# Model question paper- CMF 2206 - 2012/ 2013
Part A

1). What is the highest oxidation state that is shown by 3d transition elements?
   1. +2   2. +3   3. +5   4. +6   5. +7

2). What is the structural formula of Ammonium aquapentafluoroferrate(III)
   1. $(NH_4) [Fe(H_2O)F_5]$ 2. $(NH_4)_2 [Fe(H_2O)F]$ 3. $(NH_4) [Fe(H_2O)F]$
   4. $[Fe (NH_3)(H_2O)F_5]$ 5. $(NH_4)_2 [Fe(H_2O)F_5]$

3) Which of the following statement is/ are **incorrect** about carbon and their oxides.

   a. C is only metal in group 14.   b. Elemental C exists only in 2 forms diamond and graphite.
   c. CO and CO_2 are two stable oxides of carbon.   d. CO_2 is a trigonal planer molecule.

   1. a, b and d only   2. a and c only   3. c and d only   4. a,c and d only.   5. C only

4.) What is the catalyst used in lead chamber process for the production of sulphuric acid?
   1. V_2O_5 2. Ni   3. SO_2 4. NO   5. Conc H_2SO_4

5). What is the **incorrect** statement regarding noble gases?

   1. They are found in very small quantities in air. . 2.They are chemically not very active.
   3. The boiling point is decreases as go down the group   4. All are monoatomic gases
   5. In liquid phase, they have weak ven der walls forces between atoms.

6.) What are the oxidation states of Sulphur in following complexes respectively?
   $$SO_3, \quad NaHSO_3, \quad H_2SO_3, \quad SO_3^{2-}$$
   1. +6, +4, +6, +4   2. +3, +4, +4, +6   3. +6, +4, +4, +4   4. +6, +4, +2. +4   5. +6, +2, +4, +4

7.) Which of the following statement is **incorrect** about transition metals.

   1. They are malleable and ductile.   2. They have low boiling point and low melting points.
   3. They show variable oxidation states.   4. Their ions contain partially filled d electron levels.
   5. They form coloured compounds.

8). Which statement is **correct** about the structure of H_3PO_2, H_3PO_3 and H_3PO_4
   1. H_3PO_2 molecule has one P-H bond   2. H_3PO_2 molecule has three P-H bonds
   3. H_3PO_4 molecule has one P-H bond   4. H_3PO_4 molecule has three O-H bonds
   5. H_3PO_3 molecule has three O-H bonds.

9). What is the **correct order** of bond dissociation energies of halegons?

   1. D(Cl-Cl) > D (Br- Br) > D(F-F) ≈ D(I-I)   2. D(Cl-Cl) > D (Br- Br) > D(F-F) > D(I-I)
   3. D(F-F) > D (Cl- Cl) > D(Br-Br) > D(I-I)   4. D(F-F) > D (Cl- Cl) > D(Br-Br) ≈ D(I-I)
   5. D(Cl-Cl) ≈ D (Br- Br) > D(I-I) > D(F-F)

10) Predict the   major product(s) of the following reaction.
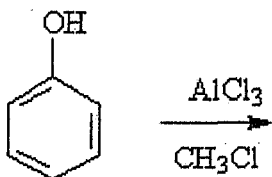
   1. *m*-chlorophenol   2. *o*-chlorophenol and *p*-chlorophenol   3. *m*-hydroxytoluene

4. *o*-hydroxytoluene and *p*-hydroxytoluene 5. p – chlorophenol

11). Arrange the following amines in the **increasing order** of their basicity.

