SHRI KRISHNA ACADEMY

BOARD EXAM (10,+1,+2) ,NEET AND JEE COACHING CENTRE
SBM SCHOOL CAMPUS,TRICHY MAIN ROAD,NAMAKKAL
CELL:9965531727-9443231727

+2 COMMON QUARTERLY EXAMINATION - SEP - 2019

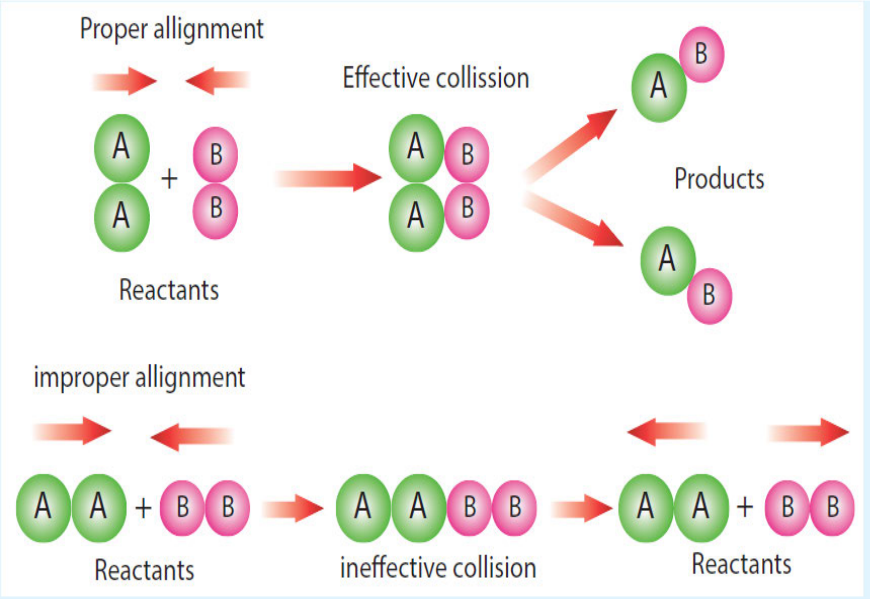
Tentative answer key

SUBJECT: CHEMISTRY **MARKS: 70**

Q.NO	CONTENT	MARKS
I.	**SECTION-I** **CHOOSE THE CORRECT ANSWER:**	**15X1=15**
1	c)3.87BM	1
2	a)four (2c-2e) and two (3c-2e)	1
3	b)Al<Ga<In<Tl	1
4	b)F_2	1
5	a)PH_3	1
6	b)Zn	1
7	d)In the metallurgy of gold ,the metal is leached with dilute NaCl solution	1
8	a)Both assertion and reason are true and reason is correct explanation of assertion	1
9	b)0	1
10	b)$K[Pt\ Cl_3(C_2H_4)]$	1
11	b)848.5pm	1
12	c)Molecular solid	1
13	c)120 min	1
14	a)First order	1
15	b)Activation energy	1

Q.NO	SECTION - II	6x2=12
16	❖ Fluorine is most electronegative thus it is more reactive among the halogens . ❖ This is due to the minimum value of F-F bond dissociation energy	2
17	Gd^{3+}= [Xe] $4f^7$ $5d^0$ = colourless d^0 , d^{10} electronic configuration have no unpaired electron so it is colourless	2
18	[Co (NH_3)Cl] SO_4 and [Co(NH_3) SO_4]Cl are ionisation isomers. [Co (NH_3)Cl] SO_4 +$BaCl_2$ → $BaSO_4$ (white precipitate) [Co(NH_3) SO_4]Cl+$BaCl_2$ → No reaction [Co(NH_3) SO_4]Cl+$AgNO_3$ → AgCl (curdy white precipitate)	1 1
19	**Ag_2O and HgO undergo self reduction:** ❖ Ellingham diagram for the formation of Ag_2O and HgO is at upper part of the diagram and their decomposition temperatures are 600 and 700 K respectively. ❖ It indicates that these oxides are unstable at moderate temperatures and will decompose on heating even in the absence of a reducing agent.	1 1
20	**Graphite :** ❖ It is composed of flat two dimensional sheets of carbon atoms. Each sheet is a hexagonal net of sp2 hybridised carbon atoms with a C-C bond length of 1.41 Å which is close to the C-C bond distance in benzene (1.40 Å).	1

