UNIT TEST 1A

Date : 28-Jul-19

12th Standard 2019 EM

CHEMISTRY

Reg.No. : | | | | | | |

DRAW DIAGRAMS AND WRITE EQUATIONS WHEREVER NECESSARY

Time : 02:00:00 Hrs

Total Marks : 70

PART - A

15 x 1 = 15

CHOOSE AND WRITE THE CORRECT ANSWER

1) Cupellation is a process used for the refining of

(a) Silver (b) Lead (c) Copper (d) iron

2) The following set of reactions are used in refining Zirconium

$(impure) + 2I_2 \xrightarrow{523k} ZrI_4$

$ZrI_4 \xrightarrow{1800K} Zr(pure) + 2I_2$ This method is known as

(a) Liquation (b) van Arkel process (c) Zone refining (d) Mond's process

3) Which of the following plot gives Ellingham diagram

(a) $\Delta SVsT$ (b) ΔG^0VsT (c) $\Delta G^0Vs\frac{1}{T}$ (d) ΔG^0VsT^2

4) In acid leaching process. the insoluble sulphide is converted into soluble sulphate and elemental_____

(a) carbon (b) lead (c) sulphur (d) zinc

5) Boric acid is an acid because its molecule (NEET)

(a) contains replaceable H+ ion (b) gives up a proton (c) combines with proton to form water molecule (d) accepts OH- from water ,releasing proton.

6) Which of these is not a monomer for a high molecular mass silicone polymer?

(a) Me_3SiCl (b) $PhSiCl_3$ (c) $MeSiCl_3$ (d) Me_2SiCl_2

7) The compound that is used in nuclear reactors as protective shields and control rods is

(a) Metal borides (b) metal oxides (c) Metal carbonates d) metal carbide (d) none of these

8) In graphite electrons are

(a) localised on each C-atom (b) localised on every third C-atom (c) delocalised within the layer (d) present in anti-bonding orbital

9) Match items in column - I with the items of column – II and assign the correct code.

Column-I		Column-II	
A.	Cyanide process	(i)	Ultrapure Ge
B	Froth floatation process	(ii)	Dressing of ZnS
C	Electrolytic reduction	(iii)	Extraction of Al
D	Zone refining	(iv)	Extraction of Au
		(v)	Purification of Ni

(a)

A	B	C	D

(b)

A	B	C	D
(i)	(ii)	(iii)	(iv)

(c)

A	B	C	D
(iii)	(iv)	(v)	(i)

(d)

A	B	C	D
(ii)	(iii)	(i)	(v)

10) Identify the correct statement(s) with respect to the following reaction.

$2Na[Al(OH)_1]_{(aq)} + CO_{2(g)} \longrightarrow Al_2O_3.xH_2O_{(g)} + 2NaHCO_{3(aq)}$

(i) CO_2 is acting as a reducing agent.

(ii) The solution is neutralised by passing CO_2 gas to form hydrates Al_2O_3 precipitate.

(iii) Insoluble sulphate is converted into soluble sulphate.

(iv) The precipitate is filtered off and heated around 1670 K to get pure Alumina.

(a) only (ii)

(b) only (iv)

(c) both (ii) & (iv)

(d) both (i) and (iii)

11) I. Potash alum is a white crystalline solid.

II. It is soluble in water.

III. It is used as a styptic agent

IV. The aqueous solution is base.

a) III & IV

b) Only II

c) Only I

d) I, II & III

12) I.Froth flotation is used to concentrate sulphide ores.

II. Magnetic separation is applicable for ferromagnetic ores.

III. Roasting method used to sulphide ores to oxides

IV.Magnetic separation is used to concentrate heavy oxide ores.

a) III & IV

b) Only II

c) Only I

d) I, II & III

13) **Assertion** :A dilute solution of NaCN is used for leaching ores of silver and gold.

Reason : Impurities present in these ores dissolve in NaCN

a) Both assertion and reason are true and the reason is the correct explanation of the assertion.

b) Both assertion and reason are true but the reason is not the correct explanation of the assertion.

c) Assertion is true, but reason is false.

d) Both assertion and reason are false

14) a) Metallic oxides can be reduced by an alumino thermitc process.

b) Flux + gangue$\rightarrow$ slag

c) Silica gangue present in the ore is basic in nature

d) $Cu_2S + FeS \rightarrow$Copper matter

15) a) Alum is potassium aluminium sulphate

b) Alum is extracted from colemanite

c) Anhydrous aluminium chloride a catalyst in Friedels crafts reactions.

d) Its a Lewis acid

PART -B

6 x 2 = 12

ANSWER ANY SIX QUESTIONS IN ONE OR TWO SENTENCES

16) What is the difference between minerals and ores?

