# CHAPTER 15
# ORGANIC COMPOUNDS

Question

Who constructed the theory of organic structures?

1. Friedrich August Kekulé and Archibald Scott Couper
2. Friedrich August Kekulé and Joseph Lister
3. Friedrich August Kekulé and Louis Pasteur
4. Friedrich August Kekulé and Alexander Mikhaylovich Butlerov

**Answer**

**Friedrich August Kekulé and Archibald Scott Couper**

**Q. What is the subject matter of organic chemistry?**

**Answer**

**Carbon compounds**

Carbon is the main element of organic compounds and also substances contain hydrogen and oxygen.

Question

Which elements are present in organic compounds?

1. Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur
2. Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur, halogens, metals
3. Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur, halogens, rare, synthetic
4. Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur, halogens

**Answer**

**Carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur, halogens, metals

# EXERCISE

**Q1. Select the *right* answer from the choices given with each question.**

1) **The major portion of natural gas is:**
a) Ethane b) Propane c) Butane d) Methane

2) **In organic compounds carbon atoms form;**
a) Ionic bond b) Metallic bond c) Covalent bond d) None of these

3) **Which of the following is an aromatic compound?**
a) Propanol b) Cyclohexane c) Acetone d) Benzene

4) **There are few homologous series of compounds. The existence of homologous series is due to:**
a) Functional group b) Cracking
c) Isomerism d) Polymerization

5) **Which of the following compound is heterocyclic?**
a) Pyridine b) Pyrole c) Thiphene d) All of the above

6) **Select from the following the one, which is alcohol;**
a) $CH_3 - CH_2 - OH$ b) $CH_3$-O-$CH_3$
c) $CH_3$ COOH d) $CH_2$-$CH_2$-Br

7) **Lassaignes' solution is prepared in the detection of elements of organic compound. Which metal is used for the reaction with organic compound?**
a) Aluminium b) Sodium c) Iron d) Copper





8) **When AgN03 is added to the Lassaignes' solution which colour is formed for Iodine:**
a) Blue b) Violet c) Green d) Deep yellow

9) **When water vapours are passed over, white anhydrous copper sulphate, which colour is formed?**
a) White b) Deep blue c) Yellow d) Brown

10) **The Simplest molecule of Bucky Ball contain carbon atoms;**
a) 20 b) 8 c) 60 d) IOO

11) **If a molecule contains more than one functional group it is known as:**
a) Derivative b) Poly functional
c) Heterocyclic d) Isomer

**Answers**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1)** | a | **2)** | C | **3)** | d | **4)** | a | **5)** | d |
| **6)** | a | **7)** | b | **8)** | d | **9)** | b | **10)** | c |
| **11)** | b | | | | | | | | |

**Q2. Give brief answers for the following questions.**

**Q1: What is functional group?**

**Answer**

Please see Answer of Ql 7 of Chapter Notes.





**Q2: What is the Difference between partial and total synthesis of organic compounds?**

**Answer**

**Total Synthesis**

In an organic chemistry a total synthesis is in principle, the complete chemical synthesis of complex organic male cubes from simpler pieces, usually without the aid of biological processes. In practice these simpler pieces are commercially available in bulk and semi — bulk quantities and are often petrochemicals precursors.

Sometimes bulk natural products (e.g sugar) are used as starting materials and it assumed that these have been or can be synthesized from constituent elements. The target molecules can be natural products, medicinally important active ingredients or organic compounds of the oratical in chemistry or biology. A new route for synthesis is developed in the course of the investigation, and the route may be the first one to developed for the substance.

**Examples:**

Cholesterol, cortisone, strychnine, lysergic acid, chlorophyll, vitamin B and quinine etc.

**Partial Synthesis**

Partial synthesis is a type of chemical synthesis that uses compounds isolated from natural sources (e.g plant material or bacterial or cell cultures) as a starting material. These natural biomolecules are usually large and complex molecules.

