# SECTION - A (Marks 17)

Time a	llowed:	25	Minutes
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Q.

Section—A is compulsory and comprises pages 1-2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil. NOTE:-

1 Circ	cle the	correct option i.e. A / B / C / D. Each par				
(i)	What is the formula of Sodium oxide if 0.69 g of Sodium combines with 0.24 g of Oxygen?					
	Α.	NaO NaO	В.	Na <sub>2</sub> O		
	С,	NaO <sub>2</sub>	D.	Na <sub>2</sub> O <sub>2</sub>		
(ii)	Wh	ich of the following pairs of mixture can be				
	A.	Na <sub>2</sub> SO <sub>4</sub> and NaCl	В.	Benzoic acid and H <sub>2</sub> O		
	C.	Sand and Naphthlene	D.			
(iii)	The	critical temperature of a gas				
	A.	Depends on the critical pressure	B.	Does not depend on nature of gas		
	C.	Is lower than inversion temperature	D.	Is higher than inversion temperature		
(iv)	HFi	s among the weakest halogen acid due to		o and a second competitude		
	A.	Strong polar bond between H2 and F2	В.	Electronegativity of Fluorine		
	C.	Smaller size of Fluorine	D.	Hydrogen bonding		
(V)	Whic	ch of the following are Isomorphs?				
	Α.	NaNO3 and CaCO3	B.	ZnSO <sub>4</sub> and NiSO <sub>4</sub>		
	C.	NaF and MgO	D.	All of these		
(vi)	The blue colour of water in sea is due to					
	A.	Reflection of blue sky by sea water				
	B.	Reflection of blue light by impurities in	sea wa	ater		
	C.	Scattering of blue light by H <sub>2</sub> O molecule				
	D.	Absorption of other colours except blue		O molecules		
(vii)	An io	nic compound will dissolve in water only if				
	A.	Hydration energy low and lattice energy		terres ent militar le smilitar programme de la		
	B.	Hydration energy high and lattice energ				
	C.	Hydration energy high and lattice energ		high		
	D.	Hydration energy and lattice energy low				
(viii)	For a	ny system the difference between enthalpy		nternal energy can be expressed as		
	Α.	CP	B.	CV		
	C.	RT	D.	PV		
(ix)	The s	The specific rate constant for the forward and reverse reactions are $25 \times 10^{-2}$ and $5 \times 10^{3}$ ,				
	respe	ctively. The equilibrium constant for the rea	action	$A+B \rightleftharpoons C+D$		
	A.	$2.5 \times 10^{-6}$	В.	5x10 <sup>-5</sup>		
	C	2:10-4		2		

