ARYA COLLEGE OF ENGINEERING (ACE)

DEPARTMENT OF HUMANITIES & APPLIED SCIENCES

1FY2-03: ENGINEERING CHEMISTRY

GUESS PAPER (Session: 2025-26)

Unit 1: Water and water treatment

Short Answers: (2 Marks Each)

Q. 1 What do you understand by Break point chlorination?
Q. 2 Explain calgon and phosphate conditioning?
Q. 3 What principle is applied to remove the hardness of water by lime soda process.
Q. 4 Why do we express hardness of water in terms of calcium carbonate equivalent?
Q. 5 Give any two methods of disinfection methods .
Q. 6 write a note on sludge and scale formation in boilers.
Q.7 How silica can be removed from water .
Q.8.What is carbonate and non carbonate hardness of water ?
Q .9. Define degree of hardness and various units of hardness.

Descriptive Answers: (5 to 20 Marks)

Q. 1 Explain Zeolite process of water softening in detail.
Q. 2 Define hardness ?Discuss hardness determination by EDTAmethod.
Q. 3 Explain water purification methods in detail.
Q. 4 Discuss demineralization / ion exchange process in detail.
Q. 5 Calculate the quantity of hydrate lime and soda required to soften **10,0000** litres of water containing following salts **– HCl=7.3 mg/l ,$Al_2(SO_4)_3$=34.2 mg/l, $MgCl_2$=9.5 mg/l, NaCl=29.25 mg/l**
purity of lime is 90% and that of soda is 98%. 10% of chemicals are to be used in excess in order to complete the reaction quickly.
Q. 6 A sample of water on analysis has been found to contain following impurities
$Mg(HCO_3)_2$= 73**mg**/L,$MgCl_2$ = 95**mg**/L
$Ca(HCO_3)_2$= **1**62**mg**/L
$CaSO_4$ = 136**mg**/L,NaCl = 29mg/L
Calculate the temporary and permanent hardness of given water sample.
Q.7. 0.5 gm of calcium carbonate was dissolved in HCl and the solution was made upto 500 ml.with distilled water. 50 ml of this water sample required 48 ml of EDTA solution .50 ml of sample hard water required 15 ml of EDTA.50 ml of boiled water sample when titrated required 10 ml of EDTA. Calculate the temporary ,permanent and total hardness of the given water sample.
Q.8. An exhausted Zeolite softner was regenerated by 300 litre of Nacl solution containing 55 gm/l of Nacl solution .How many litres of hard water of hardness 220 mg/l can be softened by Zeolite softner?
Q9. Explain continous cold & hot lime soda process with sutaible diagram.

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Unit 2:Fuels and Fuels Analysis

Short Answers: (2 Marks Each)

Q. 1 Explain HCV and LCV of fuel. The gross calorific value of a coal sample is 9650 k cal/kg .Calculate the net calorific value if coal contains 6% hydrogen .
Q. 2 What is power alcohol and sweetening of petrol?
Q. 3 Give the composition and uses of coal gas and oil gas.
Q. 4 Arrange n-octane,iso octane napthalean in increasing knocking order also explain Knocking phenomenon in a petrol engine.
Q. 5 Name the catalyst used in Fischer –Tropsch process.
Q. 6 Define octane and cetane number of fuel , antiknocking agents.
Q.7.What is synthetic petrol? Name any two methods used to convert coal to gasoline.
Q8. What is meant by combustion of fuels? Mention also combustible and non combustible constituents of fuels.

Descriptive Answers: (5 to 20 Marks)

Q. 1 Describe the method to determine the calorific value of solid fuels by Bomb calorimeterand compare the properties of solid fuels with liquid fuels.
Q. 2 Explain moving bed catalytic cracking .
Q. 3 What is carbonization of coal ? Discuss ottohofman by product coke oven process in detail.
Q. 4 What is proximate analysis of coal? Asample of coal was found to have the following % composition by weight –C=70%, H=6%, O=14%,**rest is ash**.Calculate gross and net calorific value of coal sample by using dulong's formula.
Q. 5 (a) Discuss ultimate analysis of coal sample . A fuel is found to contain – C =80%, H=5%,N_2=15%. Calculate the weight of air required for combustion of 1 kg of fuel. Also calculate the dry product by volume**.**

Q. 6 Describe manufacturing of synthetic petrol by Fischer Tropsch process.
Q7. Write a short note on refining of petroleum with labeled diagram of different fractions.
Q 8.**Explain the determination of calorific value of a fuel using a Junker's calorimeter.**
A sample of coal was found to contain C=92% ,H=5% and ash =3% .When this coal was tested in Bomb calorimeter to find it's calorific value gave the following data-
Weight of coal burnt=0.95 gm
Weight of water taken =700 gram
Water equivalent of bomb calorimeter =2.0gm
Rise in temperature= 2.48^0 c
Cooling correction-.02^0 C
Fuse wire correction=10 cal
Acid correction=60 cal.

