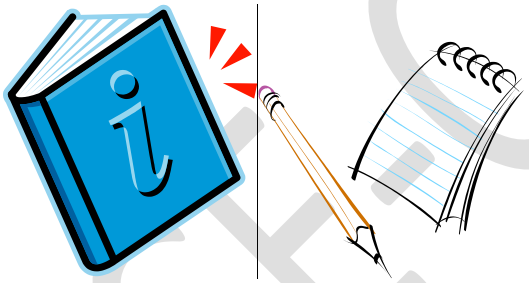
DMI COLLEGE OF ENGINEERING

CHENNAI- 600 123

Department of Science and Humanities



CY3151-ENGINEERING CHEMISTRY

PART-A-QUESTION BANK

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UNIT-I
WATER AND ITS TREATMENT
PART-A

1. Why is water softened before using in boiler? (or) write any disadvantages of hard water in boilers. (Apl-May 2015) (Apl-May 2017)

If hard water obtained from natural sources is fed directly into the boilers, the following troubles may arise.

- Scale and sludge formation
- Priming and foaming
- Caustic embrittlement
- Boiler corrosion.

2. What are scales and sludges? (Nov/Dec 2020)

Sludge: If the precipitate is loose and slimy it is called sludge. Sludges are formed by substances like $MgCl_2$, $MgCO_3$, $MgSO_4$, and $CaCl_2$. They have greater solubilities in hot water than cold water.

Scale: On the other hand, if the precipitate forms hard and adherent coating on the inner walls of the boiler, it is called scale. Scales are formed by substances like $Ca(HCO_3)_2$, $CaSO_4$ and $MgCl_2$.

3. What is meant by reverse osmosis? How it is applied in the desalination of water?

If pressure in excess of osmotic pressure is applied on the higher concentration side, the solvent flow is reversed. Solvent flows from higher concentration (salt water) to lower concentration (water). This process is called reverse osmosis is taken as higher concentration and water is taken as solvent. If pressure is applied on the salt water, the water flows from salt water to water side.

4. Define desalination.

The process of removing common salt from the water is known as desalination.
The water containing dissolved salts with a peculiar salty or brackish taste is called brackish water.

5. What are the disadvantages of scale formation?

It acts as thermal insulators. It decreases the efficiency of boiler. Any crack developed on the scale, leads to explosion.

6. Define softening of water. How it is carried out?

The process of removing hardness producing salts from water is known as softening or conditioning of water. It can be done in two methods.

1. External treatment 2. Internal treatment

7. Give some examples for cation and anion exchange resins.

Cation exchange resins: Sulphonated coals, sulphonated polystyrene

Anion exchange resins: Cross linked quaternary ammonium salts, urea – formaldehyde resin.

8. What is calgon conditioning? (May-June 2014) (Nov/Dec 2016) (May/Jun 2016) (Nov/Dec 2020)

Calgon is sodium hexa meta phosphate $Na_2[Na_4(PO_3)_6]$. This substance interacts with calcium ions forming a highly soluble complex and thus prevents the precipitation of scale forming salt.

$$2\ CaSO_4 + Na_2[Na_4(PO_3)_6] \rightarrow Na_2[Ca_2(PO_3)_6] + 2\ Na_2SO_4$$

9. What is blow down operation?

Blow-down operation is a process of removing a portion of concentrated water by fresh water frequently from the boiler during steam production.