	❖ Each carbon atom forms three σ bonds with three neighbouring carbon atoms using three of its valence electrons and the fourth electron present in the unhybridised p orbital forms a π-bond. **Diamond:** ❖ The carbon atoms in diamond are sp3 hybridised and bonded to four neighbouring carbon atoms by σ bonds with a C-C bond length of 1.54 Å. ❖ This results in a tetrahedral arrangement around each carbon atom that extends to the entire lattice.	1
21	**Uses of Potash Alum:** ❖ It is used for purification of water . ❖ It is also used for water proofing and textiles ❖ It is used in dyeing, paper and leather tanning industries	2
22	In a body centered cubic lattic atom touch along the body diagonal of the cube. Thus 4r = $\sqrt{3a}$ r = $\sqrt{\frac{3}{4}}a$ = ($\sqrt{\frac{3}{4}}$) (4.29$A°$) = 1.86 $A°$	1 1
23	**Limitations of VB theory**: ❖ It does not explain the colour of the complex ❖ It considers only the spin only magnetic moments and does not consider the other components of magnetic moments. ❖ It does not provide a quantitative explanation as to why certain complexes are inner orbital complexes and the others are outer orbital complexes for the same metal. For example, $[Fe(CN)_6]^{4-}$ is diamagnetic	2

	(low spin) whereas $[FeF^6]^{4-}$ is paramagnetic (high spin).	
24		1 1
Q.NO	**SECTION-III**	**6X3=18**
25	**Classification of molecular solid with example:** ❖ **Non-polar molecular solids** Examples: naphthalene, anthracene etc., ❖ **Polar molecular solids** Examples are solid CO_2 , solid NH_3 etc. ❖ **Hydrogen bonded molecular solids** Examples: solid ice (H_2O), glucose, urea etc.,	1 1 1
26	**i)Cryolite in the extraction of aluminium.** Lowers the melting point of the mixture **ii)Iodine in the refining of Zirconium.** To form a volatile compound which further heating decomposes to give pure Zn. $Zr + 2I_2 \longrightarrow ZrI_4 \xrightarrow{\Delta} Zr + 2I_2$	$1_{1/2}$ $1_{1/2}$

