

WELCOME
TO Adda247

*"There is
nothing
impossible to
they who will
try."*

GATE 2024



प्रताप Batch

PRODUCTION

Casting

PART-2

Mechanical Engineering



GATE 2024



प्रत्न Batch

MECHANICAL ENGINEERING



MON/ TUE/ WED- 9PM

THEORY OF MACHINE (TOM)

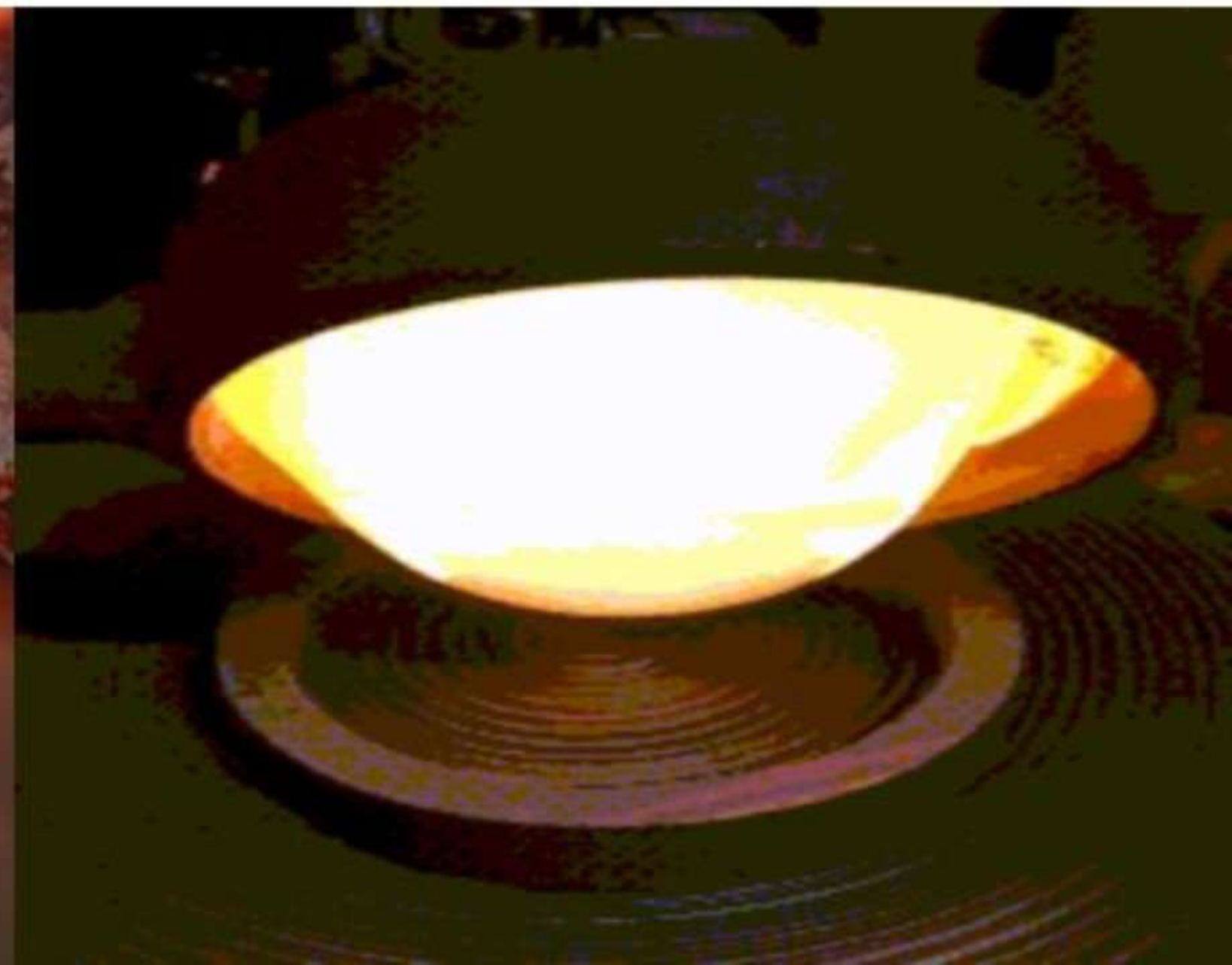


THUR/ FRI/ SAT- 6PM

PRODUCTION ENGINEERING

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CASTING



Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine (CMM).

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools; additive manufacturing.

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.



