

Roll No: _____

Subject Code-043

Please check that this question paper contains 33 questions and 10 printed pages.

DAV INSTITUTIONS, CHHATTISGARH

Sample Paper: 2023-24

CLASS XII

Chemistry (043)

TIME: 03 HOURS

M.M.: 70

General Instructions:

1. The question paper comprises five sections A, B, C, D and E. There are 33 questions in this question paper. All questions are compulsory.
2. Section-A - consists of 16 multiple choice questions carrying 1 mark each
3. Section-B - consists of 5 very short answer questions carrying 2 marks each.
4. Section-C - consists of 7 short answer type questions, carrying 3 marks each
5. Section-D - consists of 2 case based questions carrying 4 marks each.
6. Section E consists of 3 long answer questions carrying 5 marks each.
7. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
8. Use of log tables and calculators are not allowed

SECTION -A

The following questions are multiple choice questions with one correct answer. There is no internal choice in this section and each question carries 1 mark

1. X reacts with NaNO_2 and HCl at 0°C to form Y, which on reaction with CuCN gives Z. Z on reduction gives benzyl amine. X, Y, Z respectively are
 - a) $\text{C}_6\text{H}_5\text{NH}_2, \text{C}_6\text{H}_5\text{N}_2\text{Cl}, \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$
 - b) $\text{C}_6\text{H}_5\text{NH}_2, \text{C}_6\text{H}_5\text{N}_2\text{Cl}, \text{C}_6\text{H}_6$
 - c) $\text{C}_6\text{H}_5\text{NH}_2, \text{C}_6\text{H}_5\text{N}_2\text{Cl}, \text{C}_6\text{H}_5\text{CN}$
 - d) $\text{C}_6\text{H}_5\text{NH}_2, \text{C}_6\text{H}_5\text{N}_2\text{Cl}, \text{C}_6\text{H}_5\text{OH}$
2. The expected mechanism for the reaction: $\text{CH}_3\text{Br} + \text{OH}^- \rightarrow \text{CH}_3\text{OH} + \text{Br}^-$
 - a) SN^1 mechanism
 - b) SN^2 mechanism
 - c) SE^1 mechanism
 - d) SE^2 mechanism

3. Compound A on reduction gives B. compound B on reaction with nitrous acid gives ethanol. The compound A is

- a) propane nitrile b) ethane nitrile c) nitromethane d) methyl isocyanate

4. Which of the following is a maximum boiling azeotrope

- a) acetic acid—pyridine b) water—ethanol c) cyclohexane—ethanol
d) water—methanol

5. Which of the following statements is not correct

- a) copper liberates hydrogen from acids
b) in its higher oxidation state, Mn forms stable compounds with oxygen and fluorine
c) Mn^{+3} and Co^{+3} are oxidizing agents in aqueous solution
d) Ti^{+2} and Cr^{+2} are reducing agents in aqueous solution

6. which will have highest conductance

- a) Ag at 30°C b) Ag at 60°C c) Cu at 30°C d) Cu at 60°C

7. A liquid is mixed with ethanol and few drops of conc. Sulphuric acid is added. Then a compound with fruity smell is formed. The liquid is

- a) HCHO b) CH_3CHO c) CH_3COOH d) CH_3COCH_3

8. The number of ions formed on dissolving one molecule of $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$

- a) 3 b) 4 c) 5 d) 6

9. Addition of HBr to pent-2-ene gives

- a) 2-Bromopentane only
b) 3-Bromopentane only
c) 2-Bromopentane and 3-Bromopentane
d) 1-bromopentane and 3-bromopentane

10. The linkage present in nucleic acid is

- a) glycosidic b) peptide c) phosphodiester d) all of the above

11. Which of the following metals of 3d series have lowest melting point

- a) Fe b) Mn c) Zn d) Cu

12. The CFSE of $[CoCl_6]^{3-}$ is 18000cm^{-1} . the CFSE for $[CoCl_4]^-$ will be

- a) 18000cm^{-1} b) 8000cm^{-1} c) 2000cm^{-1} d) 16000cm^{-1}

13. Given below are two statements labelled as assertion(A) and reason(R)

A: Haloalkanes when treated with alcoholic KCN forms alkanenitrile as the major product

R: potassium cyanide is a covalent compound

- a) Both A and R are true And R is the correct explanation of A
- b) Both A and R are true but R is not the correct explanation of A
- c) A is true but R is false
- d) A is false but R is true

