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Chemistry (Theory)

PAPER 01

Class – XI

Time allowed:3hours **Maximum Marks:70**

General Instructions:

a) All the questions are compulsory.
b) There are **26** questions in total.
c) Questions **1** to **5** are very short answer type questions and carry **one** mark each.
d) Questions **6** to **12** carry **two** marks each.
e) Questions **13** to **24** carry **three** marks each.
f) Questions **25** to **27** carry **five** marks each.
g) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions in five marks each. You have to attempt only one of the choices in such questions.
h) Use of calculators is **not** permitted. However, you may use log tables if necessary.

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1. If a metal is higher than a particular metal in electrochemical series, will it be stronger reducing agent or weaker reducing agent? Why?
2. If the critical temperature for carbon dioxide and methane are 31.1^{0}C and -81.9^{0}C respectively, then which of these has strong intermolecular forces? Give reason.
3. Which of these contain the largest number of atoms 1.0 g Li(s) and 1 g Na(s)?
4. Predict the shape of the PH_3 molecule according to VSEPR theory.
5. Give reason: "Metallic hydrides are used for storing hydrogen".
6. (a) Name the energy which arises due to motion of atoms or molecules in a body.
   (b) How is this energy affected when the temperature is increased?

   Or

   Give the relationship between isothermal and free expansion of an ideal gas.
7. Predict the formulae of the stable binary compounds that would be formed by the combination of the following pairs of elements:
   (a) Element 71 and F
   (b) Al and I
   (c) Si and O
   (c) P and F.
8. Why the bottle containing hydrogen peroxide should be cooled before opening?
9. Why Be and Mg does not give colour to flame than the alkaline earth metals?
10. Calculate the molality of the solution if the density of 3M solution of NaCl is 1.25 g/mL.
11. Calculate packing efficiency in primitive unit cell.
12. (i) Why nitrogen is inert at room temperature?
    (ii) State the formula of oxide of nitrogen in which nitrogen shows +3 oxidation state.
13. What happens when
    (a) Sodium metal is dropped in water?
    (b) Sodium metal is heated in free supply of air?
    (c) Sodium peroxide dissolves in water?
14. Justify giving reactions that among halogens, fluorine is the best oxidant among hydrohalic compounds while hydroiodic acid is the best reductant?
15. Write the balance equation for the following:

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(i) $BF_3 + LiH \rightarrow$

(ii) $B_2H_6 + H_2O \rightarrow$

(iii) $NaH + B_2H_6 \rightarrow$

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16. Explain the principle of paper chromatography.

17. Write a brief note on the following environmental terms:
    (i) Acid rain
    (ii) Eutrophication
    (iii) Green Chemistry

18. A liquid is in equilibrium with its vapour in a sealed container at a fixed temperature. The volume of the container is suddenly increased.
    (a) How do rates of evaporation and condensation change initially?
    (b) What is the initial effect of the change on vapour pressure?

19. (a) How would you distinguish between $BeSO_4$ and $BaSO_4$?
    (b) Which is thermally most stable alkaline earth metal carbonate among $MgCO_3$, $CaCO_3$, $SrCO_3$, $BaCO_3$? Give reasons.

20. Derive the structure of:
    (a) 2-Chlorohexane
    (b) Pent-4-en-2-ol
    (c) 3-Nitrocyclohexene
    (d) Cyclohex-2-en-1-ol

Or

Why NH_3 has a higher dipole moment than NF_3?

21. Why is the entropy of a substance taken as zero at 0 K? Calculate the standard Gibbs free energy change for the reaction

    $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at 298 K.

    The value of equilibrium constant for the above reaction is 6.6×10^5. [R=8.314 J K^{-1} mol^{-1}]

22. Indicate the no. of unpaired electrons in the following by giving electronic configuration
    (i) Cr (ii) Cu (iii) Fe

23. Define:
    (i) Lattice enthalpy
    (ii) Bond length
    (iii) Bond angle.

24. (i) Name the class of hydrides to which H_2O and NaH belong.
    (ii) What do you understand by the term hydride gap?
    (iii) What do you mean by 15 volume H_2O_2 solution?

25. (a) Convert:
    (i) Benzene to p-nitrobromobenzene
    (ii) Ethyl chloride to ethene.
    (b) Give mechanism of addition of HBr to propene.
    (c) Write a note on Friedel-Crafts alkylation.

Or

(i) Balance the following equation in acidic medium by half reaction method.

$Cr_2O_7^{2-} + C_2H_4O \rightarrow Cr^{3+} + C_2H_4O_2$

(ii) Assign oxidation no. of Na in the following (a) NaH_2PO_4 (ii) $NaHSO_4$

26. From the structures given below, answer the questions
    (i) $CH_3-CH_2-CH(OH)-CH_3$

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(ii) $(CH_3)_2$π-πCπ(OH)π-CH_3π
(iii) CH_3π-πCH_2π-πCH_2π-πCH_2π-OHπ
(iv) CH_3π-πOπ(CH_3)π-πCHπ-CH_3π
(v) CH_3π-πOπ-πCH_2π-πCH_2π-CH_3π
(vi) CH_3π-πCH_2π-πOπ-πCH_2π-CH_3π
(vii) CH_3π-πCHπ(CH_3)π-πCH_2π-OHπ
(a) Theπpairπofπcompoundsπthatπrepresentπchainisomerism.π
(b) Theπpairπofπcompoundsπthatπrepresentπpositionisomerism.π
(c) Theπpairsπofπcompoundsπwhichπareπfunctionalπgroupisomers.π
(d) Theπcompoundsπthatπformπpairsπofmetamers.π
(e) Distinguishπbetweenπpositionπandπfunctionalπisomerismπwithπanexample.π

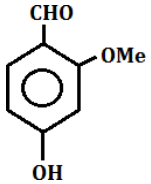
Or

Convertπtheπfollowing:π
(a) Benzeneπtoπ Benzoicacidπ
(b) BromoethaneπtoButan-1-olπ
(c) EtheneπtoPropeneπ
(d) EthyneπtoMethaneπ
(e) PropeneπtoPropan-2-olπ

27. (a)πGiveπoneπmethodforπindustrialπpreparationπforlaboratorypreparationofCOandCO$_2$each.π
(b) πSelectπthemember(s)πofπgroupπ14thatπ(i)πformsπtheπmostπacidicπdioxideπ(ii)πusedπasπ semiconductors.π
(c) ExplainπstructureofDiborane.π

Or

(a) Identifyπtheπfunctionalπgroupsπinπthefollowing:π



(b) Drawπtheπbondπnotationπofheptan-4-one.π
(c) Giveπtheπpossibleπisomersπforπmonosubstituted π
(d) Giveπtheπpossibleπisomersπforπdiπsubstitutedbenzene?π

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Answers

1. Itπwillπbeπanπweakerπreducingπagentπifπelectrochemicalπseriesπhasπelementsπinπdecreasingπorderπofπ theirπreductionpotential.π
2. Theπintermolecularπforcesπinπcarbonπdioxideπareπmoreπthanπinπmethaneπmoleculesπbecauseπofπ greaterpolarityπ
3. 1πgπLi.π
4. Trigonalpyramidal.π
5. Metallicπhydridesπtrapπhydrogenπinπtheirπvoidsπformingπinterstitialπhydrides,πthusπtheyπcanπbeπ usedπforπstoringhydrogen.π
6. (a)πKineticenergy.π
(b) Itπincreasesπwithπincreaseπintemperature.π

Or

WorkπdoneπinπisothermalπreversibleπexpansionπofπanπidealπgasπWπ-π
π

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–2.303nRTlogV$_2$/V$_1$=–2.303nRTlogP$_1$/P$_2$

In the free expansion of an ideal gas, w=0 because ideal gases have negligible force of attraction, therefore work done is zero in free expansion because no external force is acting. W=

-P$_{ext}$ΔV

P$_{ext}$=0; w=0

7. (a) LuF$_3$
   (b) AlI$_3$
   (c) SiO$_2$
   (d) PF$_5$
8. Hydrogen peroxide is unstable and so decomposes in water and oxygen on long standing or heating. Hence to lower the vapour pressure inside the bottle, it is cooled before opening.
9. Due to small size, the ionization energy of Be and Mg are much higher than alkaline earth metals. So they need large amount of energy for excitation of electrons to higher energy levels. This energy is not available in Bunsen flame and so do not impart any colour to the flame.
10. Molarity=3M

Density=1.25g/mL

Mass of NaCl in 1 L solution

=Molarity×molar mass=3×58.5=175.5g

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Mass of 1 L NaCl solution=1.25×1000=1250g

Mass of water in solution=1250-175.5=1074.5g=1.0745kg

$$\text{Molality} = \frac{\text{No. of moles of solute}}{\text{Mass of water}} = \frac{3}{1.074} = 2.79\text{m}$$

11. Correct mathematical derivation 2
12. Correct answer ..... 1+1
13. (a) Sodium hydroxide and hydrogen gas will be formed which will catch fire

$$2Na(s) + 2H_2O(l) \rightarrow 2NaOH\ (aq) + H_2\ (g)$$

   (b) Sodium peroxide is formed

$$2Na + O_2 \rightarrow Na_2O_2$$

   (c) Sodium hydroxide and hydrogen peroxide are formed

$$Na_2O_2 + 2H_2O \rightarrow 2NaOH + H_2O_2$$

14. F$_2$ is best oxidizing agent because it has highest standard reduction potential. It has low bond dissociation energy, high electron affinity and highest hydration energy of F$^-$ ions. H-I is best reductnt due to low bond dissociation energy.
15. (i) $2BF_3 + 6LiH \rightarrow B_2H_6 + 6LiF$

   (ii) $2BF_3 + 6LiH \rightarrow B_2H_6 + 6LiF$

   (iii) $B_2H_6 + 6H_2O \rightarrow 2B(OH)_3 + 6H_2$

   (iv) $2NaH + B_2H_6 \rightarrow 2NaBH_4$
16. Paper chromatography – It is a type of partition chromatography. A special quality of paper known as chromatographic paper is used which traps water and act as a stationary phase. The mixture of components is dissolved in suitable solvent. This solvent act as a mobile phase. It is based on continuous differential partitioning of components of mixture between stationary and mobile phase.
17. (i) Acid rain – It is a rain which contains water along with sulphuric acid, nitric acid and hydrochloric acid which are formed from the oxides of sulphur, nitrogen and CO$_2$ present in the air as pollutants and has a pH of 4-5.

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(ii) Eutrophication – It refers to the ageing of the confined water bodies, for example lakes. Normally it is a slow geological phenomenon but the process is accelerated due to the flow of excessive nutrients into the lake. Excessive flow of fertilizers, pesticides etc., into the lake lead to the algae bloom that ultimately leads to the death of aquatic life. The dead matter sinks to the bottom of the lake making lake shallow and marshy.

(iii) Green Chemistry - The term green chemistry is used to refer the procedures of synthesis of chemical of our needs through a process that neither use nor emit toxic chemicals. For example earlier chlorine gas was used for bleaching paper which is a highly toxic gas but it has now been replaced by hydrogen peroxide with a suitable catalyst.

18. (a) Initially the vapour pressure will decrease.

(b) The rate of evaporation remains constant at constant temperature in a closed vessel. But the rate of condensation will be low initially because there are fewer molecules per unit volume in the vapour phase and hence the no. of collisions per unit time with the liquid surface decreases.

19. (a) Barium and Beryllium sulphate can be distinguished by solubility test. Beryllium sulphate is soluble in water and barium sulphate is insoluble in water.

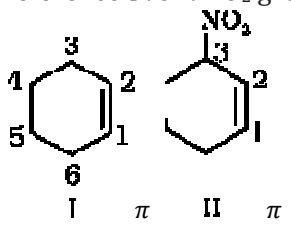
(b) Barium carbonate is thermally most stable alkaline earth metal carbonate because; its ion being larger in size is more stabilized by larger carbonate ion through the formation of stable lattice.

20. (a) The word hexane' indicates the presence of 6 carbon atoms in the chain. The functional group chloro is present at carbon 2. Hence, the structure of the compound is CH_3-CH_2-CH_2-CH_2-CH(Cl)-CH_3.

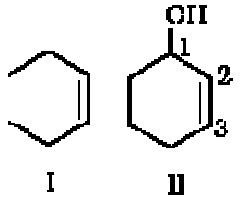
(b) The word pent' indicates that parent hydrocarbon contains 5 carbon atoms in the chain. 'en' and 'ol' correspond to the functional groups C=C and -OH at carbon atoms 4 and 2 respectively. Thus, the structure is CH_2=$CHCH_2CH$(OH)CH_3.

(c) Six membered rings containing a carbon-carbon double bond is implied by cyclohexene, which is numbered as shown in (I). The prefix 3-nitro means that a nitro group is present on

C-3. Thus, complete structural formula of the compound is (II). Double bond is suffixed functional group whereas NO_2 is prefixed functional group therefore double bond gets preference over $-NO_2$ group:



(d) 1-ol' means that a OH group is present at C-1. OH is suffixed functional group and gets preference over C=C bond. Thus the structure is as shown in (II):



Or

NH_3 has a higher dipole moment than NF_3. In case of NH_3 orbital dipole due to lone pair is in same direction as resultant dipole due to three N-H bonds. Therefore lone pair moment adds on the resultant dipole of N-H bonds. In case of NF_3 orbital dipole due to lone pair is in opposite direction as resultant dipole due to three N-F bonds. Therefore lone pair moment cancels the resultant dipole of N-F bonds.

21. The entropy of all substances at absolute zero (0 K) is taken as zero because of complete order in the system. That is the atoms or molecule do not move at all in the perfectly crystalline state.

$\Delta G^0 = -2.303 RT \log K$

$= 2.303 \times 8.314\ JK^{-1} mol^{-1} \times 298\ K \log 6.6 \times 10^5$

$= 19.147\ J \times 298 \log 6.6 \times 10^5$

$= 5705.8 [\log 6.6 + \log 10^5]$

$= 5705.8 [0.8195 + 5.0000]$

$= 5705.8 \times 5.8195\ J$

$= 33204.903\ J$

$\Delta G^0 = -33.205\ kJ mol^{-1}$

22. Correct electronic configuration and no. of unpaired e-

23. (a) The Lattice Enthalpy of an ionic solid is defined as the energy required to completely separating one mole of an solid ionic compound into gaseous constituentions.

(b) Bond length is defined as the equilibrium distance between the nuclei of two bonded atoms in a molecule.

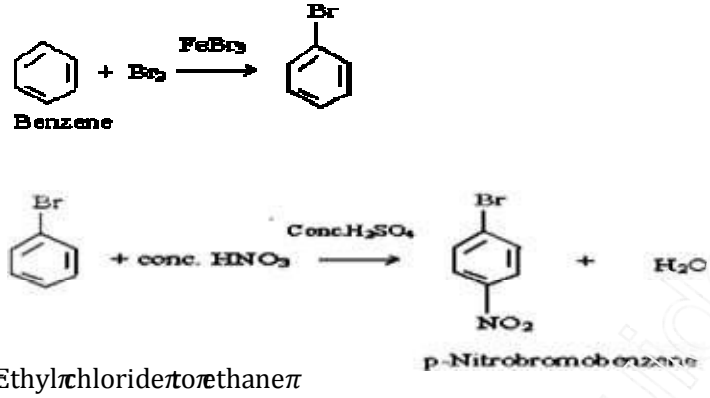
(c) Bond angle is defined as the angle between the orbitals containing bonding electron pairs around the central atom in a molecule/complexion.

24. (a) H_2O is covalent hydride whereas NaH is ionic or saline hydride.

(b) Group 17 to group 18 elements do not form hydrides. This region of periodic table from group 17 to 18 is called as hydride gap.

(c) 1 L of H_2O_2 gives 15 L of O_2 at NTP.

25. (a) (i) Benzene to p-Nitrobromobenzene



(ii) Ethyl chloride to ethane

CH_3CH_2Cl + Alc. KOH © CH_2 = CH_2 + KCl + H_2O

(a) Mechanism of addition of HBr to propene

Step-1

$CH_3 - CH = CH_2 + H^+ \rightarrow CH_3 - CH - CH_2\overset{+}{H}$ (Primary carbocation, less stable)

Step-2

$CH_3 - CH = CH_2 + H^+ \rightarrow CH_3 - C\overset{+}{H} - CH_3$ (Secondary carbocation, more stable)

Step-3

$CH_3 - C\overset{+}{H} - CH_3 + Br^- \rightarrow CH_3 - CH(Br) - CH_3$ (Major product)

(b) Friedel-Crafts alkylation - It is the reaction of benzene with alkyl halide in presence of anhydrous aluminium chloride. The reaction results in the formation of alkylbenzene.

$$C_6H_6 + CH_3Cl \xrightarrow{Anhy.AlCl_3} C_6H_5CH_3 + HCl$$

Or

(a) Write the oxidation no. of each atom 3

$$\underset{+6}{Cr_2}O_7^{2-} + \underset{-1}{C_2H_4}O \rightarrow \underset{0}{C_2H_4O_2} + \underset{+3}{Cr^{3+}}$$

(b) Write separately oxidation & reduction half reactions

Oxidation half reaction:

$$\underset{-1}{C_2H_4O} \rightarrow \underset{0}{C_2H_4O_2}$$

Reduction half reaction:

$$\underset{+6}{Cr_2}O_7^{2-} \rightarrow \underset{+3}{Cr^{3+}}$$

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(c) Balance Cr atoms in reduction half reaction

$Cr_2O_7^{2-} \rightarrow 2Cr^{3+}$

(d) Balance O atoms and H atoms

$C_2H_4O + H_2O \rightarrow C_2H_4O_2 + 2H^+ + 2e^-$

$Cr_2O_7^{2-} + 14H^+ \rightarrow 2Cr^{3+} + 7H_2O$

(e) Balance the charges

$C_2H_4O + H_2O \rightarrow C_2H_4O_2 + 2H^+ + 2e^-$

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

(e) Equalize the electrons lost and gained by multiplying the oxidation half reaction with 3

$3C_2H_4O + 3H_2O \rightarrow 3C_2H_4O_2 + 6H^+ + 6e^-$

Adding the oxidation half reaction and reduction half reaction

$3C_2H_4O + 3H_2O \rightarrow 3C_2H_4O_2 + 6H^+ + 6e^-$

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

$3C_2H_4O + Cr_2O_7^{2-} + 8H^+ \rightarrow 3C_2H_4O_2 + 2Cr^{3+} + 4H_2O$

(ii) Correct oxidation no. 1+1

26. (a) I and III

(b) I and III

(c) VI and VII

(d) V and VI

(e) Those isomers which differ in position of functional groups are called position isomers. Eg- But-1-ene and But-2-ene and those isomers which differ in functional groups are called functional isomers. Eg- Ethanol and Dimethylether.

Or

(a) $CH_6 \xrightarrow{CH_3Cl/an.AlCl_3} CH_6CH_5 \xrightarrow{(O)/KMnO_4} CH_3COOH$

(b) $CH_3CH_2Br \xrightarrow{Wurtz\ Reaction} CH_3CH_2CH_2CH_3 \xrightarrow{Cl_2/hv} CH_3CH_2CH_2CH_2Cl \xrightarrow{KOH} CH_3CH_2CH_2OH$

(c) $CH_2=CH_2 \xrightarrow{HI} CH_3CH_2I \xrightarrow{KCN} CH_3CH_2CN \xrightarrow{4[H]} CH_3CH_2CH_2NH_2 \xrightarrow{HNO_2} CH_3CH_2CH_2OH \xrightarrow{alc.KOH} CH_3-CH=CH_2$

(d) $CH\equiv CH \xrightarrow{H_2O/HgSO_4\ or\ H_2SO_4} CH_3CHO \xrightarrow{(O)/KMnO_4} CH_3COOH \xrightarrow{NaOH} CH_3COONa \xrightarrow{decarboxylation/NaOH/CaO} CH_4$

(e) $CH_3-CH=CH_2 \xrightarrow{HBr} CH_3-CH(Br)-CH_3 \xrightarrow{aq.KOH} CH_3-CH(OH)-CH_3$

27(a) Carbon monoxide:

Industrial preparation:

$2C(s) + O(g) \xrightarrow{Limited\ air} 2CO(g)$

Laboratory preparation:

$HCOOH \xrightarrow{Conc.\ sulphuric\ acid} CO(g) + H_2O$

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Carbon dioxide: Industrial preparation:

$$C(s) + O_2(g) \xrightarrow[\text{Excess air}]{} CO_2(g)$$

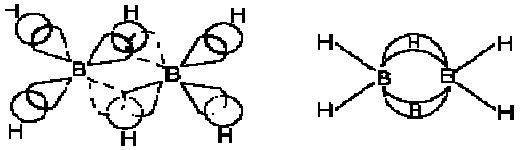
Laboratory preparation:

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

(b) (i) Forms the most acidic oxide – Carbon (i.e. CO_2).

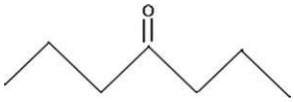
(ii) Used as semiconductor – Silicon and Germanium.

(c) Each boron atom in diborane is sp^3 hybridised. Four sp^3 hybrid orbitals adopt tetrahedral arrangement. Two hybrid orbitals of each B atom overlaps with 1s orbital of two H atoms. Of the two hybrid orbitals left on each B atom one contains an unpaired electron while other is vacant. Hybrid orbital containing unpaired electron of one boron atom and vacant hybrid orbital of second boron atom overlaps simultaneously with 1s orbital of H atom to form B-H-B bond, an three centre electron pair bond. The four terminal B-H bonds are regular two centre-two electron bonds while the two bridge (B-H-B) bonds are can be described in terms of three centre–two electron bonds.



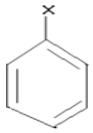
Or

(a) The principal functional group is aldehydic group – CHO and the secondary functional group is alcoholic group – OH and methoxy (-OMe) group.

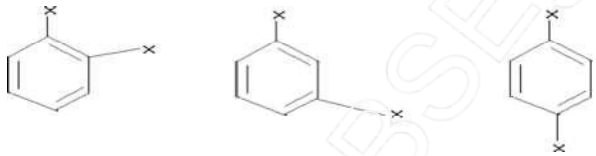


(b)

(c) For mono-substituted benzene, there is only one isomer.



(d) For disubstituted benzene, there are three isomers.



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S.No	Chapters	V.S.A	S.A	S.A	Long Answers	Total Marks
1	Some basic concepts of chemistry	1	2			3
2	Structure of Atom			3		3
3	Classification of Elements and Periodicity in property			3		3
4	Chemical Bonding and Molecular Structure	1		3		4
5	States of Matter	1	2	3		6
6	Thermodynamics			3		3
7	Equilibrium			3		3
8	Redox Reactions	1				1
9	Hydrogen	1	2	3		6
10	S-block Elements		2	3		5
11	P-Block Elements		2+2	3	5	12
12	Oraganic Chemistry: Some basic Principles And Techniques		2	3	5	10
13	Hydrocarbons			3	5	8
14	Environmental Chemistry			3		3
	TOTAL	5	14	36	15	70

CHEMISTRY SESSION ENDING EXAMINATION

CHEMISTRY (Theory)

PAPER 02

CLASS – XI

Time allowed: 3 hours Maximum Marks: 70

GENERAL INSTRUCTIONS:

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b) There are **27**questions in total.
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d) Questions **6** to **12** carry **TWO** marks each.
e) Questions **13** to **24** carry **THREE** marks each. .
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h) Use of calculators is **NOT** permitted. However, you may use log tables if necessary.

1. Express 32.392800 to four significant figures.
2. Write the correct symbol for the nucleus with:
   i. Atomic number 56 and mass number 138
   ii. Atomic number 26 and mass number 55.
3. Why is Ga smaller in size than Al?
4. Draw the structure of
   a) 2,3-Dimethylpentane
   b) 4-Phenylbut-1-ene
5. If a tank is full of water coming in and out at the same rate, then what will happen to the level of water in a tank?
6. Why Be and Mg does not give colour to flame than the alkaline earth metals?
7. What is Smog How Photochemical smog is different from classical smog.
8. Calculate the molality of the solution if the density of 3M solution of NaCl is 1.25g/mL.
9. (a) Name the energy which arises due to motion of atoms or molecules in a body.
   (b) How is this energy affected when the temperature is increased?

   Or

   Give the relationship between isothermal and free expansion of an ideal gas.

Q10 (a) Give the importance of measuring BOD of a water body.

(b) What is desirable concentration of fluoride ion pH of drinking water?

Q11 Predict the formulae of the stable binary compounds that would be formed by the combination of the following pairs of elements:

a) Element 71 and F

b) Al and I

c) Si and O

d) P and F.

12 Why the bottle containing hydrogen peroxide should be cooled before opening?
Write oxiding and reducing reaction of Hydrogen per oxide.

13 Calculate the standard enthalpy of formation of one mole of CH_3OH (l), if the combustion of one mole of methanol takes place at 298 K and 1 atm and after combustion CO_2 (g) and H_2O

(l) are produced and 726 kJ of heat is liberated. Assume that the standard enthalpies of formation of CO_2 (g) and H_2O (l) are - 393 kJ/mol and -286 kJ mol respectively.

14 What are the uses of sodium carbonate? Write its preparation and involved reactions

15 Describe in detail the expanded octet with suitable examples.

16 How would you prepare alkanes from alkenes?

17.(i)Which defect lowers the density of solids.

(ii)Explain the following terms

(a)Ferromagnetism

(b) F –Centres

OR

The density of copper is 8.95g/cm^3.It has fcc structure. What is the radius of Cu atom.Atomic mass of Cu is 63.5g/mol.

18. (a) Define:

i) Intensive properties

ii) Adiabatic process

(b) Derive $\Delta G = -T\Delta S_{total}$ from the relationship G = H – TS.

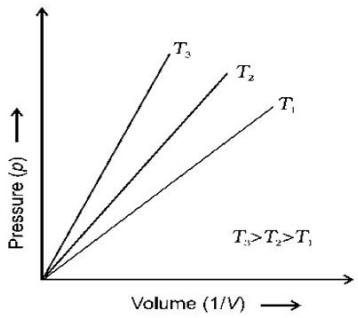
19 We know that 75% of solar energy reaching the earth, is absorbed by earth's surface increases its temperature. The rest of heat radiates back to the atmosphere. Some of the heat is trapped by gases such as CO, CH_4, O_3, CFC's and water vapours present in the atmosphere. This causes global warming.

a) Suggest some measures to decrease CO gas in the atmosphere.

b) Give a method to save ozone layer.

c) Will the use of solar energy solve our problems? Comment.

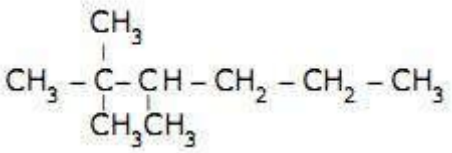
20 Comment on the graph below.20

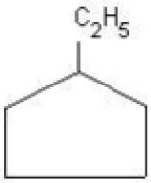


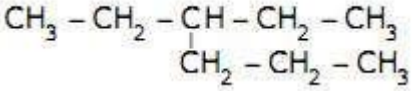
21If the density of 3M solution of NaCl is 1.25g/mL, calculate the molality of the solution.

22(i) Draw the structural isomers of pentane.

Q23 Give the IUPAC names of the following compounds.

a) 

b) 

c 

24.Account for the following

(i)Nitrogen is found in gaseous state.

(ii)Nitrogen does not form pentahalides.

(iii)Ammonia is more basic than phosphine.

25a) Convert :

a. Benzene to p-nitrobromobenzene

b. Ethyl chloride to ethene.

i. Give mechanism of addition of HBr to propene.

ii. Write a note on Friedel-Crafts alkylation.

Or

Balance the following equation in acidic medium by half reaction method.

$$Cr_2O_7^{2-} + C_2H_4O \rightarrow C_2H_4O_2 + Cr^{3+}$$

26 From the structures given below, answer the questions.

I. $CH_3 - CH_2 - CH(OH) - CH_3$

II. $(CH_3)_2 - C(OH) - CH_3$

III. $CH_3 - CH_2 - CH_2 - CH_2 - OH$

IV. $CH_3 - O(CH_3) - CH - CH_3$

V. $CH_3 - O - CH_2 - CH_2 - CH_3$

VI. $CH_3 - CH_2 - O - CH_2 - CH_3$

VII. $CH_3 - CH(CH_3) - CH_2 - OH$

a) The pair of compounds that represent chain isomerism.

b) The pair of compounds that represent position isomerism.

c) The pairs of compounds which are functional group isomers.

d) The compounds that form pairs of metamers.

e) Distinguish between position and functional isomerism with an example.

Or

Convert the following:

a) Benzene to Benzoic acid

b) Bromoethane to Butan-1-ol

c) Ethene to Propene

d) Ethyne to Methane

e) Propene to Propan-2-ol

27(i).For the reaction, 2 Cl(g) → Cl2(g), what are the signs of ΔH and ΔS ?

(ii) For the reaction 2 A(g) + B(g) → 2D(g) ΔU 0 = –10.5 kJ and ΔS0 = –44.1 JK–1. Calculate ΔG0 for the reaction, and predict whether the reaction may occur spontaneously.

ANSWER KEY

CHEMISTRY (Theory)

CLASS – XI

Time allowed: 3 hours **ANSWERS** Maximum Marks: 70

1. 32.93.

2.

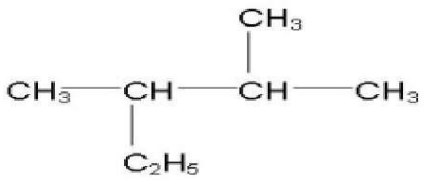
i. $^{138}_{56}Ba$

ii. $^{55}_{26}Fe$

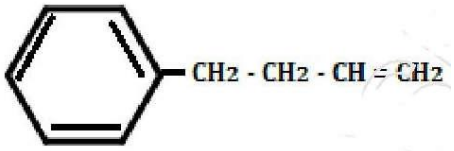
3. Due to poor screening effect of 10 d electrons, effective nuclear charge in Ga increases leading to decrease in size.

4.

a)



b)



5. It will remain the same because the rate of inflow is equal to the rate of outflow. This state is called state of equilibrium.

6. Due to small size, the ionization energy of Be and Mg are much higher than alkaline earth metals. So they need large amount of energy for excitation of electrons to higher energy levels. This energy is not available in Bunsen flame and so do not impart any colour to the flame.

7. Any two diferrence

8Molarity = 3M

Density = 1.25g/mL

Mass of NaCl in 1L solution

= Molarity x molar mass = = 3 x 58.5 = 175.5g

Density = $\frac{\text{Mass}}{\text{Volume}}$

Mass of 1L NaCl solution = 1.25 x 1000 = 1250g

Mass of water in solution = 1250-175.5 = 1074.5g = 1.0745 kg

$$\text{Molality} = \frac{\text{No. of moles of solute}}{\text{Mass of water}} = \frac{3}{1.0745} = 2.79 \text{ m}$$

9

a) Kinetic energy.

b) It increases with increase in temperature.

Or

Work done in isothermal reversible expansion of an ideal gas

$W = -2.303\ nRT \log V_2/V_1 = -2.303\ nRT \log P_1/P_2$

In the free expansion of an ideal gas, w = 0 because ideal gases have negligible force of attraction, therefore work done is zero in free expansion because no external force is acting.

$W = -P_{ext}\ \Delta V$

$P_{ext} = 0$; $w = 0$

10 BOD is a measure of level of pollution caused by organic biodegradable material. Low value of BOD means water is less polluted.

1 ppm is desirable concentration of fluoride ions in drinking water. The pH of drinking water should be between 5.5 – 9.5.

11.

a) LuF_3

b) AlI_3

c) SiO_2

d) PF_5

12 Hydrogen peroxide is unstable and so decomposes in water and oxygen on long standing or heating. Hence to lower the vapour pressure inside the bottle, it is cooled before opening.

13

a) Combustion of methanol:

$CH_3OH\ (l) + 3/2O_2\ (g)\ \ CO_2\ (g) + 2H_2O\ (l);\ \Delta H = -726\ kJ/mol$ ----- (1)

b) Enthalpy of formation of carbon dioxide:

$C_{(graphite)} + O_2\ (g)\ \ CO_2\ (g)\ ;\ \Delta H = -393\ kJ/mol$ ---------- (2)

c) Enthalpy of formation of water:

$H_2\ (g) + ½\ O_2\ (g)\ \ H_2O\ (l);\ \Delta H = -286\ kJ/mol$ ---------- (3)

d) Required reaction:

$C_{(graphite)} + 2H_2 (g) + 1/2\ O_2 \quad CH_3OH\ (l)$; $\Delta H = ?$ ---------- (4)

$\Delta H = (-572 - 393) - 726 = -239$ kJ/mol

14.

