

# + 2 CHEMISTRY

Volume 1 & 2


(Answer key is available in the middle page.  
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**UNIT-1: METALLURGY****Choose the Best Answer****EVALUATION**

- Bauxite has the composition **(MAY 22)**  
(a)  $\text{Al}_2\text{O}_3$  (b)  $\text{Al}_2\text{O}_3 \cdot n\text{H}_2\text{O}$  (c)  $\text{Fe}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$  (d) None of these
- Roasting of sulphide ore gives the gas (A). (A) is a colourless gas. Aqueous solution of (A) is acidic. The gas (A) is  
(a)  $\text{CO}_2$  (b)  $\text{SO}_3$  (c)  $\text{SO}_2$  (d)  $\text{H}_2\text{S}$
- Which one of the following reaction represents calcinations?  
(a)  $2\text{Zn} + \text{O}_2 \rightarrow 2\text{ZnO}$  (b)  $2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$   
(c)  $\text{MgCO}_3 \rightarrow \text{MgO} + \text{CO}_2$  (d) Both (a) and (c)
- The metal oxide which cannot be reduced to metal by carbon is  
(a)  $\text{PbO}$  (b)  $\text{Al}_2\text{O}_3$  (c)  $\text{ZnO}$  (d)  $\text{FeO}$
- Which of the metal is extracted by Hall-Heroult process? **(MAR 23)**  
(a) Al (b) Ni (c) Cu (d) Zn
- Which of the following statements, about the advantage of roasting of sulphide ore before reduction is not true?  
(a)  $\Delta G_f^0$  of sulphide is greater than those for  $\text{CS}_2$  and  $\text{H}_2\text{S}$   
(b)  $\Delta G_r^0$  is negative for roasting of sulphide ore to oxide  
(c) Roasting of the sulphide to its oxide is thermodynamically feasible.  
(d) Carbon and hydrogen are suitable reducing agents for metal sulphides.
- 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	B	C	B
(a)	(i)	(ii)	(iii)	(iv)
(b)	(iii)	(iv)	(v)	(i)
(c)	(iv)	(ii)	(iii)	(i)
(d)	(ii)	(iii)	(i)	(v)

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8. Wolframite ore is separated from tinstone by the process of **(PTA MQ, MAR 20)**  
(a) Smelting (b) Calcination (c) Roasting (d) Electromagnetic separation
9. Which one of the following is not feasible?  
(a)  $\text{Zn}_{(s)} + \text{Cu}^{2+}_{(aq)} \rightarrow \text{Cu}_{(s)} + \text{Zn}^{2+}_{(aq)}$   
(b)  $\text{Cu}_{(s)} + \text{Zn}^{2+}_{(aq)} \rightarrow \text{Zn}_{(s)} + \text{Cu}^{2+}_{(aq)}$   
(c)  $\text{Cu}_{(s)} + 2\text{Ag}^{+}_{(aq)} \rightarrow \text{Ag}_{(s)} + \text{Cu}^{2+}_{(aq)}$   
(d)  $\text{Fe}_{(s)} + \text{Cu}^{2+}_{(aq)} \rightarrow \text{Cu}_{(s)} + \text{Fe}^{2+}_{(aq)}$
10. Electrochemical process is used to extract  
(a) Iron (b) Lead (c) Sodium (d) silver
11. Flux is a substance which is used to convert  
(a) Mineral into silicate  
(b) Infusible impurities to soluble impurities  
(c) Soluble impurities to infusible impurities (d) All of these
12. Which one the following ores is best concentrated by froth – floatation method?  
(a) Magnetite (b) Hematite (c) Galena (d) Cassiterite
13. In the extraction of aluminium from alumina by electrolysis, cryolite is added to  
(a) Lower the melting point of alumina  
(b) Remove impurities from alumina  
(c) Decrease the electrical conductivity  
(d) Increases the rate of reduction
14. Zinc is obtained from ZnO by **(JULY 22)**  
(a) Carbon reduction (b) Reduction using silver  
(c) Electrochemical process (d) Acid leaching
15. Extraction of gold and silver involves leaching with cyanide ion. Silver is later recovered by **(NEET-2017, Corona-20)**  
(a) Distillation (b) Zone refining  
(c) Displacement with zinc (d) liquation
16. Considering Ellingham diagram, which of the following metals can be used to reduce alumina? **(NEET-2018)**  
(a) Fe (b) Cu (c) Mg (d) Zn