14. Given below are two statements labelled as assertion(A) and reason(R)

A: aniline does not undergo Friedel craft reaction

R: Friedelcraft reaction is an electrophilic substitution reaction

- a) Both A and R are true And R is the correct explanation of A
- b) Both A and R are true but R is not the correct explanation of A
- c) A is true but R is false
- d) A is false but R is true

15. Given below are two statements labelled as assertion(A) and reason(R)

A: Electrolytic conduction of electrolyte depends on size of ions

R: larger the size of ions lesser will be the mobility of ions

- a) Both A and R are true And R is the correct explanation of A
- b) Both A and R are true but R is not the correct explanation of A
- c) A is true but R is false
- d) A is false but R is true

16. Given below are two statements labelled as assertion(A) and reason(R)

A: In bimolecular reaction if one of the reactant is in excess, it is called Pseudo first order reaction

R: rate of reaction does not depend on reactant in excess

- a) Both A and R are true And R is the correct explanation of A
- b) Both A and R are true but R is not the correct explanation of A
- c) A is true but R is false
- d) A is false but R is true

SECTION- B

(This section contains 5 questions with internal choice in one questions. The following questions are very short answer type and carry 2 marks each)

17. $\text{CoSO}_4 \cdot 5\text{H}_2\text{O}$ exists in two isomeric forms. Isomer A reacts with AgNO_3 to give white precipitate, but does not react with BaCl_2 . Isomer B gives white precipitate with BaCl_2 but does not react with AgNO_3 .

a) Identify A and B write their structural formula

b) Give their IUPAC name

18) Using E^0 values of A and B, predict which is better for coating the surface of iron

($E^0_{\text{Fe}^{2+}/\text{Fe}} = -0.44\text{V}$) to prevent corrosion and why $E^0_{\text{A}^{2+}/\text{A}} = -2.37\text{V}$ $E^0_{\text{B}^{2+}/\text{B}} = -0.14\text{V}$

19) Arrange the following compounds in increasing order of their property indicated

a) CH_3CHO , $\text{C}_6\text{H}_5\text{CHO}$, HCHO (reactivity towards nucleophilic addition)

b) 2,4-dinitrobenzoic acid, 4-methoxy benzoic acid, 4-nitrobenzoic acid (acidic character)

OR

Give simple chemical test to distinguish between the following pairs of compounds

a) phenol and benzoic acid

b) ethanal and propanone

20. When RNA is hydrolysed, there is no relationship among the quantities of different bases obtained. What does this fact suggest about the structure of RNA

b) Amino acids behave like salt rather than simple amines or carboxylic acids. Explain.

21. $\text{A} + 2\text{B} \rightarrow 3\text{C} + 2\text{D}$. the rate of disappearance of B is $1 \times 10^{-2} \text{mol L}^{-1} \text{s}^{-1}$

a) What will be rate of reaction?

b) Rate of change in concentration of A and C

SECTION C

(This section contains 7 questions with internal choice in ONE question .the following questions are short answer type and carry 3 marks each.)

22. An aqueous solution containing 1.248 g of BaCl_2 (molar mass = 208.34 g/mol) in 100 g of water boils at 100.0832°C . Calculate the degree of dissociation of BaCl_2 . ($K_b = 0.52 \text{K Kg/mol}$)

OR

Calculate the boiling point of 1 molar aqueous solution (density = 1.04 g/ml) of potassium chloride. ($K_b = 0.52 \text{K Kg/mol}$; atomic masses K = 39, Cl = 35.5)

23. How are the following conversions carried out

- a) benzylalcohol to benzoic acid
- b) propanone to 2-methyl propan -2-ol
- c) propene to propan-1-ol

24. Give reasons :

- a) Racemic mixture is optically inactive
- b) Neopentyl chloride does not follow SN^2 mechanism
- c) Although chlorine is an electron withdrawing group, yet it is ortho-para directing in electrophilic substitution following

25. a) give the electronic configuration of the following complexes on the basis of crystal field splitting energy $[CoF_6]^{-3}$, $[Fe(CN)_6]^{-4}$

- b) Out of NH_3 and CO which is a strong ligand and why
- c) Why do coordination complexes having similar geometry have different magnetic moments

26. a) ethereal solution of an organic compound A when heated with magnesium gave B. B on treatment with ethanal followed by acid hydrolysis gave propan-2-ol. Identify the compound A and B . Write the reactions

b)Phenol does not give protonation reaction readily

27. Arrange the following compounds in the increasing order of property indicated against it

- a) $C_6H_5NH_2, (C_2H_5)_2NH, C_2H_5NH_2$ (increasing order of solubility)
- b) $NH_3, CH_3NH_2, (CH_3)_2NH, (CH_3)_3N$ (increasing order of basic strength in aqueous solution)
- c) aniline, p-nitroaniline, p-toluidine (increasing order of pK_b value)

