

## Modules 8 and 9

### Precious metals , secondary metals , energy & environment

Discuss the validity/invalidity of the following statements

1. **Platinum is more expensive than gold because it is rarer.**

Ans- The first part of the sentence is correct but the second part is not. In nature Pt is more abundant than gold.

The value of a metal depends on many factors – there is utility value, exchange value, prestige value etc but it must depend on availability also. In theory , there are more Pt in nature but the metal is more difficult to extract from its sources and , therefore, it is priced higher .

2. **Metals obtained as by products of extraction processes are known as secondary metals.**

Ans – This statement is not correct. Secondary metals are those that are obtained from scrap i.e. metal items either discarded during the manufacturing process as unsuitable for the market or discarded by the consumers after use. For example, steel produced from discarded automobiles, machines, tools and a variety of consumer items, produces secondary steel after reprocessing of these items. Scrap can be generated also within plant premises during various production steps. However, if these are recirculated within the plant itself as feed in the processing step then they comprise only a small part of the raw materials used, and, hence , the metal produced will not be called secondary metal. A secondary metal uses only the scrap as the main raw material.

3. **A small amount of aluminium can recover a large amount of zinc from zinc dross.**

Ans- This statement is correct. Dross formed during galvanizing is  $\text{Fe}_3\text{Zn}_{13}$  which contains 6.2% Fe and rest Zn. Some additional amount of zinc remains physically trapped. In the Al process for Zn recovery Al is added to molten Zn dross to form  $\text{FeAl}_3$ . In this reaction, 1 kg Al replaces at least 13 Kg Zn from 30 Kg dross. Since melting point of  $\text{FeAl}_3$  (1160°C) is higher and density is half Zn (m.p. 419.5°C) separation is very effective.

**4. Black copper is obtained by blast furnace smelting of low grade scrap copper**

Ans- The statement is not completely correct. Blast furnace smelting is indeed used but the charge has to be, in addition to copper scrap, appropriate amounts of iron ore, coke, limestone and quartz as is done for blast furnace operation for iron production. The scrap copper melts to mix with liquid iron and a 'black copper' is produced that contains 83-90% Cu and rest iron. This product goes for converting to blister copper with additions of scrap brass, bronze, gun metals, coke etc.

**5. Air pollution means presence in air one or more contaminants that is/are injurious to human health.**

Ans- The definition is not complete. One has to also mention injury to plant and animal life and adverse impact to property as well as comfort and welfare of people.

**6. Ecologically sustainable development means development without damage to the environment and a level of production that can be comfortably maintained indefinitely.**

Ans – Both parts of the statement are invalid. There can be no development without any damage to the environment. However, the environment has a carrying capacity to correct the adverse affects of development upto a limit and restore itself. In many cases a production level can be sustained if supply of raw materials, energy, capital, labour etc are available but this is not what is meant by sustainable development. The word has been defined as development which will meet the need of the present generation without compromising the ability of future generations to meet their own needs for development. This is possible if one ensures that industrial activities are within the carrying capacity of the supporting eco-system.

**7. The rate of GDP growth is not the correct index of progress**

Ans- This statement is valid. GDP (Gross Domestic Product) growth comes from agricultural and industrial production sectors and also the service sector. However, all activities in these sectors imply adverse impact on the ecology in varying degrees. The actual growth can be estimated if adjustments are made to take into account these adverse effects.

The financial estimate of damage to health of humans , animals, plant life and to property due to environmental degradation can be partly estimated by calculating restoration costs. There are restoration costs for damage to land, air and water bodies too. No estimates can be made for loss of flora and fauna or social costs of population's inconvenience on displacement, loss of comfort, traditions, culture etc. Then there is a cost of depletion of resources. Estimates based on cost of such and other adverse effects need to be subtracted from values of GDP to estimate the correct value after adjustments. Obviously, this will often substantially reduce the normal GDP estimate. If development continues unabated without adequate attention to environmental degradation then the GDP growth rate can even show a negative value i.e. retardation in progress.

### **8. Pyrometallurgical processes are more energy intensive than hydrometallurgical processes**

Ans- This statement is not valid. Pyrometallurgical processes occur at elevated temperatures and, therefore, one may think that they would be necessarily consuming more energy but this is not always true. Many high temperature processes are exothermic and high temperature off-gases may allow heat recovery. These can reduce heat requirement. On the other hand hydrometallurgical processes, even though they are carried out at or near room temperatures, may consume large amounts of energy in pumping of dilute leach liquors, drying, filtering etc. Moreover, to estimate actual heat requirement of a process one needs to consider the energy requirement for producing the raw materials also.

The energy aspect of any processes , therefore, is estimated based on a term called  
Process Fuel Equivalent ( PFE)

$$PFE = F + EI + Sr - Bu$$

Where,        F = Direct Fuel Consumption  
                   EI = Fuel equivalent of electrical energy  
                   Sr = Total fuel resources used to produce reagents, fluxes and other major supplies consumed  
                   Bu = Sum of useful surplus heat and PFE of saleable by products

One can also use a term    MFE= PFE + Rw

Where Rw is PFE of the raw material feed to the process

If one takes into account a holistic and rational view, some pyrometallurgical processes may be comparable if not better as compared to hydrometallurgical processes for achieving the same goal.