

$$K_h = \frac{K_w}{K_a}$$

* Hydrolysis of salt obtained from strong acid and weak base :

$$K_h = \frac{K_w}{K_b}$$

* Hydrolysis of salt obtained from weak acid and weak base

$$K_h = \frac{K_w}{K_a \times K_b}$$

→ The solubility of KNO_3 and $Al_2(SO_4)_3$ increases with increase in temperature.

→ The solubility of certain solids like $Ce_2(SO_4)_3$, Li_2CO_3 and LiCl decreases with increase in temperature

→ Solubility of NaCl and KBr is almost not affected by increase or decrease in temperature but remains constant.

Exothermic Examples:

$NaOH$ in water

$CaCl_2$ in water

$MgSO_4$ in water

-Endothermic Examples:

KI in water

NH_4NO_3 in water

NaCl in water

KCl in water

Cold Packs:

NH_4NO_3 in water

This can also be used as freezing mixture

Hot Packs:

$CaCl_2$ or $MgSO_4$ in water

* Neutron - highest penetration power
* The boiling point and decomposition point of glycerine is 290°C at 760mmHg (1atm)
* Glycerine can be purified by vacuum distillation at any 210°C and 50mmHg
* 1 poise = 0.1 kg/m/s
* smaller the size of cation greater is lattice energy
* Purification of NaCl is carried out by passing HCl gas through a saturated solution of NaCl
* Greater the value of Ka stronger would be the acid
Greater the value of pKa weaker would be the acid
* A buffer solution can be made by mixing a weak acid with one of its salts or mixing a weak base with one of its salts.
* Salts that are from strong bases and strong acids donot hydrolyze. e.g NaCl, Na_2SO_4, KNO_3 etc.
* In Salt formation, we get the negative ion from the acid and positive ion from the base.
* log10 = 1
* log 1 = 0
* HCl can poison MnO_2 in decomposition of H_2O_2
* CO in Haber's process can poison Fe.
* Critical solution temperature of Phenol - water : 65.9°C
* Kb (ebullioscopic constant) of water = 0.52°C

EXAMPLES OF REACTIONS WHEN $\Delta H° = +ve$ endothermic

1. Enthalpy of atomization
2. Enthalpy of ionization

EXAMPLES OF REACTIONS WHEN $\Delta H° = -ve$ exothermic

1. Enthalpy of neutralization
2. Enthalpy of combustion

EXAMPLES OF REACTIONS WHEN $\Delta H° = +ve$ or $-ve$

1. Enthalpy of formation
2. Enthalpy of solution

* $q = mC\Delta T$

  c : Specific Heat Capacity

* $q = nC\Delta T$

  C : molar Heat Capacity

* $C_M = M \times C_S$

  C_M : molar heat capacity

  C_S : Specific heat capacity

  M : Molar mass

$W = ZIt$ → Faraday 1^{st} Law

$W = \frac{Ite}{F}$ → Faraday 2^{nd} Law

$F = 96500C$

* Kf (cryoscopic constant) of water - 1.86
* The standard state of any substance is taken as its natural state at 25°C (298K) under 1atm pressure.
* Enthalpy is measured under standard conditions.
* The enthalpy of neutralization of NaOH by HCl is -57.4 kJ/m
* The standard enthalpy of formation for an element in its standard state is zero.
* First electron affinity is always exothermic in nature.
* Oxidizing agent - oxidation number decrease
* Reducing agent - oxidation number increase
* Oxidation - increase in oxidation number
* Reduction - decrease in oxidation number
* Oxidation ocxurs at anode
* Reduction occurs at cathode
* In voltaic cell anode is negatively charged and cathode is positively charged (opposite to that of electrolytic cell)

* Electrode potential of SHE is arbitrarily considered as zero.
* When reduction occurs on SHE voltmeter reading will be positive.
* When oxidation occurs on SHE voltmeter reading will be negative.
* The electrochemical series are arranged in order of increasing strength as an oxidizing agent and increasing reduction potentials.
* Metals will displace another another metal from aqueous solution of its salt if it lies above the electrochemical series.
* In electrochemical series, higher elements acts as anode and lower elements act as cathode.

Every species have a specific number of chromosomes in their cells.			
Man	46 (23 pairs)	**Frog**	26 (13 pairs)
Chimpanzee	48 (24 pairs)	**Drosophila**	8 (4 pairs)
Onion	16 (8 pairs)	**Potato**	48 (24pairs)
Garden pea	14 (7 pairs)	**Pigeon**	80(40 pairs)

Contents	**Bacterial Cell**	**Mammalian Cell**
Water	70	70
Proteins	15	18
Carbohydrates	3	4
Lipids	2	3
DNA	1	0.25
RNA	6	1.1
Enzymes, Hormones etc	2	2
Inorganic Ions etc	1	1

Enyzme	pH Optimum
Lipase (Pancreas)	8.0
Lipase (Stomach)	4.0-5.0
Lipase (Castor oil)	4.7
Pepsin (Stomach)	1.5-1.6
Trypsin (Small Intestine)	7.8-8.7
Urease	7.0
Invertase	4.5
Maltase	6.1-6.8
Amylase (Pancreas)	6.7-7.0
Amylase (malt)	4.6-5.2
Catalase	7.0

