Solution

III Rd Semester IPE

Industrial & Production Engg

Subject – Manufacturing Process

Section (A)

1.

(i) – (b) MIG Welding

(ii) – (a) Spot Welding

(iii) – (a) electrode holder (–) and work (+)

(iv) – (c) Neutral

(v) – (a) bare electrode

(vi) – (a) 30°

(vii) – (d) All of the above

(viii) – (d) All of the above

(ix) – (a) cope

(x) – (d) All of the above

(xi) – (b) act as a reservoir for the molten metal

(xii) – (c) Molten metal is forced into mould under pressure

(xiii) – (d) die cast

(xiv) – (d) All of the above

(xv) – (d) All of the above

(xvi) – (a) Sand casting

(xvii) – (b) becomes part of the weld

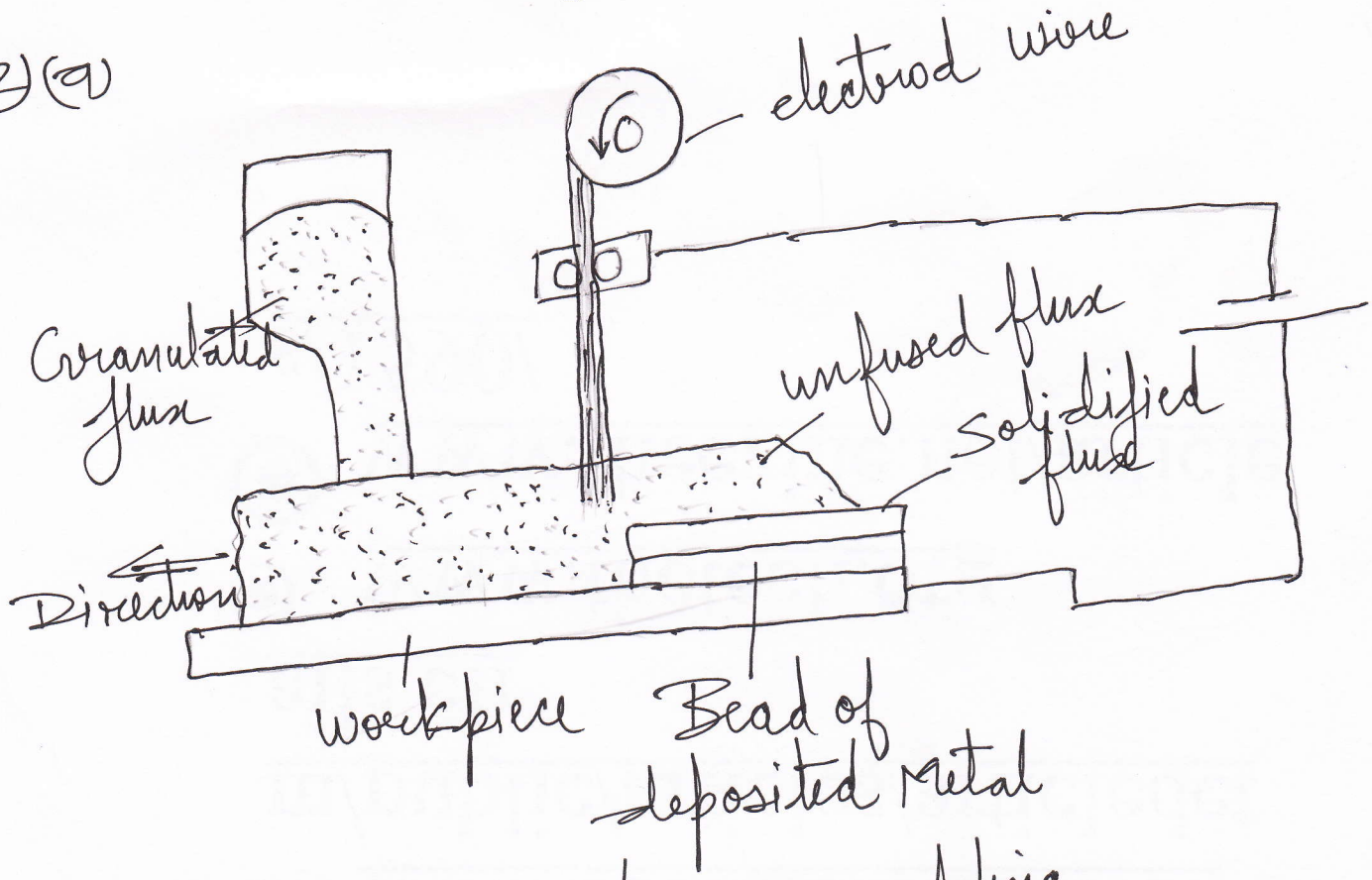
(xviii) – (a) to make desired recess in casting

(xix) – (a) Vertical passage

(xx) – (c) GTAW

Section (B)

2) (a)



Sub merged arc welding

→ In this welding the arc is produced between a bare electrode & the work piece.

