Department of Electrical Engineering
Final – Term Examination Spring 2020
Date: 27/06/2020

Course Details

Course Title:	Applied Chemistry	Module:	2nd
Instructor:	Engr. Khalil Muhammad Khan	Total Marks:	50

Student Details

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Note: Attempt all of the following questions.

Part A (Objective Type)

10 Marks

1. A good liquid lubricant must possess the property of ____**b**_______
   a) Low viscosity
   b) High boiling point
   c) High freezing point
   d) Low oiliness
2. Which of the following is not the liquid lubricant? **(d)**
   a) Olive oil
   b) Palm oil
   c) Castor oil
   d) Grease
3. Petroleum oils are also called as _**b**________
   a) Petrol oils
   b) Hydrocarbon oils
   c) Fatty oils
   d) Whale oil
4. Petrol captured the market up to the percentage of ___**c**_
   a) 100%
   b) 90%
   c) 98%
   d) 75%
5. A dispersion system consisting of two immiscible liquids is called __**b**______
   a) Lubricants
   b) Emulsions
   c) Semi solids
   d) Solids

6. In oil in water emulsions, how much water is present ___**b**____
a) 3-20%
b) 40-50%
c) 3-4%
d) 5-8%
7. Which of the following is the example of the electrolytes? **(a)**
a) Acids
b) Metals
c) Alloys
d) Oxides
8. The resistance of the conductor in the electrolytic cell ___**a**________with increase in temperature.
a) Increase
b) Decrease
c) Slightly increase
d) Do no change
9. The process of decomposition of an electrolyte by passing electric current through its solution is called as___**c**_______
a) Electrolyte
b) Electrode
c) Electrolysis
d) Electrochemical cell
10. The electrolyte is placed in a special type of cell known as____**d**________
a) Conductivity cell
b) Conductance cell
c) Equivalent cell
d) Conduction cell

Part B (Subjective Type)

20 marks

Q. 2 a. What is addition and condensation polymerization? Give examples. (5)

Answer:

<u>Addition polymer</u>:

An addition polymer is a polymer that forms by simple linking of monomers *without* the co-generation of other products. Addition polymerization differs from condensation polymerization, which *does* co-generate a product, usually water.[1][2] Addition polymers can be formed by chain polymerization, when the polymer is formed by the sequential addition of monomer units to an active site in a chain reaction, or by polyaddition, when the polymer is formed by addition reactions between species of all degrees of polymerization. Addition polymers are formed by the addition of some simple monomer units repeatedly. Generally polymers are unsaturated compounds like alkenes, alkalines etc. The addition polymerization mainly takes place in free radical mechanism. The free radical mechanism of addition polymerization completed by three steps i.e. Initiation of free radical, Chain propagation, Termination of chain.

An addition polymer is a polymer formed by chain addition reactions between monomers that contain a double bond. Molecules of ethene can polymerize with each other under the right conditions to form the polymer called polyethylene.

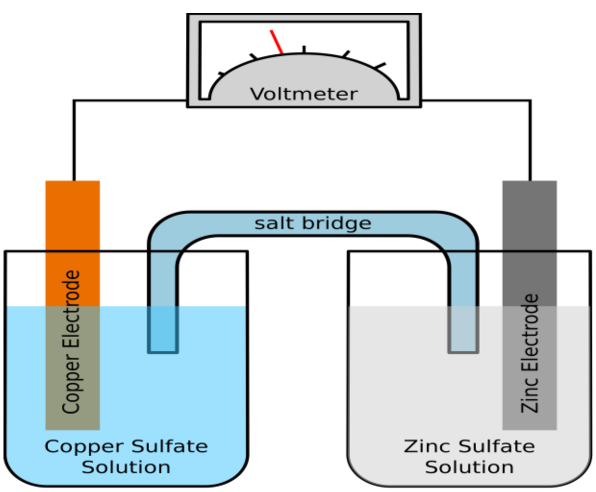
examples of addition polymerization are PVC, polyethene, Teflon etc.

