CBSE (AI) EXAMINATION PAPER—2019
CHEMISTRY

Time : 3 hrs. *Max. Marks : 100*

GENERAL INSTRUCTIONS:

(*i*) ***All*** *questions are compulsory*

(*ii*) *Section A : Questions number* ***1*** *to* ***5*** *are very short answer questions and carry* ***1*** *mark each.*

(*iii*) *Section B : Questions number* ***6*** *to* ***12*** *are short answer questions and carry* ***2*** *marks each.*

(*iv*) *Section C : Questions number* ***13*** *to* ***24*** *are also short answer questions and carrying* ***3*** *marks each.*

(*v*) *Section D : Questions number* ***25*** *to* ***27*** *are long answer questions and carry* ***5*** *marks each.*

(*vi*) *There is no overall choice. However, an internal choice has been provided in two questions of one mark, two questions of two marks, four questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.*

(*vii*) *Use of log tables, if necessary. Use of calculators is* ***not*** *allowed.*

Set–I

SECTION A

1. Name the defect in the following crystal: **(1)**

$X^+ Y^- X^+ Y^-$

$Y^- \square Y^- X^+$

$X^+ \square X^+ Y^-$

$Y^- X^+ Y^- X^+$

2. When a coordination compound $CrCl_3 . 6H_2O$ is mixed with $AgNO_3$, two moles of AgCl are precipitated per mole of the compound. What is the structural formula of the coordination compound? **(1)**

OR

What is the difference between a complex and a double salt? **(1)**

3. Define associated colloid with an example. **(1)**

4. What is *t*-butyl bromide more reactive towards S_N1 reaction as compared to *n*-butyl bromide? **(1)**

5. Write the reaction involved in the Hoffmann bromamide degradation reaction. **(1)**

OR

Propanamine and N,N-dimethylmethanamine contain the same number of carbon atoms, even though Propanamine has higher boiling point than N, N-dimethylmethanamine. Why? **(1)**

SECTION B

6. Give reasons for the following: **(2)**

(a) Aquatic species are more comfortable in cold water than warm water.

(b) At higher altitudes people suffer from anoxia resulting in inability to think.

OR

What type of azeotropic mixture will be formed by a solution of acetone and chloroform? Justify on the basis of strength of intermolecular interactions that develop in the solution. **(2)**

7. Explain with a graph, the variation of molar conductivity of a strong electrolyte with dilution. **(2)**

8. When dilute ferrous sulphate solution is added to an aqueous solution containing nitrate ion followed by careful addition of concentrated sulphuric acid along the sides of test tube, a brown ring is formed at the interface between the solution and sulphuric acid layers. Which anion is confirmed by the appearance of brown ring? What is the composition of the brown ring? **(2)**

OR

How can you prepare Cl_2 from HCl and HCl from Cl_2? Write reactions only. **(2)**

9. Use the data to answer the following and also justify giving reason: **(1 × 2 = 2)**

	Cr	Mn	Fe	Co
$E^\circ_{M^{2+}/M}$	– 0.91	– 1.18	– 0.44	– 0.28
$E^\circ_{M^{3+}/M^{2+}}$	– 0.41	+ 1.57	+ 0.77	+ 1.97

(a) Which is a stronger reducing agent in aqueous medium, Cr^{2+} or Fe^{2+} and why?

(b) Which is the most stable ion in + 2 oxidation and why?

10. Define with equation: **(1 × 2 = 2)**

(a) Riemer-Tiemann Reaction

(b) Williamson's Synthesis

11. Give the structures of monomers of the following polymers: **(1 × 2 = 2)**

(a) Nylon-6, 6 (b) Buna-S

12. Classify the following as addition and condensation polymers giving reason: **(1 × 2 = 2)**

(a) Teflon (b) PHBV

SECTION C

13. Chromium crystallises in bcc structure. If its edge length is 300 pm, find its density. Atomic mass of chromium is 52 u. [$N_A = 6.022 \times 10^{23}$ mol^{-1}] **(3)**

14. At 300 K, 30 g of glucose present in a litre of its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of a glucose solution is 1.52 bar at the same temperature, what would be its concentration? **(3)**

15. Calculate $\Delta_r G^\circ$ and log K_C for the following reaction:

$$Cd^{+2}(aq) + Zn(s) \longrightarrow Zn^{2+}(aq) + Cd(s)$$

Given: $E^\circ_{Cd^{2+}/Cd} = -0.403$ V

$E^\circ_{Zn^{2+}/Zn} = -0.763$ V **(3)**

OR

Chromium metal is electroplated using an acidic solution containing CrO_3 according to the following equation:

$$CrO_3(aq) + 6H^+ + 6e^- \longrightarrow Cr(s) + 3H_2O$$

Calculate how many grams of chromium will be electroplated by 24,000 coulombs. How long will it take to electroplate 1.5 g chromium using 12.5 A current?

[Atomic mass of Cr = 52 g mol^{-1}, 1 F = 96500 C mol^{-1}]

16. Give reasons for the following: **(1 × 3 = 3)**

(*a*) Leather gets hardened after tanning.