* Glycogen → Branched chains of glucose monomers
  Cellulose → unbranched chain of glucose
  Starch → may be branched (Amylopectin) or unbranched (Amylose)

→ Chitin : polymer of glucose with amino ($-NH_2$) group

→ Human blood contains 100 mg of glucose per 100 ml of blood

* Acylglycerol → Glycerol + Fatty Acid

Phospholipids → 1 Glycerol + 2 Fatty Acids + 1 Phosphoric Acid usually linked to some nitrogen group

Waxes → Long Chain fatty acid bonded to long chain alcohol

Steroids → No Fatty acid. Four fused carbon rings containing 17 carbon atoms

Carbon Rings (3 Hexagonal, 1 Pentagonal)

Terpenoids → No fatty acids. formed of isoprenoid units

* Triglycerides → 1 Glycerol + 3 Fatty Acids

* Nitrogenous Bases are:
  1. Pyramidines (single ring)
  2. Purines (Double Ring)

* Pyramidines → Thymine, Cytosine, Uracil
* Purines → Adenine, Guanine

* Examples of:

Mononucleotide → Adenosine Triphosphate (ATP)

Dinucleotide → Adenine Dinucleotide

Polynucleotides → DNA + RNA

* centrioles present in animal cells, cells of some microscopic organisms and lower plants.
* In the stroma, CO_2 is faixed to manufacture sugars.
* Enzyme Nomenclature :
1. Oxidoreductases - oxidades, oxygenases, peroxidases
2. Transferases - Transcarboxylases, transmethylases
3. Hydrolases - esterases, phosphatases, peptidases
4. Lyases - decarboxylases, deaminases, synthases
5. Isomerases - epimerases, mutases
6. Ligases - DNA ligases, RNA ligases
* oleic acid - unsaturated fatty acid
* palmatic acid - saturated fatty acid
* All the members of oomycota (water mold) are either parasites or saprophytes.
* In oomycota cell wall is made of cellulose.
* Oomycota have characteristic biflagellate zoospores.
* Upto one quarter of world's photosynthesis is formed by algae and its associates.
* Cellulose - unbranched polysaccharide
* chitin - a nitrogen containing polysaccharide (polymer of glucose with amino group)
* Yeast contain high level of b vitamins and about 50% of yeast is protein.
* Ferns flourished well and dominated the earth during the Permian and Triassic period.
* Ammonoid mollusks dominated the earth during Triassic and Jurassic period.

* Animals - 2 million
* Plants - 0.5 million
* Spermotophytes - 300,000 (3 lac)
* Dicots - 200,000 (2 lac)
* Monocots - 50,000
* Gymosperms - 700
* Algae - 18,000
* Fungi - 80,000
* Ferns - 10,000
* Graminae (grass family) - 7500
* Platyhelminthes - 15,000
* Mollusca - 80,000 (35,000 fossils)
* Class Pisces - 29,000

* in algae, mosses and liverworts - dominant gametophyte
* Bryophytes also called embryophytes
* Sphenopsida (horsetails) also called arthrophytes.
* Psilopsida - leafless
* Lycopsida and Sphenopsida - microphyllous leaf
* Pteropsida - megaphyllous leaf
* In gymnosperms, leaves may be dimorphic i-e foliage leaves and scale leaves.
* Each stamen consist of an anther with four pollen sacs.
* In angiosperms two male gametes and a tube nucleus constitutes the male gametophyte.
* In angiosperms the megaspore generally develops into seven celled female gametophyte or embryo sac.
* syrinx is present at the junction of trachea and bronchi.
* Female birds have only left ovary.
* The bones of flightless birds are not hollow.
* Mammals are believed to be evolved from reptiles.
* Birds - oval, nucleated RBCs
* Mammals - biconcave, non nucleated RBCs
* Eutheria are divided into 16 orders.
* Liver store Vitamin A, B12, D, E, K and minerals like iron and copper.
* 400 - 800 mL of gastric juice at each meal.
* 500 - 800 mL pancreatic fluid per day

ECG

PQRST

* TP Interval → Ventricular Diastole (Relax)
* P Wave → Atrial systole (contract)
* QR Interval → End of ventricular Diastole
* RS Interval → Ventricular Systole (contract)
* ST Interval → Atrial Diastole (Relax)
* T Wave → Ventricular Diastole (Relax)

TP	P	QR	RS	ST	T
V	A	V	V	A	V
D	S	D	S	D	D

Table 12.1 Showing blood flow in milliliter/ minute

Organ	At Rest	During Strenuous Exercise
Heart	250	750
Kidneys	1,200	600
Skeletal Muscles	1,000	12,5000
Skin	400	1,900
Viscera	1,400	600
Brain	750	750
Other	600	400
Total	5,600	17,500