28. Give reason

- a) Elevation of boiling point of 1M KCl solution is double than that of 1M sugar solution
- b) Aquatic species are more comfortable in cold water than in warm water
- c) Doctors advice to gargle with saline water in case of sore throat

SECTION- D

(The following questions are case based questions. Each question has an internal choice and 4(1+1+2) marks each. Read the passage carefully and answer the questions that follow)

29. The rate of a reaction, which may also be called its velocity or speed of a reaction, can be defined to the concentration of any one of the reacting substance or to that of any product of the reaction. If the species chosen is a reactant which has a concentration c at time t the rate is dx/dt . Any concentration unit may be used for expressing the rate; thus if mols per litre are employed for concentration and seconds for the time, the unit for the rate are $\text{mollitre}^{-1}\text{sec}^{-1}$. For gas reaction pressure units are sometimes used in place of concentration so that legitimate units for the rate would be $(\text{mmHg}) \text{sec}^{-1}$ and atmsec^{-1}

The order of a reaction concerns the dependence of the rate upon the concentration of reacting substance; thus if the rate is found experimentally to be proportional to the α^{th} power of the concentration of one of the reactant A, to the β^{th} power of the concentration of a second reactant B and so forth, via

$$\text{Rate} = k C_A^\alpha C_B^\beta \quad \dots(1)$$

The overall order of the reaction is simply

$$n = \alpha + \beta + \dots(2)$$

Such a reaction is said to be of α^{th} order with respect to the substance A, β^{th} order with respect to B and so on...

(Laidler, K.J. & Glasstone. S(1948) rate order and molecularity in chemical kinetics, journal of chemical education)

Answer the following question

- a) Do you think the rate of a reaction remains same throughout the reaction and why
- b) For a reaction: $\text{NO}_2 + \text{CO} \rightarrow \text{CO}_2 + \text{NO}$, the rate law expression is :rate = $k[\text{NO}_2]^2$. How many molecules are involved in the slowest step
- c) Assuming that energy of activation for most of the reaction is 52 kJ, what conclusion would you draw about the effect of temperature on the rate of a reaction

OR

75% of a first order reaction was completed in 32 minutes. When was 50% of the reaction completed.

30. Read the following passage and answer the questions that follow

EVIDENCE FOR THE FIBROUS NATURE OF DNA The basic chemical formula of DNA is now well established. As shown in figure it consists of a very long chain, the backbone of which is made up of alternate sugar and phosphate groups, joined together in regular 3' 5' phosphate di-ester linkages. To each sugar is attached a nitrogenous base, only four different kinds of which are commonly found in DNA. Two of these--adenine and guanine- are purines, and the other two thymine and cytosine-are pyrimidines. A fifth base, 5-methyl cytosine, occurs in smaller amounts in certain organisms, and a sixth, 5-hydroxy-methyl- cytosine, is found instead of cytosine in the T even phages. It should be noted that the chain is unbranched, a consequence of the regular internucleotide linkage. On the other hand the sequence of the different nucleotides is, as far as can be ascertained, completely irregular. Thus, DNA has some features which are regular, and some which are irregular. A similar conception of the DNA molecule as a long thin fiber is obtained from physicochemical analysis involving sedimentation, diffusion, light scattering, and viscosity measurements. These techniques indicate that DNA is a very asymmetrical structure approximately 20 Å wide and many thousands of angstroms long. Estimates of its molecular weight currently center between 5×10^6 and 10^7 (approximately 3×10^6 nucleotides). Surprisingly each of these measurements tend to suggest that the DNA is relatively rigid, a puzzling finding in view of the large number of single bonds (5 per nucleotide) in the phosphate-sugar back bone. Recently these indirect inferences have been confirmed by electron microscopy.