(*b*) $FeCl_3$ is preferred over KCl in case of a cut leading to bleeding.

(*c*) Freundlich isotherm becomes independent of pressure at high pressure for a gas absorbed on a solid.

17. What is the role of. **(1 × 3 = 3)**

(*a*) Depressants in forth floatation?

(*b*) Carbon monoxide in Mond's process?

(*c*) Concentrated sodium hydroxide in leaching of alumina from bauxite?

OR

Write chemical reactions taking place in the extraction of Aluminium from Bauxite ore. **(3)**

18. Explain the method of preparation of sodium dichromate from chromite ore. Give the equation representing oxidation of ferrous salts by dichromate ion. **(1 × 3 = 3)**

OR

Complete the following reactions: **(1 × 3 = 3)**

(*a*) $MnO_2 + KOH + O_2 \longrightarrow$

(*b*) $I^- + MnO_4^- + H^+ \longrightarrow$

(*c*) $Cr_2 2O_7^{2-} + Sn^{2+} + H^+ \longrightarrow$

19. Write the hybridization and magnetic character of the following complexes: **(3)**

(*i*) $[Fe(H_2O)_6]^{2+}$ (*ii*) $[Ni(CN)_4]^{2-}$

[Atomic number : Fe = 26, Ni = 28]

20. Give reasons for the following: **(1 × 3 = 3)**

(*a*) The presence of $-NO_2$ group at ortho or para position increases the reactivity of haloarenes towards nucleophilic substitution reactions.

(*b*) *p*-dicholorobenzene has higher melting point than that of ortho or meta isomer.

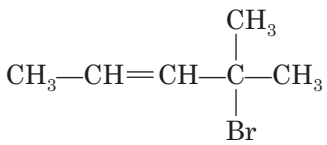
(*c*) Thionyl chloride method is preferred for preparing alkyl chloride from alcohols.

OR

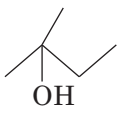
(*a*) Write equation for preparation of 1-iodobutane from 1-chlorobutane.

(*b*) Out of 2-bromopentane, 2-bromo-2-methylbutane and 1-bromopentane, which compound is most reactive towards elimination reaction and why?

(*c*) Give IUPAC name of



21. (*a*) How will you synthesise the following alcohol from appropriate alkene: **(1 + 2 = 3)**



(*b*) Write the mechanism of the following reaction:

$$CH_3CH_2OH \xrightarrow[443\,K]{H^+} CH_2 = CH_2 + H_2O$$

22. (*a*) Give one chemical test to distinguish between the compounds of the following pairs:

(*i*) CH_3NH_2 and $(CH_3)_2NH$ (*ii*) Aniline and Ethanamine

(*b*) Why aniline does not undergo Friedel-Crafts reaction? **(1 + 2 = 3)**

23. (*a*) Give any one property of glucose that cannot be explained by the open chain structure.

(*b*) Compare amylase with amylpectin in terms of constituting structure.

(*c*) Why do amino acids show amphoteric behaviour? **(1 × 3 = 3)**

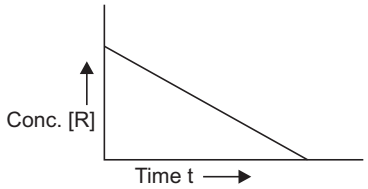
24. Define the following with suitable example of each: **(1 × 3 = 3)**

(*a*) Antiseptics (*b*) Non-narcotic analgesics

(*c*) Cationic detergents

SECTION D

25. (*a*) Consider the reaction R → P for which the change in concentration of R with time is shown by the following graph:



(*i*) Predict the order of reaction.

(*ii*) What does the slope of the curve indicate?

(*b*) The rate of reaction quadruples when temperature changes from 293 K to 313 K. Calculate E_a assuming that it does not change with time. [R = 8.314 JK^{-1} mol^{-1}]

(1 + 2 = 3)

OR

(*a*) Draw the plot of *ln* k vs 1/T for a chemical reaction. What does the intercept represent ? What is the relation between slope and E_a?

(*b*) A first order reaction takes 30 minutes for 20% decomposition. Calculate $t_{1/2}$. [log 2 = 0.3010] **(2 + 1 = 3)**

26. (*a*) Draw the structure of the following:

(*i*) $HClO_3$ (*ii*) $H_2S_2O_8$

(*b*) Give reasons for the following:

(*i*) Above 1000 K sulphur shows paramagnetism.

(*ii*) Although electron gain enthalpy of fluorine is less negative than that of chlorine, yet flourine is a better oxidising agent than chlorine.

