

PART– A (15 marks, 30 minutes) Close Book

ID #:

Name

Q1) Fill in the blanks (0.5 x 8= 4 marks)

- a) IR spectroscopy shows the absence or presence of key _____ groups.
- b) For qualitative analysis, % transmittance vs. _____ is plotted in IR spectrum.
- c) To absorb IR light molecule must have a vibration during which change in _____ w.r.t distance is non-zero.
- d) Single atomic entities like Argon, Helium have _____ IR spectrum.
- e) Chemical bond's _____ and reduced mass determines the peak position in IR spectrum of any compound.
- f) The colour of SPADNS reagent gets bleached by _____ ions in water.
- g) The Winkler's method is a technique used to measure _____ in freshwater systems.
- h) Priming is the carryover of droplets of _____ in steam which lowers the energy efficiency of steam.

Q2) Choose the correct option (put Tick mark) (0.5 x 6= 3 marks)

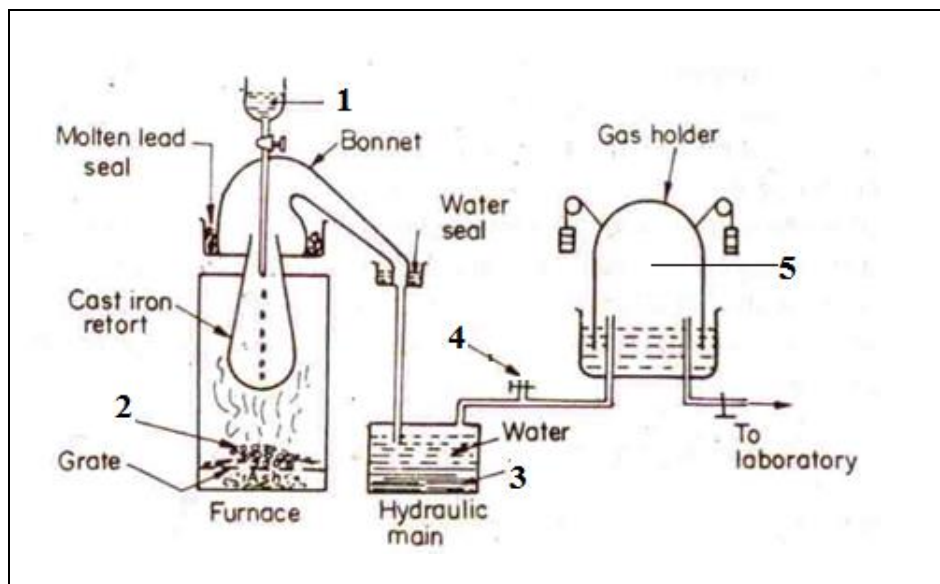
- (i) An oxime is formed when an aldehyde/ketone reacts with
(a) hydroxylamine (b) phenylhydrazine (c) hydrazine (d) semicarbazide
- (ii) The Beckmann rearrangement involves an _____ migration.
(a) alkyl (b) hydroxyl (c) hydrogen (d) amine
- (iii) Aldol condensation is characteristic reaction of aldehydes and ketones which contain _____ atom.
(a) alpha carbon (b) beta carbon (c) alpha hydrogen (d) beta hydrogen
- (iv) Base catalyzed aldol reaction occurs with
(a) formaldehyde (b) acetaldehyde (c) trimethyl acetaldehyde (d) benzaldehyde
- (v) Friedel–Crafts alkylation involves the alkylation of an aromatic ring with an alkyl halide using a strong _____ catalyst.
(a) Nickel (b) platinum (c) Ziegler-Natta (d) Lewis acid
- (vi) In _____ reaction, the reaction is stereospecific with respect to both diene and dienophile.
(a) Friedel–Crafts (b) Pinacol-pinacolone (c) Ziegler-Natta (d) Diel's–Alder

Q3) Match the following (choose correct option from last column and fill up in the blank column) (1 x 4 =4 marks)

a)	Mandelic acid- used to reduce wrinkles		Hofmann rearrangement
b)	Nylon 6- used in clothing industry		Internal cannizzaro reaction
c)	Dibenzalacetone- used as sunscreen in cosmetic industry		Crossed Aldol
d)	Anthranilic acid used in preparing perfumes to imitate jasmine.		Beckmann rearrangement

Q4 (a) See the figure below and name the missing labels 1 to 5.

(2+2=4 marks)



1	
2	Coal
3	
4	
5	

(b) Fill in the blanks with respect to figure above

(i)The picture above shows the laboratory preparation of_____.

(ii) The proper cracking of the oil is estimated from the _____.

(iii)The above gas is used to improve the _____of watergas and the mixture of the two gases is called_____.