<table>
<tr><td>27</td><td>i) $2B + 6NaOH \rightarrow 2Na_3BO_3 + 3H_2$
ii) $2SiCl_4 + NH_3 \xrightarrow[ether]{330K} Cl_3Si - NH - SiCl_3 + 2HCl$</td><td>$1_{1/2}$
$1_{1/2}$</td></tr>
<tr><td>28</td><td>Let
$[A_0] = 100;$
when $t = t_{99.9\%}$; $[A] = (100\text{-}99.9) = 0.1$
$k = \frac{2.303}{t}\log\left(\frac{[A_0]}{[A]}\right)$
$t_{99.9\%} = \frac{2.303}{k}\log\left(\frac{100}{0.1}\right)$
$t_{99.9\%} = \frac{2.303}{k}\log 1000$
$t_{99.9\%} = \frac{2.303}{k}(3)$
$t_{99.9\%} = \frac{6.909}{k}$
$t_{99.9\%} \simeq 10 \text{ x } \frac{0.69}{k}$
$t_{99.9\%} \simeq 10\, t_{1/2}$</td><td>3</td></tr>
<tr><td>29</td><td>Compare lanthanide and actinide:
<table>
<tr><th>s.no</th><th>Lanthanoids</th><th>Actinoids</th></tr>
<tr><td>1</td><td>electron enters in 4f orbital</td><td>electron enters in 5f orbital</td></tr>
<tr><td>2</td><td>Binding energy of 4f orbitals are higher</td><td>Binding energy of 5f orbitals are lower</td></tr>
<tr><td>3</td><td>less tendency to form complexes</td><td>greater tendency to form complexes</td></tr>
</table></td><td>3</td></tr>
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<tr><td>4</td><td>Most of the lanthanoids are colourless</td><td>Most of the actinoids are coloured. For example.
U^{3+} (red), U^{4+} (green) , UO_2^{2+} (yellow)</td></tr>
<tr><td>5</td><td>They do not form oxo cations</td><td>They do form oxo cations such as UO_2^{2+} NpO_2^{2+}, etc</td></tr>
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<tr>
<td>30</td>
<td>
Dehydrating property of sulphuric acid :
❖ The dehydrating property can also be illustrated by its reaction with organic compounds such as sugar, oxalic acid and formic acid.
$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2SO_4 \longrightarrow 12C + H_2SO_4.11H_2O$
$\underset{\text{Formic acid}}{HCOOH} + H_2SO_4 \longrightarrow CO + H_2SO_4.H_2O$
$\underset{\text{Oxalic acid}}{(COOH)_2} + H_2SO_4 \longrightarrow CO + CO_2 + H_2SO_4.H_2O$
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<td>3</td>
</tr>
<tr>
<td>31</td>
<td>
Fe^{3+} is more stable than Fe^{2+}:
The electronic configuration of Fe is [Ar] $3d^6$ $4s^2$
Fe^{2+}= [Ar] $3d^6$
Fe^{3+}= [Ar] $3d^5$
Half filled d shell which is highly stable. So Fe^{3+} is more stable than Fe^{2+}
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<td>**32**</td>
<td>
Differentiate Molecularity from Order:
<table>
<tr><th>s.no</th><th>Order of a reaction</th><th>Molecularity of a reaction</th></tr>
<tr><td>1</td><td>It is the sum of the powers of concentration terms involved in the experimentally determined rate law.</td><td>It is the number of reactant species that are involved in an elementary step.</td></tr>
<tr><td>2</td><td>It can be zero (or) fractional (or) integer</td><td>It is always a whole number , cannot be zero or a fractional number</td></tr>
<tr><td>3</td><td>It is assigned for a overall reaction.</td><td>It is assigned for each elementary step of mechanism.</td></tr>
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</td>
<td>1^{12}
$1^{1/2}$</td>
</tr>
<tr>
<td>**33**</td>
<td>
i)**Na_2 [Ni (EDTA)]**
Sodium 2, 2’,2”,2”’ –(ethane-1,2-diyldinitrilo) tetraacetatonickelate(II)
ii) [Co (en)$_3$]$_2$ (SO $_4$)$_3$
Tris (ethane1,2 diamine) Cobalt(III) sulphate
iii) **[Pt (NH_3)$_2$ Cl (NO_2)]**
Diamminechloroidonitrito-*kN Platinum(II)*
</td>
<td>1
1
1</td>
</tr>
<tr>
<th>Q.NO</th>
<th>SECTION-IV</th>
<th>5X5=25</th>
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<tr>
<td>**34**</td>
<td>
a)i) **Observations of Ellingham diagram:**
❖ For most of the metal oxide formation, the slope is positive. It can be explained as follows. Oxygen gas is consumed during the formation of metal oxides which results in the decrease in randomness. Hence, ΔS becomes negative and it makes the term, TΔS positive in the straight line equation.
</td>
<td>3</td>
</tr>
</table>

- The graph for the formation of carbon monoxide is a straight line with negative slope. In this case ΔS is positive as 2 moles of CO gas is formed by the consumption of one mole of oxygen gas. It indicates that CO is more stable at higher temperature.

