



SNS College of Technology

Department of Mechanical Engineering



MANUFACTURING TECHNOLOGY

Unit - I

Topic : Sand Casting: Sand Mould, Sand Properties



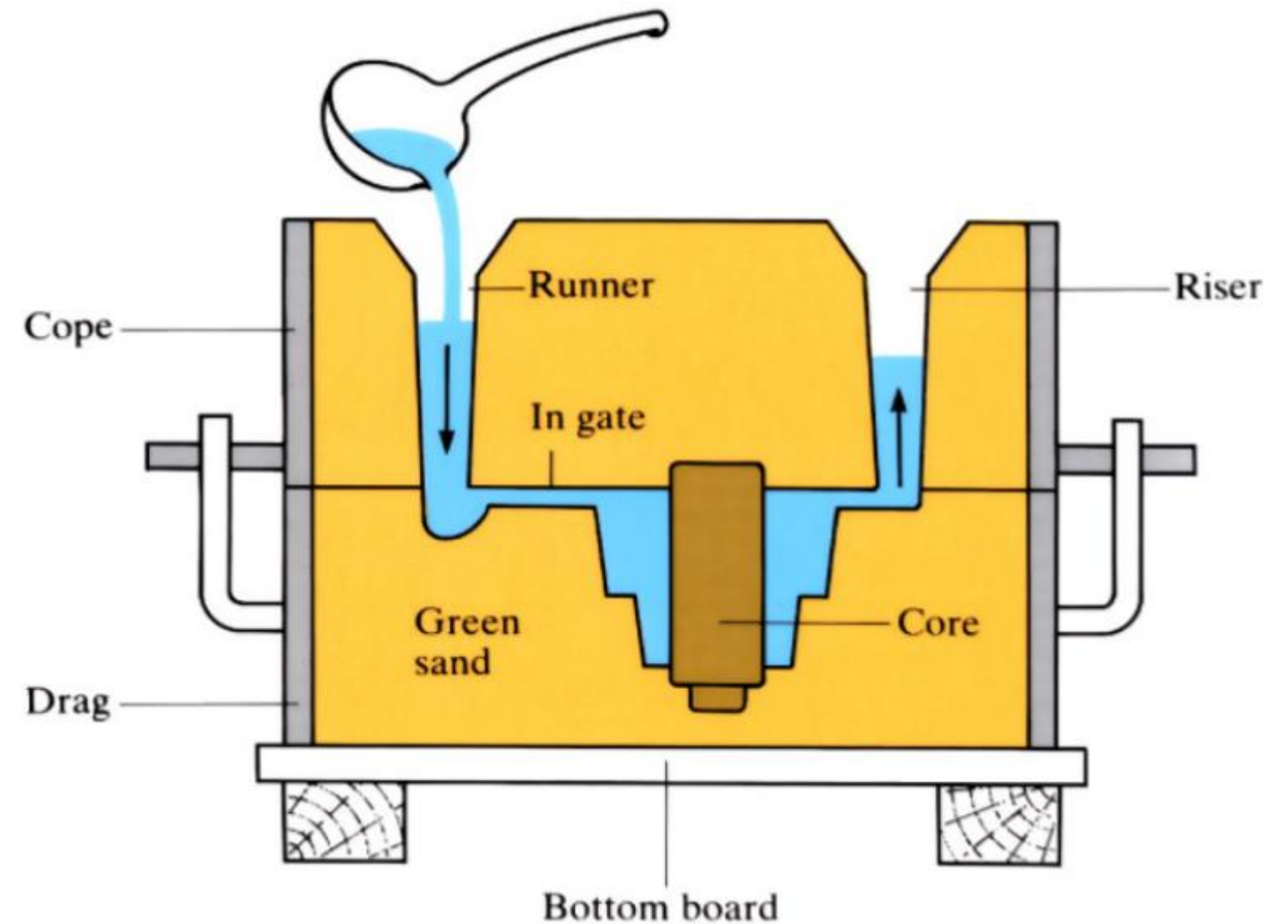
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Sand Casting

Sand casting, also known as **sand molded casting**, is a metal casting process characterized by using sand as the mold material. The term "sand casting" can also refer to an object produced via the sand casting process. Sand castings are produced in specialized factories called foundries. Over 60% of all metal castings are produced via sand casting process.

