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CARBON AND ITS COMPOUNDS

Carbon is Tetravalent :- One carbon atom requires 4 more electrons to achieve the 8-electron inert gas structure, therefore the valency of carbon is 4, hence Carbon is Tetravalent.

Types of Organic Compounds :-

1. HYDROCARBONS :

(A) Saturated Hydrocarbons (Alkanes) :- General formula is C_nH_{2n+2} (Single Bond)

Examples :

Methane (CH_4) Structural Formula: CH_4, (JAYANT SHARMA – 9414537474)

Ethane (C_2H_6) Structural Formula: CH_3CH_3,

Propane (C_3H_8) Structural Formula: $CH_3CH_2CH_3$,

Butane (C_4H_{10}) Structural Formula: $CH_3CH_2CH_2CH_3$ or: $CH_3(CH_2)_2CH_3$,

Pentane (C_5H_{12}) Structural Formula: $CH_3CH_2CH_2CH_2CH_3$ or: $CH_3(CH_2)_3CH_3$,

Hexane (Molecular Formula: C_6H_{14}, Structural Formula: $CH_3CH_2CH_2CH_2CH_2CH_3$ or: $CH_3(CH_2)_4CH_3$),

Heptane (Molecular Formula: C_7H_{16}, Structural Formula: $CH_3CH_2CH_2CH_2CH_2CH_2CH_3$ or: $CH_3(CH_2)_5CH_3$)

Octane (Molecular Formula: C_8H_{18} Structural Formula: $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$ or: $CH_3(CH_2)_6CH_3$),

Nonane (Molecular Formula: C_9H_{20}, Structural Formula:$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$ or: $CH_3(CH_2)_7CH_3$

Decane (Molecular Formula: $C_{10}H_{22}$Structural Formula: $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$ or: $CH_3(CH_2)_8CH_3$)

(B) Unsaturated Hydrocarbons (Alkenes) :- General formula is C_nH_{2n} (Double Bond)

Examples : Ethene (C_2H_4), Propene (C_3H_6), Butene (C_4H_8), Pentene (C_5H_{10}),
Hexene (C_6H_{12}), Heptene (C_7H_{14}), Octene (C_8H_{16}), Nonene (C_9H_{18}), Decene ($C_{10}H_{20}$)

(C) *Unsaturated Hydrocarbons* (Alkynes) :- General formula is C_nH_{2n-2} (Triple Bond)

Examples : Ethyne (C_2H_2), Propyne (C_3H_4), Butyne (C_4H_6), Pentyne (C_5H_8),
Hexyne (C_6H_{10}), Heptyne (C_7H_{12}), Octyne (C_8H_{14}), Nonyne (C_9H_{16}), Decyne ($C_{10}H_{18}$)

Cyclic Hydrocarbons :

Hydrocarbons in which the carbon atoms are arranged in the form of a ring are called Cyclic Hydrocarbons.

Examples : Cycloalkanes :- General formula ($C_nH_{2n)}$ and

Cycloalkenes :- General formula :- C_nH_{2n-2} (2n-2 for every double bond present)

IUPAC Nomenclature for Branched – chain Saturated Hydrocarbons :- (JAYANT SHARMA – 9414537474)

1. Butane ($\boldsymbol{C_4H_{10}}$), IUPAC Name :- 2-methylpropane, Common Name :- iso-butane.

2. Pentane ($\boldsymbol{C_5H_{12}}$), IUPAC Name :- 2-methylbutane, Common Name :- iso-pentane.

IUPAC Name :- 2,2-dimethylpropane, Common Name :- neo-pentane.

3. Hexane ($C_6H_{14)}$, IUPAC Name :- 2-methylpentane, Common Name :- iso-hexane.

IUPAC Name :- 3-Methylpentane,

IUPAC Name :- 2,3-Dimethylbutane ,

IUPAC Name :- 2,2-Dimethylbutane , Common Name :- neo-hexane.

4. Heptane ($C_7H_{16)}$, Heptane has nine isomers: (JAYANT SHARMA – 9414537474)

Heptane (*n*-heptane), $H_3C–CH_2–CH_2–CH_2–CH_2–CH_2–CH_3$,

2-Methylhexane (isoheptane), $H_3C–CH(CH_3)–CH_2–CH_2–CH_2–CH_3$,

3-Methylhexane, $H_3C–CH_2–C^*H(CH_3)–CH_2–CH_2–CH_3$

2,2-Dimethylpentane, $(H_3C)_3–C–CH_2–CH_2–CH_3$,

2,3-Dimethylpentane, $(H_3C)_2–CH–C^*H(CH_3)–CH_2–CH_3$

2,4-Dimethylpentane, $(H_3C)_2–CH–CH_2–CH–(CH_3)_2$,

3,3-Dimethylpentane, $H_3C–CH_2–C(CH_3)_2–CH_2–CH_3$,

3-Ethylpentane, $H_3C–CH_2–CH(CH_2CH_3)–CH_2–CH_3$,

2,2,3-Trimethylbutane, $CH_3–C(CH_3)_2–CH(CH_3)–CH_3$, this isomer is also known as pentamethylethane and triptane.