CH_3NH_2, $(CH_3)_3N$, NH_3, $(CH_3)_2NH$, $C_6H_5NH_2$

1. $(CH_3)_3N < (CH_3)_2NH < CH_3NH_2 < NH_3 < C_6H_5NH_2$
2. $C_6H_5NH_2 < NH_3 < CH_3NH_2 < (CH_3)_2NH < (CH_3)_3N$
3. $C_6H_5NH_2 < (CH_3)_3N < (CH_3)_2NH < CH_3NH_2 < NH_3$
4. $(CH_3)_3N < C_6H_5NH_2 < (CH_3)_2NH < CH_3NH_2 < NH_3$
5. $C_6H_5NH_2 < (CH_3)_2NH < CH_3NH_2 < NH_3 < (CH_3)_3N$

12). Arrange the following carboxylic acid derivatives in the **decreasing order** of their reactivity towards nucleophilic substitution. Acid anhydride, Amide, Carboxylic acid , Acid chloride, ester

1. Acid chloride > Carboxylic acid > Ester> Acid anhydride > Amide
2. Carboxylic acid > Ester> Acid chloride > Acid anhydride > Amide
3. Ester> Acid chloride > Acid anhydride > Carboxylic acid > Amide
4. Acid chloride > Acid anhydride > Ester>Carboxylic acid > Amide
5. Acid anhydride > Acid chloride > Carboxylic acid > Amide> Ester

13. A gaseous mixture was prepared by taking equal moles of CO and N_2. If the total pressure of the mixture is 1 atm, the partial pressure of the N_2 in the mixture will be,

1. 1 atm　　　　2. 0.5 atm　　　　3. 0.8 atm　　　　4. 1.5 atm　　　　5. 0.25 atm

14. A sample of an ideal gas is held at consonant temperature. If the pressure is decreased by ½ , the volume will be,

1. Increased by 2　　　　　　2. Decreased by ½　　　　　　3. Unchanged.
4. Unable to determine without more information.　　　　　　5, Increased by 4.

15. Suppose that the temperature of an ideal gas is increased from 300K to 1200K. Which statement is true about its kinetic energy?

1. Does not change.　　　　　2. Increases by a factor of two
2. Increases by a factor of four　　　　3. Increases by a factor of eight
5 Increases by a factor of sixteen
6

16. The reacton A + B ⟶ P is found to be second order in (A) and first order in (B). The rate equation would be,
　　1. $R = k (A)(B)$　　　2. $R = k (A)^2(B)$　　　3. $R = k (A)(B)^2$　　4. $R= k (B)$　　　5. $R = k (A)^2$

17. Which of the following is **not** a strong electrolyte in aqueous solution?
　　1. $CuSO_4$　　　　2. H_2SO_4　　　　3. $Ba(OH)_2$　　　　4. NH_3　　　　5. NaCl

18. If some hot water is taken in a thermos flask whose mouth is closed, such a system is known as, A thermos flask containing hot water is known as,
　　1. Open system　　　　　　2. Isolated system　　　　　　3. Closed system
　　4. Endothermic system　　　　5. Exothermic system

19.　$M^{2+}(aq) + 2e \longrightarrow M(s)$　　$E^0 = -0.76 V$
　　$X_2 (s) + 2e \longrightarrow 2X^- (aq)$　　$E^0 = +1.07 V$

Which is the **correct** statement about above electrochemical cell half reactions

1. M is the cathode   2. X_2 is the anode   3.M has negative charge
4. The emf of the cell is – 0.31 V   5. The emf of the cell is – 0.31 V

20) Which spectroscopic method can be used to get the information about presence of conjugated π System

    1. IR   2. Mass   3. UV-Vis   4. ^{H}Nmr   5. ^{13C}Nmr

21) A 2 dm^3 of acid solution is prepared by adding 1 dm^3 of 0.2 mol dm^{-3} H_2SO_4 and 1 dm^3 of 0.2 moldm^{-3} HCl. If all acids are completely dissociated, H^+ ion concentration of this solution in moldm^{-3} is

    1. 0.1   2. 0.15   3. 0.2   4. 0.3   5. 0.4

22) Which statement is **incorrect** about indicators used in titration?