Sectional view of a casting mould



Source : open.edu



Fundamental of Metal Casting

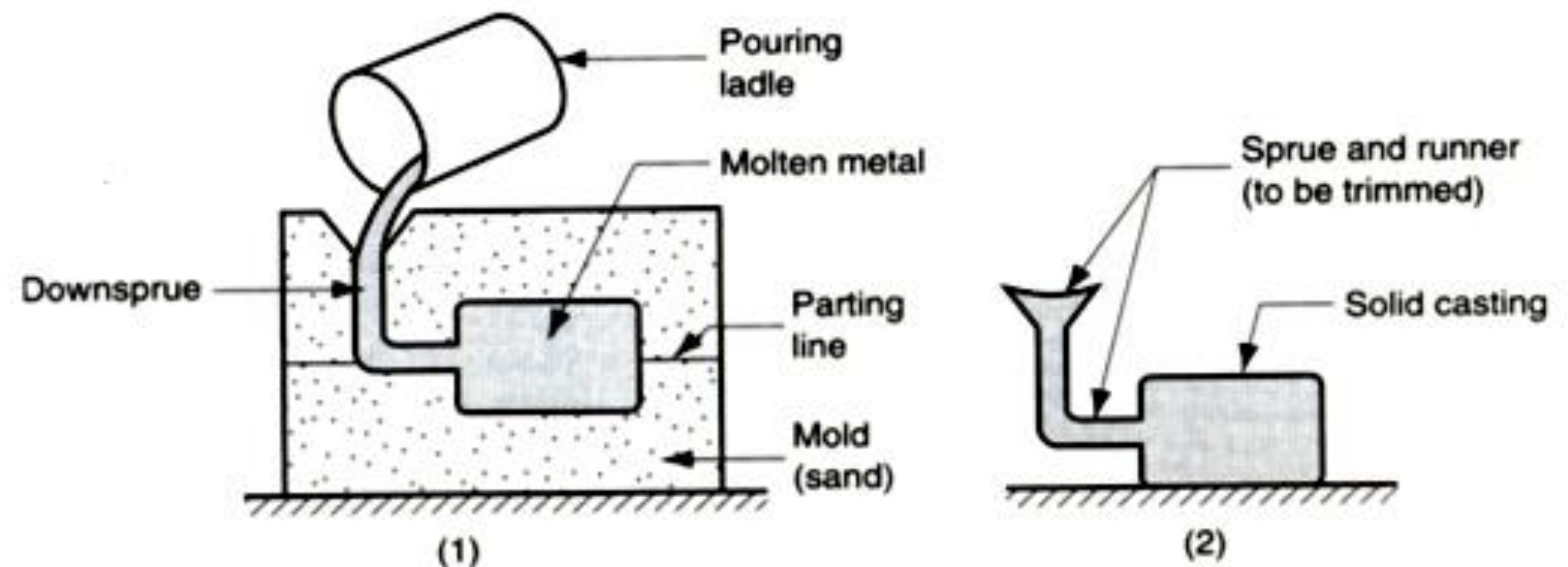


The casting process basically involves

- Pouring molten metal into a mold patterned after the part to be manufactured
- Allowing it to cool
- Removing the metal from the mold