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	Which	n of the following statements about		
	Α.	The order of reaction can only be		by experiment
	B.	A second order reaction is alway		
	C.	The order of reaction must be a		
	D.	The order of reaction increases		n temperature
(xi)	One	mg of solute per kilogram of solut	tion is	The same of the same of
	A.	1 M	В.	1 PPm
	C.	1 m	D.	1% w/w
xii)	If 5.8	5 g of NaCl are dissolved in 90 g of	H <sub>2</sub> O, the mole	fraction of NaCl is
	A.	0.1	В.	0.2
	C,	0.0196	D.	0.01
xiii)	A cor	npound decomposes with half life of	of 8 seconds a	nd half life is independent of concentra
	How	much time is consumed to convert	the concentrat	ion of $\frac{1}{16}th$ (one sixteenth) of its initial
	conce	entration?		
	A.	32 s	В.	24 s
	C.	40 s	D.	14 s
(xiv)	Stand	dard reduction electrode potential of	f the three me	tals A, B and C are 0.5 v, -3.0 v and -
	respe	ectively. The order of reducing power	er is	
	A.	B > C > A	B.	A > B > C
	C.	C > B > A	D.	A > C > B
		C-B-A		
(xv)	Shap	be of $CI\overline{O}_3$ is		
(xv)	Shap A.	The state of the s	В.	Tetrahedral
(xv)	A. C.	te of $Cl\overline{O}_3$ is Triangular pyramidal Triangular bipyramidal	B. D.	Triangular planer
	A. C.	te of $Cl\overline{O}_3$ is Triangular pyramidal Triangular bipyramidal	B. D.	
	A. C. The	te of $Cl\overline{O}_3$ is Triangular pyramidal Triangular bipyramidal	B. D. the arrangement	Triangular planer
	A. C. The	the of $CI\overline{O}_3$ is Triangular pyramidal Triangular bipyramidal properties which depend mainly on	B. D. the arrangement	Triangular planer ent of atoms in the molecule and to
	A. C. The pales	or of $CI\overline{O}_3$ is  Triangular pyramidal  Triangular bipyramidal  properties which depend mainly on ser extent on their number are calle	B. D. the arrangement	Triangular planer ent of atoms in the molecule and to properties.
(xvi)	A. C. The pales A. C.	Triangular pyramidal Triangular bipyramidal Triangular bipyramidal properties which depend mainly on ser extent on their number are calle Colligative Additive	B. D. the arrangement B. D.	Triangular planer ent of atoms in the molecule and to properties.  Constitutive Chemical
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(xvi)	A. C. The part a less A. C. The A.	Triangular pyramidal Triangular bipyramidal properties which depend mainly on ser extent on their number are calle Colligative Additive temperature at which the solid and	B. D. the arrangement B. D. liquid phase o	Triangular planer ent of atoms in the molecule and to properties. Constitutive Chemical f a substance coexists is called
(xvi) (xvii)	A. C. The pales A. C. The A. C.	Triangular pyramidal Triangular bipyramidal properties which depend mainly on ser extent on their number are calle Colligative Additive temperature at which the solid and Consulate temperature Boiling point	B. D. the arrangement B. D. liquid phase o	Triangular planer ent of atoms in the molecule and to properties.  Constitutive Chemical f a substance coexists is called Triple point
(xvi)	A. C. The pales A. C. The A. C.	Triangular pyramidal Triangular bipyramidal properties which depend mainly on ser extent on their number are calle Colligative Additive temperature at which the solid and	B. D. the arrangement B. D. liquid phase of B. D.	Triangular planer ent of atoms in the molecule and to properties.  Constitutive Chemical f a substance coexists is called Triple point Freezing point
	A. C. The pales A. C. The A. C.	Triangular pyramidal Triangular bipyramidal properties which depend mainly on ser extent on their number are calle Colligative Additive temperature at which the solid and Consulate temperature Boiling point	B. D. the arrangement B. D. liquid phase of B. D.	Triangular planer ent of atoms in the molecule and to properties.  Constitutive Chemical f a substance coexists is called Triple point



Time allowed: 2:35 Hours

Total Marks Sections B and C: 68

03

Student Bounty Com Sections B and C comprise pages 1-2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

#### SECTION - B (Marks 42)

- 0.2 Answer any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines. (14 x3 = 42)
  - (i) What volume of 27% (W/v) HCl, with a density of 1.14 g/cm3 is required to produce 10.0 g of Hydrogen by the following equation:

 $Mg_{(s)} + 2HCI_{(aq)} \rightarrow MgCI_{2(aq)} + H_{2(g)}$ 

(ii) Why H<sub>2</sub> and Helium are nearly ideal at room temperature and ordinary pressure but SO2 is non-ideal? 03

(iii) 180 g of glucose and 342 g of sucrose have the same number of molecules but different number of atoms present in them. Justify the statement. 03

- (iv) Differentiate between Isomorphism and Polymorphism. 1.5+1.5=03
- (V) Why is the lattice energy of NaCl greater than KCl which in turn is greater than KBr? 03
- BF<sub>3</sub>, BCl<sub>3</sub> and AlCl<sub>3</sub> are triangular planer molecule but NH<sub>3</sub>, NF<sub>3</sub> and PCl<sub>3</sub> are triangular pyramids (vi) although in all these compounds the central atom is connected with three other atoms. 03
- (vii) Calculate the radius of third (n=3) orbit of Hydrogen atom. What is the energy of an electron in this orbit?
- (viii) Explain Hybridization in BF<sub>3</sub>. 03
- Calculate the heat of formation of C<sub>3</sub>H<sub>8</sub> Propane from the following data: (ix) Heat of combustion of C,  $H_2$  and  $C_3H_8$  is -393 kjm<sup>-1</sup>, -286 kjm<sup>-1</sup> and -2213 kjm<sup>-1</sup>, respectively. **03**
- (x) What are the optimum conditions of temperature, pressure and catalyst for obtaining maximum yield of products in the following industrial processes: 1.5+1.5=03
  - $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$
  - $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$
- Explain why aqueous solution of CuSO<sub>4</sub>, CH<sub>3</sub>COONa and NaCl are acidic, basic and neutral (xi) respectively.