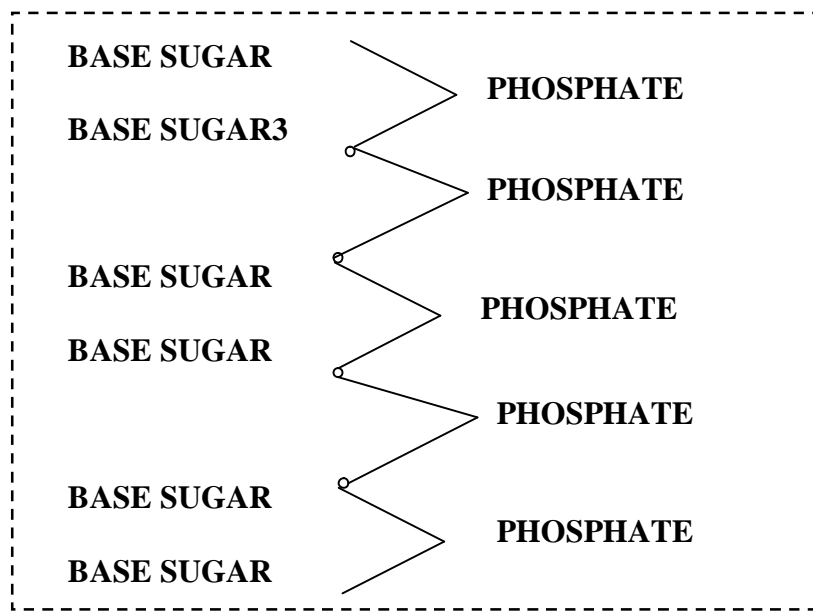


Fig. Chemical formula (diagrammatic) of a single chain of deoxyribonucleic acid.)

(source: Watson, J. D., & Crick, FH. (1953, January). The structure of DNA. In Cold Spring Harbor symposia on quantitative biology (Vol. 18, pp. 123-131). Cold Spring Harbor Laboratory Press.)

- a) **If one strand of DNA has the sequence of 5'-G-G-A-C-T-A-C-T-3'. What is the sequence of bases in the complementary strand**
- b) **A sample of hair and blood was found at two sites. Scientists claim that it belongs to the same species. How did the scientist arrive at this conclusion**
- c) **The sample of virus was tested and it was found to contain 20%adenine,20% thymine,20% guanine and the rest is cytosine. Is the genetic material of this virus) DNA –double helix b)DNA-single helix c) RNA. What do you infer from this data**

OR

Give two functions of RNA

SECTION- E

The following questions are long answer type questions and carry 5 marks each. All questions have internal choice

- 1a) **Why does dry cell become dead after long time ,even if it has not used**
- b) **Limiting molar conductivity of acetic acid cannot be determined experimentally**
- c) **Calculate the potential of the cell at 298 K**

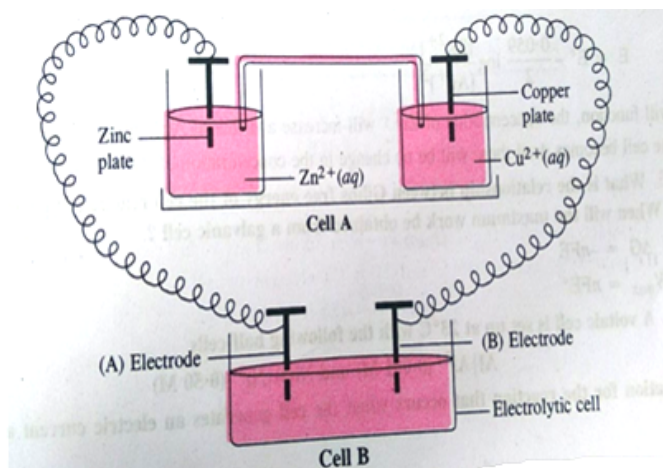
$\text{Cd} / \text{Cd}^{2+} (0.1\text{M}) // \text{H}^+ (0.2\text{M}) / \text{Pt}, \text{H}_2 (0.5\text{atm})$

Given E° for Cd^{2+}/Cd is -0.43V , R is $8.314 \text{ J}^{-1}\text{mol}^{-1}$, F is 96500 C mol^{-1}

($\log 5=0.6990$, $\log 4=0.6021$)

OR

- a) the standard reduction potential for the $\text{Zn}^{2+}(\text{aq})/\text{Zn}(\text{s})$ half cell is -0.76 V . write the reactions occurring at the electrode when coupled with standard hydrogen electrode (SHE)



Cell A has $E_{\text{cell}}= 2\text{V}$ and Cell B has $E_{\text{cell}}=1.1\text{V}$. Which of the two cells will act as an electrolytic cell?

- i) Cell A has $E_{\text{cell}}=0.5\text{V}$ and Cell B has $E_{\text{cell}}=1.1\text{V}$. Which of the two cells will act as an electrochemical cell? What will be the reaction at anode and cathode?