Sand Mould

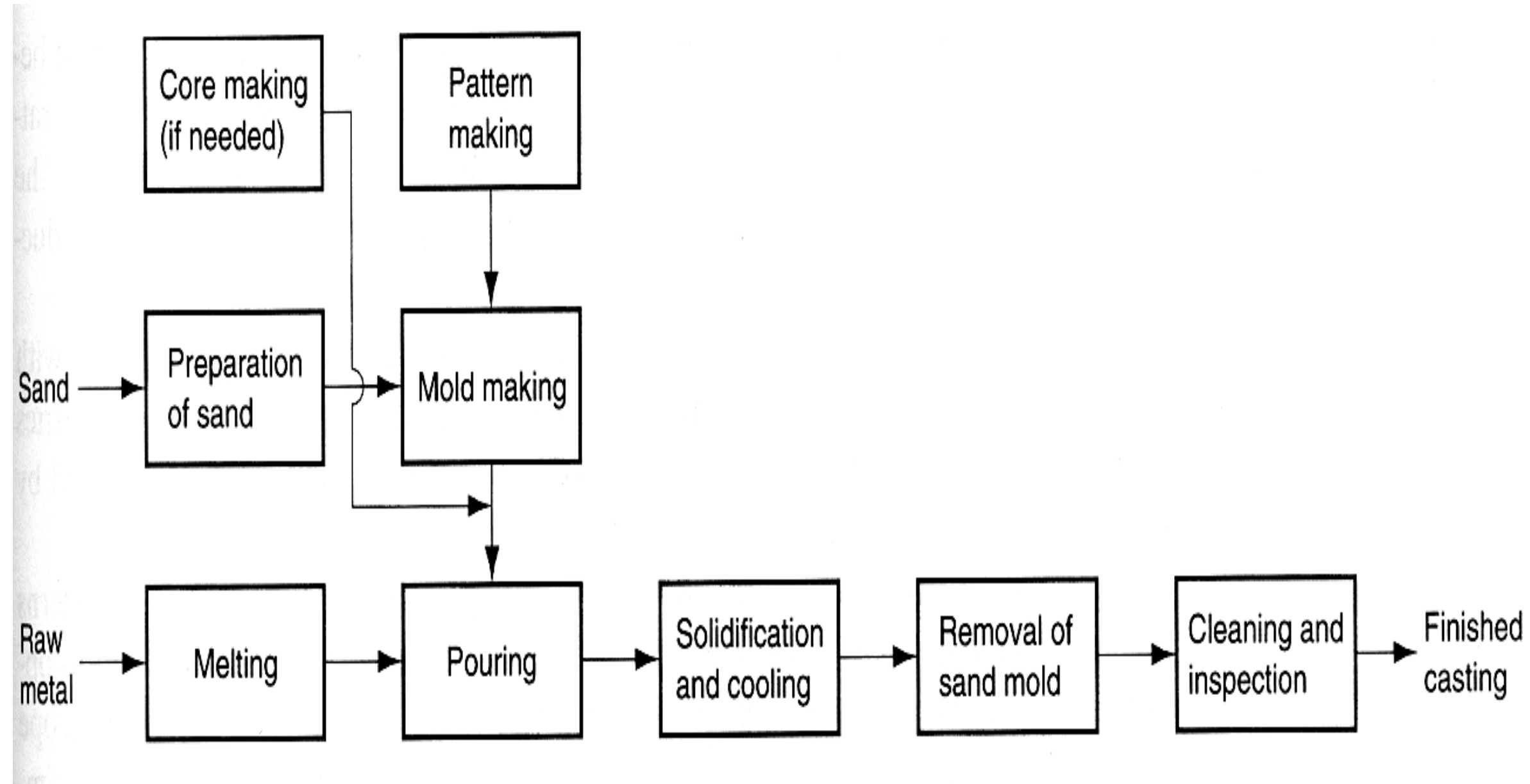
A hollow container used to give shape to molten or hot liquid material when it cools and hardens.



