

CHAPTER 3

GROUP IIIA AND GROUP IVA ELEMENTS

MULTIPLE CHOICE QUESTIONS

- Which metal is used in thermite process because of its activity:
(a) Fe (b) Cu
(c) Al (d) Zn
- Aluminum oxide is:
(a) Acidic (b) Basic
(c) Amphotric (d) None of these
- Which element form an ion with change +3:
(a) Be (b) Al
(c) C (d) Si
- Which of the following element is not present abundantly in earth's crust:
(a) Si (b) Al
(c) Na (d) O
- Which of the following radicals give blue colour (in cold and hot state) in oxidizing flame when subjected to Borax Bead test:
(a) Cu^{+2} (b) Co^{+2}
(c) Cr^{+3} (d) Ni^{+2}
- Sulphur is not present in:
(a) Onion (b) Garlic
(c) Egg (d) Fat
- Which is the formula of clay:
(a) $\text{Al}_2\text{O}_3 \cdot \text{SiF}_4$ (b) Al_2O_3
(c) $\text{Na}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ (d) $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$

8. **BF_3 acts as Lewis acid because it behaves as:**
(a) Free radical (b) Cationic specie
(c) Electrophile (d) Nucleophile
9. **Which of the following gas will turns lime water milky:**
(a) Cl_2 (b) NO_2
(c) CO (d) CO_2
10. **Elements which exhibits maximum catenation property:**
(a) C (b) Pb_3O_4
(c) Ge (d) PbO_2
11. **Chrome yellow is:**
(a) PbMoO_4 (b) $\text{K}_2\text{Cr}_2\text{O}_7$
(c) PbCrO_4 (d) K_2CrO_4
12. **Which one of the following is the formula of litharge:**
(a) PbO (b) PbO_2
(c) Pb_3O_4 (d) Pb_2O_3
13. **A gas which burn with blue flame is:**
(a) CO_2 (b) N_2
(c) CO (d) NO
14. **Which compound of silicon used as filler in soap to make it heavy:**
(a) SiO_2 (b) Na_2SiO_3
(c) H_2SiO_3 (d) Silicones
15. **Pb_3O_4 has chemical name of:**
(a) Litharge (b) Massicot
(c) Sandhur (d) Halite
16. **Stable shape in which PbCrO_4 exist:**
(a) Triclinic (b) Monoclinic
(c) Rhomleric (d) None of these
17. **Chief ore of Al is:**
(a) Na_3AlF_6 (b) $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$
(c) Al_2O_3 (d) $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$

18. Tincal is a mineral of:

- (a) Al (b) B
(c) Si (d) C

19. What is the nature of solution of Borax:

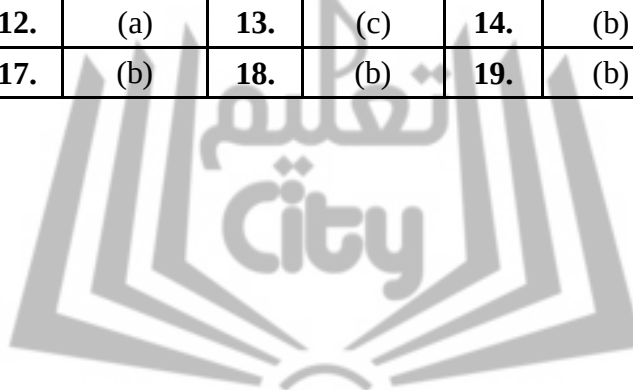
- (a) Neutral (b) Alkaline
(c) Acidic (d) Corrosive

20. Which of the following is the correct number of lone-pair with oxygen in CO:

- (a) 1 (b) 2
(c) 3 (d) 4

answers

1.	(c)	2.	(c)	3.	(b)	4.	(c)	5.	(b)
6.	(d)	7.	(d)	8.	(c)	9.	(d)	10.	(a)
11.	(c)	12.	(a)	13.	(c)	14.	(b)	15.	(c)
16.	(b)	17.	(b)	18.	(b)	19.	(b)	20.	(a)



solved EXERCISE

Q.1 Fill in the blanks:

- (i) _____ acid has the chemical formula HBO_2 .
- (ii) Aluminium normally occurs as _____ minerals found in the rocks of outer portion of the earth.
- (iii) Aluminium gives _____ gas with hot concentrated H_2SO_4 .
- (iv) Boron forms _____ bond in its compounds.
- (v) The chemical formula of white lead is _____.
- (vi) _____ is the only element with less than four electrons in the outer most shell that is not a metal.
- (vii) In the group IIIA of the periodic table, _____ is a semi-metal.
- (viii) Borax that occurs as a natural deposit, is called _____.
- (ix) Cryolite is an important mineral of aluminium and its formula is _____.
- (x) A _____ is a substance that has different resistances to the passage of an electric current under different circumstances.

answers

(i)	metaboric acid	(ii)	alumino-silicate	(iii)	SO_2
(iv)	three	(v)	$2\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$	(vi)	boron
(vii)	boron	(viii)	tincal	(ix)	Na_3AlF_6
(x)	semiconductor				

Q.2 Indicate True or False:

- (i) Boron always uses all the three of its valence electrons for bonding purposes.
- (ii) Diaspore is an ore of carbon.
- (iii) Emerald is an ore of aluminium that has the chemical formula $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$.
- (iv) An aqueous solution of borax is feebly acidic in nature.
- (v) In case of borax bead test of cupric oxide, the beads are coloured blue in the reducing flame.

- (vi) Boric acid can be titrated with sodium hydroxide.
 (vii) Carbon and silicon are the only non-metals in group IVA.
 (viii) PbO is commonly known as litharge.
 (ix) Basic lead carbonate is a reddish brown pigment.
 (x) Aluminium oxide (Al_2O_3) is also called bauxite.

answers

(i)	True	(ii)	False	(iii)	False	(iv)	False	(v)	False
(vi)	False	(vii)	True	(viii)	True	(ix)	False	(x)	False

Q.3 Multiple choice questions. Encircle the correct answer:

- (i) Which metal is used in the thermit process because of its activity:
 (a) Iron (b) Copper
 (c) Aluminium (d) Zinc
- (ii) Aluminium oxide is:
 (a) Acidic oxide (b) Basic oxide
 (c) Amphoteric oxide (d) None of these
- (iii) Chemical composition of colemanite is:
 (a) $\text{Ca}_2\text{B}_6\text{O}_{11} \cdot 5\text{H}_2\text{O}$ (b) $\text{CaB}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$
 (c) $\text{Na}_2\text{B}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$ (d) $\text{CaNaB}_5\text{O}_9 \cdot 8\text{H}_2\text{O}$
- (iv) Which element forms ion with charge +3:
 (a) Beryllium (b) Aluminium
 (c) Carbon (d) Silicon
- (v) Which electronic configuration corresponds to an element of group-IIIA of the periodic table:
 (a) $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$ (b) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$
 (c) $1s^2, 2s^2, 2p^6$ (d) $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$
- (vi) Which element among the following belongs to group IVA of the periodic table:
 (a) Barium (b) Iodine
 (c) Lead (d) Oxygen

(vii) Boric acid cannot be used:

- (a) As antiseptic in medicine (b) For washing eyes
(c) In soda bottles (d) For enamels and glazes

(viii) Which of the following elements is not present abundantly in earth's crust:

- (a) Silicon (b) Aluminium
(c) Sodium (d) Oxygen

(ix) Tincal is a mineral of:

- (a) Al (b) B
(c) Si (d) C

(x) The chief ore of aluminium is:

- (a) Na_3AlF_6 (b) $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$
(c) Al_2O_3 (d) $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$

answers

(i)	(c)	(ii)	(c)	(iii)	(a)	(iv)	(b)	(v)	(a)
(vi)	(c)	(vii)	(c)	(viii)	(c)	(ix)	(b)	(x)	(b)

Q.4 What is the action of an aqueous solution of borax on litmus?