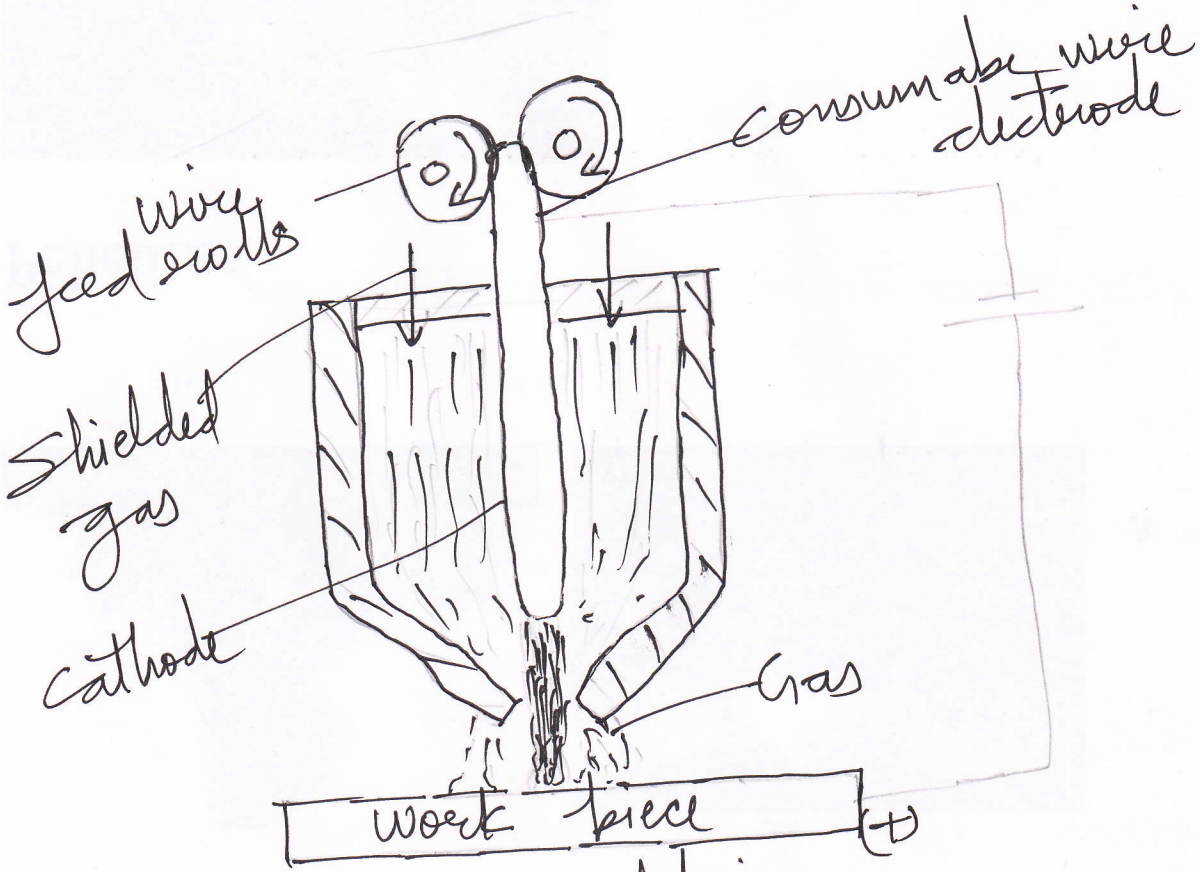
→ In this Process the region of the arc is completely submerged in a granulated material acting as a flux.

→ During welding the intense heat of the arc produces a pool of molten metal in the joint and at the same time melts some of the granular flux.

⇒ The slag solidifies with the metal and is easily removed.

⇒ After welding the excess granular material which has not been melted by the arc is picked up and used again.

(2)(b)



MIG welding

⇒ a

In this case electrode is in the form of continuous wire that is fed into the arc.

⇒ This method uses consumable electrode in the Reel

⇒ In this method the shielding gas flows by or along the electrode through a nozzle.

⇒ A filler metal may or may not be used.

⇒ The welding area is flooded with a gas which will not combine with metal.