10. Why is hard water unsuitable for boilers?

The hard water is not suitable for boilers due to the following reasons. If you use hard water in boilers it may arise

- ✓ Scale and sludge formation,
- ✓ Priming and foaming
- ✓ Caustic embrittlement
- ✓ Boiler corrosion

11. What is phosphate conditioning? (or) What is the role of phosphates in the internal treatment of water?

Scale formation can be avoided by adding sodium phosphate. It is used in high pressure boilers. The phosphate reacts with calcium and magnesium salts to give soft sludges of calcium and magnesium phosphates.

$$3\ CaSO_4 + 2\ Na_3PO_4 \rightarrow Ca_3(PO_4)_2 + 3\ Na_2SO_4$$

12. How is exhausted ion-exchange resins regenerated?

When the cation exchange resin is exhausted, it can be regenerated by passing a solution of dil. HCl or dil. H_2SO_4.

$$RCa + 2HCl \rightarrow RH_2 + CaCl_2$$
$$RNa + HCl \rightarrow RH + NaCl$$

Similarly, when the anion exchange resin is exhausted, it can be regenerated by passing a solution of dil. NaOH.

$$R'Cl_2 + 2NaOH \rightarrow R'(OH)_2 + 2NaCl$$

13. Mention the units to measure hardness.

- Parts per million (ppm)
- Milligrams per litre(mg/lit)
- Clarke's degree(°Cl)
- French degree (°Fr).

14. What is hardness of water?

Hardness is the property or characteristics of water, which does not produce lather with soap solution.

$$2C_{17}H_{35}COONa+CaCl_2 \rightarrow (C_{17}H_{35}COO)_2\,Ca+ 2NaCl$$

15. Mention any two disadvantages of formation of deposits in steam boilers. (Nov-Dec 2015)

1. Wastage of fuels:

Since scales have low thermal conductivity, the consumption of fuels are more.

2. Decrease in efficiency:

Scales deposits in the valves and condensers of the boiler leads in decreases the efficiency of boiler.

3. Boiler explosion:

Scales develops large amount of steam and high pressure inside the boiler which leads to explosion.

16. Distinguish between internal and external conditioning of water. (Nov-Dec 2014)

S.No	Internal conditioning	External conditioning
1	It takes place inside the boiler	It takes place outside the boiler
2	Removal of scale forming substances by adding chemicals directly into the boilers. Ex. Sodium carbonate, Sodium phosphate	Removal of hardness producing salts from the water before feeding into the boiler.

17. What are boiler compounds? (Apl-May 2015)

Removal of scale forming substances by adding chemicals directly into the boilers. Ex. Sodium carbonate, Sodium phosphate

PART-B

1. Write short notes on:
   (a) Priming and Foaming **(Nov-Dec 2015)** (b) Phosphate conditioning **(Nov-Dec 2015)**
   (c) Caustic embrittlement **(May-June2014) (Nov-Dec 2014) (Nov/Dec 2016) (Apl-May 2017)**
   (d) Scales and sludges **(Apl-May 2015) (Apl-May 2017)** (f) Calgon conditioning **(Nov-Dec 2014)**

2. What is desalination? With a neat diagram, describe the reverse osmosis for the desalination of brackish water. **(Nov-Dec 2014)**

3. What are boiler troubles? How can scale formation be prevented by calgon conditioning? **(Nov-Dec 2014) (Nov-Dec 2015)**

4. Distinguish between softening and demineralization of water. Name any two methods of demineralization of water and explain briefly.(or) Draw a suitable diagram and describe the ion

exchange process for softening of hard water. **(May-June2014) (Nov-Dec 2015) (Nov/Dec 2016) (May/Jun 2016) (Apl-May 2017)**

5. What is meant by reverse osmosis? Explain the purification of water by reverse Osmosis. **(Apl-May 2015) (Nov/Dec 2016) (May/Jun 2016) (Apl-May 2017)**

6. Explain the softening of water by zeolite process? **(May-June2014) (Nov-Dec 2014) (Apl-May 2015) (Nov/Dec 2016) (May/Jun 2016)**

7. Describe briefly the various methods of internal conditioning of boiler feed water. **(May-June2014) (Apl-May 2015) (May/Jun 2016) (Apl-May 2017)**

8. What are the factors which causes boiler corrosion? How can it be minimized? **(Nov/Dec 2014)**

UNIT-III

PHASE RULE

PART - A

1. What are the uses of a phase diagram? (April/May 2017)

i) It is possible to predict from the phase diagrams whether a eutectic alloy or a solid solution is formed on cooling a homogeneous liquid containing mixture of two metals.

ii) The phase diagrams are useful in understanding the properties of materials in the heterogeneous equilibrium system.

iii) The study of low melting eutectic alloys, used in soldering, can be carried out using phase diagrams.