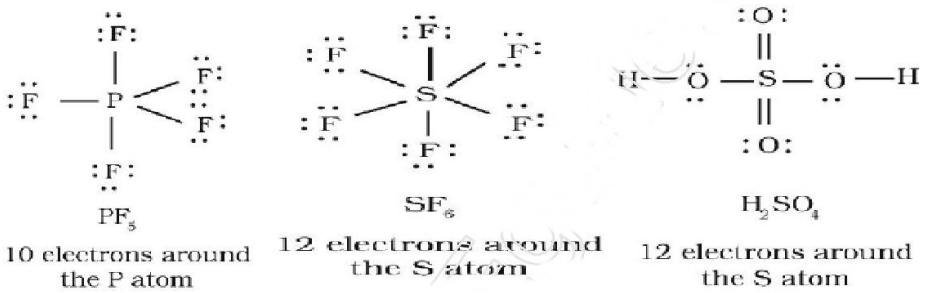
a) It is used in water softening, laundering and cleaning.

b) It is used in the manufacture of glass, soap, borax and caustic soda.

c) It is used in paper, paints and textile industries.

d) It is an important laboratory reagent both in qualitative and quantitative analysis.

15Elements in and beyond the third period of the periodic table have, apart from 3*s* and 3*p* orbitals, 3*d* orbitals also available for bonding. In a number of compounds of these elements there are more than eight valence electrons around the central atom. This is termed as the expanded octet. Obviously the octet rule does not apply in such cases. Some of the examples of such compounds are: PF_5, SF_6, H_2SO_4 and a number of coordination compounds.



16 Dihydrogen gas adds to alkenes and alkynes in the presence of finely divided catalysts like platinum, palladium or nickel to form alkanes. This process is called hydrogenation. These metals adsorb dihydrogen gas on their surfaces and activate the hydrogen – hydrogen bond. Platinum and palladium catalyses the reaction at room temperature but relatively higher temperature and pressure are required with nickel catalysts.

$$CH_2 = CH_2 + H_2 \xrightarrow{Pt/Pd/Ni} CH_3 - CH_3$$

$$CH_3 - CH = CH_2 + H_2 \xrightarrow{Pt/Pd/Ni} CH_3 - CH_2 - CH_3$$

17.Correct definition and explanation.

OR

Radius of Cu=128pm

18. $\sqrt{}$

a) Nitrogen dioxide is extremely toxic to living tissues and harmful to plants, paints, textiles and metals. It causes acid rain. It produces photochemical smog.

19.

a)

i) The properties which depend only on the nature of the substance and not on the amount of the substance are called intensive properties. Example: Density.

ii) A process in which no heat flows between the system and the surroundings is called an adiabatic process i.e. $q = 0$.

b) Change in Gibbs energy, $\Delta G = G_2 - G_1$,
Enthalpy change, $\Delta H = H_2 - H_1$,

Entropy change, $\Delta S = S_2 - S_1$,

$\Delta G = \Delta H - T\Delta S$

$\Delta S_{total} = \Delta S_{system} + \Delta S_{surrounding}$

$$\Delta S_{total} = \Delta S_{system} - \frac{\Delta H_{sys}}{T}$$

$$\Delta S_{total} = \Delta S - \frac{\Delta H}{T}$$

Multiply by T,

$T\Delta S_{total} = T\Delta S - \Delta H$

$T\Delta S_{total} = \Delta H - T\Delta S = \Delta G$

Therefore, $\Delta G = - T\Delta S_{total}$

20.

a) Using CNG as a fuel, using public transports, electric cars and bicycles and avoiding burning of dry leaves, plastic bags etc.

b) Banning CFCs used in refrigerators, AC etc., and using less amount of diesel and petrol.

c) Yes. Solar energy reduces pollution. By making green building, a lot of natural light and natural cooling and heating takes place which save lot of energy and environment.

21It represents the graph between *P* and 1/V. It is a straight line passing through origin. However at high pressures, gases deviate from Boyle's law and under such conditions a straight line is not obtained in the graph.

21 Molarity = 3M

Density = 1.25g/mL

Mass of NaCl in 1L solution

= Molarity x molar mass = = 3 x 58.5 = 175.5g

Density = Mass/Volume

Mass of 1L NaCl solution = 1.25 x 1000 = 1250g

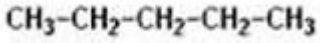
Mass of water in solution = 1250-175.5 = 1074.5g = 1.0745 kg

Molality = No. of moles of solute/Mass of water

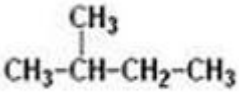
$$= \frac{3}{1.0745} = 2.79 \text{ m}$$

22.

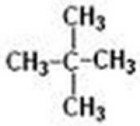
i. There are three structural isomers of pentane:



n-Pentane



2-Methylbutane



2,2-Dimethylpropane

23 a)2, 2, 3-Trimethylhexane

a) Ethylcyclopentane

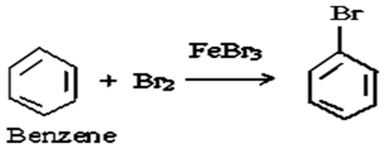
b) 3-Ethylhexane

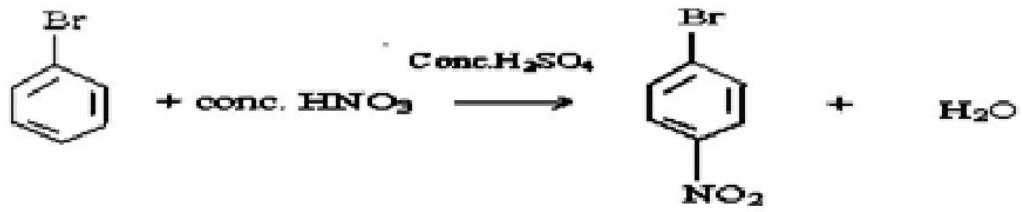
24.Correct reason

25.

a)

(i) Benzene to p-Nitrobromobenzene





p-Nitrobromobenzene

ii) Ethyl chloride to ethane

CH_3CH_2Cl + Alc. KOH $CH_2 = CH_2 + KCl + H_2O$

a) Mechanism of addition of HBr to propene

Step – 1

$CH_3 - CH = CH_2 + H^+ \rightarrow CH_3 - CH_2 - \overset{+}{C}H_2$ (Primary carbocation, less stable)

Step – 2

$CH_3 - CH = CH_2 + H^+ \rightarrow CH_3 - \overset{+}{C}H - CH_3$ (Secondary carbocation, more stable)

Step – 3

$CH_3 - \overset{+}{C}H - CH_3 + Br^- \rightarrow CH_3 - CH(Br) - CH_3$ (Major product)

b) Friedel- Crafts alkylation – It is the reaction of benzene with alkyl halide in presence of anhydrous aluminium chloride. The reaction results in the formation of alkyl benzene.

$$C_6H_6 + CH_3Cl \xrightarrow{Anhy.AlCl_3} C_6H_5CH_3 + HCl$$

Or

a) Write the oxidation no. of each atom

$$\underset{+6}{Cr_2}O_7^{2-} + \underset{-1}{C_2}H_4O \rightarrow \underset{0}{C_2}H_4O_2 + \underset{+3}{Cr^{3+}}$$

b) Write separately oxidation & reduction half reactions

Oxidation half reaction:

$$\underset{-1}{C_2}H_4O \rightarrow \underset{0}{C_2}H_4O_2$$

Reduction half reaction:

$$\underset{+6}{Cr_2}O_7^{2-} \rightarrow \underset{+3}{Cr^{3+}}$$

c) Balance Cr atoms in reduction half reaction

$$Cr_2O_7^{2-} \rightarrow 2Cr^{3+}$$

d) Balance O atoms and H atoms

$$C_2H_4O + H_2O \rightarrow CH_2O_2 + 2H^+ + 2e^-$$

$$Cr_2O_7^{2-} + 14H^+ \rightarrow 2Cr^{3+} + 7H_2O$$

e) Balance the charges

$$C_2H_4O + H_2O \rightarrow CH_2O_2 + 2H^+ + 2e^-$$

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$$

f) Equalize the electrons lost and gained by multiplying the oxidation half reaction with 3

$$3C_2H_4O + 3H_2O \rightarrow 3C_2H_4O_2 + 6H^+ + 6e^-$$

Adding the oxidation half reaction and reduction half reaction we get,

$$3C_2H_4O + 3H_2O \rightarrow 3C_2H_4O_2 + 6H^+ +$$

$$6e^- Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$$

$$3C_2H_4O + Cr_2O_7^{2-} + 8H^+ \rightarrow 3C_2H_4O_2 + 2Cr^{3+} + 4H_2O$$

26.

a) I and III

b) I and III

c) VI and VII

d) V and VI

e) Those isomers which differ in position of functional groups are called position isomers. Eg – But-1-ene and But-2-ene and those isomers which differ in functional groups are called functional isomers. Eg – Ethanol and Dimethyl ether.

Or

a) $C_6H_6 \xrightarrow{CH_3Cl/an.AlCl_3} C_6H_5CH_3 \xrightarrow{(O)/KMnO_4} C_6H_5COOH$

b) $CH_3CH_2Br \xrightarrow{WurtzReaction} CH_3CH_2CH_2CH_3 \xrightarrow{Cl_2/hv} CH_3CH_2CH_2CH_2Cl$

$\xrightarrow{KOH} CH_3CH_2CH_2CH_2OH$

c) $CH_2 = CH_2 \xrightarrow{HI} CH_3CH_2I \xrightarrow{KCN} CH_3CH_2CN$

$\xrightarrow{4[H]} CH_3CH_2CH_2NH_2 \xrightarrow{HNO_2} CH_3CH_2CH_2OH \xrightarrow{alc.KOH} CH_3 - CH = CH_2$

d) $CH \equiv CH \xrightarrow{H_2O/HgSO_4 \text{ or } H_2SO_4} CH_3CHO \xrightarrow{(O)/KMnO_4} CH_3COOH \xrightarrow{NaOH} CH_3COONa$

$\xrightarrow{\text{decarboxylation/NaOH/CaO}} CH_4$

e) $CH_3 - CH = CH_2 + HBr$ $CH_3 - CH(Br) - CH_3 + aq.KOH$ $CH_3 - CH(OH) - CH_3$

27. (i)ΔH and ΔS are negative The given reaction represents the formation of chlorine molecule from chlorine atoms. Here, bond formation is taking place. Therefore, energy is being released. Hence, ΔH is negative. Also, two moles of atoms have more randomness than one mole of a molecule. Since spontaneity is decreased, ΔS is negative for the given reaction.

(ii) For the given reaction, 2 A(g) + B(g) → 2D(g) Δng = 2 – (3) = –1 mole Substituting the value of ΔUθ in the expression of ΔH: ΔHθ = ΔUθ + ΔngRT = (–10.5 kJ) – (–1) (8.314 × 10–3 kJ K–1 mol–1) (298 K) = –10.5 kJ – 2.48 kJ ΔHθ = –12.98 kJ Substituting the values of ΔHθ and ΔS θ in the expression of ΔGθ : ΔGθ = ΔHθ – TΔS θ = –12.98 kJ – (298 K) (–44.1 J K–1) = –12.98 kJ + 13.14 kJ ΔGθ = + 0.16 kJ Since ΔGθ for the reaction is positive, the reaction will not occur spontaneously

BLUE PRINT

SESSION ENDING CHEMISTRY QUESTION PAPER

CLASS –XI

TIME : 3hrs

S.NO	UNIT	VSA (1 MARK)	SA1 (2 MARKS)	SA II (3 MARKS)	LA (5 MARKS)	TOTAL MARKS
1	SOME BASIC CONCEPS		1-	1	-	5
2	ATOMIC STRUCRURE	1-	-	2	-	7
3	CLASSIFICATION &PERIODIC PROPERTIES	-	-2		-	4
4	CHEMICAL BONDING	-	1	1		5
5	STATES OF MATTER	-	2	-	-	4
6	CHEMICAL THERMODYNAMICS	-	-	2	-	6
7	EQUILIBRIUM	1		-	1	6
8	REDOX	-	-	1		3
9	HYDROGEN	-		1	-	3
10	S-BLOCK ELEMENTS		1	1	-	5
11	P BLICK ELEMENTS	1	-	-	1	6
12	ORGANIC BASIC CONCEPS	2	-	1	-	5
13	HYDROCARBON	-		1	1	8
14	ENVIORENMENTAL CHEMISTRY		-	1	-	3
	QUESTIONS	5	7	12	3	
	TOTAL MARKS	5	14	36	15	70

DESIGN

S.NO	TYPE OF QUESTION	MARKS FOR EACH QUESTION	NO. OF QUESTION	TOTAL MARKS
1	**LONG ANSWER(LA)**	5	3	15
3	**SHORT ANSWERS-II (SA II)**	3	12	36
4	**SHORT ANWERS- I (SA I)**	2	7	14
5	**VERY SHORT ANSWER (VSA)**	1	5	5
	TOTAL		27	70

SESSION ENDING EXAM

CLASS—XI

PAPER 03

Time-3hrs **SUB—CHEMISTRY** **MM70**

General Instructions:

1. All questions are compulsory
2. Marks of each question are indicated against it.
3. Question numbers 1 to 5 are very short questions, each of 1 mark. Answer these in one word or about one sentence each.
4. Question numbers 6 to 12 are short answer questions of 2 marks each. Answer this in about 30 words each.
5. Question numbers 13 to 24 are short answer questions of 3 marks each. Answer these in about 40 words each.
6. Question numbers 25to 27 are long answer questions of 5 marks each. Answer these in about 70 words.
7. Use log tables if necessary. Calculators are not permitted

Q1	What is the lowest value of *n* that allows g orbitals to exist?
Q2	Indicate sigma and pi bonds in HCONHCH3
Q3	What is inorganic benzene.
Q4	Write the conjugated base of HSO4-
Q5	Give the reason for the fusion of an organic compound with metallic sodium for testing nitrogen , sulphur and halogens ?
Q6	What do you mean by electron gain enthalpy ?The electron gain enthalpy of **S** is More than Oxygen. OR a)Mg^{2+}, N^{3-}, Na^{+}, O^{2-} (arrange in increasing order of ionic radii) b),K, Na, Mg, Ca, Cs, Al,(arrange in increasing order of metallic character)
Q7	A sample of sulphuric acid is 98% by mass and density is 1.84 g/cm3.Find its molarity.
Q8	Give reason i) Alkali metal impart color with flame.s ii)BeO is insoluble but BeSO4is soluble in water.
Q9	a)Write IUPAC name and symbol of element having Z=112.

	b) Out of Na and Na+ which has higher ionisation enthalpy and why.
Q10	On the basis of VSEPR theory draw the structure and mention the shape of A)SO2 b) XeF4
Q11	a) Classify each of the following as ionic, molecular and covalent solids:Graphite, LiBr, I_2 b)What are F-centre? c)How many atoms are present in FCC crystal.
Q12	a)What are the values of molar volume and temperature at SATP b)What is compressibility factor c)What is the SI unit of surface tension
Q13	What do you understand by the terms— a)Enthalpy of Atomisation. b)Lattice enthalpy c)define the term Entropy and predict the sign of entropy change H2O (l) → H2O (s)
Q14	(a) balance the following equation in acidic medium $Cr_2O_7^{2-} + Fe^{2+} \rightarrow Cr^{3+} + Fe^{3+}$ (b) assign the oxidation number of S in H2SO4
Q15	(i) calculate the energy of the second orbit of He+ ion (i) write the electronic configuration of Cr(Z= 24) and indicate the number of unpaired electrons
Q16	(i) Define law of multiple proportion with one example (ii) Define limiting reagent with one example (iii) Express the number 1.789896 to four significant figure
Q17	(i) What is photochemical; smog? (ii) How can it be controlled? (iii) What do you mean Biolgical Oxygen Demand (BOD) ?
Q18	Illustrate with one reaction (i) Friedel craft alkylation (ii) Anti Markownikov addition or Karasch effect (iii) Wurtz reaction
Q19	Explain with an example

(a) Inductive effect
(b)Electrophilie
(c)Write the bond line formula for But-2-en-1-ol

Q20 Describe M.O diagram of $O2^{2-}$ and find the bond order and magnetic behaviour

OR

Describe hybridization and bonding in C2H2

Q21(a) Write Hunds rule of maximum multiplicity
(b)Write all quantum numbers for 3d4 .

Q22 Calculate standard enthalpy of formation of CH3OH (l) from the following data
(i) CH3OH(l) + 3/2 O2 → CO2 + 2H2O , ΔfHO =-726Kj/mol
(ii)C + O2 → CO2 , , ΔfHO = 393 Kj/mol
O2 -→ H2O , ΔfHO = 285,83Kj/mol

Q23 (i) What causes temporary and permanent hardness of water ?
(ii) write one method to remove permanent hardness of water ?

Q24 (i) Write one biological importance of Na and K
(ii) Potasssium Carbonate cannot be prepared by Solvay process
(iii) Write two diagonal relationship between Be and Al

Q25 (i) $[SiF6]^{2-}$ is known but $[SiCl6]^{2-}$ not why ?
(ii) TlCl is more stable than TlCl3 , Why?
(iii) What are silicones? How is it prepared ? Write its one application

OR

(a) What is the action of heat on boric acid ?
(b) $AlF6^{3-}$ exists But $BF6^{3-}$ does not ?
(c) Describe the hybridization and bonding in di borane (B2H6)

Q26 (a) Di hydrogen gas is obtained from natural gas by partial oxidation with steam as CH4(g) + H2O (g) ←→ CO (g) + 3H2(g)
(i) Write the expression for Kp
(ii) What will be effect of increase in pressure on equilibrium ?

(b) For the reaction CH4 (g) + 2H2S ← → CS2 (g) + 4H2 (g) at 1173K , the equillibirum constant Kc is 3.6 if [CH4] = 1.07M , [H2S] = 1.20M ,[CS2] = 0.90M ,

	[H2] = 1.78M , Find the direction of reaction OR (a) Why is HCl added before H2S during qualitative analysis of second group radicals ? Explain with reaction ? (b) The solubility product of AgCrO4 at 298K is 4×10^{-12}.Find out its solubility at this temperature. **Q27** Complete the following reactions . (a) (i) C6H6 + ? → $C_6H_5COCH_3$ (acetophenone) + HCl (ii) (CH3)2C=CHCH3 + O3/H2O → ? (b) Write the mechanism for nitration of benzene OR How would you convert (write chemical reaction only) (i) propene to 1-bromopropane (ii) ethene to ethane (iii) propane to propene (iv) benzene to toluene (v) ethanoic acid to methane

SESSION ENDING EXAMINATION 2017-18
CLASS: XI
SUBJECT: CHEMISTRY

MM: 70 TIME: 3 Hours

SUGGESTIVE MARKING SCHEME

ANSWER NO.	EXPECTED VALUE POINTS FOR EACH STEP	DISTRIBUTION OF MARKS	TOTAL MARKS
1.	n=5 if g orbital	1	1
2.	7-sigma and 01 Pi bond	½ each	1
3.	Borazine/formula B3 N3 H6	1	1
4.	SO_4	½	1
5.	To convert in the Inorganic salt	1	1
6.	Definition of electron gain enthalpy- Less inter electronic repulsion in large 3p orbitals of Sulphur. Or (a) $Mg^2+<Na+<O^2-<N^3-$ (b) Al < Mg <Ca <Na <K < Cs	1 1 1 1	2
7.	Given Let Mass of impure sulphuric acid = 100 g Mass of pure sulphuric acid = 98 g Density =1.84g/ml Volume of Sulphuric acid = 100/1.84 = 54.38ml = 0.0543 litre Mole of 98 g sulphuric acid = 98/98 = 1 Molarity = mole /vol(litre) = 1/0.0543 = 1804 M	1 1	2
8.	(i) Low ionization enthalpy. Excited electrons releases energy (ii) Due to hydration enthalpy and lattice enthalpy	1 1	2
9.	(a) IUPAC name: Ununbium Symbol: Uub (b) Na+fully filled stable electronic configuration	½ ½	2
10.	(a) correct structure Shape : Pyramidal (b) correct structure Shape: square planar	1 1	2

	Q11 i)correct classification **ii)correct statement** **iii)4** **Q12 a)24.8L &298.15K** **b)Z=PV/nRT** **c)Nm-1**		
12.	(i) correct definition (ii) correct definition (iii) Definition Sign – Negative	1 1 1	3
13.	(a) $Cr_2O_7^{2}$- +14H+ + 6Fe^{2}--→2Cr^{3} +7H_2O + 6 Fe^{3}+ (b) +6	1 1	3
14	(i) Z =2 n = 2 Correct formula, Calculation Ans = -2.18 x 10-18 J/atom ( ) Electronic Configuration: 4s,13d5 Unpaired electron : 6	 1 1 ½ +1/2	3
15	(i) Correct statement with one example (ii) Correct definition with one example (iii) 1.790	1 1 1	3
16	(i) It is mixture of smoke and fog caused by warm, dry and sunny climate. Its components are unsaturated hydrocarbons and nitrogen oxides. (ii) By plantation of Pinus,Juniparus,Qujercus etc plants which metabolise nitrogen oxides.by using catalytic converter in automobiles which prevent the release of nitrogen dioxide. (iii) Correct definition	1 1 1	3
17	(i) Correct Definition with one reaction (ii) Correct Definition with one reaction ( ) Correct Definition with one reaction	1 1 1	3
18.	(i) Correct Definition with one example	1	

	(ii) Correct Definition with one example ( ) But-2-en-1 –o1 correct bond line formula	1 1	3
19	Hybridization in C_2H_2 is sp. Its Correct Description, diagram of bond formation. Or Correct MO diagram Bond order = 1 (calculation required) Magnetic nature = Diamagnetic	1+1+1 2 1/2 1/2	3 3
20	(a) correct statement with one example (b) n = 3, 1 = 2, m = 1, s = = 1/2	2 1	 3
21.	Required reaction for the formation of CH_3OH(1) is as follows: Formula, calculations. j/mol By (ii) + 2x(iii) – (i) Ans = - 238.66 Kj/mol	1 1 1	 3
22	(i) Cause of temporary hardness of water: Presence of calcium or magnesium salt of hydrogencarbonate Cause of permanent hardness of water: presence of calcium or magnesium salt of chloride or sulphate ( )any one method to remove permanent hardness of water: by treatment with sodium carbonate, Calgon's method, ion-exchange method or synthetic resin method	1 1 1	 3
23.	(i) in the transmission of nerve signals, ion regulating the flow of water across cell membrane, and metabolism. (ii) Pottasium bi carbonate is highly soluble and cannot be precipitated, 1, ( ) (a) Like aluminium, Be is not readily attacked by acids. (b) Both Be and Al have strong tendency to form complexes.	1 1 1	3
24	(a) Karanvir (b) The atmospheric pressure is less at hill station due to which water boils below 100 c and vegetable and pulses take long time in cooking. (c) Scientic method to save time, money and energy. (d) Karanvir needs less fuel as pressure cooker helps in cooking at faster rate.	1 1 1 1	 4
25	(a) (i) because of larger size of chlorine it can not accommodate around Silicon. (ii) because of inert pair effect. ( ) (i) they are a group of organosilicon Polymers which have (-R_2SiO-) as a repeating unit.	 1 1 1	

	Preparation: the starting materials for the manufacture of silicones are alky1 or ary1 substituted silicon chlorides. Description, reaction Application: as sealant,greases,electrical Insulators and for water proofing of fabrics etc. Or (a) (i) H_3BO_3 HBO_2+H_2O $2HBO_2$ $B2O_3 + H_2O$ ( ) Since Boron does not contain d-suborbit, Its maximum covalency is four. Sp3 (b) Proper description	1 1 1 1 3	5
26	(a) (i) Kp= expression (ii) Backward reaction (c) Values given Formula, calculation Ans = 1.8 73 QC OF Reaction It is less than 3.6. Hence its direction is forward. OR (a) HCl and H_2S dissociates: Hydrochloric acid being a strong acid produces sufficient H+ .So the concentration of sulphide ions produced by the ionization of H_2S is sufficiently decreased due to common ion effect. As a result of which the sulphide ion concentration is sufficient only to exceed the solubility product of the sulphides of group II cations. Correct Reaction (b) Equation and calculations. We know, Ksp = $(2S)^2xS$ Ans – 10^{-4}	1 1 1 2 1 1 1	5
27	(a) (i) CH3COCl (ii) acetone and acetaldehyde ( ) Correct mechanism. OR (i) Correct reaction (ii) Correct reaction (iii) Correct reaction (iv) Correct reaction (v) Correct reaction	1 1 3 1 1 1 1 1	5

SESSION ENDING EXAMINATION
CHEMISTRY
CLASS-XI
PAPER 04

BLUE PRINTTime Allowed: 3 Hrs. Maximum Marks:70

S No	UNIT	VSA(1 marks)	SAI(2marks)	SAII(3marks)	LA(5 marks)	TOTAL
1	Some basic concept of chemistry		2(1)	3(1)		11
2	Structure of atom	1(1)	2(1)	3(1)		
3	Classification of elements and periodicity in properties	1(1)		3(1)		4
4	Chemical bonding and molecular structure		2(1)	3(1)		21
5	States of matter; gases and liquid	1(1)				
6	Thermodynamics			6(2)		
7	Equilibrium				5(1)	
8	Redox reaction		2(1)			16
9	Hydrogen	1(1)	2(1)			
10	S-block elements			6(2)		
11	Some p block elements		2(1)		5(1)	
12	Organic chemistry: some basic principle and technique			6(2)		18
13	Hydrocarbons		2(1))	3(1)	5(1)	
14	Environmental chemistry	1(1)		3(1)		
	TOTAL	5(5)	14(7)	36(12)	5(3)	70(27)

SESSION ENDING EXAMINATION

SUB: CHEMISTRY

CLASS-XI

TIME: 3 Hrs. MAX.MARKS-70

GENERAL INSTRUCTIONS:

1. *Answer all the questions:*
2. *Questions no.1 to 5 carry one mark each.*
3. *Questions no.6 to 12 carry 2 marks each.*
4. *Questions no.13 to 24 carry 3 marks each.*
5. *Questions no.25 to 27 carry 5 marks each.*
6. *There is no overall choice. However there is internal choice in one question each of two mark and three marks questions. All 5 marks questions have internal choice.*
7. *Calculator or any other electronic items are not allowed. However logarithm book may be used for calculations.*

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1) State Dalton's law of partial pressure.

2) What do you mean by green chemistry?

3) Write the correct set of four quantum no for the valence electron of Potassium atom(Z=19)

4) . Draw the structure of BeCI2 (vapour).

5) Write the IUPAC name and symbol for the element with atomic no 119.

6) How many grams of NaOH should be dissolved to make 100 ml of 0.15 M NaOH solution?

7) An electron has a speed of 40 ms^{-1} accurate up to 99.99% what is uncertainty in locating its position?(Given Me=9.11×10^{-31}kg)

8) Give correct reason for the following:

(a) BF_3 has zero dipole moment although the B—F bonds are polar.

(b)Give the resonance structures of CO_3^{2-} ion.

9) Balance the following redox reaction by ion electron method in basic medium.

MnO_4^{-1} (aq) $+I^- \rightarrow MnO_2(s) + I_2(s)$

10) Complete the following reactions

(a) $PbS(s) + H_2O_2$ (aq)→

(b) Ca $(HCO_3)_2$ +Ca $(OH)_2$→

OR

Account for the following:

(a) Soft water lathers with soap but not hard water.

(b) Temporary hardness of water can be removed by boiling.

11. Draw the *cis*and *trans*structures of but-2-ene. Which isomer will have higherb.p. and why?

12.(i) Why does boron triflouride behave as a Lewis acid ?

(ii) $PbCl_4$ is better oxidising agent than $PbCl_2$?

13) Account for the following:

(a) Ionisation enthalpy of nitrogen is more than that of Oxygen

(b) Acation is always smaller than their parent atom.

(c) Noble gases have large positive electron gain enthalpy.

14) (i) State and explain Hess´s law of constant heat summation?

(ii) For the reaction:

$2A (g) + B (g) \rightarrow 2D (g)$

$\Delta H^\circ = -10.5 KJ$ and $\Delta S^\circ = -44.1\ JK^{-1}\ mol^{-1}$ Calculate ΔG° for the reaction .

15) (a)StatePauli's exclusion Principles
(b) Account for the following:

(i) Chromium has the configuration $3d^5 4S^1$ and not $3d^4\ 4S^2$

(ii) Bohr's orbit are called stationary orbits or states.

16) (a) What do you mean by BOD?

(b)Give two difference between classical smog and photo chemical smog..

17) (a) write the molecular configuration of O_2^+ molecular ion calculate its bond order and predict its magnetic behaviour.

(b) What is state of hybridization of nitrogen in NH_4^+ ion.

18) Account for the following:

(a)Solutions of alkali metals in liquid ammonia are paramagnetic.
(b) Beryllium and Magnesium do not give colour to flame.
(c)Alkali metals and alkaline earth metals cannot be obtained by chemical reduction.

OR

Compare the alkali metals and alkaline earth metals with respect to (i) ionisation enthalpy (ii) basicity of oxides and (iii) solubility of hydroxides.

19) a) Define surface tension with their unit.
b) Calculate the volume occupied by 8.8 gm of CO_2 at 31.1^0C and 1 bar pressure.
($R=0.083 bar\ LK^{-1} mol^{-1}$)

20) Arrange the following in order of property mentioned against each:

(a) (i) $(CH_3)_3C^+$, $CH_3CH_2CH^+(CH_3)$, $CH_3CH_2CH_2CH_2^+$ (decreasing stability order)

(ii)CH_3CH_2COOH, $(CH_3)_2CHCOOH$ and $(CH_3)_3COOH$ (Increasing acidic strength)

(b)Write the name of Isomerism among the following compounds

CH_3-O-$CH_2CH_2CH_3$& C_2H_5-O-C_2H_5

21) Calcium carbonate react with aqueous HCl to give $CaCl_2$ and CO_2 according to reaction:

$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

What mass of $CaCO_3$ is required to react completely with 25 ml of 0.75M HCl ?

22) Write the all reactions involved in the preparation of sodium carbonate from sodium chloride in Solvay process.

23) (a) Which of the following carboanion is more stable and why?

(i) $(CH_3)_3CCH_2^{\ominus}$

(ii) $CH_3C^{\ominus}HCH_2CH_3$

(iii) $CH_3CH_2CH_2^{\ominus}$

(b)Why is $O_2NCH_2O^-$ is expected to be more stable than $CH_3CH_2O^-$

24) (a) How do you account for the formation of ethane during chlorination of methane? Explain giving mechanism.

(b)How many sigma and Pi bonds are present in

CH_2=CH—C≡CH

25) (a) Write the conjugate acid of CH_3OO^-

(b) Calculate the pH of a $1x10^{-8}$ M solution of HCl.

OR

(a)Write the conjugate acid of NH_3.

(b)Consider the reaction:

$N_2(g) + H_2(g) \rightleftharpoons 2NH_3$ +Heat

Indicate the direction in which the equilibrium will shift when:

(i) Temperature is increased

(ii) Pressure is increased

26. a) Draw the structure of B_2H_6.

b) What happens when

(i) Boric acid is added to water

(ii)Aluminium is treated with dilute NaOH

c) Give suitable reason for the following:

(i)$[SiF_6]^{2-}$ is known whereas $[SiCl_6]^{2-}$ not

(ii)In group 14, the tendency for catenation decreases with increasing atomic no.

OR

(a)Complete the following chemical equation:

heat

(i) $Fe_2O_3 + 3CO \rightarrow$

(ii) $CaCO_3 + 2HCl \rightarrow$

(b)Write a brief account for the following:

(i) Diamond is covalent yet it has high melting point.

(ii) Atomic radius of gallium (135pm) is less than that of Aluminium (143pm).

(iii)Graphite is a good conductor of electricity but but diamond is insulator

27. (a) Explain the following reaction with examples

i) Wurtz reaction.

ii) Friedal-craft alkylation reaction.

