SAMPLE PAPER

Class XI

Chemistry

Time allowed: 3 hours **Max marks: 70**

General instructions:

- All questions are compulsory.
- Questions must be attempted serial wise only.
- Answers must be precise and to the point.
- Use log table if necessary.
- Use of calculators is not allowed.

1. Calculate the number of moles of carbon atoms and hydrogen atom in three moles of ethane. **1**

2. Out of CH_3COO^- and OH^- which is stronger base and why? **1**

3. For an isolated system, $\Delta U=0$, then what will be the ΔS? **1**

4. Which electrons take part in bond formation . **1**

5. Why is graphite used as a lubricant? **1**

6. Which of the two $O_2NCH_2CH_2O^-$. Or $CH_2CH_2OH^-$ is expected to be more stable? **1**

7. What would be the IUPAC name and symbol for the element with atomic number 120? **1**

8. Write down Vander wall equation for one mole of real gas? **1**

9. A sample of $NaNO_3$ weighing 0.83 g is placed in a 50ml volumetric flask. The flask is then filled with water to the mark on the neck. What is the molarity of the solution? **2**

OR

Determine the empirical formula of an oxide of iron which has 69.9% iron and 30.1% dioxygen by mass. **2**

10. What is the difference between a quantum and a photon? **2**

11. Among the second period elements the actual ionization enthalpies are in the order of:

Li<B<Be<C<O<N<F<Ne **2**

Explain why:-Be has higher Δ_iH than B.O has lower than Δ_iH than N and F.

12. Arrange the following compounds in order of increasing ionic character in the molecules:

LiF, K_2O, N_2, SO_2 and ClF_3. **2**

13. 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 and predict whether the reaction may occur spontaneously. 2

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14. What is meant by conjugate acid base pair? Find the conjugate acid/base for the following: HNO_2, CN^-, **2**

15. We do not see a car moving as a wave on the road. Why? **2**

16. Would you expect the second electron gain enthalpy of O as positive, more –ve or less –ve than the first. Justify your answer**.** **2**

17. How many electrons in an atom may have the following quantum numbers:
1.n=4, m= -1/2
2. n=3, l=0 **1+1=2**

18. In sulphur estimation 0.157 g of an organic compound gave 0.4813g of BaSO4. What is the percentage of sulphur in the organic compound? **2**

19. Although geometries of NH_3 and H_2O molecules are distorted tetrahedral, bond angles in water is less then that of ammonia. Discuss. **2**

20. (i) Density of gas is found to be 5.46g/dm^3 at 27˚C at 2 bar pressure. What will be its density at STP. **3**

(ii) Critical temperature for CO_2 and CH_4 are 31.1˚C and -81.9˚C respectively. Which of these has stronger intermolecular forces and why? **2+1=3**

21. Calculate the enthalpy change for the process:
$CCl_4(g) \rightarrow C(g) + 4Cl(g)$
And Calculate bond Enthalpy of C-Cl in $CCl_4(g)$
$\Delta vapH^\circ_{(CCL4)}$=30.5 KJ/mol
$\Delta_f H^\circ_{(CCl4)}$=-135 KJ/mol
$\Delta_a H^\circ_{(c)}$=715.0 KJ/mol
$\Delta_a H^\circ_{(CCl2)}$=242 KJ/mol**.** **3**

22. Equilibrium constant Kc for the reaction:
$N_2(g) + 3H_2(g)$ $2NH_3(g)$ at 500K is 0.061.

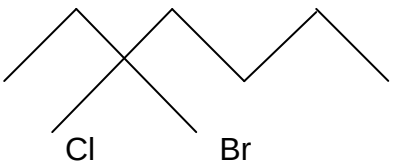
At particular time analysis shows that composition of the reaction mixture is 3.0 mo/L N_2 2.0 mol/L NH_3. Is the reaction at equilibrium? If not in which direction does the reaction tend to proceed to equilibrium and why? **3**

23. (i) Find the oxidation state of P in NaH_2PO_4 .
(ii) What is the function of salt bridge in electrochemical-cell? **1+2**

