
QUESTION BANK ON CPI-II
5TH SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY SATARUPA SAHU

A. 2 MARKS

1. Define pesticides.
2. Differentiate between paint and varnishes.
3. Differentiate between lacquers and varnishes.
4. Define paints.
5. Define plasticizer.
6. Define varnishes.
7. Define lacquers.
8. Define enamels.
9. Define explosive.
10. Define detonating explosive.
11. Define deflagrating explosive.
12. Define polymer.
13. Differentiate between natural rubber and synthetic rubber.
14. Differentiate between soap and detergent.
15. Differentiate between soft soap and hard soap.
16. Write down the purpose of hydrogenation of oil.
17. Define rancidity.
18. Define iodine value of oil.
19. Define saponification value of oil
20. Define acid value of oil.

B. 5 MARKS

1. Classify the types of pesticides.
2. Write down the constituents of paints and their characteristics.
3. Classify the types of explosives and write down their characteristics.
4. Describe the manufacturing of dynamite with a neat diagram.
5. Describe the manufacturing of titanium oxide paint with the chemical reactions.
6. Differentiate between organo-chlorine and organo-phosphorus insecticides.
7. Differentiate between thermosetting polymer and thermoplastic polymer.
8. Classify fiber.
9. Describe the manufacturing of detergent with a neat diagram.
10. Write down the components of detergent.
11. Write down five name of detergent builders and their uses.
12. Classify the types of Pharmaceutical Products.
13. Write down the types of penicillin products.
14. Describe the hydrogenation of oil with a neat diagram and write down the chemical reactions.



15. Describe the manufacturing of NBR and also write the properties and uses.

C. 10 MARKS

1. Describe the manufacturing of nitro cellulose with a neat diagram.
2. Describe the manufacturing of nitro glycerine with a neat diagram.
3. Describe the manufacturing of DDT with a neat diagram.
4. Describe the manufacturing of phenol formaldehyde with a neat diagram and also write the properties and uses.
5. Describe the manufacturing of urea formaldehyde with a neat diagram and also write the properties and uses.
6. Describe the manufacturing of polyethylene with a neat diagram and also write the properties and uses.
7. Describe the manufacturing of P.V.C with a neat diagram and also write the properties and uses.
8. Describe the manufacturing of Nylon with a neat diagram and also write the properties and uses.
9. Describe the manufacturing of Viscose rayon with a neat diagram and also write the properties and uses.
10. Describe the manufacturing of SBR with a neat diagram and also write the properties and uses.
11. Describe the manufacturing of sugar with a neat diagram
12. Describe the manufacturing of industrial alcohol with a neat diagram.
13. Describe the manufacturing of Soap with a neat diagram.
14. Describe the manufacturing of pencilling with a neat diagram.
15. Describe the extraction of oil with a neat diagram



QUESTION BANK ON ENERGY ENGINEERING
5TH SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY SOVAN KUMAR SAHU

- (a) Define carbonization of coal ?(2)
- (b) Explain chemical composition & different uses of coal .(6)
- (c) Explain the manufacture,composition & uses of water gas .(8)
- 2 (a) What do you mean by reforming ?(2)
- (b) Give a comparison between solid, liquid and gaseous fuel.(6)
- (c) Explain detail the process of waste heat recovery system?(8)
- 3 (a) Differentiate between CNG & LPG .(2)
- (b) Briefly explain the process of Fischer-tropsch synthesis .(6)
- (c) Write the different principles of Energy conservation .(8)
- 4 (a) Write the uses of bio gas?(2)
- (b) Calculate the amount of air required for theoretically complete combustion of 100 kg of coal of the following composition.
- C = 82% , H = 6% , O₂ = 4% , ash = 8% , moisture = 2% .(6)
- (c) Give a comparison between solar energy & wind energy with their uses.(8)
- 5 (a) Give two properties of gasoline.(2)
- (b) Briefly explain about the recuperators.(6)
- (c) Explain the crude oil distillation process.(8)
- 6 (a) Define combustion & give a combustible reaction.(2)
- (b) Briefly explain Bergius synthesis.(6)
- (c) Explain the manufacture, composition and uses of refinery gases.(8)
- 7 (a) Define caking & coking of Coal. (2)
- (b) Briefly explain tidal energy & their uses.(6)
- (c) Give a description about storage and handling of liquid fuel.(8)