Ans. The aqueous solution of borax is alkaline in nature due to the formation of strong alkali (NaOH)



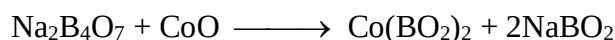
Strong base Weak acid

Therefore, in the solution of borax litmus becomes blue.

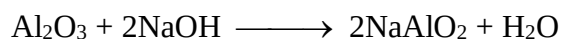
Q.5 Give equations to represent the following reactions.

Ans.

(a) Borax is heated with CoO:



(b) Al_2O_3 is heated with NaOH solution:



Q.6 (i) Why is aluminum not found as a free element?

(ii) Explain the chemistry of borax bead test.

Ans.

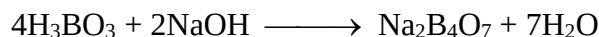
(i) Aluminum does not exist in free state because it is a highly reactive metal. It is third most abundant element of earth crust and mostly found in the form of alumino—silicates.

(ii) See text for detailed answer.

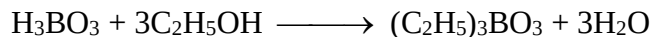
Q.7 How does orthoboric acid react with?

Ans.

(a) Sodium hydroxide:



(b) Ethyl alcohol:



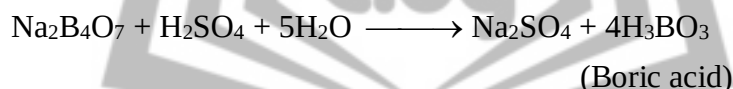
Q.8 How will you convert boric acid into borax and vice versa?

Ans.

(i) Boric acid into borax:



(ii) Borax into boric acid:



Q.9 Why are liquid silicones preferred over ordinary organic lubricants?

Ans.

Liquid silicones are preferred over ordinary organic lubricants because with the change of temperature, small change in viscosity takes place. In the presence of air or oxygen at high temperature, silicone oils remain free from acid formation and oxidation whereas these phenomena limit the usefulness of ordinary lubricants.

Q.10 Explain:

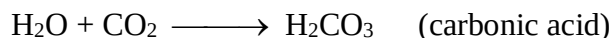
(a) CO₂ is non-polar in nature.

(b) CO₂ is acidic in character.

Ans.

(a) See Q.8 of Short Questions.

- (b) CO_2 is a non-metal oxide. When CO_2 is dissolved in water it changes into carbonic acid and hence CO_2 is acidic in nature.



Q.11 Why is CO_2 a gas at room temperature while SiO_2 is a solid?

Ans. See Q.9 of Short Questions.

Q.12 Give the names and the formulas of different acids of boron.

Ans. Acids of Boron:

- (i) Metaboric acid HBO_2
- (ii) Orthoboric acid H_3BO_3
- (iii) Tetraboric acid $\text{H}_2\text{B}_4\text{O}_7$
- (iv) Pyroboric acid $\text{H}_6\text{B}_4\text{O}_9$

Q.13 What is the importance of oxides of lead in paints?

Ans. For details see text book.

Q.14 Give the names, electronic configurations and occurrence of group-III A elements of the periodic table.

Ans. Detailed question see text book.

Q.15 Discuss the peculiar behaviour of boron with respect to the other members of group-III A elements.

Ans. Descriptive question. See text book for details.

Q.16 (a) What is borax?

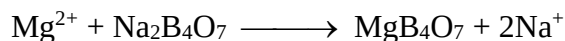
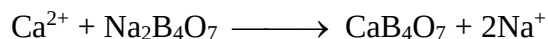
(b) Describe its commercial preparation.

(c) Outline the principal uses of borax.

(d) How does borax serve as a water softening agent?

Ans. For answer of (a), (b) and (c) see text book.