32.a) write the products formed when ethanal reacts with a) $\text{NH}_2\text{CONHNH}_2$ b) $\text{C}_6\text{H}_5\text{CHO}$ in presence of NaOH .

b) An alkene with molecular formula $\text{C}_5 \text{H}_{10}$ on ozonolysis gives a mixture of two compounds, B and C. compound B gives positive Fehlings test and also reacts with iodine and NaOH solution. Compound C does not give Fehlings solution test but forms iodoform. Identify the compounds A, B and C write the reactions

OR

- a) Carboxylic acid does not give the characteristic reactions of carbonyl group. Why?

b) An organic acid A($C_5H_{10}O_2$) reacts with bromine in presence of phosphorous to give B. Compound B contains asymmetric carbon and gives C on dehydrobromination. Compound C does not show geometrical isomerism and on decarboxylation gives an alkene D which on ozonolysis gives E and F. Give structure of A, B, C, D, E and F

33. Answer any five of the following

- a) Which is a stronger reducing agent Cr^{+2} or Fe^{+2}
- b) Transition metals and many of their compounds show paramagnetic behavior
- c) Transition metals and many of their compounds act as good catalyst
- d) Mention an important alloy of lanthanoid elements and mention its uses
- e) What is the effect of increasing pH on a solution of potassium dichromate
- f) How does acidified potassium permanganate solution react with SO_2
- g) Explain why does the colour of $KMnO_4$ disappear when oxalic acid is added to its solution in acidic medium

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Answer Key

1. c
 2. SN2 mechanism
 3. b) ethane nitrile
 4. acetic acid –pyridine
 5. a) copper liberates hydrogen from acids
 6. a) Ag at 30°C
 7. c) CH₃COOH
 8. c) 5
 9. c) 2-Bromopentane and 3-Bromopentane
 10. c) phosphodiester
 11. c) Zn
 12. b) 8000cm⁻¹
 13. d
 14. b
 15. a
 16. a
 - 17 A -[Co(H₂O)₅SO₄]Cl Pentaamminesulphato cobalt (III) chloride
B-[Co(H₂O)₅Cl]SO₄ pentaamminechloridocobalt(III) sulphate
 - 18 A will be better than B. lower the reduction potential greater the tendency to get oxidized. A will be sacrificed to protect iron from rusting
 - 19 A) C₆H₅CHO,) CH₃CHO , HCHO
b) 4-methoxy benzoic acid, 4-nitrobenzoic acid, 2, 4-Dinitrobenzoic acid
- OR**
- a) Add NaHCO₃ solution to each of them benzoic acid will give effervescence while phenol will not
 - b) Add Tollens reagent Ethanal will form silver mirror on heating , while propanone will not (or any other suitable test)
- 20 Because RNA has single helix structure

B) NH₂ group accept a proton released by the COOH group.hence there is a cationic and anionic part with in the Zwitter ion

$$21. \text{Rate} = -\frac{dA}{dt} - \frac{dB}{2 dt} = + \frac{dC}{3 dt} = \frac{dD}{2dt}$$

$$\text{Rate} = -\frac{dB}{2 dt} = -\frac{1 \times 10^{-2}}{2} = 5 \times 10^{-3}$$

$$\text{Change in con. of A} = 5 \times 10^{-3} \text{ molL}^{-1}\text{S}^{-1}$$

$$\text{Change in con of C} = 3 \times 1 \times 10^{-2} \text{ molL}^{-1}\text{S}^{-1}$$

$$\Delta T_b = I \times K_b \times w b \frac{1000}{m b x w a}$$

SECTION -C

$$22 \quad 0.0832 = I \times 0.52 \times \frac{1.248 \times 1000}{208.34 \times 100}$$

$$I = 2.67$$

$$\alpha = \frac{i-1}{n-1} = \frac{2.67-1}{3-1} = 0.835$$

OR

$$\text{Mass of 1 L solution} = 1000 \times 1.04 = 1040 \text{ g}$$

$$\text{Mass of solute} = 1040 - 74.5 = 965.5 \text{ g}$$

$$I = 2$$

$$\Delta T_b = I \times K_b \times w b \frac{1000}{m b x w a}$$

$$2 \times 0.52 \times 74.5 \times 1000 / 74.5 \times 965.5 = 1.077 \text{ K}$$

$$T = 373 + 1.077 = 374.077 \text{ K}$$

23.correct equation

24.A) Racemic mixture contains equal amounts of dextro and laevo rotatory compounds