QUESTION BANK ON FLUID MECHANICS
3rd SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY SUBASINI JENA

1. (a) What is fluid? (2)
(b) Write down the properties of fluid? (5)
(c) Discuss the principle of U-tube manometer and its application? (7)
2. (a) Define Reynolds number? (2)
(b) Derive the Bernoulli's theorem? (5)
(c) The water is flowing through a pipe having diameters 20cm and 10cm at section -1 and 2 respectively. The rate of flow through the pipe is 35 lit/s. The section -1 is 6m above datum and section- 2 is 4m above datum. If the pressure at section -1 is 39.24 N/cm², find the intensity of pressure at section -2? (7)
3. (a) Write down the advantages of venturimeter? (2)
(b) Explain the working principle of venturimeter with net sketch? (5)
(c) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm² and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through venturimeter. Take $c_d = 0.8$. (7)
4. (a) What are the types of valve? (2)
(b) Derive the net positive suction head (NPSH)? (5)
(c) Write down the construction and working principle of centrifugal pump? (7)
5. (a) What is fluidization? (2)
(b) Discuss the types of fluidization? (5)
(c) What is minimum fluidization velocity? Write down the expression of minimum fluidization velocity? (7)
6. (a) Define laminar flow? (2)
(b) Write down the equation of continuity? (5)
(c) An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and down stream of the orifice meter gives readings of 19.62 N/cm² and 9.81 N /cm². Coefficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe? (7)
7. (a) What is Newton's law of viscosity? (2)



- (b) Write down the construction and working principle of reciprocating pump? (5)
- (c) Derive the fanning friction factor? (7)



QUESTION BANK ON HEAT TRANSFER
4TH SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY SUBASINI JENA

1. (a) Write down the Fourier's law? (2)
(b) Derive the expression for heat transfer through the composite wall made of three different materials in series? (6)
(c) A pipe 65 mm outside diameter is lagged with 50mm layer of asbestos (conductivity = 0.14 w/mk) and a 40 mm layer of cork (conductivity = 0.035 w/mk). If the temperature of the outer surface of the pipe is 423 k and the temperature of outer surface of the cork is 308 k, calculate the heat loss per meter of pipe? (8)

2. (a) Define natural and forced convection? (2)
(b) Derive the log mean temperature difference? (6)
(c) Cold fluid flowing through the heat exchanger at a rate of 15 m³/h. It enters the heat exchanger at 303 k and leaves at 328 k. The hot thermic fluid enters the heat exchanger at the rate of 21 m³/h at a temperature of 388 k. Find out the area of heat transfer required assuming the flow is counter current and overall heat transfer coefficient be 3490 w/m² k. (8)
Data: density of fluid = 1000 kg/m³
Density of thermic fluid = 950 kg/m³
Specific heat of cold fluid = 4.187 kj/kg k
Specific heat of thermic fluid = 2.93 kj/kg k

3. (a) Define black body? (2)
(b) State the Kirchoff's law of radiation? (6)
(c) Estimate the total heat loss by convection and radiation from an unlagged steam pipe 50 mm o.d at 415 k to air at 290 k.
Data: e = 0.90
Film coefficient (h_c) for calculation of heat loss by natural convection is given by
$$= 1.18 \left(\frac{\Delta T}{D_o} \right)^{0.25} \text{ w/m}^2 \text{ k} \quad (8)$$

4. (a) What do you mean by evaporation? (2)
(b) Discuss the material and enthalpy balances for single effect evaporator? (6)
(c) Write down the construction and working principle of forced circulation evaporators? (8)



5. (a) Define condensation? (2)
- (b) Write down difference between heat drop wise and film wise condensation? (6)
- (c) Hot oil at a rate of 1.2 kg/s [$c_p = 2083 \text{ j/kg}$] flows through double pipe heat exchanger. It enters at 633 k and leaves at 573 k. The cold fluid enters at 303 k and leaves at 400 k. If the overall heat transfer coefficient is $500 \text{ w/m}^2 \text{ k}$. Calculate the heat transfer area for (i) parallel flow (ii) Counter current flow. (8)
6. (a) What is conduction? (2)
- (b) State the Stefan Boltzmann's law? (6)
- (c) Write down construction and working principle of shell and tube heat exchanger? (8)
7. (a) Define concurrent flow? (2)
- (b) Derive the total emissive power ? (6)
- (c) Write down the construction and working principle of jacketed pan evaporator? (8)