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Calculate the net and gross calorific value of the coal in cal/gm. Assume the latent heat of condensation of steam as 580 cal/gm.

Q 9. Define Knocking ? Explain the phenomenon of knocking in a petrol Engine.

Q.10.During the determination of calorific value of a gaseous fuel by junker's calorimeter, the following results were recorded. Calculate HCV & LCV of fuel.
Volume of gaseous fuel burnt at NTP =0.098 m^3
Volume of water used for cooling the combustion products =50 kg

Weight of steam condensed =.051 kg ,Temperature of outlet water = 46.5 ^oC

Temperature of inlet water = 26.1^oC

Unit 3:Corrosion

Short Answers: (2 Marks Each)

Q. 1 How galvanization protect iron from corrosion and give importance of Tinning?
Q. 2 Why does corrosion occur in steelpipe connected to Cu plumbing.
Q. 3 State Pilling Bedworth rule with example.
Q. 4 Define corrosion ? discuss **it's** consequences. Why anodic coatings are better than cathodic coatings for corrosion control?
Q. 5 Explain pitting corrosion .
Q. 6 Under identical conditions why does impure metal corrode faster than pure metal also give chemical formula of rust.
Q.7. What do you understand by Galvanic series ?How it differs from Electrochemical series?

Descriptive Answers: (5 to 20 Marks)

Q. 1 Discuss electrochemical /wet corrosion by oxygen absorption and hydrogen evolution mechanism in detail.
Q. 2 Discuss various methods protection from corrosion.
Q. 3 Explain concentration cell and galvanic corrosion with suitable example **.**
Q. 4 Discuss the mechanism of dry/chemical corrosion..

Unit 4: Cement ,Glass ,Lubricants

Short Answers: (2 Marks Each)

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Q. 1 What are clinkers and glassy state of matter?
Q. 2 Give the lime saturation factor in cement .What is the flash set of cement ? name the compound responsible for it.
Q. 3 Define cloud and pour point and steam emulsion number .
Q. 4 What is annealing of glass? Write significance of annealing of glass.
Q. 5 What is role of Gypsum in cement manufacturing.
Q. 6 Define lubricants?Give the classification with examples.

Descriptive Answers: (5 to 20 Marks)

Q. 1 What is portland cement ? discuss the manufacturing of cement by rotary kiln technology.
Q. 2 Name the additives mixed with lubricant used for extreme pressure lubrication in detail.
Q. 3 Write a short note on following types of glass – 1.Borosilicate glass 2. Safety glass 3.Lead /flint glass 4. Optical glass
Q. 4 Discuss**(A)** thick and thin film lubrication (B) Flash and fire point (C) Viscosity and Viscosity index
Q. 5 Explain manufacturing of ordinary glass by tank furnace.
Q. 6 Discuss setting and hardening of cement with suitable chemical reactions.
Q.7. How viscosity of oil is determined by Redwood viscometer no 1.

Unit 5:Organic reaction mechanism and drugs synthesis

Short Answers: (2 Marks Each)

Q. 1 What is electrophile and nucleophile ?
Q. 2 Why do substitution reactions occur in benzene ?
Q. 3 State markovnikoff's rule with example.
Q. 4 Discuss Saytzeff's rule.
Q. 5 What is peroxide /kharash effect.
Q. 6 In SN1 reaction,racemization occurs if the reaction occurs at a stereogenic centre, However 50:50 mixture of enantiomers rarely obtained ,why?

Descriptive Answers: (5 to 20 Marks)

Q. 1 Explain the mechanism of Nucleoplilic substitution reaction in t butyl bromide with stereochemistry of the product.
Q. 2 Discuss electroplilic aromatic substitution reaction in benzene and free radical halogenations reactions .
Q. 3 What type of addition reactions occurs in carbonyl compounds and why ?Explain addition reaction with suitable examples..
Q. 4 Explain following rearrangements- A. Pinacol-Pincolone rearrangement B.Beckmann rearrangement.
C. Hoffmann rearrangement
Q. 5 Discuss properties, synthesis and uses of Paracetamol and Aspirin .
Q. 6 Explain dehydrohalogenations in alkyl halides.