⇒ In this method electrical energy is converted into heat energy.

⇒ The arc is produced around the area to be welded. on solidification the welding Joint is obtained.

(2)(c) welding is the Process of Joining two similiar or disssimiliar metals by the application of heat or without pressure or by the application of pressure without heat with or with out the use of filler metals.

The different methods of welding include

(1) Pressure welding or non-fusion

(2) fusion welding

(a) Pressure welding :

In this method the metal joined is never brought to a molten stage. It is heated to a welding temperature and the actual union is brought about the application of pressure.

eg - Butt welding, spot welding, Projection welding.

(b) Fusion welding

In this method the metal being joined is actually melted and union is produced on subsequent solidification

eg - gas welding, electric arc, thermit welding.

(3)(a) The following factors govern the selection of a proper material for pattern making:-

→ Service requirement eg quality, quantity and degree of accuracy and surface finish

→ No of castings to be produced i.e possibility of repeat orders.

→ Possibility of design changes.

→ Type of moulding process.

→ weight, hard, durable etc.

Pit moulding - In this moulding moulds of large Jobs are generally prepared in a pit dug in the foundary floor which facilitates in lifting the pattern and casting the mould easily.

Plate moulding : In this process the pattern is devided into

half across the parting. The pattern can be handled easily and rapidly.

→ The pattern can be drawn quickly and easily.

(3)(b)

Core — Castings are often required to have holes, recess etc of various sizes and shapes.

The impression are obtained by cores which are made up of sand. Cores are seperately made in boxes known as core boxes. Cores are used to make hollow castings.

Core print: For supporting the cores in the mould cavity an expression in the form of a recess is made in the mould with the help of suitable placed on the

pattern. The Projection on the pattern is known as core print.

⇒ A core print is an added projection on a pattern and it forms a seat which is used to support and locate the core in the mould.

Type of core print

⇒ Horizontal core print or parting line
⇒ Vertical core print or cope and drage core print
⇒ Balancing core print
⇒ Hanging or cover core print etc.

The types of core boxes include

⇒ Half box
⇒ Dump box
⇒ Split box
⇒ Right & left hand box
⇒ Gang box
⇒ Stickle box
⇒ core box.

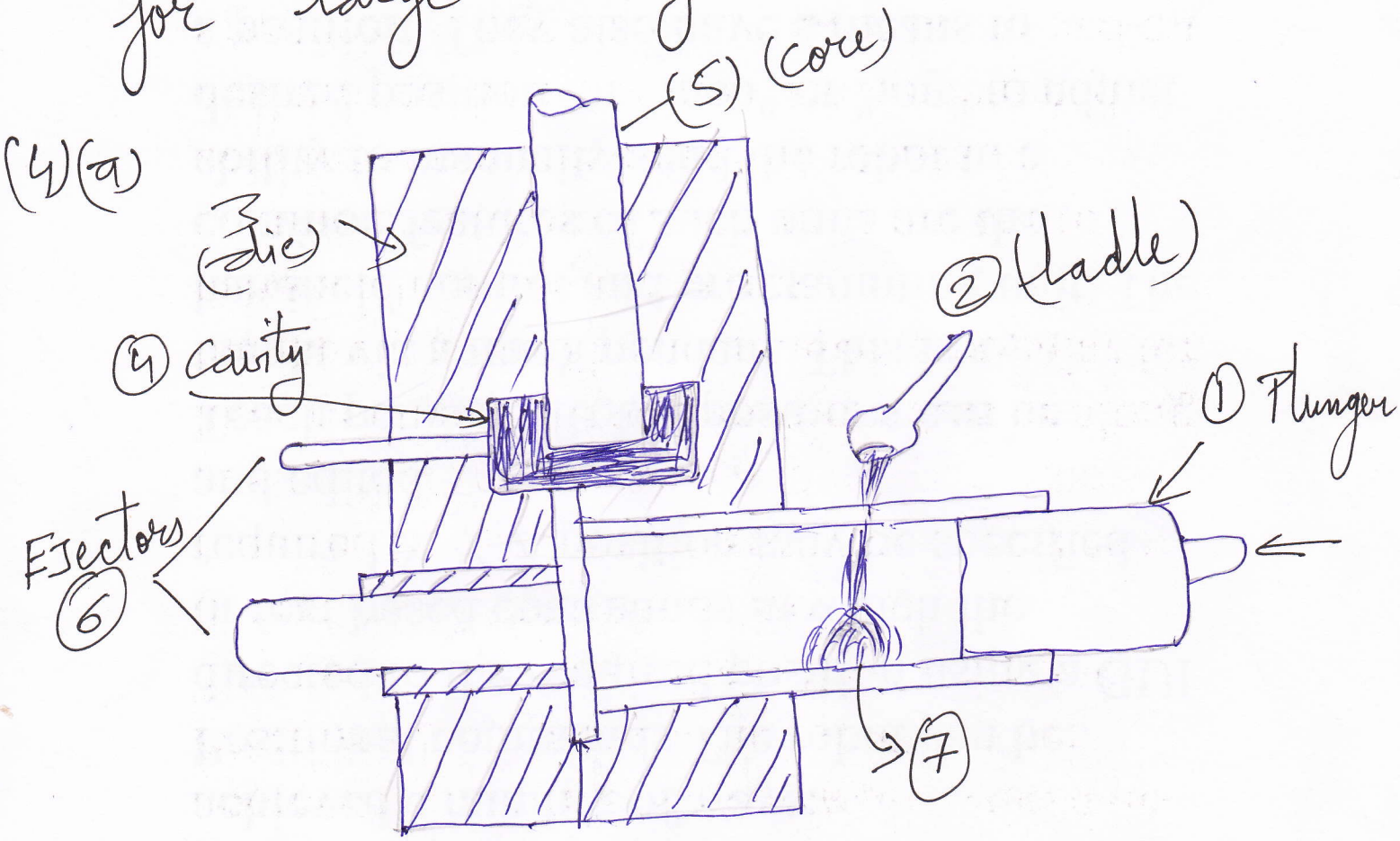
(3)(c)