QUESTION BANK ON INSTRUMENTATION AND PROCESS CONTROL
5TH SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY SOVAN KUMAR SAHOO

2 MARKS

1. Define instrument.
2. Define sensitivity of instrument.
3. Define refractive index.
4. What is absorbance of spectrophotometer?
5. What are the different types of glass electrodes used for pH measurement?
6. What is pyrometry?
7. Differentiate between gauge pressure and absolute pressure.
8. What are the disadvantages of float type level indicator?
9. Write down any two advantages of bellows pressure gauge.
10. Define automatic control system.

5 MARKS

1. Describe the working principle and construction of Falling Sphere Viscometer.
2. Write construction and working principle of Bourdon type pressure gauge.
3. Describe the closed loop control system with the block diagram and advantages.
4. Describe the working of an instrument to measure electrical conductivity.
5. Derive the transfer function of first order system.
6. Describe the working of resistant thermometer with neat sketch.

10 MARKS

1. Explain the static characteristics of an instrument.
2. Explain principle of PLC
3. Explain computer added measurements
4. Write the functional elements of instruments with neat diagram.
5. Explain briefly the construction and working principle of spectrophotometer with neat sketch.
6. Describe the construction and working of a thermocouple with advantages and disadvantages.
7. Write the construction and operation of pH meter.





QUESTION BANK ON NST
6TH SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY SATARUPA SAHU

A. 2 MARKS

1. Write down the components of a membrane separation process.
2. What is the importance of membrane separation process?
3. Give two examples of membrane (organic and inorganic).
4. Define membrane.
5. What are the parameters affecting the flux for membrane?
6. Write down the future aspect of membrane separation.
7. Define membrane module and state the types of membrane modules.
8. Write down the types of micro-porous and asymmetric membrane.
9. Write down the differences between micro-porous and asymmetric membrane.
10. Write down the morphology and types of synthetic membranes.
11. Describe the material used and manufacturing method for thin film composite membrane synthesis.
12. Define osmosis with an example.
13. What are the forces required for osmosis process to work?
14. Write down Gibbs free energy equation.
15. Define isotonic solution.
16. Define reverse osmosis.
17. Write down the membrane material and module used for reverse osmosis
18. What is the driving force and transport mechanism for reverse osmosis
19. Why nano-filtration is called as ultra-osmosis?
20. What are the modules used for nano-filtration?
21. Write down the membrane material used for nano-filtration?
22. Write down the membrane materials used for ultra-filtration.
23. Write down the types of fouling in micro-filtration.
24. Write down the membrane materials used for micro-filtration.
25. Define gas Separation?
26. Define pervaporation.
27. Give examples of amorphous and crystalline membrane.
28. What is the necessity of cross-linking?
29. Define swelling degree.
30. Classify ion-exchange membranes.
31. Define Permselectivity.
32. Write down the components used in electro-dialysis process
33. Write down the characteristics of ion-exchange membrane (any two).