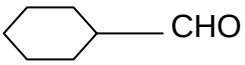
OR

Complete and balance the following equation.
$MnO_4^- + H_2S \rightarrow Mn^{2+} + S$ (acidic medium) **3**

24. (i) Write IUPAC names of following:
(a)



(b)



(ii) Write bond line formula of isopropyl alcohol. **2+1=3**

25. Arrange the following :
i) CaH_2 , BeH_2 and TiH_2 in order of increasing electrical conductance ?
ii) H-H, D-D and F-F in order of increasing bond dissociation enthalpy.
iii) NaH, MgH_2 and H_2O in order of increasing reducing property? **1+1+1=3**

26. Carbon monoxide gas is more dangerous than carbon dioxide gas. Why? **3**

27 1. Draw the resonance structure for $CH_3-CH=CH-CH3$
Using curve arrow notation.
ii) Name the best and latest technique for isolation, purification and Separation of organic compounds.
2+1=3

28. (i)State as to why:
(a) Aqueous solution of Na_2CO_3 is alkaline.
(b) BaO is soluble but $BaSO_4$ is insoluble in water.
(ii) Draw structure of $BeCl_2$ (vapour).
(iii) Complete the following:
a) $KO_2 + H_2O \rightarrow$
b) $Na(s) + H_2O \rightarrow$
2+1+2=5

OR

(I) What happens when:
(a) Sodium peroxide dissolves in water.
(b) Gypsum is heated to 393 K.
(ii) Account for the following:
(a) Lithium salts are commonly hydrated and those of other alkali metal ions are usually anhydrous.
(iii) What do you understand by the term 'autoprotolysis' of water? What is its significance? **1+1+1+2=5**

29. (i) Give reasons for the following:
(a) Concentrated HNO_3 can be transported in aluminium container.
(b) Atomic radius of Ga is lower than that of Al.
(ii) What happen when B_2H_6(diborane) is heated with excess of ammonia?
(iii) Describe inert pair effect with reference to 13th group. **2+1+2=5**

OR

(i) Give reasons:
(a) Which is the most stable form of carbon?
(b) Lead is known not to form PbI_4
(c) B-F bond length in BF_3 (130pm) and BF_4^- (143pm) differ.
(ii) What happened when:
(a) Borax is heated strongly.
(b) CO is being heated with ZnO. **3+2=5**

30. i) Arrange the following : HCl, HBr, HI, HF in order of their decreasing reactivity towards alkenes.
ii) How ethylene can be converted into ethane?
iii) Define heat of hydrogenation?

iv) Why is wurtz reaction not preferred for the preparation of alkanes containing odd number of carbon atoms? Illustrate your answer by taking an example.

1+1+1+2=5

OR

i) What effect does branching of an alkane chain has on its boiling point?
ii) Define Ozonolysis Reaction?
iii) Define cracking?
iv) Why benzene is extra ordinary stable though it contains three double bonds?
v) Why Nitro-benzene doesn't undergo Friedel-Craft alkylation? **1+1+1+1+1**

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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	1+1	2+2				6
3	Classification of Elements and Periodicity in property		2+2				4
4	Chemical Bonding and Molecular Structure	0	2	3			5
5	States of Matter	1		3			4
6	Thermodynamics	1	2	3			6
7	Equilibrium	1	2	3			6
8	Redox Reactions			3			3
9	Hydrogen			3			3
10	S-block Elements				5		5
11	P-Block Elements		2		5		7
12	Oraganic Chemistry: Some basic Principles And Techniques	1+1	2	3			7
13	Hydrocarbons			3	5		8
14	Environmental Chemistry			3			3
	TOTAL	8	20	27	15		70

