CHAPTER 8

INDUSTRIAL CHEMISTRY

Q1. Define the following

Industrial chemistry: Industrial chemistry is the manufacturing art concerned with the transformation of matter into useful materials in useful amounts.

Chemical industry: The chemical industry is the one responsible industry for converting raw materials like petroleum, water, air, minerals, crops, metals, and etc into more valuable products.

Saponification: Saponification is the reaction of triglycerides with sodium or potassium hydroxide to create glycerol and "soap" a fatty acid salt.

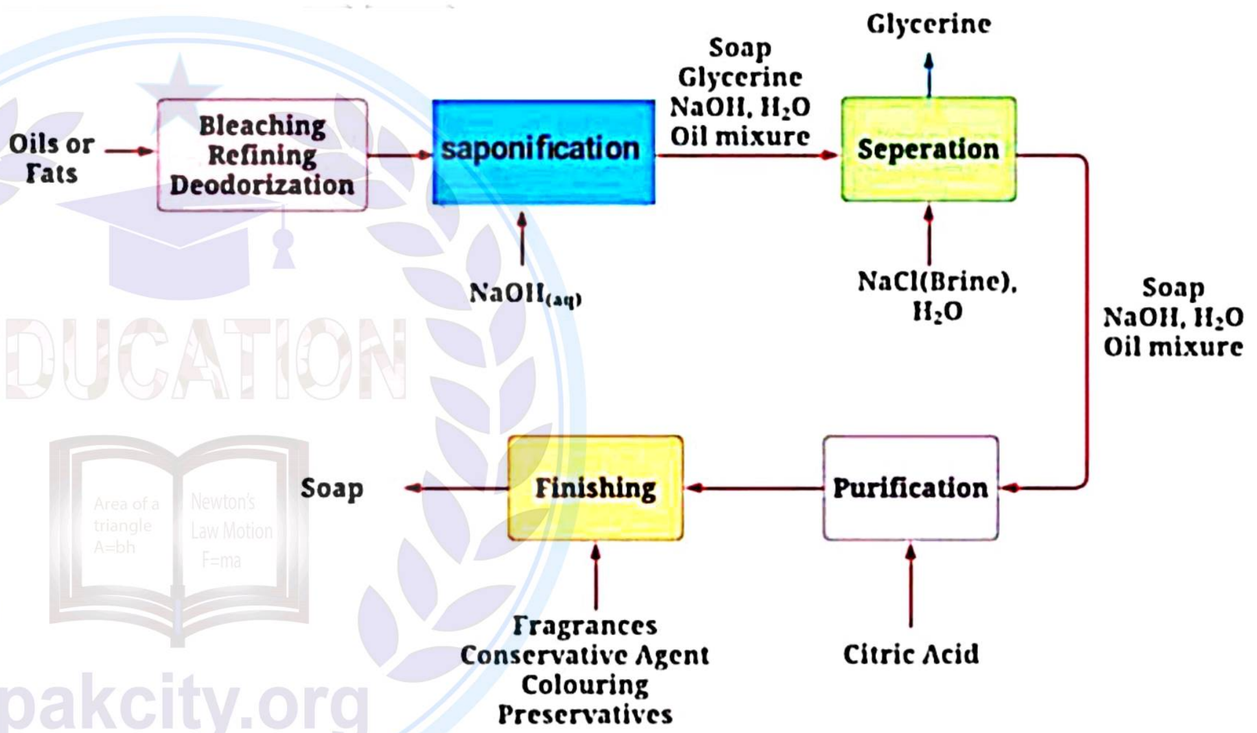
Heart and Soft soap: A hard soap is created when sodium hydroxide is used. The use of potassium hydroxide produces a soft soap.