B. 5 MARKS

1. Differentiate between equilibrium and rate governed separation.
2. Write down basic principle of membrane separation.
3. What is the active, passive and carrier mediated transport?
4. Classify the membrane process based on driving force.
5. Describe the characteristics of membrane process.
6. Write down the various permeates and retentates for membrane processes.
7. Describe the micro-porous and asymmetric membrane with advantages.
8. Write down the advantages of different membrane modules.
9. Write down the design aspects and advantages of plate and frame membrane module.
10. Write down the design aspects and advantages of tubular membrane module.
11. Write down the design aspects and advantages of spiral wound membrane module.
12. Write down the design aspects and advantages of hollow fibre membrane module.
13. Write down the types of flow patterns involved in membrane process
14. Write down Van't Hoff formula with assumptions.
15. Calculate the osmotic pressure of a solution containing 0.10g mol KCl/1000gH₂O at 25°C.
16. Describe the thermodynamic consideration of osmosis.
17. Describe the physical significance of Gibbs free energy equation in osmosis.
18. Differentiate between high pressure and low pressure reverse osmosis.
19. Describe the advantages and disadvantages of reverse osmosis.
20. Write down the parameters affecting nano-filtration.
21. Write down the advantages of ultra-filtration.
22. Differentiate between ultrafiltration and conventional filtration.
23. Draw the flow diagrams for recycle configuration and tapered configuration.
24. Write down the principle of Micro-filtration.
25. Difference between cross flow and dead-end Micro-filtration
26. Write down the factors affecting fouling in micro-filtration
27. Write down the principle of gas Separation?
28. Write down the type of membranes used in gas-separation.
29. Explain the principle of pervaporation.
30. Write down the type of membranes used in pervaporation
31. Describe the methods of cross-linking.
32. Describe the principle of ion-exchange membranes.
33. Draw the schematic diagram of electro-dialysis process.
34. Write down the chemical equations occurring in ion-exchange membrane.
35. Explain Donnan exclusion principle.
36. Write down manufacturing methods of homogeneous and heterogeneous membrane.
37. Write down the mechanism of membrane distillation.
38. Describe the membrane characteristics of membrane distillation.



C. 10 MARKS

1. Write down the advantages and disadvantages of a membrane separation process.
2. Write down the applications of a membrane separation process.
3. Describe the electrically charged membrane with characteristics and applications.
4. Describe the characteristics of inorganic membrane.
5. Write down the applications, advantages and manufacturing methods of Inorganic membrane.
6. Write down the major application areas of Micro-filtration.
7. Describe the Industrial application of gas Separation.
8. Describe the mass transfer in pervaporation
9. Write down the applications of pervaporation.
10. Write down the applications of ion-exchange membrane
11. Write down the different configuration of membrane distillation
12. Write down the application of membrane distillation
13. Describe the function of membrane in membrane reactor
14. Write down the types of membranes in membrane reactor.
15. Write down the major application areas of reverse osmosis process
16. Describe the Industrial application of Nano-filtration.
17. Write down the type of devices used in ultra-filtration.
18. Describe the factors affecting the performance of ultrafiltration.
19. Write down the major application areas of ultra-filtration process
20. Differentiate between external fouling and internal fouling with diagram.



QUESTION BANK ON ORGANIC CHEMISTRY
4TH SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY RAGHUNATH MARANDI

- 1) a) Define homologous series.
 - b) Give the classification about organic compounds.
 - c) How is methane prepared in the laboratory? Give its important reactions and uses.
- 2) a) Write the IUPAC name of these compounds $\text{CH}_2 = \text{CH} - \text{CH} - (\text{CH}_3)_2$, $\text{Cl}_3 - \text{C} - \text{CH}_2 - \text{CHO}$.
 - b) Explain the term polymerisation with two examples?
 - c) Discuss general methods of preparation of alkenes?
- 3) a) What is Lindlar's catalyst?
 - b) Write a short note on acetylene with its uses.
 - c) Write any five chemical properties of alkyl halides to show their importance.
- 4) a) Give one example each of primary, secondary and tertiary alcohol?
 - b) Discuss two general methods of preparation of ester.
 - c) How is ethanol prepared? Give its important properties.
- 5) a) What do you mean by aromaticity?
 - b) Write the uses of benzene & phenol?
 - c) Explain the method of preparation of benzaldehyde?
- 6) a) Define carbohydrate?
 - b) Write a short note on absolute alcohol, denatured alcohol & power alcohol?
 - c) Discuss the method of preparation of toluene? Mention its uses.
- 7) a) Define isomerism with example.
 - b) Differentiate between chloroform & carbon tetrachloride?
 - c) Give a description about oil & fat?