    1. $KMnO_4$ can act as a self indicator. 2. Ferroin is a well known acid base indicator
    3 Most redox indicators are sensitive to the sudden electrode potential change at the equivalence point.
    4. Acid base indicators are sensitive to the sudden pH change at equivalence point.
    5. Starch is used as an indicator in iodometric titration.

23) Which of the following is a disaccharide?

    1. Glucose   2. Lactose   3. Ribose   4. Deoxyribose   5. Glyceraldehyde

24) Correct IUPAC name of the fatty acid $CH_3(CH_2)_7$ $CH=CH(CH_2)_7COOH$ is,

    1. Cis-9-octadecaenoic acid   2. Cis-8-heptadecaenoic acid   3. trans-9-octadecaenoic acid
    4. Trans-9- heptadecaenoic acid   5. Non of the above

25) Which of the following statement(s) is/ are about Bakelite is **correct**?

    a. It is a synthetic thermosetting polymer   b. It is a addition polymer prepared by phenol and HCHO.
    c. It has greater strength and weight.   d. It is a synthetic thermoplastic polymer

    1. a only   2. b only   3.c only   4. d only   5. b and c only

Part B

1). (a) (i) Give the IUPAC names of following complexes.

    1. [As $(C_6H_5)_4$] Br   2. [Pt Br_2 $(NH_3)_4$] $(NO_3)_2$]

(ii) Determine the oxidation and coordination number of each of the metal centres of following complexes.

    1. [$FeBr_2$ $(CO)_4$]   2. [$CrBrCl(NO_2)(NH_3)_3$]

(b) (i)Consider some properties of group 17 elements given below.

	F	Cl	Br	I
Boiling point	-188	-34	58	183
Electro negativity	4.0	3.0	2.8	2.5
Atomic size / pm	64	99	111	128

    1. What is the trend of boiling point and electro negativity when you go down the group 17?
    2. Explain the reason for your answer.

(ii) 1. Briefly explain the reason(s) for the increasing solubility of hydroxides in group 2 elements when you go down the group.

(c) i. Predict the Product (s) of following reactions.
  1. $Ti\ (s)\ +\ H_2O\ (g) \longrightarrow$
  2. $Cr\ (s)\ +\ O_2(g) \longrightarrow$
  3. $MnCl_2(s)\ +\ HCl\ (aq) \longrightarrow$
  4. $ZnO + NaOH + H_2O \longrightarrow$
  5. $SiO_2\ (s)\ +\ C\ (s)$
  6. $LiH\ (S)\ +\ B_2H_6\ (g) \longrightarrow$
  ii. Write a brief account on industrial production of NaCl by sea water.

(d) i. What are the two crystalline allotropes of sulphur?
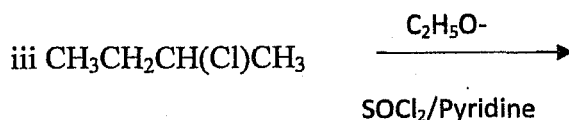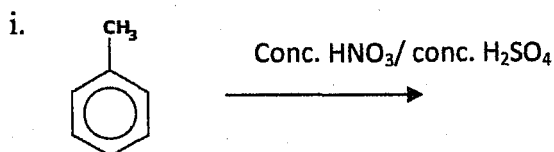 ii. Write balanced equations to show the reaction of S with HNO_3 , H_2SO_4 and NaOH
  iii. How you can prepare H_2S gas in the laboratory?
  iv. Give one example reaction to show that
      - H_2S as reducing agent
      - H_2S as oxidising agent

2) (a) Predict the major product (s) of following reactions.

i.

