CHEMISTRY

WORKSHEET-2

STEP

A PROJECT BY PUNJAB GROUP

Worksheet-2

(C. Organic Chemistry)

Hydrocarbons

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Q.1 The reaction of chlorine with methane is carried out in the presence of diffused sunlight. What is function of the light?

A) To break up the C - H bonds in methane

B) To break up the chlorine molecules into free radicals

C) To heat up the mixture

D) To break up the chlorine molecules into ions

Q.2 Methane when burnt in the presence of metallic catalyst (Cu), at high temperature (400°C) and pressure (200atm), which of the following is the ultimate product?

A) Methanol C) Methanal

B) Ethanal D) Methanoic acid

Q.3 Chlorination of methane is believed to proceed through free radical mechanism. Which of the following is propagation step?

A) $Cl\text{-}Cl \xrightarrow{h\nu} 2Cl^{\cdot}$

B) $CH_3^{\cdot} + Cl_2 \longrightarrow Cl^{\cdot} + CH_3\text{-}Cl$

C) $CH_3 + HCl \longrightarrow H^{\cdot} + H_3C\text{-}Cl$

D) $H_3C^{\cdot} + C^{\cdot}H_3 \longrightarrow H_3C\text{-}CH_3$

Q.4 Nitrobenzene maybe prepared by reacting benzene with a mixture of conc. H_2SO_4 and conc. HNO_3 at 55°C. Which of the following best explains the role of conc. H_2SO_4?

A) It removes water

B) It forms an unstable complex with benzene

C) It is protonating nitric acid

D) It acts as a solvent

Q.5 Benzene reacts with acetyl chloride in the presence of catalyst $AlCl_3$ to give:

A) Aldehyde C) Benzyl Chloride

B) Acetophenone D) Benzophenone

Q.6 **β-elimination is competitive to nucleophilic substitution reaction. It has all of the following conditions for reaction as compared to nucleophilic substitution reaction EXCEPT:**

A) It takes place in the presence of less polar solvent (like alcohol)

B) It takes place at high temperature

C) It requires strong nucleophile (base)

D) It takes place at low temperature

Q.7 **All of the following are dehydrating agents EXCEPTS:**

A) SiO_2 C) Al_2O_3

B) Conc. H_2SO_4 D) H_3PO_4

Q.8 **Which of the following is correct order of ease of dehydration of alcohols?**

A) 1 ◦ alcohol > 2 ◦ alcohol > 3 ◦ alcohol

B) 3 ◦ alcohol > 2 ◦ alcohol > 1 ◦ alcohol

C) 2 ◦ alcohol > 1 ◦ alcohol > 3 ◦ alcohol

D) 3 ◦ alcohol > 1 ◦ alcohol > 2 ◦ alcohol

Q.9 **Which of the following tests is not used to distinguish between alkanes and alkenes?**

A) Baeyar's test C) $Cl_2(CCl_4)$

B) $Br_2(CCl_4)$ D) Tollen's test

Q.10 **A hydrocarbon, which is a liquid at room temperature, decolourizes aqueous bromine. Which could be the molecular formula of the compound?**

A) C_2H_2 C) C_7H_{16}

B) C_2H_4 D) $C_{10}H_{20}$

Q.11 **Which of the following alkenes does not follow Markownikov's rule?**

A) 1-Pentene C) 1-Hexene

B) 1-Butene D) 2-Butene

Q.12 **Aromatic compounds burn with sooty flame because:**

A) They have high percentage of hydrogen

B) They have a ring structure

C) They have high percentage of carbon

D) They resist in reaction with air

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Q.13 Alkanes are used as fuels. We burn them for many reasons. Which of the following is not its use?

A) They are used to generate electricity in power stations
B) They are used to heat our homes and cook our food
C) They are used to provide electricity for electrolytic cell
D) They are used to provide electricity for galvanic cell

Q.14 Consider the following reaction:

$$H_2C = CH_2 + HBr \rightarrow H_3C - CH_2Br$$

The mechanism of reaction is:

A) Nucleophilic addition reactions
B) Electrophilic addition reaction
C) Free radical substitution
D) Nucleophilic substitution reaction

Q.15 Which property of benzene may be directly attributed to the stability associated with its delocalized pi-electrons?