QUESTION BANK ON PETROCHEMICAL TECHNOLOGY
6TH SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY SATARUPA SAHU

- 1)a) Define petrochemicals? (2)
 - b) Explain about different processes occurring in petroleum refinery industry? (6)
 - c) Describe the vacuum distillation of crude oil ?(8)
- 2)a) What do you mean by petroleum refining?(2)
 - b) Describe the manufacture of iso-propyl alcohol?(6)
 - c) Describe the production of LPG ?(8)
- 3)a) Write the uses of methanol?(2)
 - b) Explain the manufacture of acetic acid ?(6)
 - c) Explain steam cracking of naphtha ?(8)
- 4)a) Define octane & cetane number ?(2)
 - b) Briefly explain recent development in petrochemical industry?(6)
 - c) Explain the BTX separation from crude BTX?(8)
- 5)a) Write some uses of benzene ?(2)
 - b) Briefly explain different types of lubricants?(6)
 - c) Explain the manufacture aniline from phenol ?(8)
- 6)a) What do you mean by reforming?(2)
 - b) Define these terminology i.e. cloud point, pour point, aniline point?(6)
 - c) Explain the manufacture of styrene from ethyl benzene?(8)
- 7)a) Write the fullform of these petroleum industry i.e. ONGC, GAIL?(2)
 - b) Write a short note on C2 splitter?(6)
 - c) Explain manufacture of ethanol from ethylene? (8)



QUESTION BANK ON PHYSICAL CHEMISTRY
3RD SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY RAGHUNATH MARANDI

2 MARKS

1. Define emulsion
2. Define acid-base buffer with example.
3. Explain redox reaction with example
4. Define law of reciprocal proportion.
5. Define osmotic pressure and write down its formula.
6. Differentiate between ideal and non-ideal solutions.
7. Define hybridisation.
8. Write the definition of colloids and crystalloids.
9. What is the relationship between half-life and average life of radioactive material?
10. Define artificial radioactivity.

5 MARKS

1. Explain the concept of freezing point depression.
2. With a suitable example, state and explain the law of conservation of mass with example.
3. Write Ostwald dilution law for strong Electrolyte.
4. Compare alpha, Beta and gamma rays.
5. Write down the concept of gel.
6. State and explain Nernst equation with its mathematical formula.
7. Differentiate between sigma and pi bond

10 MARKS

1. Explain the law of multiple proportion with suitable example.
2. State and explain three laws of osmotic pressure.
3. Explain in details the VSEPR theory.
4. Define Faraday's laws of electrolysis with suitable examples.
5. Explain in details the natural and artificial radioactivity.



QUESTION BANK ON PR&PCT
6TH SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY SATARUPA SAHU

A. 2 MARKS

1. Define Petrochemicals.
2. Differentiate between petroleum and petrochemical.
3. What are the methods used for detection of petroleum?
4. What are the various means for transportation of crude oil?
5. Define desalting of crude.
6. Define stabilisation of crude.
7. Write down the composition of crude oil by weight percentage of elements.
8. Define cracking.
9. What are the types of cracking?
10. What is the necessity of cracking?
11. What is the effect of temperature on cracking?
12. What is the effect of pressure on cracking?
13. Define visbreaking.
14. Write down the dis-advantages of pyrolysis.
15. Define Conrandson Decarbonising Efficiency (CDE).
16. Write down the different methods of coking.
17. Define catalytic cracking.
18. Define catalytic reforming.
19. Write down the names of catalyst used in catalytic reforming (any two).
20. Define Polymerisation.
21. Define Alkylation.
22. Define isomerisation.
23. Define slip- velocity for cracking.
24. Why vacuum is used in three stage crude oil distillation system?
25. Write down the uses of aromatics.
26. Write the uses of olefins.
27. Write down the reactions involved in manufacturing of formaldehyde.
28. Write the operating conditions for high pressure for melamine manufacturing.

B. 5 MARKS

1. Write down the development and growth of petrochemical industry in India.
2. Describe the importance of petrochemical industry.
3. Write the theory/ reaction mechanism of thermal cracking.
4. Define pyrolysis and write a short notes on pyrolysis process.
5. Briefly describe the process of fluid coking with flow-sheet.
6. Briefly describe the process of flex coking with flow-sheet.
7. Write the main advantages of catalytic cracking.
8. Write down the difference between Amorphous catalysts and Zeolites
9. Write down the reforming reactions.
10. Write the types of catalytic reforming.