Weightage to difficulty level				
	level	easy	Average	HOD
	Percentage	15	70	15

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Marking scheme

Q.No	Answers	Marks
1	As 1 mol of ethane (C_2H_6) contains 2 moles of carbon atoms. 3 moles of ethane contains 2x3 =6 moles of carbon atom. As 1 mole of ethane contains 6 moles of hydrogen. 3 moles of ethane will contains 6x3 = 18 moles of hydrogen atom.	½ ½ 1
2	OH^- ions can combine with H^+ ions more readily than CH_3COO^- ions can do. Hence, OH^- is a strong base. Alternatively, the conjugate acid of CH_3COO^- and OH^- are CH_3COOH and H_2O. As CH_3COOH is stronger acid than H_2O, the conjugate base of CH_3COOH, viz CH_3COO^- will be a weaker base.	1
3	For an isolated system ΔU=0, then ΔS will be positive.	1
4	Valance electrons present in the outermost shell take part in the bond formation.	1
5	Graphite is used as lubricant because in graphite carbon is sp2 state forming hexagonal layers which slide over each other.	1
6	Out of $O_2NCH_2CH_2O^-$ and $CH_2\ CH_2\ OH^-$ $O_2NCH_2CH_2O^-$ is more stable.	1
7	Unbinilium.	1
8	$(p+a/v^2)(v-b)=RT$	1
9	Molar mass of $NaNO_3$= 23+14+48= 85g/mol V=50ml M=0.83/(85 x 50) =0.089M of $NaNO_3$	1

OR

Element	%	Atomic mass	Relative no of atoms	Simplest ratio	Whole no ratio
Iron	69.9	56	69.9/56=1.25	1.25/1.25=1	2
dioxygen	30.0	16	30.1/16=1.89	1.89/1.25=1.5	3

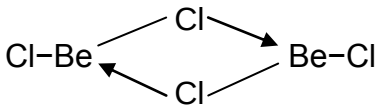
1 (Whole no ratio); 1 (Iron row)

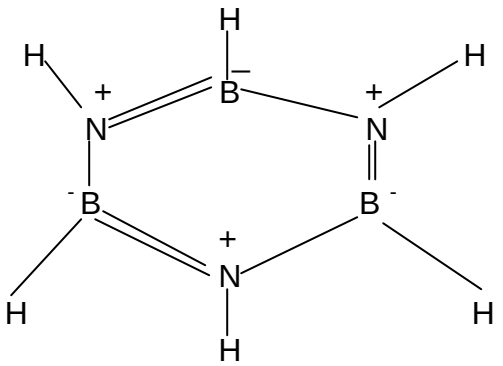
Empirical formula= Fe_2O_3 — 1+1

10	The smallest packet of energy of any radiations is called a quantum whereas that of light is called photon.	1+1
11	i) Be has higher Δ_iH than B because of stable configuration. ii)O has lower Δ_iH than N and F because of stable configuration of$2px^1\ 2py^1\ 2pz^1$	

	because of effective nuclear charge on F.	
12	$N_2 < ClF_3 < SO_2 < K_2O < LiF_3$	2
13	For the reaction $\Delta G = \Delta H - T\Delta S$ $\Delta G = -10.5\{-298 \times (-44.1 \times 10^{-3})\}$ $= 138614.7 \times 10^{-3}$ $= 138.6147$and	1 1
14	A pair of acid and base which differ from one another by a proton are said to be a conjugate acid base pair. $HNO_2 \rightarrow NO_2$ $CN^- \rightarrow HCN$	2
15	According to de- Broglie relation, $\lambda = h/mv$. The mass of car is very large and its wavelength or wave character is negligible. So we do not see a car moving like a wave	1 1
16	Second electron is to be added in an anion O^{-}, which will require extra energy to overcome the repulsive forces.	2
17	i) Number of electrons 16. ii) Number of electrons 2.	1 1
18	Weight of sulphur in $BaSO_4$= (32/233) X 0.4813 Percentage of sulphur=(32/233) X(0.4813/0.57) X100= 42.17%	2
19	In NH_3, there is only one lone pair on N-atom to repel the bond pairs whereas in H_2O, there are two lone pairs on O-atom to repel the bond pairs. Hence, the repulsion on bond pairs inH_2O are greater than in NH_3 and hence the bond angle is less.	2
20.(i)	Given: d_1= 5.46 g/dm^3 T_1=27°C P_1=2 bar at STP, d_2=? T_2=0°C P_2=1bar $d_1/d_2 = P_1T_2 / T_1P_2$ $5.46/d_2$= 2x273 / 300x1 Or d_2=3 gdm^{-3}	1 1 1
(ii)	Higher the critical temperature more easily the gas can be liquefied, i.e, greater are the intermolecular forces of attraction. Hence, CO_2 has stronger intermolecular forces then CH_4.	1
21.	(i) $CCl_4(l) \rightarrow CCl_4(g)$, ΔH=30.5 kJ/mol	1 1