A) It has a low boiling point
B) Its enthalpy change formation (ΔH_f) is positive
C) It is susceptible to attack by nucleophilic reagent
D) It tends to undergo electrophilic substitution rather addition reaction

Q.16 Among the followings the compound that can be most readily nitrated is:

A) Benzoic acid C) Phenol
B) Benzene D) Chlorobenzene

Q.17 When toluene is treated with chlorine in the presence of sunlight, which of the following is ultimate product?

A) Benzyl chloride C) Benzoyl chloride
B) Benzotrichloride D) Benzal dichloride

Q.18 The most important addition reaction of alkenes forms the basis of the plastic industry. Addition polymerization is such process in which smaller molecules (monomers) repeatedly combine to form large molecular having greater molar mass (polymer) as shown:

$$H_2C = CH_2 \xrightarrow[100\ atm.]{400°C} \text{-}(H_2C - CH_2)\text{-}_n$$

Traces of O_2 (0.1%) n = 1000

A good quality polythene is obtained when ethene is polymerized in the presence of:

A) Aluminium triethyl $(C_2H_5)_3$ only
B) Titatinum tetrachloride ($TiCl_4$) only
C) $TiCl_4 + AlCl_3$
D) $TiCl_4 + Al(C_2H_5)_3$

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Q.19 Benzene cannot undergo:

A) Substitution reaction C) Addition reaction

B) Elimination reaction D) Oxidation reaction

Q.20 All of the following statements are correct EXCEPT:

A) Introduction of R-group in the benzene ring in the presence of $AlCl_3$ is called alkylation

B) Introduction of acyl group in the benzene ring in the presence of $AlCl_3$ is called acylation

C) Benzene cannot undergo polymerization

D) Ozonolysis of benzene results in the formation of $(COOH)_2$

Q.21 o- and p- directing groups have all of the following properties EXPECT:

A) They are electron-donating groups

B) They increase reactivity of mono- substituted benzene ring

C) They have all lone pair at the central atom of molecules expect alkyl group

D) Halogeno-substituted benzene is more reactive than benzene

Q.22 All of the following methods explain stability of benzene EXPECT:

A) Resonance energy

B) Resonance method

C) Crystal field theory

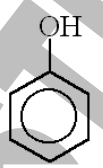
D) Atomic orbital treatment

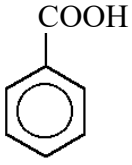
Q.23 When different alkenes are treated with hot concentrated $KMnO_4$ solution, different products are obtained. Which of the following alkenes produces two moles of ketone?

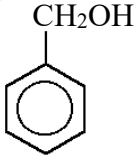
A) $H_2C = CH_2$ C) $R^1R^2C = CR^3R^4$

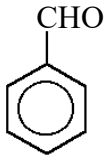
B) $R - CH = CH - R$ D) $R^1R^2C = CH^3R^4$

Q.24 On the oxidation of toluene by acidified $KMnO_4$, which of the following products is obtained?

A) 

C) 

B) 

D) 

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Q.25 Which of the following methods is used to prepare ethyne on the industrial scale by?

A) Dehydrohalogenation of vic-dihalides

B) Dehalogenation of tetrahalides

C) Electrolysis of aqueous solution of potassium salt of unsaturated dicarboxylic acids

D) Reaction of calcium carbide with water

Q.26 Kolbe's electrolytic method is used to prepare ethyne. Which of the following salts of carboxylic acid is used for this purpose?

A) Sodium acetate C) Sodium oxalate

B) Sodium succinate D) Potassium maleate

Q.27 On oxidation of ethyne with strong alkaline $KMnO_4$ solution, the final product formed is:

A) Glyoxal C) Acetic acid

B) Glycol D) Oxalic acid

Q.28 Acetaldehyde is prepared by the reaction of ethyne with water in the presence of $HgSO_4$/ H_2SO_4 at 75°C. Number of steps involved in this reaction is:

A) 1 C) 2

B) 4 D) 3

Q.29 When ethyne is treated with ammonical Cu_2Cl_2 solution, then ppt of dicopper acetylide are formed. The colour of ppt is?