* pH of urease, catalase, amylase = 7
* pH of invertase = 4.5
* 60% of peptic ulcers caused by bacterial infections.
* Normal BMI - 18.5 - 24.9
* Right atrium communicates with right ventricle through tricuspid valve.
* Left atrium communicates with left ventricle through bicuspid valve (mitral valve)
* Deoxygenated blood comes to right atrium through vena cava.
* Oxygenated blood comes to left atrium through pulmonary veins.
* Deoxygenated blood from right ventricle is pumped to the lungs through pulmonary arteries.
* Oxygenated blood pumped into aorta from left ventricle.
* Every time heart pours about 85mL of blood into aorta with great pressure.
* Lub - contraction
* Dub - Relaxation
* SA Node (pacemaker) - initiates nerve impulses
* AV Node - electrical control system of heart, coordinate heart rate
* Arterioles - 3mm - 10 micro meter
* capillary - 7.5 micro meter
* Venules - 8-100 micro meter
* Sphygmomanometer - to measure blood pressure

Name of Vessel	Systolic B.P.	Diastolic B.P	B.P
Aorta	120	80	
Arteries	102	60	
Arterioles	60	45	
Capillaries	-	-	40
Venules	-	-	20
Veins	-	-	10
Vena cava	-	-	0

To Find units of Rate Constant k

$$k = \frac{rate}{[A]^n} = \frac{M/s}{[M]^n}$$

Chlorophyll a → $C_{55}H_{72}O_5N_4Mg$

Chlorophyll b → $C_{55}H_{70}O_6N_4Mg$

* Metallic crystals do not have cleavage planes.
* Order of reaction cannot be greater than 3
* two synergid cells
* three antipodal cells
* Psilopsida is called whisk fern
* Phylum Ctenophora or minor phyla - ignored animals, mostly inhabitants of deep sea
* Isobars differ in atomic number but same mass number.

1. Oxidoreductases :
Catalyze oxidation - reduction reactions
Examples : oxidases, oxygenases, peroxidases

2. Transferases :
Transcarboxylases, transmethylases

3. Hydrolases :
Catalyze reactions in which cleavage of bonds is accomplished by addition of water
Examples : esterases, phosphatases, peptidases

3. Lyases :
Reactions in which groups are removed from a double bond or added to a double bond
Examples : decarboxylases, deaminases, synthases

4. Isomerases :
Intermolecular rearrangements
Examples : epimerases, mutases

5. Ligases :
Catalyze bond formation
Examples : DNA ligase, RNA ligase

Table: 2.3: Examples and functions of monosaccharides

Class	Formula	Aldoses	Ketoses	Function
Trioses (3C)	$C_3H_6O_3$	Glyceraldehyde	Dihydroxy acetone	Intermediates in photosynthesis and cellular respiration.
Tetroses (4C)	$C_4H_8O_4$	Erythrose	Erythrulose	Intermediates in bacterial photosynthesis.
Pentoses (5C)	$C_5H_{10}O_5$	Ribose, Deoxyribose ($C_5H_{10}O_4$)	Ribulose	Ribose and deoxyribose are components of RNA and DNA respectively. Ribulose is an intermediates in photosynthesis.
Hexoses (6C)	$C_6H_{12}O_6$	Glucose, Galactose	Fructose	Glucose is respiratory fuel (initial substrate) Fructose is an intermediate in respiration. Galactose is the component of milk sugar.
Heptoses (7C)	$C_7H_{14}O_7$	Glucoheptose	Sedoheptulose	Intermediates in photosynthesis.

Table 6.1: Differences between bacteria and archaea

Main Features	Bacteria	Archaea
rRNA sequences	Many unique to Eubacteria	Many match eukaryotic ones
RNA polymerase	Relatively small and simple	Complex similar to eukaryotic
Introns (noncoding parts of genes)	Absent	Present in some genes
Antibiotic sensitivity (to streptomycin, chloramphenicol)	Inhibited	Not inhibited
Peptidoglycan in cell wall	Present	Absent
Membrane lipids	Carbon chains unbranched	Carbon chains branched

Table 6.2: Difference between Gram positive and Gram negative cell wall

	Character	Gram positive	Gram negative
1	Number of layers	One	Two
2	Thickness	Thick (20-80 nm)	Thin (8-10 nm)
3	Outer membrane	Absent	Present
4	Periplasmic space	Present in some	Present in all
5	Chemical composition	Peptidoglycan, Teicholc acid and lipotechoic acid	Lipopolysaccharide, lipoporte[illegible] and peptodoglycan
6	Porins proteins	Absent	Present
7	Lipid	Less	More
8	Peptidoglycan	More	Less
9	Permeability of molecules	More penetrable	Less penetrable
10	Resistance to molecules	less	More

Table 6.3 Some of the member of normal location

Members of Normal Flora	Anatomic Location
Clostridium species	Colon
Escherichia coli and other coliforms	Colon, vagina, outer urethra
Lactobacillus species	Mouth, colon, vagina
Staphylococcus aureus	Nose, skin
Enterococcus faecalis	Colon
Viridans streptococci	Mouth, nasopharynx