2. Give the condensed / reduced phase rule. (Jan 2014) (April/May 2015)

The system studied under constant pressure in which only the solid and liquid phases are considered and the gas phase is ignored is called a condensed system.

$$F' = C - P + 1$$

3. Calculate the number of components, phases and degrees of freedom for the following Equilibrium. (NOV / DEC 2016)

$$NH_4Cl_{(s)} \leftrightarrow NH_{3(g)} + HCl_{(g)}$$

The system consists of two phases namely solid NH_4Cl and the gaseous mixture containing NH_3 + HCl. When NH_3 and HCl are present in equivalent quantities the composition of both the phases can be represented by the same chemical compound NH_4Cl and hence the system will be a one component system.

Hence, P = 2; C = 1; Then, Degrees of Freedom, F = C – P + 2;

= 1 – 2 + 2; = 1

So, degree of freedom is one.

4. State the number of degrees of freedom for the following systems. (NOV / DEC 2016)

i) PCl_5 (s) ↔ PCl_3 (g) + Cl_2 (g) at 50°C

i) F = C – P + 1;
= 2 – 3 + 2;
= 1.

ii) $CaCO_3$ (s) ↔ CaO (s) + CO_2 (g)

ii) F = C – P + 1;
= 2 – 3 + 2;
= 1.

iii) $MgCO_3$ (s) ↔ MgO (s) + CO_2 (g)

iii) F = C – P + 1;
= 2 – 3 + 2;
= 1.

5. What are the uses of eutectic mixture?

i) Suitable alloy composition can be predicted with the help of eutectic systems.

ii) Eutectic systems are used in preparing solders, used for joining two metal pieces together.

6. State phase rule and explain the terms involved?

If the equilibrium between any number of phases is not influenced by gravity, or electrical, or magnetic forces but are influenced only by pressure, temperature, and concentration then the number of degree of freedom (F) of the system is related to number of components (C) and number of phases (P) by the following phase rule equation.

F = C – P + 2

7. Explain the terms component and degree of freedom? (Nov/Dec 2015)

Component is defined as "the smallest number of independently variable constituents, by means of which the composition of each phase can be expressed in the form of a chemical equation".

Degree of freedom is defined as, "the minimum number of independent variable factors such as temperature, pressure and concentration, which must be fixed in order to define the system completely".

8. What is eutectic or eutectic point? ?(Nov/Dec 2020)

It is the point at which two solid and one liquid phase are in equilibrium.

9. How is thermal analysis conducted? What are the applications of thermal analysis curves?

Thermal analysis is a method involving a study of the cooling curves of various compositions of a system during solidification. The shapes of the freezing point curves for any

system can e determined by thermal analysis. The form of the cooling curve indicates the composition of the solid.

Applications:

i) Melting point and eutectic temperature can be noted from the cooling curve.

ii) Percentage purity of the compounds can be noted from the cooing curve.

10. Define Phase (P).

Phase is defined as, "any homogeneous physically distinct and mechanically separable portion of a system which is separated from other parts of the system by definite boundaries.

11. What is triple point? (May-June 2014)

It is the point at which three phases namely solid, liquid and vapour are simultaneously at equilibrium.

12. How many phases and components are existing at triple point in ice - water – water vapour system?

Phases – 3; Components – 1.

13. Calculate the number of phases in the following systems

1. Emulsion of oil in water
   Phases=2
2. $MgCO3(s) \leftrightarrow MgO(s) + CO2(s)$
   Phases=3
3. Ice(s) $\leftrightarrow$ Water (l) $\leftrightarrow$ Water vapour (g)
   Phases=3

14. How many phase, components and degrees of freedom are available in the equilibrium?

$NH_4Cl_{(s)} \rightarrow NH_{3\,(g)} + HCl$

The system consists two phases and one components P=2, C=1

F=C-P+2 =1-2+2=1

15. A system consists of benzene and water. What is the number of phases?

Two liquid phase and one vapour phase.