A) White C) Yellow

B) Reddish brown D) Violet

Q.30 When acetylene is passed under pressure over an organo-nickel catalyst at 70°C _____ is formed?

A) Vinyl acetylene C) Neoprene

B) Di-vinyl acetylene D) Benzene

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Q.31 Consider the following reaction

$$HC \equiv CH + H_2O \xrightarrow[HgSO_4]{\text{dil. } H_2SO_4} CH_2 = CH - OH \rightleftharpoons Y \xrightarrow[[O]]{V_2O_5} Z$$

Which of the following is correct sequence for the product shown as Y, Z?

A) CH_3CHO, CH_3COOH

B) CH_3COCH_3, CH_3COOH

C) CH_3CH_2OH, CH_3CHO

D) CH_3CHO, CH_3CH_2OH

Q.32 According to atomic orbital treatment of benzene, all of the following statements are correct about benzene EXCEPT:

A) In it each carbon atom has sp^2-orbital hybridization

B) It is cyclic hexagonal planar structure

C) It has diffused or decolonized electron cloud

D) It has 10 sigma bonds and 6 pi electrons

Q.33 Cyclohexane is an example of:

A) Alicyclic hydrocarbons

B) Aromatic hydrocarbon

C) Aliphatic saturated hydrocarbon

D) Aliphatic unsaturated hydrocarbon

ANSWER KEY (Worksheet-2)							
1	B	11	D	21	D	31	A
2	D	12	C	22	C	32	D
3	B	13	D	23	C	33	A
4	C	14	B	24	C		
5	B	15	D	25	D		
6	D	16	C	26	D		
7	A	17	B	27	D		
8	B	18	D	28	C		
9	D	19	B	29	B		
10	D	20	D	30	D		

ANSWERS EXPLAINED

Q.1 (B) The function of the light is to **break up** the chlorine molecules **into free radicals** such as

$Cl–Cl \xrightarrow{h\mu} \dot{Cl}+\dot{Cl}$ (initiation).

Halogenation is believed to proceed through **free radical substitution mechanism.** It involves the three steps such as **initiation, propagation and termination.**

Q.2 (D) Ultimate product of catalytic oxidation of methane is **methanoic acid.**

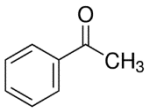
Q.3 (B) **Propagation step** is such as

$CH_3^{\bullet} + Cl_2 \longrightarrow CH_3 – Cl + Cl^{\bullet}$

Q.4 (C) The role of **conc. H_2SO_4** is **protonating nitric acid** such as

$$HONO_2 + H_2SO_4 \underset{}{\overset{50–55°C}{\rightleftharpoons}} NO_2^+ + HSO_4^- + H_2O$$

Q.5 (B) **Acetophenone**



Acetophenone is the organic compound with the formula **$C_6H_5COCH_3$** (also represented by the letters **PhAc** or **BzMe).** It is the simplest aromatic ketone. This colourless, viscous liquid is a precursor to useful resins and fragrances.

(IUPAC 1-Phenylethan-1-one)

Other names:

- **Methyl phenyl ketone**
- **Phenylethanone**

Q.6 (D) **β-Elimination does not** take place at **low temperature**, however it takes place at **high temperature,** in the presence of less polar solvent and in the presence of strong nucleophile.