17. The following set of reactions are used in refining Zirconium  
**(PTA MQ, AUG 21)**  

$$\text{Zr (impure)} + 2\text{I}_2 \xrightarrow{523\text{K}} \text{ZrI}_4$$
 This method is known as  

$$\text{ZrI}_4 \xrightarrow{1800\text{K}} \text{Zr (pure)} + 2\text{I}_2$$
 (a) Liquation (b) van Arkel process (c) zone refining (d) Mond's process
18. Which of the following is used for concentrating ore in metallurgy?  
 (a) Leaching (b) Roasting (c) Froth floatation (d) Both (a) and (c)
19. The incorrect statement among the following is **(SEP 20)**  
 (a) Nickel is refined by Mond's process  
 (b) Titanium is refined by Van Arkel's process  
 (c) Zinc blende is concentrated by froth floatation  
 (d) In the metallurgy of gold, the metal is leached with dilute sodium chloride solution
20. In the electrolytic refining of copper, which one of the following is used as anode?  
 (a) Pure copper (b) Impure copper (c) Carbon rod (d) Platinum electrode
21. Which of the following plot gives Ellingham diagram?  
 (a)  $\Delta S$  Vs  $T$  (b)  $\Delta G^0$  Vs  $T$  (c)  $\Delta G^0$  Vs  $\frac{1}{T}$  (d)  $\Delta G^0$  Vs  $T^2$
22. In the Ellingham diagram, for the formation of carbon monoxide  
 (a)  $\left(\frac{\Delta S^0}{\Delta T}\right)$  is negative (b)  $\left(\frac{\Delta G^0}{\Delta T}\right)$  is positive  
 (c)  $\left(\frac{\Delta G^0}{\Delta T}\right)$  is negative  
 (d) initially  $\left(\frac{\Delta T}{\Delta G^0}\right)$  is positive, after  $700^\circ\text{C}$ ,  $\left(\frac{\Delta G^0}{\Delta T}\right)$  is negative
23. Which of the following reduction is not thermodynamically feasible?  
 (a)  $\text{Cr}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$   
 (b)  $\text{Al}_2\text{O}_3 + 2\text{Cr} \longrightarrow \text{Cr}_2\text{O}_3 + 2\text{Al}$   
 (c)  $3\text{TiO}_2 + 4\text{Al} \longrightarrow 2\text{Al}_2\text{O}_3 + 3\text{Ti}$  (d) none of these
24. Which of the following is not true with respect to Ellingham diagram?  
 (a) Free energy, changes follow a straight line. Deviation occurs when there is a phase change.

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- (b) The graph for the formation of  $\text{CO}_2$  is a straight line almost parallel to free energy axis.
- (c) Negative slope of CO shows that it becomes more stable with increase in temperature.
- (d) Positive slope of metal oxides shows that their stabilities decrease with increase in temperature.