- (d) Hardness in water is because of Ca^{2+} and Mg^{2+} . Borax has ability to remove Ca^{2+} and Mg^{2+} ions from water as calcium tetra-borate and magnesium tetra-borate and hence borax can be used as water softening agent.



- Q.17** (a) What is boric acid?
(b) How is boric acid prepared in laboratory?
(c) Give properties and uses of boric acid.

Ans. Descriptive question. See text book for details.

- Q.18** (a) Give the names along with the formulas of three important area of aluminum.
(b) How and under what conditions does aluminum react with the following:
(i) Oxygen (ii) Hydrogen (iii) Halogens
(iv) Acids (v) Alkalies

Ans.

- (a) **Three Ores of Aluminum:**

Bauxite $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$

Cryolite Na_3AlF_6

Gibbsite $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$

- (b) (i) **Reaction with O_2 :**



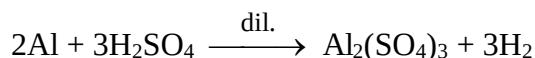
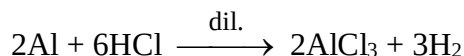
- (ii) **Reaction with H_2 :**



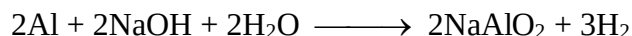
- (iii) **Reaction with Halogens:**



- (iv) **Reaction with Acids:**



- (v) **Reaction with Alaklies:**



- Q.19** Give the names, electronic configurations, and occurrence of group IV a elements of the periodic table.

Ans. Descriptive question. See text book for details.

Q.20 Discuss the peculiar behaviour of carbon with respect to the other members of group-IV A of the periodic table.

Ans. Descriptive question. See text book for details.

- Q.21**
- (a) What are silicones?
 - (b) Give a brief summary of the principal properties of silicones.
 - (c) Out live the uses of silicones.
 - (d) What are silicates?
 - (e) Describe the important uses of silicates.

Ans.

- (a) **Silicones:** Long chain compounds of alternating Si and O (oxygen) atom in which alkyl radical is attached to Si.

For the answer of (b) and (c) consult text book.

- (d) **Silicates:** The compounds which are derived from metasilicic acid (H_2SiO_3) e.g.,

Asbestos : $\text{CaMg}_3(\text{SiO}_3)_4$

Talc : $\text{H}_2\text{Mg}_3(\text{SiO}_3)_4$

- (e) (i) **Sodium Silicate:**

- * Used as a filler for soap in soap industry.
- * Used in textile as a fire proof.
- * Used as furniture polish.
- * Used in calico printing.

- (ii) **Aluminum Silicate:**

- * Used in making pottery and ceramic material.
- * Used in making porcelain and china ware.
- * Making of tiles and bricks.
- * Glazing of tiles.

- (iii) **Talc or Soapstone:**

- * Used in making cosmetics.
- * Making household articles.

- (iv) **Asbestos:**

- * Used in making incombustible fabrics.
- * Used in making hard board.
- * Insulation and sealer for cars.

DO YOU KNOW?

1. Borax occurs as natural deposit called tincal. It is found in dried lakes of Tibet and California.
2. Borax bead test is used for basic coloured radicals like Cu^{+2} , Fe^{+3} , Mn^{+2} , Co^{+2} , Cr^{+3} and Ni^{+2} .
3. Formula of copper metaborate is $\text{Cu}(\text{BO}_2)_2$.
4. H_3BO_3 is mono basic acid.
5. The process in which Al is used as reducing agent is called "Thermite Process". For example
$$\text{Cr}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$$
6. Aluminum foil is used to jam radar.
7. Sodium silicate is called water glass or soluble glass.
8. PbO is called litharge.
9. Formula of red lead is Pb_3O_4 .
10. PbCrO_4 is called chrome yellow.
11. $\text{PbCrO}_4 \cdot \text{PbO}$ is called chrome red.