Q.7 (A) **SiO_2** is **not dehydrating** agent while others **B, C and D** are used as **dehydrating agent.**

Q.8 (B) Order of reactivity of alcohols for dehydration is such as **3° alcohol > 2° alcohol > 1° alcohol.** Because the order of stability of their carbocations is as **3° carbocation > 2° carbocation > 1° carbocation.**

Q.9 (D) **Tollen's test is not** used to distinguish between **alkanes and alkenes. Tollen's test** is used to distinguish between **alkenes and alkynes** while **alkynes** having acidic **hydrogen terminal alkynes** give this test. By passing acetylene in the **ammonical silver nitrate** white **ppt. of disilver acetylide** are obtained as shown in the reaction.

$$HC \equiv CH + 2AgNO_3 + 2NH_4OH \longrightarrow$$

$$AgC \equiv CAg + 2NH_4NO_3 + 2H_2O$$

white ppt

Q.10 (D) **Decene ($C_{10}H_{20}$)** is an **alkene** with the formula **$C_{10}H_{20}$**. It is in the liquid state. It decolourizes reddish brown aqueous bromine solution because of the presence of double bond **(unsaturation). Decene** contains a chain of ten carbon atoms with one double bond. There are many isomers of decene depending on the position and geometry of the double bond.

Q.11 (D) **2-Butene** is a symmetrical molecule and does not follow **Markownikov's rule.** Its structure is shown as follow **CH_3-CH=CH-CH_3 (symmetrical molecule).**

Q.12 (C) They have **high percentage** of carbon.

Q.13 (D) It is **not** used to provide electricity for **galvanic cell** because **galvanic cell** is itself the source of electricity.

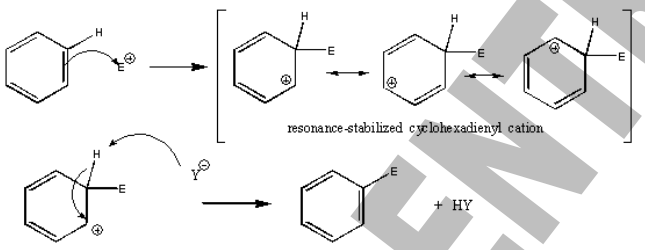
Q.14 (B) **Electrophilic addition reaction is shown as**

$$H_2C = CH_2 + {}^{\delta+}H\text{-}Br^{\delta-} \rightarrow H_3C\text{-}CH_2Br$$

Nucleophile Electrophile

Q.15 (D) Due to the **extra resonance stability** of the benzene ring, it **does not** undergo addition reaction in which the benzene ring resonance would be destroyed. Benzene ring by undergoing preferably electrophilic substitution retains the aromatic system. Other **A, B, and C options do not fulfill the condition.**

$$E - Y \longrightarrow E^+ + Y^-$$



Q.16 (C) **Phenol** is the more reactive because **OH-** group is activating group, order of **reactivity is as follow:**

Phenol > Benzene > Chrlorobenzene > Benzoic acid. Thus phenol can be the most readily nitrated.

Q.17 (B) As a result of **chlorination** of **benzene** in the presence of **sunlight mixture** of products are obtained such as **benzyl chloride, benzal dichloride and benzotrichloride. Benzotrichloride** is the ultimate product.

Q.18 (D) For the better quality of polyethylene, mixture of **$TiCl_4$ + $Al(C_2H_5)_3$** are used as a catalyst. It is known as **Ziegler-Natta catalysts.**

Q.19 (B) Benzene **does not give** elimination and **polymerization reaction.**

Q.20 (D) **Benzene** reacts with **ozone** and gives **glyoxal** through benzene **triozonide** but **not oxalic acid.**

Q.21 (D) Halogeno-substituted benzene is less reactive than benzene because its inductive effect and resonance effect are in opposite direction. Its resonance effect is slightly greater than inductive effect, because of this reason halogen group is ortho-para-directing group but with more deactivation of benzene ring .

Q.22 (C) Crystal field theory doesn't explain stability of benzene. It explain color formation by the complexes of transition metal ions .It involves d-d transition.

Q.23 (C) When $R^1R^2C = CR^3R^4$ is treated with concentrated with $KMnO_4$ solution two moles of ketones are obtained.

