

# Metal Casting & Welding

## 1<sup>st</sup> IAT - Scheme & Solution

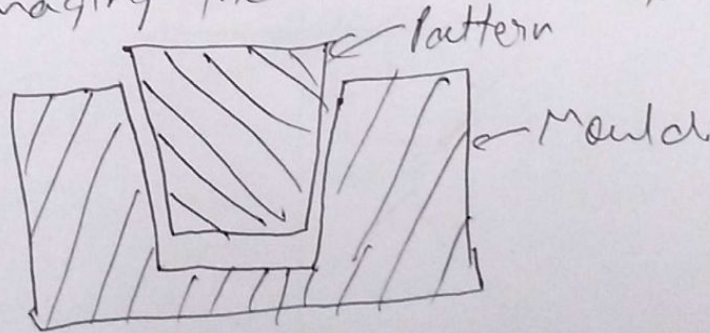
①

Q1

Why is draft allowance, shrinkage allowance & distortion allowance given to a pattern?

Sol<sup>n</sup> - Draft allowance

It is given to a pattern having long vertical edges. Here a small taper (not more than  $15^\circ$ ) is given so that the pattern can be withdrawn from the mould without damaging the mould cavity.



Shrinkage allowances

The molten metal as it solidifies shrinks and because of it the required dimension of the casting cannot be obtained. To overcome this the pattern and thereby the mould cavity itself is made larger so after shrinking the accurate dimension is obtained.