Table 8.1: Differences between dicots and monocots

	Dicots	Monocots
LEAF	Broad, generally bifacial with reticulate venation	Long narrow, lanceolate, monoficial with parallel venation.
STEM	Vascular bundle in ring, vascular cambium is present which gives secondary growth.	Vascular bundles scattered vascular cambium usually absent so no secondary growth occurs.
ROOT	Primary root is a tap root which develops lateral root. 2-8 patches of xylem, vascular cambium present, secondary growth occurs.	Adventitious roots arise from the base of stem, and give rise to a fibrous root system. Always more than 8 patches of xylem. Vascular cambium absent so no secondary growth.
SEED	Embryo has two cotyledons.	It has one cotyledon.
FLOWER	Typically tetra or penta-merous calyx and corolla usually differ from each other. Flowers are usually insect pollinated.	Parts usually in three,i.e., trimerous. No distinction between calyx and corolla. Flowers are often air pollinated.
Example	Rose, pea, buttercup etc.	Lilies, orchids, grasses, wheat, rice.

Table 10.1 Mineral nutrition in plants

Macronutrients	Major Functions
Carbon, Hydrogen, Oxygen	Component of carbohydrates, lipids, protein and nucleic acid molecules
Nitrogen	Component of proteins, nucleic acids, chlorophyll and enzymes
Phosphorus	Component of nucleic acids, phospholipids, ATP and NADP.
Calcium	Component of cell wall, involved in membrane permeability, enzyme activator.
Magnesium	Component of chlorophyll, acts as enzyme activator
Sulphur	Component of certain amino acids and vitamins.
Potassium	Osmosis and ionic balance, opening and closing of stomata, enzyme activator
Micronutrients	**Major Functions**
Chlorine	Activator of enzymes, involved in photosynthesis.
Iron	Activator of enzymes, components of cytochromes, feridoxin, plastoquinone, assists in the manufacture of chlorophyll and other biochemical processes.
Manganese	Activator of enzymes, needed for chlorophyll production.
Copper	Activator of enzymes, component of plastocyanin, helps plants to metabolize nitrogen.
Zinc	Activator of enzymes, used in development of enzymes and hormones. It is used by the leaves and needed by legumes to form seeds.