- As the temperature increases, generally ΔG value for the formation of the metal oxide become less negative and becomes zero at a particular temperature. Below this temperature, ΔG is negative and the oxide is stable and above this temperature ΔG is positive. This general trend suggests that metal oxides become less stable at higher temperature and their decomposition becomes easier.

- There is a sudden change in the slope at a particular temperature for some metal oxides like MgO, HgO. This is due to the phase transition (melting or evaporation).

ii) **Idetification of borate radical:** 2

- When boric acid or borate salt is heated with ethyl alcohol in presence of conc. sulphuric acid, an ester, trialkylborate is formed.
- The vapour of this ester burns with a green edged flame and this reaction is used to identify the presence of borate.

$$H_3BO_3 + 3C_2H_5OH \xrightarrow[H_2SO_4]{Conc.} B(OC_2H_5)_3 + 3H_2O$$

OR	b)i)**Integerated equation for a zero order :** $A \longrightarrow$ product A reaction in which the rate is independent of the concentration of the reactant over a wide range of concentrations is called as zero order reactions. The rate law can be written as, Rate = k $[A]^0$ $-d\frac{[A]}{dt} = k\,(1)$ $\quad ([A]^0 = 1)$ -d [A] =k dt Integrate the above equation between the limits of $[A]_0$ at zero time and [A] at some later time 't', $-\int_{A_0}^{[A]} d[A] = k\int_0^t dt$ $-\left([A] \right)_{[A]_0}^{[A]} = k\,(t)_0^t$ Equation (2) is in the form of a straight line y = mx + c Ie., $[A] = -kt + [A_0]$ ⇒ y = c + mx A plot of [A] Vs time gives a straight line with a slope of −k and y - intercept of $[A_0]$. ii)**Inert pair effect:** The less availability of ns electron in bonding which is known as inert pair effect.	1 1 1 2
35	a) i) The number of Fe^{2+} ions in the crystal be x The number of Fe^{3+} ions in the crystal be y Total number of Fe^{2+} and Fe^{3+} ions is $x+y$ given that $x+y = 0.93$ the total charge =0 $x(2+) + (0.93 - x)(+3) - 2 = 0$ $2x + 2.97 - 3x - 2 = 0$ $x = 0.79$ Percentage of Fe^{3+} $= \left(\frac{(0.93 - 0.79)}{(0.93)} \right) 100 = 15.05\%$	3

ii)**Pseudo first order reaction:**

- A second order reaction can be altered to a first order reaction by taking one of the reactant in large excess, such reaction is called pseudo first order reaction. 1
- Let us consider the acid hydrolysis of an ester,

$$CH_3COOCH_3\ (aq) + H_2O\ (l) \xrightarrow{H^+} CH_3COOH\ (aq) + CH_3OH\ (aq)$$
$$\text{Rate} = k\ [CH_3COOCH_3]\ [H_2O]$$ 1

OR

b)i) Schottky defect:

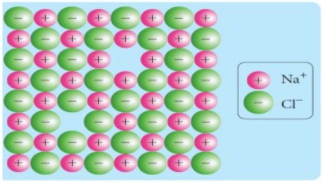
i)Schottky defect arises due to the missing of equal number of cations and anions from the crystal lattice. 1

ii)This effect does not change the stoichiometry of the crystal. 1

iii)Ionic solids in which the cation and anion are of almost of similar size show schottky defect.

iv) presence of large number of schottky defect in a crystal it also lowers the density

Example: NaCl. 1



Schottky Defect

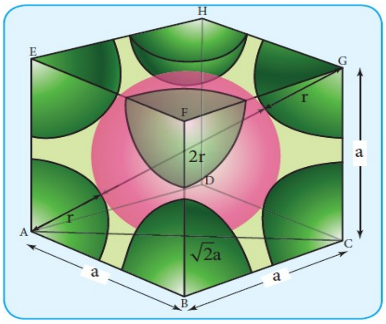
ii)**Differentiate mineral and ore:**

MINERALS	ORES
A naturally occurring substance obtained by mining which contains the metal in free state or in the form of compounds like oxides, sulphides etc... is called a **mineral**.	minerals that contains a high percentage of metal from which metal can be extracted conveniently and economically.
All minerals are not ores	All ores are minerals