(b)An alkene A on ozonolysis gives a mixture of ethanal and pentan-3-one write the structure of compound A

(c)Give a chemical test to distinguish between ethane and ethyne

OR

a. Write the suitable reason for the following:

(i)C-C bond length in benzene ring is 139 pm which is in between C-C (single bond)154pm and C=C (double bond) 133pm

(ii)Trans – 2-butene has higher melting point than cis – isomer.

b. Draw cis and trans isomers of 1,2-Dicloroethene.

c. How will you carry out following conversions :

(i)Ethyne to benzene

(ii)propene to 2-bromo propane

MARKING SCHEME

1. The total pressure exerted by the mixture of non-reactive gases is equal to the sum of the partial pressures of individual gases i.e., the pressures which these gases would exert if they were enclosed separately in the same volume and under the same conditions of temperature.

1

2. Green chemistry is a way of thinking and is about utilising the existing knowledge and principles of chemistry and other sciences to reduce the adverse impact on environment.

1

3. n=4,l=0,m=0,s=+½ 1

4. Correct structure 1

5. Ununennium,Uue

6. Molarity = W_B/M_B x 1000/vol. of sol. in ml.1/2

M_B = 23+16+1 = 401/2

W_B = 0.15 x 40 x 100/1000 = .6g½+½

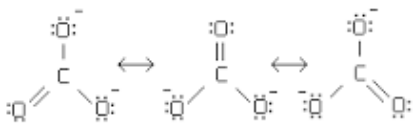
7. $\Delta x = h/4\pi m\Delta v$ 1/2

$$= \frac{6.6\times10^{-34}}{4\times3.14\times9.11\times10^{-31}\times.004}$$ (Δv = 0.4 x0.01) 1/2

$=1.447\times10^{-2}$m ½+½

8. a. Due to symmetrical structure, Dipole moments cancel1

b.



1

9. Oxidation half $I^-(aq) \rightarrow I_2(s)$ 1/2

Reduction half $MnO_4^{1-}{}_{(aq)} \rightarrow MnO_2(s)$ 1/2

$6I^-(aq) + 2MnO_4^- + 4H_2O(l) \rightarrow 3I_2(s) + 2MnO_2(s) + 8OH^-$ 1

10. a. $PbS(s) + H_2O_2(aq) \rightarrow PbSO_4(s) + 4H_2O(l)$ 1

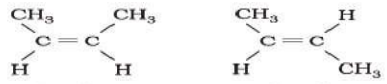
b. $Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2CaCO_3(s) + 2H_2O(l)$ 1

OR

a. Hard water contain ions of calcium and magnesium which react with soap and form scum 1

b. Due to formation of insoluble calcium carbonate 1

11.



cis-But-2-ene (b.p. 277 K) *trans*-But-2-ene (b.p. 274 K)

cis - isomer has more b.p. due to more dipole moment.

12. (i) electron deficient central atom B and thus electron pair acceptor.
(ii)Pb^{2+} is more stable than Pb^{4+} due to inert pair effect.

13. a. Due to extra stability of half filledorbital(2p) 1
b. Due to more effective nuclear charge 1
c. due to stable octet 1

14. (i)The enthalpy change for a reaction is same irrespectiveof whether the reaction takes place in one or more steps .1
(ii) For the reaction ΔG= ΔH-TΔS 1/2

ΔG=-10.5{-298x(-44.1x10^{-}3)} 1/2

=138614.7 X10^{-}3

=138.6 KJ/mol 1

15. a. An orbital can have maximum two e-s and that with opposite spin.

Or any other definition1

b. (i) due to half filledconfiguration(or more exchange of energy) 1

(ii) Energy of orbits is fixed 1

16. (a) The amount of oxygen consumed by micro organism in decomposing organic waste of sewage water.

(b)**Photochemical smog**

(i)It is formed as the result of photochemical decomposition of nitrogen dioxide and chemical reaction involving hydrocarbons.

(ii)It takes place during dry warm season in presence of sunlight 1

(iii)It is oxidising in nature.

Classical Smog

(i) It is formed due to condensation of SO2 vapours on particles of carbon in cold climate

(ii) It is generally found during winter when there is severe cold1

(iii)It is reducing in nature

17. a.O_2^{+}= $(\sigma\ Is^2)\ (\sigma\ *Is^2)\ (\sigma\ 2s^2)\ (\sigma\ *2s^2)\ (\sigma\ 2p_z^2)\ (\pi 2p_x^2 = \pi 2p_y^2)(\pi\ *2p_x^1)$ 1

Bond Order = $l/2[N_b-N_a]$ 1/2

$= 1/2[10-5] = 2.5$ As O_2^+ has one unpaired e^- so is Paramagnetic 1/2

b. SP^3 1

18. a. due to presence of ammoniated electron 1

b. because high energy is required to excite electron 1

c. because they are stronger reducing agents 1

OR

Alkali metals have comparatively

(i)low ionization enthalpy (ii) Higher basicity of oxides (iii) High solubility of oxides (1+1+1)

19 a.Force acting per unit length is known as surface tension. Its unit is N/m 1

1

b .PV=nRT 1/2

1 x V=8.8 x .083 x 304.1/44 1/2

V=5.048L 1

20. a. $(CH_3)_3C^+$> CH3$CH_2CH^+(CH_3)$> CH3CH2CH2CH2$^+$1 1

b. $(CH_3)_3COOH$ < $(CH_3)_2CHCOOH$ <CH_3CH_2COOH 1

c. metamerism1

21. 25 ml of 0.75M HCl= 1X25X0.75/1000 mole of HCl 1

=0.01875mol of HCl 1

$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

1 mole 2 mole

(100gm)

0.01875 mole of HCl react with with = 100X0.01875/2 = 0.9375 g 1

22. $2NH_3+H_2O+CO_2 \rightarrow (NH_4)_2CO_3$ 1/2

$(NH_4)_2CO_3+H_2O +CO_2 \rightarrow NH_4HCO_3$ 1/2

$NH_4HCO_3 + NaCl \rightarrow NH_4Cl + NaHCO_3$ 1

$2NaHCO_3 \rightarrow Na_2CO_3 +CO_2 + CO_2 + H_2O$ 1

23. a. $CH_3CH_2CH_2^-$ because increase in no. of alkyl gp. showsmore+I effect thereby increasing e^- density and decreasing stability . 2

b.Because of electron withdrawing nature of NO_2 1

24.(a) Initiation Cl----Cl ---- hv------→ 2Cl $^\cdot$free radical 1/2

Propagation CH_3-H + Cl $^\cdot \rightarrow CH_3^\cdot$+HCl 1/2

$CH_3^\cdot$ +Cl-Cl $\rightarrow CH_3Cl + Cl^\cdot$ 1/2

Termination $CH_3^\cdot + CH_3^\cdot \rightarrow CH_3-CH_3$ 1/2

(b) No. of σ bonds= 7 1/2

No. of π bonds=3 1/2

25. a. CH_3COOH 1

b. $[H^+] = 10^{-7} + 10^{-8} = 10^{-7} (1 + 0.1) = 1.01 \times 10^{-7}$ 1/2

$pH = - \log[H^+]$ 1/2

$pH = - \log[1.01 \times 1]$ 1/2

pH= 6.79 1/2

OR

a .NH_4^+ 1

c . (i) backward 1

(ii) forward 1

26. a.correct structure 1

b. (i) $B(OH)_3 + 2HOH \rightarrow [B(OH)_4]^- + H_3O^+$ 1

(ii) $2Al(s) + 2NaOH(aq) + 6H2O \rightarrow 2Na^+[Al(OH)_4^-] (aq) + 3H_2(g)$ 1

c.(i) due to small size of F silicon can accommodate six F atom while size of chlorine is big silicon cannot accommodate six chlorine atom 1

(ii) from top to bottom atomic size increases the bond strength decrease 1

OR

Δ

(i)$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ 1

(ii) $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$ 1

b.(i) each carbon atom is attached with with four carbon atom by sp^3 hybridisation in tetrahedral manner . 1

(ii) due to d orbital which have poor shielding effects 1

(iii) in graphite each carbon atom is attached with three carbon atom having Sp^2 hybridisation each carbon atom has one electron free which is responsible for conductivity 1

27. a.(i) $2R\text{-}X + 2Na \rightarrow R\text{-}R + 2NaX$ 1

(ii) $C_6H_6 + CH_3Cl \xrightarrow{(anhyd.)AlCl_3} C_6H_5CH_3 + HCl$ 1

b. $CH_3\text{-}CH_2\text{-}C{=}CH\text{-}CH_3$

$|$ 1

$CH_2\text{-}CH_3$

c. Ethyne gives white ppt with ammonical silver nitrate while ethane do not give test / any other correct answer 1

OR

a. (i) due to resonance 1

(ii) molecule of trans isomer can fit more tightly into one another 1

b. See problem 13.10, page no.379 of NCERT text book 1

c. (i) $3CH{\equiv}CH \xrightarrow{\text{Red hot(Cu)}} C_6H_6$

(ii) $CH_3CH{=}CH_2 \xrightarrow{HBr} CH_3\text{-}\underset{\underset{Br}{|}}{CH}\text{-}CH_3$

2

SESSION ENDING EXAMINATICLASS-XI– (2018-19)

SUBJECT- CHEMISTRY (CODE-043

PAPER 05

No.	Unit	VSA 1 mark	SA-I 2 marks	SA-II 3 marks	LA 5 mark	TOTAL
I	Some Basic Concepts of Chemistry	1(1)	2(1)			8
II	Structure of Atom		2 (1)	3(1)		
III	Classification of Elements & Periodicity in Properties		2 (2)			4 (2)
IV	Chemical Bonding and Molecular Structure				5 (1)	20(7)
V	States of Matter Solids Gases and Liquids		2(1)	3 (1)		
VI	Thermodynamics	1(1)		3 (1)		
VII	Equilibrium			3(2)		
VIII	Redox Reaction	1(1)	2(2)			20(8)
IX	Hydrogen			3(1)		
X	s-Block Elements	1(1)		3(1)		
XI	Some p Block Elements			3(1)	5(1)	
XII	Organic Chemistry: Some Basic Principles & Techniques	1(1)		3(2)		18(6)
XIII	Hydrocarbons			3(1)	5(1)	
XIV	Environmental Chemistry			3(1)		
	Total	5(5)	14(7)	36(12)	15(3)	70(27)

SESSION ENDING EXAMINATION

CLASS-XI– (2018-19)
SUBJECT- CHEMISTRY (CODE-043)

Time: 3 hours **Max. Marks: 70**

General Instructions:
i) This Question Paper contains Twenty Seven 27 Questions.
ii) All Questions are Compulsory.
iii)Q.No. 1 to 5 are very Short Answer Type Questions and carry 1 Mark each.
iv)Q.No. 6 to 12are Short Answer Type Questions and carry 2 Marks each.
v)Q.No. 13 to 24 are also Short Answer Type Questions and carry 3 Marks each.
.vii)Q.No. 25 to 27 are Long Answer Type Questions and carry 5 Marks each.
viii)There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions in five marks each. You have to attempt only one of the choices in such questions.
(ix) Use Log Table if necessary. Use of Calculator is not allowed**.**

Q.1 Calculate the formula mass of Calcium Chloride.
Q.2 Why is KO_2 paramagnetic?

Q.3 Calculate the oxidation no. of Mn in $KMnO_4$

Q.4 Name the alkaline earth metal which shows resemblance with aluminium.

Q.5 Write IUPAC name of following organic compound.
$CH_3C(Cl)_2CH_2CH_2CHO$

Q.6 (i) Write the IUPAC name and Symbol of the element with atomic number 120 .
(ii) What are isoelectronic species? Give example.

Q.7 Using s, p, d, f notations, describes the orbital with the following quantum numbers
a) n=4,l=2
b) n = 5, l=3

Q.8 Give suitable reason for the following observations:
a) Oxygen (O) has lower ionization enthalpy than N .
b) Cl has more negative electron gain enthalpy than F.

Q.9 Define law of multiple proportions? Give one example.

Q.10 Balance the following redox reaction

$Fe^{2+}(aq) + Cr_2O_7^{2-}(aq) + H^+ \rightarrow Fe^{3+}(aq) + Cr^{3+}(aq) + H_2O(l)$

Or

Depict the galvanic cell in which the reaction

$Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$ takes place

Further show:

a) Which of the electrode is negatively charged?

b) Individual reaction at each electrode.

Q.11 At 25°C and 760mm of Hg pressure a gas occupies 600ml volume .What will be its pressure at a height where temperature is 10°C and volume of the gas is 640 ml.

Q.12Write the conjugate acids and the conjugate bases for the following species -

(a) NH_3 (b) HSO_4^- (c) HCO^-_3

Q13 An element has a body-centred cubic *(bcc)* structure with a cell edge of 288 pm. The density of the element is 7.2 g/cm^3. How many atoms are present in 208 g of the element

Q.14 Give reasons for the following:

a) Aqueous solution of ammonia is slightly basic.

b) The bond angle in PH_4^+ higher than in PH_3.

c) Axial bonds in PCl_5 longer than equatorial bonds.

Q.15 a) Define Molarity?

b) Clalculate the molarity of NaOH in the solution prepared by dissolving its 4g in enough water to form 250 ml of the solution.

Q.16 (a) Define standard enthalpy of formation?

(b) Given that:

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g): \Delta_r H^\theta = -92.4 kJmol^{-1}$

What is the standard enthalpy of formation of NH_3 gas?

Q.17 Explain the reason for the following observations:

a) Beryllium and Magnesium do not impart colour to flame where as other alkaline earth metals do so. Why?

b) LiI is more soluble than KI in ethanol.

c) Solubility of alkaline earth metal hydroxides in water increase down the group.

Q.18 A sample of HI (g) is placed in a flask at a pressure of 0.2atm. At equilibrium the partial pressure of HI (g) is 0.04 atm. What is K_p for the given equilibrium?

$2HI(g) \leftrightharpoons H_2(g) + I_2(g)$

OR

Explain the following terms by giving suitable examples:

(a) Common ion effect

(b) Homogenous equilibrium

(c) Conjugate acid-base pair

Q.19 What is smog? How is classical smog different from photochemical smog?

Q.20 What do you understand by the terms:

a) Hydrogen Economy

b) Syngas

c) Hard water

Q.21 For the reaction at 298 K

$2A + B \longrightarrow C$

$\Delta H = 400\ \mathrm{kJmol^{-}} and \Delta S = 0.2\ \mathrm{kJK^{-}mol^{-}}$.

At what temperature will the reaction become spontaneous considering $\Delta H\ and \Delta S$ to be constant over the temperature range?

Q.22 Explain by giving an example.

i)Wurtz reaction ii) Markovnikov's rule. (iii) Decaboxylation

Q.23 In Dumas method for estimation of nitrogen, 0.3g of an organic compound gave 50ml of nitrogen collected at 300K temperature and 715 mm Pressure. Calculate the percentage composition of nitrogen in the compound.(Aqueous tension at 300K =15 mm)

Q.24Explain the following terms:

a) Carbocation

b) Inductive effect

c) Homolytic bond fission

Q.25 a) What is meant by hybridization of atomic orbitals? Describe $sp^2$and sp^3 hybridization by giving one example of each.

b) Distinguish between sigma bond and pi bond.

OR

a) Draw the geometry of the followings:

i)PCl_5 ii)SF_4 iii)XeF_4

b) What is meant by the term Bond order? Calculate the bond order of O_2 and N_2.

Q.26 a)Write balanced equation for:

i) $B_2H_6 + H_2O \rightarrow$

ii) $BF_3 + LiH \rightarrow$

b) Give suitable reasons:

i) Graphite is used as a lubricant and Diamond is used as abrasive.

ii)$CO_2$is a gas but SiO_2 is a solid at room temperature.

iii)Aluminium utensils should not be kept in water overnight.

OR

a) What do you understand by the following terms?

i) Allotropy ii) Catenation

b) What happenswhen?

i) Borax is heated strongly?

ii) Boric acid is added to water?

iii) Aluminum is treated with dilute NaOH?

Q.27 a) How will you convert the following:

i) Benzene to Acetophenone

ii) Propene to Bromopropane

iii) Ethanol to Ethene

b) Propanal and pentan-3-one are the ozonolysis products of an alkene? What is the structural formula of the parent alkene?

OR

a) Complete the following reactions:

i) $CH_3COONa + NaOH \xrightarrow{CaO}$

ii) $CH_3CH{=}CH_2 + O_3 \xrightarrow{Zn+H_2O}$

iii) $CH{\equiv}CH + H_2O \xrightarrow{Hg^{2+}|H^+}$

b) What are the necessary and sufficient conditions for an organic compound tobe aromatic?

MARKING SCHEME

1	Formula mass of CaCl2= 40+2 x35.5=40+71 = 111 u	1
2	The superoxide O_2^- is paramagnetic because of one unpaired electron in π*2p molecular orbital.	1
3	Oxidation Number of Mnin $KMnO_4$ is +7.	1
4	Beryllium (Be)	1
5	4,4-dichloropentanal.	1
6	(i)Symbol – Ubn IUPAC name - unbinilium (ii)Atoms and ions which contain the same number of electrons. Example : O^{2-},F^-,Na^+ and Mg^{2+}	½+ ½ ½ + ½
7	(a) 4d (b) 5f	1+1
8	(a) Nitrogen has half filled electronic configuration. (b) Cl has large size, less $\bar{e} - \bar{e}$ repulsions.	1 1
9	Law of Multiple Proportions: If two elements can combine to form more than one compound the masses of one element that combine with a fixed mass of the other element bear a simple whole number ratio. e.g Hydrogen + Oxygen → Water 2(g) 16(g) 18(g) Hydrogen + Oxygen → Hydrogen Peroxide 2(g) 32(g) 34(g) Here Masses of Oxygen (i.e 16g and 32 g) which combine with a fixed mass of hydrogen (2g) bear a simple ratio. i.e 16:32 or 1:2.	1 1
10	$6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \rightarrow 6Fe^{3+}(aq) + 2Cr^{3+}(aq) + 7H_2O(l)$ Or $Zn(s)\|Zn^{2+}\|\|Ag^+\|Ag(s)$ Anode Cathode (a) Zn is negatively charged (b) $Zn(s) \rightarrow Zn^{2+} + 2\bar{e}$(Anode) $Ag^+ + e^- \rightarrow Ag(s)$ (Cathode)	2 ½ ½ ½ ½
11	According to Combined Gas Law – $p_1V_1/T_1 = p_2V_2/T_2$ $p_2 = p_1V_1T_2/T_1V_2$ p_2 = 760x600x283/640x298 =676.6mm Hg.	1 1 1
12	(a) Conjugate acid – NH_4^+ , Conjugate base – NH_2^- (b) Conjugate acid – H_2SO_4 , Conjugate base – SO_4^{2-}	1 1

	(c) Conjugate acid – H_2CO_3 , Conjugate base – CO_3^{2-}	1
13	DENSITY = $\frac{Z \times M}{a^3 No}$ $7.2 = \frac{2xM}{288x\ 10^{-10} \times 6.02x10^{23}}$ M = 51.8 208gm of the element contains atoms = $\frac{6.02x10^{23} \times 208}{}$ = $24.17x\ 10^{23}$	
14	) N in NH_3 has a lone pair of electrons that can be donated to form linkage with the metal ions and hence NH_3 acts as Lewis base. b) Lone pair of electronsare not present in PH_4^+ but in PH_3,theseare present and repel the bonds, giving a smaller bond angle. (a) c) Axial bonds are longer than equatorial bonds in PCl_5 because of the higher repulsion experienced by the axial bond pairs as three pairs of electrons repel them whereas only two pairs of electrons atrracts the equatorial bonds.	
15	(b) It is defined as the number of moles of the solute in 1 litre of the solution. (c) Molarity = No. of moles of solute/Volume of solution in litres = Mass of NaOH/Molar mass of NaOH/0.250L =4g/40g/0.250L = 0.1mol/0.250L =0.4 M	1 1 1
16	(a) Standard enthalpy of formation:The Standard enthalpy change for the formation of one mole of a compound from its elements in their most stable states of aggregation. (b) $\Delta rH^\theta = 2\Delta_f H^\theta$ $\Delta_f H^\theta = \frac{\Delta rH^\theta}{2} = \frac{-92.4}{2} kJmol^{-1} = -46.2kJmol^{-1}$	1 1 1
17	(a) Be, Mg have high ionization enthalpy. (b) Li I is more covalent than KI. (c) Lattice enthalpy decreases much more than the hydration enthalpy.	1 1 1
18	2HI (g) ⇋ H_2 (g) + I_2 (g) Initial 0.2atm 0 0 At eqbm (0.2-2x) xx Given $0.2 - 2x = 0.04$ $2x = 0.16$ $x = 0.08$ $K_P = \frac{(P_{H_2})(P_{I_2})}{(P_{HI})^2} = \frac{0.08 \times 0.08}{(0.04)^2}$	1 1

	$K_P = 4$ Or	1
	(a) Common ion effect: The suppression in the dissociation a weak electrolyte by the the addition of a strong electrolyte having a common ion is called common ion effect. eg. $NH_4OH \leftrightharpoons NH_4^+ + OH^-$ $weakelectrolyte$ $NH_4Cl \rightarrow NH_4^+ + Cl^-$ Strong electrolyte common ion (b) Homogenous equilibrium: All reactants and products are in the same phase e.g. $N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3(g)$ (c) Conjugate acid base pair: It differs by one proton. $HCl(aq) + H_2O(l) \leftrightharpoons H_3O^+(aq) + Cl^-(aq)$ $Acid$ Base Conjugate Conjugate base acid	½ ½ ½ ½ ½ ½
19	Smog = smoke + fog Classical Smog / Photochemical smog i. Occurs in cool humid climate / i. Occur in warm, dry and sunny climate ii. Contains SO_2 / ii. Contains Hydrocarbons nitrogen oxides iii. Reducing in nature / iii. Oxidising in nature.	1 2
20	(a) Hydrogen Economy: It is the transportation and storage of energy in the form of liquid or gaseous dihydrogen. (b) Mixture of CO + H_2 = syn gas (c) Hard water- the water which does not give foam with soap easily	1 1 1
21	$\Delta G = \Delta H - T\Delta S$ $\Delta G = -ve$ (Since reaction is spontaneous) $\Delta H - T\Delta S < 0$ $T > \frac{\Delta H}{\Delta S}, T > \frac{400\ kJmol^{-1}}{0.2\ kJK^{-1}mol^{-1}} = 2000K$ Reaction will be spontaneous above 2000K.	1 1 1
22	(a) $CH_3Cl + 2Na + CH_3Cl \rightarrow CH_3 - CH_3 + 2NaCl$	1

	(b) $CH_3 - CH = CH_2 + HBr \rightarrow CH_3 - \underset{\underset{Br}{\vert}}{CH} - CH_3$ (c) $CH_3COONa + NaOH \xrightarrow{CaO} CH_4 + Na_2CO_3$	1 1
23	Volume of nitrogen collected at 300K and 715 mm pressure is 50ml Actual Pressure = 715-15 = 700 mm Volume of nitrogen at STP = 273x700x50/300x760 = 41.9 mL 22.400 mL of N_2 at STP weighs = 28 g 41.9 mL of nitrogen weighs = 28 x 41.9/22400g %age of nitrogen = 28x41.9x100/22400x0.3 = 17.46 %	 1 1 1
24	(a) Carbocation: Group of atoms having positively charged carbon atom. (b) Inductive effect: The permanent displacement of electrons along a carbon atom chain due to the presence of an atom or group of different electronegatively at the end of the carbon atom chain. (c) Homolytic bond fission: Each atom gains one electron of the shared pair during bond fission.	1 1 1
25	(a) Hybridisation – The process of intermixing of the orbitals of slightly different energies soas to redistribute their enegies resulting in the formation of new set of orbitals of equivalent enegies and shape. Sp^2 hybridisation e.g. ethene or any other example Sp^3 hybridisation e.g. ethaneor any other example b) Any two correct differences	1 1 1 1

Sigma Bond	pi Bond
1.It is formed by the end to end filled atomic orbitals along the internuclear axis.	It is formed by the sidewise overlap of two half-filled p-orbitals.
2.s-orbitals can participate in the formation of sigma bond.	2.s-orbitals cannot participate in the formation of pi bond.

	Or (a) One mark for each correct structure/geometry. PCl_5 – Trigonal bipyramidal SF_4 – See Saw XeF_4 – Square Planer (b) Bond order = $\frac{1}{2}[N_b - N_a]$ Bond order of $O_2, N_2$is 2,3 respectively	 1 1 1 1 1

26	(a) (i) $B_2H_6 + 6H_2O \rightarrow 2H_3BO_3 + 6H_2$ (ii) $2BF_3 + 6LiH \rightarrow B_2H_6 + 6LiF$ (b) (i) Graphite is soft & Diamond is very hard (ii) CO_2 can form $P\pi - p\pi$ multiple bond but SiO_2 can not. (iii) Since Al reacts with $H_2O$to give Al^{3+}ions, which are injurious to health. Or (a) (i) Allotropy –The different forms of the same element having different physical properties but almost similar chemical properties. (ii) Catenation – Carbon aoms have the tendency to link with one another through covalents bonds to forms chains and rings.This property is called Catenation. (b) (i) $Na_2B_4O_7 10H_2O \xrightarrow{\Delta} Na_2B_4O_7 + 10H_2O$ $Na_2B_4O_7 \xrightarrow{Heat} 2NaBO_2 + B_2O_3$ (ii) $B(OH)_3 + H_2O \rightarrow [B(OH)_4]^- + H^+$ (iii) $2Al + 2NaOH + 6H_2O \rightarrow Na[Al(OH)_4] + 3H_2O$	1 1 ½ + ½ 1 1 1 1 1 1 1
27	(a) (i) $C_6H_6 + CH_3COCl \xrightarrow{Anhy.Alcl_3} C_6H_5COCH_3 + HCl$ (ii) $CH_3 - CH = CH_2 + HBr \xrightarrow{BenzoylPeroxide} CH_3CH_2CH_2Br$ (iii) $CH_3CH_2OH \xrightarrow{Conc.H_2SO_4}, CH_2 = CH_2 + H_2O$ (b) $CH_3CH_2CH = C - CH_2 - CH_3$ | CH_2 | CH_3 $3 - Ethylhex$-3-ene	1 1 1 1 1
	Or (a) (i) $CH_4 + Na_2CO_3$ (ii) $CH_3CHO + HCHO$ (iii) CH_3CHO b) Condition to be aromatic (Any two correct points) (i) Planarity (ii) Complete delocalisation of the π-electronic cloud in the ring (iii) Presence of $(4n + 2)\pi$ electrons in the ring (Huckel Rule)	 1 1 1 2

KENDRIYA VIDYALAYA SANGATHAN

SESSION ENDING EXAM OF CLASS XI

PAPER 06

Time : 3 hrs MM:70

General Instruction :

1. All questions are compulsory.
2. Q.No.1-5 carrying 1 mark each. one
3. Q.No.6-12 carrying 2 marks each.
4. Q.no.13- 24, carrying 3 marks each.
6. Q.No. 25-27 of 5 marks each..
7.. Use of log tables if necessary .Use of calculator is not permitted.

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1. How are 0.5 m of NaOH different from 0.5 M of NaOH?

2. Write the electronic configuration of Cr atom.

3. Chlorine show more electron gain enthalpy than fluorine. Why?

4. Under what condition of temperature and pressure do real gases tend to show ideal gas behavior?

5. Predict in which of the following entropy decreases / increases:

   i) Water converts in ice.

   ii) H_2 (g)→ 2H(g)

6. What is the concentration of sugar ($C_{12}H_{22}O_{11}$) in mol L^{-1}if 20g of it is dissolved in enough water to make final volume up to 2L?

7. Calculate the mass of a photon with wavelength $3.6A^0$ [h = 6.626 x 10^{-34} Js].

8. What is meant by 'Polar Covalent Bond '? Give suitable example.

Or

Differentiate between sigma[σ] and pi[π] bond.

9. State Hess's law of Constant Heat Summation by giving an example.

10. For the Galvanic cell reaction :

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

   i) Which electrode is negatively charged?

   ii) What is the direction of current?

11. Account for the following :

   i) KO_2paramagnetic.

ii) Potassium carbonate cannot be prepared by solvay's process.

12. Draw resonating structure of CO_3^{2-}& state the hybridization of carbon in it.

13. Write bond line structural formula for :

i) butane -1-ol ii) 2,2,4- Tri methyl pentane.

Also give the sigma and pi bonds in each of them.

14. State the principle of the following techniques taking an example in each case:

i) Distillation under reduced pressure.
ii) Chromatography.
iii) Crystallisation

15.(a)What do you understand by the Inductive effect?

(b) How will this justify the following order of acidic strength:

$CH_3CH_2COOH > (CH_3)_2CHCOOH > (CH_3)_3COOH$

16. a) State Heisenberg's Uncertanity Principle.

b) Using s, p, d, f notations, describe the orbital with following quantum numbers :

i) n=2, l=1

ii) n = 4, l =0

iii) n =5, l=3

iv) n-3, l =2

17. Predict the formula of the binary compound formed by the combination of the following pairs of elements :

i) Magnesium and nitrogen.

ii) Phosphorous and fluorine

iii) Aluminum and iodine.

18. What is LCAO method of bonding? Explain the magnetism and bond order for O^{2-} ,O^{2+},O_2^{2-} , O_2 on the basis of MOT

19.a) Which type of intermolecular forces exist between KI & I_2.

b) What will be the pressure of the gaseous mixture when 0.5 L of H_2 at 0.8 bar and 2.0L of O_2 at 0.7 bar are introduced in a 1L vessel at 27^0 C?

20. The equilibrium constant for a reaction is 10. What will be the value of ΔG^o?

21. What are electron deficient, electron precise and electron rich compounds of hydrogen? Give one

example of each.

Or

What do you understand by the following terms :

i) Demineralised water
ii) Auto – protolysis of water.
iii) Amphoteric oxides

22. What happens when :

i) Sodium peroxide dissolves in water.
ii) Lithium nitrate is heated.
Iii) Quick lime is heated with silica?

23. 1) what is the role of ozone layer in our atmosphere
2) Define BOD and its importance for living organisms.
3) Name any two compounds that are responsible for acid rain.

24. Write the order of free radical stability and define free radical mechanism for reaction of chlorine a with methane.

25. a) Find the conjugate acid / base for the following species :

HF, CN-, NH_4+, HCO_3^-

b) The ionization constant of HCOOH & HCN at 298 K are 1.8 x $10^{-4}$and 4.8x10^{-9}respectively.Calculate the ionization constant of the corresponding conjugated bases.

Or

a) Predict if the solutions of the following salts are neutral, acid or basic :

NaCl, NH_4NO_3, KCN , Na NO_2 ,

b) State Le Chatelier 's principle . Give the effect of pressure change & temperature change on the state of equilibrium giving example.

26. a) A certain salt 'X' in its aqueous solution is alkaline :
i) It swells up to a glassy martial 'Y'.
ii) Its hot solution on treatment with conc. H_2SO_4 gives white crystals of an acid 'Z' Identify 'X', 'Y' and 'Z' an give the chemical reactions.
b) What do you understand by:

i) Inert pair effect.
ii) Ionozation Enthalpy

Or

a) Complete and balance the following equation :

i) $B_2H_6 + NH_3 \rightarrow$
ii) Al + NaOH + $H_2O \rightarrow$

b) Give reasons :

i) Graphite is used as lubricant.
ii) Conc. HNO_3 can be transported in aluminum container.
iii) Co is poisonous in nature.

27. a) Give the chemical equations for the following reaction :

i) Freidel – Crafts' reaction
ii) Ozonolysis
iii) Wurtz reaction.

b) Account for the following :

i) Benzene is extra – ordinary stable through it contains three double bonds.
ii) Out of toluene , benzene , m-dinitrobenzene , toluene will undergo nitration most easily.

Or

a) State Markovnikov rule.
b) Write IUPAC name of the product obtained by addition reaction of HBr to hex-1-ene.
c) What happens when : [Give chemical equations]

i) Butane undergoes complete combustion.
ii) Ethanol is heated with conc. H_2SO_4.
iii) Ethyne is passed through red hot iron tube at 873K.