Q2. Name and describe the Materials needed for soap preparation

Materials needed for soap preparation

The raw materials needed for preparation of soap areas follows:

- Animal Fat
- Plant Oil
- Caustic Soda
- Potassium Hydroxide
- Additives (colour, texture, scent)
- Abrasives (silica, talc, marble)



Flow Diagram for Soap Production

Animal Fat: Animal fat tallows from cows, such as lard, are often used for soap making.

Plant oil: Soybean oil, like canola, safflower, and sunflower, is often used as a potion of a soap making recipe in combination with other "core" oils like coconut, olive, and palm.

It's pretty unremarkable, but if you have it on hand, use it 5-15% of your soap recipe. It is mild, moisturizing, and gives a low creamy leather.

Caustic soda/Potassium hydroxide (Alkali): Caustic soda (NaOH) causes saponification and is an essential ingredient in soap making. When flakes or beads of sodium hydroxide get added to a liquid, it forms a lye solution. This solution, when mixed with oils or fats, will lead to the chemical reaction called saponification.

Sodium hydroxide is employed as alkali for the saponification of soap nowadays. Soap may also be manufactured with potassium hydroxide (caustic potash) as the alkali.

Additives: The major raw materials for soap manufacture are fat and alkali. Other substances, such as optical brighteners, colour, texture, scent, water softeners, are known as additives.

Abrasives: Water-insoluble minerals such as talc, diatomaceous earth, silica, marble, volcanic ash (pumice), Chalk, feldspar, quartz, and sand are often powdered and added to soap or synthetic detergent formulations. Abrasives of an organic nature, such as sawdust, are also used. Abrasives help in removing grease and dirt from skin.

Q3.List the Materials needed for sugar preparation

Materials needed for sugar preparation

The raw materials needed for the preparation of sugar from sugarcane rs follows:

- Sugarcane beads
- Lime
- Water

Q4.Describe the Preparation of sugar from sugarcane

Preparation of sugar from sugarcane

The preparation of sugar from sugarcane composed of following steps.

- Harvesting and delivery
- Juice extraction
- Clarification
- Concentration
- Crystallization
- Crystal separation and drying

Harvesting and delivery of sugarcane: Sugarcane is generally harvested in the cooler months of the year, although it is harvested year-round in all over the Sindh. As much as two-thirds of the world's can crop is harvested by hands but in some countries this process is also done by machines. Harvested cane is transported to the factory by many means and vehicles, such as oxcarts, trucks, railway cars, or barges.