When a pattern is drawn from a mould there is always some possibility of InIuring the ~~ds~~ edgs of the mould. Thus pattern can be made in two pieces. In which one part will produce the lower half of the mould and the other the upper half.

Parting Sand: parting sand is used to keep the green sand from sticking to the pattern and also to allow the sand on the parting surface of the cope and drag to separate.

Loam Sand: loam is a clay and sand mixed with water to form a thin plastic mixture from which moulds are made. A typical loam sand @ mixture comprises of silica sand, clay, coke & moisture.

loam sand is high in clay as much as 50% . This is particularly employed for loam moulding usually for large castings.



Cold chamber die casting m/c

→ In cold chamber die casting m/c the plunger (1) is driven by air or hydraulic pressure to force the charge into die (3)

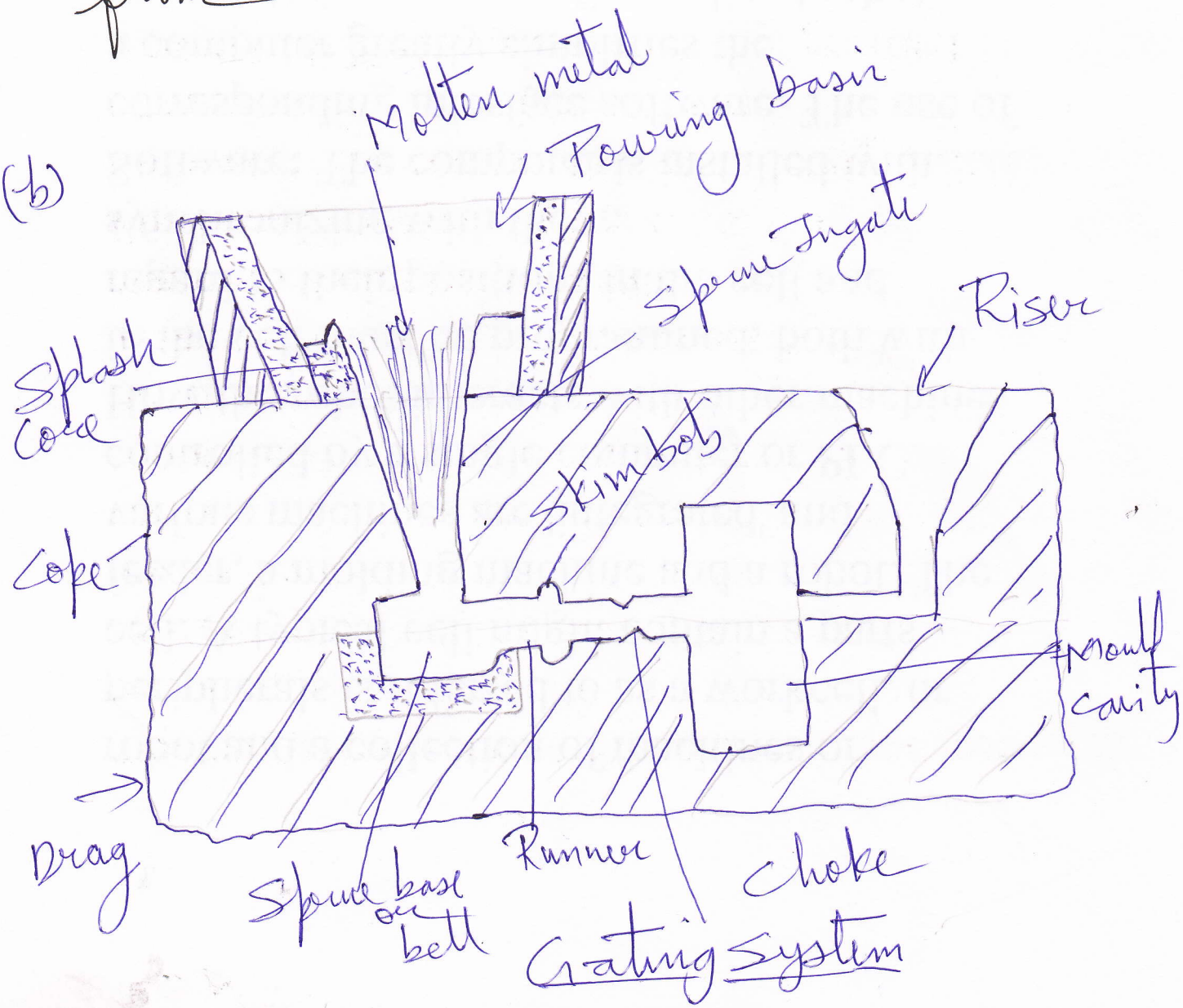
→ As soon as the ladle (2) is

emptied plunger moves to the left and forces the metal into cavity (4).

→ After the metal solidified the core (5) is withdrawn and then the die is opened

→ Ejectors (6) are employed to remove the casting automatically from the die.

(4) (b)



Gating system includes the following elements

1) Pouring Basin
2) Sprue
3) Sprue Base or Bell
4) Runner
5) Choke
6) Skim bob
7) Gates or in gates
8) Riser
9) Splash core

Sprue —

→ Deliver the molten metal from Pouring basin to runner & gate

→ The vertical passage that passes through the cope and connects the Pouring basin with the runner or gate is called sprue.

→ The cross section of the sprue may be square, rectangular or circular.