17) What are the various steps involved in extraction of pure metals from their ores?

18) Describe a method for refining nickel

19) What is calcination? Give example.

20) Write a short note on anamolous properties of the first element of p-block

21) Boron does not react directly with hydrogen. Suggest one method to prepare diborane from BF_3.

22) What is catenation ? describe briefly the catenation property of carbon

23) What is burnt alum?

24) Give the formula of chlorosilazanes. Explain its preparation from $SiCl_4$.

PART -C 6 x 3 =18

ANSWER ANY SIX QUESTIONS IN DETAIL

25) (A) Predict the conditions under which
(i) Aluminium might be expected to reduce magnesia.
(ii) Magnesium could reduce alumina.
(B) Carbon monoxide is more effective reducing agent than carbon below 983K but, above this temperature, the reverse is true –Explain.
(c) it is possible to reduce Fe_2O_3 by coke at a temperature around 1200K

26) Explain the electrometallurgy of aluminium

27) Explain the following terms with suitable examples.
(i) Gangue
(ii) slag

28) Explain alkali leaching in the extraction of aluminum,

29) What are the applications of the Ellingham diagram?

30) Describe the structure of diborane

31) Give one example for each of the following
(i) icosogens
(ii) tetragen
(iii) prictogen
(iv) chalcogen

32) Write a note on metallic nature of p-block elements

33) How is boron trifluoride obtained from boron trioxide?

PART-D 5 x 5 = 25

ANSWER ANY FIVE QUESTIONS IN DETAIL

34) Describe the role of the following in the process mentioned.
(i) Silica in the extraction of copper.
(ii) Cryolite in the extraction of aluminium.
(iii) Iodine in the refining of Zirconium.
(iv) Sodium cyanide in froth floatation.

35) Give the limitations of Ellingham diagram

36) Write a short note on electrochemical principles of metallurgy.

37) Explain froth flotation, with diagram.

38) How will you identify borate radical?

39) A hydride of 2^{nd} period alkali metal (A) on reaction with compound of Boron (B) to give a reducing agent (C). identify A , B and C.

40) CO is a reducing agent . justify with an example.

41) Distinguish between diamond and graphite.

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PART - A

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CHOOSE AND WRITE THE CORRECT ANSWER

1) (a) Silver
2) (b) van Arkel process
3) (b) $\Delta G^0 Vs T$
4) (c) sulphur
5) (d) accepts OH- from water ,releasing proton.
6) (a) Me_3SiCl
7) (a) Metal borides
8) (c) delocalised within the layer
9) (c)

A	B	C	D
(iii)	(iv)	(v)	(i)

10) both (ii) (iv)
11) I, II & III
12) I, II & III
13) Assertion is true, but reason is false
14) Silica gangue present in the ore is basic in nature
15) Alum is extracted from colemanite

PART -B

6 x 2 = 12

ANSWER ANY SIX QUESTIONS IN ONE OR TWO SENTENCES

16)

Minerals	**Ores**
A naturally occurring substance obtained by mining which contain Ithe metal in free state or in the form of compounds.	Ore contains a high percentage of metal, from which it can be extracted conveniently and economically.
All minerals are not ores	All ores are Minerals
It contains a low percentage of metal	It contains a high percentage of metals
Ex:Hematite, Magnetite.	EX:Bauxite,China cla

17) The various steps involved in the extraction of pure metals from their ores are
(i) concentration of the ore
(II) extraction of crude metal
(Ill) refining of crude metal

18) (I) The impure metal is heated in a stream of carbon monoxide at around 350K.

(ii) The nickel reacts with the CO to form a highly volatile nickel tetra carbonyl.

(iii), The solid impurities are left behind.

$Ni_{(s)} + 4CO_{(g)} \rightarrow Ni(CO)_{4(g)}$

(iv) On heating the nickel tetracarbonyl • around 460K, the complex decomposes to give pure metal.

$Ni(C0_4)_{(g)} \rightarrow Ni_{(s)} + 4CO_{(g)}$

19) The conversion of ore into metal oxide (oxidation) is called calcination. It is the process in which the ore is subjected to the action of heat at high temperature in the absence of air below its melting point. Example

$CaCO_3(limestone) \longrightarrow Cao + CXO_2 \uparrow$

$MgCO_3\,(Magnesite) \longrightarrow MgO + CO_2 \uparrow$

20) **Anamolous properties of the first element of p-block:**

In p-block elements ,the first member of each group differs from the other elements of the corresponding group. The following factors are responsible for this anomalous behaviour

(i) Small size of the first member.