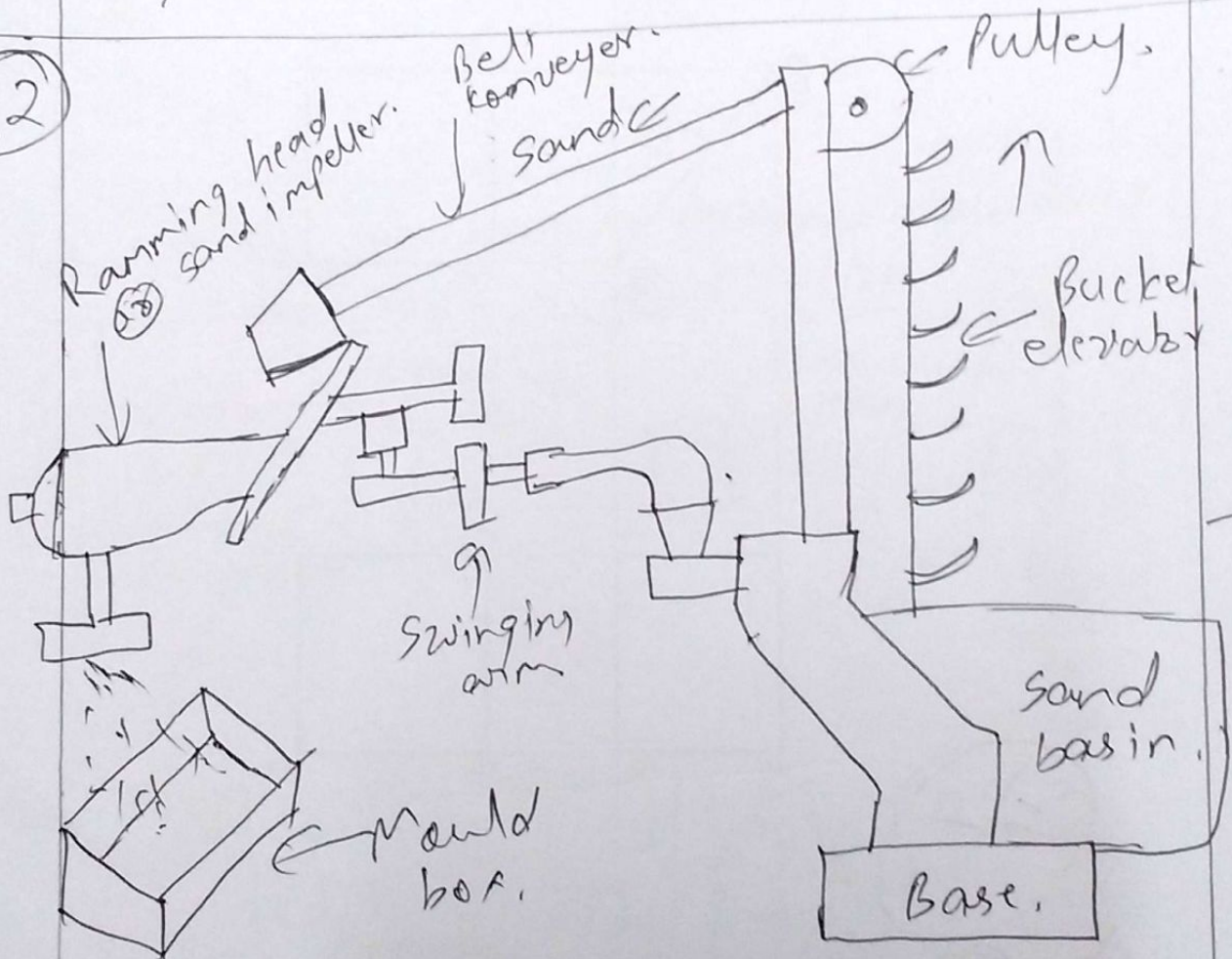
-3-

## Distortion allowance

(2)

When a metal solidifies the cooling rate is uneven which can cause some shapes like U, T, V, to distort so to avoid this the pattern is bulged at the corners so as the metal solidifies it gets the required shape.

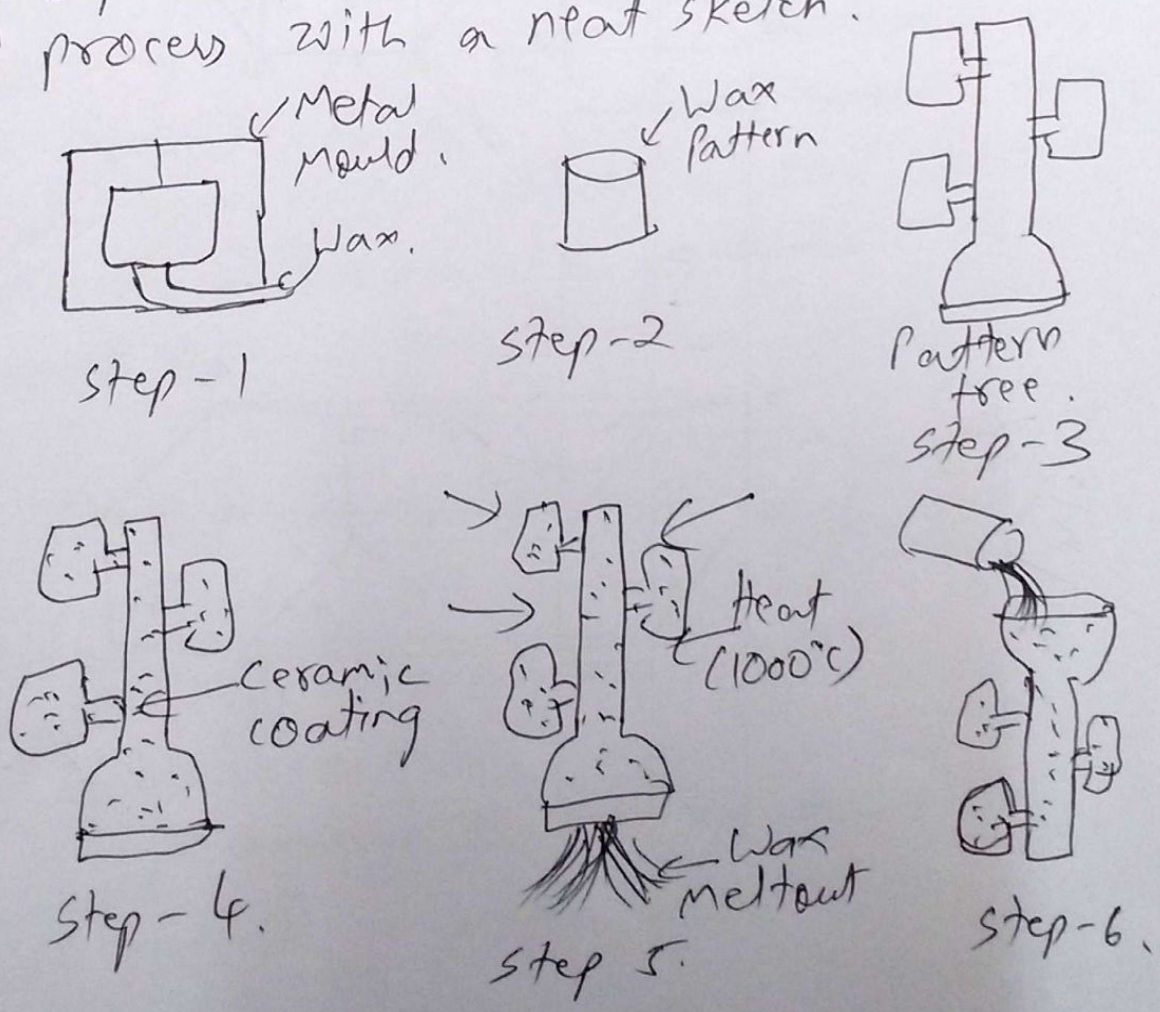
(Q2)