03

	(xii)	Balance the following equations by ion-electron method in basic medium:	1.5+1.5=03
		$CN^- + MnO_4^- \rightarrow CNO^- + MnO_2$	
		$10_3^- + ASO_3^{3-} \rightarrow 1^- + ASO_4^{3-}$	
	(xiii)	How is power generated by using the fuel cell?	03
	(xiv)	Differentiate between Molecularity and Order of reaction.	1.5+1.5=03
	(xv)	Why is it necessary to state the physical state of reactants and products in the	
		thermochemical equations?	03
	(xvi)	What is common ion-effect? Give its two applications.	03
	(XVII)	Differentiate between stationary phase and mobile phase.	02
		b. What is the role of stationary phase in chromatography?	01
	(xviii)	Derive Graham's law of diffusion from Kinetic Molecular theory.	03
	(xix)	Differentiate between Continuous and Line spectrum.	1.5+1.5=03
		SECTION – C (Marks 26)	
Note:-		Attempt any TWO questions. All questions carry equal marks.	(2 x 13 = 26)
Q. 3	a.	Derive an expression for the calculations of energy, frequency and wave number of photo	ron
		emitted when electron jumps from n=1 to n=2 orbit.	06
	b.	What is Absolute Zero?	03
	C.	Why is the Molecular orbital theory superior to valence bond and VSEPR theory?	04
Q. 4	a.	Derive Arrhenius equation.	04
	b.	Draw a complete fully labelled "Born-Haber" cycle for the formation of NaCl.	05
	c.	What is the pH of 10 <sup>-4</sup> moles dm <sup>-3</sup> of HCI and Ba(OH) <sub>2</sub>	04
Q. 5	a.	What is Planck's Quantum theory?	03
	b.	9.2 molar HClO <sub>4</sub> is available from the market. The density of this solution is 1.54 gcm <sup>-3</sup> .	
		What is the percentage by weight of HClO <sub>4</sub> ?	05
	c.	Describe the standard Hydrogen Electrode. How will you use "SHE" to measure the standard	dard
		electrode potential of Zinc electrode?	05
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Answer Sheet No	29	OHNE	
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## SECTION - A (Marks 17)

Time allowed: 25 Minutes

NOTE:- Section—A is compulsory and comprises pages 1-2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

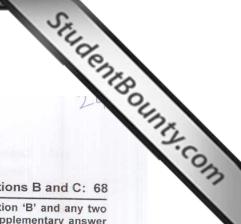
Ci	rcle the c	orrect option i.e. A / B / C / D. Eac	ch part carrie	es one mark.
(i)	Wat	ter has mass of 27g. The number of	water moleci	ules is
	A.	6.02 x10 <sup>23</sup>	В.	9.033 x10 <sup>23</sup>
	C.	3.011 x10 <sup>23</sup>	D.	12.04 x10 <sup>23</sup>
(ii)	VVhi	ch of the following elements can NC	T be analyze	ed directly by combustion analysis?
	Α.	Nitrogen	В.	Hydrogen
	C.	Carbon	D.	Oxygen
(iii)	Whi	ch of the following substances is us	ed as a decol	
	A.	Animal charcoal	В.	P <sub>2</sub> O <sub>5</sub>
	C.	Silica gel	D.	None of these
(iv)	Which	ch property of the gas is a state fund	ction?	
	A.	Entropy	B.	Enthalpy
	C.	Pressure	D.	All of these
(V)	Wha	t happens when Copper electrode is	s coupled with	h Aluminium electrode in the galvanic cell?
	A.	Oxidation takes place at Cu elec		
	B.	Reduction takes place at Cu ele	ctrode	
	C.	Reduction takes place at Alumin	ium electrode	
	D.	None of these		
(vi)	Fort	he given value of oxidation state wh	ich is the oxid	dation state of Carbon in $C_6H_{12}O_6$ ?
	A.	+6	В.	+12
	C.	Zero	D.	-6
(vii)	An ac	queous solution of water and ethano	ol may have v	apour pressure
	A.	Equal to that of H2O	В.	Equal to that of Ethanol
	C.	More than that of water	D.	Less than that of water
(viii)	If und	ertainty in position of electron is zer Zero	ro, then uncer B.	
	C.	Less than zero	D.	$\frac{h}{2\pi}$
(ix)	N <sub>2</sub> an	d $O_2$ are present in air but they do r	not react chen	nically at ordinary temperature and pressure
		ise it is		
	A.	Non-spontaneous reaction	В.	Spontaneous reaction
	C.	Reversible reaction	D.	Exothermic reaction
(x)	The s	olubility of $PbF_2$ is 2.6 x $10^{-3}$ mol dm	<sup>-3</sup> . Its solubilit	ty product will be
	A.	$7.0 \times 10^{-8}$	В.	6.2 x 10 <sup>-8</sup>
	C.	$8.0 \times 10^{-7}$	D	7.8 × 10-8