INDEX

Introduction of Casting

Broad Steps in Sand Casting

Cooling Curve for Sand Casting ***



Patterns

😊 * Pattern Size = Casting Size \pm Allowances

😊 * $P.S = C.S \pm$ Allowances

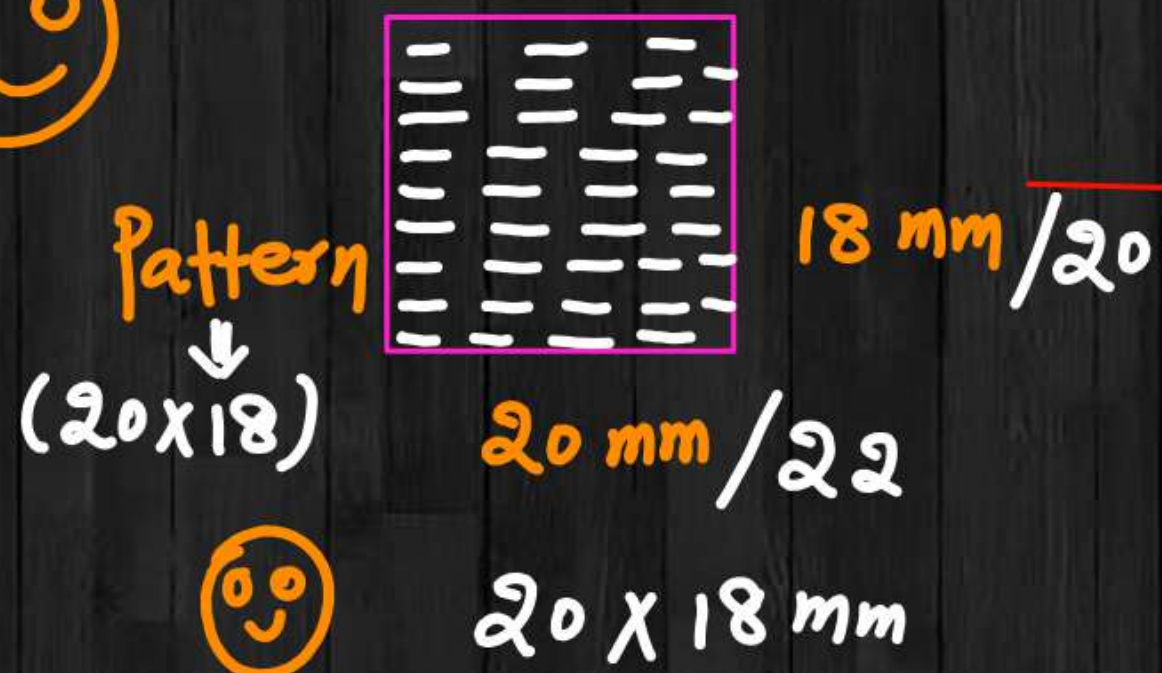
→ $P.S = C.S +$ Allowances

→ $P.S = C.S -$ Allowances

😊 * $P.S > C.S$

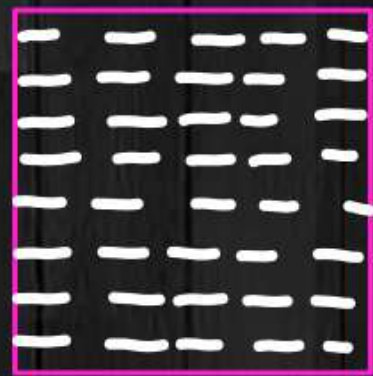
😊 * $P.S < C.S$

Case-1



* Pattern Size > Casting Size \rightarrow +ve Allowances

😊 case-2



18 mm / 16

20 mm / 18

* Pattern \rightarrow (20 x 18 mm)

\hookrightarrow (18 x 16 mm)



20 / 18 mm

22 / 20 mm

* casting \rightarrow (22 x 20 mm)

Allowances

\hookrightarrow (20 x 18 mm)

😊 Pattern Size < Casting Size \rightarrow -ve Allowances

Types of Allowances

✓ Shrinkage or contraction

Draft or Taper

Machining or Finish

Shake or Rapping

Distortion or camber

Pouring Temperature (T_p)