Source : Book - Manufacturing Engineering & Technology by Serope Kalpakjian



Casting Flow Process



Source : Book - **Manufacturing Engineering & Technology** by Serope Kalpakjian



Steps in Casting



1. Pattern and Mould
2. Melting and Pouring
3. Solidification and Cooling
4. Removal, Cleaning, Finishing and Inspection



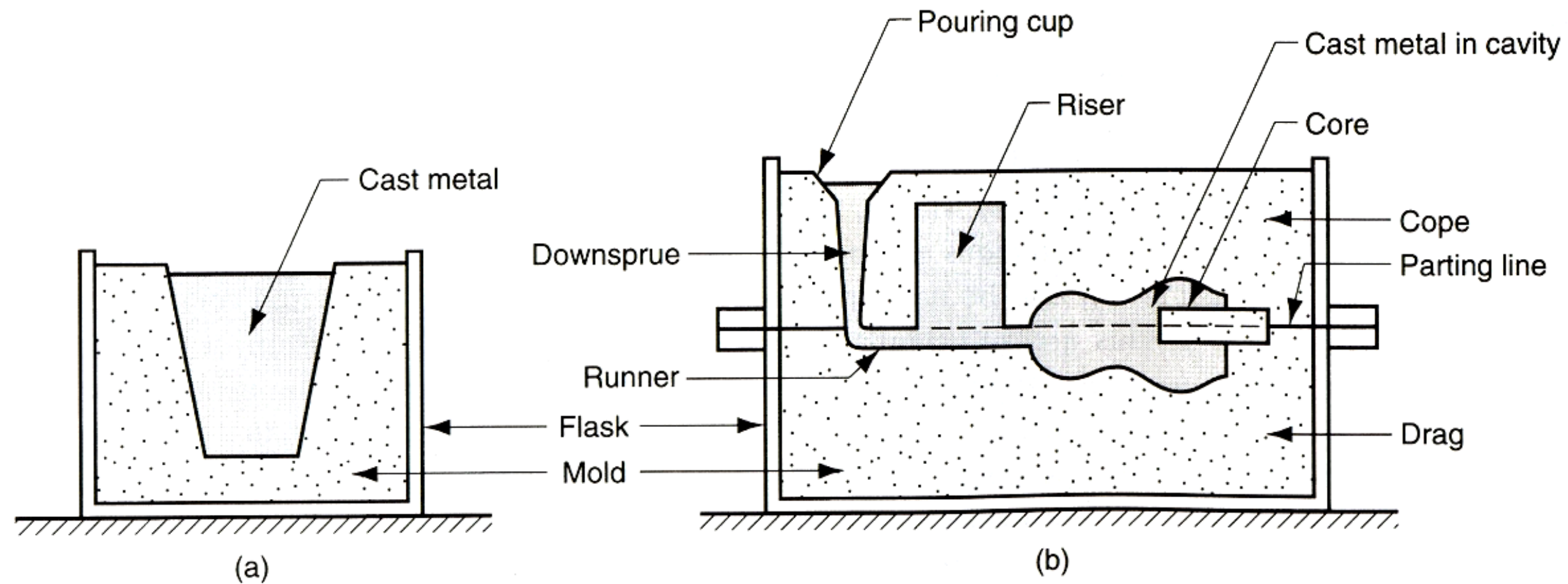
1. Pattern and Mould

- A pattern is a replica of the final product and is used for preparing mould cavity made of wood or metal
- Mould cavity which contains molten metal is essentially a negative of the final product
- Mould material should possess refractory characteristics and withstand the pouring temperature
- When the mold is used for single casting, it is made of sand and known as **expendable mold**
- When the mold is used repeatedly for number of castings and is made of metal or graphite are called **permanent mould**
- For making holes or hollow cavities inside a casting, cores made of sand are used.



1. Pattern and Mould

- Open and Closed Mould



Source : Book - Manufacturing Engineering & Technology by Serope Kalpakjian



2. Melting and Pouring

- The quality of casting depends on the method of melting.
- Molten metal is prevented from oxidation by covering the molten metal with fluxes

The two main consideration during pouring are the temperature and pouring rate

- **Fluidity:** *Capability of molten metal to fill mold cavities*
Characteristics of molten metal