16. What is the degree of freedom at eutectic point in lead–silver system? (NOV/DEC 2014)

Solid lead + solid silver $\leftrightarrow$ melt

F' = c-p+1 (F' = 2-3+1) F'=0 (Non- variant)

17. Define degree of freedom. (May/June 2016) (April/May 2017)

Degree of freedom is defined as the minimum number of independent variable factors such as temperature, pressure and concentration is must be fixed in order to define the system completely**.**

PART – B

1. State phase rule and explain the terms involved in it. **(MAY / JUNE 2014)**

2. Draw and explain the phase diagram of one component water system. **(JAN 2014) (NOV / DEC 2014) (APRIL / MAY 2015) (Nov/Dec 2015) (May/June 2016) (NOV / DEC 2016) (April/May 2017)**
3. Explain the two component system with an example. (or) Explain the lead – silver system**.(MAY / JUNE 2014) (APRIL / MAY 2015) (Nov/Dec 2015) (May/June 2016) (NOV / DEC 2016)**

UNIT- IV

FUELS AND COMBUSTION

PART-A

1.What are the different varieties of coal? How do you rank them in the order of increasing calorific value?

Coal is classified on the basis of its rank. The rank of coal indicates its degree of maturity. Various types of coal are Wood-peat-lignite-bituminous coal-anthracite. Calorific value increases from left to right.

2.What is meant by the term "Fixed Carbon"?

It is the pure non-volatile, carbon content present in the coal. Higher the percentage of fixed carbon greater is its calorific value.

3.What is carbonization of coal?

When bituminous coal is heated strongly in the absence of air, the volatile matter escapes out and the mass becomes hard, strong, porous and coherent which is called Metallurgical coke. This process is called carbonization.

4.Give the characteristics of metallurgical coke.

i) Purity: The moisture, ash, sulphur contents in metallurgical coke should be low.
ii) Porosity: Coke should be highly porous.
iii) Strength: It should have high mechanical strength.
iv) Calorific value: The calorific value of coke should be high.

5. How is coke superior to coal? Or Distinguish between coal and coke.

i) Percentage of fixed carbon and hence the calorific value of coke is high.
ii) Percentage of moisture, volatile and ash contents are higher in coal, where as they are low in coke.

6. Why is coke used in metallurgical process than coal?

i) Percentage of fixed carbon in coke is more.
ii) The moisture, ash, sulphur contents are very low.
iii) The mechanical strength, calorific value is high.

7. Explain the term "knocking" of a petrol engine.

Knocking is a kind of explosion due to rapid pressure rise occurring in petrol engine. This can be reduced by adding TEL. ie: Tetraethyl lead.

8. Define octane number of petrol? How it can be improved? (Nov-Dec 2014)

Octane number is defined as, the percentage of iso-octane present in a mixture of Iso-octane and n-heptane. It can be improved by adding anti-knock agents like TEL.

9. Define cetane number (or) cetane rating of a diesel oil? How it can be improved? (Nov/Dec 2016)

It is defined as the percentage of cetane present in a mixture of cetane and alpha-methyl cetane. It can be improved by adding dopes like ethyl nitrate.

10. What is leaded petrol? Give its significance in automobiles.

When the petrol is mixed with TEL it is called leaded petrol. Knocking in petrol engine is minimized.

11. How will you improve the anti-knocking characteristics of diesel?

Anti-knocking characteristics of diesel can be improved by increasing n-cetane value of the fuel. Cetane value can be increased by adding dopes like ethyl nitrate, iso-amyl nitrate.

12. What is ignition temperature?

It is the lowest temperature to which the fuel must be heated, so that it starts burning smoothly.

13. Define spontaneous ignition temperature. ?(Nov/Dec 2020)

It is defined as "the minimum temperature at which the fuel catches fire (ignites) spontaneously without external heating".