		(ii) $C(s) + 2\ Cl_2(g) \rightarrow CCl_4(l)$, ΔH=-135.5 kJ/mol (iii) $C(s) \rightarrow C(g)$, ΔH=715.0 kJ/mol (iv) $Cl_2(g) \rightarrow 2Cl(g)$, ΔH=242 kJ/mol Aim: $CCl_4(g) \rightarrow C(g) + 4Cl(g)$, ΔH=?	
22.		Eqn.(iii)+2 x Eqn. (iv) – Eqn. (i) – Eqn. (ii) gives the required equation with ΔH=715.0 + 2(242) – 39.5 -(-135.5) kJ/mol =1304 kJ/mol Bond enthalpy of C−Cl in CCl_4 (avg. value)=1304/4=326kJ/mol.	1 1
23.(i)		Q_c for the given reaction is: $Q_c = [NH_3]^2 / ([N_2]\ [H_2]^3) = (8.13/20) / (1.57/20)(1.92/20)$ $= 2.38 \times 10^3$ As $Q_c \neq K_c$, the reaction mixture is not in equilibrium. As $Q_c > K_c$, the net reaction will be in backward direction.	1 1 1
(ii)	a.	NaH_2PO_4 =1(+1) + 2(+1) + 1(x) + 4(-2)= 0 Or x=+5 Thus oxidation number of P in NaH_2PO_4 = +5.	1
	b.	To complete the electric circuit without mixing the two solution of two half cells. Avoids the accumulation of electric charges in two half cells	1 1
		OR	1
24.(i)	(a)	$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$]x2 $H_2S \rightarrow S + 2H^+ + 2e^-$]x5	
	(b)	$2MnO_4^- + 5H_2S + 6H^+ \rightarrow 2Mn^{2+} + 5S + 8H_2O$	1
	(ii)	3-Bromo-3-Chloroheptane	1 1
25. i) ii) iii)		Cyclohexanecarbaldehyde 	1 1 1
26.		$TiH_2 < CaH < BeH_2$ F-F <D-D<H-H $H_2O < MgH_2 < NaH$ CO binds to haemoglobin for which it has 200 times more affinity than	1 1 1

27. (i)	oxygen and forms carboxyhaemoglobin. In blood when the concentration of carboxyhaemoglobin reaches 3-4%, the oxygen caring capacity of blood is greatly reduced which causes further many diseases. On the other hand CO_2 does not combine with blood. Hence less harmful as pollutant.	1+2
(ii)	$CH_3-CH=CH-\overset{+}{C}H_2 \longleftrightarrow CH_3-\overset{+}{C}H-CH=CH_2$ But-2-en-1-ylcarbocation	
28.(i) a)	Chromatography is the process for isolation, purification and separation of organic compounds.	2
b)	Na_2CO_3 is a salt of weak acid and strong base. Therefore it undergoes hydrolysis to produce strong base NaOH and hence its aqueous solution is alkaline in nature.	1
(ii)	The size of O^{2-} ion is much smaller than that of the SO_4^{2-} ion. Since a bigger cation stabilizes a bigger cation more than a smaller anion stabilizes a bigger cation. Therefore the lattice energy of BaO is much Smaller than that of $BaSo_4$ and Hence BaO is soluble while $BaSo_4$ is insoluble in water.	1 1
(iii)	$BeCl_2$ (vapour) It exists as chlorobridged dimer.  	1
	a) $4KO_2 + 2H_2O \rightarrow 4KOH + 3O_2$ b) $2Na(s) + 2H_2O \rightarrow 2NaOH + H_2$	1 1
	OR	
	i) a) Oxygen gas is evolved when sodium peroxide is dissolved in water. $2Na_2O_2 + 2H_2O \rightarrow 4NaOH + O_2$	1
	b) $CuSO_4.2H_2O \rightarrow CaSO_4.\ ½H_2O(s)$ $\downarrow$(437K) CaSO4{dead burnt plastic}	
	ii) a) Lithium salts are commonly hydrated because of the smallest size of lithium ion and maximum hydration enthalpy.	2
29.(i) (a)	iii) The self ionization of water is called autoprotolysis of water. $H_2O + H_2O = H_3O^+ + OH^-$ It shows that it is amphoteric in nature and also shows that its ph is 7.	1
	Al reacts with H_2O to form a very thin layer of aluminium oxide on its surface	1

