RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2014

FIRST YEAR

Date : 23/05/2014   **INDUSTRIAL CHEMISTRY (Honours)**

Time : 11 am – 2 pm   Paper : II   Full Marks : 75
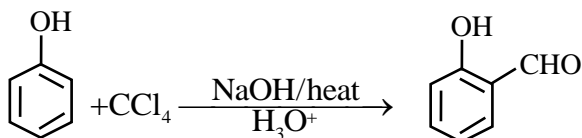
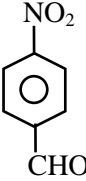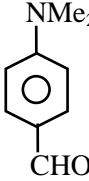## (Use a separate Answer Book for each group)

Group – A
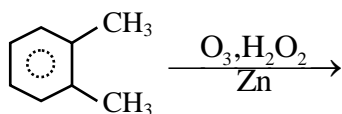
Unit – I

*(Answer **any three** questions)*

1. a) Sketch the mechanistic steps of the following reaction. [3]

    b) Why and do not take part in benzoin condensation reaction? Explain. [2]

2. a) Substitution and addition reactions of anthracene occur preferentially at the 9 and 10 positions. Explain. [2]

    b) Predict the possible products for the following reaction (with suitable mechanism) : [3]


3. Propose the structures for compounds A, B, C & D. Give the mechanism of formation of [A] in the following reaction. [5]
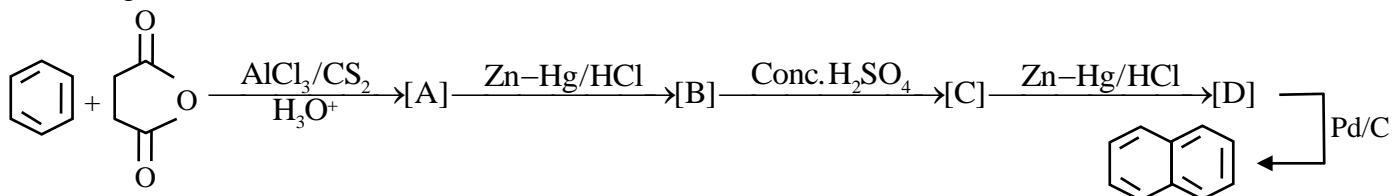

4. a) 2,4,6–trimethylbenzoic acid does not undergo esterification under ordinary acid catalysis condition; whereas in concentrated sulphuric acid it undergoes quantitative esterification. Explain. [2]

    b) How would you carry out the following conversion ? Give mechanism. [3]

$$CH_3CH_2CHO \rightarrow CH_3CH_2 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3$$
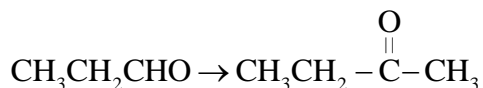
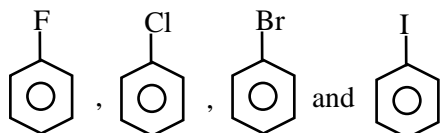5. a) Discuss the addition of HBr to 2-methylpropene in presence of dibenzoyl peroxide. Predict the product with proper mechanism. [2]

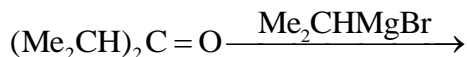   b) Carry out the following conversion and give plausible mechanism involved. [3]

$$PhCHO \rightarrow Ph_2\overset{\overset{\displaystyle OH}{|}}{C}H - CO_2H$$
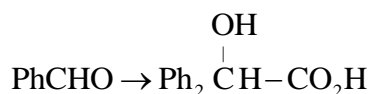
6. a) What is the order of electrophilic substitution reaction rate for the following compounds and explain. [2]

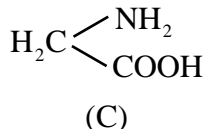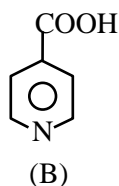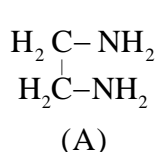b) Predict the product(s) with plausible mechanism of the following reaction. [3]

$$(Me_2CH)_2C=O \xrightarrow{Me_2CHMgBr}$$

Unit – II
(*Answer **any two** questions*)

7. a) What do you mean by primary and secondary valencies in coordination complex? Give examples. [3]

   b) A solution of potassium ferricyanide cannot oxidise iodide to iodine but it can do so in presence of Zn^{2+} ion. Explain. Given, $E^o_{Fe(CN)_6^{3-}/Fe(CN)_6^{4-}} = 0.36v$, $E^o_{\frac{1}{2}I_2/I^-} = 0.54v$. [2]

8. a) What do you mean by inner metallic complex of first order?
   Which of the following ligands A, B, C will be able to form inner metallic complex of first order with a M^{2+} ion. Justify. [1+1½]

   $$H_2C-NH_2$$
   $$H_2C-NH_2$$
   (A)

   (B) [structure: pyridine ring with COOH and O]

   $$H_2C\begin{cases}NH_2\\COOH\end{cases}$$
   (C)

   b) Discuss the role of Zimmermann-Reinhardt solution during the titration of Fe^{2+} ion with $KMnO_4$ in presence of dilute HCl. [2½]

9. a) Name the following compounds according to IUPAC system [1+1]
   i) $Na[Co(acac)_3]$
   ii) $[Co(en)_2Cl_2]Cl$

   b) Brass can be electrodeposited from a solution containing $ZnSO_4$, $CuSO_4$ and KCN; but not in the absence of KCN. Explain. [3]