11. Describe the olefin polymerisation.
12. Write down the products obtained from a refinery, temperature range and uses of petroleum products.
13. Describe single stage crude oil distillation system with flow sheet.
14. Describe two stage crude oil distillation system with flow sheet.
15. Describe three stage crude oil distillation system with flow sheet.
16. Describe the storage of Petrochemical Products.
17. Describe the safety procedure of Petrochemical Products.
18. Classify the aromatics feed stock with examples.

C. 10 MARKS

1. Write down the theories on origin of petroleum.
2. Write down the classification and composition of petroleum.
3. Describe the various ways of transportation of crude oil for refining.
4. Describe the sulphuric acid alkylation process with flow-sheet.
5. Briefly describe the process of thermal cracking with flow-sheet.
6. Briefly describe the process of visbreaking with flow-sheet.
7. Briefly describe the process of delayed coking and decoking with flow-sheet.
8. Write down the Carbonium ion mechanism on catalytic cracking.
9. Write down the Fixed Bed Crackers (Houdry Process) with flow-sheet.
10. Write down the Moving Bed-Air lift- Thermofar catalytic cracking with flow sheet.
11. Write down the Moving Bed- Houdri Flow Process with flow sheet.
12. Describe the catalytic reforming with flow sheet.
13. Describe the isomerisation process with flow-sheet.
14. Describe fluid catalytic cracking with flow-sheet.
15. Describe the overviews of refineries in India.
16. Describe the category of Petrochemical feed stock.
17. Describe the process of Steam reforming of naphtha with flow-sheet.
18. Describe industrial method of cyclohexane manufacturing with flow-sheet.
19. Describe manufacturing of methanol from synthesis gas with flow-sheet.
20. Describe manufacturing of ethanol from synthesis gas with flow-sheet.
21. Describe manufacturing of vinyl monomer (vinyl chloride) with flow-sheet.
22. Describe manufacturing of vinyl monomer (vinyl acetate) with flow-sheet.
23. Describe manufacturing of vinyl monomer (Acrylonitrile) with flow-sheet.
24. Describe manufacturing of Polyester monomer (Terephthalic acid) with flow-sheet.
25. Describe manufacturing of Phthalic Anhydride with flow-sheet.
26. Describe the manufacturing of formaldehyde from synthesis gas with a neat diagram.
27. Describe the manufacturing of acetaldehyde with flow-sheet.
28. Describe the manufacturing of Acetic acid with flow-sheet.
29. Describe the manufacturing of Benzene, Toulene and Xylene with flow-sheet.
30. Describe the manufacturing of Aniline with flow-sheet.
31. Describe the manufacturing of Melamine with flow-sheet



QUESTION BANK ON INDUSTRIAL STOICHIOMETRY
3RD SEMESTER, CHEMICAL ENGINEERING
UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA
PREPARED BY SATARUPA SAHU

A. 2 MARKS

1. Define unit.
2. Classify the physical quantities.
3. Define basis of calculation.
4. Define katom and kmole.
5. Write down the formula for weight fraction and mole fraction.
6. Write down the formula for weight % and mole %.
7. Define principle of atom conservation.
8. Define limiting reagent and excess reagent.
9. Define Ideal gas law.
10. Write down the formula for average molecular weight of a binary system.
11. Write down the formula for density of gas mixture involving average molecular weight.
12. Define Partial pressure and vapour pressure.
13. Define Amagat's law.
14. Define Dalton's law.
15. Define Roul't's law
16. Define Henry's law.
17. State Law of conservation of mass.
18. Write overall material balance based on mixing with block diagram.
19. Write overall material balance based on Evaporation with block diagram.
20. Write overall material balance based on Distillation with block diagram.
21. Write overall material balance based on Drying with block diagram.
22. Write overall material balance based on Extraction with block diagram.
23. Write overall material balance based on Absorption with block diagram.
24. Write down the formula for percentage excess.
25. Write down the formula for conversion.
26. Write down the formula for yield.
27. Write down the formula for selectivity.
28. Define Hess's Law.
29. Define standard heat of reaction.
30. Define recycle and by pass and recycle ratio.