This is opposed to a total synthesis where large molecules are synthesized from a stepwise combination of small and cheap (Usually petrochemicals) building blocks.





Partial synthesis is usually used when precursor molecule is too structurally complex. For example, artemether.

**Q3: How organic compounds are derived by fermentation process?**

**Answer**

In fermentation process some enzymes are used to decompose naturally occurring substances into some other useful substances.

For example, to get ethyl alcohol there are added diastase, invertase and zymase enzymes in starch. Reactions involving process of fermentation of starch are as follows

**Q4: What is coal? How is coal used as a source of organic compound?**

**Answer**

Please see Answer ofQ9 of Chapter Notes.

**Q5: What is the name of new allotropic from of carbon? Give is definition?**

**Answer**

Please see Answer of Q 14 of Chapter Notes.

**Q6: What is Homologous series?**

**Answer**

Please see Answer of Ql 5 of Chapter Notes.





**Q7: How metals can be detected in organic compounds?**

**Answer**

The substance in a crucible preferably of platinum, fill all reaction ceases. An incombustible residue indicated the presence of a metal in a substance. The residue is extracted with dilute acid and the solution is test for the presence of metallic radical by the usual scheme employed for inorganic salts.

**Q3. Give detailed answers for the following questions.**

**Ql. What are the main sources of organic compounds? Also give the fractions of petroleum.**

**Answer**

Please see Answer of Ql and Q2 of Chapter Notes

**Q2: Write down the characteristics of organic compounds from inorganic compounds.**

**Answer**

Please see Answer of Q 1 0 of Chapter Notes.

**Q3: How organic compounds are used in our daily life?**

**Answer**

Food, vitamins, clothes etc are all organic compounds.





**Q4: Write down any ten functional groups of organic compounds? Give reasons for the importance of organic chemistry.**

**Answer**

Please see Answer of Ql 7 of Chapter Notes.

**Q5: Give the chemical tests for the detection of elements in organic compounds?**

**Answer**

Please see Answer ofQ20 of Chapter Notes.



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# Multiple Choice Questions

**1) The unsaturated hydrocarbons are called:**
(a) Paraffins (b) Olefins (c) Acetylenes (d) Vinylenes

**2) The valence of carbon in its group state is:**
(a) 1 (b) 2 (c) 3 (d) 6

**3) In methane molecule, the 4 bonds of carbon form a shape of:**
(a) Cube (b) Tetra hederon
(c) Square Prism (d) Octa hederon

**4) One of Characteristics of alkanes is that they have:**
(a) Planar shape (b) Linear snape
(c) tetrahedera shape (d) Cycle of C atoms

**5) The smallest cycloalkane known is:**
(a) cyclo pentane (b) cyclo butane
(c) cyclo propane (d) cyclo ethane

**6) A gas which is colourless, odorless, insoluble but found in natural gas is:**
(a) Propane (b) Hexane
(c) Cyclohexane (d) None of these





**7) Methane can react with halogens under catalyzed conditions of sunlight. Such reactions are called:**
(a) Addition (b) Substitution
(c) Displacement (d) Photo chemical

**8) To prepare ammonia industrially through Haber's process, Hydrogen is obtained from:**
(a) Water (b) Propane
(c) Methane (d) Polymerization

**9) Polyethylene is produced from ethylene at high tem. & pressure. This is an example of reactions:**
(a) Addition (b) Hydrosylation
(c) -hydrogenation (d) Polymerization

**10) The Hydrocarbon gas that is applied as general anesthesia is:**
(a) Ethyne (b) Ethane (c) Ethylene (d) Natural gas

**11) If we heat sodium propionate with soda lime we'll get the gas:**
(a) Methane (b) Ethane (c) Propane (d) Butane
(b)

**12) The gas obtained by a reaction of $CaC_2$ and water is:**
(a) Ethane (b) Ethene (c) Propane (d) Methane

**13) The name of** is





(a) α - Naphthol (b) β- Naphthol
(c) Naphthalene (d) Anthracene

**14) When methane is burnt and obtained gases are passed through aqueous solution of $Ca(OH)_2$, the ppt. Obtained are:**
(a) Cao (b) $CaCO_3$ (c) $CaCO_3$ (d) None of these