*

$$T_p = T_m + \Delta t$$

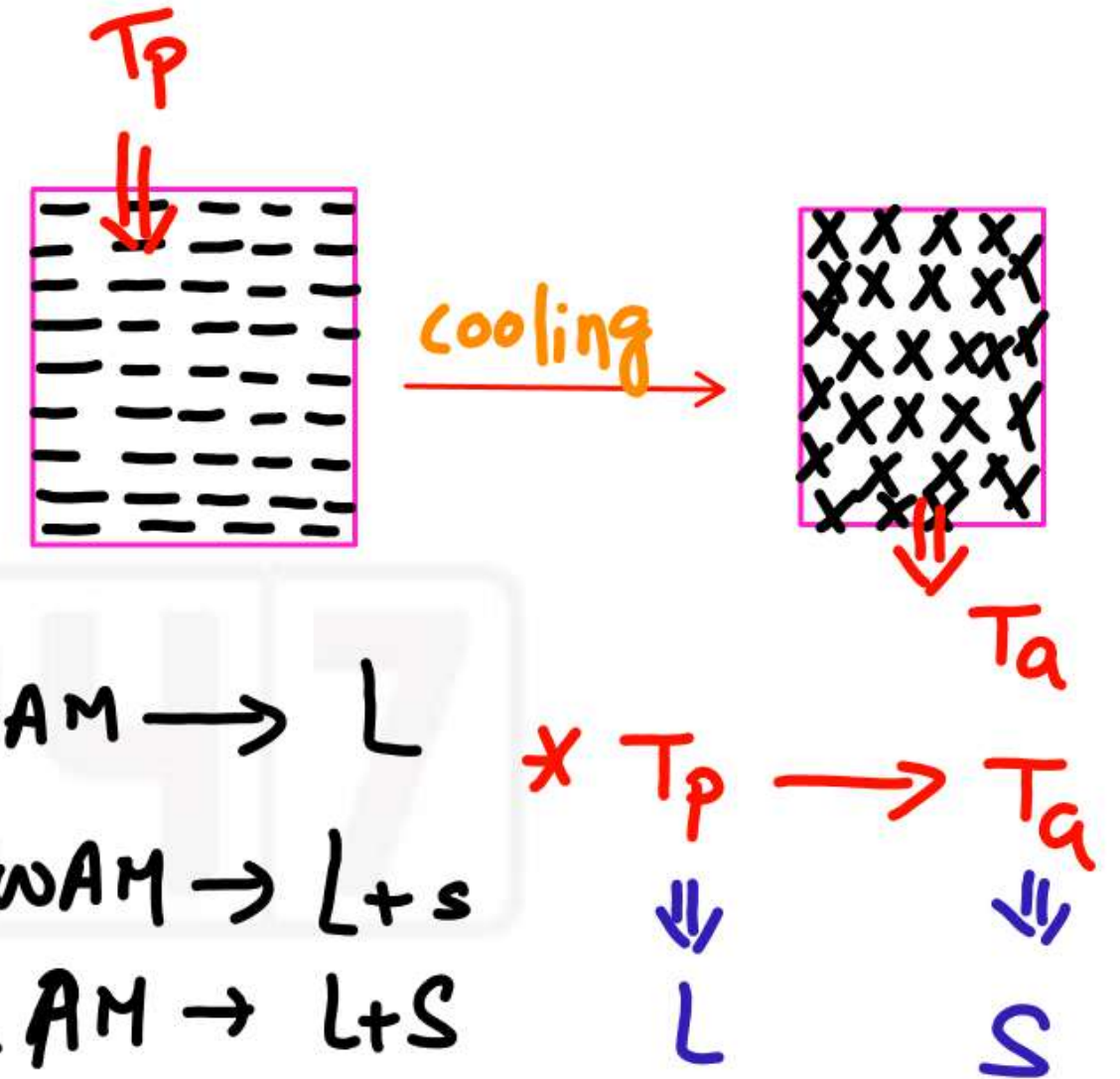
↓
Melting
temp

↓
Degree of
Superheat
↓
(150°C to 250°C)

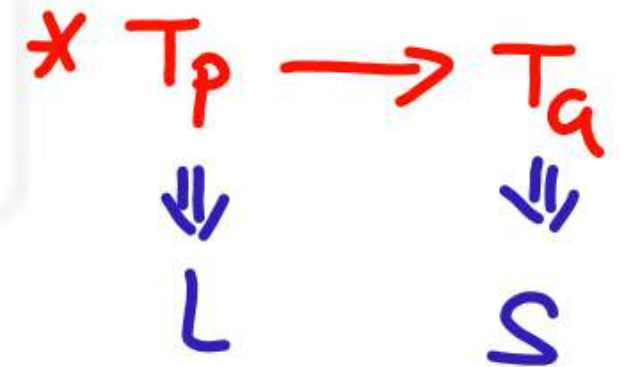


Shrinkage or contraction Allowances
(Solid Shrinkage)

$$* T_p = T_m + \Delta t$$



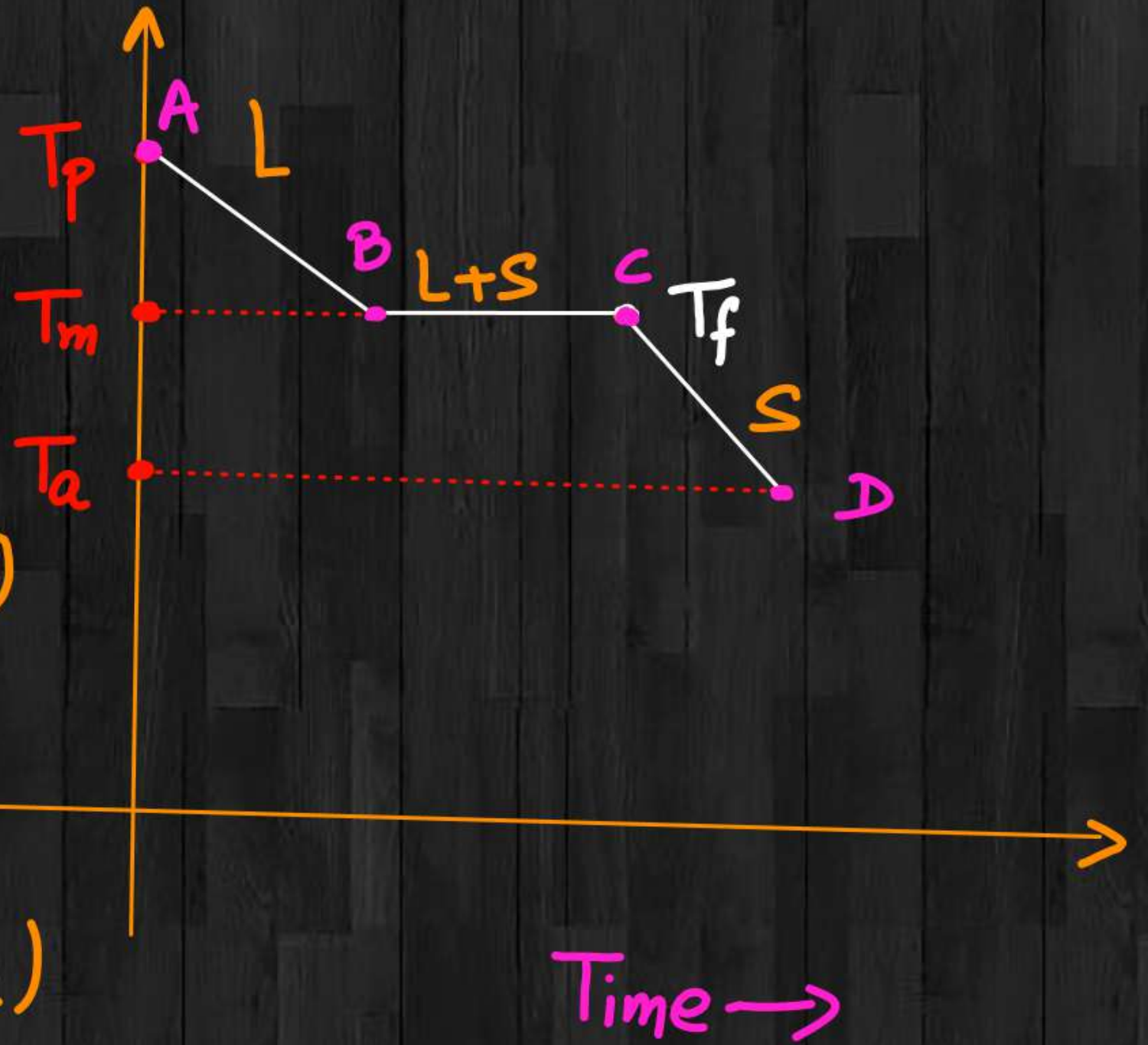
- * 9:00 AM → L
- * 10:00 AM → L+S
- * 12 AM → L+S
- 2 PM L+S
- 4 PM S