The diagram above schematically represents sand slinger. It has a bucket elevator which carries the pre mixed sand from the sand basin and deposits

it onto the sand conveyer. ③  
 The sand conveyer transfers the sand to the ramming head which has a set of impellers which break the lumps and impart velocity to the sand particles. This high velocity sand is thrown into the mould box with the pattern already in it. The direction to the sand is given by the swinging arm.

Q3 Explain investment ~~casting~~ moulding process with a neat sketch.



-5

Wax is injected into a metal mould to produce the wax pattern. (4)

Then this wax pattern is arranged with runner, gates, pouring basin to form a wax pattern tree. Then the whole setup is dipped in ceramic slurry and allowed to dry, then its dipped again. This process is continued until the required ceramic thickness is obtained. Then the whole setup is heated to around  $1000^{\circ}\text{C}$  at which temp the wax melts out and the ceramic mould cavity is produced. The molten metal is poured into the ceramic mould cavity. Once the metal solidifies the ceramic mould is broken to obtain the casting. -5-

Q4 List out any 4 factors that determine the selection of casting alloy.

- sol: (i) Uni-directional heat flow.  
(ii) Low density.  
(iii) High ~~boiling~~ melting point.  
(iv) Inertness in molten state.

$1 \times 4$   
 $= 4.$

Q4

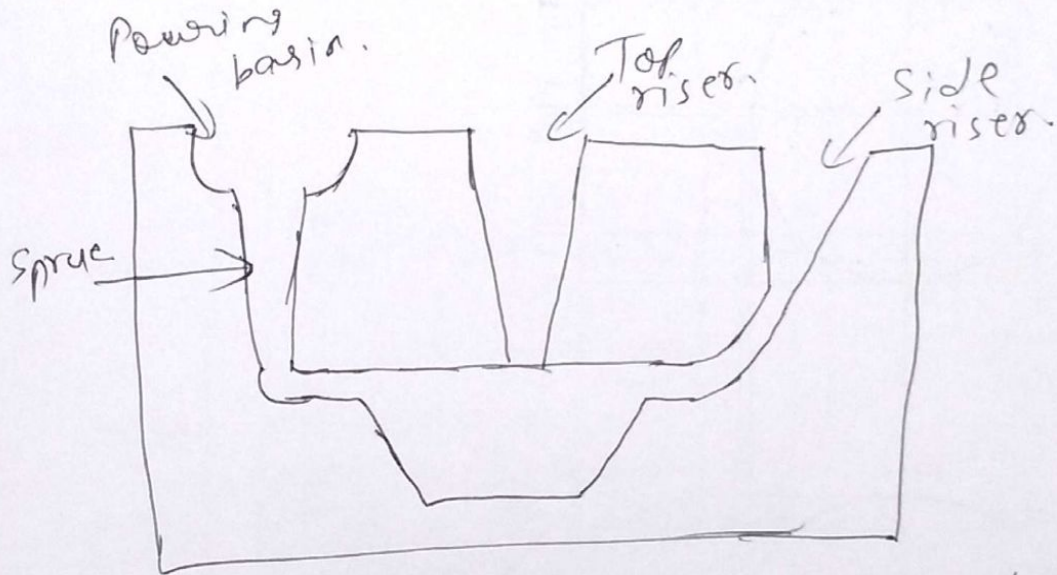
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(b)

With neat sketches explain open riser & blind riser.