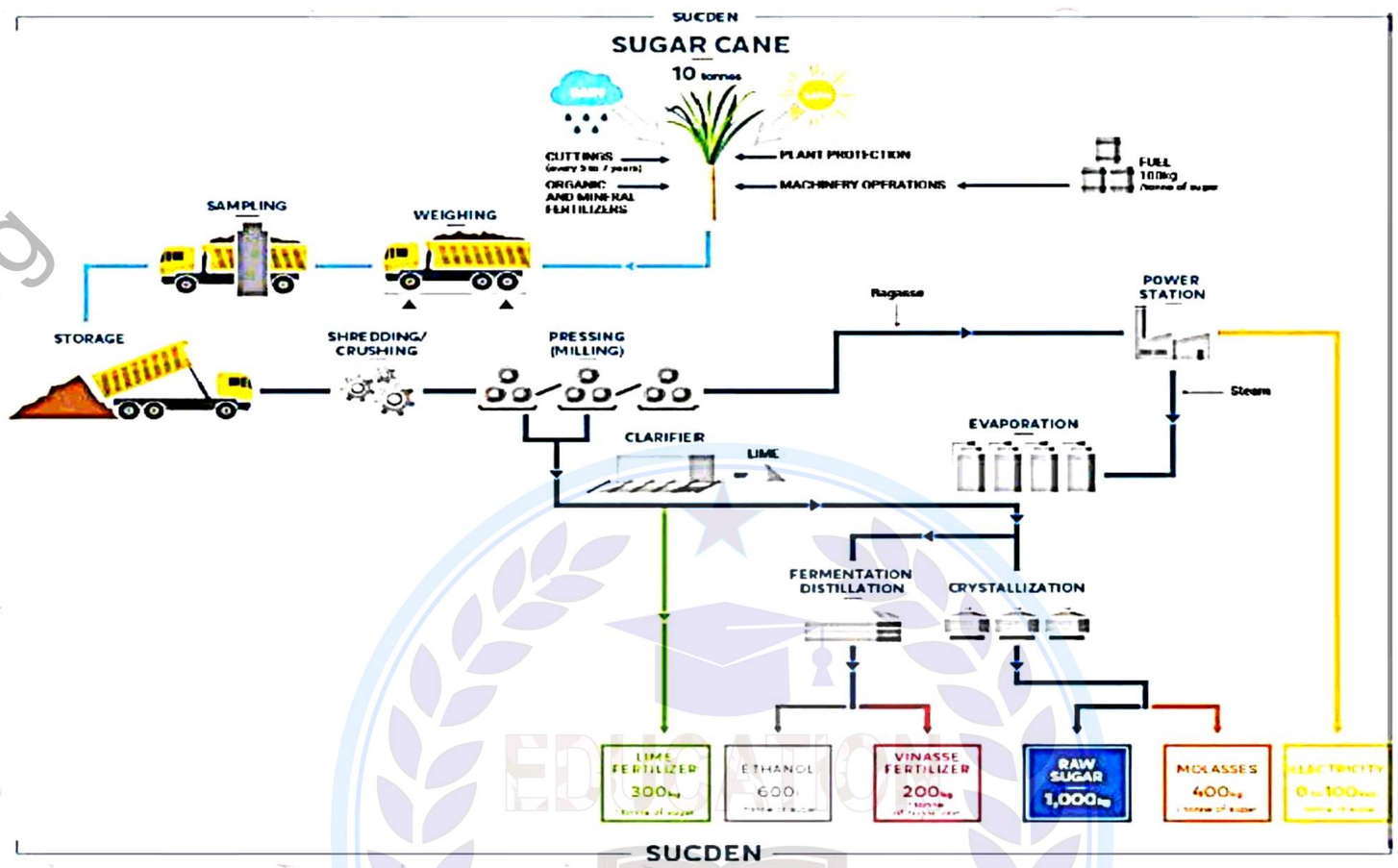
Juice extraction of sugarcane: After weighing, sugarcane is loaded by hand or crane onto a moving table. The table carries that cane into one or two sets of revolving knives, which chop the cane into chips in order to expose the tissue and open the cell structure, thus readying the material for efficient extraction of the juice.

Clarification of extracted juice: Mixed juice from the extraction mills or diffuser is purified by addition of heat, lime, and flocculation aids. The lime is a suspension of calcium hydroxide, often in a sucrose solution, which forms a calcium saccharate compound. The heat and lime kill enzymes in the juice and increase pH from a natural acid level of 5 – 6.5 to a neutral pH. Control of pH is important throughout sugarcane manufacture.

Concentration of clarified juice: Steam is used to heat the first of a series of evaporators. The juice is boiled and drawn to the next evaporator, which is heated by vapour from the first evaporator. The process continues through the series until the clarified juice, which consists of 10-15% sucrose, is concentrated to evaporator syrup, consisting of 55 – 59% sucrose and 60 – 65% by weight total solids.

Crystallization of concentrated juice: Syrup from the evaporators is sent to vacuum pans, where it is further evaporated, under vacuum, to supersaturation. Fine seed crystals are added, and the sugar "mother liquor" yields solid precipitate of about 50% by weight crystalline sugar. Crystallization is a serial process and named as A molasses, B molasses, C molasses, and final molasses which is 25% sucrose and 20% (glucose and fructose).

Crystal separation and drying: Crystals are separated in basket-type centrifuge machines. These machines continuously break the crystals through continuous centrifuge process and a fine jet of water is spread on the sugar pressed against the wall of the centrifugal basket, reducing the syrup coating on each crystal. In modern factories, the washing process is quite extensive in an effort to produce high-purity raw sugar.