😊 * cooling curve → (Metal)

* 😊 $T_m = T_f$

↑
Temp



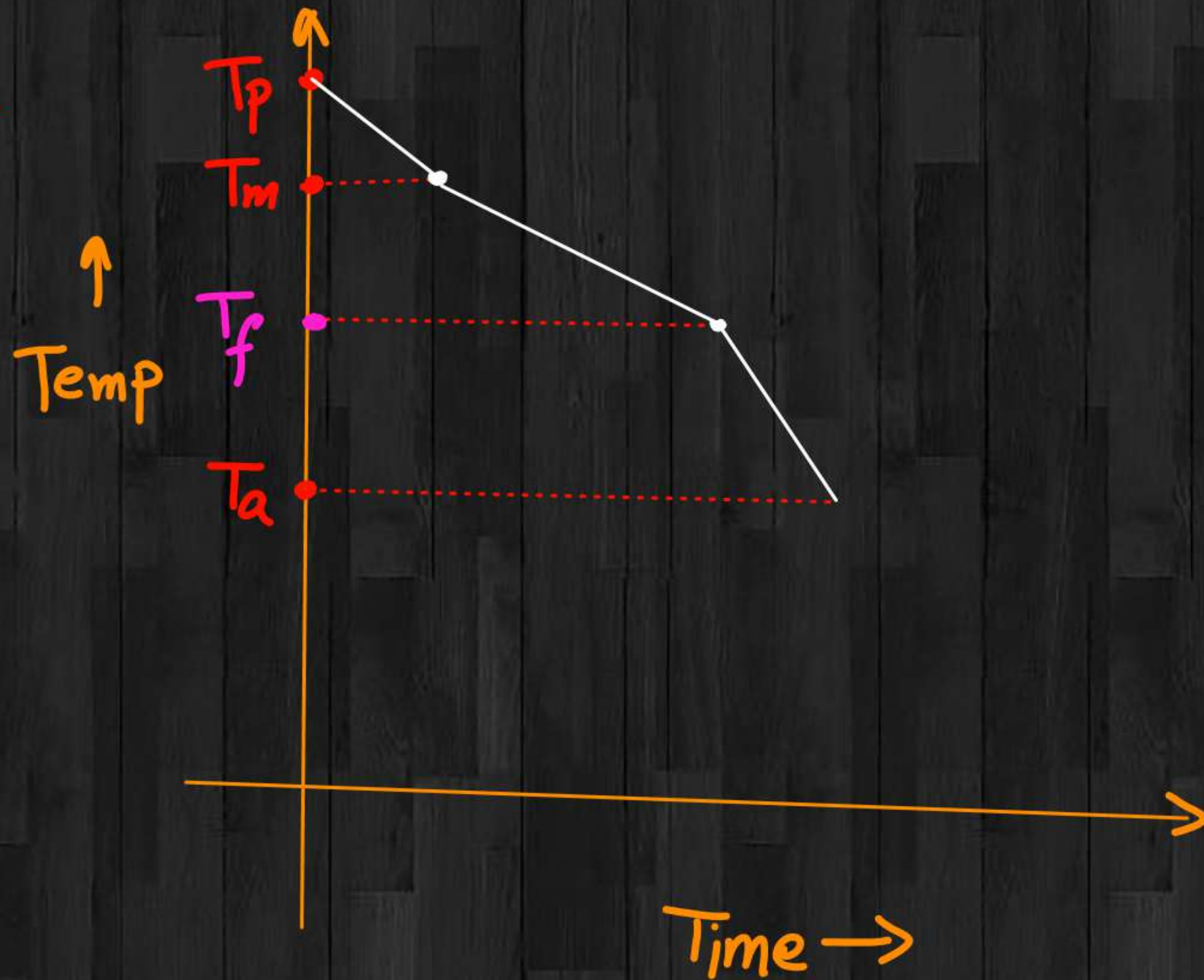
* AB → Liquid Shrinkage ($T_p \rightarrow T_m$)