14. Name the important units of calorific values.

i) Calorie
ii) Kilocalorie
iii) British thermal unit (B.T.U.)
iv) Centigrade Heat Unit (C.H.U.)

15. What are the reagents used in flue gas analysis? Indicate their functions?

Reagents	Absorbent
KOH solution	CO_2
Alkaline Pyrogallic acid	O_2
Ammoniacal. Cuprous. chloride	CO

16. Mention combustible and non-combustible constituents present in the fuel.

Combustible constituents: C, H, S and O
Non-combustible constituents: N, CO_2

17. Calculate the Dulongs formula for the calculation of GCV and NCV.

GCV= 1/100 (8080C+34 500(H-O/8) + 2240S)K.Cal/Kg
NCV= (HCV- 9/100 H*587) k.cal/Kg

18. Mention the uses of flue gas analysis.

Flue gas analysis gives an idea about the complete or incomplete combustion process. If the flue gases contain considerable amount of CO, it indicates that incomplete combustion. If the glue gases contain considerable amount of O_2, it indicates that complete combustion.

19. Write the characteristics of good fuel.

The characteristics of good fuel are as follows.

i. It should have a high calorific value.
ii. It is cheap and readily available.
iii. It should undergo spontaneous combustion.
iv. It should have very low non-combustible matter.

20. What are the requisites of good coke for metallurgy?

Purity: The moisture, ash, sulphur contents in metallurgical coke should be low.

Porosity: Coke should be highly porous.

Strength: It should have high mechanical strength.

Calorific value: The calorific value of coke should be high.

21. What is the significance of analyzing sulphur in coal? (or) what are the drawbacks of sulphur in coal? (Apl-May 2015)

Significance:

Though sulphur increases the calorific value, its presence in coal is undesirable because,

i. The combustion products of sulphur, i.e., SO_2 and SO_3 are harmful and have corrosion effects on equipments.
ii. The coal containing sulphur is not suitable for the preparation of metallurgical coke as it affects the properties of the metal.

22. What do you meant by synthetic petrol? Give the suitable reaction.

The preparation of liquid fuels from solid coal is called hydrogenation of coal or synthetic petrol.

$$nCO + 2n\ H_2 \rightarrow C_nH_{2n} + n\ H_2O$$

$$(2n+1)\ H_2 + n\ CO \rightarrow C_n\ H_{2n+2} + n\ H_2O$$

23. The ultimate analysis of a coal sample indicates Carbon=84%, Sulphur=1.5%, Nitrogen=0.6%, Hydrogen5.5% and Oxygen=8.4%. Calculate the GCV.

GCV=1/100[8080C+34500(H-O/8) +2240S] kcal/kg

GCV= 1/100[8080X84+34500(5.5-8.4/8) +2240X1.5] kcal/kg

= 1/100[678720+34500(4.45) +3360] kcal/kg

= 8356.05 kcal/kg

24. What is the difference between caking coal and coking coal?

S.No	Caking coal	Coking coal

1	When coals are heated strongly, the mass becomes soft, plastic and fuses to give a coherent mass. Such types of coals are called caking coals	If the mass so produced is hard, porous and strong then the coals are called coking coals. It has lower volatile matter and used for manufacture of metallurgical coke.

25. What is the calorific value of coal? (Nov-Dec 2015) (May/Jun 2016)

It is defined as "the total amount of heat liberated when a unit mass of coal is burnt completely".

i) Calorie, ii) Kilocalorie

iii) British thermal unit (B.T.U.), iv) Centigrade Heat Unit (C.H.U.)

26. What is power alcohol? Mention the advantage. (May-June2014)

When ethyl alcohol is blended with petrol at concentration of 5-10%, it is called power alcohol.

Advantage :

- It is cheaper than petrol.
- If any moisture is present power alcohol absorbs it.