Runner — A runner is commonly a

horizontal channel which connects the sprue with the gates thus allows the molten metal to enter the mould cavity.

(4)(c) $V_S = V_c$

$\frac{4}{3}\pi R^3 = \frac{\pi}{4} d^2 h$ ($d = h$ = cylinder)

$d = h$ R = sphere

$$\boxed{d^3 = \frac{16}{3} R^3} \rightarrow (1)$$

Solidification time

$$\text{cylinder} = \frac{V_c}{A_c}$$

$$= \frac{\frac{\pi}{4} d^2 h}{\pi d h + 2\frac{\pi}{4} d^2} = \left(\frac{d}{6}\right)$$

$d = h$

put $d =$ from (1)

$$= \frac{1}{6}\left(\frac{16}{3} R^3\right)^{\frac{1}{3}}$$

$$\boxed{\frac{V_c}{A} = 0.29\, R} \rightarrow (2)$$

Solidification time

$$\text{sphere} = \frac{V_s}{A_s}$$

$$= \frac{\frac{4}{3}\pi R^3}{4\pi R^2} = \frac{R}{3} = 0.33R$$

$$\boxed{\frac{V_s}{A_s} = 0.33R} \rightarrow (3)$$

Thus from (2) & (3) it is clear that a solid casting of cylindrical crossection will solidify faster than the spherical workpiece.

(5) (a) The raw mt. of blast furnace includes:

(a) Iron ore
(b) cooking coal (coke)
(c) flux

(a) Iron ore: These are generally carbonates, hydrates or oxides of the metals. These iron ore are found in several states of India namely Bihar, Orissa, M.P, A.P etc.

The chief iron ore includes magnetite, Red hematite, siderite or spathic etc.

Coke- The coke used in blast furnace should be a very high class hard coke obtained from good quality cooking coal containing as low phosphorous and sulphur as possible.

It is produced by heating what is commonly called "dry distillation" of the coking coals in coke ovens made of silica bricks in the absence of air to avoid giving off valuable gases.