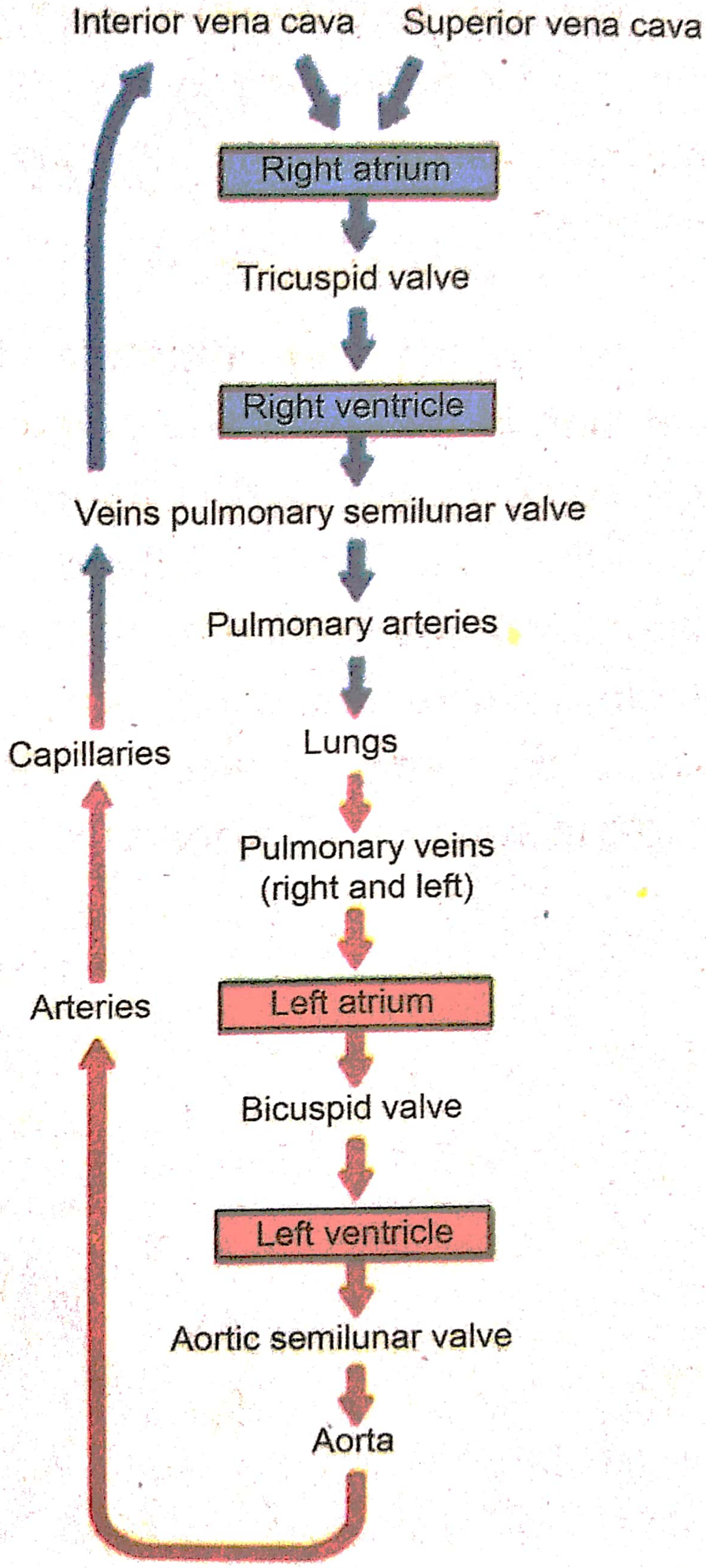


Fig. 12.3: Passage of blood through heart

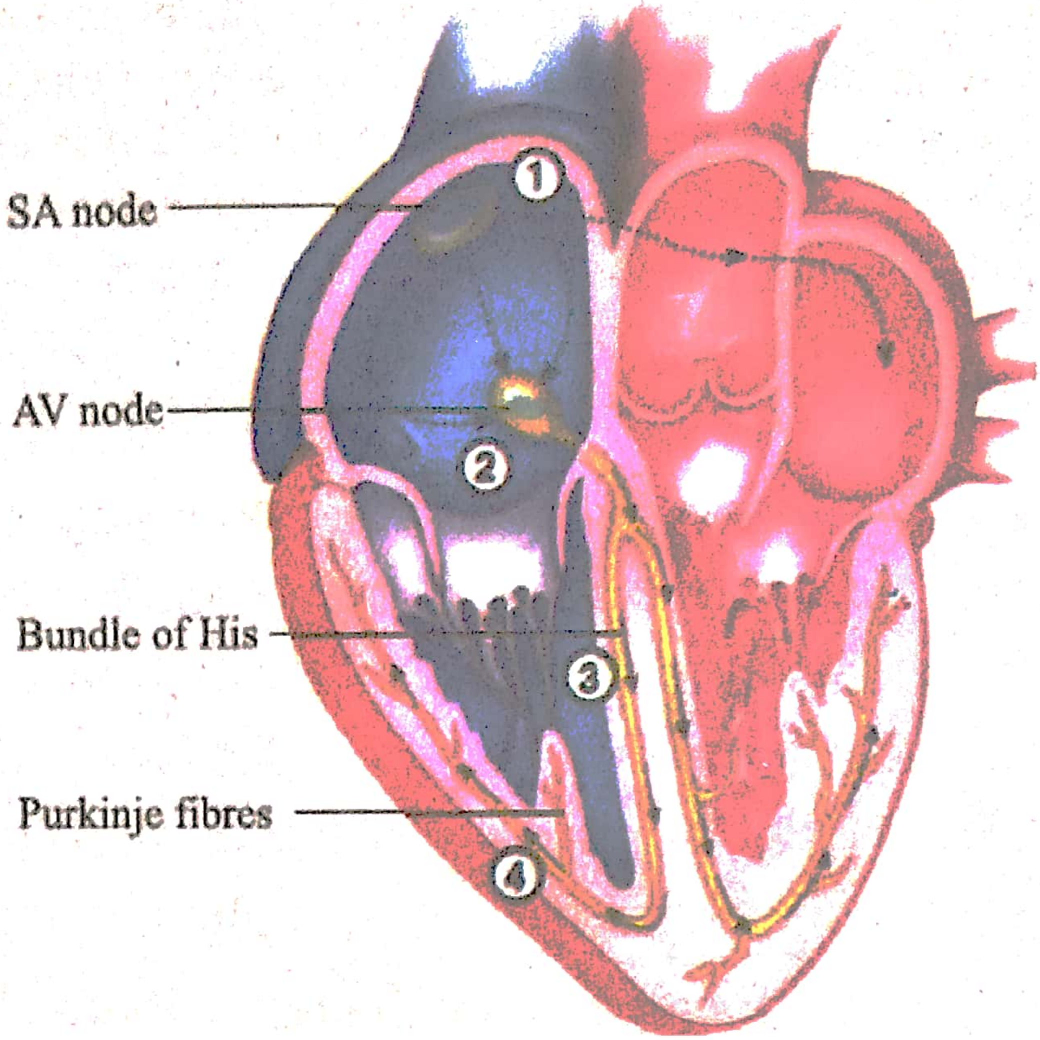


Fig. 12.5: Conducting system of the heart

1. Action potentials originate in the sinoatrial (SA) node and travel across the wall of the atrium (arrows) from the SA node to the atrioventricular (AV) node.
2. Action potentials pass through the AV node and along the atrioventricular (AV) bundle, which extends from the AV node, through the fibrous skeleton, into the interventricular septum.
3. The AV bundle divides into right and left bundle branches, and action potentials descend to the apex of each ventricle along the bundle branches.
4. Action potentials are carried by the Purkinje fibres from the bundle branches to the ventricular walls.