Sol<sup>n</sup>:

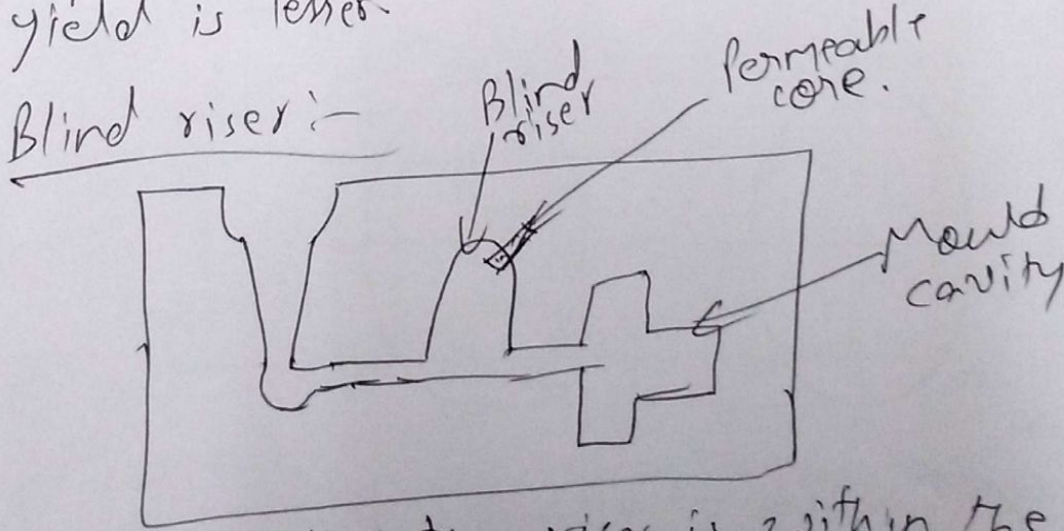
Open riser:-



2+1  
= 3

In open riser the riser is open to the atmospheric pressure. So no vacuum can be created. And there are chances that impurities can get into the casting. The yield is lesser.