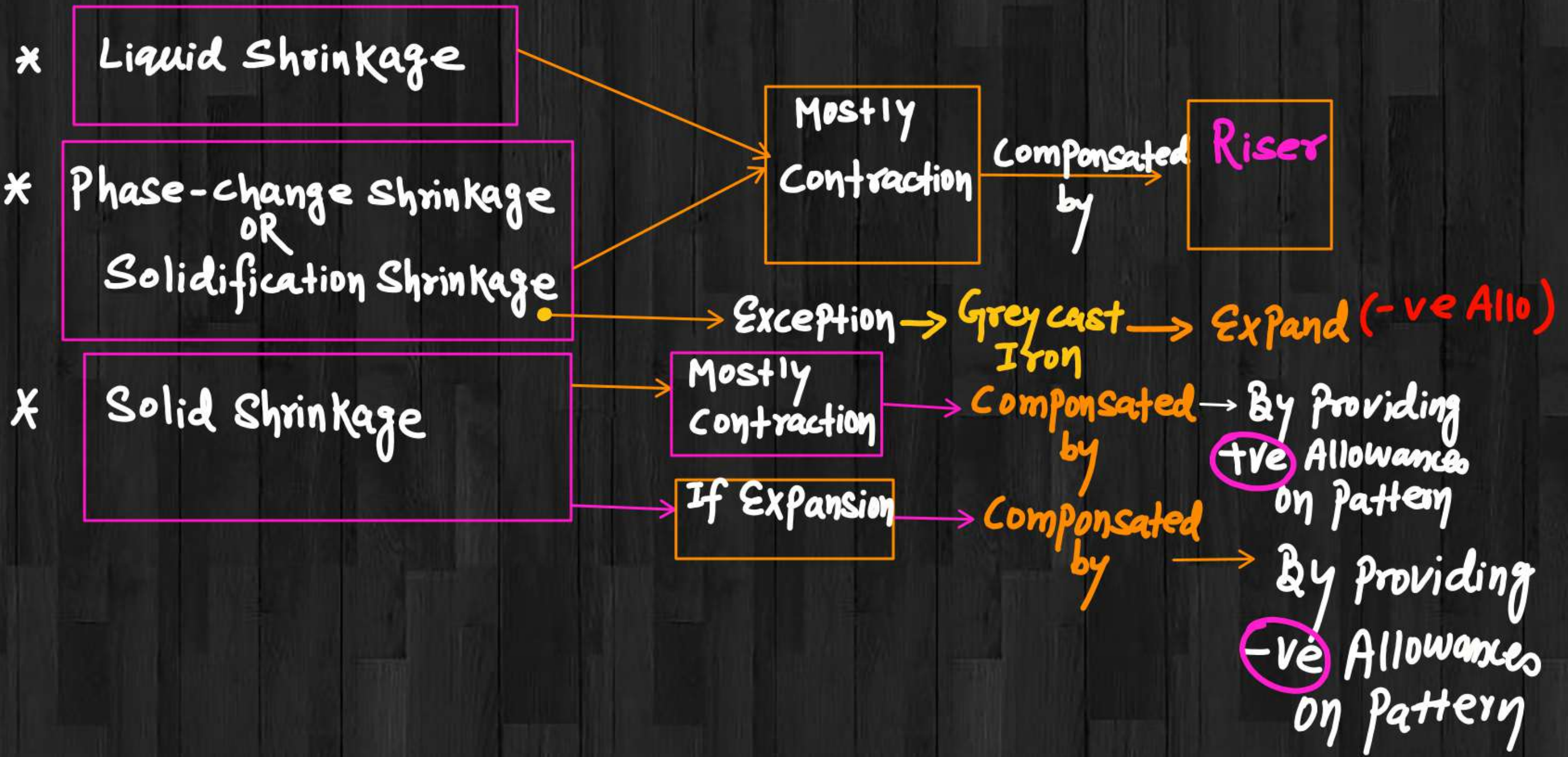
* BC → Phase change
OR ($T_m = T_f$)
Solidification Shrinkage

* CD → Solid Shrinkage ($T_f \rightarrow T_a$)

😊 * cooling curve for "Alloys"