Conc. HNO_3/ conc. H_2SO_4 $\longrightarrow$

ii. $CH_3Cl + KOH \longrightarrow$

iii $CH_3CH_2CH(Cl)CH_3$

$\xrightarrow{C_2H_5O-}$

$\xrightarrow{SOCl_2/Pyridine}$

iv $CH_3OH \longrightarrow$

v

$\xrightarrow[\text{heat}]{\text{Conc } H_2SO_4}$
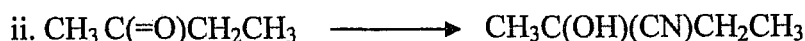
(b) Explain the following statements with relevant structures.
i. NH_2 group in aniline is act as a strong ortho, para directing group."
ii. "Amides have the highest boiling point among all carbonyl compounds."

(c) Write down the suitable chemical/ reagent/ reaction conditions for the following reactions.
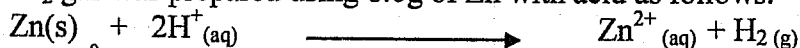
i.

$\longrightarrow$

ii. $CH_3 C(=O)CH_2CH_3 \longrightarrow CH_3C(OH)(CN)CH_2CH_3$

4

iii. $C_6H_5NH_2$ + HCl $\longrightarrow$ $C_6H_5N_2^+Cl^-$.

iv. ⬡ + $CH_3C(=O)Cl$ $\longrightarrow$ $C_6H_5C(=O)CH_3$ + HCl

v. $CH_3CH(Br)CH_3$ $\longrightarrow$ $H_2C=CHCH_3$ + NaBr + C_2H_5OH

(d) Write the radical reaction mechanism for the following reaction including all the steps.

$$CH_4 + Cl_2 \xrightarrow{\text{Heat or light}} CCl_4 + HCl$$
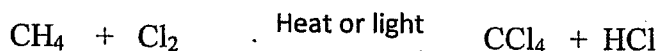
3) (a) i. State Dolton's Law of partial pressure

ii. H_2 gas was prepared using 8.0g of Zn with acid as follows.

$$Zn(s) + 2H^+_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + H_{2\,(g)}$$

At 22 ^{0}C, the H_2 gas was collected over water and the total pressure of collected gas was750 mm Hg. At 22°C, P_{H_2O} = 20 mm Hg

1. Calculate the partial pressure of Hydrogen?
2. Calculate the volume of H_2 gas collected over water?

(b) i. Write down the four postulates of kinetic molecular theory?

ii. What is the root mean square velocity of an oxygen molecule at 300K (Molecular weight of O_2 is 32.00 g mol^{-1} and R = 8.31 J $mol^{-1}K^{-1}$)

(c). (i) State the Avogadro's Law

(ii) At a particular temperature and pressure, the volume of 11.0g of CO_2 is 8.00 L. What is the volume of 12.0g of CH_4 at the same temperature and pressure?

(d) How does the rate of a reaction increase with temperature? Explain using Maxwell-Boltzmann distribution curve.

**4)** (a) i. State the Hess's law.

ii. A 4. 0 g sample of glass was heated from 274 K to 314 K. It was found to have absorbed 32 J of energy as heat.

1. Calculate the specific heat of the glass.
2. How much energy will the same glass sample gain when it is heated from 314 K to 344 K.

(b) i. Draw an energy diagram for a reaction where ΔH = - 40 kJ. The activation energy of the uncatalyzed reaction is + 120 kJ and the activation energy for a catalyzed reaction is + 80 kJ. Indicate the position of the activated complex for both catalyzed and uncatalyzed reaction.

ii. Write down the basic reactions involved when iron is converted to rust

iii. Consider the following elementary reaction.

$$2NO + 2H_2 \longrightarrow N_2 + 2H_2O$$
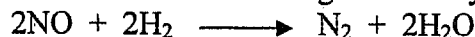
1. what is the rate expression for the above reaction.
2. What is the overall order of the reaction
3. Explain the reason for your answer.