(ii) High ionisation enthalpy and high electroriegativity.

(iii) Absence of d-orbitals in their valance shell.

21) (i) Boron does not react directly with hydrogen. However, it forms a variety of hydrides called boranes.

(ii) The simplest borane is diborane - B_2H_6. Other larger boranes can be prepared from diborane.

(iii) Treatment of gaseous boron trifluoride with sodium hydride around 450 K

gives diborane. To prevent subsequentpyrolysis, the product diborane is trapped immediately.

$2BF_3 + 6NaOH \xrightarrow{450k} B_2H_6 + 6NaF$

22) (i) Catenation is an ability of an element to form chain of atoms.

(ii) The following conditions are necessary for catenation.

(a) The valency of element is greater than or equal to two,

(b) Element should have an ability to bond with itself

(c) The self bond must be as strong as Its bond with other elements

(d) Kinetic inertness of catenated compound towards other molecules.

(iii) Carbon possesses all the above properties , and forms a wide range of compounds with itself and with other elements such as H, 0, N, S and halogens

23) On heating to 475 K potash alum loses water of hydration and swells up. The swollen mass is known as burnt alum.

24) Chlorosilazanes is $Cl_3Si - NH - SiCl_3$

Silicon tetrachloride undergoes ammonialysis to form chlorosilazanes.

$2SiCl_4 + NH_3 \xrightarrow[Ether]{330K} Cl_3Si - NH - SiCl_3$ ·

PART -C 6 x 3 =18

ANSWER ANY SIX QUESTIONS IN DETAIL

25) (A)

(i) Magnesium can reduce aluminum oxide and aluminum can also reduce magnesium oxide.

(ii) Ellingham diagram, suggest; that below 1350°C, Mg can reduce aluminum oxide Al_2O_3, and when temperature is above 1350°C, Al can reduce magnesium oxide MgO.

(B)

(i) Both thermodynamics and kinetic factors make carbon monoxide a better reducing agent than carbon.

(ii) When coke or coal is used to reduce a metal oxide, it get oxidised to CO, when CO itself is the reducing agent it is oxidized to CO_2 ,

(iii) The value of G for change of C to CO_2 is less than the value of G for the change from CO to CO_2. Therefore coke (carbon) is better reducing agent than CO at 983K. Fe_2O_3 undergoes reduction by hot coke to iron (Ii) (iii)

(C) Fe_2O_3 undergoes reduction by hot coke to iron

$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$ + heat

Thus CO is more effective agent than carbon.

26) (i) In the method Hall-Herold ,process electrolysis is carried out in an iron tank lined with carbon which acts as a cathode.

(ii) The carbon blocks immersed in the electrolyte acts as a anode

(iii) A 20% solution of alumina, obtained from the bauxite ore is mixed with molten Cryolite and is taken in the electrolysis chamber..

(iv) About 10% calcium chloride is also added to the solution. Calcium chloride helps to lower the melting point of the mixture.

(v) The fused mixture is maintained at a temperature of above 1270 K.

(vi) The chemical reactions involved in this process are

Ionisaiton of alumina

$Al_2O_3 \longrightarrow 2Al^{3+} + 3O^{2-}$

Reaction at cathode

$2Al^{2+}(melt) + 3e^- \longrightarrow Al_{(l)}$

Reaction at anode

$2O(melt) \longrightarrow O_2 + 3e^-$

(vii) Since carbon acts as anode the following reaction takes place

$C_{(s)} + O^{2-}(melt) \longrightarrow CO + 2e^-$

$C_{(s)} + 2O^{2-}(melt) \longrightarrow CO_2 + 4e^-$

(viii) Due to the above two reactions, anodes are slowly consumed during the electrolysis. The pure aluminium is formed at the cathode and settles at the bottom.

(ix) The net electrolysis reaction can be written as follows

$4Al^{3+}(melt) + 6O^{2-}(melt) + 3C_{(s)} \longrightarrow 4Al_{(l)} + 3CO_{2(g)}$

27) (i) Gangue :The rockey impurity associated with the ore is called gangue or matrix

(ii) siag : Slag is the fusible product formed when flux reacts with gangue during the extraction of metal.

28) (i) In this method, the ore is treated with aqueous alkali to form a soluble complex.