😊 * $T_m > T_f$

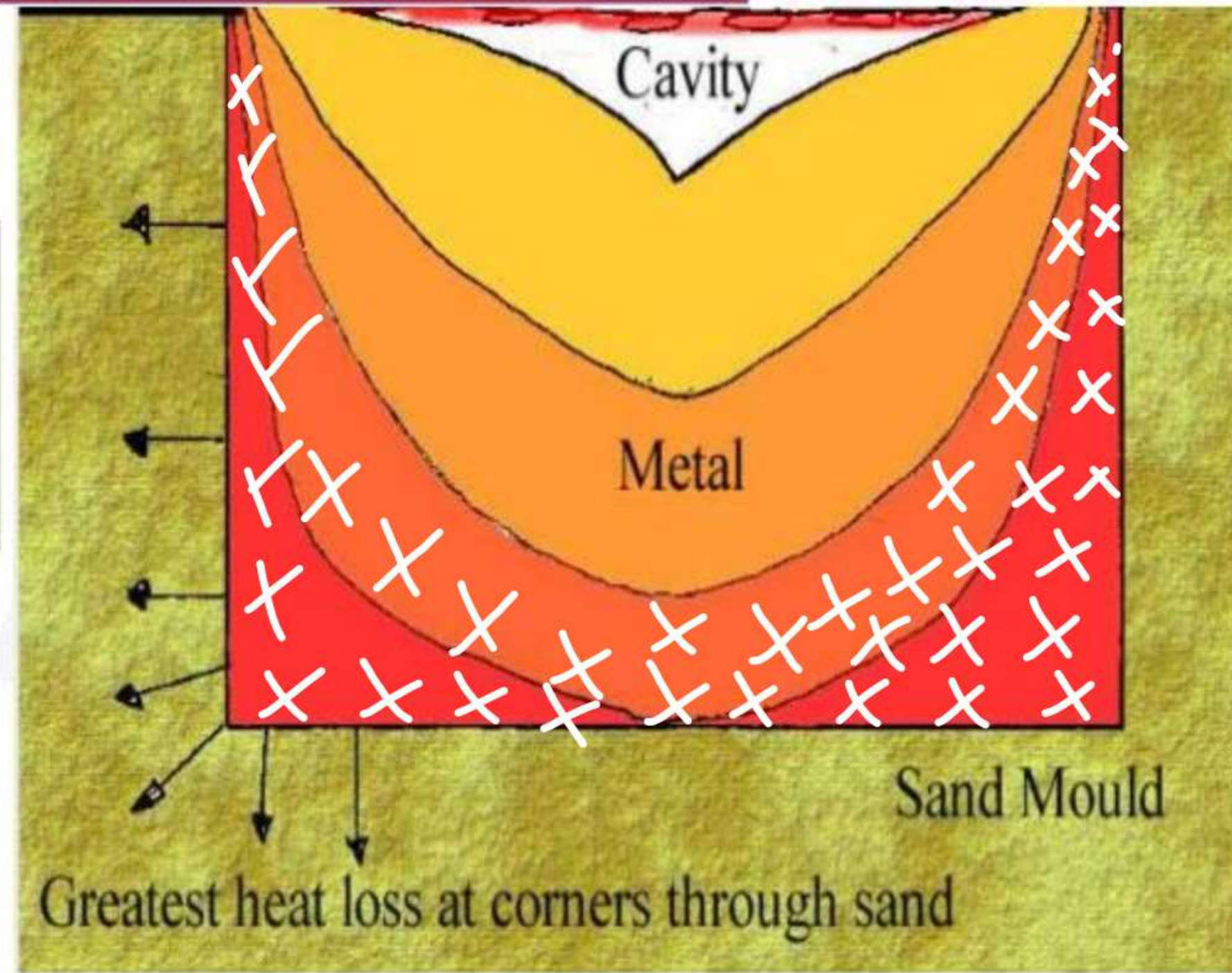
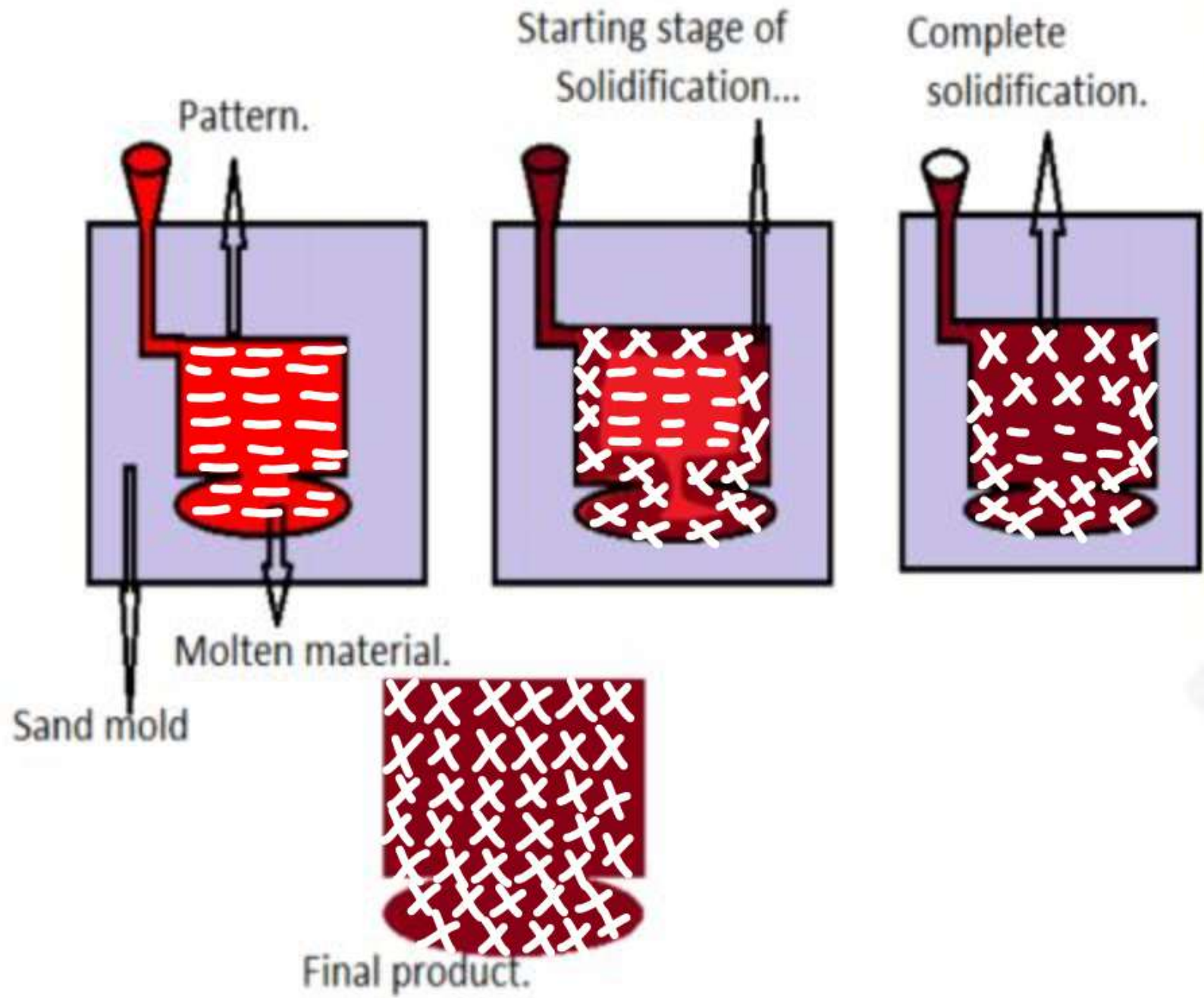