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(xi)	Whic	h of the following has the highest va	alue of pH?		
	A.	0.1 M NaOH	В.	Pure water	
	C.	Bread	D.	Rain water	
(xii)	Whe	n a colourless, odourless gas was c	ompressed, a	whitish solid is formed.	What is the ga
	A.	NH <sub>3</sub>	В.	SO <sub>2</sub>	
	C.	SO <sub>3</sub>	D.	CO <sub>2</sub>	
(xiii)	Dipol	le moment is the measure of polarity	y. Which of th	e following molecules is p	oolar?
	A.	CCI <sub>4</sub>	B.	BF <sub>3</sub>	
	C.	CF <sub>4</sub>	D.	NF <sub>3</sub>	
(xiv)	The	reaction rate becomes four times by	doubling the	concentration of a reacta	ant, then order
	with i	respect to that reactant is			
	A.	Zero order	В.	First order	
	C.	Second order	D.	Third order	
(xv)	A cer	rtain ion has ground state configurat	$ion[Ar]3d^{10}$ .	This ion is	
	A.	Cu <sup>2+</sup>	B.	Cu <sup>+</sup>	
	C.	Zn <sup>+</sup>	D.	Cr <sup>3+</sup>	
(xvi)	In wh	nich crystal $a \neq b \neq c, \alpha = \beta = \gamma = 90$	° ?		
	A.	Cubic	В.	Triclinic	
	C.	Orthorhombic	D.	Hexagonal	
(xvii)	Dipol	e-dipole interactions are present in	the		
	A.	Atoms of the Helium gas	В.	Molecules of CCI <sub>4</sub>	
	C.	Molecules of solid I <sub>2</sub>	D.	Molecules of NH <sub>3</sub>	
		ar and the production of the			
For E	xamine	er's use only:			
			Tota	I Marks:	17
			Mark	s Obtained:	

Page 2 of 2 (Chem)





Time allowed: 2:35 Hours

Total Marks Sections B and C: 68

NOTE:- Sections B and C comprise pages 1-2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