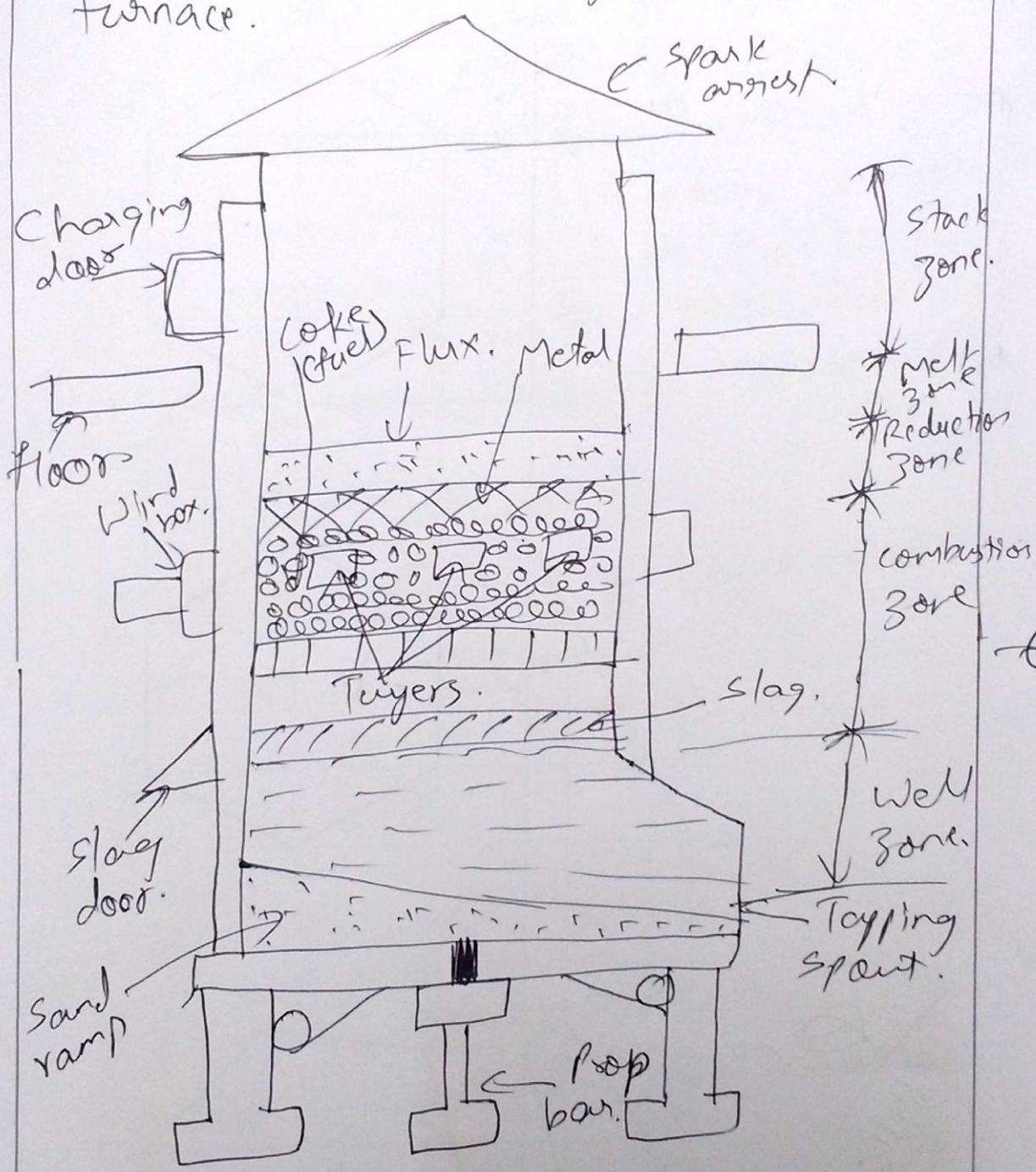
Blind riser:-



2+1  
= 3

In blind riser the riser is within the mould. A permeable core is given so that vacuum is not created and yield is very good in this method of risering.

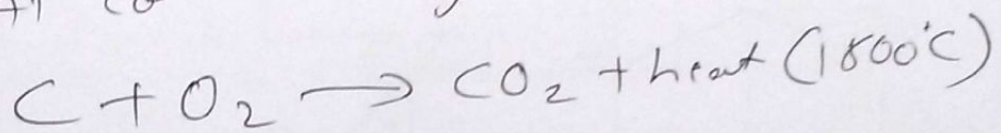
Q5 With a neat diagram explain the construction and working of a cupola furnace. (6)



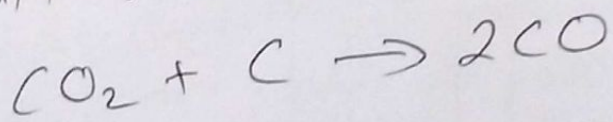
~~The dia~~ Cupola furnace is mainly used to melt ferrous metals. Its dia is around 1-2 meters and its length is around 5 times its dia.

Initially the prop bar is removed <sup>(3)</sup> to open the drop doors and to remove the residue of the previous melt. Then its closed, the furnace is charged with coke (Fuel), metal and flux (lime stone). Then wood is placed inside coke and burnt. As the wood burns, the coke catches fire. Now as the coke burns, following reactions take place.

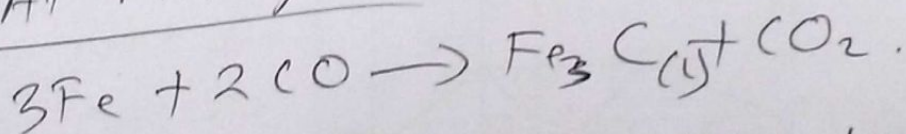
At combustion zone:-



At reduction zone.