### ADDITIONAL QUESTIONS

25. The method of zone refining of metals is based on the principle of:
- Greater mobility of the pure metal than that of impurity.
  - Higher melting point of the impurity than that of pure metal.
  - greater noble character of the solid metal than that of the impurity.
  - Greater solubility of the impurity in the molten state than in the solid.
26. Which of the following pairs of metal is purified by Van-Arkel method?
- Ga and In
  - Ni and Fe
  - Ag and Au
  - Zr and Ti
27. Aluminium is extracted from alumina ( $\text{Al}_2\text{O}_3$ ) by electrolysis of molten mixture of?
- $\text{Al}_2\text{O}_3 + \text{KF} + \text{Na}_3\text{AlF}_6$
  - $\text{Al}_2\text{O}_3 + \text{HF} + \text{NaAlF}_4$
  - $\text{Al}_2\text{O}_3 + \text{Na}_3\text{AlF}_6 + \text{CaF}_2$
  - $\text{Al}_2\text{O}_3 + \text{CaF}_2 + \text{NaAlF}_4$
28. **Assertion (A)** : Pine Oil act as frothing agent in froth floatation.  
**Reason (R)** : Sulphide Ores are concentrated by froth floatation method.
- If A and R both are correct and R is correct explanation of A
  - If A and R both are correct and R is not correct explanation of A
  - Assertion if true but Reason is false
  - Assertion if false but Reason is true
29. Zinc can be coated on iron to produce galvanised iron but the reverse is not possible it is because?
- Zn has lower melting point than iron
  - Zn has lower negative electrode potential than iron
  - Zinc has higher negative electrode potential than iron
  - Zinc is lighter than iron
30. Elements like silicon and Germanium to be used as a semi conductor is purified by **(PTA MQ)**
- heating under vacuum
  - Van-Arkel Method
  - zone refining
  - Electrolysis

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31. The process of converting hydrated alumina into anhydrous alumina is called. **(PTA MQ)**  
(a) Roasting (b) Smelting (c) Auto-reduction (d) Calcination
32. The metal which is used in packing material for food items **(SEP 20)**  
(a) Zn (b) Zr (c) Al (d) Au



**Unit Test-1: 1. METALLURGY**

Test Code: 1201

Marks: 25

Time: 45 minutes

**I. Choose the most appropriate answer from the given  $5 \times 1 = 5$  four alternatives and write the option code and the corresponding answer:**

- The metal oxide which cannot be reduced to metal by carbon is  
(a) PbO (b)  $\text{Al}_2\text{O}_3$  (c) ZnO (d) FeO
- Electrochemical process is used to extract  
(a) Iron (b) Lead (c) Sodium (d) Silver
- Which of the following is used for concentrating ore in metallurgy?  
(a) Leaching (b) Roasting (c) Froth floatation (d) Both (a) and (c)
- Which of the following pairs of metal is purified by Van-Arkel method?  
(a) Ga and In (b) Ni and Fe (c) Ag and Au (d) Zr and Ti
- The process of converting hydrated alumina into anhydrous alumina is called  
(a) Roasting (b) Smelting (c) Auto-reduction (d) Calcination

**II. Answer any three Questions:**

 $3 \times 2 = 6$ 

- Which type of ores can be concentrated by froth floatation method? Give two examples for such ores.
- Give the uses of Zinc.
- What is roasting?
- Using the Ellingham diagram. Predict the conditions under which, aluminium might be expected reduce magnesia.

**III. Answer any three Questions:**

 $3 \times 3 = 9$ 

- What is the difference between minerals and ores?
- Describe a method for refining nickel.
- Explain the following terms with suitable example.
- Write a note on Gravity separation or Hydraulic wash.

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IV. Answer all Questions:

$1 \times 5 = 5$

14. Explain the principle of electrolytic refining with an example.

(or)

15. Explain froth flotation process.

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**ANSWER KEY**

Question No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Gem guide Question No.	4	10	18	26	31	4	8	22	7(i)	1	5	10	18	13	43



**Unit Test-2: 2. p-BLOCK ELEMENTS-I**

Test Code: 1202

Marks : 25

Time : 45 minutes

**I. Choose the most appropriate answer from the given  $5 \times 1 = 5$  four alternatives and write the option code and the corresponding answer:**

- Which among the following is not a borane?  
(a)  $B_2H_6$  (b)  $B_3H_6$  (c)  $B_4H_{10}$  (d) none of these
- Which of the following is not  $sp^2$  hybridised?  
(a) Graphite (b) Graphene (c) Fullerene (d) Dry ice
- Duralumin is an alloy of  
(a) Cu, Mn (b) Cu, Al, Mg (c) Al, Mn (d) Al, Cu, Mn, Mg
- Which of the following oxide is amphoteric?  
(a)  $SiO_2$  (b)  $CO_2$  (c)  $SnO_2$  (d) CaO
- Inorganic benzene is:  
(a)  $B_2H_6$  (b)  $B_3N_3H_6$  (c)  $H_3BO_3$  (d)  $H_2B_4O_7$

**II. Answer any three Questions:**

 $3 \times 2 = 6$ 

- Give the uses of Borax.
- Give one example for each of the following.  
i) Icosogens ii) Tetragen iii) Pnictogen iv) Chalcogen
- Write preparation of Boric acid.
- CO is a reducing agent, justify with an example.

