Lecture 41 Self evaluation MHB

1. Stannite deposits constitute an important source for which of the following metal
   a) Thorium
   b) Titanium
   c) Molybdenum
   d) Tin

2. In mineral beneficiation
   a) Mineral is separated
   b) Particles containing mineral are separated
   c) Mineral is concentrate
   d) Tailing are separated

3. The imperial smelting process for Zinc employs
a) Horizontal retort
b) Blast furnace
c) Rotary kiln
d) Laser beam

4. The Pidgeo is process for magnesium production uses
   a) Carbon
   b) Aluminum
   c) Hydrogen
   d) Ferro-silicon

5. The highest roasting rate is achieved in a
   a) Hearth roaster
   b) Blast roaster
   c) Flash roaster
   d) Shaft roaster

6. Hindered settling condition favors
    a) Classification according to size
    b) Classification according to specific gravity
    c) Separation of slime
    d) Thickening of pulp.

7. Matte is a
    a) Solid solution of sulphides
    b) Liquid solution of oxides and sulphides
    c) Liquid solution of metal sulphides
    d) Solid solution of sulphides and arsenides.

8. Horizontal retort is used for production of zinc. Choose the correct ones from the following
    a) The retort is made of clay
    b) The input materials are heated above the boiling point of zinc.
    c) The retort is made of metal
    d) The input materials are heated upto the melting point of zinc

9. The output of Zn-retort process is
    a) Liquid Zn +residue
    b) Zn vapour + residue
    c) Residue only
    d) Spelter + residue

10. In imperial smelting process
    a) Molten lead is used to condense zinc vapors
    b) Lead and zinc both can be produced
    c) Liquid zinc is produced
    d) Molten tin is used to condense zinc vapors

11. Answer the following in two or three sentences

(i) Write down the ore minerals of copper, zinc, lead and nickel.

(ii) What is the role of scrap iron in lead blast furnace smelting?

(iii) Why is it necessary to smelting concentrate in two/three stages?

(iv) Write down the anodic and cathodic reactions in the electro winning of copper.

(v) Though it is possible to dehydrate aluminium hydroxide at $800 - 900°C$, the calcination is done at $1200°C$.
(vi) What is the purpose of poling in fire-refining of copper?
(vii) What is cryolite ratio in Hall-Heroult bath?
(viii) Why is it not possible to used high silica bauxite for the Bayer process?
(ix) While galena and sphalerite concentrates are dead roasted but not the chalcopyrite concentrate. Give reasons.
(x) Distinguish between kroll and Hunter processes of titanium production.
(xi) Name aluminium production plants and their locations in India?
(xii) Why is it not possible to produce Al by reduction smelting?

12) A copper converter treats per charge 10tons of 40% matte. Blast is furnished at the r at of 100Cu. m. per minute. Before adding flux a preliminary blow of 9 min. is given to produce a magnetite coating, which analyzes as Fe_3O_4 75%, FeO 5%, CuO 5%, and unoxidized constituents15%. Assume that this is entirely corroded by the SiO_2, 5% CuO. The flux carries Cu_2S 3%; FeS 27%; SiO_2 52%.

The blister copper is 100% Cu. The converter gases carry no free oxygen.

Required:

a) The weight of magnetite coating produced, flux required and slag made.
b) The weight of blister copper, and the $\%$ of copper recovery
c) The blowing time of each stage.
d) The volume and $\%$ composition of the converter gases.

13) A cupola melts per hour 15 tons of pig iron of composition
C 3.5%, Si 2.2% Mn 0.8% and P0.7 $\%$; and 5 tonof scrap
containing C 3, $\%$, Si1.8% Mn 1.1% and P 0.2%.

The dry air used is 849.6m^3 measured at 313K to melt 1ton of pig iron and scrap per minute.

During melting 20% of total Si charged, $15\%$of total Mn charged 1% of total Fe charged and 5% of C is oxidized,19% of carbon of coke is absorbed by iron during milting. Enough $CaCO_3$ is charged to give 30% CaOin slag. The coke is 92% C and 8% SiO2 and weight of coke is $1/9$ of the total weight of pig iron and scrap.

Required:

a) Charge balances of cupola for 5 hr run.
b) The % composition of resulting cast iron, slag and gases.

14) A plant treats 210 tonnes of material in a shift of metal grade 40% and tailing has metal grade 0.2%. Calculate mass of concentrate and tailing.

15) A roasted lead ore is smelted in a blast furnace with enough $CaCO_3$ to make a slag of 18.5% CaO.The coke is 16% of the roasted ore and analyzes 90% C and10% SiO_2. The composition of roasted ore;PbO 25%, PbS 18%, Fe_2O_3, 22% , Cu_2S 2% , $SiO^2 29\%$, and CaO 4%. Of the lead charged 5% is lost in dust andflue, and 8% enters the matte. Of the copper charged 50 % enters the matte and rest copper enters into lead bullion .Ten % of S enters into gases.

Find: Per 1000Kg roasted ore
The amounts of lead bullion, matte and $CaCO_3$

15) Regenerator receives hot flue gases at 1400℃ and cold air at 25 ℃, the flue gases leave at 750 ℃ and the air is preheated to 1100℃. As estimated 15% of the heat given up by the flue gases is heat lost to the regenerator surroundings, and the rest (85%) is recovered in the preheated air. It may be assumed for estimating purposes that $C_P = 0.3$ for flue gases and $C_P = 0.25$ for air, independent of temperature. **Estimate over all thermal efficiency, efficiency limit, and relative efficiency for this heat exchange operation.**

Suppose now that the depth of the regenerator is increased to 2.5 times in such a way to double the heat exchange area while keeping constant the over-all heat transfer coefficient $U\left(\frac{\text{Btu}}{\text{hr ft}^2\text{°F}}\right)$.The quantities and entering temperatures of the flue gases and air will be kept the same. Heat losses are same as that in a). **Estimate for the enlarged regenerator (a) air preheat temperature, (b) over-all thermal efficiency and relative thermal efficiency**

16) The exit gas composition from a Fe_2O_3 charged furnace is 24 vol % CO, 22 VOl % CO_2. $54\%N_2$. The air blast is 1400 $m^3/1000$ kg of product Fe. The hot metal contains 5% C. Calculate

(a) Quantity of active carbon in kg| ton Fe
(b) Total carbon in kg

17) An electric melting furnace is used to melt copper scrap .The scrap is initially at 25°C .The overall power consumption is 300 kW -hr /ton of molten copper ,when heated to a temperature of 1523 K. Estimate the thermal efficiency of this furnace . melting point of copper 1356 K, Latent heat of melting =12970 J/g. mole

$$\text{Cp(solid Cu)} = 22.64 + \frac{(6.28 \text{ x } 10^{-3}\text{ T})}{\text{g}}\frac{\text{J}}{\text{g. mole K}} \quad \text{Cp(liquid Cu)} = 31.38\frac{\text{J}}{\text{g. mole K}}$$