Answer Key:

1. 0.5 m NaOH stands for 0.5 moles of NaOH in 1 Kg of solvent while 0.5 M NaOH means 0.5 moles of NaOH in 1 Litre of solution.
2. $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \pi 2p_x^2 = \pi 2p_y^2 \pi^* 2p_x^1 = \pi^* 2p_y^1$
3. Correct definitions of both along with their unit.
4. Under low temperature and low pressure.
5. (i) decreases (ii) increases
6. Formula used: Molarity = $\frac{\text{No. of moles of sugar}}{\text{Volume of solution in litres}}$

   No. of moles = Given mass/ Molar mass

   = 20/342 = 0.058 moles

   Molarity = 0.058/2 = 0.029 M

Ans 7: Formula used: $\lambda = \frac{h}{mc}$

$\lambda = 3.6\ A^0 = 3.6 \times 10^{-10}$ m

$c = 3 \times 10^8\ ms^{-1}$; $h = 6.626 \times 10^{-34}$ Jsec

rearranging the formula: $m = \frac{h}{\lambda c}$

$= \frac{6.626 \times 10^{-34}}{3.6 \times 10^{-10} \times 3 \times 10^8}$

$= 0.6135 \times 10^{-32} = 6.135 \times 10^{-31}$ Kg

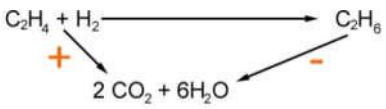
Ans 8: Correct definition. Eg. H – F, H_2O

Or

Sigma bond	Pi bond
Formed by Head on overlapping	Formed by side wise overlapping
Strong bond	Weak bond

Or any other points.

Ans 9: **Hess's law** states that energy changes are state functions. The amount of energy depends only on the states of the reactants and the state of the products, but not on the intermediate steps. Energy (enthalpy) changes in chemical reactions are the same, regardless whether the reactions occur in one or several steps.



Enthalpies of Combustion

C_2H_4 = -1393 kJ/mol
H_2 = -286 kJ/mol
C_2H_6 = -1561 kJ/mol

$\Delta H = (-1393 + -286) + 1561$
$= -118$ kJ/mol

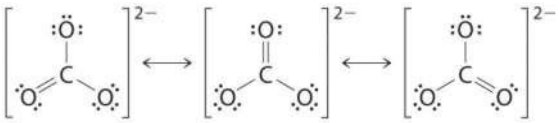
Ans 10. (i) Zinc electrode

(ii) Direction of current is from silver to zinc.

Ans 11 (ii) LiI being covalent in nature due to polarization is soluble in organic compound.

(iii) As the solubility of $KHCO_3$ is high.

Ans 12.



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Hybridisation : sp^2 **Geometry:** Trigonal planar

Ans 13. Correct structures

(i) No. of sigma bonds : 14 No. of pi bonds : 0

(ii) No. of sigma bonds : 25 No. of pi bonds : 0

Ans 14: (i) This method is used to purify liquids having very high boiling points and those which decompose at or below their boiling point. Eg. Glycerol from spent-lye in soap industry

(ii) This is based o the fact that different compounds are adsorbed on an adsorbent to different degrees. Eg; To separate the colour components of plants, dyes from ink etc.
(iii)It is based on the difference in the solubilities of the compound and impurities in a suitable solvent. Eg: Crystallisation of $CuSO_4$

Ans15(a)The polarization of sigma bond caused by the polarization of adjacent polar sigma bond is called inductive effect.

(b) + I effect of methyl group. More the methyl groups, lesser is the acidic strength.

Ans 16: (a) It is impossible to measure both the momentum and position of a microscopic particle simultaneously with accuracy.

(b) (i) 2p (ii) 4s (iii) 5f (iv) 3d

Ans 17. (i) Mg_3N_2 (ii) PF_5 (iii) AlI_3

Ans 18. Correct statement of hybridization.

Essential conditions:

(i) The orbital undergoing hybridization should have similar energy i.e. two 1 s orbital can combine together but one 1-s and 4-s orbital cannot combine together due to difference in their energies.

(ii) It is not necessary that only half filled orbital takes part in the hybridization, in some cases fully filled valence shells have also taken part in hybridization.

(iii) The orbitals present in the valence shell of an atom are hybridized.

SF_4 has *see-saw* shape.

Ans 19(a) Dipole induced dipole interactions.

(b) Formula used: $p_1V_1 = p_2V_2$
Partial pressure of Hydrogen gas
$V_1 = 0.5$ L $V_2 = 1$ L
$P_1 = 0.8$ bar $p_2 = ?$
$P_2 = p_1V_1/V_2 = (0.8) \times (0.5) / 1 = 0.40$ bar
Partial pressure of oxygen gas
$V_1 = 2.0$ L $V_2 = 1$ L
$P_1 = 0.7$ bar $p_2 = ?$
$P_2 = p_1V_1/V_2 = (0.7) \times (2.0) / 1 = 1.40$ bar
Pressure of the gaseous mixture
$P_{mix} = p_{H2} + p_{O2} = 0.4 + 1.40 = 1.80$ bar

Ans 20. Given :$K_c = 10$
Formula used: $\Delta G^o = - 2.303RT\log K_c$
$= - 2.303 \times 8.314 \times 298 \times \log 10$
$= -2.303 \times 8.314 \times 298 = 5705.85$ Joules/mol or 5.705 KJ/ mol
Ans 21. Correct definition of electron deficient, electron precise and electron rich compounds of hydrogen and their respective examples.

OR

(i) Making water free from all kinds of minerals through synthetic resins method.

(ii) Self ionization of water

$H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$

(iii) Metals of group 7, 8, 9 do not form hydrides which are termed to be hydride gap.

Ans 22. (i) $Na_2O_2 + H_2O \rightarrow H_2O_2 + Na^+ + OH^-$

(ii) $4LiNO_3 \xrightarrow{Heat} 2Li_2O + 4\,NO_2 + O_2$

(iii) $CaO + SiO_2 \longrightarrow CaSiO_3$

Ans 23. 1) uv protection 2) correct reason 3) any two pollutants

Ans 24 correct order ---1 and mechanism -- 2

Ans 25: (a) F^- , HCN, NH_3, H_2CO_3/ CO_3^{2-}

(b) K_a (HCOOH) = 1.8×10^{-4}

K_b ($HCOO^-$) = $K_w/K_a = 10^{-14}/1.8 \times 10^{-4}$

$= 5.6 \times 10^{-11}$

K_a (HCN) = 4.8×10^{-9}

K_b (CN^-) = $K_w/K_a = 10^{-14}/4.8 \times 10^{-9}$

$= 2.08 \times 10^{-6}$

OR

(a) **Neutral:** NaCl, KCN
Acidic: NH_4NO_3
Basic: Na NO_2

(b) That whenever there is a change in concentration, pressure or temperature of a system at equilibrium, the system will try to readjust in such a way so as to cancel the effect of that change.

Increase in pressure shifts the equilibrium reaction towards the direction of lesser no. of gaseous moles.

Increase in temperature will shift the equilibrium reaction towards the direction which involves decrease in heat i.e. towards endothermic reaction.

Quote any equilibrium reaction.

Ans 26: (a) $Na_2B_4O_7.10H_2O \xrightarrow{HEAT} Na_2B_4O_7 \xrightarrow{HEAT} NaBO_2 + B_2O_3$

$\downarrow$ Conc. H_2SO_4 $\qquad$ $\downarrow$ $7H_2O$

$Na_2SO_4 + 4\,B(OH)_3 \qquad 2NaOH + 4\,H_3BO_3$

X = $Na_2B_4O_7.10H_2O$ Y = $NaBO_2 + B_2O_3$ Z= $B(OH)_3$

(b) i) Inert pair effect: Correct statement

ii) Ionization Enthalpy : Correct statement

Or

a) i) $3B_2H_6 + 6NH_3 \rightarrow 2\,B_3N_3H_6 + 2\,H_2$

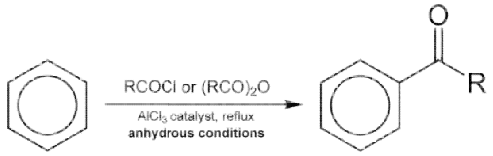
ii) $2Al + 2NaOH + 6H_2O \rightarrow 2Na[Al(OH)_4] + 3H_2$

(b) (i) Because of layered structure f graphite

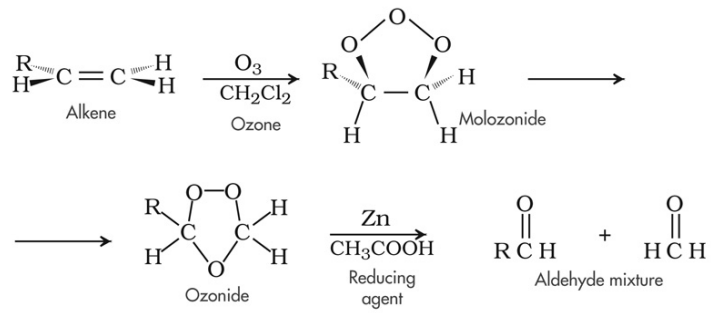
(ii) Conc. HNO_3 turns Al passive by forming a layer of Al_2O_3 which protects it from further reaction.

(iii) Its ability to form a 300 times more stable complex with haemoglobin than oxygen.

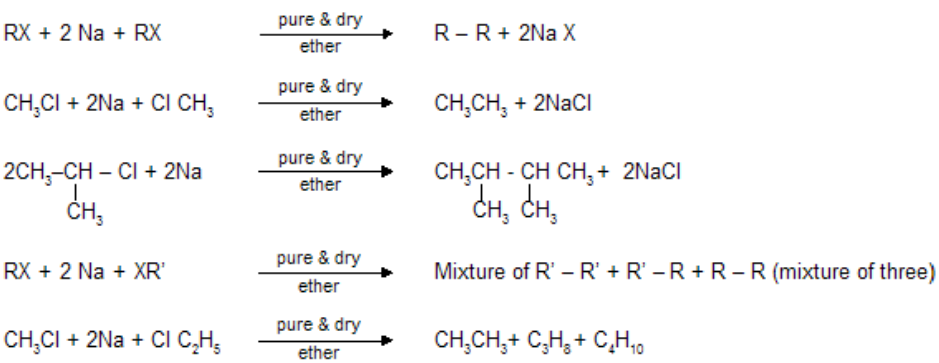
Ans 27: (i)



(ii)



(iii)



(b) (i) Due to resonance, there is delocalization of π electrons.
(ii) In toluene, CH_3- group is electron releasing group increasing the electron density at o- and p-positions of benzene. Hence, facilitates the attack of electrophile at these positions .

Or

a) Correct statement with an example.
b) 2-Bromohexane

(i) $2\,C_4H_{10} + 13\,O_2 \longrightarrow 8\,CO_2 + 10\,H_2O$

(ii) $CH_3CH_2OH + \text{Conc. } H_2SO_4 \xrightarrow{443\ K} CH_2{=}CH_2 + H_2O$

(ii) $3\,C_2H_2 \xrightarrow{\text{red hot iron, 873 K}} C_6H_6$

KENDRIYA VIDYALAYA SANGATHAN

CLASS XI

SUB CHEMISTRY

PAPER 07

MAX MARKS 70 TIME 3 HRS

General Instructions:

1. All questions are compulsory.
2. Question nos. 1 to 5 are very short answer questions and carry one mark each.
3. Question nos. 6 to 12 are short answer questions and carry two marks each.
4. Question nos. 13 to 24 are also short answer questions and carry three marks each.
5. Question nos. 25to 27 are long answer questions and carry five marks each.
6. Use log tables if necessary. Calculators are not allowed.

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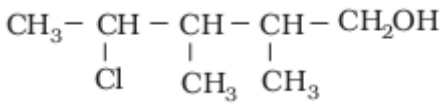
1. Write the general electronic configuration of Cr. (1)
2. Write the IUPAC name and symbol for the element with atomic number 119. (1)
3. Write van der Waals equation for n moles of a gas. (1)
4. Write the corresponding conjugate acid and conjugate base of HCO_3^-. (1)
5. Name the alkali metal carbonate which decomposes at a lower temperature. (1)
6. State Avagadro's law. Find the volume of 14 g of nitrogen gas at STP. (2)
7. (i) How many electrons in an atom may have the quantum numbers $n = 4 \& l = 1$?
   (ii) What evidence in the cathode ray discharge tube experiment led to the conclusion that electrons are basic constituents of all atoms? (2)
8. (i) Write the resonance structures for carbonate ion CO_3^{-2}.
   (ii) Draw the shape of BrF_3 molecule using VSEPR model. (2)
9. 0.3780 g of an organic chloro compound gave 0.5740 g of silver chloride in Carius estimation. Calculate the percentage of chlorine in the compound.
   (Atomic mass of Ag = 108 u, Cl = 35.5 u)

   OR

   If both S and N are present in an organic compound , how is it detected by Lassaigne's test? Write the reaction involved in it.
   (2)
10. (i) Give the IUPAC name of



   (ii) Draw the structure of 4-oxopentanoic acid.

11 Name the compound of calcium used for immoblising the fracture affected part of our body.How is this compound prepared? (2)

12 When an alkali metal dissolves in liquid ammonia the solution can acquire different colours. Explain the reasons for this type of colour change (2)

13(i) Define molarity.
(ii) Commercially available concentrated hydrochloric acid contains 38% HCl by mass. What is the molarity of this solution ? The density of the solution is 1.10 g mL^{-1}.
(3)

14The work function for caesium atom is 1.9 eV. Calculate the threshold frequency of the radiation. If the caesium element is irradiated with a wavelength of 500 nm, calculated the kinetic energy of the ejected photo-electron. (3)

15Arrange the following species in the increasing order of the property mentioned.

(i) Na, Mg, Al, Si (First ionisation enthalpy)
(ii) C, N, Si, P (Electronegativity)
(iii) $N^{3-}, O^{2-}, F^{-}, Na^{+}$ (Ionic radii) (3)

16Calculate the bond order of O_2 and O_2^- and indicate their magnetic properties.

OR

(i) Deduce the shape of CCl_4 molecule based on hybridisation.
(ii) Explain why BeH_2 molecule has a zero dipole moment although the Be-H bonds are polar. (3)

17 (i) State Dalton's law of partial pressures.
(ii) Calculate the density of methane at 2.0 atm pressure at 27^0C.
($R = 0.0821\ L\ atm\ mol^{-1}K^{-1}$). (3)

18Calculate the standard enthalpy change for the reaction

$$OF_2(g) + H_2O\ (g) \rightarrow O_2(g) + 2HF(g)$$

at 298 K .Given that enthalpies of formation of $OF_2(g), H_2O(g), HF(g)$ are +20, -250 and 270 kJ/mol respectively. (3)

11.(i) State the second law of thermodynamics.

Q19 For the reaction $H_2(g) \rightarrow 2H(g)$, what are the signs of ΔH and ΔS ?

Discuss the effect of temperature on the spontaneity of a reaction, when both ΔH^0 and ΔS^0 have positive signs. (3)

20(i) Balance the following redox reaction

$$MnO_4^- + C_2O_4^{2-} + H^+ \rightarrow Mn^{2+} + CO_2 + H_2O$$

(ii) The $E^0_{M^{3+}/M^{2+}}$ values for Mn and Fe are +1.57 V and +0.77 V respectively. For which one of these metals, the change in oxidisation state from +2 to +3 is easier?(3)

21(i) What are saline hydrides? Give an example.

(ii) What is the cause for permanent hardness of water?

(iii) What is the basic principle of hydrogen economy? (3)

22 (i) Write the functional isomers with molecular formula C_3H_8O.

(ii) What are nucleophiles ? Give an example.

(iii) Explain why tertiary butyl carbocation is more stable than methyl carbocation. (3)

23Illustrate the following reactions with an example.

(i) Wurtz reaction

(ii) Friedel Craft's reaction

(iii) Decarboxylation reaction. (3)

24 (i) What do you mean by BOD ?

(ii) What are particulate pollutants ? Name two viable particulates. (3)

25(i) State Le-Chatelier's principle.

(ii) If Qc>Kc for a reaction, predict the direction in which the reaction will proceed?

(iii) The Kp value for the reaction

$H_2(g) + I_2(g) \rightleftarrows 2HI(g)$

at 460 ^{0}C is 49. If the initial pressuresof both$H_2$and I_2 are 0.5 bar, determine the partial pressure of each gas at equilibrium. (1+1+3)

OR

(i) Define (a) Common ion effect

(b) Buffer solution

(ii) Calculate the degree of ionisation of 0.01 M solution of HCN. Ka of HCN is $4.8x\ 10^{-10}$.Also calculate the hydronium ion concentration. (2+3)

26(i) Complete the following.

(a) $BF_3 + NaH \rightarrow$

(b) $SiO_2 + HF \rightarrow$

(c) $H_3BO_3 + 2H_2O \rightarrow$

(ii) What are silicones ? Mention its any two uses. (3+2)

OR

Account for the following.

(i) Diamond is covalent,yet it has high melting point.

(ii) Pb(IV) acts as a good oxidising agent.

(iii) Catenation ability of carbon is high.

(iv) Carbon monoxide is highly poisonous.

(v) Boron is unable to form BF_6^{3-}. (5)

27(i) Complete the following.

(a) $CH_3CH_2CH = CH_2 \xrightarrow[Zn,H_2O]{O_3} >$

(b) $(CH_3)_2C = CH_2 + HBr \rightarrow$

(c) 

(ii) Which of the following would have lower boiling point ? Give reason.

2 – Methylpentane ,2,3 – Dimethylbutane

(iii)Arrange the following in the increasing order of their reactivity towards electrophilic substitution.

Aniline , benzene , nitrobenzene (3+1+1)

OR

(i) Carry out the following conversions.

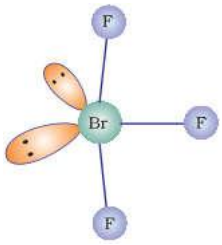
(a) Propan – 1-ol to 1 – bromopropane

(b) Benzene to chlorobenzene

(c) Ethyne to ethanal

(ii) The compound given below is not aromatic. Why?

(iii) Draw the geometrical isomers of but-2-ene. (3+1+1)

KENDRIYA VIDYALAYA **CLASS XI SUB CHEMISTRY** **MARKING SCHEME**		
1	Correct configuration	1
2	Ununennium , Uue	½ + ½
3	$(p + an^2/V^2)(V-nb) = nRT$	1
4	H_2CO_3 , CO_3^{2-}	½ + ½
5	Lithium carbonate	1
6	(i) Equal volumes of gases at the same temperature and pressure contain equal number of molecules. (ii) V = 14 x 22.4 / 28 = 11.2 L	1 1
7	(i) 6 (ii) Do not depend upon the nature of the electrodes and the nature of the gas	1 1
8	(i) Correct resonance structures (ii)  	1 1
9	% of Cl = $\frac{35.5 \times 0.3780 \times 100}{143.5 \times 0.5740}$ = 16.29 % **OR** Coorect test Correct equation	1 1 1 1

10	4-Chloro-2,3-dimethylpentan-1-ol	1
	$CH_3COCH_2CH_2COOH$	1
11	Plaster of Paris	2
	$2(CaSO_4.2H_2O)\ (heat) \rightarrow 2(CaSO)_4.H_2O + 3H_2O$	
12	The blue colour of the solution is due to the ammoniated electron which absorbs energy in the visible region of light and thus imparts blue colour to	2
13	No of moles of solute present on 1 L of a solution.	1
	V = 100/1.10 mL	½
	M = no of moles of solute / Vol of soln in L	½
	= 38 x 1.10 x 10 / 36.5	½
	= 11.45 M	½
14	Threshold frequency $\nu_0 = E_0 / h = 1.9 \times 1.6 \times 10^{-19} / 6.6 \times 10^{-34}$	
	$= 4.59 \times 10^{14}\ s^{-1}$	1
	Frequency $\nu = c / \lambda = 3 \times 10^{8} / 500 \times 10^{-9}$	1
	$= 6 \times 10^{14}\ s^{-1}$	
	$KE = h(\nu - \nu_0) = 6.6 \times 10^{-34} (6 \times 10^{14} - 4.59 \times 10^{14})$	1
	$= 9.036 \times 10^{-34}$	
15	(i) Na < Al < Mg < Si	1
	(ii) Si < P < C < N	1
	(iii) $Na^{+} < F^{-} < O^{2-} < N^{3-}$	1
16	Configuration of O_2 & O_2^{-}	1
	Bond order O_2 = 2 & O_2^{-} = 2.5	1
	Both are paramagnetic	1
	OR	
	(i) sp^3	½
	Tetrahedral	½
	Steps	1
	(ii) BeF_2 is linear. The two equal bond dipoles get cancelled.	1
17	(i) Statement	1
	(ii) d = pM/ RT	1
	= 2 x16/0.0821 x 300	½
	= 1.3 g L^{-1}	½
18	$\Delta_r H^{\Theta} = [2 \times \Delta_f H^{\Theta} HF] - [\Delta_f H^{\Theta} OF_2(g)] + \Delta_f H^{\Theta}[H_2O(g)]$	1
	= 2(-270) – (20- 250)	1
	= - 310 kJ	1
19	(i) Statement	1
	(ii) ΔH = +ve ΔS = +ve	1
	(iii) At high temperature – spontaneous .	½
	At low temperature - non spontaneous	½

20	(i) $5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \rightarrow 10\ CO_2 + 2Mn^{2+} + 8H_2O$ Steps (ii) Fe	1 1 1
21	(i) Compounds of dihydrogen formed with s-block elements which are highly electropositive in character. Any one eg. (ii) Soluble salts of magnesium and calcium in the form of chlorides and sulphates (iii) The transportation and storage of energy in the form of liquid or gaseous dihydrogen.	1 1 1
22	(i) $CH_3CH_2OCH_3$ and $CH_3CH_2CH_2OH$ (ii) Reagents that bring an electron pair, any one eg. (iii) In ter butyl carbocation the hyperconjugation interaction is greater than methyl carbocation.	1 1 1
23	Illustration with eg	1+1+1
24	(i) Amount of oxygen required by bacteria to break down the organic matter present in a certain volume of a sample of water. (ii) Minute solid particles or liquid droplets in air. Bacteria, fungi, moulds, algae. (Any 2)	1 1 1
25	(i) Statement (ii) Backward (iii) $H_2 + I_2 \rightleftarrows 2HI$ At equilibrium 0.5-x 0.5-x 2x $K_p = \frac{(pHI)^2}{(pH_2)(pI_2)}$ $49 = \frac{(2x)^2}{(0.5-x)^2}$ x = 0.389 pH_2 = 0.111 bar pI_2 = 0.111 bar **OR** (i) Correct definition (ii) $HCN + H_2O \rightleftarrows CN^- + H_3O^+$ $K_a = c\alpha^2/1-\alpha$ $\alpha = \sqrt{Ka/c}$ $= \sqrt{4.8\ x\ 10^{-10}}/0.01$ $= 2.2 \times 10^{-4}$ $[H_3O]^+ = c\alpha$ $= 0.01 \times 2.2 \times 10^{-4} = 2.2 \times 10^{-6}$ M	 1 1 ½ 1 ½ ½ ½ 1+1 ½ ½ 1 ½ ½

26	(i) (a) $2BF_3 + 6NaH \rightarrow B_2H_6 + 6NaF$ (b) $SiO_2 + 4HF \rightarrow SiF_4 + 2H_2O$ (c) $H_3BO_3 + 2HOH \rightarrow [B(OH)_4]^- + H_3O^+$ (ii) Organosilicon polymers, which have (R_2SiO) as a repeating unit. Used as sealant, greases, electrical insulators and for water proofing of fabrics. (any 2) **OR** (i)Diamond has a three-dimensional network involving strong C-C bonds. (ii) Due to inert pair effect (iii) Due to strong C-C bond. (iv) CO forms a more stable complex with haemoglobin than the oxygen-haemoglobin complex which prevents haemoglobin in the red blood corpuscles from carrying oxygen round the body and ultimately resulting in death. (v) Due to non-availability of d orbitals.	1 1 1 1 ½+½ 5(1)
27	(i) (a) $CH_3CH_2CHO + HCHO$ (b) $(CH_3)_2C(Br)CH_3$ (c) C_6H_{12} (cyclohexane) (ii) 2,3 – Dimethylbutane, low magnitude of vander Waal's forces due to more branching (iii) nitrobenzene <benzene < aniline **OR** (i) Correct conversions (ii) Absence of (4n+2) Π electons / lack of delocalization of (4n+2) Π electrons in cyclic system (iii) cis and trans isomers	½+½ 1 1 1 1 3 1 ½+½

KENDRIYA VIDYALAYA

Class XI CHEMISTRY BLUE PRINT MAX.MARKS: 70

TIME: 3hrs.

S.No	Chapter	VSA	SA I	SA II	VBQ	
		(1 Mark)	(2 Marks)	(3 Marks)	(4 Marks)	(5
1	Some Basic concepts of chemistry	-	2(1)	3(1)	-	
2	Structure of Atom	1(1)	2(1)	3(1)	-	
3	Classification of Elements and Periodicity in Properties	1(1)	-	3(1)	-	
4	Chemical Bonding and molecular Structure	-	2(1)	3(1)	-	
5	States of Matter: Gases and Liquids	1(1)	-	3(1)	-	
6	Thermodynamics	-	-	6(2)	-	
7	Equilibrium	1(1)	-		-	
8	Redox Reactions		-	3(1)	-	
9	Hydrogen	-	-	3(1)	-	
10	s Block elements	1(1)	2(2)			

11	**p Block elements**	-	-		-	
12	**Organic chemistry – Some basic principles & techniques**	-	4(2)	3(1)	-	
13	**Hydrocarbons**	-	-	3(1)	-	
14	**Environmental chemistry**	-	-	3(1)	-	
	M(Q)	**5(5)**	**10(5)**	**36(12)**	**4(1)**	

CHEMISTRY
CLASS-XI
BLUE PRINT
PAPER 08

Time Allowed: 3 Hrs. Maximum Marks:70

S No	UNIT	VSA(1 marks)	SAI(2marks)	SAII(3marks)	LA(5 marks)	TOTAL
1	Some basic concept of chemistry	1(1)	4(2)			11
2	Structure of atom	1(1)			5(1)	
3	Classification of elements and periodicity in properties	1(1)		3(1)		4
4	Chemical bonding and molecular structure	2(1)		3(1)		21
5	States of matter		2(1)	3(1)		
6	Thermodynamics				5(1)	
7	Equilibrium			6(2)		
8	Redox reaction			3(1)		16
9	Hydrogen			3(1)		
10	S-block elements		2(1)	3(1)		
11	p block elements		2(1)	3(1)		
12	Organic chemistry: some basic principle and techniques		2(1)	6(2)		18
13	Hydrocarbons		2(1)		5(1)	
14	Environmental chemistry			3(1)		
	TOTAL	5(5)	14(7)	36(12)	5(3)	70(27)

Class-XI
(Chemistry)
Time allowed: 3 hours] Maximum marks: 70

General Instructions:

(i) All questions are compulsory.
(ii) Question nos. 1 to 5 are very short answer questions and carry 1 mark each.
(iii) Question nos.6to 12are short answer questions and carry 2 marks each.
(iv) Question nos. 13 to 24are also short answer questions and carry 3 marks each.

(v) Question nos. 25to 27are long answer questions and carry 5
(v))Use log tables if necessary, use of calculators is not allowed

Q1.State Pauli exclusion principle.

Q2. Which has higher ionization enthalpy N or O? Why?
Q3.Draw Lewis structure of carbon dioxide.
Q4.Why Ne_2 does not exist?
Q5. State law of definite proportions ?
Q6. (i)Why liquid drops are spherical in shape?
(ii)State Dalton's law of partial pressure.
Q7. (i) Why does boron triflouride behave as a Lewis acid ?
(ii)$PbCl_4$ is better oxidising agent than $PbCl_2$?

Q8. 0.3780 g of an organic chloro compound gave 0.5740 g of silver chloride in Carius estimation. Calculate the percentage of chlorine present in the compound?
Q9.(i) Why are Potassium and caesium, rather than lithium used in photoelectric cells?
(ii) When an alkali metal dissolves in liquid ammonia the solution can acquire different colours. Explain the reasons for this type of colour change?

Q10. Draw the *cis* and *trans* structures of but-2-ene. Which isomer will have higher b.p. and why?
Q11. (i) Calculate the molarity of water if its density is 1000 kg/m3.

Q.12.Calculate the number of atoms in each of the following
(a) 52 g of He. (b) 52 u of He

Q13. (i)Differentiate between electronegativity and electron gain enthalpy.
(ii)What are the atomic numbers of elements whose outermost electrons are represented by a) $2p^3$ b) $3d^6$? Also predict the group to which they belong.

Q14.(i)What is salt bridge ?Write its function also
ii)Balance the following ionic equation:
$MnO_4^- + H^+ + SO_3^{2-} \rightarrow Mn^{2+} + SO_4^{2-} + H_2O$

Q15. (i)State Le Chatelier's principle
ii) Indicate the direction in which the equilibrium will shift when:
$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ + heat
(a)Pressure is increased.
(b) Concentration of SO_2 is increased.
(c) Concentration of SO_3 is increased.
(d) Temperature is increased.

Q16.Write a brief note on the following environmental terms:
Photochemical smog
Eutrophication
Green Chemistry

Q17. Define Boyle's Law. A gas occupies a volume of 250 mL at 745 mm Hg and 25^0C. What additional pressure is required to reduce the gas volume to 200 mL at the same temperature?

Q18 What happens when
a) Sodium metal is dropped in water?
b) Sodium metal is heated in free supply of air?
c) Sodium peroxide dissolves in water?

Q19. (a)Write coal gasification reaction
(b) Complete the following reactions:
(i) $MnO_4^- + H_2O_2 \rightarrow$
(ii) $PbS + H_2O_2 \rightarrow$

Q20.Write the balance equation for the following:
i) $BF_3 + LiH \rightarrow$
ii) $B_2H_6 + H_2O \rightarrow$
iii) $Al + NaOH \rightarrow$

Q21.On the basis of VSEPR theory draw the structure and predict the shape of :
(i)XeF_4 (ii) ClF_3 (iii) H_2O

Q22.(i) Write IUPAC nomenclature of $CH_3COCH_2CH_2COOH$.
(ii)Explain why alkyl groups act as electron donors when attached to a πsystem
(iii)Name the technique used to separate the mixture of o-nitro phenol and p- nitro phenol

Q23.(i)What are electrophiles and nucleophiles ? Explain with examples.
(ii)Explain the reason for the fusion of an organic compound with metallic sodium for testing nitrogen, sulphur and halogens.

Q24. (i)Determine the pH of 0.005M H_2SO_4 solution.
(ii) Write the expression for equilibrium constant for the following reaction.
$CH_3COOC_2H_5(aq) + H_2O(l) \rightleftharpoons CH_3COOH(aq) + C_2H_5OH(aq)$

Q25.(i) State Hess's law of constant heat summation.
(ii) Calculate the standard enthalpy of formation of one mole of CH_3OH (l), if the combustion of one mole of methanol takes place at 298 K and 1 atm and after combustion CO_2 (g) and H_2O (l) are produced and 726 kJ of heat is liberated. Assume that the standard enthalpies of formation of CO_2 (g) and H_2O (l) are - 393 kJ/mol and -286 kJ mol respectively.
OR
(i)Explain how is enthalpy related to spontaneity of a reaction?
(ii)State second law of thermodynamics.

(iii)Calculate the free energy change and Kc for the given reaction and predict the spontaneity of the reaction.

$2C(s) + O_2(g) \rightarrow 2CO_2(g)$

$\Delta H = -300$ kJ mol-1, $\Delta S = 3$ kJK^{-1} mol^{-1} at 300 K

Q26.(i)Explain giving suitable reactions:

(a)Markovnikov's rule

(b)Wurtz reaction.

(c)β – elimination.

(ii)An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3-one. Write structure and IUPAC name of 'A'

OR

a) Convert :

i) Benzene to p-nitrobromobenzene

ii) Ethyl chloride to ethene.

b) Give mechanism of addition of HBr to propene.

c) Write a note on Friedel-Crafts alkylation.

Q27.(i) Define an orbital?

(ii)What is meant by photoelectric effect?

(iii)The threshold frequency for a metal is 7.0×10^{14} s^{-1}. Calculate the kinetic energy of an electron emitted when radiation of frequency $\nu = 1.0 \times 10^{15}$ s^{-1} hits the metal.

OR

(a) States Heisenberg's Uncertainty Principle?

(b)What designations are given to the orbitals having

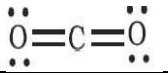
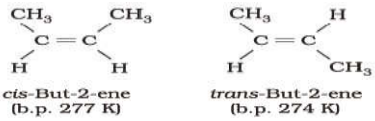
(i) n = 3, l = 1 (ii) n = 2, l = 0

(c) Which quantum number determines

(i) Energy of electron (ii) Orientation of orbitals.

(d) What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition, n = 4 to n =2 of He^+ spectrum?