**III. Answer any three Questions:**

 $3 \times 3 = 9$ 

- Write the conditions for catenation.
- Write a note on metallic nature of p-block elements.
- A hydride of 2<sup>nd</sup> period alkali metal (A) on reaction with compound of Boron (B) to give a reducing agent (C). Identify A, B and C.
- Write the uses of carbon monoxide.

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**IV. Answer all Questions:**

$1 \times 5 = 5$

14. Describe the structure of diborane.

(or)

15.A) Write a note on Diamond.

B) Explain the carbon allotrope fullerenes.

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**ANSWER KEY**

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### Unit Test-3: 3. p-BLOCK ELEMENTS-II

Test Code: 1203

Marks : 25

Time : 45 minutes

**I. Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer:  $5 \times 1 = 5$**

1. An element belongs to group 15 and 3 rd period of the periodic table, its electronic configuration would be  
(a)  $1s^2 2s^2 2p^4$  (b)  $1s^2 2s^2 2p^3$  (c)  $1s^2 2s^2 2p^6 3s^2 3p^2$  (d)  $1s^2 2s^2 2p^6 3s^2 3p^3$
2. Most easily liquefiable gas is  
(a) Ar (b) Ne (c) He (d) Kr
3. Among the following the correct order of acidity is  
(a)  $\text{HClO}_2 < \text{HClO} < \text{HClO}_3 < \text{HClO}_4$   
(b)  $\text{HClO}_4 < \text{HClO}_2 < \text{HClO} < \text{HClO}_3$   
(c)  $\text{HClO}_3 < \text{HClO}_4 < \text{HClO}_2 < \text{HClO}$   
(d)  $\text{HClO} < \text{HClO}_2 < \text{HClO}_3 < \text{HClO}_4$
4. The correct geometry and hybridisation for  $\text{XeF}_4$  are?  
(a) Trigonal Bipyramidal  $sp^3d$  (b) Octahedral,  $sp^3d^2$   
(c) Square Planar,  $sp^3d^2$  (d) Planar Triangle  $sp^3d^3$
5. .... is used for producing smoke screen as it gives large smoke  
(a) Borax (b) Diborane (c) Potash Alum (d) Phosphine

**II. Answer any three Questions:**

 $3 \times 2 = 6$ 

6. What is inert pair effect?
7. What are interhalogen compounds? Give examples.
8. Give the uses of sulphuric acid.
9. What type of hybridisation occurs in the following compounds?  
(a)  $\text{BrF}_5$  (b)  $\text{IF}_7$

**III. Answer any three Questions:**

 $3 \times 3 = 9$ 

10. How will you prepare chlorine in the laboratory?
11. Write the reason for the anomalous behaviour of Nitrogen.
12. What happens when  $\text{PCl}_5$  is heated?
13. What is action of HF on glass?

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**II. Answer all Questions:**

$1 \times 5 = 5$

14. a) Write the structure of ammonia.

b) Write the molecular formula and draw the structure of sulphurous acid and Marshall's acid.

(or)

15. List any five compounds of Xenon and mention the type of hybridisation and structure of the compounds?

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Gem guide Question No.	3	13	17	22	29	1	5	11	66	10	13	19	58	70	69