27. Define explosive range of fuel. (May-June2014)

Explosive range or explosive limit is the limiting composition of a gas air mixture beyond which the mixture will not ignite and continue to burn is called explosive range or explosive limit.

28. What is bio diesel? Mention its advantage. (Nov/Dec 2016)

Triglycerides of long chain fatty acids derived from natural sources.

Advantage:

Bio degradable
Less pollutant
Renewable energy.

29. Distinguish between Proximate and Ultimate analysis

S. No	**Proximate analysis**	**Ultimate analysis**
1	It involves determinations of physical constituents like moister, volatile, ash and fixed carbon contents in coal	It involves determinations of chemical constituents like carbon, hydrogen, nitrogen, oxygen and sulphur contents in coal
2	It gives approximate composition of main constituent of coal	It gives the exact composition of the elemental constituents of coal

30. Write the classification of fuels with an example. ?(Nov/Dec 2020)

PART – B

1. Discuss briefly proximate analysis of coal and their significance? (or)What is the importance of proximate analysis **(Nov-Dec 2015) (Apl-May 2015) (May/Jun 2016)**
2. Discuss the ultimate analysis of coal? **(May-June2014) (Apl-May 2017)**
3. Describe the Otto-Hoffman method of coke manufacture and the recovery of various byproducts? / Describe any one method of manufacturing metallurgical coke. **(Nov-Dec 2014) (Apl-May 2015) (Nov-Dec 2015) (Nov/Dec 2016) (May/Jun 2016)**
4. How synthetic petrol is obtained by Bergius process? **(May-June2014)**
5. Calculate gross and net calorific value of coal having the following compositions Carbon-85%, hydrogen-8%, Sulphur-1%, nitrogen-2%, ash-4%.
6. A sample of coal was found to contain the following, C=81%,H=4%,O=2%,N=10%,S=2% and the remaining being ash. Estimate the quantity of air required for the complete combustion of 3 kg of the sample.
7. Explain the flue gas analysis by orsat method. **(Nov/Dec 2016)(May-June2014) (Nov-Dec 2014) (May/Jun 2016) (Apl-May 2017)**
8. Write short notes on Octane and Cetane number.
9. Calculate the volume of air required for the complete combustion of $1m^3$ of gaseous fuel having the composition. CO=46% CH_4= 10% H_2=4% C_2H_2=2% N_2=1% and remaining being CO_2 **(May-June2014)**
10. Write a note on (i) power alcohol and (ii) biodiesel **(Nov-Dec 2014)**
11. What is meant by knocking in petrol engine? How is knocking prevented? **(Apl-May 2015)**
12. Write short notes on the following: **(Nov/Dec 2016)** 1. Ignition Temperature 2. Explosive range
13. What is Bio-diesel? Explain transesterification and advantages of Bio-diesel. **(Apl-May 2017)**

UNIT-V
ENERGY SOURCES AND STORAGE DEVICES

PART-A

1. What is Nuclear energy? Explain using a suitable example

The energy released by the nuclear fission is called nuclear fission energy (or) Nuclear energy.

Example: When U^{235} nucleus is hit by a thermal neutron, the following reaction occurs with the release of energy.

$$_{92}U^{235} + _0n^1 \rightarrow _{56}Ba^{139} + _{36}Kr^{94} + 3_0n^1 + \text{Energy}$$

2. What is the nuclear reactor?

The arrangement or equipment use to carry out fission reaction under controlled conditions is called nuclear reactor.

3. What are the general components of a nuclear reactor?

1. Fuel rods
2. Control rods
3. Coolants.
4. Moderators
5. Pressure vessel.

4. What is breeder reactor? (Nov/Dec 2016)? (Nov/Dec 2020)

Breeder reactor is the one which converts non-fissionable material($U^{238,}$ Th^{232}) into fissionable material (U^{235}, Pu^{239})

5. What is photo galvanic cell (or) Solar cell?

Photo galvanic cell is the one, which converts the solar energy (energy obtained from the sun) directly into electrical energy. It consists of a p-type semiconductor (such as Si doped with P). They are in close contact with each other.