(*iii*) In solid state PCl_5 exists as an ionic compound. **(2 + 3 = 5)**

OR

(*a*) Complete the following reactions:

(*i*) $PbS(s) + O_3 \longrightarrow$ (*ii*) $XeF_6 + NaF \longrightarrow$

(*b*) Arrange the following in increasing order of property indicated, giving reason:

(*i*) Hydrides of group 15 – boiling points

(*ii*) Hydrides of group 17 – acidic strength

(*iii*) Hydrides of group 16 – reducing character **(2 + 3 = 5)**

27. (*a*) Carry out the following conversions:

(*i*) P-nitrotoluene to 2-bromobenzoic acid

(*ii*) Propanoic acid to acetic acid

(*b*) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds, B and C. Compound B gives positive Fehling test and also reacts with iodine and NaOH solution. Compound C does not give Fehling solution test but forms iodoform. Identify the compounds A, B and C. **(2 + 3 = 5)**

OR

(*a*) Carry out of the following conversions:

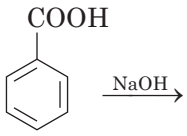
(*i*) Benzoic acid to aniline

(*ii*) Bromomethane to ethanol

(*b*) Write the structure of major product(s) in the following:

(*i*) $CH_3—CH_2—\underset{\underset{O}{\|}}{C}—H \xrightarrow[(b)\ KOH,\ Glycol/heat]{(a)\ H_2N–NH_2}$

(*ii*) $CH_3—\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}—CHO \xrightarrow{conc.\ NaOH}$

(*iii*)  $\xrightarrow{NaOH}$

(2 + 3 = 5)

Set–II

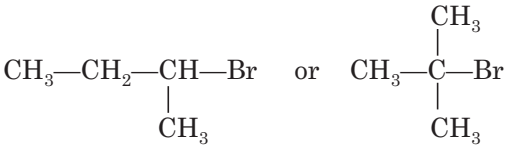
SECTION A

Questions are different from Set I.

1. What is the coordination number of atoms in a (*i*) bcc structure, and (*ii*) fcc structure? **(1)**

2. Why are powdered substances more effective adsorbents than their crystalline forms? **(1)**

4. Which alkyl halide from the following pair would you expect to react more rapidly by a S_N2 mechanism? **(1)**



7. Define electrochemical cell. What happens when applied external potential becomes greater than $E°_{cell}$ of electrochemical cell? **(2)**

9. Write the equations involved in the following reactions: **(2)**

(*a*) Kolbe's reaction (*b*) Friedel-Crafts alkylation of anisole

12. Write the structures of monomers of the following polymers: **(1 × 2 = 2)**

(*a*) Terylene (*b*) Buna-N

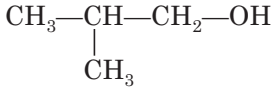
16. Give reasons for the following: **(1 × 3 = 3)**

(*a*) Brownian movement provides stability to the colloidal solution.

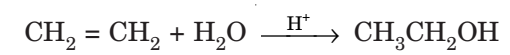
(*b*) True solution does not show Tyndall effect.

(*c*) Addition of alum purifies the water.

21. (*a*) Show how you will synthesise the following alcohol prepared by the reaction of a suitable Grignard reagent on methanal?



(*b*) Write the mechanism of the following reaction:



23. What happens when D-glucose is treated with the following reagents: **(3)**

(*a*) Br_2 water (*b*) HCN

(*c*) $(CH_3CO)_2O$

24. Define the following terms with a suitable example of each: **(3)**

(*a*) Antacids (*b*) Artificial sweeteners

(*c*) Anionic detergents

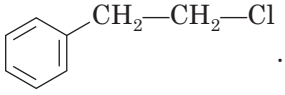
Set–III

SECTION A

Questions are different from Set I and Set II.

1. What would be the nature of solid if there is no energy gap between Valence band and Conduction band? **(1)**

2. Write the main reason for the stability of colloidal sols. **(1)**

4. Write the IUPAC name of  . **(1)**

7. Using the E° values of X and Y, predict which is better for coating the surface of iron to prevent rust and why? **(2)**

Given: $[E^\circ_{(Fe^{2+}/Fe)} = -0.44\ V$

$E^\circ_{(X^{2+}/X)} = -2.36\ V$

$E^\circ_{(Y^{2+}/Y)} = -0.14\ V]$

9. Write the name of monomers and their structures for the following polymers: **(2)**

(*a*) Neoprene (*b*) Nylon-6

12. What happens when **(1 × 2 = 2)**

(*a*) Phenol reacts with Conc. HNO_3?

(*b*) Ethyl chloride reacts with $NaOC_2H_5$?

Write the chemical equations involved in the above reactions.

15. Define the following terms with a suitable example of each: **(3)**

(*a*) Sol (*b*) Aerosol (*c*) Hydrosol

20. (*a*) What are antidepressant drugs? Give an example.

(*b*) Name the sweetening agent used in preparation of sweets for a diabatic patient.

(*c*) Why are detergents non-biodegradable?

21. (*a*) What is the difference between native protein and denatured protein?

(*b*) Which one of the following is a disaccharide:

Glucose, Lactose, Amylose, Fructose

(*c*) Write the name of the vitamin responsible for the coagulation of blood.

23. (*a*) Butan-1-ol has a higher boiling point than diethyl either. Why? **(3)**

(*b*) Write the mechanism of the following reaction:

$$2CH_3CH_2OH \xrightarrow[413\,K]{H^+} CH_3CH_2{-}O{-}CH_2{-}CH_3$$