Chemistry (Class- XI)
MARKING SCHEME

1.	An orbital can accommodate maximum two electrons with opposite spin.	1
2.	N , as it has half filled 2p orbitals.	1/2+1/2
3.		1
4.	Bond order = 0 ,molecule does not exist.	1
5.	Correct definition	1
6.	(i) due to surface tension. (ii)correct definition.	1+1
7.	(i) electron deficient central atom B and thus electron pair acceptor. (ii)Pb^{2+} is more stable than Pb^{4+} due to inert pair effect.	1 1
8.	% of chorine = (35.5 X mass of ppt) x 100/143.5 x mass of o.c. = 35.5 x 0.5740 x 100/143.5 x 0.3780 = 37.5 %	1 1
9.	(i) Potassium and caesium, have low Ionsation enthalpy. (ii)Due to ammoniated electrons.	1 1
10.	 *cis*-But-2-ene (b.p. 277 K) *trans*-But-2-ene (b.p. 274 K) cis - isomer has more b.p. due to more dipole moment.	1 1
11.	Molarity of water means the number of moles of water in 1 litre of water 1L of water = 1000 cm^3 = 1000 g ($\because$ 1000 kg/m^3 = 1g/cm^3) 1000 g of water = $\frac{1000}{18}$ = 55.56 moles Molarity = 55.56 M	
12.	a) (i) 4 g of He = 6.022×10^{23} atoms of He $\therefore$ 52 g of He $= \frac{6.022 \times 10^{23} \times 52}{4}$ atoms of He = 7.8286×10^{24} atoms of He b) (ii) 1 atom of He = 4 u of He Or, 4 u of He = 1 atom of He 1 u of He $= \frac{1}{4}$ atom of He 52u of He $= \frac{52}{4}$ atom of He i.e. 13 atoms of He.	
13.	(i) Any two correct differences. (ii) N = 7(group 15) ; Fe = 26(group = 8)	2 1

14.	(i) correct definition and one function. (ii) $2\ MnO_4^- + 6H^+ + 5SO_3^{2-} \rightarrow 2Mn^{2+} + 5SO_4^{2-} + 3H_2O$	1/2+1/2 1
15.	(i) Correct definition. (ii) (a)Forward (b)Forward (c)backward (d)backward.	1 1/2+1/2 1/2+1/2
16.	(i)Correct definition. (ii)Correct definition. (iii) Correct definition.	1 1 1
17.	Correct definition. $P_1 \times V_1 = P_2 \times V_2$ V2 = (745 x 250)/200 =931.25mm Hg Excess pressure required = 186.25 mm Hg.	1 ½ ½ 1
18.	i. $2Na + 2H_2O \rightarrow 2Na^+ + 2OH^- + H_2$ ii. $2Na + O_2 \rightarrow Na_2O_2$ (peroxide) iii. $Na_2O_2 + H_2O \rightarrow NaOH + H_2O_2 + O_2$	1 1 1
19.	(a)$C + H_2O \rightarrow CO + H_2$ (b)(i) $MnO_4^- + H_2O_2 + 6H^+ \rightarrow Mn^{2+} + 8H_2O + O_2$ (ii) $PbS + H_2O_2 \rightarrow PbSO_4 + H_2O$	1 1 1
20.	i. B_2H_6 + LiF ii. 2B(OH)3(aq) + 6H2(g) iii. 2 Na+ [Al(OH)4] $^-$(aq) + 3H2(g)	1 1 1
21.	Correct structure and shape Square planar , T-shaped ,bent shape.	1 +1+1
22.	i. 4-oxobutanoic acid ii. Hyperconjugation iii. steam distillation	1 1 1
	i. correct definition and examples ii. To convert covalently bonded atoms into ions	1+1 1
	i. pH = $-\log H^+$,Substituting correct value and calculation, 2 ii. $Kc = \frac{[CH_3COOH][C_2H_5OH]}{[CH_3COOC_2H_5]}$	1+1 1
25.	i. correct statement ii.correct substitution of values and correct calculation , -239 kJ mol^{-1} or i.correct explanation ii.correct statement iii. correct formula, substitution of values and calculation ($\Delta G = \Delta H - T\Delta S$, $\Delta G = -2.303RT\log Kc$)	2 3 1 1 3
26.	i.correct explanation with reaction ii. correct structure, 3-ethylpent-2-ene or i.correct reaction ii.correct mechanism iii.correct reaction	1+1+1 1+1 1+1 2 1

27	i.correct definition ii.correct statement iii.Kinetic energy = $1/2mev^2=h(\nu - \nu 0)$ $=1.988 \times 10^{-19}$ J Or i.correct definition ii.3p, 2s iii. n and m iv. n=2 to n=1 (correct formula and substittion)	1 1 3 1 1 1 2

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XI Chemistry
PAPER 09

Time : 3 Hours Maximum Marks : 70

S.No.	Unit	VSA (1)	VSA (2)	SA (3)	LA (5)	Total
1	Some basic concept of chemistry	1(1)	2(1)			8(4)
2	Structure of atom		2(1)	3(1)		
3	Classification of elements and periodicity in properties	1(1)		3(1)		4(2)
4	Chemical bonding and molecular structure				5(1)	20(7)
5	States of matter; gases and liquid and solids		2(1)	3(1)		
6	Thermodynamics		2(1)	3(1)		
7	Equilibrium		2(1)	3(1)		
8	Redox reaction	1(1)		3(1)		20(8)
9	Hydrogen			3(1)		
10	S-block elements	1(1)		3(1)		
11	Some p block elements	1(1)		3(1)	5(1)	
12	Organic chemistry: some basic principle and technique		2(1)	3(1)		18(6)
13	Hydrocarbons			3(1)	5(1)	
14	Environmental chemistry		2(1)	3(1)		
Total		5(5)	14(7)	36(12)	15(3)	70(27)

Note: Number of Questions are given within brackets and marks outside the brackets.

Prepared By:- Sanjeev Kumar Bhandari
PGT Chemistry
KV Hiranagar

QUESTION PAPER CLASS XI

CHEMISTRY

SET 1

Time Allowed: 3 Hrs MM: 70

GENERAL INSTRUCTIONS:

1. All the questions are compulsory.
2. Q. No. 1 to 5 are very short answer type, carrying 1mark each.
3. Q. No. 6 to 12 are short answer type, carrying 2 marks each.
4. Q. No. 13 to 24 are short answer type, carrying 3 marks each.
5. Q. No. 25 to 27 are long answer type, carrying 5 marks each.
6. There is no overall choice in the question paper. However, an internal choice is provided in one question of two marks, one question of three marks and all three questions of five marks.
6. Use of calculators is not allowed, use log tables wherever required.

1. Define law of multiple proportions? Give one example.
2. Write the IUPAC name and Symbol of the element with atomic number 120 .
3. Calculate the oxidation no. of Mn in $KMnO_4$.
4. Why is KO_2 paramagnetic?
5. Why PCl_5 is more covalent than PCl_3?
6. Clalculate the molarity of NaOH in the solution prepared by dissolving its 4g in enough water to form 250 ml of the solution.
7. Using s, p, d, f notations, describes the orbital with the following quantum numbers
a) n=4, l=2 b) n = 5, l=3
8. An element has a bcc structure with a cell edge of 288pm . The density of the element is 7.2 g/cm^3. How many atoms are present in 208 g of the element.
9. (a) Define standard enthalpy of formation?
(b) Given that: $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$: $\Delta_r H^\theta = -92.4 kJmol^{-1}$
What is the standard enthalpy of formation of NH_3 gas?
10. Explain the following terms by giving suitable examples: (a) Common ion effect
(b) Homogenous equilibrium
11. Explain the following terms: (a)Carbocation (b) Inductive effect.
12. Write a brief note on the following environmental terms: (a) Photochemical smog
(b) Eutrophication

OR

(a) What do you mean by BOD?
(b) Give two difference between classical smog and photo chemical smog.
13. The threshold frequency for a metal is $7.0 \times 10^{14}\ s^{-1}$. Calculate the kinetic energy of an electron emitted when radiation of frequency $\nu = 1.0 \times 10^{15}\ s^{-1}$ hits the metal.
14. Account for the following:
(a) Ionisation enthalpy of nitrogen is more than that of Oxygen
(b) A cation is always smaller than their parent atom.
(c) Noble gases have large positive electron gain enthalpy.

15. A student forgot to add the reaction mixture to the round bottomed flask at 270c but instead he placed the flask on the flame.After a lapse of time he realised his mistake and using the pyrometer he found that temperature of flask was 4770c. What fraction of air would have been expelled out?

16. For the reaction at 298 K

$$2A + B \longrightarrow C$$

$\Delta H = 400\ \mathrm{kJmol^{-}}\ and\ \Delta S = 0.2\ \mathrm{kJK^{-}mol^{-}}$.

At what temperature will the reaction become spontaneous considering $\Delta H\ and\ \Delta S$ to be constant over the temperature range?

17. A sample of HI (g) is placed in a flask at a pressure of 0.2atm. At equilibrium the partial pressure of HI (g) is 0.04 atm. What is K_p for the given equilibrium?

$$2HI\ (g) \leftrightharpoons H_2\ (g) + I_2\ (g)$$

18. (i) Balance the following equation by ion electron method:

$Cr_2O_7^{-2}(aq) + SO_2(g) \rightarrow Cr^{+3}(aq) + SO_4^{-2}(aq)$(IN ACIDIC MEDIUM)

(II) Assign oxidation no. of S in H_2SO_4 and N in NO_3^-

19. What do you understand by the terms:a) Hydrogen Economyb) Syngasc) Hard water

20. Explain the reason for the following observations:

(a) Beryllium and Magnesium do not impart colour to flame where as other alkaline earth metals do.

(b) LiI is more soluble than KI in ethanol.

(c)Solubility of alkaline earth metal hydroxides in water increase down the group.

21. Give suitable reasons:

(i)Graphite is used as a lubricant and Diamond is used as abrasive.

(ii)$CO_2$is a gas but SiO_2 is a solid at room temperature.

(iii)Aluminium utensils should not be kept in water overnight

22. In Dumas method for estimation of nitrogen, 0.3g of an organic compound gave 50ml of nitrogen collected at 300K temperature and 715 mm Pressure. Calculate the percentage composition of nitrogen in the compound.(Aqueous tension at 300K =15 mm)

23.Explain the following terms:a) Acid rainb) Green chemistryc) Ozone layer depletion

24.Explain by giving an example.(i)Wurtz reaction (ii)Markovnikov's rule (iii) Decaboxylation

OR

Write IUPAC names of the following compounds :

(i) $(CH_3)_3CCH_2C(CH_3)_3$

(ii) $(CH_3)_2C(C_2H_5)_2$

(iii) tetra – *tert*-butylmethane

25. (i) Write elecrtonic configuration, calculate bond order& writemagnetic property of O_2.(3)

(ii) On the basis of VSEPR Theory explain the geometry of; ClF_3&CH_4.(2)

OR

Give Correct explanation for each:

(i)Bond angle in water is less than ammonia.

(ii)Sigma bond is stronger than Pi bond

(iii)BF_3 has Zero dipole moment although B-F bond is polar.

(iv)Explain the structure of following molecule on the basis of Hybridisation: (a)NH_3 (b) SF_6

26.) a) Write balanced equation for:

(i)$B_2H_6 + H_2O \rightarrow$

(ii)$BF_3 + LiH \rightarrow$

(b)Give suitable reasons:

(i) Graphite is used as a lubricant and Diamond is used as abrasive.

(ii)$CO_2$is a gas but SiO_2 is a solid at room temperature.

(iii)Aluminium utensils should not be kept in water overnight.

OR

(a)What do you understand by the following terms?

(i)Allotropy (ii) Catenation

(b) What happenswhen?

(i) Borax is heated strongly?

(ii) Boric acid is added to water?

(iii) Aluminum is treated with dilute NaOH?

27.(a)How will you convert the following:

(i)Benzene to Acetophenone

(ii)Propene to Bromopropane

(iii)Ethanol to Ethene

(b) Propanal and pentan-3-one are the ozonolysis products of an alkene? What is the structural formula and IUPAC name of of the parent alkene?

OR

(a) Complete the following reactions:

(i) $CH_3COONa + NaOH \xrightarrow{CaO}$

(ii) $CH_3CH{=}CH_2 + O_3 \xrightarrow{Zn + H_2O}$

(iii) $CH{\equiv}CH + H_2O \xrightarrow[333K]{Hg^{2+}|H^+}$

(b) What are the necessary and sufficient conditions for an organic compound tobe aromatic?

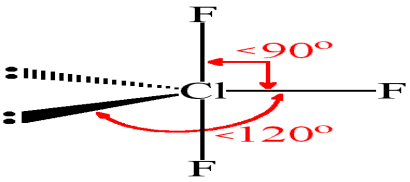
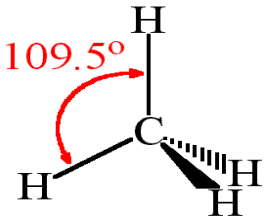
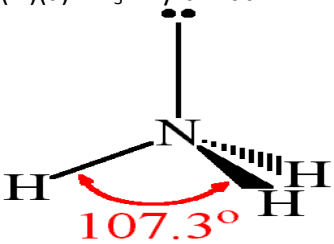
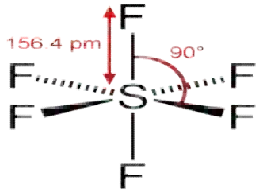
CHEMISTRY XI

MARKING SCHEME SET 1

Q.No.	Answers	Marks
1	Law of Multiple Proportions: If two elements can combine to form more than one compound the masses of one element that combine with a fixed mass of the other element bear a simple whole number ratio. e.g Hydrogen + Oxygen → Water 2(g) 16(g) 18(g) Hydrogen + Oxygen → Hydrogen Peroxide 2(g) 32(g) 34(g) Here Masses of Oxygen (i.e 16g and 32 g) which combine with a fixed mass of hydrogen (2g) bear a simple ratio. i.e 16:32 or 1:2.	½ + ½
2	Symbol – Ubn IUPAC name - unbinilium	½ + ½
3	Oxidation Number of Mnin KMnO4 is +7.	1
4	The superoxide O_2^- is paramagnetic because of one unpaired electron in π*2p molecular orbital.	1
5	Because P^{5+} has more polarising power than P^{3+}.	1
6	Molarity = No. of moles of solute/Volume of solution in litres = Mass of NaOH/Molar mass of NaOH/0.250L =4g/40g/0.250L = 0.1mol/0.250L =0.4 M	½ ½ ½ ½
7	(a) 4d (b) 5f	1+1
8	Volume of the unit cell =a^3 = $(288pm)^3$ =$(288x10^{-12}m)=(288x10^{-10}cm)^3$ =$2.39x10^{-23}cm^3$ Volume of 208 g of the element= mass/density =$208g/7.2gmcm^{-3}=28.88cm^3$ Number of unit cells in this volume =$(288.88cm^3)$ / $2.39x10^{-23}cm^3$/unit cell =$12.08x10^{23}$ unit cells Since each bcc cube unit cell contains 2 atoms, therefore, the total number of atoms in 208g =2(atoms/unit cell)x$12.08x10^{23}$ unit cells =$24.16 x10^{23}$ atoms	1 1 1
9	(a)Standard enthalpy of formation:The Standard enthalpy change for the formation of one mole of a compound from its elements in their most stable states of aggregation. $(b)\ \Delta rH^\theta = 2\Delta_f H^\theta$ $\Delta_f H^\theta = \frac{\Delta rH^\theta}{2} = \frac{-92.4}{2} kJmol^{-1} = -46.2kJmol^{-1}$	1 ½ ½
10	(a)Common ion effect: The suppression in the dissociation a weak electrolyte by the the addition of a strong electrolyte having a common ion is called common ion effect. eg. $NH_4OH \leftrightharpoons NH_4^+ + OH^-$	½

	$weak\ electrolyte$ $NH_4Cl \rightarrow NH_4^+ + Cl^-$ Strong electrolyte common ion (b)Homogenous equilibrium: All reactants and products are in the same phase e.g. $N_2(g) + 3H_2(g) \leftrightharpoons 2NH_3(g)$	 ½ ½
11	(a) Carbocation: Group of atoms having positively charged carbon atom. (b) Inductive effect: The permanent displacement of electrons along a carbon atom chain due to the presence of an atom or group of different electronegatively at the end of the carbon atom chain.	1 1
12	(i) Photochemical smog occurs in warm, dry and sunny climate. The main components of the photochemical smog result from the action of sunlight on unsaturated hydrocarbons and nitrogen oxides produced by automobiles and factories.Photochemical smog has high concentration of oxidising agents and is, therefore, called as oxidising smog. (ii)The process in which nutrient enriched water bodies support a dense plant population, which kills animal life by depriving it of oxygen and results in subsequent loss of biodiversity is known as Eutrophication. OR (a) The amount of oxygen consumed by micro organism in decomposing organic waste of sewage water. (b)	1 1 1
	Photochemical smog / Classical Smog (i)It is formed as the result of photochemical decomposition of nitrogen dioxide and chemical reaction involving hydrocarbons. / (i) It is formed due to condensation of SO2 vapours on particles of carbon in cold climate (ii)It takes place during dry warm season in presence of sunlight / (ii) It is generally found during winter when there is severe	½ ½
13	According to Einstein's equation Kinetic energy = ½ $m_e v^2 = h(\nu - \nu_0)$ $= (6.626 \times 10^{-34}\ J\ s)(1.0 \times 10^{15}\ s^{-1} - 7.0 \times 10^{14}\ s^{-1})$ $= (6.626 \times 10^{-34}\ J\ s)(10.0 \times 10^{14}\ s^{-1} - 7.0 \times 10^{14}\ s^{-1})$ $= (6.626 \times 10^{-34}\ J\ s) \times (3.0 \times 10^{14}\ s^{-1})$ $= 1.988 \times 10^{-19}\ J$	 ½ ½ 1 1
14	a. Due to extra stability of half filled orbital(2p) b. Due to more effective nuclear charge c. due to stable octet	1 1 1
15	consider Volume =V At 27^0c V_1=V V_2=? T1=300K T2=750K $V_1/T_1=V_2/T_2$ V_2=2.5V Volume Expelled=2.5V-V=1.5 V Fraction of air expelled=1.5v/2.5V=0.6	 1 1 1
16	$\Delta G = \Delta H - T\Delta S$ $\Delta G = -ve$ (Since reaction is spontaneous) $\Delta H - T\Delta S < 0$	½ ½

	$T > \frac{\Delta H}{\Delta S}$, $T > \frac{400\ kJmol^{-1}}{0.2\ kJK^{-1}mol^{-1}} = 2000K$ Reaction will be spontaneous above 2000K.	1 1
17	2HI (g) ⇋ H_2 (g) + I_2 (g) Initial 0.2atm 0 0 At eqbm (0.2-2x) x x Given $0.2 - 2x = 0.04$ $2x = 0.16$ $x = 0.08$ $K_P = \frac{(P_{H_2})(P_{I_2})}{(P_{HI})^2} = \frac{0.08 \times 0.08}{(0.04)^2}$ $K_P = 4$	 1 1 ½ ½
18	Correct balanced equation $Cr_2O_7^{-2}$(aq)+3 SO_2(g) +2H^+---→ 2Cr^{+3}(aq)+3SO_4^{-2}(aq) +H_2O O.S. Of S = +6 N= +5	2 1
19	(a)Hydrogen Economy: It is the transportation and storage of energy in the form of liquid or gaseous dihydrogen. (b)Mixture of CO + H2 = syn gas (c)Hard water- the water which does not give foam with soap easily	1 1 1
20	(a) Be, Mg have high ionization enthalpy. (b) Li I is more covalent than KI. (c) Lattice enthalpy decreases much more than the hydration enthalpy.	1 1 1
21	(i) Graphite is soft & Diamond is very hard (ii) CO_2 can form $P\pi - p\pi$ multiple bond but SiO_2 can not. (iii) Since Al reacts with $H_2O$to give Al^{3+}ions, which are injurious to health	1 1 1
22	Volume of nitrogen collected at 300K and 715 mm pressure is 50ml Actual Pressure = 715-15 = 700 mm Volume of nitrogen at STP = 273x700x50/300x760 = 41.9 mL 22.400 mL of N_2 at STP weighs = 28 g 41.9 mL of nitrogen weighs = 28 x 41.9/22400g %age of nitrogen = 28x41.9x100/22400x0.3 = 17.46 %	 1 1 1
23	(a) Acid rain: it refers to the ways in which acid from the atmosphere is deposited on the earth's surface. Oxides of nitrogen and sulphur which are acidic in nature can be blown by wind along with solid particles in the atmosphere and finally settle down either on the ground as dry deposition, or in water, fog and snow as wet deposition. (b) Green chemistry: Green Chemistry is a way of thinking and is about utilizing the existing knowledge and principles of Chemistry and other sciences to reduce the adverse impact on environment. Utilization of existing knowledge base for reducing the chemical hazards along with the developmental activities is the foundation of green chemistry. (c) Ozone layer depletion: the upper stratosphere consists of ozone which protects us from the harmful effects of harmful UV radiations coming from the sun. it is important to maintain the ozone shield. In recent years there have been reports of the depletion of this protective ozone layer because of the presence of certain chemicals in the stratosphere. The main reason for the depletion of ozone layer is the release of chlorofluorocarbons compounds (CFCs), also known as	1 1 1

	freons. These chemicals are used in refrigerators and air-conditioners. Once these are released into the atmosphere. Chlorine radicals produced from CFCs cause the breakdown of ozone.	
24	(a) $CH_3Cl + 2Na + CH_3Cl \rightarrow CH_3 - CH_3 + 2NaCl$ (b) $CH_3 - CH = CH_2 + HBr \rightarrow CH_3 - \underset{\underset{Br}{\vert}}{CH} - CH_3$ (c) $CH_3COONa + NaOH \xrightarrow{CaO} CH_4 + Na_2CO_3$ OR (i) 2,2,4,4-tetramethylpentane (ii) 3, 3-Dimethylpentane (iii) 3,3-Di-tert-butyl -2, 2, 4, 4 - tetramethylpentane	1 1 1 1 1 1
25	(i) $(\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2(\sigma 2pz)^2(\pi\ 2px)^2 \equiv (\pi\ 2py)^2(\pi^* 2px)^1 \equiv (\pi^* 2py)^1(\sigma^* 2pz)$ Bond Order = $(N_b - N_a) / 2 = (10 - 6) / 2 = 2$ Magnetic property – Paramagnetic. (ii)ClF_3:- T shape  CH_4:- Tetrahedral  OR (i) Two L.P. in water & Ammonia has only one lone pair . (ii) due to greater extent of overlapping in sigma bond. (iii)Due to symmetrical structure. (iv)(a) NH_3 - Pyramidal  (b) SF_6 - Octahedral  	1 1 1 1 1 1 1 1 1 1

26	(a) (i) $B_2H_6 + 6H_2O \rightarrow 2H_3BO_3 + 6H_2$ (ii) $2BF_3 + 6LiH \rightarrow B_2H_6 + 6LiF$ (b) (i) Graphite is soft & Diamond is very hard (ii) CO_2 can form $P\pi - p\pi$ multiple bond but SiO_2 can not. (iii) Since Al reacts with $H_2O$to give Al^{3+}ions, which are injurious to health. Or (a)(i) Allotropy –The different forms of the same element having different physical properties but almost similar chemical properties. (ii) Catenation – Carbon aoms have the tendency to link with one another through covalents bonds to forms chains and rings.This property is called Catenation. (i) $Na_2B_4O_7 10H_2O \xrightarrow{\Delta} Na_2B_4O_7 + 10H_2O$ $Na_2B_4O_7 \xrightarrow{Heat} 2NaBO_2 + B_2O_3$ (ii) $B(OH)_3 + H_2O \rightarrow [B(OH)_4]^- + H^+$ (iii) $2Al + 2NaOH + 6H_2O \rightarrow Na[Al(OH)_4] + 3H_2O$	1 1 1 1 1 1 1 1
27	(a) (i) $C_6H_6 + CH_3COCl \xrightarrow{Anhy.Alcl_3} C_6H_5COCH_3 + HCl$ (ii) $CH_3 - CH = CH_2 + HBr \xrightarrow{Benzoyl\ Peroxide} CH_3CH_2CH_2Br$ (iii) $CH_3CH_2OH \xrightarrow{Conc.H_2SO_4}, CH_2 = CH_2 + H_2O$ (b) $CH_3CH_2CH = C - CH_2 - CH_3$ $\vert$ CH_2 $\vert$ CH_3 $3 - Ethylhex$-3-ene OR (a) (i) $CH_4 + Na_2CO_3$ (ii) $CH_3CHO + HCHO$ (iii) CH_3CHO b) Condition to be aromatic (i) Planarity (ii) Complete delocalisation of the π-electronic cloud in the ring (iii) Presence of $(4n + 2)\pi$ electrons in the ring (Huckel Rule)	1 1 1 1 1 1 1 ½ ½ 1

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PGT Chemistry
KV Hiranagar

SESSION ENDING EXAMINATION
CHEMISTRY
CLASS-XI
PAPERNO 10
BLUE PRINT

Time Allowed: 3 Hrs. Maximum Marks:70

S No	UNIT	VSA(1 marks)	SAI(2marks)	SAII(3marks)	LA(5 marks)	TOTAL
1	Some basic concept of chemistry		2(2)			12
2	Structure of atom		2(1)	3(2)		
3	Classification of elements and periodicity in properties	1(1)		3(1)		4
4	Chemical bonding and molecular structure				5(1)	21
5	States of matter; gases and liquid	1(1)		3(1)		
6	Thermodynamics			3(1)		
7	Equilibrium	1(1)	2(1)	3(2)		
8	Redox reaction			3(1)		16
9	Hydrogen			3(1)		
10	S-block elements		2(1)		5(1)	
11	Some p block elements			3(1)		
12	Organic chemistry: some basic principle and technique	1(1)	2(2)	3(1)		17
13	Hydrocarbons	1(1)			5(1)	
14	Environmental chemistry			3(1)		
	TOTAL	5(5)	10(7)	36(12)	1 5(3)	70(27)

KENDRIYA VIDYALAYA, SANGATHAN

SESSION ENDING EXAMINATION

CLASS: XI

SUBJECT: CHEMISTRY

Time: 3 hrs **M.M. 70**

General instructions:

i. All questions are compulsory.
ii. Question numbers 1 – 5 are very short answer questions each of 1 mark. Answer them in about one sentence each.
iii. Question numbers 6 – 12 are short answer questions of 2 marks each. Answer them in not more than 30 words each.
iv. Question numbers 13 – 24 are short answer questions of 3 marks each. Answer them in not more than 40 words each.
v. Question numbers 25 – 27 are long answer questions of 5 marks each. Answer them in not more than 70 words each.
vi. Use log tables if necessary. Calculators are not allowed.

---

1. What is the value of compressibility factor (z) for ideal gas? **(1)**

2. What would be the IUPAC name for the element with atomic number 120? **(1)**

3. Name a chemical reagent used to distinguish ethene and ethyne. **(1)**

4. Write the structural formula of 3 – methylpent – 3 – en – 1 – yne. **(1)**

5. Write the conjugate base of HCO_3^-. **(1)**

6. (a) Name a suitable method to purify ammonium chloride. **(2)**
   (b) I f blood red colouration is obtained on adding $FeSO_4$ solution and dil H_2SO_4 to the sodium extract of the organic compound, Identity the elements present in the organic compound.

7. In Carius method, 0.15g of an organic compound gave 0.12g of AgBr. Calculate the percentage of bromine in the compound. [Atomic mass of Ag = 108u and Br = 80u] **(2)**

8. Complete and balance the following: **(2)**
   (a) $B_2H_6 + H_2O \longrightarrow$
   (b) $C + O_2 + N_2 \longrightarrow$

9. What are buffer solutions? Give an example. **(2)**

10. A compound contains 4.07% hydrogen, 24.27% carbon and rest of chlorine. Its molar mass is 98.96g. What are its empirical and molecular formulas? **(2)**

OR

32g of CH_4 is allowed to react with 32g of O_2. Calculate the mass of CO_2 formed and Identify the limiting reagent :

$CH_4 (g) + 2O_2 (g) \longrightarrow CO_2 (g) + 2H_2O (g)$

11. (a) Write the electronic configuration of Cu^+ ion. **(2)**
    (b) State Pauli's exclusion principle.

12. (a) Calculate the number of molecules present in 6.4g of SO_2. **(2)**

    [Atomic mass of S=32u, O= 16 u]

    (b) What is the effect of temperature on molality and molarity of a solution?

13. (a) State Heisenberg's uncertainty principle. **(3)**
    (b) Calculate the uncertainty in the position of an electron if the uncertainty in its velocity is 5.7×10^{-5} ms^{-1}.
    [$h = 6.6 \times 10^{-34}$ Js and $m_e = 9.1 \times 10^{-31}$ kg]

14. (a) What are iso-electronic species? **(3)**
    (b) What do you mean by diagonal relationship in the periodic table?
    (c) The Ionisation enthalpy of boron is slightly less than that of beryllium – Give reason.

15. (a) Name the type of intermolecular attractive force existing in the following pairs : **(3)**
    (i) N_2 and He (ii) water and ethanol
    (b) Calculate the volume occupied by 8.8g of CO_2 gas at 31.1°C and 1 bar pressure. [R = 0.083 bar LK^{-1} mol^{-1}]

16. (a) Show that $\Delta H = \Delta U + \Delta n_g RT$ **(3)**
    (b) For the reaction,
    $2Cl(g) \longrightarrow Cl_2 (g)$, What are the signs of ΔH and ΔS?

17. Calculate the value of equilibrium constant K_c for the reaction at 400K : **(3)**

$$2NOCl (g) \rightleftharpoons 2NO (g) + Cl_2 (g)$$

$\Delta H° = 77.2$ kJ mol^{-1}, $\Delta S° = 122$ JK^{-1} mol^{-1} at 400k and R = 8.314 JK^{-1} mol^{-1}

OR

For the reaction at 298k,

$$2A + B \longrightarrow C$$

$\Delta H = 400$ kJ mol^{-1} and $\Delta S = 200$ JK^{-1} mol^{-1}

At what temperature will the reaction becomes spontaneous?

18. (a) $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ **(3)**

Write an expression for K_p for the above equilibrium reaction.

(b) What is the effect on the above equilibrium by increasing the pressure.

(c) Calculate the pH of NaOH solution if its pOH is 3.

19. (a) What is the oxidation state of sulphur in $Na_2S_2O_7$? **(3)**

(b) Identify the oxidizing agent and reducing agent in the following reaction:

$$6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$$

(c) What is disproportionation reaction?

20. (a) What is syngas? **(3)**

(b) What causes the temporary hardness of water ?

(c) Write any one use of heavy water.

21. Give reasons : **(3)**

(a) Graphite is used as Lubricant.

(b) Boron is unable to form BF_6^{3-} ion.

(c) HF acid cannot be stored in glass containers.

22. (a) Write the IUPAC name of the compound $CH_3 - O - CH(CH_3)_2$

(b) Write the functional isomer of propanal.

(c) What is the hybrid state of the second carbon atom in $CH_3CH = CHCHO$?

23. Write a brief note on the following environmental terms: **(3)**

(a) Photochemical smog

(b) Eutrophication

(c) Green chemistry

24. (i)The energy associated with the first orbit in the hydrogen atom is -2.18×10^{-18} J/atom. What is the energy associated with the fifth orbit? **(3)**

(ii) Calculate the radius of Bohr's fifth orbit for hydrogen atom.

25. (a) State Markovnikov's rule and illustrate with an example. **(5)**

(b) Complete the following organic reactions:

(i) $CH_3COONa + NaOH \xrightarrow[\text{heat}]{CaO}$

(ii) $CH_3CH_2CH_2Br \xrightarrow{\text{alc. KOH}}$

(iii) $C_6H_5OH + Zn \xrightarrow{\text{heat}}$

OR

(a) State Huckel rules.

(b) Draw the geometrical isomers of but-2-ene.

(c) Convert (i) bromomethane to ethane

(ii) Calcium carbide to ethyne

26. (a) Discuss the various reactions that occur in the Solvay process for manufacture of sodium carbonate. **(5)**

(b) What is white metal? Write its use.

OR

(a) (i) What is the role of gypsum in cement?

(ii) What is 'dead burnt plaster'?

(iii) Write any one use of plaster of paris.

(b) Explain the commercial preparation of caustic soda by Castner – Kellner method.