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6. Write any four methods adopted for harnessing wind energy?

Sky sail

1. Ladder mill
2. Kite ship (large free flying sails)
3. Sky wind power (Flying electric generator)
4. Briza technologies (Hovering wind turbine)
5. Sequoia automation (The kite wind generator)

7. How is the reactor wastes disposed?

Nuclear fission products like $Ba^{139,}$ $Kr^{92,}$, Mo^{98}, Ba^{141} are themselves radioactive. i.e., they emit dangerous radiation for several hundred years. Hence, the reactor wastes are placed in concrete barrels which are buried deep in the sea.

8. What is meant by nuclear binding energy?

Loss of mass defect during the formation of the nucleus from nucleons is converted into energy. The release of energy imparts stability to the nucleus. The energy released when constituent nucleons combine to form a nucleus, is called binding energy of the nucleus.

9. Define light water nuclear power plant.

Light water nuclear power plant is the one, in which U^{235} fuel rods are submerged in water. Here, water acts as both moderator and coolant.

10. What are nuclear moderators? Give two examples

The substances used to slow down speed of the neutrons are called moderator.

Ex - Graphite, Cadmium rod.

11. What is a primary battery? Give an example. (or) what are primary cells

Primary cells are cells in which the electrode and the electrode reactions cannot be reversed by passing an external electrical energy. The reactions occur only once and after use they become dead. Therefore, they are not chargeable. Example: **Leclanche's cell**

12. Write the overall equation for the reaction taking place in an alkaline battery?

At anode,

$$Zn_{(s)} + 2OH_{(aq)} \rightarrow Zn(OH)_2 + 2e^-$$

At cathode,

$$2MnO_{2(s)} + H_2O_{(l)} + 2e^- \rightarrow Mn_2O_{3(s)} + 2OH^-$$

Overall cell reaction:

$$Zn_{(s)} + 2MnO_{2(s)} + H_2O_{(l)} \rightarrow Zn(OH)_{2(s)} + Mn_2O_{3(s)}$$

13. State the reaction when a lead storage battery is recharged.

The cell can be recharged by passing electric current in the opposite direction. The electrode reaction gets reversed. As a result, is deposited on anode and PbO2 on the cathode. The density of H_2SO_4 also increases.

The net reaction during charge is,

$$PbSO_4 + H_2O + Energy \leftrightarrow Pb_{(s)} + PbO_{2\,(s)} + 2H_2SO_{4(aq)}$$

14. Write the charging and discharging reaction of lead accumulator.

$$Pb_{(s)} + PbO_{2\,(s)} + 2H_2SO_{4(aq)} \leftrightarrow PbSO_{4\,(s)}\,(s) + 2H_2O + Energy$$

15. Lithium battery is the cell of future. Why? Or what are the advantages of using lithium as anode in batteries?

- Its cell voltage is high, 3.0 V.
- Since Li has the most negative E_0 value, it generates a higher voltage than the other types of cells
- Since Li is a light-weight metal, only 7g (1 mole)material is required to produce 1 mole of electrons

16. What is wind energy? How is it harnessed?(or) Write how wind energy is generated. (Nov-Dec 2015)

Moving air is called wind. Energy recovered from the fore of the wind is called wind energy. The energy possessed by wind is because of its high speed. The wind energy is harnessed by making use of wind mills.

17. What are non-conventional energy sources?

- ✓ Wind energy
- ✓ Solar energy
- ✓ Hydropower
- ✓ Tidal energy

18. What are fissile and fertile nucleides?

- The fissional nucleides like U^{235} and Pu^{239} are called fissile nucleides.
- The non fissionable nucleides such as U^{238} and Th^{232} are called fertile nucleides.

19. What are the applications of solar cells?

- ❖ Solar cells can be used to drive vehicles
- ❖ They can be used for lighting purposes
- ❖ Solar cells are used in boilers to produce hot water for domestic and industrial uses
- ❖ They can be used to produce hydrogen by electrolysis of water

20. What are the applications of lithium batteries?

Button sized Li batteries are used in calculators, watches, cameras, mobile phones, laptop, computers.