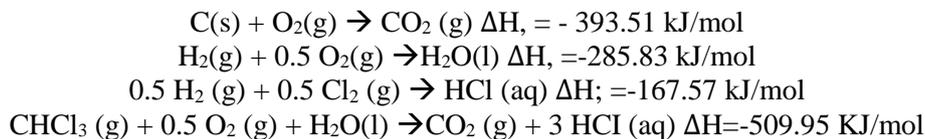
B. 5 MARKS

1. Write down the formula for weight fraction, mole fraction, volume %, weight % and mole % of a binary mixture.
2. Find molecular weight of (i) H_2SO_4 (ii) Na_2CO_3 and (iii) KMnO_4
3. Derive relationship between partial pressure and total pressure of a gas mixture.
4. Derive relationship between pure component volume and total volume of a gas mixture.
5. An aqueous solution of sodium chloride is prepared by dissolving 25 kg of sodium chloride in 100 kg of water. Determine (a) weight % and (b) mole % composition of solution.
6. 15 kg of carbon dioxide is compressed at a temperature of 303 K (30 °C) to a volume of 0.5 m³. Calculate the pressure required for given duty. Assume ideal gas law is applicable.
7. Assuming air to contain 79 % nitrogen and 21% Oxygen, by volume, calculate the density of air at NTP.



8. A solution containing 55% benzene, 28% toluene and 17% xylene by weight is in contact with its vapour at 373 K (100°C). Calculate the total pressure and molar composition of the liquid and vapour.
Data: Vapour pressure data at 373 K (100°C).
Benzene = 178.60 kPa, Toluene = 74.60 kPa, Xylene = 28 kPa
9. A compound having molecular weight 60 is the following composition of the elements: C = 20%, Oxygen, = 26.66%, Nitrogen, = 46.66% and rest hydrogen. Find out the empirical formula of the compound and probable name of the compound.
10. An evaporator is fed with 15000 kg/h of a solution containing 10% NaCl, 15% NaOH and rest water. In the operation, water is evaporated and NaCl is precipitated as crystals. The thick liquor leaving the evaporator contains 45% NaOH, 2% water.
Calculate:
(a) kg/h water evaporated, (b) kg/h salt precipitated, (c) kg/h thick liquor.
11. The dilute acid containing 25% H₂SO₄ is concentrated by commercial grade sulfuric acid containing 98% H₂SO₄ to obtain desired acid containing 65% H₂SO₄. Find the quantities of the acids required to make 1000 kg of desired acid.
12. 2000 kg of wet solids containing 70% solids by weight are fed to a tray dryer where it is dried by hot air. The product finally obtained is found to contain 1% Moisture by weight, calculate
(a) the kg of water removed from wet solids,
(b) the kg of product obtained.
13. In manufacture of acetic acid by oxidation of acetaldehyde, 100 kmol of acetaldehyde is fed to a reactor per hour. The product leaving the reactor contains 14.81% acetaldehyde, 59.26% acetic acid, and rest oxygen (on mole basis). Find the percentage of conversion of acetaldehyde.
14. In manufacture of sulphur trioxide, feed to a reactor consists of 50 kmol sulphur dioxide and 150 kmol air. Calculate the % excess air is used.
15. A stream of carbon dioxide flowing at a rate of 100 kmol/min is heated from 298 K (25°C) to 383 K (110°C). Calculate the heat that must be transferred using C_p.
Data: C_p = 21.3655 + 64.2841 * 10⁻³ T - 41.0506 * 10⁻⁶ T² + 9.7999 * 10⁻⁹ T³, kJ/(kmol-K)
16. Calculate the standard heat of formation of chloroform gas from its elements using Hess's law.

Data :



C. 10 MARKS

- Write down the overall material balance, component balance equations with block diagram for mixing, evaporation, distillation, drying, extraction, absorption.
- Find the limiting agent in the manufacturing of ammonia from nitrogen and hydrogen for the following cases.
 - Feed: N₂ = 60 kmol, H₂ = 180 kmol
 - Feed: N₂ = 60 kmol, H₂ = 200 kmol
 - Feed: N₂ = 60 kmol, H₂ = 150 kmol
 - Product: NH₃ = 20 kmol, N₂ = 10 kmol, H₂ = 20 kmol