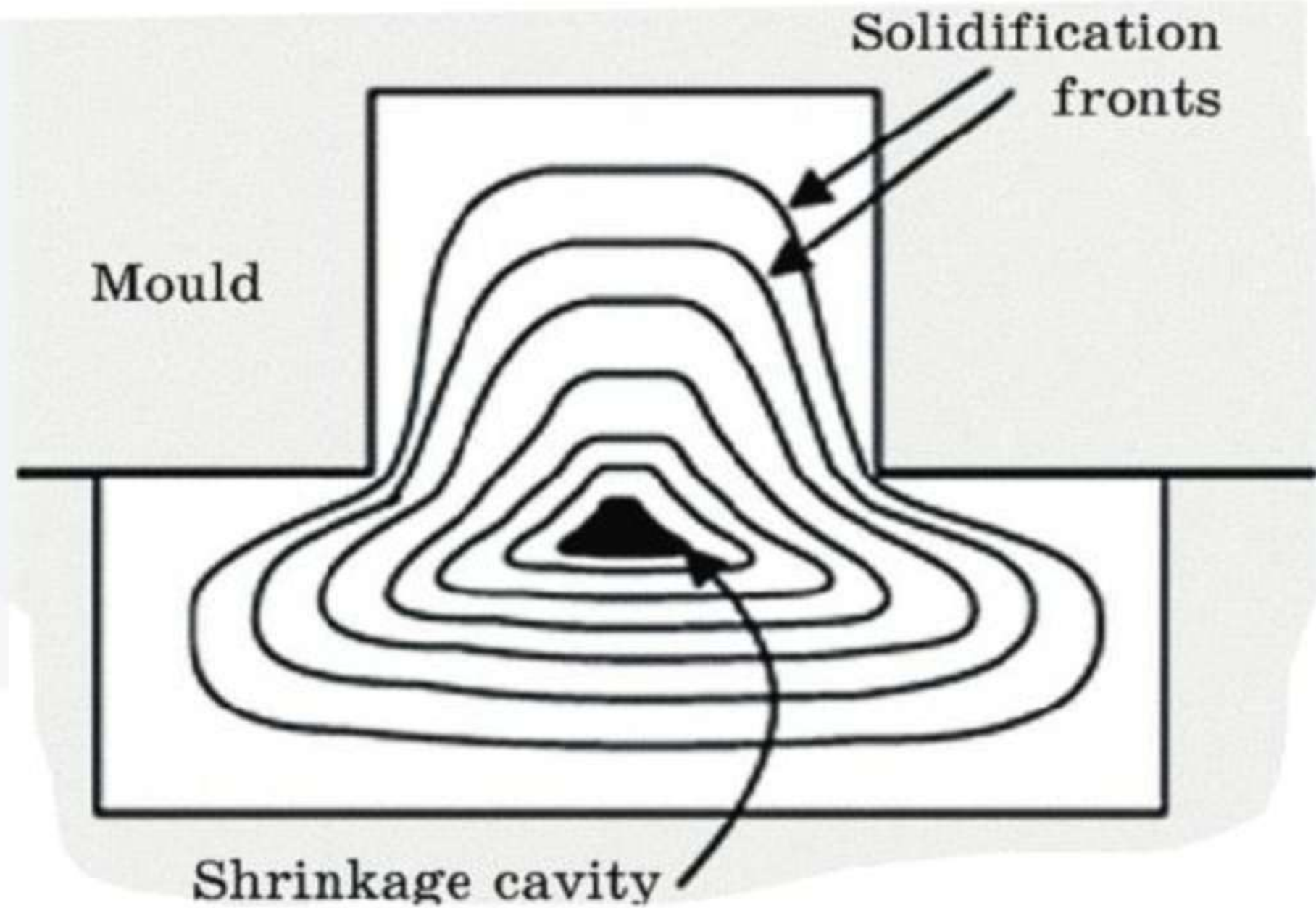




* If contraction \longrightarrow +ve Allowances

* If Expansion \longrightarrow -ve Allowances





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Shrinkage values (Solid Shrinkage) \rightarrow (mm/m)

Bismuth \rightarrow Negligible

White metal \rightarrow 5mm/m

Cast iron \rightarrow 10mm/m

Aluminium \rightarrow 13mm/m

Copper \rightarrow 17mm/m

Steel \rightarrow 20mm/m

Brass \rightarrow 23mm/m

😊 * Brass \rightarrow Max Shrinkage
* Steel \rightarrow Max Total Shrinkage

Q Design a pattern for the casting shown below if it is produced by steel materials by considering shrinkage allowance.

Solution: \rightarrow Steel $\rightarrow 20\text{mm/m}$

* $\therefore 1000\text{ mm} \rightarrow 20\text{ mm}$

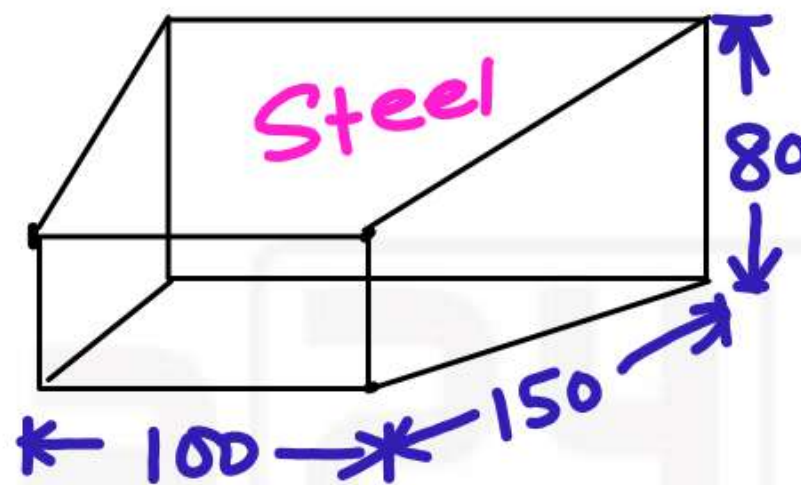
$\therefore 100\text{ mm} \rightarrow \frac{20 \times 100}{1000} = 2\text{ mm}$