21. What are the drawbacks of nuclear energy? (May-June2014)

Nuclear fission products like $Ba^{139,}$ $Kr^{92,}$, Mo^{98}, Ba^{141} are themselves radioactive. i.e., they emit dangerous radiation for several hundred years.

22. Will the emf of a battery vary with size? Give reason. (May-June2014)

No, the emf of a battery will not vary with size.

Reason: EMF of a battery depends only on concentration and nature of anode and cathode.

23. What are batteries? (Nov-Dec 2014) (May/Jun 2016)

Batteries are an arrangement of several electrochemical cells, connected in series that can be used as a source of direct electric current.

24. What are the limitations of hydrogen – oxygen fuel cell? (Apl-May 2015)

1. Hydrogen gas is explosive.
2. It is very expensive to be carried out.

25. Point out the advantages of wind energy. (Nov/Dec 2016)

1. No pollution
2. Renewable energy
3. Available at all time

26. Alkaline battery is superior to dry cell?

Zn does not dissolve readily in a basic medium

The life of alkaline battery is longer than dry cell

Alkaline battery maintains its voltage, as the current is drawn from it

27. What is fuel cell?

Fuel cell is a voltaic cell, which converts the chemical energy of the fuels directly into electricity without combustion. In these cells, the reactants, products and electrolytes pass through the cell.

28. Write a short note on super capacitors.

Super capacitor is a high capacity capacitor with capacitance value much higher than other capacitor. They store 10 to 100 times more energy per unit volume and deliver charge much faster than batteries. Super capacitors, do not use the conventional solid dielectric, but rather they use electrostatic double layer capacitance.

40. Mention any two examples for secondary cells**? (Nov/Dec 2020)**

PART-B

1. What are the main parts of light water nuclear reactor? What is a breeder reactor? **(May-June2014) (Nov-Dec 2014) (Nov/Dec 2016) (Apl-May 2017)**
2. State the principle and application of solar batteries.
3. What are fuel cells? Describe the construction and working of H_2-O_2 fuel cell. **(May-June2014) (Nov-Dec 2014) (Nov/Dec 2016) (May/Jun 2016) (Apl-May 2017)**
4. Explain the power generation from light water nuclear reactor. (or) Explain the method of conversion of nuclear energy into electrical energy in a nuclear reactor. **(May-June2014) (Nov-Dec 2015). (Apl-May 2015)**
5. Describe the conversion of solar energy into electrical energy. **(Nov/Dec 2016)**
6. What are the components of a nuclear reactor? Write briefly about each component.
7. Write briefly about the advantages and limitations of the wind energy. **(Apl-May 2015) (May/Jun 2016)**
8. Explain the construction and functioning of lead acid accumulator. **(May/Jun 2016)**
9. Discuss about the principle and functions of an alkaline battery.
10. Write a note on photovoltaic cell/solar cell. **(Nov-Dec 2014) (Apl-May 2015)**
11. Give an account on the different methods by which solar energy can be harnessed?
12. What is reversible battery? Describe the Construction and working of Lead acid storage battery with reactions occurring during charging and discharging cycles.
    (Jan 2013) (Dec 2014)(Nov-Dec 2015)
13. What are storage batteries? Giving cell reactions explain the Construction and working of Lead acid storage battery. **(May-June2014) (Nov-Dec 2014)**
14. Write a short note on lithium batteries. (or) How is solid state lithium battery constructed Describe its functioning. **(Nov-Dec 2015) (Apl-May 2017)**
15. Explain about breeder reactor**. (May/Jun 2016)**
16. Describe the construction and working of hydrogen-oxygen fuel cell.
    (Jan 2013) (Dec 2014)(May 2017)
17. What are lithium-ion batteries? Explain the construction and working of LIB.
18. Brief about the super capacitor.