Functional groups :- (JAYANT SHARMA – 9414537474)

1. Halo Group or Halogeno Group : $\boldsymbol{-X}$ (X can be Cl, Br or I) , haloalkanes (R—X)

where R is an alkyl group (CH_3 or $\boldsymbol{C_2H_5}$) and X is the halogen atom.

Chloromethane ($\boldsymbol{CH_3-Cl}$) (common name methyl chloride) ,

bromomethane ($\boldsymbol{CH_3-Br}$),

iodomethane ($\boldsymbol{CH_3-I}$).

Chloroethane ($\boldsymbol{C_2H_5-Cl}$ or $\boldsymbol{CH_3-CH_2-Cl}$) common name ethyl chloride.

Chloropropane ($\boldsymbol{C_3H_7-Cl}$ or $\boldsymbol{CH_3-CH_2-CH_2-Cl}$) common name propyl chloride.

2. Alcohol Group : --OH General formula (R—OH) where R is an alkyl group. ($\boldsymbol{C_nH_{2n+1}OH}$)

Methanol ($\boldsymbol{CH_3OH}$) common name : methyl alcohol

Ethanol ($\boldsymbol{C_2H_5OH}$) common name : ethyl alcohol

Propanol ($\boldsymbol{C_3H_7OH}$) common name : propyl alcohol

Butanol ($\boldsymbol{C_4H_9OH}$) common name : butyl alcohol

Pentanol ($\boldsymbol{C_5H_{11}OH}$) common name amyl alcohol

Hexanol ($\boldsymbol{C_6H_{13}OH}$)

3. Aldehyde Group : $-\boldsymbol{CHO}$ or $-C(=O)-H$ General formula (R—CHO) where R is an alkyl group

Methanal (HCHO) common name formaldehyde.

Ethanal ($\boldsymbol{CH_3CHO}$) or ($\boldsymbol{CH_3-CHO}$) common name acetaldehyde

Propanal ($\boldsymbol{CH_3CH_2CHO}$) or ($\boldsymbol{CH_3-CH_2-CHO}$) common name propionaldehyde

Butanal ($CH_3CH_2CH_2CHO$) common name butyraldehyde

Pentanal ($C_5H_{10}O$) common name pentanaldehyde or valeraldehyde

Hexanal ($\boldsymbol{C_6H_{12}O}$) common name Hexanaldehyde

4. Ketone Group : —CO—

Propanone ($\boldsymbol{CH_3COCH_3}$) common name Acetone

Butanone ($\boldsymbol{CH_3COCH_2CH_3}$) common name Methyl ethyl ketone

Pentanone ($\boldsymbol{CH_3COCH_2CH_2CH_3}$) common name methyl propyl ketone

Hexanone ($\boldsymbol{CH_3COCH_2CH_2CH_2CH_3}$) common name methyl butyl ketone

5. Carboxylic Acid Group : —COOH or —C(=O)—OH (JAYANT SHARMA – 9414537474)

Methanoic acid (HCOOH) common name formic acid

Ethanoic acid (CH_3COOH) common name acetic acid

Propanoic acid (CH_3CH_2COOH) common name propionic acid

Butanoic acid ($CH_3CH_2CH_2COOH$) common name Butyric acid

Pentanoic acid ($CH_3CH_2CH_2CH_2COOH$) common name Valeric acid

Hexanoic acid ($CH_3CH_2CH_2CH_2CH_2COOH$) common name caproic acid

SOAPS (JAYANT SHARMA – 9414537474)

A soap is the sodium salt (or potassium salt) of a long chain carboxylic acid (fatty acid).

Examples : Sodium Stearate ($C_{17}H_{35}COO^-Na^+$) & Sodium Palmitate ($C_{15}H_{31}COO^-Na^+$)

DETERGENTS

A detergent is the sodium salt of a long chain benzene sulphonic acid (or the sodium salt of a long chain alkyl hydrogensulphate). (JAYANT SHARMA – 9414537474)

Examples : Sodium n-dodecyl benzene sulphonate ($CH_3-(CH_2)_{11}-C_6H_4-SO_3^-Na^+$)

Sodium n-dodecyl sulphate ($CH_3-(CH_2)_{10}-CH_2-SO_4^-Na^+$).

B = Solids Hg = Liquids Kr = Gases Pm = Not found in nature

1												13	14	15	16	17	18
1 H 1.00794	2																2 He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050	3	4	5	6	7	8	9	10	11	12	13 Al 26.581538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6534	29 Cu 63.545	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.504	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 196.56655	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	71 Lu 174.967	72 Hf 178.49	73 Ta 180.94.79	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.56655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.58038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	103 Lr (262)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Ds (269)	111 Rg (272)	112 Cn (277)	113 Uut (277)	114 Uuq (277)	115 Uup (277)	116 Uuh (277)		118 Uuo (277)

57 La 138.9055	58 Ce 140.116	59 Pr 140.50765	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.92534	66 Dy 162.50	67 Ho 164.93032	68 Er 167.26	69 Tm 168.93421	70 Yb 173.04
89 Ac 232.0381	90 Th 232.0381	91 Pa 231.035888	92 U 238.0289	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)