(ii) Bauxite, an important ore of aluminum is heated with a solution of sodium hydroxde or sodium carbonate in the temperature range 470 - 520 K at 35 atm to form soluble sodium meta-aluminate leaving behind the impurities, iron oxide and titanium oxide

$Al_2O_{3(s)} + 2NaOH_{(aq)} + 3H_2O_{(l)} \longrightarrow 2Na[Al(OH)_4]_{(aq)}$

(iii) The hot solution is decanted, cooled, and diluted. This solution is neutralised by passing CO_2 gas, to the form hydrated Al_2O_3 precipitate

$2Na[Al(OH)_4]_{(aq)} + CO_{2(g)} \longrightarrow Al_2O_3.xH_2O_{(s)} + 2NaHCO_{3(aq)}$

(iii) The precipitate is filtered off and heated around 1670 K to get pure alumina Al_2O_3

29) (i) Ellingham diagram helps us to select a suitable reducing agent and appropriate temperature range for reduction.

(ii) From the Ellingham diagram, we can infer the relative stability of different metal oxides at a given temperature.

(iii) Ellingham diagram is used to predict thermodynamic feasibility of reduction of oxides of one metal by another metal,.

30) (i) In diborane two BH2 units are linked by two bridged hydrogens. Therefore, it has eight B-H bonds.

(ii) However, diborane has only 12 valance electrons and are not sufficient to form normal covalent bonds.

(iii) The four terminal B-H bonds are normal covalent bonds (two centre - two electron bond or 2c-2e bond).

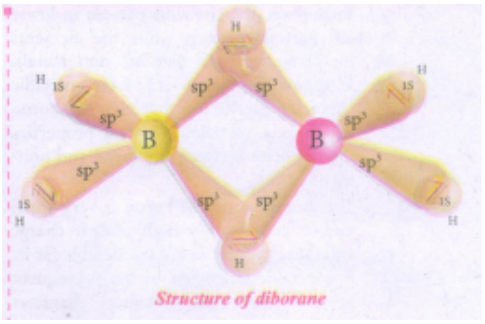
(iv) The remaining four electrons have to be used for the bridged bonds. i.e. two three centred B-H-B bonds utilise two electrons each.

(v) Hence, these bonds are three centre- two electron bonds (3c-2e). The bridging hydrogen atoms are in a plane as shown in the figure.

(vi) In diborne, the boron is SP3 hybridised .Three of the four sp3 hybridised orbitals contains single electron and the fourth orbital is empty.

(vii) Two of the half filled hybridised orbitals of each boron overlap with the two hydrogens to form four terminal2c-2e bonds, leaving one empty and one half filled hybridised orbitals on each boron.

(viii) The three centre - two electron bonds), B-H-B bond formation involves overlapping the half filled hybridised orbital of one boron, the empty hybridised orbital of the other boron and the half filled Is orbital of hydrogen.



Structure of diborane

31) (i) icosogens - Boron

(ii) tetragen Carbon

(iii) pnictogen - Nitrogen

(iv) chalcogen - Oxygen

32) (i) The tendency of an element to form a cation by loosing electrons is known as electropositive or metallic character.

(ii) This character depends on the ionisation energy

(iii) Generally on descending a group the ionisation energy decreases and hence the metallic character increases.

(iv) In p-block, the elements present in lower I left part are metals while the elements: in the upper right part are non metals.Elements of group 13 have metallic character except the first element boron which is a metalloid, having properties: I intermediate between .the metal and non metals.

(v) The atomic radius of boron is very small and it has relatively high nuclear charge and these properties are responsible for its nonmetallic character .. In the subsequent groups the non-metallic character increases.

(vi) In group 14 elements, carbon is a non metal while silicon and germanium are metalloids. In group 15, nitrogen and phosphorus are non metals and arsenic & antimony are metalloids

(vii) In group 16, oxygen, sulphur and selenium are non metals and tellurium is a metalloid All the elements of group 17 arid 18 are non metals.

33) (i) Boron trifuloride is obtained by the treatment of calcium fluoride with boron trioxide in presence of cone. sulphuric acid.

$B_2O_3 + 3CaF_2 + 3H_2SO_4 \xrightarrow{\triangle} 2BH_3 + 3CaSO_4 + 3H_2O$

(ii) It can also be obtained by treating boron trioxide with carbon and fluorine.

$B_2O_3 + 3C + 3F_2 \longrightarrow 2BF_3 + 3CO$

(iii) In the laboratory pure BF3 is prepared by the thermal decomposition of benzene diazonium tetrafluoro borate.

$PhN_2BF_4 \xrightarrow{\triangle} BF_3 + PhF + N_2$

PART-D

5 x 5 = 25

ANSWER ANY FIVE QUESTIONS IN DETAIL

34) (i) Silica, an acidic flux is used to remove slag during the process of roasting

(ii) Lowers the melting point to 1173K

(iii) To form a volatile compound which on further heating decomposes to give pure Zn.