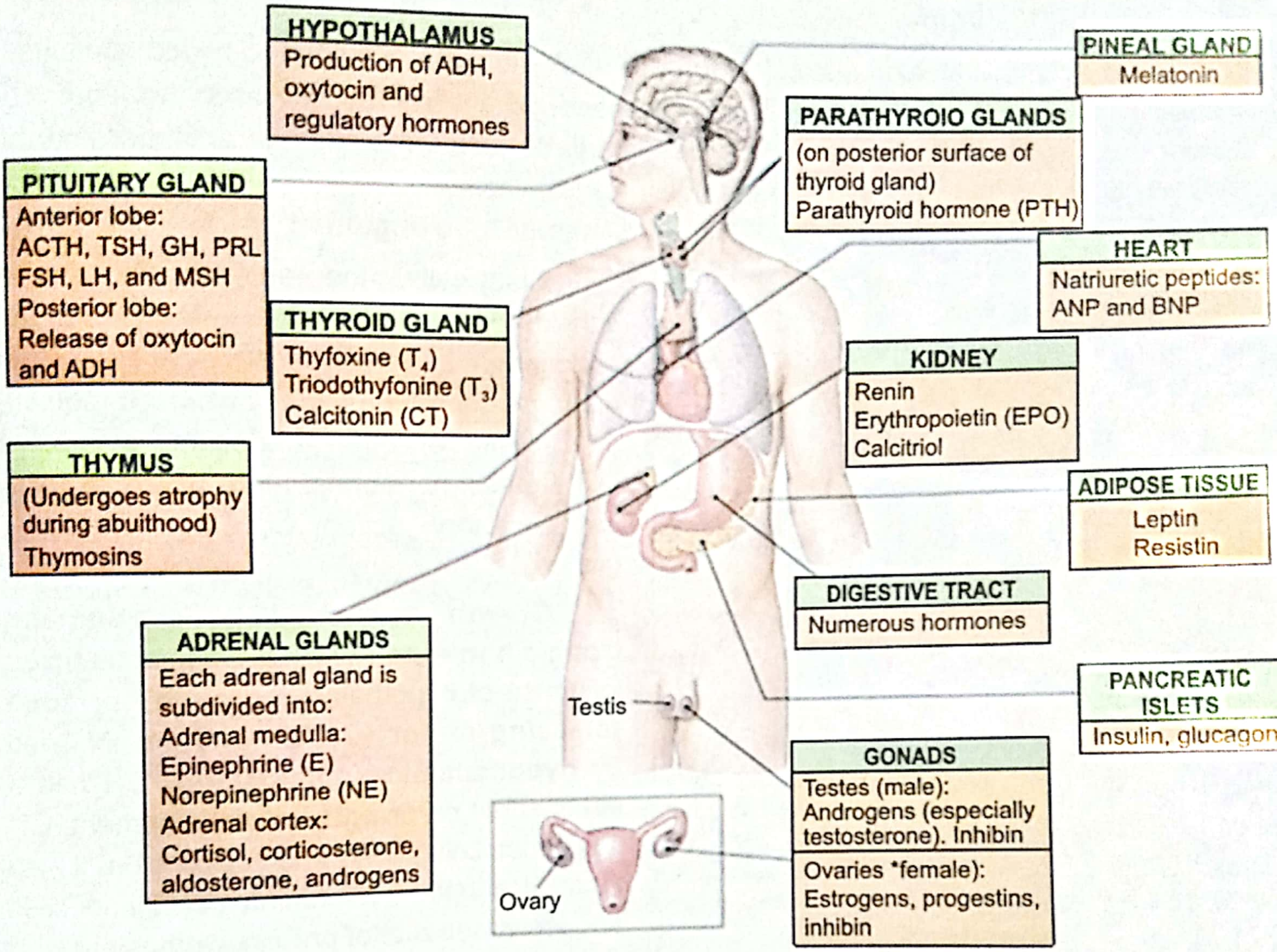


Fig. 18.3 Major endocrine glands and their locations in human

Table 18.1 Hypothalamic hormones and their effect on pituitary gland

Hormone from the hypothalamus	Anterior pituitary response
Growth hormone releasing factors **(GHRF)**	Secretion of growth hormone **(GH)**
Somatostatin	Inhibition of **GH**
Thyrotrophin releasing factor **(TRF)**	Secretion of thyroid stimulating hormone **(TSH)**
Adrenocorticotrophin releasing factor **(CRF)**	Secretion of adrenocorticotrophic hormone **(ACTH)**
Prolactin inhibiting factor **(PIF)**	Inhibits secretion of prolactin
Gonadotrophin releasing hormone **(GnRH)**	Secretion of **FSH** and **LH**