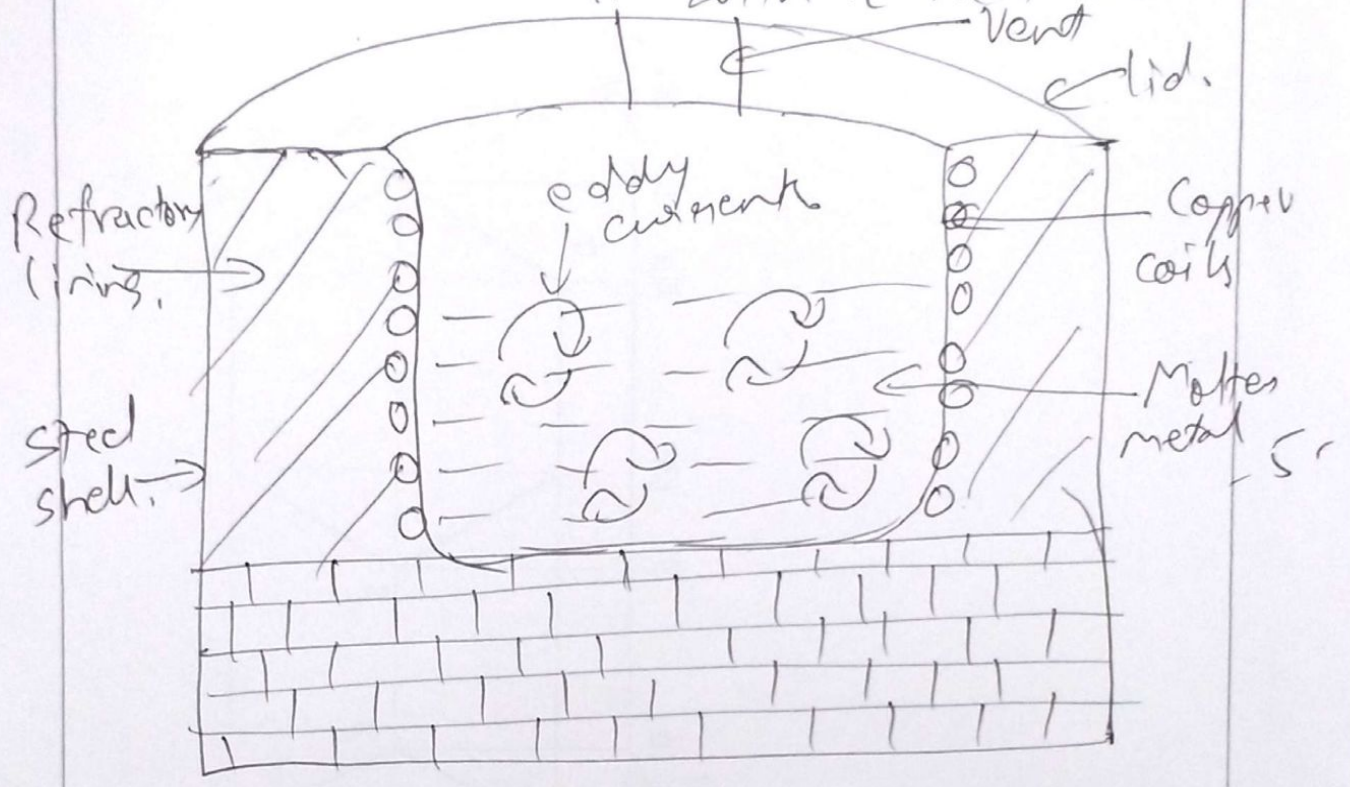
At melt zone:-



This liquid metal is extracted out of the tapping spout and the slag which is lighter than the molten metal floats on top of it and that is extracted out through the slag doors.

Q6

Explain the working of a coreless induction furnace with a neat sketch.



The coreless induction furnace is a steel shell with refractory lining on the inner walls to prevent heat transfer. It has a lid with a vent to enable the gases out. The lid is opened and the crucible is filled with the metal to be processed. It has a primary coil around the crucible. As electricity passes through the primary coil, it produces a magnetic field which induces electricity to the metal charge. Due to the resistance to the flow of current, heat is produced and the metal melts. Now the eddy currents will stir the molten metal to give it a homogeneous composition. The lid is opened to gain access to the molten metal.