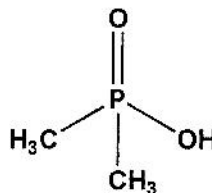
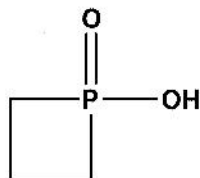


Answer any five questions

- 1.(a) For a first-order reaction like reactant A giving rise to product P derive the rate expression with k as the first-order rate constant (assume 'a' as the initial concentration of A). What will be the concentration of A after ten half-lives? 6 + 4
- (b) The rate constant of a first-order reaction is 2.0 s^{-1} . What is the half-life of the reaction? 5
- (c) What is Acid Rain? What are the major harmful effects of it? 5
- 2.(a) Reaction of Ce^{4+} with Fe^{2+} in acidic media is fast whereas reaction of Ce^{4+} with Tl^+ is slow. Explain. 7
- (b) For a pure second-order reaction how rate constant and half-life is related? Derive the necessary relation. 8
- (c) Which compound is called 'Inorganic Benzene'? Why? 5

3 a) Arrange the following with increasing order of acidity/basicity and give explanation in support of your answer [4x4=16]

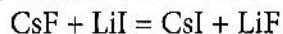
- i) 2° amine and 3° amine
- ii) H_3PO_3 and H_3PO_4
- iii) Ammonia and phosphine
- iv) HClO_3 and HClO_4
- v)



b) Write a short note on the theory of conjugate acids and bases [4]

4.a) What do you mean leveling and differentiating solvent? Give examples.

b) Predict the direction of the reaction and give explanation in support of your answer.



c) How can you determine pH of very dilute solution of a strong acid? Calculate pH of $1 \times 10^{-7} \text{ M}$ HCl.

d) Derive the expression of pH when a salt of strong acid and weak base is hydrolyzed.

e) Calculate pH of 10 mL of 0.05 (M) NaOH solution when (i) 10 mL of 0.05 (M) acetic acid and (ii) 10 mL of 0.05 (M) hydrochloric acid is added separately.

Given: K_a of acetic acid is 1.75×10^{-5} .

[4x5]

[Turn over

- 5 (a) Find out the energies of bonding, nonbonding and antibonding MOs in cyclic H_3^+ system. [9]
- (b) Draw the MO energy level diagram for HF [6]
- (c) Two atomic orbitals, χ_A and χ_B , undergo out of phase overlap to form the bonding and antibonding MOs. Find out the normalization constants and hence calculate the energy of both the normalized MOs. [5]
- 6 (a) Draw molecular orbital energy level diagram of dioxygen and hence comment on its magnetism. [5]
- (b) He_2 does not exist. Comment. [5]
- (c) Using Walsh Diagram for linear and bent H_3 systems. [5]
- (d) Comment on the structure and shape of the following molecule. Draw the structure. Write the hybridization of the central atom (any two). XeF_4 , SCl_4 , BrF_3 [5]