Condensation polymers :

Condensation polymers are any kind of polymers formed through a condensation reaction—where molecules join together—*losing* small molecules as byproducts such as water or methanol. Condensation polymers are formed by poly condensation, when the polymer is formed by condensation reactions between species of all degrees of polymerization, or by condensative chain polymerization, when the polymer is formed by sequential addition (by condensation reaction) of monomers to an active site in a chain reaction. The main alternative forms of polymerization are chain polymerization and polyaddition, both of which give addition polymers.

Q2 b. Draw a neat sketch of a galvanic cell. (5)

Answer:



Q.3 Write any three applications of liquid crystals (5)

Answer:

Three application of liquid crystals:

1) Liquid crystal lenses converge or diverge the incident light by adjusting the refractive index of liquid crystal layer with applied voltage or temperature. Generally, the liquid crystal lenses generate a parabolic refractive index distribution by arranging molecular orientations. Therefore, a plane wave is reshaped into a parabolic wavefront by a liquid crystal lens. The focal length of liquid crystal lenses could be continuously tunable when the external electric field can be properly tuned. Liquid crystal lenses are a kind of adaptive optics. Imaging system can be benefited with focusing correction, image plane adjustment, or changing the range of depth-of-field or depth of focus. Liquid crystal lens is one of the candidates to develop vision correction device for myopia and presbyopia eyes (e.g., tunable eyeglass and smart contact lenses).
2) Liquid crystal lasers use a liquid crystal in the lasing medium as a distributed feedback mechanism instead of external mirrors. Emission at a photonic bandgap created by the periodic dielectric structure of the liquid crystal gives a low-threshold high-output device with stable monochromatic emission.
3) Polymer dispersed liquid crystal (PDLC) sheets and rolls are available as adhesive backed Smart film which can be applied to windows and electrically switched between transparent and opaque to provide privacy.

Q.4 a. Explain suspension polymerization method. (5)

Answer:

Suspension polymerization is one of the most popular methods for systhesis of IIPs. Suspension polymerization is a heterogeneous polymerization process, and the reaction mixture is usually composed of a liquid matrix and monomer droplets. The monomer and initiator are not soluble in the liquid phase, and monomer droplets can be generated within the liquid matrix and suspended as the viscosity increases under continuous mechanical agitation. The polymerization occurs in the droplets of the dispersed phase, which are used as small-sized reactors, resulting in polymer beads. In suspension polymerization, heat transfer within the droplets is relatively fast due to the large surface area and volume ratio, thus the hindrance of heat transfer can be overcomed. Because the monomer droplets are independent under stirring, a more uniform suspension is formed and a relatively narrow size distribution of beads can be easily obtained

Q4 b. Write notes on p-type conducting polymers. (5)

Answer:

p-type conducting plolymers:

Conductive polymers or, more precisely, intrinsically conducting polymers (ICPs) are organic polymers that conduct electricity. Such compounds may have metallic conductivity or can be semiconductors. The biggest advantage of conductive polymers is their processability, ma inly by dispersion

They are p-type conducting polymers:

- Addition Polymers. Addition polymers such as polyethylene, polypropylene, poly(vinyl chloride), and polystyrene are linear or branched polymers with little or no cross-linking.
- Polyethylene.
- Polypropylene.
- Poly(tetrafluoroethylene) .
- Poly(vinyl Chloride) and Poly(vinylidene Chloride) .
- Acrylics.
- Condensation Polymers

Q.5 Dielectric constant of gases possess values very close to each other. Why? (5)

Answer:

A dielectric gas, or insulating gas, is a dielectric material in gaseous state. Its main purpose is to prevent or rapidly quench electric discharges. Dielectric gases are used as electrical insulators in high voltage applications, e.g. transformers, circuit breakers (namely sulfur hexafluoride circuit breakers), switchgear (namely high voltage switchgear), radar waveguides, etc.

A good dielectric gas should have high dielectric strength, high thermal stability and chemical inertness against the construction materials used, non-flammability and low toxicity, low boiling point, good heat transfer properties, and low cost.[1]

The most common dielectric gas is air, due to its ubiquity and low cost. Another commonly used gas is a dry nitrogen.