**15) $CH_4$ on reaction with atomic oxygen at 400°C, 200 atm. And Cu catalyst gives.**
(a) Acetaldehyde (b) Acetylene.
(c) Methanol (d) Water gas

**16) Electricity was passed through an aqueous solution of sodium acetate. The Hydrocarbon gas obtained is:**
(a) Methane (b) Ethane (c) Ethene (d) Ethyne

**17) Ethane was heated with conc. $H_2SO_4$ at 180°C. Then the product obtained was hydrogenation in presence of pt at room temp. The final product is:**
(a) Ethane (b) Methane (c) Dimethyl ether (d) Acetylene

**18) Ethylene was heated with an aqueous solution of $H_2SO_4$ (10%) along with $HgSO_4$. The product obtained is:**
(a) Ethane (b) Ethene (c) Ethanol (d) None of these





**19) Ethene was reacted with atomic oxygen in presence of Ag as Catalyst. The product obtained was hydrolyzed with water. Final product is:**
(a) Ethanol. (b) Ethane (c) Ethyne (d) Ethanal

**20) Ethylene was heated with an aqueous solution of $H_2SO_4$ (10%) along with $HgSO_4$. The product obtained is:**
(a) 1,2 — Dibromo ethane (b)1 , 1 — Dibromo ethane
(c) Bromo ethane (d)None of these is correct

**21) Chemically Baeyer's reagent is:**
(a) 1% alkaline $KmnO_4$ (b) 10% alkaline $KmnO_4$
(c) 15% alkaline $KmnO_4$ (d)30% alkaline $KmnO_4$

**22) Which alcohol is dehydrated first:**
(a) Prime. Alcohol (b) Sec. Alcohol
(c)Tert. Alcohol (d) None of these

**23) Reaction of chlorine with methane is called:**
(a) Substitution reaction (b) Addition reaction
(c) Displacement reaction (d) Double displacement reaction

**24) Carbon black is obtained from:**
(a) Alkanes (b) Alkenes (c) Alkynes (d) Benzene

**25) Catalytic oxidation of $CH_4$ gives:**
(a) Formic acid (b) Acetic acid (c) Carbolic acid (d) Carbonic acid

**26) Sodium propionate on reaction with NaOH gives:**





(a) $CH_4$ (b) $C_2H_6$ (c) $C_3H_6$ (d) $C_3H_8$
(b)

**27) The correct chemical name for $CH_3$ — $CH$ $(CH_3)$ — $CH_3$ is:**
(a) Butane (b) 2 — methyl propane
(c) Isopropyl methane (d) Dimethyl ethane

**28) Which of the following reagent distinguishes ethylene from acetylene?**
(a) Aq. Alk. $KMnO_4$ (b) Chlorine dissolved in CC14
(c) Ammoniacal cuprous chloride (d) Conc. H2S04

**29) Synthetic rubbers are made by polymerization of:**
(a) Chloroform (b) Acetylene (c) Divinyl acetylene (d) Butene

**30) Type of orbital hybridization in acetylene is:**
(a) $sp^3$ (b) $sp^2$ (c) sp (d) none of these

**31) Soda lime on reaction with sodium propionate yields:**
(a) $C_2H_6$ + $Na_2CO_3$ (b) $CH_4$ + $Na_2CO_3$
(c) $C_3H_8$ + $Na_2CO_3$ (d) $C_4H_{10}$ + $Na_2CO_3$