(c) (i) Consider the electrochemical cell given below that had been used to light a bulb in a chemistry laboratory which consist a copper electrode and a zinc electrode. The copper rod was found to be the positive terminal.
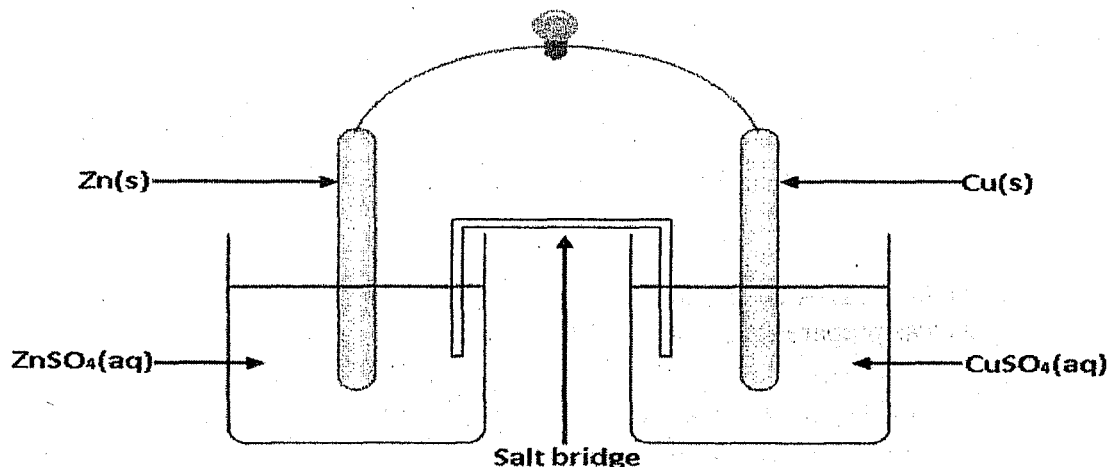
Salt bridge

1. Simply explain the term "copper electrode".
2. Why do we use a salt bridge in this set up? Explain your answer.
3. Explain the direction of electron flow.
4. Write down the two half cell reactions and the cell reaction.

(ii) Consider the electrochemical cell containing standard aluminium and tin electrodes at 298 K. The standard electrode potential values of each electrode are given below.

$$E^0_{Al^{3+}|Al} = -1.66 \text{ V} \qquad E^0_{Sn^{2+}|Sn} = -0.14 \text{ V}$$

1. What is meant by the standard electrode potential of an aluminium electrode?
2. What is the anode?
3. What is the cathode?
4. Write down the half cell reactions and the cell reaction.
5. Calculate the emf value at 298 K.

(d) Compare the electrical conductivity of following saturated salt solutions.
 PbS, $CaCl_2$, $AlCl_3$, $NaCl$ Explain your answer.

5). (a) Consider the titration of 25.0 cm^3 of 0.1 mol dm^{-3} NaOH with 0.2 mol dm^{-3} HCl.
   i. What is the expected end point?

Measurement	Student A/ cm^3	Student B/ cm^3	Student C/ cm^3
1	12.50	12.30	12.30
2	12.50	12.40	12.35
3	12.45	12.50	12.45

Using relevant calculations,
   ii. Explain which student got the most accurate results?
   iii. Explain which student got the least precise results?

(b)(i) A 100. 0 cm^3 of water sample containing $Mg(HCO_3)_2$, $NaCl$ and $BaCl_2$ was titrated with 0.04 mol dm^{-3} HCl in the presence of methyl orange and required HCl volume was 16.00 cm^3. Calculate the Mg^{2+} concentration in water sample.

(ii) In aqueous solution of H_2SO_4 acid H_3O^+ concentration is 3×10^{-4} mol dm^{-3} .
   1. Calculate OH$^-$ concentration in this solution
   2. Calculate pH of the solution   3. Calculate the pOH of the solution

(c) (i)Using following chemical reaction construct an experiment that can be used to determine the effect of temperature on the rate of a chemical reaction. You have to indicate the apparatus, chemicals and major steps that you want to follow.
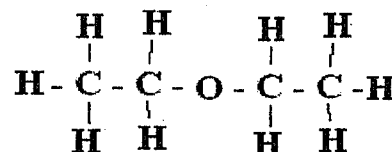
$$MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$$
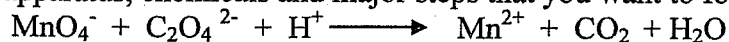
(ii) Predict the number of signals and their mulplicities of Hnmr spectra of following compounds.