- **$R^1R^2C = CR^3R^4 + [O] \rightarrow R^1R^2C = O + R^3R^4C = O$**
- **Oxidation under harsh conditions using a hot, concentrated solution of $KMnO_4$. Three reactions take place and different products are obtained.**
- **If a carbon atom is bonded to two hydrogen atoms we get oxidation to a CO_2 molecule**

$$H_2C = CH_2 + 6[O] \longrightarrow CO_2 + CO_2 + 2H_2O$$

- **If a carbon atom is bonded to one hydrogen atom and one alkyl group we get oxidation to a**

–COOH (carboxylic acid) group

$RCH = CHR + 2[O] \longrightarrow RCHO + RCHO \xrightarrow{2[O]} RCOOH + RCOOH$

Q.24 (C) Alkyl benzenes are readily oxidized by acidified $KMnO_4$ or $K_2Cr_2O_7$. In these reactions, the alkyl groups are oxidized keeping the benzene ring intact.

- **Whatever the length of an alkyl group may be, it gives only one carboxyl group. Moreover, the colour of $KMnO_4$ is discharged. Therefore this reactions is used as a test for alkylbenzenes.**

Q.25 (D) In the reaction between calcium carbide and water, acetylene gas is produced on the industrial scale:

$$CaC_{2(s)} + 2H_2O_{(l)} \longrightarrow Ca(OH)_{2(s)} + C_2H_{2(g)}$$

Q.26 (D) On the electrolysis of aqueous solution of potassium maleate results in the preparation of ethyne as shown in the reaction.

$$\begin{matrix} HC-COOK \\ \| \\ HC-COOK \end{matrix} + 2H_2O \xrightarrow{\text{electrolysis}} H-C\equiv C-H + 2CO_2 + 2KOH + H_2$$

Q.27 (D) Ethyne on oxidation by strong alkaline $KMnO_4$ gives glyoxal followed by its further oxidation results in the formation of oxalic acid as shown in the reaction.

$$\underset{\text{Ethyne (Acetylene)}}{HC\equiv CH} + \underset{\text{Oxidising agent}}{4[O]} \xrightarrow{\text{dil. alk. } KMnO_4} \underset{\text{Ethane dioic acid (Oxalic acid)}}{\begin{matrix} COOH \\ | \\ COOH \end{matrix}}$$

Q.28 (C) When acetylene is treated with water in the presence of $HgSO_4/H_2SO_4$ at 75°C, No of steps involved in this reaction is 2 as shown in the reactions:

i. $$HC\equiv CH + H^{\delta+}-OH^{\delta-} \xrightarrow[H_2SO_4]{HgSO_4} H_2C=CH-O-H$$

ii. $$H_2C=CH-O-H \rightleftharpoons CH_3-\overset{\overset{O}{\|}}{C}-H$$

Q.29 (B) When ethyne is treated with ammonical Cu_2Cl_2 solution, then ppt of dicopper acetylide are formed. The colour of ppt is reddish brown as shown in the reaction.

$$CH\equiv CH + Cu_2Cl_2 + 2NH_4OH \rightarrow \underset{\text{Dicopperacetylide (Reddish brown ppt)}}{CuC\equiv CCu} + 2NH_4Cl + 2H_2O$$

Q.30 (D) When acetylene is passed under pressure over an organo-nickel catalyst at 70°C benzene is formed as a result of addition polymerization.

$$\underset{\text{Acetylene}}{3HC\equiv CH} \xrightarrow[70^oC]{\text{Organo-Nickel catalyst}} \underset{\text{Benzene}}{\bigcirc}$$

Q.31 (A) The correct sequence for the product is as B (CH_3CHO), C (CH_3COOH) first of all product B (ethanal) is formed which on further oxidation gives ethanoic acid as shown in the reaction

$$HC\equiv CH + H_2O \xrightarrow[HgSO_4]{\text{dil. } H_2SO_4} CH_2=CH-OH \longrightarrow \underset{(Y)}{CH_3CHO} \xrightarrow[[O]]{V_2O_5} \underset{(Z)}{CH_3COOH}$$

Q.32 (D) In fact, benzene has 12 sigma bonds and 6 pi electrons.

Q.33 (A) Cyclohexane is an example of **alicyclic hydrocarbon**.

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