**32) Ethyl bromide on reaction with alcoholic KOH produces:**
(a) Ethanol (b) Ethene (c) Ethyne (d) Ethane

**33) When air is passed over ethane in presence of heated silver. Product is:**
(a) Epoxy ethane (b) $CO_2$ + $H_2O$ (c) C+ $H_2$ (d) Ethyne

**34) Ozonolysis of ethane in presence of $O_3$ + $H_2O$ + Heat yields:**
(a) Methanol (b) Ethanal (c) Ethanol (d) Methanal





**35) The temperature of oxy-acetylene flame is:**
(a) 1000 - 1100 °C (b)1000-3000 °C (c) 400 – 500°C (d) 500 -600 °C

**36) Vinyl bromide on reaction with HBr in presence of $R_2O_2$ give the proct.**
(a) 1, 2-dibromo ethane (b) 1,1 — dibromo ethane
(c) 1 , 1,1 -tribromo ethane (d) None of these is correct

**37) Which of the following is an unsaturated hydrocarbon:**
(a) Cyclo alkane (b) $CH_3$ $CH(Cl)$ $CH_3$
(c) $CH_3$ CH $(CH_3)$ (d) $CH_3$ $CHCH$ $CH_3$

**38) Electrolysis of aqueous sodium succinate yields.**
(a) ethane (b) ethene (c) ethyne (d) None of these
(b)

**39) Calcium oxide was heated with carbon at 3000°C, and the obtained product was reacted with water, final product is:**
(a) ethane (b) ethene (c) ethyne (d) C + $H_2O$

**Answer:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1)** | b) | **2)** | b) | **3)** | b) | **4)** | c) | **5)** | c) |
| **6)** | a) | **7)** | d) | **8)** | c) | **9)** | d) | **10)** | c) |
| **11)** | b) | **12)** | c) | **13)** | b) | **14)** | c) | **15)** | c) |
| **16)** | b) | **17)** | a) | **18)** | d) | **19)** | a) | **20)** | a) |





| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **21)** | a) | **22)** | c) | **23)** | a) | **24)** | a) | **25)** | a) |
| **26)** | b) | **27)** | b) | **28)** | c) | **29)** | b) | **30)** | c) |
| **31)** | a) | **32)** | b) | **33)** | a) | **34)** | d) | **35)** | |
| **36)** | a) | **37)** | d) | **38)** | b) | **39)** | c) | | |

# Short Questions & Answers

**Q1: What is modern definition of organic chemistry?**

**Answer**

Organic chemistry is the branch of chemistry which deals with the study of compounds of carbon and hydrogen and their derivatives.

**Q2.a) What is Petroleum?**

A black thick oily liquid seeps out of the ground is called petroleum.

**b) What is coal?**

**Answer**

Coal is an organic compound which yields coke and coal tar on destructive distillation.

**Q3: What do you know about the origin of petroleum?**

**Answer**

Nothing definite can be said about the origin of petroleum. The word petroleum is derived from the Latin words 'petra' meaning rock and 'oleum' meaning oil. It is also called mineral oil. It is formed millions of years ago when large seas of years earth was covered by sea water they said creatures died and sank to the sea and decay and decaying result in formation of petroleum.





**Q4: What are plantations?**

**Answer**

Plantations are the tiny sea creatures includes phytoplanktons meaning drifting plants and ZOO plankton meaning drifting animals.

**Q5: Which countries have biggest deposits of petroleum name them.**

**Answer**

These include Saudi Arabia, Iran, Iraq, Kuwait, Libya, Russia, Mexico's, Nigeria, USA and Venezuela.

**Q6: What is refining?**

**Answer**

I.e process of separating petroleum into useful fractions and removal of undesirable impurities is called refining.

**Q7: What is fractional distillation?**

**Answer**

The process in which various fractions are separated according to the difference in their boiling points and it comprises evaporation and condensation is called fractional distillation.