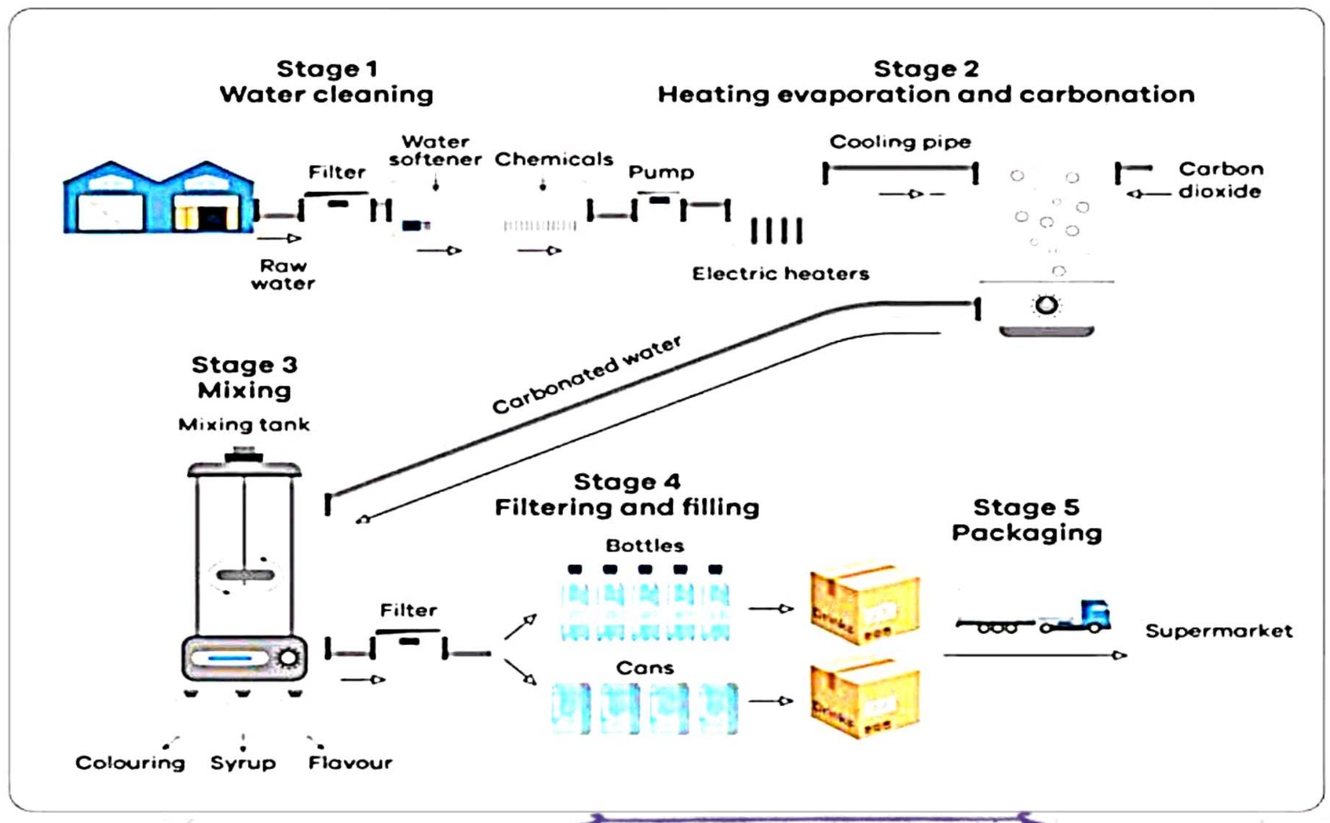
Q5. Describe the Preparation of soft drinks

Preparation of soft drinks: The basis of soft drinks, the syrup, is made up of water, sugar, acid, coloring, and flavoring agents. This syrup is prepared by dissolving these ingredients into water to 65° Brix.

