(*a*). Magnetic iron ore (Fe_3O_4). Ferrous Carbonate ($FeCO_3$). Ferric Oxide or Hæmatite (Fe_2O_3). Ferric Sulphide (FeS_2).

(*b*), The greater part of the English iron of commerce is obtained from the *Ferrous Carbonate* $FeCO_3$. The ore is first roasted, during which process, Carbonic Acid is driven off, and *Ferric Oxide* is formed. The roasted ore mixed with a due proportion of limestone is then brought into the blast furnace in alternate layers with coal. A high temperature is maintained, by forcing air heated to between 300° and 400°, through pipes near the bottom of the furnace. The chemical changes seem to be as follows:—When the air meets the coal, a vivid combustion ensues, and the Carbonic Acid produced passing upwards, combines with more Carbon, forming Carbonic Oxide. This reduces the *Ferric Oxide*, forming metallic iron and Carbonic dioxide,

$$Fe_2O_3 + 3CO = 3CO_2 + 2Fe.$$

This metal run into channels of sand constitutes the cast-iron of commerce.

(*c*). 1. Cast-iron contains greater quantities of Carbon and other impurities than wrought-iron, is more fusible, much more brittle, and possesses a highly crystalline structure.

(2). Steel has less Carbon than that needed to form cast-iron, and is nearly free from all other impurities, is less fusible than cast-iron, but much more so than wrought-iron.

(3). Wrought-iron has no crystalline structure, and is nearly pure, as it contains very small quantities of Carbon, Silicon, Phosphorous or other impurities.

Q.—7. (*a*). Illustate by formula the difference between Ferrous and Ferric Salts, Cuprous and Cupric, Mercurous, and Mercuric, (*b*). How may they be distinguished. ?

Ferrous Salts are formed from Ferrous Oxide FeO in which iron acts as a dyad ($FeSO_4$, $FeCl_2$).

(*a*) Ferric Salts are formed from Ferric. Oxide, Fe_2O_3 in which the double atom of iron acts as a triad, $Fe_2(SO_4)3$, Fe_2Cl_6, &c.

Cuprous Salts are formed from Cuprous Oxide Cu_2O in which Copper acts as *a monad* or according to a structural formula.

$$\begin{matrix} Cu \\ | \\ Cu \end{matrix} \rangle O$$ in which one arm of each copper atom is satisfied by the mutual attraction of the copper atoms themselves.

The Cupric Salts are formed from Cupric Oxide CuO. In these Salts the dyad character of copper is seen, ($CuSO_4$ $CuCl_2$, &c.) The same explanation holds good for the Mercuric and Mercurous Salts. The Mercurous are more stable than the Cuprous Salts.

Ferrous Salts (corresponding to Ferrous Oxide, FeO) may be distinguished from Ferric Salts (corresponding to Ferric Oxide Fe_2O_3) by the following re-agents:

(1). KOH. (*a*). Ferrous Salts give out of contact with air a white precipitate, $Fe(OH)_2$ which, in contact with air, becomes first green then brown $FE(OH)_2$ is oxidized to F_2O_3 (*b*). Ferric Salts give a brown prec., $Fe_2(OH)_6$, which is stable. When heated, water is given out and F_2O_3 remains.

(2). NHHO. (*a*). Ferrous Salts give no precipitate with Ammonia if Ammonia Salts are present. (*b*). Ferric Salts are not so affected — $FE_2(OH)_6$ is always thrown down by NH_4HO.

(3). K_4FeCy_6 (Potassium Ferrocyanide). Ferrous Salts produce a white precipitate which rapidly becomes blue, owing to absorption of Oxygen. (*b*). Ferric Salts produce a deep blue precipitate of soluble Prussian Blue ($Fe_4K_2Cy_{12}$) insoluble in saline solutions, soluble in pure water, producing a deep blue color.

(4). K_3FeCy_6 (Potassium Ferricyanide) (*a*). Ferrous Salts give a deep blue precipitate of soluble Prussian Blue ($Fe_4K_3Cy_{12}$) (*b*.) Ferric Salts only give a brown coloration.

(5). KCyS. (Sulphocyanate of Potassium) causes the formation of ferric sulphocyanate, which is of a deep blood-red color. There is no corresponding ferrous sulphocyanate.

(6). Na_2Co_3. (*a*). Ferrous Salts give a white precipitate ($FeCo_3$) rapidly becoming