Flux- Flux is a mineral substance that is charged into a blast furnace to lower the melting point of the ore and to promote the removal

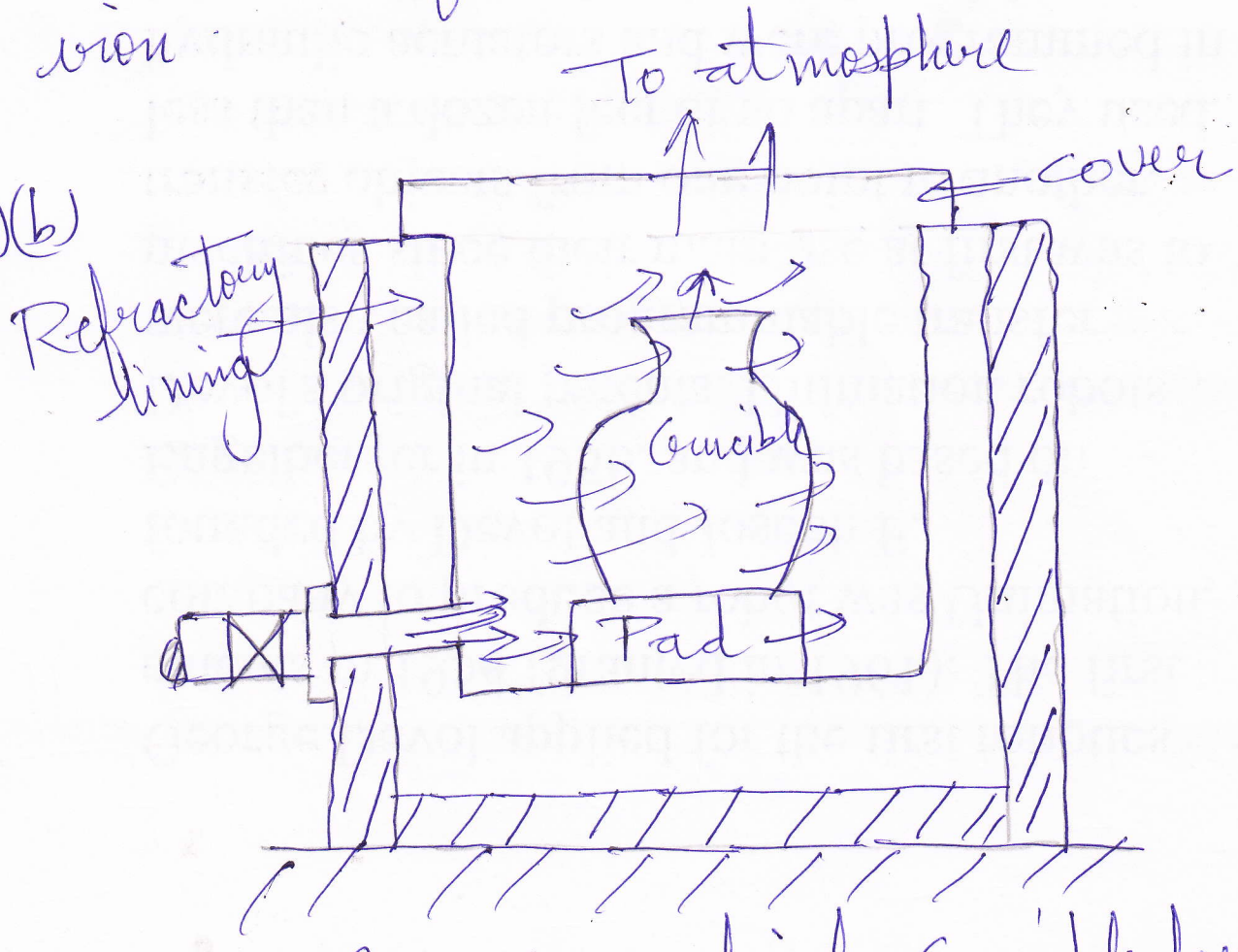
of the ash, sulphur and the residues of the burnt fuel.

→ Flux combines with the ashes of the fuel and the ore to form fusible products which separate from the metal as slag.

→ The commonly used fluxes are lime stone, Dolamite, silica etc.

The product that is obtained from blast furnace is pig iron

5(b)



A Gas fired Crucible furnace

→ These furnaces utilize oil or gas as fuel.

→ In fact a mixture of gas or air or oil and air is fed into the furnace which burns inside to produce the desired temp.

→ The furnace essentially consists of a cylindrical steel shell provided with refractory lining inside and proper passage for entry of the fuel mixture.

→ The crucible is seated on a pad formed at the bottom.