**Q8: What is Neutralization?**

**Answer**





It is the first step in the refining process in which crude oil is washed with acidic or basic solution then oil is heated in an electrical furnace above 400o° and the vapour are fed in to a tall fractionation tower.

**Q9 a)Give uses of petroleum gas?**

**Answer**

Petroleum gases are liquefied and sold as bottled gas for cookers and stoves.

**b) Give the names of refineries of Pakistan.**

**Answer**

These are:

i) Attock oil refinery; ii) Pakistan oil refinery;

iii) National oil refinery; iv) Pak – Arab refinery

**Q10: What is natural gas?**

**Answer**

It is a mixture of low boiling hydrocarbons major portion of the natural gas is methane (CH4 about 80%). In Pakistan vast reserves of gas oil is in Baluchistan, Sindh and Punjab.

**Q11: Define fermentation.**

**Answer**





The production of chemicals by the action of microorganisms is called fermentation.

**Q12: Briefly describe destructive distillation of Coal.**

**Answer**

Organic chemistry is the branch of chemistry which deals with the study of compounds of carbon and hydrogen and their derivatives.

**Q13: Briefly discuss the uses of organic compounds.**

**Answer**

They are used as food i.e. proteins, fats, clothing i.e. paints, power and transportation.

i.e. natural gas, petroleum products etc.,

**Q14: Briefly explain Bucky balls.**

**Answer**

Bucky balls named it after an architect Buckminster, who designed a Bucky balls shaped building in Manitoba. Bucky balls are used as semi-conductors and lubricants. They have carbon atom ranging from forty to hundred. The carbon atoms are arranged in a hollow cage like structure.

**Q15: Define functional group. Give example.**

**Answer**





A functional group is an atom or group of atoms in a molecule that gives the molecule its characteristic chemical properties. Example: –Cl, –Br, –OH.

**Q 16 Define sublimation.**

**Answer**

The process in which the solids directly changes into vapours without undergoing liquid phase is called sublimation.

**Q17: What are terpenoids?**

**Answer**

A large class of natural products consisting of isoprene units are called terpenoids.

**Q18: Define homologous series.**

**Answer**

A homologous series is the series of compound in which adjacent members differ by CH2 group and molecular mass 14.

| | |
|---|---|
| $CH_4$ – $CH_3$ | (Ethane) |
| $CH_3$ – $CH_2$ – $CH_3$ | (Propane) |
| $CH_3$ – $CH_2$ – $CH_2$ – $CH_3$ | (Propane) |
| $CH_3$ – $CH_2$ – $CH_2$ – $CH_2$ – $CH_3$ | (Propane) |

**Q20: How carbon and hydrogen are detected in organic compounds?**





**Answer**

Carbon and hydrogen can be detected by heating small amount of organic compound with CuO in a glass test tube and then passing obtained gases through dry $CuSO_4$ & lime water.

**Q21: How nitrogen is detected in organic compound?**

**Answer**

Take one portion of Lassaigne's filtrate, a few drops of NaOH is added to make it alkaline, then freshly prepared ferrous sulphate is added to it. The solution is boiled to 1-2 minutes and then a few drops of $FeCl_3$ is added and HCl are added to it. The appearance of blue or greenish blue (Prussian blue) colour or ppt proves the presence of nitrogen in organic compound.

**Q22: Give solver test for the identification of sulphur**

**Answer**

The second portion of Lassaigne's filtrate is acidified with acetic acid and boiled for equal H2S gas which turns lead acetate the presence of sulphur in the compound.

**Q23: Give sodium test for the identification of halogens.**

**Answer**

A third portion of Lassaigne's solution is boiled with nitric acid to expel cyanides and sulphide ion and the Ag NO3 solution is added. The formation of precipitate shows the presence of the halogen. a white ppt. Soluble in NH4OH shows the presence of chlorine a pale yellow ppt partially soluble in NH4OH shows the





presence of chlorine a pale yellow ppt partially soluble in NH4OH shows the presence of bromine and a deep yellow ppt insoluble in NH4OH indicates iodine.