Name:

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Q1) Fill in the blanks (1 x 12 =12 marks)

- (a) _____ act as biochemical catalysts and accelerate the chemical conversion but remain unmodified themselves.
- (b) According to the Le Chatlier's principle, a lower temperature should be used to shift the _____ towards the right, increasing the percentage yield.
- (c) A catalyst does not affect the _____ of equilibrium in a reversible reaction.
- (d) When corn starch dissolved in water, it behaves like a dilatant material due to _____.
- (e) _____ is the process or technique employed to reduce friction between and wear of one or both, surfaces in proximity and moving relative to each other by interposing a substance called _____.
- (f) Persulphate ions (peroxodisulphate ions) $S_2O_8^{2-}$ are very powerful _____ agents.
- (g) _____ is a time-dependent shear thinning property, example blood, paint..
- (h) NLGI stands for _____.
- (i) A grease consists of an _____ that is mixed with a _____ thickener to form a semisolid. Greases are highly structured fluids.
- (j) _____ is the internal resistance of the flow. It decreases with increase in temperature.

Q2) Tick the correct option (1 x 3 = marks)

(i) A non-Newtonian behavior of fluids whose viscosity decreases under shear strain.

- (A) Viscoplasticity (B) Viscoelasticity
- (C) Shear Thinning (D) All of the above

(ii) Even 1 mg of platinum powder is enough to catalyse the combination of 2.5 litres of a mixture of H_2 and O_2 to form

- (A) Methane (B) Formaldehyde
- (B) Water (D) Formic acid

(iii) Granular MnO_2 employed to catalyze the decomposition of

- (A) $KClO_4$ (B) $NaClO_3$
- (C) $NaClO_4$ (D) $KClO_3$

PART – C (25 marks, 1 hr) Open Book (Answer in supplementary answer sheet)

Q1) Analysis of given coal shows that it has the following composition by weight: C = 92%, O = 3%, S = 0.5%, N = 0.3%. It was found that the net calorific value (or lower calorific value LCV) of the coal sample was 8495 kcal/kg. Determine the higher calorific value (HCV in kcal/kg) of the coal sample. **(6marks)**

[Hint : Calculate percentage of hydrogen (% H) in the coal sample, and use it to find HCV. Please report % H and HCV]

Q2) Given the force constant for H-Br bond is 411.8 kg/s^2 , determine the wavenumber in cm^{-1} at which a strong line in IR spectrum of HBr will be observed. The speed of light c is $2.9979 \times 10^{10} \text{ cm s}^{-1}$. **(6 marks)**

Given: H = 1.007 amu, Br = 79.904 amu and $1 \text{ amu} = 1.66 \times 10^{-27} \text{ kg}$

[Hint: Write equation, show stepwise calculation and report wavenumber in cm^{-1}]

Q3(a) Calculate the molecular weight of polystyrene, if the degree of polymerization is 1000.

[Hint: start by writing the mer structure]

(3+3=6 marks)

(b) A sample of polystyrene is prepared by mixing three mono-dispersed samples in the following proportions:

- 1g 10,000 molecular weight
- 2g 50,000 molecular weight
- 2g 100,000 molecular weight

Using this information calculate the weight average molecular weight $\bar{M}_w$

[Hint : Please construct necessary table, write formula and show step wise calculation]

Q4) What is the hardness of sample of water (in ppm) having following salts **(7 marks)**

$\text{CaCl}_2 = 11.1 \text{ mg/l}$ $\text{Mg}(\text{HCO}_3)_2 = 7.3 \text{ mg/l}$ $\text{MgSO}_4 = 14.1 \text{ mg/l}$ $\text{Ca}(\text{HCO}_3)_2 = 8.1 \text{ mg/l}$

(a) calculate temporary hardness in ppm

(b) permanent hardness in ppm.

(c) Total hardness in ppm

All quantities are as such. (Given Atomic wt: Ca=40, Mg = 24, H=1, Na=23, C=12, O = 16, Cl =35.5, S= 32)

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Part D (Jegatha mam's portion write in main answer booklet)

Q 3) The potential of an electrode cannot be accurately, directly measured. It is not feasible to connect a measuring device to the solution of electrode, as it may lead to another equilibrium along with the existing one. What is the type of electrode used for such application? Is there any specific criteria for this type of electrode? Elaborate the same with suitable examples and diagrams.

((5+ 3) = 8 marks)

Q 4(a) The following is a table of measurement for a fluid at constant temperature. Determine the dynamic viscosity of the fluid.

du/dy (rads ⁻¹)	0.0	0.2	0.4	0.6	0.8
τ (Nm ⁻²)	0.0	0.9	1.7	2.9	3.7

(b) What are the characteristics of lubricants (Answer in 2 lines).

((4+3) = 7 marks)

Q 5) Batch test was performed in the laboratory using solutions of phenol in water and particles of granular activated carbon. The equilibrium data at room temperature is shown below.

C kg phenol/m ³ soln	0.322	0.117	0.039	0.0061	0.0011
q kg phenol/ kg carbon	0.150	0.122	0.094	0.059	0.045

a) Construct table and draw necessary graph (label axis) and then justify (in one line) that the data fits Freundlich isotherm. [start by writing an equation that represents the Freundlich adsorption isotherm]

b) Find slope, intercept and thereby report the constants.

c) Write equation that best fits the above data.

(4+ 4 + 2 = 10 marks)