→ The crucible is made up of clay and graphite

(5)(c) Pig iron :

This is the raw material obtained from the chemical reduction of iron ore in a blast furnace.

→ All iron & steel products are derived from pig iron.

→ The process of Reduction of iron ore to pig iron is known as Smelting.

→ The main raw mt required for pig iron are iron ore, coke and flux.

Cast iron:

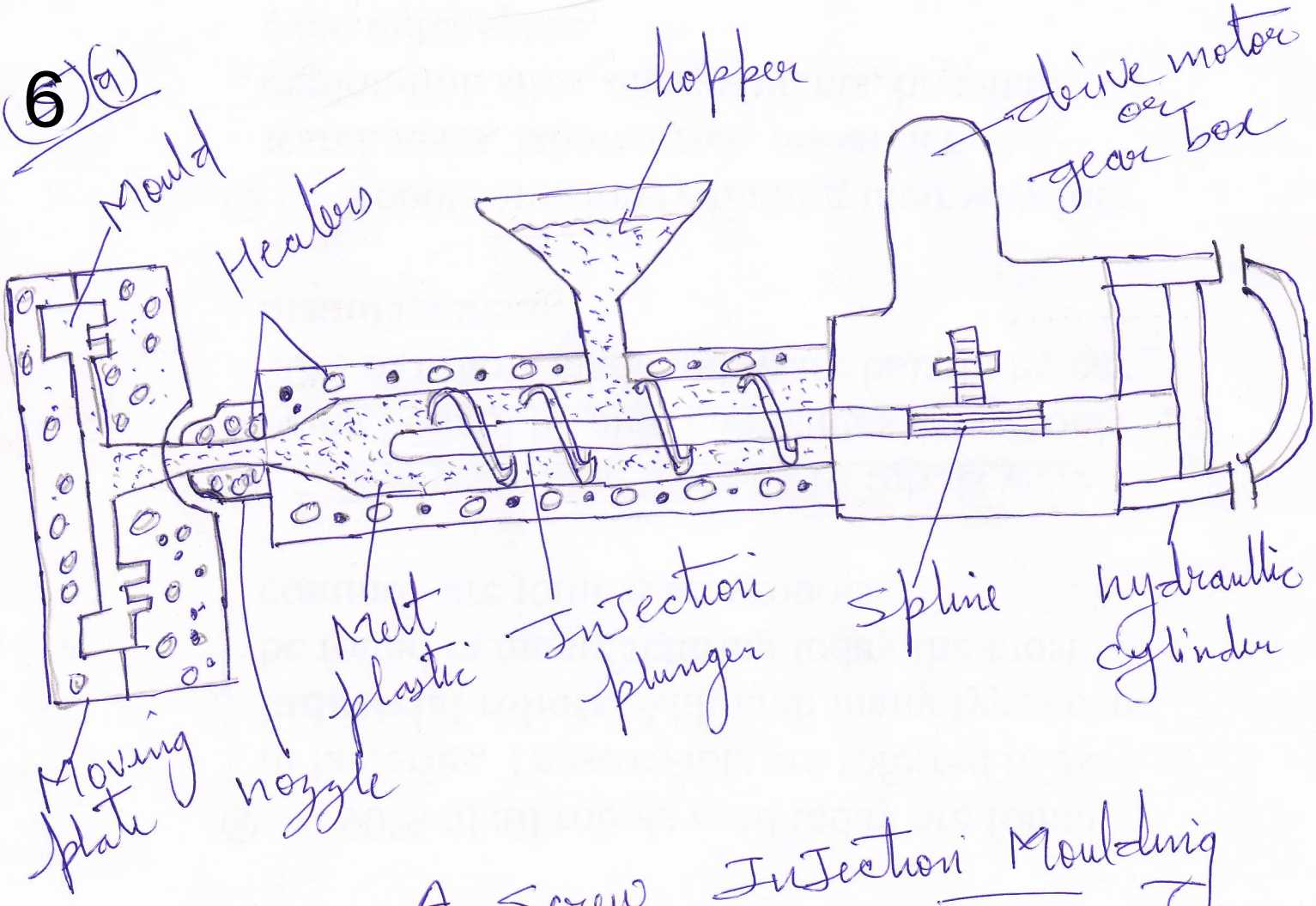
Cast iron is pig iron remelted and thereby refined together with definite amount of lime stone, steel scraps and spoiled casting in a cupola or other form of remelting furnace and poured into suitable moulds of required shape.

→ It contains about 2 to 4 percent of carbon, a small percentage of silicon, sulphur, phosphorous and magnese and certain amount of alloying elements eg nickel, chromium, molybdenum, copper and Vanadium.