27. (a) Draw the shape of NH_3 molecule and mention the hybrid state of N in it. **(5)**

(b) Calculate the bond order of O_2, O_2^+, O_2^-, O_2^{2-} species and compare the bond enthalpy of them. Indicate their magnetic properties.

OR

(a) Define the dipole moment of a molecule.

(b) Draw the shape of SF_4 molecule.

KENDRIYA VIDYALAYA, SANGATHAN

SESSION ENDING EXAMINATION

MARKING SCHEME

CLASS : XI

SUBJECT : CHEMISTRY

Q.No.	Answers (value points)	Marks
(1)	z = 1	**(1)**
(2)	unbilnilium	**(1)**
(3)	$Na^+NH_2^-$ (or) Sodamide	**(1)**

(4) $CH_3CH = C(CH_3)C \equiv CH$ **(1)**

(5) CO_3^{2-} **(1)**

(6) (a) sublimation **(1)**

(b) both N and S **(1)**

(7) $\% \ Br = \frac{80 \times 0.12 \times 100}{188 \times 0.15}$ **(1½)**

= 34.0.4 % **(½)**

(8) (a) $B_2H_6 + 6H_2O \longrightarrow 2B(OH)_3 + 6H_2$ **(1)**

(b) $2C + O_2 + 4N_2 \longrightarrow 2CO + 4N_2$ **(1)**

1

(9) For correct definition ..... → **(1)**

For any one example ..... → **(1)**

(10) For finding empiricaformula = CH_2Cl **(1)**

For finding molecular formula = $C_2H_4Cl_2$ **(1)**

OR

8g of CH_4 + 32g of $O_2 \longrightarrow$ 22g of CO_2 **(1½)**
(0.5 mol) (1 mol) (0.5mol)

Limiting reagent is O_2. **(½)**

(11) (a) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}$ **(1)**

(b) Correct statement. **(1)**

(12) a) $\frac{6.02 \times 10^{23}}{64} \times 6.4 = 6.02 \times 10^{22}$ molecules **(1)**

(b) Correct difference / explanation. **(1)**

(13) (a) Correct statement. **(1)**

(b) $\Delta x \,.\, m\Delta v = \frac{h}{4\pi}$ **(½)**

$\Delta x = \frac{6.6 \times 10^{-34}}{9.1 \times 10^{-31} \times 5.7 \times 10^{-5} \times 4 \times 3.14}$ **(1)**

$\Delta x = 1.7m$ **(½)**

(14) (a) Species (atom (or) ions) having same number of electrons (or) electronic configuration. **(1)**

(b) Correct statement. **(1)**

(c) Shielding effect (or) any other suitable reason. **(1)**

2

(15) (a) (i) dispersion force (ii) H – bond **(½ + ½)**

(b) $n = \frac{8.8}{44} = 0.2 \text{ mol}$ **(½)**

PV = nRT **(½)**

$V = \frac{nRT}{P} = \frac{0.2 \times 0.083 \times 304.1}{1}$ **(½)**

= 5.05L **(½)**

---

(16) (a) For correct derivation. **(2)**

(b) $\Delta H = -ve \Delta S = -ve$ **(½ + ½)**

---

(17) $\Delta G° = \Delta H° - T\Delta S°$ **(½)**

$= 77.2 - (400 \times 122 \times 10^{-3})$ **(½)**

$= 28.4 \text{ kJ mol}^{-1}$ **(½)**

$\Delta G° = -2.303 \text{ RT log } K_C$ **(½)**

$\log K_C = -28.4 \times 2.303 \times 8.314 \times 10^{-3}$ **(½)**

$= -5.438 \times 10^{-1} = -54.38$

$K_C = 2.399 \times 10^{-54}$ **(½)**

OR

$\Delta G = \Delta H - T\Delta S$ **(½)**

$T = \frac{\Delta H}{\Delta S}$ **(½)**

$T = \frac{400}{0.2} = 2000K$ **(1)**

Required temperature is above 200K **(1)**

---

(18) (a) $K_P = \frac{(P_{CO(g)})^2}{P_{CO(g)}}$ (OR) $\frac{P_{CO}^2}{P_{CO_2}}$ **(1)**

(b) Reverse reaction takes place. **(1)**

(c) $P^H + P^{OH} = 14$, $P^H = 14 - 3 = 11$ **(½ + ½)**

---

(19) (a) $2(+1) + 2(S) + 7(-2) = 0$, $S = +6$ **(1)**

(b) oxidising agent = $Cr_2O_7^{2-}$ **(½)**

reducing agent = Fe^{2+} **(½)**

(c) Correct statement. **(1)**

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(20) (a) the mixture of H_2 and CO gases. **(1)**

(b) hydrogencarbonates of Ca and Mg. **(1)**

(c) as a moderator in nuclear reactor (or) for study of reaction mechanism. **(1)**

---

(21) (a) Slippery due to weak Van der Waals force between hexagonal layers. **(1)**

(b) due to absence of vacant d-orbital, boron cannot expand its covalency above 4. **(1)**

(c) HF reacts with SiO_2 of glass and forms SiF_4 and H_2O (or) correct reaction. **(1)**

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(22) (a) 2 – methoxypropane **(1)**

(b) propanone **(1)**

(c) Sp^2 **(1)**

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(23) (i) Photochemical smog occurs in warm, dry and sunny climate. The main components of the photochemical smog result from the action of sunlight on unsaturated hydrocarbons and nitrogen oxides produced by automobiles and factories.
Photochemical smog has high concentration of oxidising agents and is, therefore, called as oxidising smog.

(ii)The process in which nutrient enriched water bodies support a dense plant population, which kills animal life by depriving it of oxygen and results in subsequent loss of biodiversity is known as ***Eutrophication***.

(iii) Green chemistry is a way of thinking and is about utilising the existing knowledge and principles of chemistry and other sciences to reduce the adverse impact on environment.

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(24) (i) $E_n = -2.18 \times 10^{-18}/n^2$ J **(1+1)**

$E_5 = -2.18 \times 10^{-18}/5^2$ J

$= -8.72 \times 10^{-20}$ J

(ii) $r_n = 0.529 \times n^2 A^0$

$= 0.529 \times 5^2$

$= 13.225 A^0 = 1.3225$nm

---

(25) (a) Correct statement, illustration. **(1+1)**

(b) (i) $CH_3COONa + NaOH \xrightarrow[\text{heat}]{CaO} CH_4 + Na_2CO_3$

(ii) $CH_3CH_2CH_2Br \xrightarrow{\text{alc. KOH}} CH_3CH = CH_2$ (1)

(iii) $C_6H_5OH + Zn \xrightarrow{\text{heat}} C_6H_6 + ZnO$ (1)

OR

(a) Correct statements. 4 **(2)**

(b) Correct structures for cis and trans isomers. **(1)**

(c) (i) $2CH_3Br + 2Na \xrightarrow{\text{dry ether}} CH_3CH_3 + 2NaBr$ **(1)**

(ii) $CaC_2 + H_2O \longrightarrow CaO + C_2H_2$ **(1)**

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(26) (a) $2NH_3 + H_2O + CO_2 \longrightarrow (NH_4)_2CO_3$ **(1)**

$(NH_4)_2CO_3 + H_2O + CO_2 \longrightarrow 2NH_4HCO_3$ **(1)**

$NH_4HCO_3 + NaCl \longrightarrow NaHCO_3 + NH_4Cl$ **(½)**

$NaHCO_3 \xrightarrow{\text{heat}} Na_2CO_3 + CO_2 + H_2O$ **(½)**

(b) Alloy of Li and Pb, **(1)**

to make bearing for motor engines. **(1)**

OR

(a) (i) to slow down the process of setting of cement. **(1)**

(ii) anhydrous calcium sulphate. **(1)**

(iii) any one correct use. **(1)**

(b) Cathode : $Na^+ + e^- \xrightarrow{Hg}$ Na-amalgam

anode : $Cl^- \longrightarrow \frac{1}{2}Cl_2 + e^-$

2Na-amalgam $+ 2H_2O \longrightarrow 2NaOH + 2Hg + H_2$ **(2)**

---

(27) (a) For diagram (pyramid shape), **(1)**

Sp^3 hybrid state. **(1)**

(b) bond order of O_2, O_2^+, O_2^-, O_2^{2-} are 2, 2.5, 1.5, 1 respectively. **(1)**

bond enthalpy : $O_2^+ > O_2 > O_2^-, O_2^{2-}$ **(1)**

paramagnetic : O_2, O_2^+, O_2^- **(1)**

diamagnetic : O_2^{2-} **(1)**

OR

(a) Correct definition. **(1)**

(b) for diagram (see-saw) **(1)**

(c) Definition, Explanation with example. **(1 + 2)**

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Chemistry (Theory)
Class – XI
PAPER NO 11

Time allowed:3hours **Maximum Marks:70**

General Instructions:

a) All the questions arecompulsory.
b) There are **27**questions intotal.
c) Questions **1** to **5** are very short answer type questions and carry **one**mark each.
d) Questions **6** to **12**carry **two** markseach.
e) Questions **13**to **24**carry **three** markseach.
f) Questions **25**to **27**carry **five** markseach.
g) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions in five marks each. You have to attempt only one of the choices in suchquestions.
h) Use of calculators is **not** permitted. However, you may use log tables ifnecessary.

1. WhatdoesthepropertyofmoleculesofrealgasesisindicatedbyvanderWaalsconstant'a'?
2. Using periodic table,identify

   (a) An element that would tend to gain twoelectrons.

   (b) An element that would tend to lose two electrons.
3. Give IUPAC name of allylalcohol.
4. ExplainwhyBeH_2moleculehaszerodipolemomentalthoughtheBe-Hbondsarepolar?
5. In the given equation, determine ΔH^{θ} for thereaction.

   $$2Al\,(s) + \frac{3}{2}O_2\,(g) \rightarrow Al_2O_3\,(s),\ \Delta_f H^{\theta} = -1{,}670 kJ/mol \text{ for } Al_2O_3\,(s)$$
6. Convert:

   (a) Carbon tobenzene.

   (b) Calcium carbide to oxalicacid.
7. How would you calculate the pH of 0.001MNaOH?

   Or

   Ramesh forgot to add the reaction mixture to the round bottomed flask at 27°C but instead he placed the flask on the flame. But after sometime, he realized his mistake and used pyrometer and found the temperature of the flask which was 477°C. What fraction of air would have been expelledout?
8. Define the following terms
   a) Acid Rain
   b) Eutrophication
9. State the difference between classical smog and photochemicalsmog.
10. GiventheelectrodereductionpotentialsoffourmetallicelementsA,B,CandD=+0.79,-0.74, 1.08 and – 0.31 V. Arrange these in order of decreasingelectropositive characterand support your answer.
11. Give any three factors favourable for the formation of ionicbond.
12. (a) Explain water gas shift reaction.

(b) Explain the structure of H_2O_2 in vapour phase.

13. (a) Which undergo nitration easily m-dinitrobenzene or toluene? Givereason.

(b) Whatisthenumberofσ and πbondsin$N\equiv C-CH=CH-C\equiv N$

(c) Indicate the number of σ and π bonds in$HCONHCH_3$.

14. If successive ionization energies of a certain element are IE_1 = 589.5 kJ/mol, IE_2 = 1145 kJ/mol, IE_3 = 4900 kJ/mol, IE_4 = 6500 kJ/mol, IE_5 = 8100 kJ/mol, then identify the unknown element as K, Si, Ca or As from the pattern of ionizationenergies

15. Professor of Delhi University found that some scraps emit high energy radiations which harmed large number of people. There are certain elements like Co-60 which emit radiations at their own and this phenomenon is called radioactivity. There are three kinds ofrays.
    (a) Name the ray which is used to treatcancer.
    (b) Give the source of γ-rays used for treatingcancer.
    (c) Write types of EM Radiations in decreasing order of frequency.

16. These people are not concerned with the health of other people.The first element in every group of representative elements shows properties different from the characteristic properties of the group.
    (a) Name three suchelements.
    (b) Give two abnormal properties of each one ofthem.

17. (a) Lifetimes of the molecules in the excited states are often measured by using pulsed radiation source of duration nearly in the nano second range. If the radiation source has the duration of 2 ns and the number of photons emitted during the pulse source is 2.5 x 10^{15}, then calculate the energy of thesource.
    (b) Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen.

18. Givereasons:
    (a) LiCl is more covalent thanKCl.
    (b) In aqueous solution Li+ has lowestmobility.

19. The combustion of one mole of benzene takes place at 298 K and 1 atm. Aftercombustion, CO2(g) and H2O (1) are produced and 3267.0 kJ of heat is liberated. Calculate the standard enthalpy of formation, Df H0 of benzene. Standard enthalpies of formation of CO2(g) and 2 H O(l) are –393.5 kJ mol–1 and –285.83 kJ mol–1 respectively.

20. Givereasons:
    (a) Ethyne molecule islinear.
    (b) Covalent bonds are directional while ionic bonds arenon-directional.
    (c) Water molecule has bentstructure.

21. When we eat sweets, they form acid in our mouth which reacts with calcium phosphate of the enamel and tooth starts to decay. In order to avoid tooth decay, we should brush our teeth after every meal.
    (a) Comment: “Calcium phosphate is a basicsalt”.
    (b) Give reason: “Toothpaste is basic innature”.
    (c) Give the expression for K_{sp} of calciumphosphate.

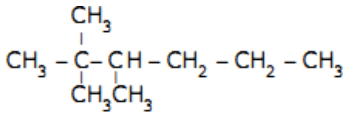
Or

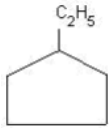
How would you classify the state of chemical equilibrium in a chemical reaction based on the extent to which the reactionsproceed?

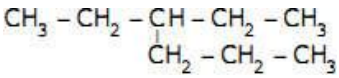
22. Explain the physical significance of van der Waalsparameters.

23. (i) Draw the structural isomers ofpentane.

(ii) Give the IUPAC names of the following compounds.

(a) 

(b) 

(c) 

24. (i) Give the chemical reactions when borax solution isacidified.

(ii) Explain why BF_3 exists whereas BH_3 doesnot?

(iii) SiO_2 is solid but CO_2 is a gas at roomtemperature.

25. (a)How are 0.50 mol and 0.50 M Na_2SO_4 different?

(b)Calculate the concentration of nitric acid in moles per litre in a sample which has a density, 1.41 g mL^{-1} and mass percent of nitric acid in it being 69%.

26. Write the balanced ionic equation for the reaction of permanganate ion with bromide ion in basic medium to give manganese dioxide and bromateion.

Or

Explain the rules for calculating oxidation number.

27. (a) Outofn-hexaneandethynewhichwillbemoreacidic.Alsogivereasonforthisbehaviour.

(b) Explain with an example: i) Wurtz reaction ii) AcidicDehydration

(c) Convert propyne topropanone.

Answers

1. Here, 'a' indicates the intermolecular forces of attraction.
2. (a) O = $1s^2\ 2s^2 2p^4$

   (b) Ca = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$
3. Prop-2-en-1-ol.
4. Because of its linear symmetrical structure.

5 . ΔH^{Θ} = 2 x (+ (1,670)) kJ/mol = + 3,340 kJ/ mol.

6. (a) $2C + H_2 \xrightarrow{\text{Electricarc}} C_2H_2 \xrightarrow{\text{redhotFe}} C_6H_6$

   (b) $CaC_2 + H_2O \rightarrow C_2H_2 \xrightarrow{\text{HotKMnO}_4} C_2H_2O_2$

7. [NaOH] = $[OH^-]$ =0.001M

   $[H_3O^+]\ [OH^-] = 1.0 \times 10^{-14}$

   $[H_3O^+] = 10^{-11}$

   pH = -log $[H_3O^+]$ = - log 10^{-11} = 11

Or

$$\frac{n_1}{n_2} = \frac{T_2}{T_1}$$

$$\frac{750}{3002} = \frac{5}{}$$

$$\frac{n_2}{n_1} = \frac{2}{5}$$ Thus, the amount of air escaped = $1 - \frac{2}{5} = 0.6$

8.Correct Definition with one example each.

9.

Classical smog	Photochemical smog
Occurs in cool humid climate.	Occurs in warm, dry and sunny climate.
It is a mixture of smoke, fog and sulphur dioxide.	Components of photochemical smog result from the action of sunlight on unsaturated hydrocarbons & oxidesof nitrogen produced by automobiles & factories.

10. Higher the electrode potential lower is its tendency to lose electrons and therefore, lower isthe

electropositive character of the metal. So the metals are arranged as: B, D, A, C.

11.(a) Low ionization enthalpy of the metalatom.

(b) High electron gain enthalpy of the non-metalatom.

(c) High lattice enthalpy of the compoundformed.

$CO_2 + H_2$

12 (a) $CO_2 + H_2O$ $\longrightarrow$

13. (a) Toluene – Nitration is an electrophilic substitution reaction. Since – CH_3 group is electron donating group, it increases the electron density on the benzene ring, thereby improves electrophilic substitution reaction. The nitro group is electron withdrawing group, therefore it is deactivating.

(b) Number of sigma bonds – 7, number of pi bonds –5.

(c) Number of sigma bonds – 8, number of pi bonds –1.

14. The unknown element is Ca. Here the third ionization energy is very high which suggest that the removal of the third electron is difficult. The electronic configuration of calcium is [Ar] $4s^2$ first two electrons can be removed without much difficulty. But the removal of third electron from the stable electronic configuration of argon is difficult. Hence, the third ionization energyis high.

15. (a) The γ-ray is used for treatingcancer.

(b) Co-60.

16. (a) B, C andN

(b) Boron

(i) Itformsacidicoxidewhereasotherelementsformamphotericoxideandbasicoxides.

(ii) It cannot form $[BF_6]^{3-}$ whereas others can form suchcomplexes.

Carbon

(i) It shows the property of catenation to maximumextent.

(ii) It cannot form $[CCl_6]^{2-}$ due to non-availability ofd-orbitals.

Nitrogen

(i) It is a gas others aresolid.

(ii) Ammonia is a liquid whereas others aregases.

17. Frequency $\upsilon = \frac{1}{2 \times 10^{-9}} = 0.5 \times 10^9/s$

Energy = Nhυ

Substituting the values, we get 8.275×10^{-10} J

$$\bar{v} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

For Balmer series $n_1 = 2$, for longest wavelength, $\bar{\nu}$ should be minimum so that $n_2 = 3$

Substituting the values, we get $\bar{\nu} = 1.097 \times 10^7 \left(\frac{5}{9}\right) = 1.523 \times 10^6\ m^{-1}$

18. (a) According to Fajan's rule smaller the size of cation and larger the size of anion greater is the covalent character of ionic bond. Li is small in size than K, thus Li^+ has a high charge density. Thus polarizing power of Li^+ is higher than K^+, hence LiCl is more covalent thanKCl.

    (b) Smaller the size of ion greater is the degree of hydration. In aqueous medium Li^+ gets heavily hydrated. Thus mobility of hydrated Li^+ is low.

19. Solve using Hess's Law:
    Writing reaction aim (1 mark)
    Steps of addition and subtraction (2 marks)

20. (a) Due to sp-hybridization with bond angle180^0.

    (b) Covalent bond is formed by overlapping of atomic orbitals, therefore they are directional whereastheionicbondsareformedbythetransferofelectronsandsoarenon-directional.

    (c) It is due to sp^3 hybridization and two lone pairs ofelectrons.

21. (a) It is because it is a salt of strong base and weak acid i.e., calcium hydroxide and phosphoric acid.

    (b) It is because it neutralizes the acid released in themouth.

    (c) $K_{sp} = \left[Ca^{2+}\right]^3 \left[PO^{3-}_4\right]^2$

Or

Based on the extent to which the reactions proceed, the state of chemicalequilibriumin a chemical reaction may be classified into three groups asfollows:

(i) The reactions that proceed nearly to completion and only negligible concentrations of the reactantsareleft.Insomecases,itmaynotbeevenpossibletodetectthese experimentally.

(ii) The reactions in which only small amounts of products are formed and most of the reactants remain unchanged at equilibriumstage.

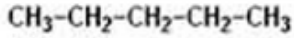
(iii) The reactions in which the concentrations of the reactants and products are comparable, when the system is inequilibrium.

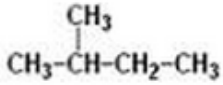
22. Significance of constant 'b' - The constant 'b' is called co-volume or excluded volume per mol of a gas. Its units are L/mol. The volume of 'b' is four times the actual volume of the molecules.

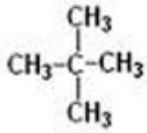
    Significance of constant 'a' – The value of constant 'a' gives the idea of the magnitude of attractiveforcesbetweenthemoleculesofthegas.Itsunitsareatm/L^2/mol^2.Largerthevalueof

‘a’ larger will be the intermolecular attraction among the gas molecules.

23. (i) There are three structural isomers ofpentane:


entane


2-Methylbutane


2,2-Dimethylpropane

a. (a) 2, 2,3-Trimethylhexane

(b) Ethylcyclopentane

(c) 3-Ethylhexane

24. (i) Borax solution on acidification forms boricacid.

$$Na_2B_4O_7 + 2HCl + 5H_2O \rightarrow 2NaCl + 4H_3BO_3$$

(ii) BF_3 is trigonal planar molecule. Due to pπ - pπ back bonding lone pair of electrons of F is back donated to B atom. This delocalization reduces the deficiency of electrons of boron thereby increasing the stability of BF_3 molecule. Due to absence of lone pair of electrons on H atom this compensation does not occur in BH_3. In other words electron deficiency of B stays & hence it reduces its electron deficiency as BH_3dimerises to formB_2H_6.

(iii) Carbonisabletoformpπ–pπbondwithOatomandconstituteastablenon-polar

molecule O = C = O. Due to weak inter particle force its boiling point is low and it is gas at room temperature. Si on the other hand is not able to from pπ – pπ bond with O atoms because of its relatively large size. In order to complete its octet Si is linked to four O atoms around it by sigma bond & these constitutes network structure, which is responsible for its solid.

25. (2+3) (a) Difference in the molarity and simple no. of moles.

    (b) Solved Numerical.

26. Step 1: The skeletal ionic equationis

$$MnO_4^-(aq) + Br^-(aq) \rightarrow MnO_2(s) + BrO_3^-(aq)$$

Step 2: Assign oxidation numbers for Mn and Br.

$$\overset{+7}{Mn}O_4^-(aq) + \overset{-1}{Br^-}(aq) \rightarrow \overset{+4}{Mn}O_2(s) + \overset{+5}{Br}O_3^-(aq)$$

Step 3: Calculate the increase and decrease of oxidation number, and make them equal.

$$2\overset{+7}{Mn}O_4^-(aq) + \overset{-1}{Br^-}(aq) \rightarrow 2\overset{+4}{Mn}O_2(s) + \overset{+5}{Br}O_3^-(aq)$$

Step 4: As the reaction occurs in the basic medium, and the ionic charges are not equal on both the sides, add 2 OH^- ions on the right to make ionic chargesequal.

$$2MnO_4^-(aq) + Br^-(aq) \rightarrow 2MnO_2(s) + BrO_3^-(aq) + 2OH^-(aq)$$

Step 5: Finally, count the hydrogen atoms, and add appropriate number of water molecules on the right to achieve balanced redoxchange.

$$2MnO_4^-(aq) + Br^-(aq) + H_2O(l) \rightarrow 2MnO_2(s) + BrO_3^-(aq) + 2OH^-(aq)$$

Or

a. In elements, in the free or the uncombined state, each atom bears an oxidationnumber of zero. Evidently each atom in H_2, O_2, Cl_2, O_3, P_4, S_8, Na, Mg, Al has the oxidation number zero.

b. For ions composed of only one atom, the oxidation number is equal to the charge on the ion. Thus Na^+ ion has an oxidation number of +1, Mg^{2+} ion, +2, Fe^{3+} ion, +3, Cl^- ion, –1, O^{2-} ion, –2; and so on. In their compounds all alkali metals have oxidation number of +1, and all alkaline earth metals have an oxidation number of +2. Aluminium is regarded to have an oxidation number of +3 in all itscompounds.

c. The oxidation number of oxygen in most compounds is –2. However, we come across two kinds of exceptions here. One arises in the case of peroxides and superoxides, the compounds of oxygen in which oxygen atoms are directly linked to each other. While in peroxides (e.g., H_2O_2, Na_2O_2), each oxygen atom is assigned an oxidation number of –1, in superoxides (e.g., KO_2,RbO_2) each oxygen atom is assigned an oxidation number of –(½). The second exception

appears rarely, i.e. when oxygen is bonded to fluorine. In such compounds e.g., oxygen difluoride (OF_2) and dioxygendifluoride (O_2F_2), the oxygen is assigned an oxidation number of +2 and +1, respectively. The number assigned to oxygen will depend upon the bonding state of oxygen but this number would now be a positive figureonly.

d. The oxidation number of hydrogen is +1, except when it is bonded to metals in binary compounds (that is compounds containing two elements). For example, in LiH, NaH andCaH_2, its oxidation number is–1.

e. In all its compounds, fluorine has an oxidation number of –1. Other halogens (Cl,Br, and I) also have an oxidation number of –1, when they occur as halide ions in their compounds. Chlorine, bromine and iodine when combined with oxygen, for example in oxoacids and oxoanions, have positive oxidationnumbers.

(iv) The algebraic sum of the oxidation number of all the atoms in a compound must be zero. In polyatomic ion, the algebraic sum of all the oxidation numbers of atoms of the ion must equal the charge on the ion. Thus, the sum of oxidation number of three oxygen atoms and one carbon atom in the carbonate ion, $(CO_3)^{2-}$ must equal–2.

27. $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$

-sp^3 hybridized with s-character25%

$CH \equiv CH$ – sp hybridized with s-character 50%

Since s-orbital are closer to the nucleus, hence due to more s character in ethyne (sp hybridized) the hybridized orbital is nearest to this carbon atom in compared to sp^2hybridised carbon. This leads to the movement of C-H bond pair more towards sp hybridized carbon, leading to the development of partial positive charge on the hydrogen attached to sphydridised carbon and eventually helps in release of proton (H^+). Thus ethyne is more acidic thann-hexane.

(i)Wurtz reaction: Alkyl halides on treatment with sodium metal in dry ether medium give higher alkanes. This is called Wurtz reaction and is used for the preparation of alkanes with even number of carbon atoms.

$$CH_3Br + 2Na + CH_3Br \xrightarrow{ether} CH_3 - CH_3 + 2NaBr$$

(ii)Acidic dehydration: Alcohols on heating with conc. H2SO4 at 443 K form alkenes with elimination of one water molecule. Since a water molecule is lost in the presence of acid, the reaction is called acidic dehydration of alcohols.

(b)

$$CH_3 - CH_2OH \xrightarrow{conc.\text{sulphuric acid}} CH_2 = CH_2 + H_2O$$

$$CH_3 - C \equiv CH \xrightarrow{H_2O + HgSO_4 + H_2SO_4 /333K} CH_3 - C(OH) = CH_2$$

(iii)

BLUE PRINT

S.No	Chapters	VSA (1 marks)	SA (2 marks)	SA (3 marks)	LA (5 marks)	Total Marks
1	Some basic concepts of chemistry				1	5
2	Structure of Atom			2		6
3	Classification of Elements and Periodicity in property	1		1		4
4	Chemical Bonding and Molecular Structure	1	1	1		6
5	States of Matter	1		1		4
6	Thermodynamics	1		1		4
7	Equilibrium		1	1		5
8	Redox Reactions				1	5
9	Hydrogen		1			2
10	S-block Elements		1	1		5
11	P-Block Elements			2		6
12	Organic Chemistry: Some basic Principles And Techniques	1		1	1	9
13	Hydrocarbons		1	1		5
14	Environmental Chemistry		2			4
	TOTAL	5	14	36	15	70

Blue Print
XI Chemistry
PAPER NO 12

Time : 3 Hours Maximum Marks : 70

S.No.	Unit	VSA (1)	VSA (2)	SA (3)	LA (5)	Total
1	Some basic concept of chemistry		2(1)	3(1)		8(4)
2	Structure of atom	1(1)	2(1)			
3	Classification of elements and periodicity in properties	1(1)		3(1)		4(2)
4	Chemical bonding and molecular structure		2(1)	3(1)		20(7)
5	States of matter; gases and liquid and solids				5(1)	
6	Thermodynamics		2(1)	3(1)		
7	Equilibrium		2(1)	3(1)		
8	Redox reaction	1(1)			5(1)	20(8)
9	Hydrogen			6(2)		
10	S-block elements	1(1)		3(1)		
11	Some p block elements	1(1)		3(1)		
12	Organic chemistry: some basic principle and technique			3(1)	5(1)	18(6)
13	Hydrocarbons		2(1)	3(1)		
14	Environmental chemistry		2(1)	3(1)		
Total		5(5)	14(7)	36(12)	15(3)	70(27)

Note: Number of Questions are given within brackets and marks outside the brackets.

QUESTION PAPER CLASS XI

CHEMISTRY

SET 2

Time Allowed: 3 Hrs MM: 70

GENERAL INSTRUCTIONS:

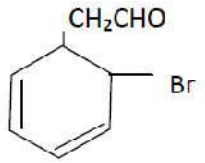
1. All the questions are compulsory.
2. Q. No. 1 to 5 are very short answer type, carrying 1mark each.
3. Q. No. 6 to 12 are short answer type, carrying 2 marks each.
4. Q. No. 13 to 24 are short answer type, carrying 3 marks each.
5. Q. No. 25 to 27 are long answer type, carrying 5 marks each.
6. There is no overall choice in the question paper. However, an internal choice is provided in one question of two marks, one question of three marks and all three questions of five marks.
6. Use of calculators is not allowed, use log tables wherever required.

1. Which has higher energy, 3d or 4s? Why?
2. What is the general electronic configuration of d-block elements?
3. What is meant by disproportionation? Give one example.
4. LiCl is more soluble in organic solvent, why?
5. By giving a balanced equation show how $B(OH)_3$ behaves as an acid in water.
6. In the combustion of methane in air, what is the limiting reagent & why?
7. Light of wavelength 5000 Å falls on a metal surface of work function 1.9 eV. Find
   (a) the energy of photos (b) kinetic energy of photoelectrons?
8. Define bond enthalpy and bond order?
9. Write the expression for the work done by 1 mole of the gas in each of the following cases:
   (i) For irreversible expansion of the gas from V1 toV2
   (ii) For reversible isothermal expansion of the of the gas from V1 toV2
10. The concentration of hydrogen ion in a sample of soft drink is 3.8×10^{-3}M.What is its pH ?
11. An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3-one. Write structure and IUPAC name of 'A'.
12. (a) Name the region of atmosphere which contains Ozone layer?
    (b) What is CFC stand for ?

    OR

    (a) What do you mean by Biochemical Oxygen Demand (BOD)?
    (b) What is eutrophication?
13. A compound contains 4.07 % hydrogen, 24.27 % carbon and 71.65 % chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formulas ?
14. Among the second period elements the actual ionization enthalpies are in the order Li < B < Be < C < O < N < F < Ne. Explain why (i) Be has higher Δi H than B (ii) O has lower Δi H than N and F?
15. Explain the structure of CO_3^{2-} ion and CO_2 molecule in terms of resonance.
16. Calculate the enthalpy of formation of $CH_3OH(l)$ From the following data:
    $\Delta cH\ CH_3OH(l) = -726\ kJmol^{-1}$ $\Delta cH\ C(s) = -393\ kJmol^{-1}$, $\Delta cH\ H_2(g) = -286\ kJmol^{-1}$

17. (a) Derive relation between Kp and Kc .(2)
    (b)What is reaction quotient. (1)
18. (a) Give an example each of an ionic hydride and a covalent hydride. (1)
    (b) What are the causes of the temporary and permanent hardness of water? (2)
19. (a) Calculate the strength of 10 volume solution of hydrogen peroxide. (2)
    (b) Draw the structure of hydrogen peroxide in gas phase. (1)
20. What happens when,
    (i) Sodium metal is dropped in water?
    (ii) Sodium metal is heated in free supply of air?
    (iii) Sodium peroxide is dissolved in water?
21. Give reason for the following observations.
    (a) The tendency for catenation decreases down the group.
    (b) The decreasing stability of +3 oxidations state with increasing atomic number in group13.
    (c) PbO_2 IS a stronger oxidizing agent than SnO_2.
22. (a) Write the IUPAC name of-



    (b)On complete combustion, 0.246 g of an organic compound gave 0.198g of carbon dioxide and 0.1014g of water. Determine the percentage composition of carbon and hydrogen in the compound.
23. Addition of HBr to propene yields 2-bromopropane, while in the presence of benzoyl peroxide, the same reaction yields 1-bromopropane. Explain and give mechanism.