Materials required for preparation of soft drink:

Following materials required for preparation of soft drink:

- Water
- Calcium and other minerals
- Coloring and flavoring agent
- Sugar for microbial growth
- Citric acid for sour taste



Q6. Write a short note on Petroleum

Petroleum: Petroleum is a natural substance in rocks beneath the Earth's crust. The term "petroleum" refers to rock oil.

Property: It is a liquid that is lighter than water yet insoluble in it.

Formation of petroleum and natural gas: Oil and gas are made up of organic material that is deposited on the seafloor as sediments, then broken down and altered over millions of years. The presence of an appropriate mix of source rock, reservoir rock, cap rock, and a trap in a given location may lead to the discovery of viable oil and gas resources.

The majority of the oil and gas resources on the Norwegian shelf are formed by a thick layer of black clay that lies thousands of meters beneath the seabed.

Composition of petroleum: Petroleum is mostly made up of hydrogen and carbon, but it also includes trace amounts of oxygen, nitrogen, sulfur, and metals including vanadium, cobalt, and nickel. Alkanes (paraffins), naphthene's, aromatics, and hetero compounds are some of the most prevalent organic substances.

The exact molecular composition of crude oil varies widely from formation to formation but the proportion of chemical elements varies over fairly narrow limits as follows

Composition by weight	
Element	**Percent range**
Carbon	83 to 85 %
Hydrogen	10 to 14 %
Nitrogen	0.1 to 2 %
Oxygen	0.05 to 1.5 %
Sulfur	0.05 to 6.0 %
Metals	< 0.1 %

Q7. Describe the Fractional distillation of petroleum

Fractional distillation of petroleum

This is done in oil refineries with the use of massive fractionating columns (also known as fractionating towers). These are frequently found near to the crude oil source. The industrial fractionating column is intended to be cold at the top and hot at the bottom, allowing it to cool and condense crude oil vapour at distinctively different temperature ranges defined by the column's temperature gradient.

Fraction distilled from crude oil	Boiling point range (°C)	Carbon chain length	Hydrocarbons present	Uses
Refinery gas	-160 to -5	1- 4	Methane CH_4 Ethane C_2H_6 Propane C_3H_8 Butane C_4H_{10}	Home heating and cooking, camping fuel
Gasoline (petrol)	40-110	5-8	Octane C_8H_{18}	Car fuel
Naphtha	110-180	8-10	Decane $C_{10}H_{22}$	Plastics
Kerosene (paraffin)	180-260	10-16	Dodecane C12H26	Jet aircraft fuel
Diesel	260-320	16-20	Hexadecane C16H34	Fuels for buses and lorries
Fuel Oil	320-400	20-50	Eicosane C_20H_{42}	Industrial heating systems
Bitumen/Residue	400-600	>50		Surfacing rods

Q8. What is pharmaceutical sector?

Pharmaceutical sectors: Companies authorized to study, manufacture, sell and distribute drugs for the prevention, treatment, and cure of illnesses and other health issues make up the pharmaceutical sector.

Describe the Importance of pharmaceutical industry

Importance of pharmaceutical industry

Here are some of the industry's most important contributions, as well as why pharmaceutical firms are so vital to patients, society, and the life sciences industry.

1. **Treatments increase life expectancy:** The pharmaceutical business has made a significant contribution to the global increase in life expectancy for men and women.

   Pharmaceutical improvements are said to have responsible for 73% of the entire increase in life expectancy between 2000 and 2009 in 30 developing and high-income nations.

2. **The industry strives to eradicate and eliminate diseases:** When it comes to create remedies, the ultimate objective is disease elimination, as this helps ecosystems on a worldwide scale. Smallpox is the first - and so far only - human illnesses to be declared eliminated globally, according to the World Health Organization (WHO).