Casting parameters

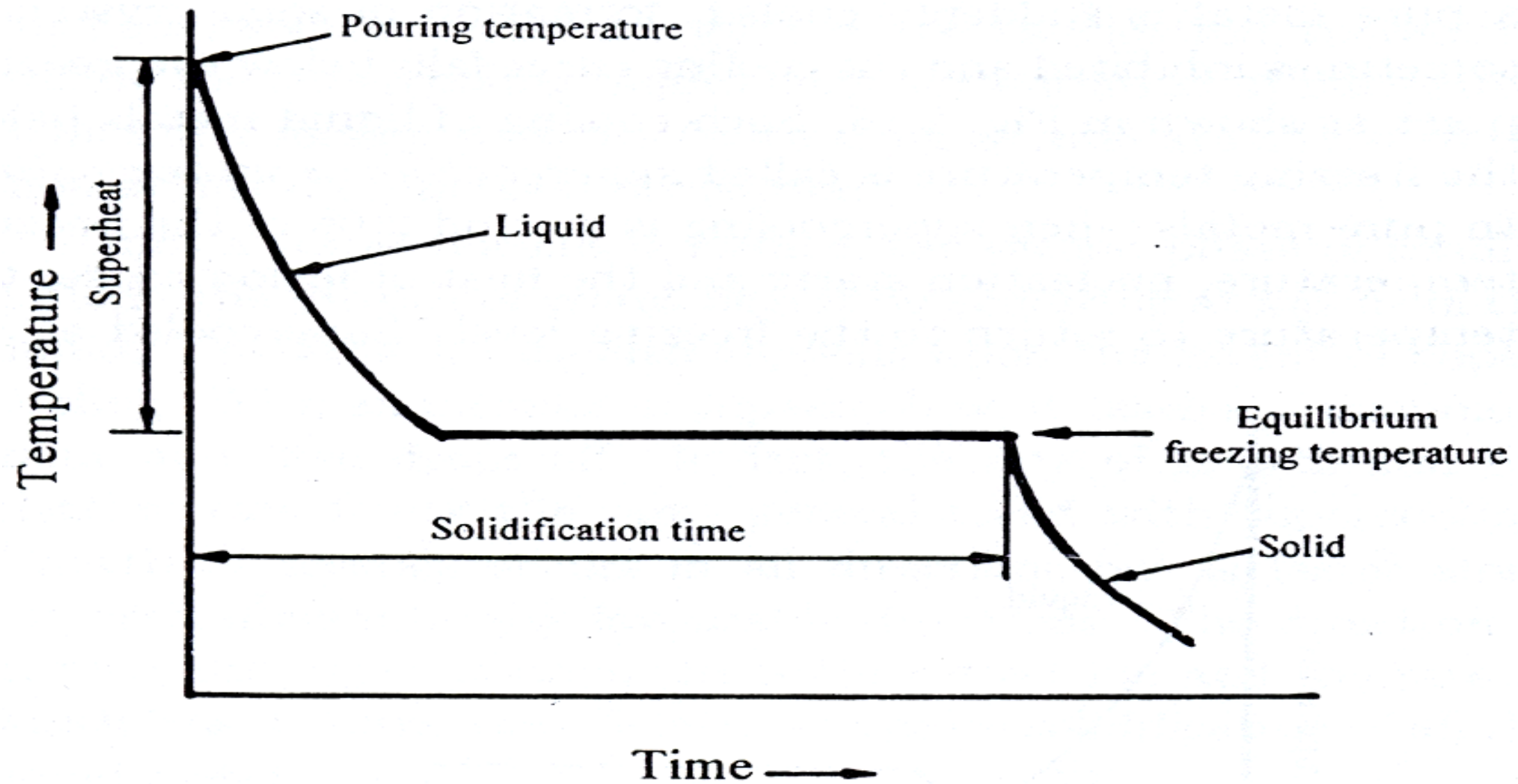
- Fluidity of molten metal is more at higher temperature but it results into more amount of dissolved gases and high temperature also damage the mould walls and results into poor surface quality of the casting