	which protects it from further action. $2Al(s) + 6HNO_3(conc.) \rightarrow Al_2O_3(s) + 6NO_2(g) + 3H_2O(l)$ Alumina	
(b)	Thus Al becomes passive and hence Al containers can be used to transport conc.HNO_3.	1
(ii)	Due to poor shielding of the valance electrons of the Ga by inner 3d-electron, the effective nuclear charge of Ga is greater in magnitude than that of Al. as a result , the electrons in gallium experience greater force of attraction by the nucleus than Al and hence atomic size of Ga(135pm) is slightly less than that of Al(143pm).	1
(iii)	When diborane is heated in excess of ammonia it forms a compound called inorganic benzene (borazine). $3B_2H_6 + 6NH_3 \rightarrow 3[BH_2(NH_3)_2] + [BH_4]^- \rightarrow 2B_3N_3H_6 + 12H_2$ Borazine 	2
	In the elements of 4th, 5th and 6th period of the p-block elements which, after d-block elements, the electrons presents in the intervening d- and f-orbitals do not shield the s-electrons of the valence shell effectively. As a result, ns^2-electrons remain more tightly held by the nucleus and hence do not participate in binding. This is called inert pair effect.	1
	O R	
	i) a) Graphite. b) Lead is known not to form PbI_4 due to inert pair effect. c) BF3 has shorter bond length because it is sp2 hybridised and BF_4^- has longer bond length due to sp3 hybridisation.	
	ii)	1
	a) When powdered Borax is heated strongly in the Bunsen flame a transparent, colourless glassy bead made of Na meta borate and boric anhydride.	1 1
30	b) Zno is reduced to Zn by CO which is a strong reducing agent. $ZnO + CO \rightarrow Zn + CO_2$.	1
	i)HI>HBr>HCl>HF	1

	ii) By catalytic reduction with H_2 in the presence of nickel at 523-573K.	
	iii) Heat of hydrogenation is the amount of heat evolved when one mole of an unsaturated compound is hydrogenated (in the presence of a catalyst).	1
	iv) Wurtz reaction is not preferred for the preparation of alkanes containing odd no of carbons atoms because whenever we take odd no of carbon atoms reaction will give mixture of products.	1 1
	For example: $CH_3\text{-}Br + CH_3\text{-}CH_2\text{-}Br + 2Na \rightarrow CH_3CH_3 + CH_3CH_2CH_3 + CH_3CH_2CH_2CH_3 + 2NaBr$	2
	OR	
	i) As branching increases, the surface area of alkene approaches that of a sphere. Since a sphere has minimum surface area, therefore, Vander walls forces of attraction are minimum and hence the boiling point of the alkene decreases with branching.	1
	ii) When an alkene is treated with ozone at low temperature ozonoid is obtained which when heated with Zn dust and water gives aldehydes and ketones depending upon the nature of alkene. Reaction is called ozonolysis.	1
	iii) The thermal decomposition of higher hydrocarbons into lower hydrocarbons in presence or absence of a catalyst is called cracking.	
	iv) Due to resonance.	1
	The NO_2 groups strongly deactivates the benzene ring for the attack of an electrophile.	1 1