    OR

    How will you convert benzene into-
    (i) p-nitrobromobenzene (ii) m- nitrochlorobenzene (iii) p - nitrotoluene
24. (a) Write down the reactions involved during the formation of photochemical smog.
    (b) What are the reactions involved for ozone layer depletion in the stratosphere?
25. (a)What type of stoichiometric defect is shown by: (i) ZnS (ii) AgBr (1/2 + 1/2)
    (b) What are paramagnetic substances? (1)
    (c) A mixture of dihydrogen and dioxygen at one bar pressure contains 20% by weight of dihydrogen. Calculate the partial pressure of dihydrogen. (3)

    OR

    (a)Niobium crystallises in body-centred cubic structure. If density is 8.55 g cm^{-3}, calculate atomic radius of niobium using its atomic mass 93 u. (3)
    (b)What will be the minimum pressure required to compress 500 dm3 of air at 1 bar to 200 dm3 at 30°C? (2)
26. (a)While sulphur dioxide and hydrogen peroxide can act as oxidising as well as reducing agents in their reactions, ozone and nitric acid act only as oxidants. Why ?(2)
    (b)Balance the following redox reaction by ion – electron method : (3)
    (a) MnO_4^- (aq) + I^- (aq) → MnO_2 (s) + I_2(s) (in basic medium)

    OR

    (a)Predict the products of electrolysis in each of the following: (2)
    (i) An aqueous solution of $AgNO_3$ with silver electrodes
    (ii) An aqueous solution $AgNO_3$ with platinum electrodes
    (b)Balance the following equation in basic medium by oxidation number method.
    (a) P_4(s) + OH^-(aq) → PH_3(g) + HPO^{2-} (aq)

27. (a) Which of the following carbocation is most stable ?(1)

(a) $(CH_3)_3C.\overset{+}{C}H_2$ (b) $(CH_3)_3\overset{+}{C}$ (c) $CH_3CH_2\overset{+}{C}H_2$ (d) $CH_3\overset{+}{C}H\,CH_2CH_3$

(b)In the Lassaigne's test for nitrogen in an organic compound, the Prussian blue colour is obtained due to the formation of:(1)

(c)Explain the reason for the fusion of an organic compound with metallic sodium for testing nitrogen, sulphur and halogens.(1)

(d)0.3780 g of an organic chloro compound gave 0.5740 g of silver chloride in Carius estimation. Calculate the percentage of chlorine present in the compound.(2)

OR

(a)Write bond line formulas for : (i)Isopropyl alcohol (ii) 2,3-Dimethyl butanal (iii) Heptan-4-one.(3)

(b)Explain why chloroacetic acid is more acidic than acetic acid.(2)

MARKING SCHEME

Q.No.	Answers	Marks
1	3d because n+l for 3d is 3+2=5, but for 4s it is 4+0=5	½ + ½
2	$(n–1)d^{1–10}ns^{0–2}$	1
3	In a disproportionation reaction an element simultaneously oxidized and reduced. $P_4 + 3OH^- + 3H_2O \rightarrow PH_3 + 3H_2PO^-_2$	½ ½
4	It is due to covalent in nature.	1
5	$B(OH)_3 + H0H \rightarrow B(OH)^-_4 + H_3O^+$	1
6	Methane is the limiting reagent. Because the other reactant is oxygen of air which is always present in excess. Thus the amounts of carbon dioxide & water formed will depend upon the amount of methane burnt.	1 1
7	Wavelength of light (λ) = 5000 = 5000 x 10^{-10} m = 5 x 10^{-7} m. Work function (hv_0) = 1.9 eV = 1.9 x 1.6 x 10^{-19} j. Step I: Energy of photons E = hv =hc /λ =(6.626 X $10^{-34}Js$)X (3 X $10^8 ms^{-1}$) / (5 X $10^{-7}m$) = 3.97 x 10^{-19} J. Step II: Kinetic energy of photoelectrons KE (1/2 mv^2) = hv – hv_0 = (3.97 x 10^{-19} J) – (1.9 x 1.6 x 10^{-19} J) = (3.97 x 10^{-19}J) – (3.04 x 10^{-19} J) = 9.3 x 10^{-20} J.	 ½ ½ ½ ½
8	Bond Enthalpy: the amount of energy required to break one mole bonds of a particular type between the atom in the gaseous state of a substance. Bond Order: According to Lewis concept, in a covalent bond, the bond order may be given as the number of bonds between two atoms in a molecule.	1 1
9	(i) Irreversible expansion takes place when external pressure is constant $W_{irr} = - P_{ext}(V2 – V1) = - P_{ext}\Delta V$ (ii) Reversible expansion takes place when internal pressure is infinitesimally greater than external pressure at every stage $W_{rev} = -nRTlnV2/V1$	1 1
10	pH = – log[3.8 × 10^{-3}] = – {log[3.8] + log[10^{-3}]} = – {(0.58) + (– 3.0)} = – { – 2.42} = 2.42 Therefore, the pH of the soft drink is 2.42 and it is acidic.	1 1
11	CH_3-CH=C-CH_2-CH_3 | CH_2-CH_3 3-Ethylpent-2-ene	1 1
12	(a) Stratosphere. (b) Chlorofluorocarbon or Freons OR (a) It is a measure of the dissolved oxygen that would be needed by micro-organisms and various pollutants. (b) Eutrophication is the process of nutrient enrichment of water bodies and subsequent loss of biodiversity.	1 1 1 1

13

Element	% Composition	At. Mass	Moles	Mole Ratio
C	24.27	12	24.27/12=2.02	2.02/2.02=1
H	4.07	1	4.07/1=4.07	4.07/2.02=2
Cl	71.65	35.5	71.65/35.5=2.02	2.02/2.02=1

½ ½ ½ ½

Empirical Formula of the compound = CH_2Cl
Empirical formula mass = 12+2X1+35.5=49.5
Molecular mass = 98.96 ½
n = 98.96/49.5 = 2 ½
Molecular formula = $(CH_2Cl)_2 = C_2H_4Cl_2$

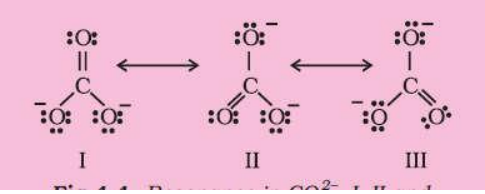
14

(i) Be has higher Δ_iH than B because Be has stable electronic configuration $1s^2 2s^2$, moreover in Be the electron to be removed is 2s-electron which is more penetrated to the nucleus as compared to 2p-electron of B. 1.5

(ii) Δ_iH of N is higher than O due to its stable half filled electronic configuration. Δ_iH of F is higher than O due to high nuclear charge. 1.5

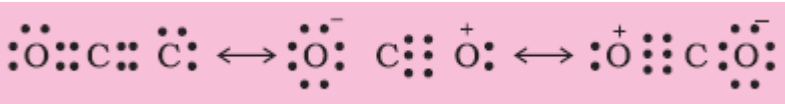
15

CO_3^{2-}:-



1.5

CO_2 :-



1.5

16

$C(s) + 2H_2(g) + ½ O_2(g) \rightarrow CH_3OH(l)$, $\Delta_fH^o = ?$ 1

Given, $CH_3OH(l) + 3/2\ O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$; $\Delta_rH^o = -726\ kJmol^{-1}$ (i)

$C(s) + O_2(g) \rightarrow CO_2(g)$; $\Delta cH^o = -393 kJmol^{-1}$ (ii)

$H_2(g) + ½ O_2(g) \rightarrow H_2O(l)$; $\Delta_fH^o = -286\ kJmol^{-1}$ (iii) 1

ΔH = Eqn.(ii) + 2 X Eqn.(iii) – Eqn.(i)

= -393 + 2 X (-286) – (-726) $kJmol^{-1}$ ½

=-239 $kJmol^{-1}$ ½

17

(a) For a reaction

$$aA + bB \rightleftharpoons cC + dD$$

$K_c = ([C]^c [D]^d)/([A]^a [B]^b)$ and $K_p = (p_C)^c(p_D)^d/(p_A)^a(p_B)^b$ ½

pV=nRT , p=nRT/V=CRT

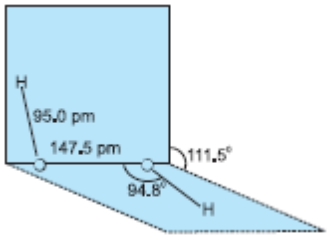
$p_A=[A]RT$, $p_B=[B]RT$, $p_C=[C]RT$, $p_D=[D]RT$ ½

$K_p=([C]\ RT)^c([D]\ RT)^d/([A]\ RT)^a([B]\ RT)^b$

$=(RT)^{(c+d)-(a+b)} X ([C]^c [D]^d)/([A]^a [B]^b)$ ½

$=(RT)^{\Delta n}K_c$ ½

(b) For any reversible reaction at any stage other than equilibrium, the ratio of the molar concentrations of the products to that of the reactants. Where each concentration term is raised to the power equal to the stoichiometric coefficient to the substance concerned, is called the reaction quotient, Qc. 1

18	(a) One example of each type of hydride (b) Cause of temporary hardness Cause of permanent hardness	½ +1/2 1 1
19	(a)10 volume H_2O_2 solution means that 1L of this solution will liberate 10L of oxygen at NTP. $2H_2O_2 \longrightarrow 2H_2O + O_2$ 2 mole 1 mole 68g 22400mL 22.4L O_2 at NTP produced from H_2O_2 = 68g 10L O2 at NTP produced from H2O2 = (68/22.4)X10 = 30.36 g Strength of 10 volume H2O2 = 30.36 g/litres (b)  	½ ½ ½ ½ 1
20	(i) NaOH is formed. (ii) Na_2O_2 is formed. (iii) NaOH and $H_2O_2$is formed.	1 1 1
21	(a) It is due to decrease in bond dissociation energy which is due to increase in atomic size (b) It is due to Inert Pair Effect. (c) PbO_2 is stronger oxidizing agent than SnO_2 because Pb^{2+} is more stable than Pb^{4+} whereasSn^{4+} is more stable than Sn^{2+}.	1 1 1
22	(a) 2-(2-Bromophenyl)ethanol. (b) Percentage of carbon=(12 X0.198X 100)/(44 X 0.246) = 21.95% Percentage of hydrogen= (2 X 0.1014 X 100) / (18 X 0.246) = 4.58%	1 1 1
23	Anti Markovnikov addition or peroxide effect or Kharash effect In the presence of peroxide, addition of HBr to unsymmetrical alkenes like propene takes place contrary to the Markovnikov rule. This happens only with HBr but not with HCl and HI. $CH_3-CH=CH_2 + HBr \xrightarrow{(C_6H_5CO)_2O_2} CH_3-CH_2-CH_2Br$ 1-Bromopropane Mechanism : Peroxide effect proceeds via free radical chain mechanism as given below:	

(i)

$$C_6H_5-\overset{O}{\overset{||}{C}}-O-O-\overset{O}{\overset{||}{C}}-C_6H_5 \xrightarrow{\text{Homolysis}}$$

Benzoyl peroxide

$$2C_6H_5-\overset{O}{\overset{||}{C}}-\dot{\underset{\cdot\cdot}{O}}: \rightarrow 2\dot{C}_6H_5 + 2CO_2$$ ½

(ii) $\dot{C}_6H_5 + H-Br \xrightarrow{\text{Homolysis}} C_6H_6 + \dot{Br}$

(iii) $CH_3-CH=CH_2 + \dot{Br}$

$\downarrow$ Homolysis ½

$CH_3-\underset{\underset{Br}{|}}{CH}-\dot{C}H_2$ (a) (less stable primary free radical) ½

$CH_3-\dot{C}H-CH_2-Br$ (b) (more stable secondary free radical) 1

(iv) $CH_3-\dot{C}H-CH_2Br + H-Br \xrightarrow{\text{Homolysis}}$

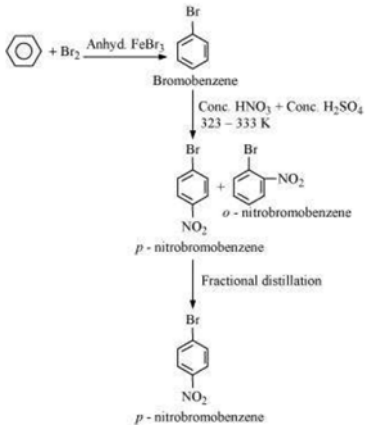
$CH_3-CH_2-CH_2Br + \dot{Br}$ (major product)

(v) $CH_3-\underset{\underset{Br}{|}}{CH}-\dot{C}H_2 + H-Br \xrightarrow{\text{Homolysis}}$ ½

$CH_3-\underset{\underset{Br}{|}}{CH}-CH_3 + \dot{Br}$ (minor product)

OR

(i)



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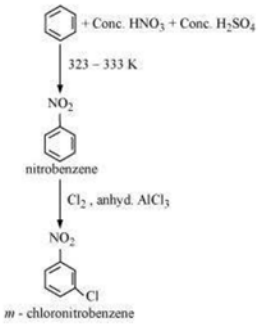
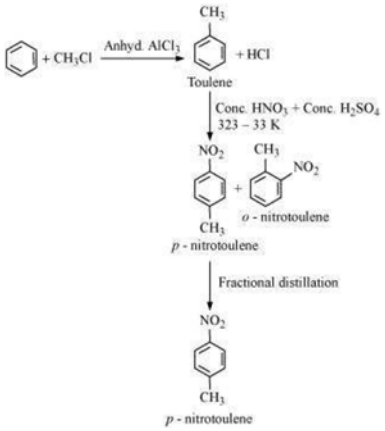
	(ii)  (iii)  	1 1
24	(a) $NO_2(g) \xrightarrow{h\nu} NO(g) + O(g)$ $O(g) + O_2(g) \rightleftharpoons O_3(g)$ $NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g)$ (b) $HOCl(g) \xrightarrow{h\nu} \dot{O}H(g) + \dot{C}l(g)$ $Cl_2(g) \xrightarrow{h\nu} 2\dot{C}l(g)$ $CF_2Cl_2(g) \xrightarrow{UV} \dot{C}l(g) + F_2Cl(g)$ $\dot{C}l(g) + O_3(g) \rightarrow Cl\dot{O}(g) + O_2(g)$ $Cl\dot{O}(g) + O(g) \rightarrow \dot{C}l(g) + O_2(g)$	½ ½ ½ ½ ½ ½
25	(a)(i)ZnS – Frenkel defect (ii) AgBr – Frenkel defect and Schottky defect (b)Substances which are weakly attracted by external magnetic field due to presence of unpaired electrons. (c)Mass of H_2 = 20 g Mass of O_2 = 80 g Moles of H_2 = 20/2 = 10 mol Moles of O_2 = 80/32 = 2.5 mol Mole fraction of H_2 = 10/ (10+2.5) = 0.8 Partial pressure = 0.8 X p = 0.8 X 1 = 0.8 bar	½ + ½ 1 ½ ½ ½ ½ ½ ½

	OR (a) It is given that the density of niobium, d = 8.55 g cm^{-3} Atomic mass, M = 93 $gmol^{-1}$ As the lattice is bcc type, the number of atoms per unit cell, z = 2 We also know that, $N_a = 6.022 \times 10^{23}$ mol^{-1} Applying the relation: $d = \frac{zM}{a^3 N_a}$ $a^3 = \frac{zM}{dNa}$ $= \frac{2 \times 93 gmol^{-1}}{8.55 gcm^{-3} \times 6.022 \times 10^{23} mol^{-1}}$ $= 3.612 \times 10^{-23}$ cm^3 So, $a = 3.306 \times 10^{-8}$ cm For body-centred cubic unit cell: $r = \frac{\sqrt{3}a}{4}$ $= \frac{\sqrt{3} \times 3.306 \times 10^{-8}}{4}$ $= 1.432 \times 10^{-8}$ cm $= 14.32 \times 10^{-9}$ cm = 14.32 nm (b) $p_1 \times V_1 = p_2 \times V_2$ $p_2 = \frac{p_1 \times V_1}{V_2}$ $p_2 = \frac{(1bar) \times (500dm^3)}{(200dm^3)}$ $p_2 = 2.5bar$	½ ½ ½ ½ ½ ½ ½ ½ ½ ½
26	(a) In sulphur dioxide (SO_2), the oxidation number (O.N.) of S is +4 and the range of the O.N. that S can have is from +6 to −2. Therefore, SO_2 can act as an oxidising as well as a reducing agent. In hydrogen peroxide (H_2O_2), the O.N. of O is −1 and the range of the O.N. that O can have is from 0 to −2. O can sometimes also attain the oxidation numbers +1 and +2. Hence, H_2O_2 can act as an oxidising as well as a reducing agent. In ozone (O_3), the O.N. of O is zero and the range of the O.N. that O can have is from 0 to −2. Therefore, the O.N. of O can only decrease in this case. Hence, O_3 acts only as an oxidant. In nitric acid (HNO_3), the O.N. of N is +5 and the range of the O.N. that N can have is from +5 to −3. Therefore, the O.N. of N can only decrease in this case. Hence, HNO_3 acts only as an oxidant.	2

(b)

(a) Step 1: The two half reactions involved in the given reaction are: ½

Oxidation half reaction: $\overset{-1}{I}_{(aq)} \longrightarrow \overset{0}{I}_{2(s)}$

Reduction half reaction: $\overset{+7}{M}nO^-_{4(aq)} \longrightarrow \overset{+4}{M}nO_{2(aq)}$ ½

Step 2:

Balancing I in the oxidation half reaction, we have:

$2I^-_{(aq)} \longrightarrow I_{2(s)}$

Now, to balance the charge, we add 2 e^- to the RHS of the reaction.

$2I^-_{(aq)} \longrightarrow I_{2(s)} + 2e^-$

Step 3: ½

In the reduction half reaction, the oxidation state of Mn has reduced from +7 to +4. Thus, 3 electrons are added to the LHS of the reaction.

$MnO^-_{4(aq)} + 3e^- \longrightarrow MnO_{2(aq)}$

Now, to balance the charge, we add 4 OH^- ions to the RHS of the reaction as the reaction is taking place in a basic medium.

$MnO^-_{4(aq)} + 3e^- \longrightarrow MnO_{2(aq)} + 4OH^-$ ½

Step 4:

In this equation, there are 6 O atoms on the RHS and 4 O atoms on the LHS. Therefore, two water molecules are added to the LHS.

$MnO^-_{4(aq)} + 2H_2O + 3e^- \longrightarrow MnO_{2(aq)} + 4OH^-$

Step 5: ½

Equalising the number of electrons by multiplying the oxidation half reaction by 3 and the reduction half reaction by 2, we have:

$6I^-_{(aq)} \longrightarrow 3I_{2(s)} + 6e^-$

$2MnO^-_{4(aq)} + 4H_2O + 6e^- \longrightarrow 2MnO_{2(s)} + 8OH^-_{(aq)}$

Step 6: ½

Adding the two half reactions, we have the net balanced redox reaction as:

$6I^-_{(aq)} + 2MnO^-_{4(aq)} + 4H_2O_{(l)} \longrightarrow 3I_{2(s)} + 2MnO_{2(s)} + 8OH^-_{(aq)}$

OR ½

(a) (i)At cathode :- Ag will be deposited ½

At anode :- Ag anode will dissolve to form Ag^+ ions

(ii)At cathode :- Ag will be deposited. ½

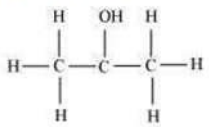
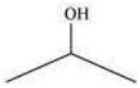
At anode :- O_2 will be liberated. ½

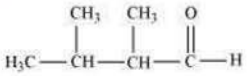
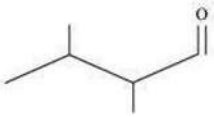
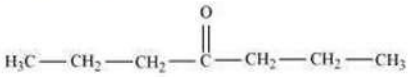
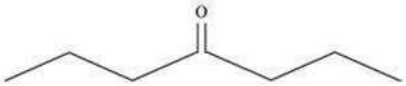
(b)

1

1

1

	Reduction (a) $\overset{0}{P_4}(s) + OH^-(aq) \longrightarrow \overset{-3+1}{PH_3}(g) + H_2\overset{+1}{P}O_2^-$ Oxidation P_4 gets oxidised to $H_2PO_2^-$ and reduced to PH_3 and therefore, P_4 acts as reducing agent as well as oxidising agent. **Oxidation number method** O.N. decreases by 3 per atom or 3 × 4 per P_4 molecule $\overset{0}{P_4}(s) + OH^-(aq) \longrightarrow \overset{-3+1}{PH_3}(g) + H_2\overset{+1}{P}O_2^-(aq)$ O.N. increases by 1 per atom or 1 × 4 per P_4 molecule Balance the increase or decrease in oxidation number by multiplying $H_2PO_2^-$ by 3 and PH_3 by 1. $P_4(s) + OH^-(aq) \longrightarrow PH_3(g) + 3H_2PO_2^-(aq)$ To balance O atoms, multiply OH^- by 6, $P_4(s) + 6OH^-(aq) \longrightarrow PH_3(g) + 3H_2PO_2^-(aq)$ To balance H atoms, add 3 H_2O to L.H.S. and $3OH^-$ on R.H.S, we have $P_4(s) + 6OH^-(aq) + 3H_2O(l) \longrightarrow PH_3(g) + 3H_2PO_2^-(aq) + 3OH^-(aq)$ or $P_4(s) + 3OH^-(aq) + 3H_2O(l) \longrightarrow PH_3(g) + 3H_2PO_2^-(aq)$	
27	(a)$(CH_3)_3C^+$ (b)$Fe_4[Fe(CN)_6]_3.xH_2O$ (c) To convert N, S, P and halogens present in the organic compound to their sodium salts. (d) Given that, Mass of organic compound is 0.3780 g. Mass of AgCl formed = 0.5740 g 1 mol of AgCl contains 1 mol of Cl. Thus, mass of chlorine in 0.5740 g of AgCl $= \frac{35.5 \times 0.5740}{143.32}$ $= 0.1421 g$ ∴ Percentage of chlorine $= \frac{0.1421}{0.3780} \times 100 = 37.59\%$ Hence, the percentage of chlorine present in the given organic chloro compound is 37.59%. OR (a)(i) Isopropyl alcohol   (ii)	1 1 1 1 1 1

	2, 3–dimethyl butanal   (iii) Heptan–4–one   (b) Electron withdrawing groups increase the acidity of carboxylic acids by stabilising the conjugate base through delocalisation of the negative charge by inductive and/or resonance effects.	1 1 2

Class: XI **PAPER NO 13** **Subject: Chemistry**

BLUE PRINT

S.No.	Unit	VSA (1 mark)	SA I (2 marks)	SA II (3 marks)	LA (5 marks)	Total	Marks Distribution
1.	Some Basic Concepts of Chemistry	-	-	3(1)	-	3(1)	08
2.	Structure of Atom	-	2(1)	3(1)	-	5(1)	
3.	Classification of Elements and Periodicity in Properties	1(1)	-	3(1)	-	4(2)	4
4.	Chemical Bonding and Molecular Structure	1(1)	-	3(1)	-	4(2)	20
5.	States of Matter	-	2(1)	3(1)	-	5(2)	
6.	Thermodynamics	-	2(1)	3(1)	-	5(2)	
7.	Equilibrium	1(1)	-	-	5(1)	6(2)	
8.	Redox Reactions	1(1)	2(1)	-	-	3(2)	20
9.	Hydrogen	-	2(1)	3(1)		5(2)	
10.	s-Block Elements	-	2(1)	3(1)	-	5(2)	
11.	p-Block Elements	-	2(1)	-	5(1)	7(2)	
12.	Organic Chemistry-Some Basic Principles and Techniques	-	-	6(2)	-	6(2)	18
13.	Hydrocarbons	1(1)	-	-	5(1)	6(2)	
14.	Environmental Chemistry	-		6(2)	-	6(2)	
		5(5)	14(7)	36(12)	15(3)	70(27)	

CLASS XI
CHEMISTRY

Time: 3 hrs **MM: 70**

General Instructions:

(i) All questions are compulsory.Please write the serial number of the Question before attempting it.
(ii) Question numbers 1 to 5 are very short-answer questions and carry 1 mark each.
(iii) Question numbers 6 to 12 are short-answer questions and carry 2 marks each.
(iv) Question numbers 13 to 24 are also short-answer questions and carry 3 marks each.
(v) Question numbers 25 to 27 are long-answer questions and carry 5 marks each.
(vi) Use Log Tables, if necessary. Use of calculators is not allowed.

1. Why ionization enthalpy of nitrogen is more than oxygen?

2. Why H_2O is liquid while H_2S is gas?

3. Why Wurtz reaction is not used to prepare propane?

4. What is the effect of temperature on K_w?

5. Can we use KCl as electrolyte in the following cell Cu/Cu^{2+} // Ag^{+}/Ag?

6. a) Why hydrogen peroxide is kept in wax lined glass or plastic vessels in dark?

b) What is water gas shift reaction?

7. Give reason: a) Alkali metals dissolve in ammonia to form conducting solutions

b) Potassium carbonate cannot be prepared by Solvay's process. Why?

8. i) Which of the following will not show deflection from the path on passing through an electric field; Give suitable reason

Proton, Cathode rays, Neutron, Anode rays, Electron

ii) What is meant by degenerate orbitals?

9. Write the oxidation number for the underlined elements in each of the following species

i) $K_2\underline{Mn}O_4$ ii) $H_2\underline{S}_2O_7$ iii) $Ca\underline{O}_2$ iv) $KAl(\underline{S}O_4)_2.\ 12\ H_2O$

OR

Balance the following redox reaction using ion-electron method:

$Cr_2O_7^{2-}$ (aq) + SO_2 (g)→ Cr^{3+} (aq) + SO_4^{2-} (aq) [In acidic medium].

10. Calculate the volume occupied by 5.0 g of acetylene gas at 50^0C and 740 mm pressure.

11. a) In a process, 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy for the process?

b) For the reaction, 2Cl (g) → Cl_2 (g), what are the signs of ΔH and ΔS?

12. Give reason:

i) Nitrogen is relatively inert as compared to phosphorus. Why?
ii) Why CO is poisonous?
13. (i) Oxygen molecule (O_2) is paramagnetic. Explain with the help of MOT.

(ii) On the basis of hybridisation explain the structure of PCl_5.

14. i) What would be the IUPAC name and symbol for the element with atomic number118?

ii) Name one amphoteric and one neutral oxide.

iii) The ionic radius of Na is 186 pm whereas the atomic radius of Na^+ is only 95 pm.

15. a) How many hydrogen bonded water molecules are present in $CuSO_4 .5 H_2O$?

(b) Explain two methods to remove permanent hardness of water.

16. A sample of 0.50 g of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was absorbed in 50 ml of 0.5 M H_2SO_4. The residual acid required 60 mL of 0.5 M solution of NaOH for neutralisation. Find the percentage composition of nitrogen in the compound.

17. a) State Charle's law and explain why -273 °C is the lowest possible temperature.

b) Why glass panes become thicker at the bottom after long period of time?

18. What do you mean by enthalpy of a reaction? Enthalpies of formation of CO (g), CO_2 (g), N_2O (g) and N_2O_4(g) are -110, -393, 81 and 9.7 KJ/mol respectively. Find the value of $\Delta_r H$ for the reaction:

$$N_2O_4 (g) + 3CO (g) \rightarrow N_2O (g) + 3CO_2(g)$$

19. A photon of wavelength 4×10^{-7} m strikes on metal surface, the work function of the metal being 2.13 eV. Calculate (i) the energy of the photon (eV), (ii) the kinetic energy of the emission, and (iii) the velocity of the photoelectron (1 eV= 1.6020 X 10^{-19} J).

OR

What are the frequency and wavelength of a photon emitted during a transition from n = 5 state to the n = 2 state in the hydrogen atom?

20. i) Name the pollutant gas that causes stiffness and fall off flower buds in plants.
ii) How classical smog is different from photochemical smog? Write three secondary constituents of photochemical smog with their formula.
21. a) Name the method of separation used to purify liquids having very high boiling point (which decompose at or below their boiling point)

b) Write the principle of Chromatography technique to separate mixtures.

c) What is functional isomerism? Give example.

22. a) Name the solvent commonly used for dry-cleaning of clothes? What can be the possible replacement for this solvent (according to Green chemistry)?

b) Define BOD.

c) Name two green-house gases.

23. What is limiting reagent? 50 kg of N_2 (g) & 10.0 kg of H_2 (g) are mixed to produce NH_3 (g). Identify the limiting reagent. Also, calculate the amount of NH_3 formed.

24. a) Why gypsum is added while manufacturing of cement?
b) What happens when: (i) Chlorine is passed through milk of lime

ii) Magnesium is burnt in nitrogen atomsphere.

25. a) Describe briefly the structure of C_2H_2 on the basis of hybridisation.

b) What is aromatisation?

c) An unsaturated compound (A) reacts with ozone in presence of zinc dust to give a mixture of propan-2-one and ethanal. Identify (A) and give reaction.

OR

(a) How do you account for the formation of ethane during chlorination of methane? Explain giving mechanism.

b) Write short notes on i) Decarboxylation ii) Conformational isomers iii) Ozonolysis

26. At 473 K, equilibrium constant, K_c for the decomposition of phosphorus pentachloride, PCl_5 is 8.3 x 10^{-3}. If the decomposition is depicted as

$$PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2\,(g) \quad \Delta_rH^0 = 124.0 \text{ kJ mol}^{-1}$$

a) Write an expression for K_c for the reaction.

b) What is the value of K_c for the reverse reaction at the same temperature?

c) What would be the effect on K_c if (i) more PCl_5 is added (ii) the pressure is increased and (iii) the temperature is increased?

OR

a) What is meant by the conjugate acid-base pair? Find the conjugate acid/base for the following species: HNO_2, CO_3^{2-}, S^{2-} and OH^-

b) The pH of a sample of vinegar is 3.76. Calculate the concentration of hydrogen ion in it.

c) Which of the following are Lewis acids? H_2O, BF_3, H^+, NH_4^+

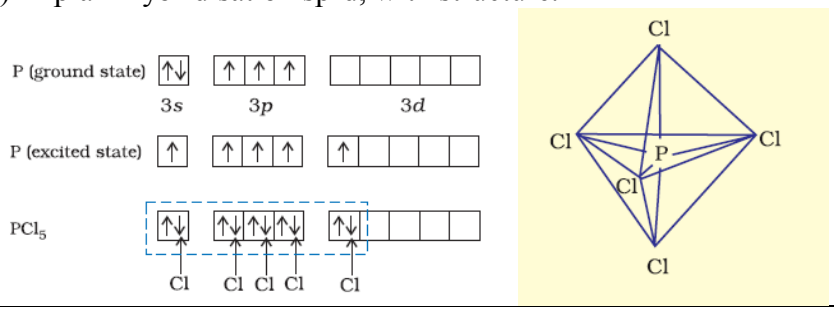
27. a) What happens when: i)Borax is heated strongly
ii) Boric acid is added to water
iii) Aluminium is treated with dilute NaOH.
b) Draw structure of: i) B_2H_6 ii) SiO_4^{4-}

OR

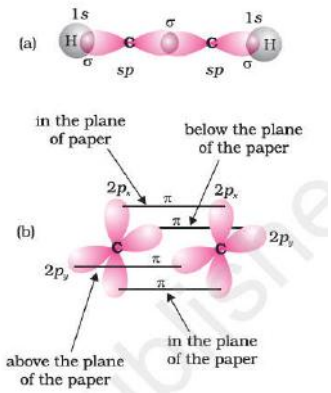
a) What are silicones? How they are prepared?
b) Give suitable reason for the following: i)$[SiF_6]^{2-}$ is known where as $[SiCl_6]^{2-}$ not
ii) In group 14, the tendency for catenation decreases with increasing atomic number.