In addition, the neurosecretory cells that arise from the hypothal

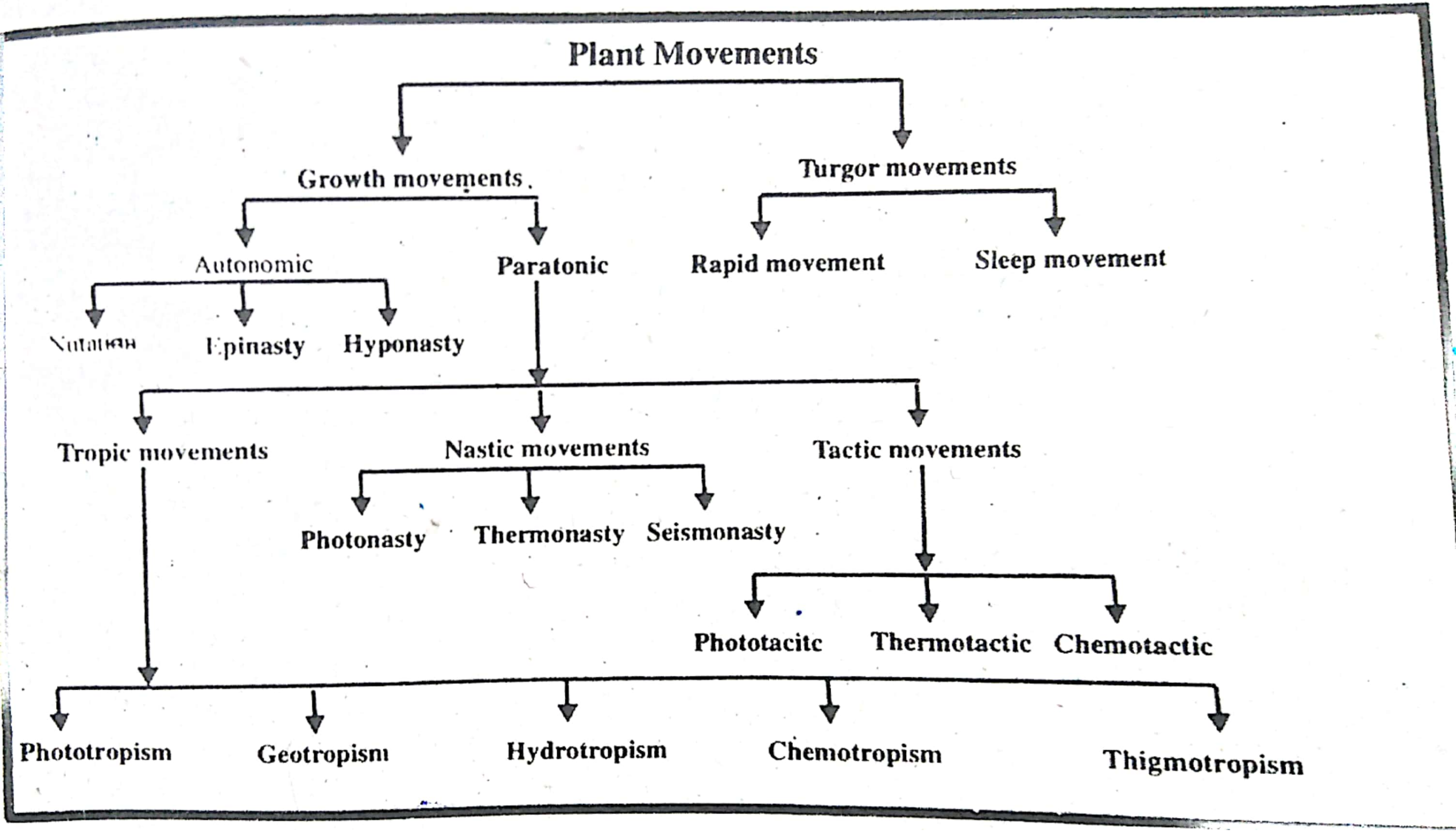
Cocci Bacteria

1. ~~Single~~ Single plane of cell division → Diplococci
   → Strepto cocci

2. Two plane of cell division → Square of four cells, called tetrad

3. Three plane of cell division → Cubical arrangement of eight cells called sarcinae

4. Irregular plane → arrange like bunches of grapes called staphylococci



Plant Movements
Growth movements
Turgor movements
Autonomic
Paratonic
Rapid movement
Sleep movement
Nutation
Epinasty
Hyponasty
Tropic movements
Nastic movements
Tactic movements
Photonasty
Thermonasty
Seismonasty
Phototacitc
Thermotactic
Chemotactic
Phototropism
Geotropism
Hydrotropism
Chemotropism
Thigmotropism

BOND ANGLES

$BeCl_2$ → 180°
BF_3 → 120°
$SnCl_2$ → Less than 120°
CH_4 → 109.5°
NH_3 → 107.5°
H_2O → 104.5°

* 2 Bond Pairs, 0 Lone Pair → Linear (180°)
* 3 Bond Pairs, 0 Lone Pair → Trigonal Planar (120°)
* 2 Bond Pairs, 1 Lone Pair → Angular (Less than 120°)
* 4 Bond Pairs, 0 Lone Pair → Tetrahedral (109.5°)
* 3 Bond Pairs, 1 Lone Pair → Trigonal Bipyramidal (Less than 109.5°)
* 2 Bond Pairs, 2 Lone Pairs → Angular (Less than 109.5°)