## SECTION - B (Marks 42)

		510:10th B (Marks 42)	
Q. 2	Ans	wer any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines. (	14 x3 = 42
	(i)	Hydrazine (N <sub>2</sub> H <sub>4</sub> ) can be produced as follows: $CINH_2 + 2NH_3 \rightarrow N_2H_4 + NH_4CI$	· · · · · · · · · · · · · · · · · · ·
		If 2.00 kg of chloral-amine (Cl-NH <sub>2</sub> ) produces 946.0 g of hydrazine, calculate the	porcontag
		yield of hydrazine.	
	(ii)	What are Isotopes?	03
	(iii)	Derive Boyle's law and Charles' law from kinetic molecular theory.	1+2=3
	(iv)	Why is Sodium softer than Copper, but both are very good electrical conductor?	1.5+1.5=3
	(v)	What is Artificial radioactivity? Write chemical equation for the production of	03
		proton and neutron.	1+2=3
	(vi)	Calculate energy, frequency and wavelength of radiation emitted when electron drops	1+2-3
		from n=4 to n=2 for Hydrogen atom.	0.2
	(vii)	How does dipole-moment help us to predict the geometry of Triatomic molecule and	03
		Tetraatomic molecule?	03
	(viii)	Differentiate between sigma and pi-bond by giving examples of HF and O <sub>2</sub> .	1.5+1.5=3
	(ix)	Calculate the Enthalpy change $(\Delta H)$ for the reaction:	03
		$2AI_{(s)} + Fe_2O_{3(s)} \rightarrow 2Fe_{(s)} + AI_2O_{3(s)}$ $\Delta H = ?$	
		$2AI_{(s)} + 1.5O_2(g) \rightarrow AI_2O_3(s)$ $\Delta H = -1675kj$	
		$2Fe_{(s)} + 1.5O_2(g) \rightarrow Fe_2O_{3(s)}$ $\Delta H = -824kj$	
	(x)	Write three definitions of Raoult's law.	03
	(xi)	Balance the following equations by oxidation number method:	1.5+1.5=3
		a. $Mn\overline{O}_4 + C_2O_4^{} \to Mn^{++} + CO_2$	
		b. $IO_3^- + ASO_3^{3-} \rightarrow ASO_4^{3-} + I^-$	
	(xii)	Zn can replace Cu from CuSO <sub>4</sub> solution while Zn does not replace Mg from MgSO <sub>4</sub> solution	n.
		Write cell reactions in support of your answer. Reduction potential of Zn = $-0.76$ v.	
		Reduction potential of Mg = $-2.37 \text{ v}$ .	03
	(xiii)	In the reaction of NO and H2 it was observed that equimolecular mixture of gases at	
		340.5 mm pressure was half changed in 102 seconds. In another experiment with an	
		initial pressure 288 mm of Hg the reaction was half completed in 140 seconds.	
	2.2.2	Calculate the order of reaction.	03
	(xiv)	Differentiate between Hydration and Hydrolysis by giving examples.	03
	(xv)	Consider the following system: $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO(g)$	
		$K_e$ for the reaction at 2000° C is 0.10. If initial concentration of $N_2,O_2$ and NO are	
		0.100M, 0.100M and 0.00M, respectively, what are the concentrations of these substances	at
		equilibrium?	03

	(xvi)	Define Chromatography. What is the main difference between Absorption Chromatogra	phy and
		Partition Chromatography?	1+2=3
	(xvii)	Solubility is affected by temperature. Prove.	03
	(xviii)	The sum of the mole fractions of all the components is always equal to unity for any solu	ution.
		Explain with reasons.	03
	(xix)	What is meant by Activation of a catalyst and Poisoning of a catalyst?	
		Give one example in each case.	1.5+1.5=3
		SECTION - C (Marks 26)	
Note:-	A	Attempt any TWO questions. All questions carry equal marks.	(2x13 = 26)
Q. 3	a.	What is Dalton's law of Partial Pressure? How will you calculate partial pressure of a gas?	1+3=4
	b.	There is a mixture of H <sub>2</sub> , He and CH <sub>4</sub> occupying a vessel of volume 13 dm <sup>3</sup> at 37°C and	
		pressure of 1 atm. The masses of H <sub>2</sub> and He are 0.8 g and 0.12 g, respectively.	
		Calculate the Partial Pressure of each gas in torr.	05
	c.	Differentiate between Orbit and Orbital.	04
Q. 4	a.	These species $N\overline{H}_2$ , $N\overline{H}_3$ and $N\overline{H}_4^+$ have bond angles of 105°, 107.5° and 109.5°, respective	ely.
		Justify these values by drawing their structures according to VSEPR theory.	05
	b.	What are the drawbacks of Bohr's Atomic model?	04
	c.	Differentiate between Ideal and Non-ideal solutions.	04
Q. 5	a.	Derive Henderson's equation.	04
	b.	What is Catalysis? Differentiate between Homogeneous and Heterogeneous catalysis.	04
	c.	SHE acts as anode when connected with Cu electrode and as cathode when connected	
		with Zn electrode. Explain by writing cell reactions.	05

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Page 2 of 2 (Chem)