In special cases, e.g., high voltage switches, gases with good dielectric properties and very high breakdown voltages are needed. Highly electronegative elements, e.g., halogens, are favored as they rapidly recombine with the ions present in the discharge channel. The halogen gases are highly corrosive. Other compounds, which dissociate only in the discharge pathway, are therefore preferred; sulfur hexafluoride, organofluorides (especially perfluorocarbons) and chlorofluorocarbons are the most common.

The breakdown voltage of gases is roughly proportional to their density. Breakdown voltages also increase with the gas pressure. Many gases have limited upper pressure due to their liquefaction.

Q.6 What is a primary battery? Discuss the working and construction of a dry cell. (5)

Answer:

Primary battery:

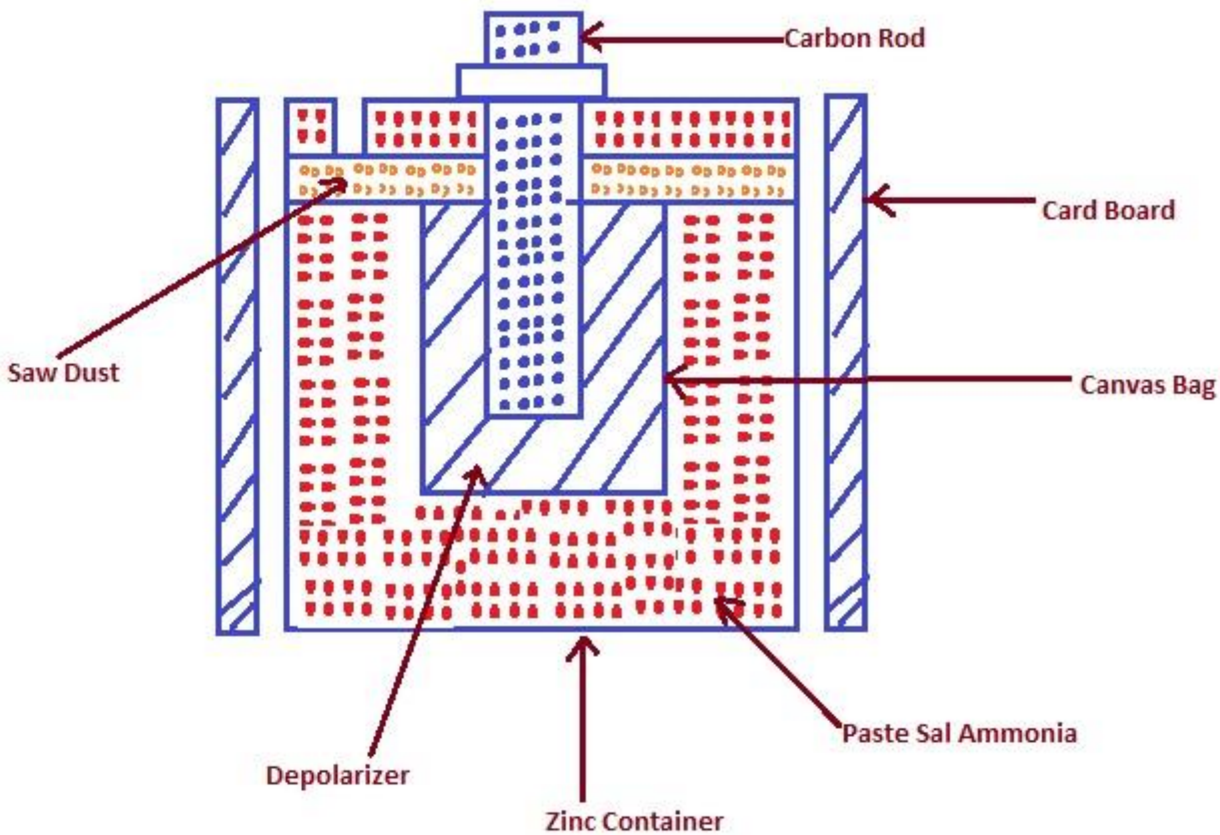
A primary cell is a battery (a galvanic cell) that is designed to be used once and discarded, and not recharged with electricity and reused like a secondary cell (rechargeable battery). In general, the electrochemical reaction occurring in the cell is not reversible, rendering the cell unrechargeable. As a primary cell is used, chemical reactions in the battery use up the chemicals that generate the power; when they are gone, the battery stops producing electricity. In contrast, in a secondary cell, the reaction can be reversed by running a current into the cell with a battery charger to recharge it, regenerating the chemical reactants. Primary cells are made in a range of standard sizes to power small household appliances such as flashlights and portable radios