3. **Reduce pain and suffering:** According to a research conducted by the World Health Organization, people who live with chronic pain are four times more likely to have melancholy, anxiety, and difficulties in work then those who do not.

4. **Vaccines save money:** Vaccines not only serve to save millions of lives, but they also help to save money. Vaccines are commonly regarded as a cost-effective public health intervention that reduces health care costs and prevents lost productivity, hence limiting the economy's overall impact.

5. **Hospital stays are shorter:** Many illnesses that used to necessitate invasive procedures and surgery can now be addressed with medications. Patients' ability to be discharged more quickly has relieved pressure on the healthcare system and personnel.

6. **The industry employees millions of people:** Pharmaceutical forms employ millions of people across the world. Who labor in fields as diverse as scientific research, technological support, and manufacture? Pharmaceutical enterprises demand highly trained and educated employees, with positions ranging from administrative to Ph.D. scientists.

7. **Pharmaceutical companies boost the global economy:** The pharmaceutical business is a vital asset to the global economy. Pharmaceutical businesses, on the whole, play an important role in assisting patients and communities. They supply more than just possible cures and life-saving treatments; they also give rewarding jobs and help to power the global economy.

Q9. What are the Different types of fire require methods to extinguish?

METHODS TO EXTINGUISH FIRE

A self-sustaining chemical chain reaction is a complicated reaction that necessitates the precise combination of fuel, oxygen, and heat energy.

Any of the above-mentioned components can be removed to put out a fire. Various fuels necessitate different strategies for extinguishment.

Extinguishing of wood fire

Water can be thrown on a wood fire to put it out. Water absorbs a lot of heat during the evaporation process, therefore it absorbs a lot of heat and deprives the wood fire of heat, making it impossible to keep the fire going on.

Extinguishing of oil fire

Oil and water do not mix, hence water will not put out on oil fire. Because oil is lighter than water, it floats and spreads across it. Water aids in the propagation of the fire. To put out an oil fire, the oxygen supply must be shut off.

Throwing sand, table salt, or baking soda on the flames will help contain this.

Extinguishing of electrical energy

Because its source of heat is electrical energy, an electrical fire is far more powerful than ordinary flames. To put it out, the oxygen supply must be shut off.

MULTIPLE CHOICE QUESTIONS

1. Soap is the term for a salt of a:

(a) Carboxylic acid (b) Citric acid (c) Sulfuric acid (d) Fatty acid

2. Surfactants reduce the — of water.

(a) Viscosity (b) Surface tension (c) Boiling point (d) Melting point

3. The carboxylate end of the soap molecule that is attracted to water is called _____.

(a) hydrophobic end (b) end point (c) hydrophilic end (d) n.o.t

4. The use of potassium hydroxide produced a:

(a) Hard soap (b) Soft soap (c) Moderate soap (d) All of these

5. The citric acid is used in preparation of cold drinks for:

(a) Sweet taste (b) Bitter taste (c) Sour taste (d) Salty test

6. This centrifuge machine used for separation of:

(a) Juice (b) pH (c) Mud (d) Crystal

7. The abrasives are:

(a) Water soluble minerals (b) Water insoluble minerals

(c) Water semi soluble minerals (d) Water absorbing minerals

8. The harvesting is most important step of:

(a) Preparation of soap (b) Preparation of cold drinks

(c) Preparation of sugar (d) Preparation of medicines

9. Which of the following is used as jet fuel:

(a) Kerosene oil (b) Diesel oil (c) Fuel oil (d) Petrol

10. Which of the following is not a fraction of crude oil?

(a) paraffin wax (b) ammonia (c) fuel oil (d) petroleum coke

1.Fatty acid	**2.Surface tension**	**3.hydrophilic end**	**4.Soft soap**	**5.Sour taste**
6.Crystal	**7.Water insoluble minerals**	**8.Preparation of sugar**	**9.Kerosene oil**	**10.ammonia**