10. a) Give one example for each of the following isomerism. [½×4]
    i)   ionization isomerism
    ii) Hydrate isomerism
    iii) Ligand isomerism
    iv) Coordination isomerism

    b) Explain the phenomena of masking and demasking using suitable examples. [3]

Unit – III
(*Answer **any three** questions*)

11. a) For the reaction, $2NO+Cl_2=2NOCl$ it was found that on doubling the concentration of both the reactants, the rate increases eightfold. But on doubling the concentration of chlorine alone, rate only doubles. What is the overall order? [3]

    b) How would you evaluate the activation energy for a reaction using Arrhenius equation? [2]

12. a) Calculate the energy of one photon of light of wavelength 2500Å. Will it be able to dissociate a bond in diatomic molecule which absorbs this photon having bond energy equal to 95 kcal per mole. [2]

    b) The quantum yield for the decomposition of HI is 2 but after sometime it comes down from 2. Explain with proper mechanism. [3]

13. a) Why water droplets spread over a glass plate and mercury droplets become spherical? [2]

    b) Show that the half lifetime for an 'n' th order reaction. $t_{\frac{1}{2}} \propto \frac{1}{a^{n-1}}$, 'a' being the initial concentration of the reactant. [2]

    c) Give an example for pseudo first order reaction. [1]

14. a) Explain the abnormally high conductance of H^+ and OH^- ions. [2]

b) Explain Kohlrausch's law and find out the λ^o_{eq} of a weak electrolyte CH_3CO_2H using it. [1+2]

15. a) Derive Michaelis-Menten equation for an enzyme catalysis reaction. [3]

b) State Hardy-Schulze rule for colloids. [1]

c) Define gold number for a colloid. [1]

16. a) Explain what do you mean by standard electrode potential? [1]

b) Starting from Van't Hoff reaction isotherm deduce Nernst's equation for a red-ox reaction given as $X + ne \rightleftharpoons x^{n-}$. [2]

c) Given that E^o values for Na^+/Na and Cu^+/Cu are $-2.60V$ and $+0.52V$ respectively. Explain whether the following reaction would be spontaneous or not : $Na^+ + Cu \rightarrow Na + Cu^+$ [The concentration of Na^+ and Cu^+ both being 0.01 gm.eq.lit^{-1}] [2]

Unit – IV
(*Answer **any one** question*)

17. a) Write a short account on thin layer chromatography. [2]

b) Two singlets of equal intensity are observed at 2.0δ and 3.6δ for the compound $C_3H_6O_2$. Predict the structure. [2]

c) What do you mean by retardation factor (R_f). [1]

18. a) Aromatic protons are more deshielded than ethylenic protons, although both the types of protons are attached to sp^2 hybridised carbon atoms. Explain. [2]

b) Write a short note on paper chromatography. [2]

c) What are used instead of non volatile metal compounds in cone of GLC. [1]

Group - B

5. Answer **any three** questions : [3×5]

a) Use Thevenin's theorem to determine the current through and the voltage across $25\,\Omega$ resistor in the following figure.
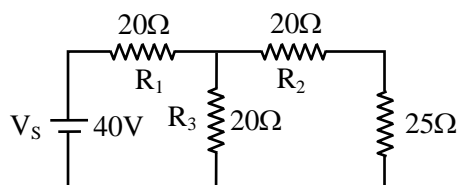
b) An eight pole d.c shunt generator with 778 wave connected armature conductors and running at 500 rpm supplies a load of $12.5\,\Omega$ resistance at a terminal voltage of 250V. The armature resistance is $0.24\,\Omega$ and the field resistance is $250\,\Omega$. Find the armature current, the induced e.m.f and the flux per pole.

c) i) What is critical resistance for a shunt d.c. generator.

ii) Explain with the help of graphs and diagrams, the external characteristics of a d.c. shunt generator. [2+3]

d) With a neat sketch explain the working of a three point starter of a d.c. shunt motor.

e) A 220V d.c series motor is running at a speed of 800 rpm and draws 100A. Calculate at what speed the motor will run when developing half the torque. The total resistance of the armature and field is $0.1\,\Omega$. Assume that the magnetic circuit is unsaturated.

f) An alternating current of frequency 60Hz has a maximum value of 120A. Write down the equation for its instantaneous value. Counting time from the instant the current is zero and is becoming positive find—

i) the instantaneous value after $\dfrac{1}{720}$ seconds and

ii) the time taken to reach 96A for the first time.

g) Calculate the equivalent resistance in the following circuit across A – B.
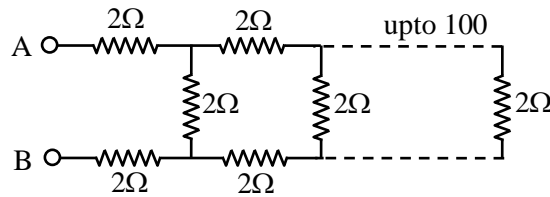
Group - C

6. Answer **any three** questions : [3×5]

a) i) With neat sketches explain the differences, advantage and disadvantages of—
'U' tube manometers, well type manometers and inclined tube manometer

   ii) Name two types of pressure sensing elements. [4+1]

b) i) Name two types of detectors commonly used for total radiation pyrometers.

   ii) Make a comparative study of the different properties of these two detectors. [1+4]

c) i) What is cold junction compensation for a thermocouple.

   ii) Explain how it is achieved. [4+1]

d) Name three classes of flow measuring devices. Explain the working principle of Magnetic Flow Meter. [1+4]

e) i) With a neat sketch explain how conductivity is measured in a liquid.

   ii) What are the applications of conductivity measurement? [3+2]

f) With a neat sketch explain the working of a gas chromatograph.

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