B1901

FINAL SCHEME FOR VALUATION

Scheme/ Answer Key for Valuation
Scheme of evaluation (marks in brackets) and answers of problems/key

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CY100
Course Name: ENGINEERING CHEMISTRY

PART A
Answer all questions, each carries 2 marks.   Marks

1   Those molecules which have change in dipole moment with vibrations are IR   (2)

    active. CO and CO_2 are IR active

2   An iron nail is dipped in 1 M HCl, what are the redox reactions taking place?   (2)

    Justify it based on the following standard reduction potentials $2H^+ + 2e \rightarrow H_2$ E^0

    $= 0$ V ; $Fe^{3+} + 3e \rightarrow Fe$ $E^0 = -0.04$ V; $Fe^{2+} + 2e \rightarrow Fe$ $E^0 = -0.44$V

    Ans :The specious having high reduction potential (0 V) get reduced

    $2H^+ + 2e \rightarrow H_2$ (H_2 liberation 1 mark)

    The specious having low reduction potential (-0.44)get oxidised

    $Fe \rightarrow Fe^{2+} + 2e$ (Fe^{2+} formation 1 mark)

    or   A Reaction is more spontaneous when its free energy is more. Reaction

    having high E_{cell} is more spontaneous . $E_{cell} = 0 - (-0.44) = 0.44$ V is more

    spotanius than $E_{cell} = 0 - (-0.04) = 0.04$V. Thus liberation of H_2 coupled with

    oxidation of Fe to Fe^{2+} takes place rather than Fe^{3+} formation.

3   Draw the thermo gram of Calcium oxalate.   (2)

    Ans: TGA graph (2)

4   What are Copolymers?   (2)

    Ans; Def(1) eg(1)

5   What are the advantages of liquid fuels over solid and gaseous fuels?   (2)

    Ans can be used in IC engines , easy transportation ,etc

6   What are semi solid lubricants? Definition (1) preparation (1)   (2)

7   Dissolved oxygen of a water sample is inversely proportional to its temperature. Justify.   (2)

When a gas molecule dissolves in a liquid the molecular speed decreases hence entropy decreases ΔS –ve . Thus from relation $\Delta G=\Delta H-T\Delta S$. When T increases –Ve value of Free energy decreases thus dissolution decreases.

or marks can be given to explanation given below

As the temperature increases, the kinetic energy of molecules increases. This leads to escape of oxygen molecules from water, thus decreasing solubility.

8   In the determination of hardness of water by EDTA method NH_4OH-NH_4Cl buffer solution is used. Why?   (2)

Ans: The indicator EBT can form complex only at pH around 10.

PART B
Answer all questions, each carries 3 marks.

9   A 100 ppm standard solution of Fe^{3+} after developing colour with excess ammonium thiocyanate solution shows a transmittance of 0.4 at 622 nm, while an unknown solution of Fe^{3+} after developing colour with excess ammonium thiocyanate solution shows a transmittance of 0.6 at same wave length. Calculate the concentration of $Fe3^{+}$ in unknown solution.   (3)

Ans $100/x = \log(0.4)/\log(0.6)$; x = 55.7 ppm

10   Calculate single electrode potential of calomel electrode at 25 ^{o}C when the concentration of KCl solution is 0.1M, given that E^0 standard calomel electrode = 0.2810 V.   (3)

E= 0.2810 – 0.0591 log (0.1) = 0.3401 V

11   Differentiate TGA and DTA.   (3)

3 differences

12   How do you classify Nanomaterials based on dimensions?   (3)

Ans:0D ,ID,2D,3D with examples

13   Explain what are solid lubricants(2) with suitable examples?(1)   (3)

14   Explain the preparation of Bio-diesel.(2) What are the important constituents of   (3)
      Bio-diesel?(1)

15   Plot a diagram of break point chlorination(2) and What is its significance?(1)   (3)

16   Calculate the carbonate and non carbonate hardness of a sample water   (3)
      containing 7.3 mg/L of $Mg(HCO_3)_2$, 40.5 mg/L of $Ca(HCO_3)_2$, 13.6 mg/L of
      $CaSO_4$.

      P hardness = 13.6x 100/136=10 ppm

      T Hardness = 7.3 x100/146 +40.5x100/162 = 30 ppm

PART C
Answer all questions, each carries10 marks.

17 a) What are the various types of electronic transitions in UV-visible spectroscopy?   (5)

        4 types sigma to sigma* , pi to pi* , n to pi* , n to sigma* 3marks + 2 examples

    b) Discuss the applications of IR spectroscopy.   (5)

        5 application 5 marks

OR

18 a) What are the different types of NMR active nuclei? How many spin   (5)
        orientations are possible in a magnetic field when I=1/2 and I=1 give examples.

        I not equal to zero are NMR active examples (3)

        2I+1 orientations when I=1/2 ; 2 x ½ +1 = 2 orientations +1/2, -1/2

        When I =1 2x 1+1 =3 orientations   +1 , 0 , -1

        2 marks .

        Full marks may be given to those who written up to 3 orientations.

    b) Explain the terms shielding and de-shielding in NMR spectroscopy.   (5)

        Shielding 3 marks+ De shielding 2

19 a) What are fuel cells? Explain the construction and working of $H_2 – O_2$ fuel cell.   (6)

        Ans: Definition (2) construction (2) Equations (2)

    b) What are the advantages and disadvantages of a fuel cell?   (4)

        Ans: Advantages (2) High efficiency , No pollution

        Disadvantages (2) High purity reactants , High cost, large size gas cylinders are
        required

OR

20 a) What are reference electrodes? Give examples for primary reference and secondary reference electrodes and give their electrode reactions. (6)

Ans: Def (1)

Primary reference electrode –SHE (3)

Secondary reference Calomel electrode and   Ag/AgCl/Cl-   anyone with equation (2)

b) Explain how single electrode potential of Zn electrode is determined? (4)

Ans: Procedure (2)

Equations or diagram (2)

21 a) Write down the principle(2) and instrumentation of DTA with a neat diagram.(3) (5)

b)   Draw the DTA of calcium oxalate(3) and explain the different reactions.(2). (5)

OR

22 a) Explain the principle(3) and classification of chromatography(2) (5)

b) Stationary phase (1) mobile phase (1) steps (2) applications (1) (5)

23 a) Discuss the working of OLED with diagram. Give its two important advantages over conventional display devices. (5)

Ans:

Working of OLED,(2) Diagram of OLED device,(2) Give two important advantages over conventional display devices.(1)

b) How do you synthesise polyaniline(3), Give two properties and applications.(2) (5)

OR

24 a) What are conducting polymers?(2) Give the classification.(3) (5)

b) How will you dope a conducting polymer? (2)   Give the mechanism of conduction in doped polymer.(3) (5)

25 Write the working of Bomb calorimeter for the determination of calorific value of a solid fuel with the help of a neat diagram (10)

Diagram (2) working (4) Calculations (3) corrections (1)

OR

26 a) fractional distillation of crude petroleum -not mentioned in syllabus marks may be given for attempt (2) and name the various products obtained.(3) (5)

b) What are the major characteristics required for a good lubricating oil? (5)

Any 5 characteristics

27 a) Explain the working(3) of trickling filter process with a neat labelled sketch. (3) (6)

b) How is exhausted resins regenerated in an ion-exchange method? (4)
Cation regeneration (2) anion (2)

OR

28 a) Explain reverse osmosis(3) with a labelled figure(1) and Mention its advantages and disadvantages. (2) (6)

b) Discuss the ion-exchange process of softening of water. (4)
Cation(2) anion (2)

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