* d_{z^2} resemble p-orbital

* Lattice energy is important in predicting the solubility of ionic solids in water. Ionic compounds with smaller lattice energies tend to be more soluble in water.
* Smaller the size of cation, greater is lattice energy.
* Cubic symmetry crystals are isotropic e.g NaCl
* Metallic crystals do not have cleavage planes
* Coordination number of

Fcc - 12

Bcc - 8

Simple cubic - 6

* Common ion effect is the phenomenon in which the solubility of one electrolyte is suppressed by the addition of another strong electrolyte having a common ion.
* In Group 2A

Solubility of hydroxides increase down the group

Solubility of sulphates decrease down the group

Solubility of carbonates increase down the group

* The frequency of emitted X-Rays increase with increase in atomic number.

* AUFBAU PRINCIPLE : n+l rule

* PAULI'S EXCLUSION PRINCIPLE :

No two electrons in atoms can have same set of 4 quantum numbers OR

No two electrons in an orbital have same spin

* HUND'S RULE : While Filling degenerate orbitals, electrons should be placed in different orbitals with same spin rather than to put them in the same orbital with opposite spins.

* All even electron species have bond order in whole number and are diamagnet except 16e species and 10e species (these are diamagnetic)
* All odd electron species have bond order in fractions and are paramagnetic.
* 14e species have bond order =3 and are diamagnetic
* 16e species have bond order = 2 and are paramagnetic
* Greater the size of atom, greater is the strength of LDF
* Greater the polarizibility, greater the strength of LDF
* In cubic system each point ta the corner of the cell is shared by 8 unit cells

Each point at the face is shared by 2 unit cells

Each point at the centre is part of only one unit cell
* A cube has 8 corners and 6 faces
* Coordination Number of :

Fcc - 12

Bcc - 8

Simple cubic - 6

* The reactions catalyzed by enzymes follow zero order kinetics
* The radioactive decay is always a first order reaction.
* When reduction occurs on SHE, voltmeter reading will be positive

When oxidation occurs on SHE, voltmeter reading will be negative
* Electrodes having higher position in series will act as anode while Electrodes having lower position in series will act as cathode.
* The electrochemical series are arranged in order of increasing strength as an oxidizing agent and increasing reduction potentials.
* Metals will displace another metal from aqueous solution of its salt if it lies above electrochemical series.
* The smaller the time constant (RC) the faster is the charging and discharging rate of capacitor.

VALUES

* $g = 9.8\ ms^{-2} = 32\ ft\ s^{-2}$
* 1 kWh = 3.6 MJ
* 1 hp = 746 Watts
* $G = 6.67 \times 10^{-11}\ Nm^2 kg^{-2}$
* $R_e = 6.4 \times 10^6\ m$
* $M_e = 6 \times 10^{24}\ kg$
* V_{es} for earth $= 11.2 \times 10^3\ ms^{-1}$
* $R_m = 1.6 \times 10^6\ m$
* $g_m = 1.6\ ms^{-2}$
* Critical Velocity For Satellite, $V = 7.9\ kms^{-1}$
* Light Year $= 9.46 \times 10^{15}\ m$
  ↳ Distance that light travels in one year
* V_{esc} for moon $= 2.3 \times 10^3\ ms^{-1}$
* Orbital Radius for Geostationary satellite: $r_0 = 4.23 \times 10^4\ km$
* Orbital Speed of earth = 30 km/s
* Orbital Speed of moon = 1 km/s
* Speed of sound in air at 0°C $= 332\ ms^{-1}$
* Speed of sound in water $= 1430\ ms^{-1}$

* RESISTANCE

A) In Case of Unstretched Condition $R = \rho \frac{L}{A}$

1. Resistance is directly proportional to length
2. Inversely proportional to area
3. Inversely proportional to square of radius
4. Inversely proportional to square of diameter

B) In Case of Stretched Condition:

1. Resistance is directly proportional to square of length
2. Inversely proportional to square of area
3. Inversely proportional to fourth power of radius
4. Inversely proportional to fourth power of diameter

* If wire is bent into circle then new resistance will be: $R' = \frac{R}{4}$

* If wire is bent into square form then new resistance will be: $R' = 4R$

1 amu = 1.6×10^{-27} kg

1 amu = 1.49×10^{-10} J

1 u = 931 MeV

1 eV = 1.6×10^{-19} J

* Mass of electron:
  - → 9×10^{-31} kg
  - → 5.4×10^{-4} u
  - → 0.51 MeV

* Mass of Proton:
  - → 1.67×10^{-27} kg
  - → 1.007 u
  - → 937 MeV

* Mass of Neutron:
  - → 1.67×10^{-27} kg
  - → 1.008 u
  - → 938 MeV

→ Succinate undergoes dehydrogenation/ oxidation to form fumarate. The hydrogen and electrons which are released from succinate are taken up by FAD to form $FADH_2$

→ A molecule of water gets added to fumarate to form malate