1.

2.

(d) A 2.00 g of limestone sample was dissolved in HCl acid and all the Ca present in the sample was converted to Ca^{2+}(aq). Excess $(NH_4)_2C_2O_4$(aq) was added to the solution to precipitate Ca^{2+} ions as CaC_2O_4(s) and its weight was 2.60 g. (Ca =40 , O= 16, C= 12 g mol $^{-1}$)

i. Write the balanced chemical equation for the precipitation reaction

ii. Determine the mass percentage by mass of Ca in the lime stone sample.

6) (a) For each of the following polymers, indicate the type of polymer and draw the monomer(s):

i)

ii)

iii)

$$- O - C - CH_2 - CH_2 -O - C - CH_2 - CH_2 - O - C - CH_2 - CH_2 - O -$$
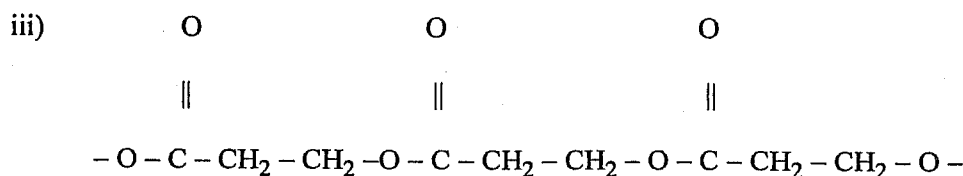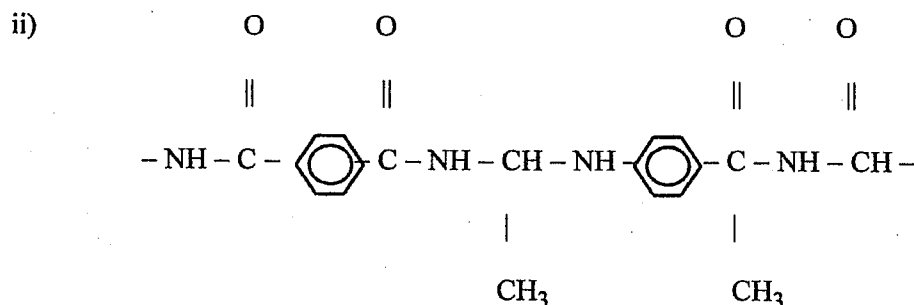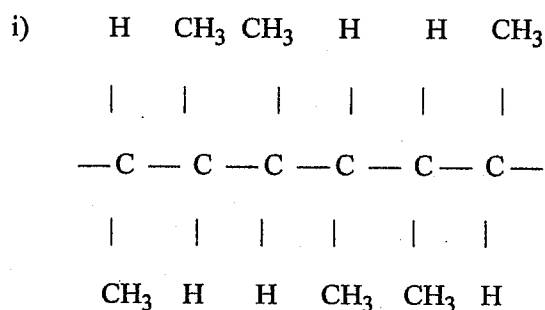
(b) Give the chemical formulae of the following fatty acids.
i. Oleic acid(18:1)9   ii Palmitoleic acid(16:1)9   iii (18:3)□3,6,9   iv (14:0)

(c) i. What is meant by food preservation ?

ii. Write four common food preservatives used in modern food industry.

iii. What is the range of E numbers given for food preservatives?

iv. Aginomoto is the well known flavor enhancer in food industry
1. What is the chemical name of Ajinomoto?
2. What are the disadvantages of using ajinomoto.

(d) i. Name 3 cancer causing agents present in cigarette smoke.

ii. How nitroglycerine can act as an effective medicine?