1

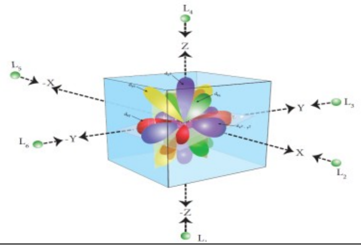
1

36	**a) Zeolites:** • Zeolites are three-dimensional crystalline solids containing aluminium, silicon, and oxygen in their regular three dimensional framework. • They are hydrated sodium alumino silicates with general formula $NaO.(Al_2O_3).x(SiO_2).yH_2O$ (x=2 to 10; y=2 to 6). **Structure:** • Zeolites have porous structure in which the monovalent sodium ions and water molecules are loosely held. • The Si and Al atoms are tetrahedrally coordinated with each other through shared oxygen atoms. • Zeolites have a three dimensional crystalline structure looks like a honeycomb consisting of a network of interconnected tunnels and cages. • Water molecules moves freely in and out of these pores but the zeolite framework remains rigid. Another special aspect of this structure is that the pore/channel sizes are nearly uniform, allowing the crystal to act as a molecular sieve.	1 1 1 1 1
OR	**b) i) Inter halogen compounds:** Each halogen combines with other halogens to form a series of compounds called interhalogen compounds. Ex: ClF , ClF_3 , IF_4 **Properties(Any two):** ❖ The central atom will be the larger one ❖ It can be formed only between two halogen and not more than two halogens. ❖ Fluorine can't act as a central metal atom being the smallest one ❖ Due to high electronegativity with small size fluorine helps the central atom to attain high coordination number	2 1

	❖ They are strong oxidizing agents ii) **Uses of Helium:** **i)** Helium and oxygen mixture is used by divers in place of air oxygen mixture. This prevents the painful dangerous condition called bends. **ii**Helium is used to provide inert atmosphere in electric arc welding of metals	1 1
37	**a) Packing efficiency:** The percentage of total volume occupied by these constituent spheres gives the packing efficiency of an arrangement. Let us calculate the packing efficiency in simple cubic arrangement. { packing fraction (or) efficiency} $= \frac{Total\ \ volume\ \ occupied\ \ by\ spheres\ in\ a\ unit\ \ cell}{Volume\ \ of\ the\ unit\ \ cell}$ x 100 Here, the spheres are touching along the leading diagonal of the cube as shown in the figure  In ΔABC $AC^2 = AB^2 + BC^2$ $AC = \sqrt{AB^2 + BC^2}$ $AC = \sqrt{a^2 + a^2} = \sqrt{2a^2}$ $= \sqrt{2}a$ In ΔACG $AG^2 = AC^2 + CG^2$ $AG = \sqrt{AC^2 + CG^2}$ $AG = \sqrt{(\sqrt{2}a)^2 + a^2}$ $AG = \sqrt{2a^2 + a^2} = \sqrt{3a^2}$ $AG = \sqrt{3}a$	1 2