Varieties of cast iron is in common use are:

1) Grey cast iron
2) White cast iron
3) chilled cast iron
4) Alloy cast iron
5) Malleable cast iron etc.

6 (a)



A Screw Injection Moulding

→ This process resembles the hot chamber die casting of metals

→ Here the die splits to allow

allow removal of the solidified. the solidified products : ejectors are provided for removing the moulded component.

→ The difference between metals and plastics lies in the supply of the polymer which is usually fed in solid form, pellets or powder through a hopper to a injector screw.

→ The die end is surrounded with heaters that generally brings the polymer to the required temperature.

(6)(b)

Cold ~~workpmo~~ working

→ The working of metals at temperature below their re-crystallization temperature is defined as cold working

→ Most of the cold working Processes however are performed at room temp.

→ The effect of cold working on the

structure of steel is to distort or elongate the grain in the direction of the flow of metal.

→ Much greater pressure are needed for cold working as compared to hot working.

→ The metal being in a more rigid state is not permanently deformed until stress exceeding the elastic limit is passed.

→ The principle cold working methods are

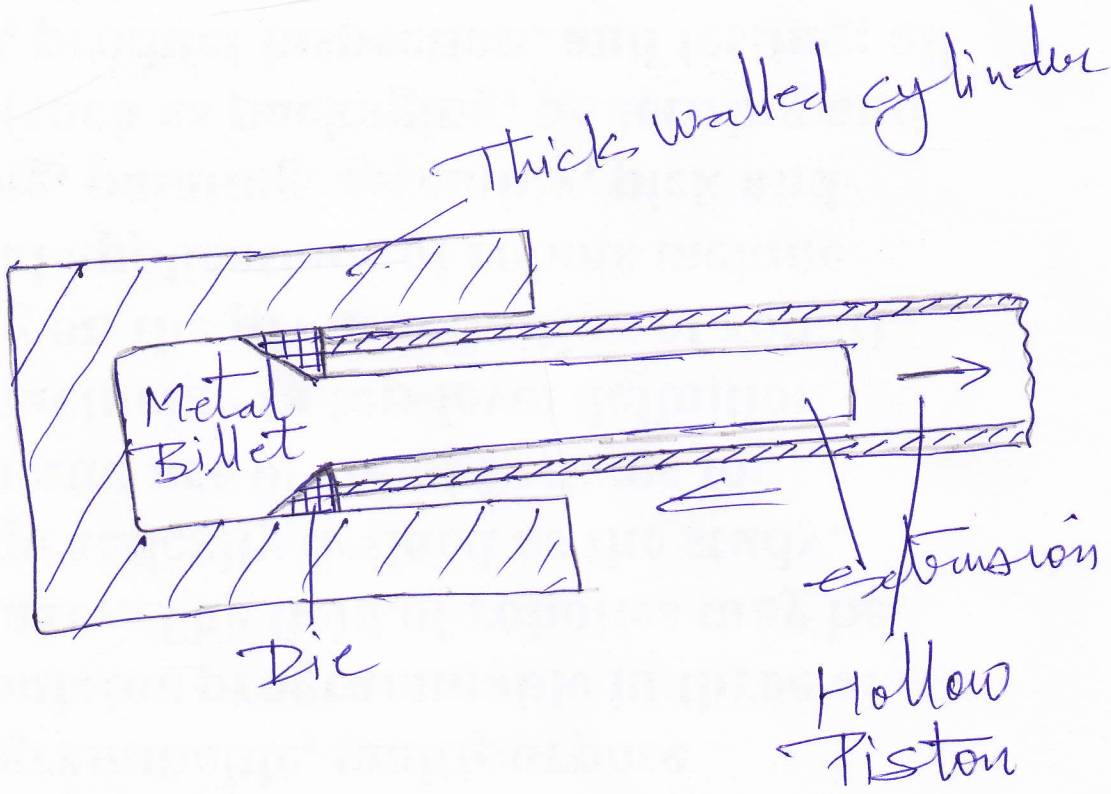
- → Rolling
- → Drawing
- → Extruding
- → Forging
- → Spinning
- → Bending etc.

6(c) Indirect Extrusion

→ Indirect extrusion is similiar to direct extrusion except that the extruded

part is forced through the hollow ram as shown in figure.

→ It involves no friction between the metal billet and container walls. because the billet does not move the container.



Indirect extrusion

→ compared with direct extrusion less total force is required but the equipment used in mechanically more complicated in order to accomodate the Passage of the extended shape