B) Due to the presence of 3 bulky alkyl group the nucleophile cannot attack the carbon

c) Due to the +R effect electron density is more at ortho and para position

25.a) Electronic configuration in $[\text{CoF}_6]^{-3} t_{2g}^4 e_g^2$

Electronic configuration in $[\text{Fe}(\text{CN})_6]^{-4} t_{2g}^6 e_g^0$

b) CO

c) depending upon the nature of the ligand, i.e., If the ligand is strong, it will be low spin complex with less number of unpaired electrons. If the ligand is weak it will be high spin complex

26.A is $\text{CH}_3\text{Br}/\text{Cl}$

B is $\text{CH}_3\text{MgBr}/\text{Cl}$

For correct reaction -1 mark

b) due to resonance the lone pair of electrons on nitrogen is delocalized over the benzene ring

27. a) $\text{C}_6\text{H}_5\text{NH}_2, (\text{C}_2\text{H}_5)_2\text{NH}, \text{C}_2\text{H}_5\text{NH}_2$

b) $\text{NH}_3, (\text{CH}_3)_3\text{NCH}_3\text{NH}_2, (\text{CH}_3)_2\text{NH}$

c) p-nitroaniline, aniline, p-toluidine

28.a) being an electrolyte KCl undergoes complete dissociation whereas glucose does not

b) solubility of oxygen in water decreases with increase in temperature

c) saline water is hypertonic solution so fluids causing irritation in throat will come out

29

a) No, as the concentration of reactant goes on decreasing rate also decreases

b) 2 molecules of NO_2

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303 \times R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$$

$$= \frac{52 \times 10^3}{2.303 \times 8.314 \times 298 \times 308} \times 10$$

$$= 0.296$$

$$\therefore \frac{k_2}{k_1} \approx 2$$

i.e. for every 10°C rise in temp the rate of reaction doubles.

OR

$$t_{75\%} = \frac{2.303}{k} \log \frac{100}{25}$$

$$32 = \frac{2.303}{k} \log 4$$

$$\therefore k = \frac{2.303}{32} \times 0.6021 = 0.043$$

$$t_{42} = \frac{0.693}{k}$$

$$= \frac{0.693}{0.043} = 16.1 \text{ min}$$

30

- 3'C-C-T-G-A-T-G-A-5'
- They studied the nucleotide composition of DNA
- Since G is not equal to C its not double helix.as T is present it is not RNA.so single helix DNA virus

OR

- helps in the synthesis of protein
- serves as a messenger between DNA and ribosome

31

- Acidic NH_4Cl reacts with Zn container and corrosion of container takes place
- As degree of dissociation increases on dilution ,no of ions increases

$$\begin{aligned}
 E_{\text{cell}} &= E_{\text{cell}}^{\circ} - \frac{0.059}{n} \log Q \\
 &= (0 - 0.43) - \frac{0.059}{2} \log \frac{(0.1) 0.5}{(0.2)^2} \\
 &= 0.43 - \frac{0.059}{2} \log \frac{5 \times 10^{-2}}{4 \times 10^{-2}} \\
 &= 0.43 - 0.0028 \\
 &= \underline{\underline{0.42}}
 \end{aligned}$$

Anode $\text{Zn} \rightarrow \text{Zn}^{+2} + 2\text{e}$

Cathode $2\text{H}^{+} + 2\text{e} \rightarrow \text{H}_2$

a) Cell B will act as an electrolytic cell because potential of B is less than that of A

ii) cell B will act as an electrochemical cell as it has higher potential

oxidation at anode and reduction at cathode

a) 32a) correct equation, $\text{CH}_3\text{CH}=\text{NNHCONH}_2$

b) $\text{C}_6\text{H}_5\text{CH}(\text{OH})\text{CH}_2\text{CHO}$

b) A is $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2$. SINCE B gives positive fehling's test and iodoform test it is CH_3CHO . compound C does not give fehling's test but forms iodoform, so it is methyl ketone. so C is CH_3COCH_3 . correct equation

OR

a) due to resonance

b)

For correct reaction---1 mark

33a) Cr^{+2} on losing one electron it attains the stable half filled t_2g electronic configuration

b) due to the presence of unpaired electron

c) ability to form complexes & multiple oxidation state

d) mischmetal, preparation of bullets

e) on increasing PH orange coloured dichromate changes to yellow coloured chromate

f) correct equation

e) KMnO_4 oxidises oxalic acid in acidic medium and gets converted to Mn^{+2} which is colourless