**Unit Test-4: 4. TRANSITION AND INNER  
TRANSITION ELEMENTS**

Test Code: 1204

Marks: 25

Time: 45 minutes

**I. Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer:  $5 \times 1 = 5$**

- The catalytic behaviour of transition metals and their compounds is ascribed mainly due to  
(a) their magnetic behaviour (b) their unfilled d orbitals  
(c) their ability to adopt variable oxidation states  
(d) their chemical reactivity
- Permanganate ion changes to ..... in acidic medium  
(a)  $\text{MnO}_4^{2-}$  (b)  $\text{Mn}^{2+}$  (c)  $\text{Mn}^{3+}$  (d)  $\text{MnO}_2$
- The most common oxidation state of actinoids is  
(a) +2 (b) +3 (c) +4 (d) +6
- Which of the following ions of salt is white in colour?  
(a)  $\text{Cd}^{2+}$  (b)  $\text{Cu}^{2+}$  (c)  $\text{Co}^{3+}$  (d)  $\text{V}^{3+}$
- The actual position of Lanthanoids in the periodic table is at  
(a) Group number 3 and Period number 4  
(b) Group number 6 and Period number 3  
(c) Group number 4 and Period number 4  
(d) Group number 3 and Period number 6

**II. Answer any three Questions:**

 $3 \times 2 = 6$ 

- What are inner transition elements?
- Which is more stable?  $\text{Fe}^{3+}$  or  $\text{Fe}^{2+}$  - explain.
- Transition metals show high melting points why?
- Explain Magnetic moment.

**III. Answer any three Questions:**

 $3 \times 3 = 9$ 

- What is lanthanide contraction and what are the effects of lanthanide contraction?
- Explain why  $\text{Cr}^{2+}$  is strongly reducing while  $\text{Mn}^{3+}$  is strongly oxidizing.

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12. Describe the variable oxidation state of 3d series elements.  
 13. What is Zigler–Natta catalyst? How poly propylene polymer is obtained.

**IV. Answer all Questions: 1 × 5 = 5**

14. Compare lanthanides and actinides.

(or)

15. Explain the oxidation of potassium permanganate in different medium.

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## Unit Test-5: 5. COORDINATION CHEMISTRY

Test Code: 1205

Marks: 25

Time: 45 minutes

**I. Choose the most appropriate answer from the given 5 × 1 = 5 four alternatives and write the option code and the corresponding answer:**

1. IUPAC name of the complex  $K_3[Al(C_2O_4)_3]$  is
  - (a) potassiumtrioxalatoaluminium(III)
  - (b) potassiumtrioxalatoaluminate(II)
  - (c) potassiumtrisoxalatoaluminate(III)
  - (d) potassiumtroixalatoaluminate(III)
2. How many geometrical isomers are possible for  $[Pt(Py)(NH_3)(Br)(Cl)]$ ?
  - (a) 3
  - (b) 4
  - (c) 0
  - (d) 15
3. Which of the following is paramagnetic in nature?
  - (a)  $[Zn(NH_3)_4]^{2+}$
  - (b)  $[Co(NH_3)_6]^{3+}$
  - (c)  $[Ni(H_2O)_6]^{2+}$
  - (d)  $[Ni(CN)_4]^{2-}$
4. Coordination number of Ni in  $[Ni(C_2O_4)_3]^{4-}$  is:
  - (a) 2
  - (b) 4
  - (c) 6
  - (d) 8
5. According spectrochemical series which of the following ligand produces strongest field and cause maximum splitting?
  - (a)  $F^-$
  - (b)  $CO$
  - (c)  $H_2O$
  - (d)  $Cl^-$

**II. Answer any three Questions:**

3 × 2 = 6

6. Classify the following ligand based on the number of donor atoms.
  - (a)  $NH_3$
  - (b) en
  - (c)  $ox^{2-}$
  - (d) pyridine
7. Why tetrahedral complexes do not exhibit geometrical isomerism.
8. What is crystal field splitting energy?
9. Write the relation between dissociation equilibrium constant and formation equilibrium constant.

**III. Answer any three Questions:**

3 × 3 = 9

10.  $[Ti(H_2O)_6]^{3+}$  is coloured, while  $[Sc(H_2O)_6]^{3+}$  is colourless – explain.
11. Give the difference between double salts and coordination compounds.
12. What are the limitations of VB theory?
13. Explain about ionisation isomerism.

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**IV. Answer all Questions:**

$1 \times 5 = 5$

14. Discuss briefly the nature of bonding in metal carbonyls.

(or)

15. Relate Step wise formation constant and overall formation constant.

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