Dry cell introduction:

. The Dry Cell was discovered by French Scientist G. Leclanche in 1868. It is the most common cell which is the improved version of Leclanche Cell. It is a portable cell and free from liquid. This is why, it is called dry cell as it do not contain any liquid. Dry Cell is widely used in our day to day life in torch, clock, toys etc.

Construction of dry cell:

The construction of dry cell is shown in figure below. As can be seen from the figure, Zinc Container acts as cathode i.e. negative electrode while carbon rod acts as positive electrode or anode.



Carbon rod is placed in the middle of Zinc container. It shall be noted that carbon rod is covered with crushed coke and Manganese dioxide and kept in canvas bag. Here the mixture of coke and Manganese dioxide acts as depolarizer. Depolarizer is basically a substance used in a cell to prevent build-up of hydrogen gas bubbles. A battery depolarizer takes up electrons during discharge of the cell and hence depolarizer is always an oxidizing agent.

In Dry Cell, electrolyte is paste of sal ammoniac and Zinc Chloride. Sal Amminiac is a mineral composed of Ammonium Chloride NH_4Cl. Electrolyte is filled in between the positive plate i.e. carbon rod and negative plate which is zinc container. Zinc chloride is added in sal ammoniac paste to keep the paste wet. Upper portion of cell is covered with saw dust and pitch compound and a small hole is kept intentionally for venting of cell.

Working Principle of Dry Cell:

When dry cell is externally connected with wire, following reactions take place,

$Zn + 2NH_4 Cl = ZnCl_2 + 2NH_3 + H_2$

Here NH_3 and H_2 are in the form of ions.

Ammonia dissolves in water and after saturation it comes out. It shall be noted here that, H_2 reaches to anode i.e. toward the carbon rod and there it reacts with MnO_2 to makes water.

$2MnO_2 + H_2 = Mn_2O_3 + H_2O$

Normally the emf of dry cell is 1.5 V and its internal resistance lies in between 0.1 to 0.5 ohm. These cells are used in portable equipment like Transistor, Torch, TV remote, remote bell push etc.

Q.7 Write the design and working of tidal power. (5)

Answer:

Tidal power generation:

There are three basic methods used for generating power from tides, these methods are constantly being researched, adapted and improved. However, all three use the basic principle of converting the mechanical energy of tidal movements into electricity. Locations where tidal power generation is available have geographic features that restrict what types of tidal generators can be used, which makes it necessary to have a range of systems available.[5]

Dynamic tidal power:

Dynamic tidal power is a technology that uses the difference between the potential energy and kinetic energy of tides. Long dams are built from coasts straight out into the sea or ocean - meaning that the tides in the areas where these systems can be implemented usually flow parallel to their respective coasts.

This technology is still in the experimental phase and requires a full scale demonstration plant to fully prove feasibility.

<u>Tidal stream generator:</u>

Tidal stream generators make use of moving water to power turbines - similar to the way wind turbines use wind to create power. There are several variations of tidal stream generators all of which use very similar processes but have different designs and can be found on the tidal stream generator page.

<u>Tidal barrage:</u>

Tidal barrage systems work similarly to hydroelectric dams, they capture the energy from water moving in and out of a bay or river due to tidal forces. Again, there are several variations of this method that all use a similar process