(iv) Sodium ethyl xanthate in froth flotation acts as a collector.

35) (i) Ellingham diagram is constructed based only on thermodynamic considerations.

(ii) The interpretation of $\triangle G$ is based on the assumption that the reactants are in equilibrium with the product which is

not always true.

(iii) It does not tell anything about the rate of the reaction.

36) (i) Electrochemical principles also find applications in metallurgical process. .

(ii) The reduction of oxides of active metals -such as sodium, potassium etc., by carbon is thermodynamically not feasible.

(iii) Such metals are extracted from their ores by using electrochemical methods.

(iv) In this technique, the metal salts are taken in a fused form or in solution form.

(v) The metal ion present can be reduced by treating it with some suitable reducing agent or by electrolysis.

(vi) Gibbs free energy change for the electrolysis process is given by the following expression ilGo = -nl'E"

(vii) Where n is number of electrons involved in the reduction process, F is the Faraday and EOis the electrode potential of the redox couple.

(viii) If EOis positive then the ilG is negative and the reduction is spontaneous and hence a redox reaction is planned in such a way that the e.m.f of the net redox reaction is .positive.

(ix) When a more reactive metal is added to the solution containing the relatively less reactive metal ions, the more reactive metal will go into the solution.

(x)For example

$Cu_{(s)} + 2Ag^{+}_{(s)} \longrightarrow Cu^{2+}_{(aq)} + 2Ag_{(s)}$

$Cu^{2+}_{(aq)} + Zn_{(s)} \longrightarrow Cu_{(s)} \longrightarrow Cu_{(s)} + Zn^{2+}_{(aq)}$

37) (i) Froth flotation method is commonly used to concentrate sulphide ores such as galena (PbS), zinc blende (ZnS) etc.

(ii) In this method, the metallic ore particles which are preferentially wetted by oil can be separated from gangue.

(iii) In this method, the crushed ore is suspended in water and mixed with frothing agent such as pine oil, eucalyptus oil etc.

(iv) A small quantity of sodium ethyl xanthate which acts as a collector is also added.

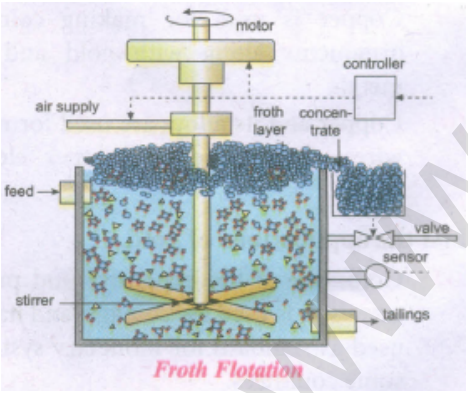
(v) A froth is generated by blowing air through this 'mixture.

(vi) The collector molecules attach to the ore particle and make them water repellent.

(vii) As a result, ore particles, wetted by the oil, rise to the surface along with the froth.

(viii) The froth is skimmed off and dried to recover the concentrated ore.

(ix) The gangue particles that are preferentially wetted by water settle at the bottom.



38) **Flame test:**

Borates on adding ethyl alcohol gives ethyl borate which when exposed to flame gives green colour flame

$H_3BO_3 + 3C_2H_2OH \xrightarrow[H_2SO_4]{Cone} B(OC_2H_5) + 3H_2O$

39) (i) A hydride of 2nd period alkali metal (A) is LH

(ii) Compound of Boron (B) is B_2H_6 diborane.

(iii) Reducing agent (C) is LBH_4

(iv) 2LiH +$B_2H_6 \xrightarrow{either}$ 2$LiBH_4$

(v) A is LiH. B is B_2H_6. Cis $LiBH_4$

40) Thermodynamically CO_2 is more stable than CO, thus carbon monoxide has a relatively high tendancy to be oxidised to form

carbon di oxide. As it is oxidised it reduces the other substance in the reaction.

Carbon monoxide acts as a strong reducing agent.

$CO+FE_2O_3 \longrightarrow 2Fe+3CO_3$

41)

DIAMOND	GRAPHITE
C is sp_3 hybridised.	C is sp_2 hybridised.
Three dimensional, tetrahedral structure.	Two dimensional, sheet like structure.
Crystalline, transparent with extra brilliance.	Crystalline, opaque and shiny substance.
It is hard with high density and high melting point.	It is soft with low density and high melting point.
Bad conductor of and electricity.	Good conductor of heat and electricity.