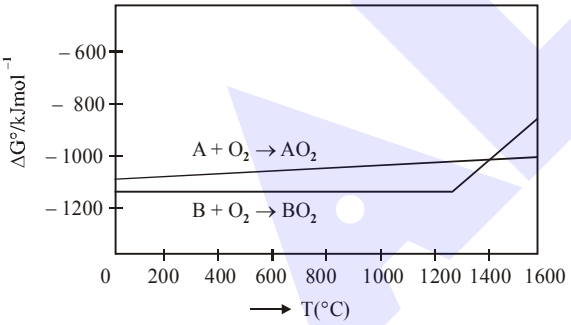
METALLURGY

1. The purest form of commercial iron is
(1) scrap iron and pig iron
(2) wrought iron
(3) cast iron
(4) pig iron

2. The refining method used when the metal and the impurities have low and high melting temperatures, respectively, is -
(1) zone refining
(2) liquation
(3) vapour phase refining
(4) distillation

3. Among the reactions (a) - (d), the reaction(s) that does/do not occur in the blast furnace during the extraction of iron is/are :
(a) $CaO + SiO_2 \rightarrow CaSiO_3$
(b) $3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$
(c) $FeO + SiO_2 \rightarrow FeSiO_3$
(d) $FeO \rightarrow Fe + \frac{1}{2}O_2$
(1) (c) and (d) (2) (a) and (d)
(3) (d) (4) (a)

4. According to the following diagram, A reduces BO_2 when the temperature is :



(1) < 1400 °C
(2) > 1400 °C
(3) < 1200 °C
(4) > 1200 °C but < 1400 °C

5. The element that can be refined by distillation is :
(1) nickel (2) zinc (3) gallium (4) tin

6. Boron and silicon of very high purity can be obtained through :
(1) vapour phase refining
(2) electrolytic refining
(3) liquation
(4) zone refining

7. An Ellingham diagram provides information about :
(1) the pressure dependence of the standard electrode potentials of reduction reactions involved in the extraction of metals.
(2) the kinetics of the reduction process.
(3) the temperature dependence of the standard Gibbs energies of formation of some metal oxides.
(4) the conditions of pH and potential under which a species is thermodynamically stable.

8. The processes of calcination and roasting in metallurgical industries, respectively, can lead to :-
(1) Global warming and acid rain
(2) Photochemical smog and ozone layer depletion
(3) Global warming and photochemical smog
(4) Photochemical smog and global warming

9. Among statements (a) -(d), the correct ones are :
(a) Lime stone is decomposed to CaO during the extraction of iron from its oxides.
(b) In the extraction of silver, silver is extracted as an anionic complex.
(c) Nickel is purified by Mond's process.
(d) Zr and Ti are purified by Van Arkel method.
(1) (c) and (d) only
(2) (a), (c) and (d) only
(3) (b), (c) and (d) only
(4) (a), (b), (c) and (d)

10. Cast iron is used for the manufacture of :
(1) wrought iron and pig iron
(2) wrought iron and steel
(3) wrought iron, pig iron and steel
(4) pig iron, scrap iron and steel

SOLUTION

1. NTA Ans. (2)

Sol. Wrought iron is purest from of commercial iron.

2. NTA Ans. (2)

Sol. Liquation method is used when the melting point of metal is less compare to the melting point of the associated impurity.

3. NTA Ans. (1)

Sol. In blast furnace (metallugy of iron) involved reactions are

(a) $CaO + SiO_2 \longrightarrow CaSiO_3$

(b) $3Fe_2O_3 + CO \longrightarrow 2Fe_3O_4 + CO_2$

4. NTA Ans. (2)

Sol. A reduces BO_2 when temperature is above 1400°C because above 1400°C A has more – ve $\Delta G°$ for AO_2 formation than B to BO_2 formation.

5. Official Ans. by NTA (2)

Sol. Impure zinc is refined by distillation method.

6. Official Ans. by NTA (4)

Sol. "Boron" and "Silicon" of very high purity can be obtained through :-
zone refining method only.
While other methods are used for other metals/ elements i.e.
(i) Vapour phase refining
(ii) electrolytic refining
(iii) liquation etc.

7. Official Ans. by NTA (3)

Sol. Ellingham diagram provides information about temperature dependence of the standard gibbs energies of formation of some metal oxides.

8. Official Ans. by NTA (1)

Sol. Due to industrial process SO_2 gas is released which is responsible for acid rain & global warming.

9. Official Ans. by NTA (4)

Sol. (a) $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$ {In Blast furnace}
lime stone
(b) Ag form cyanide complex $[Ag(CN)_2]^-$ during cyaride process

$$Ag / Ag_2S + CN^{\ominus} \rightarrow [Ag(CN)_2]^-$$

(c) Ni is purified by mond's process
(d) Zr and Ti are purified by van arkel method
All (a), (b), (c), (d) are correct statements
Thus correct option is (4)

10. Official Ans. by NTA (2)

Sol. Cast iron is used for manufacturing of wrought iron and steel.