**Q24: Give copper wire test (Beilstein's Test)**

**Answer**

The copper wire flattened at one end heated in an oxidizing burner flame till it ceases to impart any green colour to the flame. A small quantity of substance under investigation is now taken on the flattened end of the wire which is re-inserted in the Bunsen flame, upon heating for a while, the halogen present in the substance is converted to a volatile copper halide which imparts blue or green color to the flame. A substance like urea which contains no halogen also colors the flame green.

**Q25: How oxygen is detected in the inorganic compound?**

**Answer**

The substance is heated alone in a dry test tube, preferably in an atmosphere of nitrogen. Formation of droplets of water on cooler parts of the tube obviously shows the presence of oxygen.

**Q26: How phosphorus is detected in the organic compound?**

**Answer**

The solid substance is heated strongly with an oxidizing agent such as concentrated nitric acid and mixture of sodium carbonate and potassium nitrate. The residue is extracted with water, boiled with some nitric acid, and then a hot





solution of ammonium molybdate is added to it in excess. A yellow coloration of precipitate indicated the presence of phosphorus.

**Q27: How metals are detected in organic compounds?**

**Answer**

The substance is strongly heated in a crucible, preferably of platinum. till all reaction ceases. An incombustible residue indicated the presence of a metal in the substance. The residue is extracted with dilute acid and the solution is test for the presence of metals. radical by the usual scheme employed for inorganic salts.

**Q28: What is oxidation?**

**Answer**

The loss of electrons or the gain of oxygen to a molecule is called oxidation.

For Example:

$$Fe^{2+} \longrightarrow Fe^{3+} \text{ and } Fe + O_2 \longrightarrow FeO$$

**Q29: What is reduction?**

**Answer**

The gain of protons or hydrogen and the loss of oxygen to a substance is called reduction.

**Q30: What are volatile substances?**

**Answer**





Those substances which have very low boiling or melting point are called volatile substances. E.g. ether, petrol etc.

**Q31: What are precipitates?**

**Answer**

The solid crystals which are left when the substance is extensively boiled.

**Q32: What is oxidizing agent?**

**Answer**

Those substances which add electrons or oxygen to a substance are called oxidizing agent. Examples are KMnO4, K2Cr2O7 etc.

**Q33: What is reducing agent?**

**Answer**

Those substances which added protons or hydrogen or remove oxygen from a substance are called reducing agents. Example, K2C13, NH3, NH2, etc.

**Q34: What are anhydrous compounds?**

**Answer**

Those compounds which remove are called anhydrous compounds.

**Q35: What is Whole?**

**Answer**





The residue which left when the substance or liquid is passing through the filter paper is called filtrate.

**Q36a) What is use of Quinine? And how is it obtained.**

**Answer**

Quinine is used as antimalarial and antipyretic medicine. It is obtained from the quinine tree.

**b) What is use of Nicotine? And how it is obtained?**

**Answer**

Nicotine is used as insecticide. It is obtained from tobacco.

**Q37: What is use of Menthol? And how it is obtained?**

**Answer**

It is used as dilation of the capillaries and an increase in blood circulation. It is obtained from the mint i.e. Mentha species.

**Q38: What is Rutin? And how it is obtained?**

**Answer**

Rutin is used for the treatment of capillary fragility. It is obtained from citrus species

e.g. orange, grapefruit etc.





**Q39: What is use of cocaine? And how it is obtained?**

**Answer**

Cocaine is used as an anesthetic. It is obtained from coca plant.

**Q40: What is use of caffeine? And how it is obtained?**

**Answer**

Caffeine is CNS stimulant. It is obtained from tea, coffee and coca.

**Q41: What is use of Bromelain? And how it is obtained?**

**Answer**

Bromelain is anti-inflammatory drug. It is obtained from pineapple.