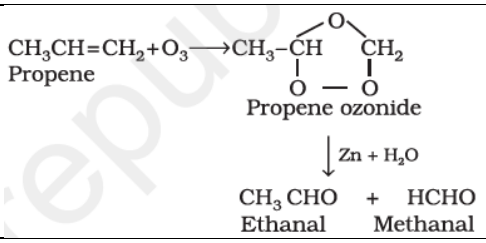
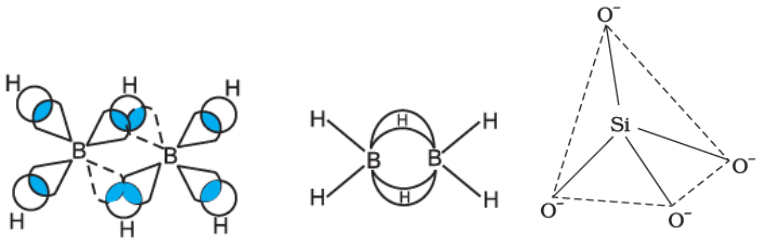
SUGGESTIVE MARKING KEY
CHEMISTRY CALSS-XI

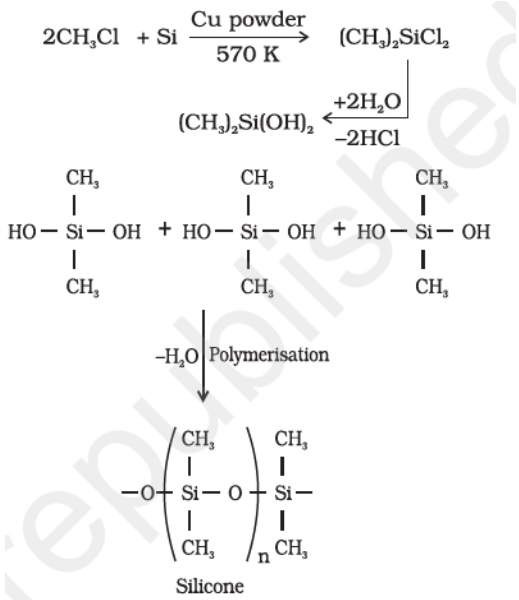
Q. No.	Answers	Marks
1.	Explain with electronic configuration, half-filled p orbital, extra stable	1
2.	Due to hydrogen bonding in H_2O	1
3.	It can prepare only alkanes with even no. as it joins two alkyl halides.	1
4.	K_w increases with increase in temperature	1
5.	KCl cannot be used in salt bridge in this cell as it will react with Ag^+	1
6.	a) $2\ H_2O_2\ (l) \rightarrow 2H_2O\ (l) + O_2\ (g)$, decomposition is catalysed by dust or metal surface, to prevent this decomposition. b) This reaction involves the commercial preparation of H_2 by selective oxidation of CO of syngas to CO_2 with the help of steam in presence of catalyst. (Reactions)	1 1
7	a) Alkali metals dissolve in ammonia to form conducting solutions as: $M + (x + y)NH_3 \rightarrow [M(NH_3)_x]^+ + [e(NH_3)_y]^-$ It is due to the ammoniated electron. b) Unlike sodium carbonate, potassium carbonate is soluble in water and does not form precipitate.	
8.	i) Neutron as it is a neutral particle ii) Degenerate orbitals are having same energy like three p-orbitals like p_x, p_y and p_z	½+ ½ 1
9.	i) $K_2\underline{Mn}O_4$: +6 ii) $H_2\underline{S}_2O_7$: + 6 iii) $Ca\underline{O_2}$: -1 iv) $KAl(\underline{S}O_4)_2.\ 12\ H_2O$: + OR Oxidation half reaction: $SO_2 + 2\ H_2O \rightarrow SO_4^{2-} + 4\ H^+ + 2\ e^-$ Reduction half reaction: $Cr_2O_7^{2-} + 14\ H^+ + 6\ e^- \rightarrow 2\ Cr^{3+} + 7\ H_2O$ Multiply the oxidation half reaction by 3 and add to reduction half. $Cr_2O_7^{2-} + 3\ SO_2 + 2\ H^+ \rightarrow 2\ Cr^{3+} + 3\ SO_4^{2-} + H_2O$	½ each ½ + ½ 1
10.	Molar mass of acetylene (C_2H_2) M = (2x12+2x1) = 26g/mol Mass of acetylene , m = 5.0 g Temperature, T = 50^0C + 273 = 323 K Pressure, P = 740 mm Hg = 740/760 = 0.9737 atm. Using the gas equation, PV = nRT V=nRT/P =mRT/MP = 5x 0.082x323/26x0.9737 = 5.23 L	½ + ½ ½ ½
11.	a) Heat absorbed by the system, q = + 701 J Work done by the system w = -394 J Change in the internal energy, ΔU = +701 – 394 = + 307 J. b) For the given reaction, ΔH is negative and ΔS is negative.	1 1
12	i) Nitrogen has a triple bond between nitrogen atoms so it is inert but phosphorous occurs as P_4 with single bonds ii) CO is poisonous as it combines with haemoglobin to form carboxy-haemoglobin which is more stable and decreases oxygen carrying capacity	1 1
13.	i) Electronic configuration of O_2: $(\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2(\sigma 2p_z)^2(\pi 2p_x^2 =$	1 + 1

	$\pi 2p_y^2$) ($\pi^* 2p_x^1 = \pi^* 2p_y^1$) , unpaired electrons present so paramagnetic. Show MOT diagram ii) Explain hybridisation sp^3d, with structure.  	½ + ½
14.	i) Ununocttium, Uuo ii) Amphoteric oxide: Al_2O_3 Neutral oxide: CO iii) Here as one e^- is removed Z_{eff} increases So, radii decreases	1 1 1
15	a) $CuSO_4 .5 H_2O$ occurs as $[Cu(H_2O)_4]^{2+} (SO_4)^{2-} . H_2O$ so, only one molecule of water is hydrogen bonded. b) i) Treatment with washing soda (sodium carbonate): Washing soda reacts with soluble calcium and magnesium chlorides and sulphates in hard water to form insoluble carbonates $MCl_2 + Na_2CO_3 \rightarrow MCO_3 \downarrow + 2NaCl$ (M = Mg, Ca) $MSO_4 + Na_2CO_3 \rightarrow MCO_3 \downarrow + Na_2SO_4$ ii) Calgon's method: Sodium hexametaphosphate ($Na_6P_6O_{18}$), commercially called 'calgon', when added to hard water. $Na_6P_6O_{18} \rightarrow 2Na^+ + Na_4P_6O_{18}^{2-}$ (M = Mg, Ca) $M^{2+} + Na_4P_6O_{18}^{2-} \rightarrow [Na_2MP_6O_{18}]^{2-} + 2Na^+$	½ + ½ ½ ½ ½ ½
16.	Total mass of organic compound = 0.50 g 60 ml of 0.5 m NaOH was required by the residual acid for neutralization. So, 60 ml of 0.5 m NaOH = 60/2 ml of 0.5 M H_2SO_4 = 30 ml of 0.5 M H_2SO_4 Thus, acid consumed in absorption of evolved NH_3 = 50-30 = 20 ml Also, 20 ml of 0.5 M H_2SO_4 = 40 ml of 0.5 M NH_3 Since, 1000 ml of 1 M NH_3 have 14 g of nitrogen So, 40 ml of 0.5 M NH_3 has (14 X 40 X 0.5) / 1000 = 0.28 g of N %age of N in 0.5 g of organic compound = 0.28/0.5 X 100 = 56 %	½ ½ ½ ½ ½ 1
17.	a) For each degree rise in temperature, volume of a gas increases by 1/273.15 of the original volume of the gas at 0 °C. $V_t = V_0 + \frac{t}{273.15} V_0$ $\Rightarrow V_t = V_0\left(1+\frac{t}{273.15}\right)$ b) The glass is an amorphous solid and flows slowly.	½+ ½ 1 1
18.	The amount of heat absorbed or evolved when stoichiometric amounts of the reactants as represented by the balanced chemical equation have completely reacted under constant pressure conditions is termed as the enthalpy of reaction. In the given problem: $\Delta_r H = \sum \Delta_f H_{(products)} - \sum \Delta_f H_{(reactants)}$	1 ½

	= [81kJ mol^{-1} + 3 x (-393 kJ mol^{-1})] - [9.7kJmol^{-1} + 3 x (-110 kJ mol^{-1})] = (-1098) – (-320.3) = -777.7 kJ mol^{-1}	1 ½
19.	Energy of photon: $E = h\nu = hc/\lambda$ Substituting the values in the given expression: $E = 4.97 \times 10^{-19}$ J $= 4.97 \times 10^{-19}$ J/ 1.6020×10^{-19} = 3.1020 eV K.E.(of emission) = $h\nu - h\nu_o$ or (Energy of photon – Work function) = 3.102 - 2.13 e = 0.97 eV The velocity of photoelectron: ½ $mv^2 = h\nu - h\nu_o$ Substituting the values in the given expression $v = \sqrt{0.3418 \times 10^{12}}\ m^2s^{-2}$ $= 5.84 \times 10^5\ ms^{-1}$ OR As, $n_i = 5$ and $n_f = 2$, so the spectral line is in the visible region of the Balmer series. $\Delta E = 2.18 \times 10^{-18} (1/n_i^2 - 1/n_f^2)$ $= -4.58 \times 10^{-19}$ J (emission energy) $\Delta E = h\nu$ So, $\nu = 4.58 \times 10^{-19}$ J / $6.626 \times 10^{-34} = 6.91 \times 10^{14}$ Hz $\lambda = c/\nu$ = 434 nm	½ ½ ½ ½ ½ ½ ½ ½ ½ ½ ½
20.	i) Sulphur dioxide (SO_2) ii) Classical smog: It occurs in cool humid climate. It is a mixture of smoke, fog and sulphur dioxide. It is a reducing mixture or reducing smog. Photochemical smog: It occurs in warm, dry and sunny climate. It is formed by action of sunlight on unsaturated hydrocarbons and nitrogen oxides produced by automobiles and factories. It is oxidising smog. Secondary pollutants: Formaldehyde, acrolein and peroxyacetyl nitrate (PAN).	1 1 1
21	a) Distillation under reduced pressure b) Chromatography is based on differential adsorption of the components of a mixture on a stationary phase and the mobile phase separates the components. c) Functional isomerism is the isomerism in which two or more compounds have same molecular formula but different functional groups. Ex: Acetone (keto group) and Propanal (aldehyde group)	1 1 1
22	a) Tetra chlroroethene ($Cl_2C=CCl_2$) is the solvent, liquefied carbon dioxide is the replacement b) The amount of oxygen required by bacteria to break down the organic matter present in a certain volume of a sample of water, is called Biochemical Oxygen Demand (BOD). c) Methane, Carbon-dioxide	1 1 ½ + ½
23	Limiting reagent is the reagent which is in less amount. 28 g nitrogen reacts with 6 g of hydrogen So, 50 g of nitrogen reacts with (6/28) x 50 = 10.71 g of hydrogen So, hydrogen is limiting reagent Also, 6 g of hydrogen forms 34 g of NH_3 So 10 g of H will produce	½ 1 ½

	(34/6)x 10 = 56.66 g ammonia.	1
24	a) To slow down the process of setting of the cement so that it gets sufficiently hardened. b) $2Ca(OH)_2 + 2Cl_2 \rightarrow CaCl_2 + Ca(OCl)_2 + 2H_2O$ c) Magnesium reacts with nitrogen to give: $3Mg + N_2 \rightarrow Mg_3N_2$	1 1 1
25.	a) Structure of C_2H_2: sp hybridisation, linear structure  (Marks will be given if hybridization is shown) b) Aromatisation involves passing of alkane like n-hexane to form benzene and its homologues at high temperature and in presence of catalyst. It involves cyclization, isomerisation and dehydrogenation c) (A) is $(CH_3)_2C{=}CHCH_3$ $(CH_3)_2C{=}CHCH_3 + O_3 \rightarrow (CH_3)_2C{=}O + CH_3CHO$ OR a) Mechanism: Write all the steps namely initiation, propagation and termination As methyl free radical is generated, so ethane is formed $H_3\dot{C} + \dot{C}H_3 \rightarrow H_3C-CH_3$ b) i) Decarboxylation: Sodium salts of carboxylic acids on heating with soda lime (mixture of sodium hydroxide and calcium oxide) give alkanes containing one carbon atom less than the carboxylic acid by elimination of carbon dioxide. $CH_3COO^-Na^+ + NaOH \xrightarrow[\Delta]{CaO} CH_4 + Na_2CO_3$ ii) The rotation around C-C axis results into infinite number of spatial arrangements of hydrogen atoms attached to one carbon atom with respect to the hydrogen atoms attached to the other carbon atom. These are called conformational isomers (conformers). iii) Ozonolysis of alkenes involves the addition of ozone molecule to alkene to form ozonide, and then cleavage of the ozonide by Zn-H2O to smaller molecules. This reaction is highly useful in detecting the position of the double bond in alkenes or other unsaturated compounds.	½ ½ ½ ½ 1 1+1 1 1 1 1

		
26.	a)$K_c = [PCl_3]\,[Cl_2]/[PCl_5]$ b)K_c (reverse reaction) = $1/K_c$(forward reaction) = $1/8.3\times10^{-3} = 120.5$ c) i) When more PCl_5 is added to the reaction mixture, the concentrations of PCl_3 and Cl_2 will increase in such a way that the value of K_c remains unchanged. ii) when pressure is increased, the reaction will move in a direction of lower volume i.e., backwards. As a result, the value of K_c will decrease. iii) the reaction is endothermic in nature. So, increase in temperature will favour the forward reaction. As a result, the value of K_c will increase. OR a) A pair of an acid and a base which differ from one another by a proton are said to be a conjugate acid-base pair. The conjugate acid/base for HNO_2, CO_3^{2-}, S^{2-} and OH^- are NO_2^-, HCO_3^-, HS^- and H_2O b) Given: pH = 3.76, - log $[H^+]$ = 3.76, $[H^+]$ = Antilog (-3.76) = 1.7×10^{-4} c) BF_3, H^+ are Lewis acids.	1 1 1 1 1 1 ½ for each 1 ½ + ½
27.	a) i) When Borax is heated strongly, it loses water of crystallization and forms colourless, transparent glass-like bead which is made up of sodium metaborate and boric anhydride. $Na_2B_4O_7.10H_2O \rightarrow Na_2B_4O_7 \xrightarrow{\Delta} 2NaBO_2 + B_2O_3$ ii) When Boric acid is added to water, it accepts a hydroxyl ion and behaves as a Lewis acid. $B(OH)_3 + H_2O \rightarrow [B(OH)_4]^- + H^+$ iii) When aluminium is treated with NaOH, it forms aluminates and hydrogen gas is liberated. $2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2\,(g)$ b) i) B_2H_6 ii) SiO_4^{4-}  OR a) Silicones are group of organosilicon polymers having $-(R_2SiO)-$ as repeating unit. They have high thermal stability, high dielectric strength and resistance to oxidation and chemicals. Used as sealant, greases, electrical insulators and for water proofing of fabrics. Preparation:	1 1 1 1+ 1 1 1 +1

	 Silicone b) (i) due to small size of F, silicon can accommodate six F atom while size of Cl is large silicon cannot accommodate six chlorine atom (ii) from top to bottom atomic size increases the bond strength decrease	1 1

CHEMISTRY
CLASS-XI
BLUE PRINT

PAPER NO 14

Time Allowed: 3 Hrs. Maximum Marks:70

S No	UNIT	VSA(1 marks)	SAI(2marks)	SAII(3marks)	LA(5 marks)	TOTAL
1	Some basic concept of chemistry		2(1)	3(1)		11
2	Structure of atom	1(1)			5(1)	
3	Classification of elements and periodicity in properties	1(1)		3(1)		4
4	Chemical bonding and molecular structure	2(2)		3(1)		21
5	States of matter; gases and liquid	1(1)	2(4)			
6	Thermodynamics				5(1)	
7	Equilibrium			6(2)		
8	Redox reaction			3(1)		16
9	Hydrogen			3(1)		
10	S-block elements		2(1)	3(1)		
11	Some p block elements		2(1)	3(1)		
12	Organic chemistry: some basic principle and technique		2(1)	6(2)		18
13	Hydrocarbons		2(1)		5(1)	
14	Environmental chemistry			3(1)		
	TOTAL	5(5)	14(7)	36(12)	5(3)	70(27)

SUBJECT : CHEMISTRY

CLASS XI

Time 3 Hrs **M.M 70**

GENERAL INSTRUCTION

All questions are compulsory.

Question numbers 1 to 5 are very short answer questions and carry 1 mark each.

Question numbers 6 to 12 are short answer questions and carry 2 marks each.

Question numbers 13 to 24 are also short answer questions and carry 3 marks each.

Question numbers 25 to 27 are long answer questions and carry 5 marks each.

Use log table, if necessary. Use of calculator is not allowed.

Q1.State Pauli exclusion principle. 1

Q2. Which has higher ionization enthalpy N or O and why? 1

Q3.Draw Lewis structure of carbon dioxide. 1

Q4. Why Ne_2 does not exist? 1

Q5.State Dalton's law of partial pressure. 1

Q6.A sample of drinking water was found to be severely contaminated with chloroform $CHCl_3$ supposed to be carcinogenic in nature the level of contamination was 15 ppm (by mass).

(i)Express this in percent by mass.

(ii) Determine the morality of chloroform in the water sample. 2

OR

Density of water at room temperature is 1.0g/cc. How many molecules are there in one drop of water if its volume is 0.1cc?

Q 7(i) Why does boron triflouride behave as a Lewis acid ?

(ii) $PbCl_4$ is better oxidising agent than $PbCl_2$?

Q8.0.3780 g of an organic chloro compound gave 0.5740 g of silver chloride in Carius estimation. Calculate the percentage of chlorine present in the compound. 2

Q9.(i) Why are Potassium and caesium, rather than lithium used in photoelectric cells? 2

(ii) When an alkali metal dissolves in liquid ammonia the solution can acquireDifferent colours. Explain the reasons for this type of colour change.

Q10. Draw the *cis* and *trans* structures of but-2-ene. Which isomer will have higher b.p. and why? 2

Q11. (a) Why aerated water bottle kept under water during summer? 1

(b) Why do real gases deviate from ideal behaviour?1

Q12.An oxygen cylinder has 10 L oxygen at 200 atm. If patient takes 0.5 mL of oxygen at 1 atm in one breathes at 370C. How many breaths are possible? 2

Q13. (i)Differentiate between electronegativity and electron gain enthalpy. 3

(ii)What are the atomic numbers of elements whose outermost electrons are represented by a) $2p^3$ b) $3d^6$?Also predict the group to which they belong.

Q14.(i)What is salt bridge ?Write its function also. 3

(ii)Balance the following ionic equation:

$MnO_4^- + H^+ + SO_3^{2-} \rightarrow Mn^{2+} + SO_4^{2-} + H_2O$

Q15.(i)State Le Chatelier's principle 3

(ii)Indicate the direction in which the equilibrium will shift when:

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ + heat

(a)Pressure is increased.

(b) Concentration of SO_2 is increased.

(c) Concentration of SO_3 is increased.

(d) Temperature is increased.

Q16.Write a brief note on the following environmental terms: 3

i) Photochemical smog

ii) Eutrophication

iii) Green Chemistry.

Q17. (i) Calculate the number of atoms in 52 u of He. **3**

(ii) Out of molarity and molality which is preferred in chemistry experimentsand why?

(iii)Write 0.00000623 in scientific notation.

Q18What happens when 3

a) Sodium metal is dropped in water?

b) Sodium metal is heated in free supply of air?

c) Sodium peroxide dissolves in water?

OR

(a) LiI is covalent in nature.

(b) Li is kept wrapped in paraffin wax and not stored in kerosene.

(c) $BeCl_2$ in aqueous exist as $[Be(H_2O)_4]^{2+}$

Q19.(a)Write coal gasification reaction. 3

(b)Complete the following reactions:

(i) $MnO_4^- + H_2O_2 \rightarrow$

(ii) $PbS + H_2O_2 \rightarrow$

Q20.Write the balance equation for the following: 3

i) $BF_3 + LiH \rightarrow$

ii) $B_2H_6 + H_2O \rightarrow$

iii) $Al + NaOH \rightarrow$

Q21.On the basis of VSEPR theory draw the structure and tell the shape of :

(i)XeF_4 (ii)ClF_3 (iii) H_2O 3

Q22. (i) Write IUPAC nomenclature of $CH_3COCH_2CH_2COOH$.

(ii)Explain why alkyl groups act as electron donors when attached to a π system.

(iii)Name the technique used to separate the mixture of o-nitro phenol and p- nitro phenol.

Q23.(i)What are electrophiles and nucleophiles ? Explain with examples. 3

(ii)Explain the reason for the fusion of an organic compound with metallic sodium for testing nitrogen, sulphur and halogens.

Q24.(i)Determine the pH of 0.005M H_2SO_4 solution. 3

(ii) Write the expression for equilibrium constant for the following reaction.

$CH_3COOC_2H_5(aq) + H_2O(l) \rightleftharpoons CH_3COOH(aq) + C_2H_5OH(aq)$

Q25.(i) State Hess's law of constant heat summation. 5

(ii) Calculate the standard enthalpy of formation of one mole of CH_3OH (l), if the combustion of one mole of methanol takes place at 298 K and 1 atm and after combustion CO_2 (g) and H_2O (l) are produced and 726 kJ of heat is liberated. Assume that the standard enthalpies of formation of CO_2 (g) and H_2O (l) are -393 kJ/mol and -286 kJ mol respectively.

OR

(i)Explain how is Gibbs free energy related to spontaneity of a reaction?

(ii)State second law of thermodynamics.

(iii)Calculate the free energy change for the given reaction :

$2C(s) + O_2(g) \rightarrow 2CO_2(g)$

$\Delta H = -300$ kJ mol^{-1}, $\Delta S = 3$ kJK^{-1} mol^{-1} at 300 K

Q26.(i)Explain giving suitable reactions: 5

(a)Markovnikov's rule

(b)Wurtz reaction.

(c)β – elimination.

(ii) An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3-one. Write structure and IUPAC name of 'A'.

OR

a) Convert :

i) Benzene to nitrobenzene

ii) Phenol to benzene

iii)Acetylene to benzene.

b) Write conditions necessary for aromaticity

Q27.(i) Define an orbital. 5

(ii)What is meant by photoelectric effect?

(iii)The threshold frequency for a metal is 7.0×10^{14} s^{-1}. Calculate the kinetic energy of an electron emitted when radiation of frequency $\nu = 1.0 \times 10^{15}$ s^{-1} hits the metal.

OR

States Heisenberg's Uncertainty Principle

What designations are given to the orbitals having

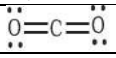
(i) n = 3, l = 1 (ii) n = 2, l = 0

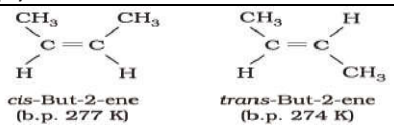
(c) Which quantum number determines

(i) Energy of electron (ii) Orientation of orbitals.

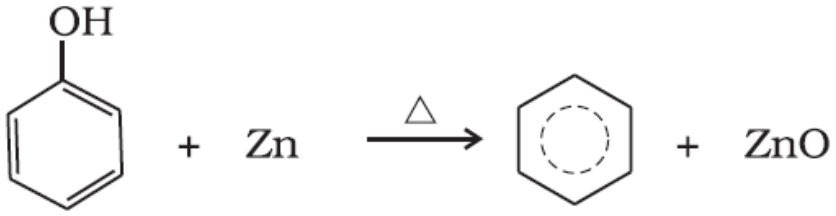
(d) What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition, n = 4 to n =2 of He^+ spectrum?

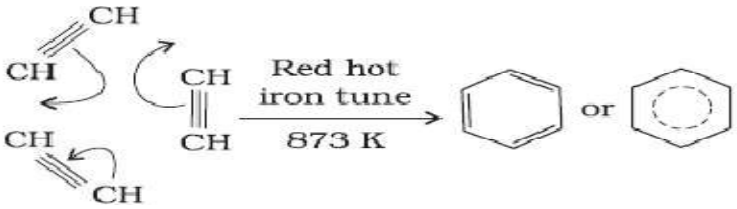
MARKING SCHEME

1.	An orbital can accommodate maximum two electrons with opposite spin.	1
2.	N , as it has half filled 2p orbitals.	1/2+1/2
3.		1
4.	Bond order = 0 ,molecule does not exist.	1
5.	It states that the total pressure of two or more non reacting gases is equal to the sum of partial pressure of individual gases	1
6.	(i)% by mass = ppm/10^4 = 15/10^4 = 15 x 10^{-4} (ii)m = 15 x 10^{-4} x 1000/119.5 x 100 = 1.225 x 10^{-4} OR	½ + ½ ½ + ½

	Mass of 1 drop of water = volume x density = 0.1 x 1 = 0.1 g No. of molecules = mass x N_a/molar mass = 0.1 x 6.022 x 10^{23}/18 = 3.34x10^{21}	
7.	(i) electron deficient central atom B and thus electron pair acceptor. (ii)Pb^{2+} is more stable than Pb^{4+} due to inert pair effect.	1 1
8.	% of chorine = (35.5 X mass of ppt) x 100/143.5 x mass of o.c. = 35.5 x 0.5740 x 100/143.5 x 0.3780 = 37.5 %	1 1
9.	(i) Potassium and caesium,have low Ionsation enthalpy. (ii)Due to ammoniated electrons.	1 1
10.	 *cis*-But-2-ene (b.p. 277 K) *trans*-But-2-ene (b.p. 274 K) cis - isomer has more b.p. due to more dipole moment.	1 1
11.	(a) To reduce the temperature so as to reduce pressure, otherwise bottle may burst. (b) Real gas deviate from ideal behavior due to force of attraction and volume of molecules of gases are negligible.	1 1
12.	$P1V1 = P2V2$ $200 \times 10 = 1 \times V2$ $V2 = 2000L$ Number of breath =$TotalVolume/Volumefor1\ breath$ $= 2000L/5\times10^{-3}L$ $= 4X10^6$	
13.	(i) a) Electronegativity is the ability of a bonded atom to attract shared pair of electrons towards itself while electron gain enthalpy is the energy liberated when an isolated gaseous atom attracts electron towards itself. b)Unit of electron gain enthalpy is Joule per mole while electronegativity has no unit (or any other) (ii) N = 7(group 15) ; Fe = 26(group = 8)	1 1 1
14.	(i) U-tube connecting two half cells and containing a solution of potassium chloride or ammonium nitrate usually solidified by boiling with agar agar and later cooling tojelly like substance Functions a) It maintains electrical neutrality b) It completes the circuit (ii) $2\ MnO_4^- + 6H^+ + 5SO_3^{2-} \rightarrow 2Mn^{2+} + 5SO_4^{2-} + 3H_2O$	1 2
15.	(i) It states that a change in any of the factors that determine the equilibrium conditions of a system will cause the system to change counteract the effect of the change.. (ii) (a)Forward (b)Forward (c)backward (d)backward.	1 1/2+1/2 1/2+1/2
16.	(i) Photochemical smog occurs in warm, dry and sunny climate. The main components of the photochemical smog result from the action of sunlight on unsaturated hydrocarbons and nitrogen oxides produced by automobiles and factories. Photochemical smog has high concentration of oxidising agents and is, therefore, called as oxidising smog. (ii)The process in which nutrient enriched water bodies support a dense plant population, which kills animal life by depriving it of oxygen and results in subsequent loss of biodiversity is known as ***Eutrophication***.orrect definition. (iii) *Green chemistry is a way of thinking and is about utilising the existing*	1 1 1

	knowledge and principles of chemistry and other sciences to reduce the adverse impact on environment..	
17.	(i) 1 atom of He = 4 u of He Or, 4 u of He = 1 atom of He 1 u of He $= \frac{1}{4}$ atom of He 52u of He $= \frac{52}{4}$ atom of He = 13 atoms of He (ii) Molality. It doesn't not change with temperature since mass remains unaffected with temperature. (iii) 6.23×10^{-6}	1 1 1
18.	i. $2Na + 2H_2O \rightarrow 2Na^+ + 2OH^- + H_2$ ii. $2Na + O_2 \rightarrow Na_2O_2$ (peroxide) iii. $Na_2O_2 + H_2O \rightarrow NaOH + H_2O_2 + O_2$ OR (a) On the basis of Fajan's rule Li+ ion will be with more polarization power due to small size and I- ion with more polarizability due to large size, therefore LiI will be covalent. (b) Li is very light so comes on the surface when kept in kerosene & get exposed to air so it is kept wrapped in paraffin wax paper. (c) Be2+ is small in size so undergoes hydration in water. BeCl2 + 4H2O ⟶ [Be(H2O)4]2+ + 2Cl-	1 1 1 1 1 1
19.	(a)C + H_2O → CO + H_2 (b)(i) $MnO_4^- + H_2O_2 + 6H^+ \rightarrow Mn^{2+} + 8H_2O + O_2$ (ii) $PbS + H_2O_2 \rightarrow PbSO_4 + H_2O$	1 1 1
20.	i. B_2H_6 + LiF ii. $2B(OH)_3(aq) + 6H_2(g)$ iii. $2\ Na^+ [Al(OH)_4]^-(aq) + 3H_2(g)$	1 1 1
21.	Square planar , T-shaped ,bent shape.	1 +1+1
22.	i. 4-oxobutanoic acid ii. Hyperconjugation iii. steam distillation	1 1 1
23.	i. A reagent that brings an electron pair is called a **nucleophile** (Nu:) i.e., nucleus seeking e.g. hydroxide (HO^-), cyanide (NC^-) ionsA reagent that takes away an electron pair is called **electrophile** (E^+) i.e., electron seeking e.g. CH_3^+ ii. To convert covalently bonded atoms into ions	1+1 1
24.	i. pH = $-\log H^+$,Substituting correct value and calculation, 2 ii. $Kc = \frac{[CH_3COOH][C_2H_5OH]}{[CH_3COOC_2H_5]}$	1+1 1
25.	i. If a reaction takes place in several steps then its standard reaction enthalpy is the sum of the standard enthalpies of the intermediate reactions into which the overall reaction may be divided at the same temperature.	2 3

	ii. CH_3OH (l) + 3/2O_2 (g) → CO_2(g) + 2H_2O (l); Δ_rH^0 = -726 KJ/mol ……(1) C (s) + O_2 (g) →CO_2 (g) ; Δ_cH^0 = -393 KJ/mol……..(2) H_2 (g) + ½ O_2 (g) → H_2O (l); $\Delta_f H^0$ = -286 KJ/mol……..(3) C (s) + 2H_2 (g) + ½ O_2 (g) →CH_3OH(l) ; Δ_fH^0 = ? Multiplying eq.(3) by 2 and adding it to eq. (2) we get, C(s) + 3H_2 (g) +2 O_2 (g) → CO_2(g) + 3H_2O (l); $\Delta_f H^0$ = -393 +2(-286)= -965kJ/mol……..(4) Subtracting eq. (1) from eq.(4) we get, C (s) + 2H_2 (g) + ½ O_2 (g) →CH_3OH(l) ; Δ_fH^0 = -965 – (-726)= -239 kJ/mol. or i.ΔG must be less than zero ii.For a spontaneous change entropy of system should be positive iii. ΔG=ΔH-TΔS = -300 – 300x3 =-1200kJmol^{-1}	 1 1 3
26.	i.a) The rule states that negative part of the addendum (adding molecule) gets attached to that carbon atom which possesses lesser number of hydrogen atoms. b) Alkyl halides on treatment with sodium metal in dry ethereal (free from moisture) solution give higher alkanes. This reaction is known as Wurtz reaction Dry ether CH_3Br +2Na + CH_3Br CH_3CH_3 +NaBr c).During dehydrohalogenation of alkyl halides hydrogen atom is eliminated from the β carbon atom (carbon atom next to the carbon to which halogen is attached). ii) 3-ethylpent-2-ene H_3C-CH=C(C_2H_5)-CH_2-CH_3 or i.  (ii)  	1+1+1 1+1 1+1 2 1

	(iii)  b) (i) Planarity (ii) Complete delocalisation of the Π electrons in the ring (iii) Presence of (4*n* + 2) Π electrons in the ring where *n* is an integer (*n* = 0, 1, 2, . . .). This is often referred to as **Hückel Rule**.	
27.	i.It states that it is impossible to determine simultaneously, the exact position and exact momentum (or velocity) of an electron. ii.When electrons (or electric current) are ejected when certain metals (for example potassium, rubidium, caesium etc.) are exposed to a beam of light of suitable frequency iii.Kinetic energy = $1/2 m_e v^2 = h(\nu - \nu_0)$ $= 1.988 \times 10^{-19}$ J Or i.It is the space around nucleus where the probability of finding an electron is maximum ii.3p, 2s iii. n and m iv. n=2 to n=1 (correct formula and substittion)	1 1 3 1 1 1 2