Source : open.edu



3. Cooling and Solidification



Source : Book - Manufacturing Engineering & Technology by Serope Kalpakjian

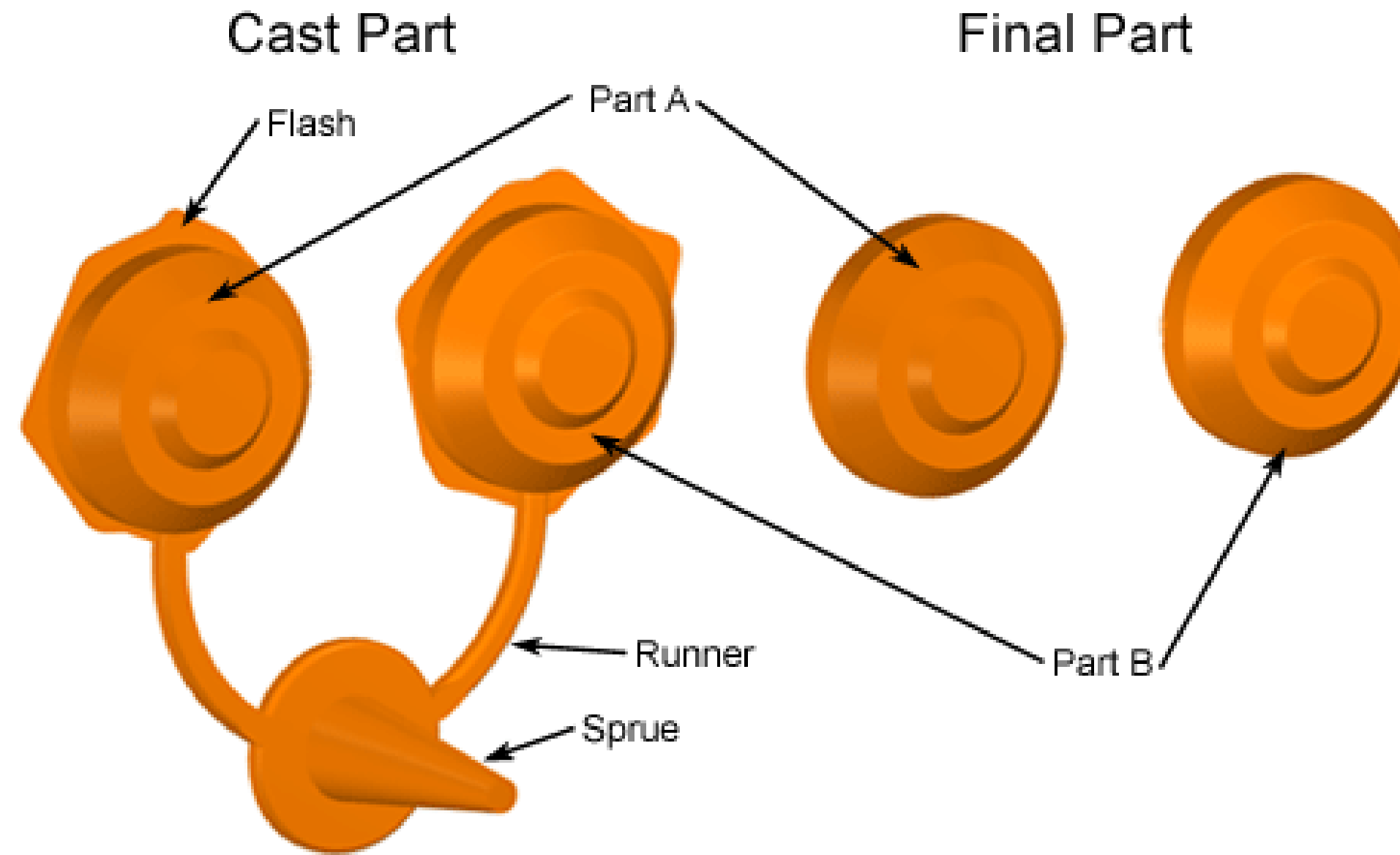


4. Cleaning and Finishing

- Casting is taken out of the mould by Shaking and the Moulding sand is recycled often with suitable additions.
- The remaining sand, some of which may be embedded in the casting, is removed by means of Shot blasting.
- The excess material in the form of sprue, runners, gates etc., along with the flashes formed due to flow of molten metal into the gaps is broken manually in case of brittle casting or removed by sawing and grinding in case of ductile material.
- The entire casting is then cleaned by either shot blasting or chemical pickling.
- Sometimes castings are heat treated to achieve better mechanical properties.
- White light inspection, pressure test, magnetic particle inspection, radiographic test, ultrasonic inspection etc. are used



Removal, Cleaning, Finishing



Source : open.edu



Moulding Sand



Moulding Sand

Molding sand, also known as **foundry sand**, is a sand that when moistened and compressed or oiled or heated tends to pack well and hold its shape. It is used in the process of sand casting for preparing the mould cavity.

Green sand is an aggregate of sand, bentonite clay, pulverized coal and water. Its principal use is in making molds for metal casting. The largest portion of the aggregate is always sand, which can be either silica. There are many recipes for the proportion of clay, but they all strike different balances between moldability, surface finish, and ability of the hot molten metal to degas.

The coal, typically referred to in as sea-coal, which is present at a ratio of less than 5%, partially combusts in the surface of the molten metal leading to offgassing of organic vapors.



Types of Moulding Sand



They are the types of sand mold

- **Green molding sand** – mixture of sand & clay, green refers that sand is moist
- **Skin dried method** - the mold surfaces are dried, either by using air (or) torches, sand moulds are oven dried because stronger than the green sand & impart the better dimensional accuracy & surface finish
- **Cold box mold process** – various organic and inorganic binders are blended into the sand to bond the grains chemically for greater strength, more expensive & more accurate than green sand mould.
- **No bake mold process** - A synthetic liquid resin is mixed with the sand, mixture hardens at room temperature



Mould Material



Major part of Moulding material in sand casting are

- 70-85% silica sand (SiO_2)
- 10-12% bonding material e.g., clay etc.
- 3-6% water

The performance of mould depends on following factors:

- (a) Permeability
- (b) Green strength
- (c) Dry strength



Source : me-mechanicalengineering.com



Properties of mould sand



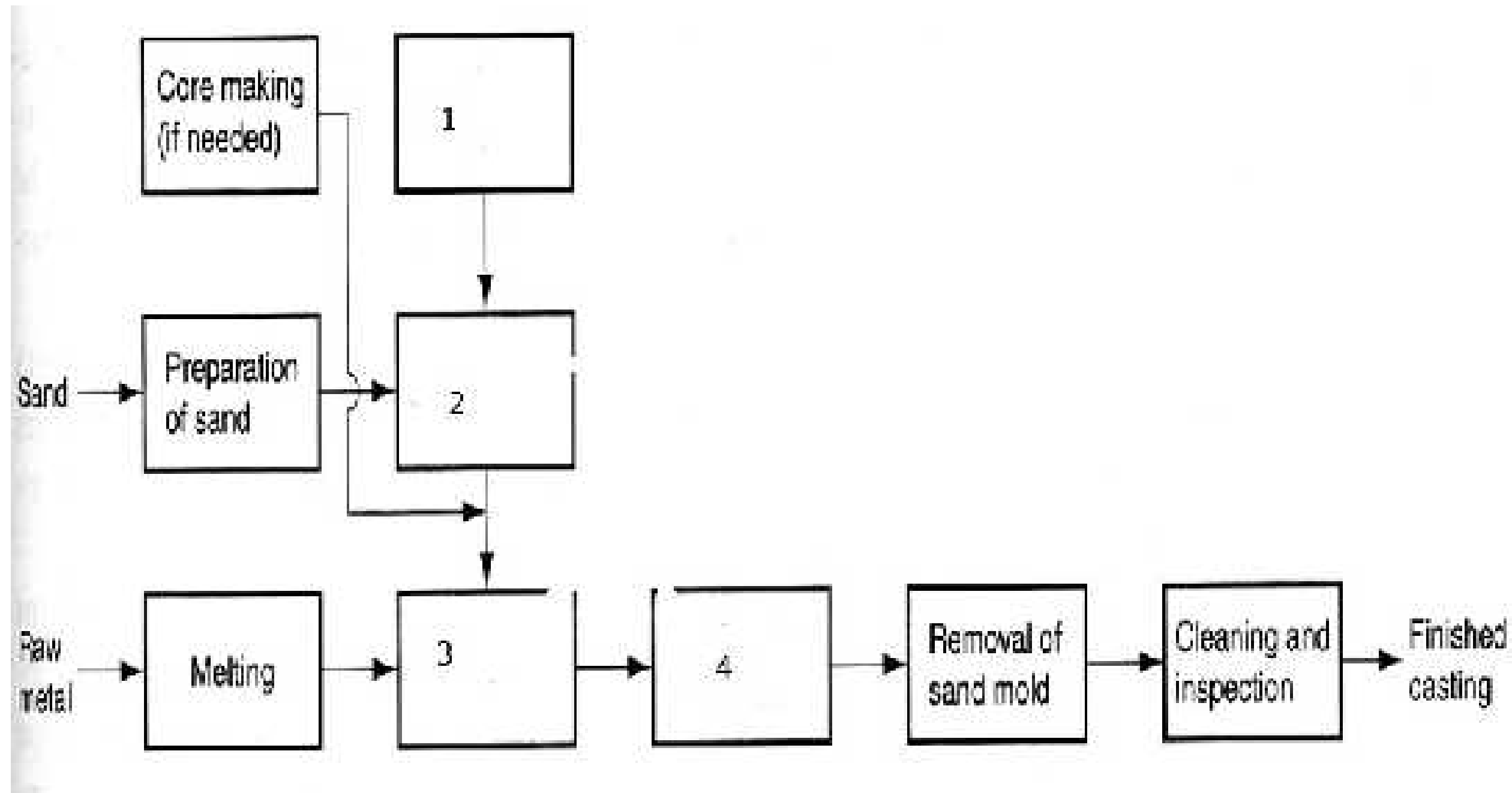
- **Porosity** – Sand must, therefore be sufficiently porous allow the gases
- **Flowability** – It will flow the all portions of mould
- **Collapsibility** – ability to permit metal to shrink after solidification
- **Adhesiveness** - Capable of adhering to adhering another body & it does not fall out of the box when it is removed.
- **Cohesiveness** – ability of sand particles to stick together
- **Refractoriness** – with standing the high temperature.



Assessment



1. Name the suitable steps in the sand casting process in the box 1,2,3,4





Assessment



2. If the sand is too fine, its permeability will be high

True / False

3. Green sand mould indicates that

- a) Polymeric mould has been cured
- b) b) Mould has been totally dried
- c) Mould is green in colour
- d) Mould contains moisture



THANK YOU