	i.e., $\sqrt{3a}$ = 4r r = $\sqrt{\frac{3}{4}}\ a$ ∴ Volume of the sphere with radius 'r' $=\frac{4}{3}\pi r^3$ $= \frac{4}{3}\pi \left(\frac{\sqrt{3}}{4}\ a\right)^3$ $= \frac{\sqrt{3}}{16}\ \pi a^3$ ……….(1) Number of spheres belong to a unit cell in bcc arrangement is equal to two and hence the total volume of all spheres $= 2 \times \left(\frac{\sqrt{3}\,\pi a^3}{16}\right) = \frac{\sqrt{3}\,\pi a^3}{8}$ Dividing (2) by (3) Packing fraction = $\frac{\frac{\sqrt{3}\,\pi a^3}{8}}{(a)^3} \times 100$ $= \frac{\sqrt{3}\pi}{8} \times 100$ $= \sqrt{3}\pi \times 12.5$ = 1.732 × 3.14 ×12.5 = 68 %	
OR	**b)i) Bleaching action of Chlorine:** Chlorine is a strong oxidising and bleaching agent because of the nascent oxygen. $H_2O + Cl_2 \longrightarrow HCl + \underset{\text{Hypo chlorous acid}}{HOCl}$ $HOCl \longrightarrow HCl + (O)$ Colouring matter + Nascent oxygen →Colourless oxidation product ❖ The bleaching of chlorine is permanent. ❖ It oxidises ferrous salts to ferric, sulphites to sulphates and hydrogen sulphide to sulphur.	1 ½

	$2FeCl_2 + Cl_2 \longrightarrow 2FeCl_3$ $Cl_2 + H_2O \longrightarrow HCl + HOCl$ ii) **d-block elements form complexes:** ❖ Transition elements have a tendency to form coordination compounds with a species that has an ability to donate an electron pair to form a coordinate covalent bond. ❖ Transition metal ions are small and highly charged and they have vacant low energy orbitals to accept an electron pair donated by other groups. Due to these properties, transition metals form large number of complexes. ❖ Examples: [Fe(CN)6]4- , [Co(NH3)6]3+ , etc..	1 ½ 2
38	**a) Postulates of Crystal field theory:** 1. Crystal Field Theory (CFT) assumes that the bond between the ligand and the central metal atom is purely ionic. i.e. the bond is formed due to the electrostatic attraction between the electron rich ligand and the electron deficient metal. 2. In the coordination compounds, the central metal atom/ion and the ligands are considered as point charges (in case of charged metal ions or ligands) or electric dipoles (in case of neutral metal atoms or ligands). 3. According to crystal field theory, the complex formation is considered as the following series of hypothetical steps. **Step 1:** In an isolated gaseous state, all the five d orbitals of the central metal ion are degenerate. Initially, the ligands form a spherical field of negative charge around the metal. In this filed, the energies of all the five d orbitals will increase due to the repulsion between the electrons of the metal and the ligand. **Step 2:** The ligands are approaching the metal atom in actual bond directions. To illustrate this let us consider an octahedral field, in which the central metal ion is located at the origin and the six ligands are coming from the +x, -x, +y, -y, +z and -z directions as shown below. The orbitals lying along the axes dx2-y2 and dz2 orbitals will experience strong repulsion and raise in energy to a greater extent than the orbitals with lobes directed between the axes (dxy, dyz and dzx).	2 1 1

	Thus the degenerate d orbitals now split into two sets and the process is called crystal field splitting. **Step 3**: Up to this point the complex formation would not be favoured. However, when the ligands approach further, there will be an attraction between the negatively charged electron and the positively charged metal ion, that results in a net decrease in energy. This decrease in energy is the driving force for the complex formation. 	1
OR	b)i) a) $MnO_4^- + 2H_2O + 3e^- \longrightarrow MnO_2 + 4OH^-$ Equivalent weight of $KMnO_4$ in neutral medium $= \frac{\text{Molecular weight of } KMnO_4}{\text{no of mols of electrons transferred}} = \frac{158}{3} = 52.67$ b) $2MnO_4^- + 10Fe^{2+} + 16H^+ \longrightarrow 2Mn^{2+} + 10Fe^{3+} + 8H_2O$ Equivalent weight of $KMnO_4$ in acid medium $= \frac{\text{Molecular weight of } KMnO_4}{\text{no of mols of electrons transferred}} = \frac{158}{5} = 31.6$ ii)**Roasting:** Roasting is the method the sulphide ore is converted into oxide ore below its melting only it exist in solid. **Smelting:** Smelting is a chemical substance that forms an easily fusible slag with gangue.	11/2 11/2 1 1