* $\therefore 1000\text{ mm} \rightarrow 20\text{ mm}$

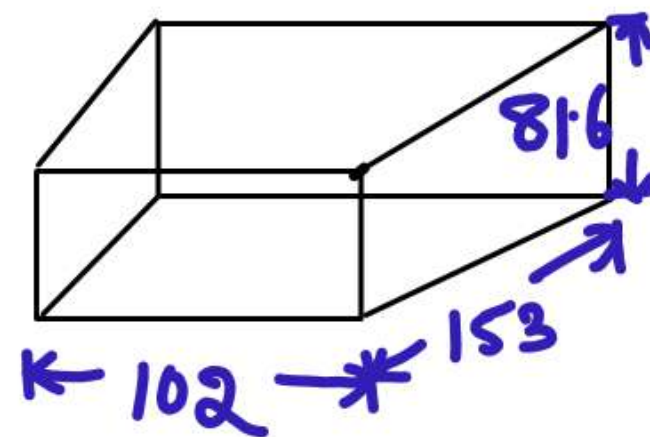
$\therefore 150\text{ mm} \rightarrow \frac{20 \times 150}{1000} = 3\text{ mm}$

* $\therefore 1000\text{ mm} \rightarrow 20\text{ mm}$

$\therefore 80\text{ mm} \rightarrow \frac{20 \times 80}{1000} = 1.6\text{ mm}$



CASTING (Steel)
(100 x 150 x 80 mm)



Pattern
(102 x 153 x 81.6) mm



$$* \frac{\text{Volume of Pattern}}{\text{Volume of casting}} = ?$$

$$* \frac{V_p}{V_c} = \frac{102 \times 153 \times 81.6}{100 \times 150 \times 80}$$

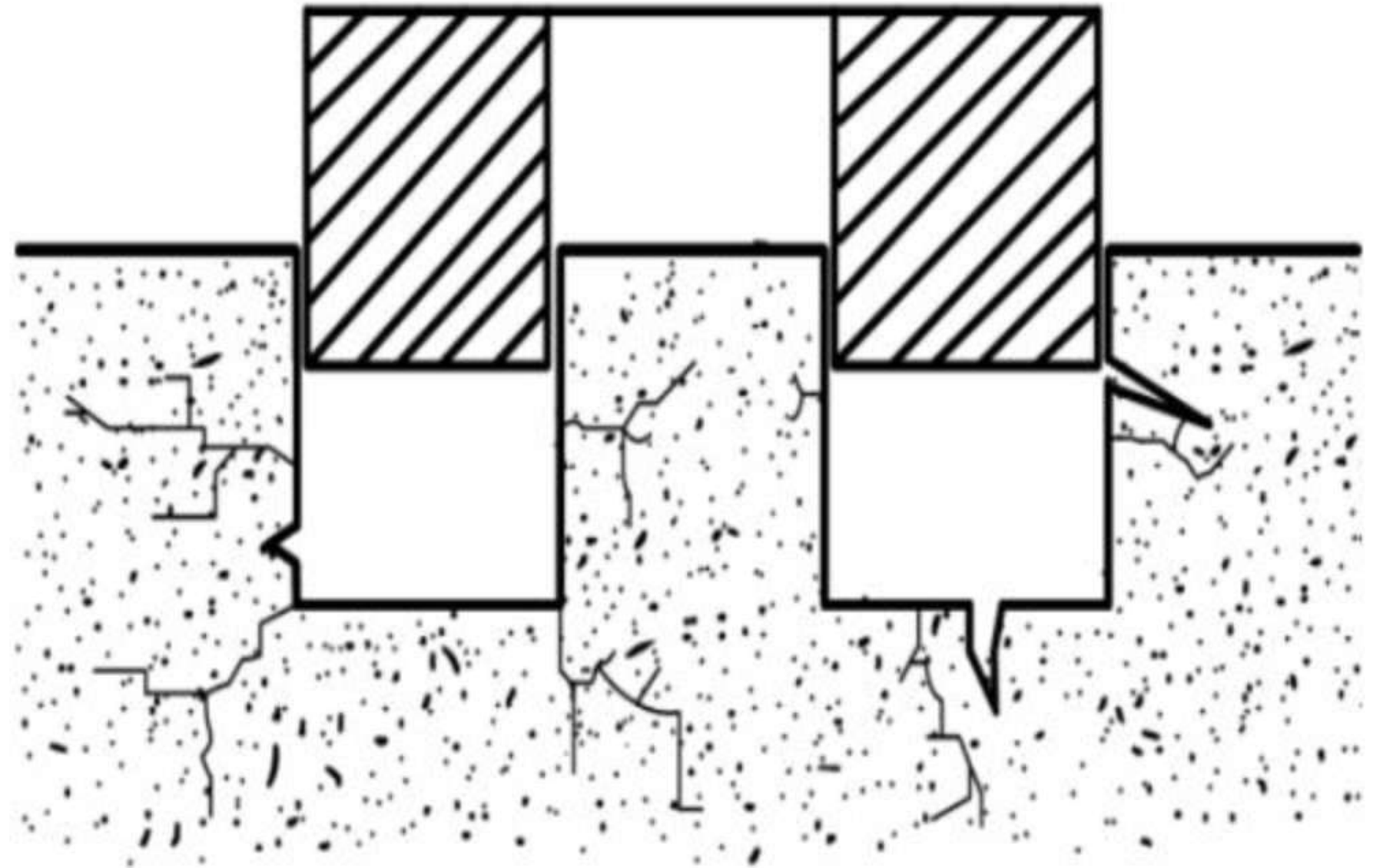
$$* \frac{V_p}{V_c} > 1$$

$$* V_p > V_c$$

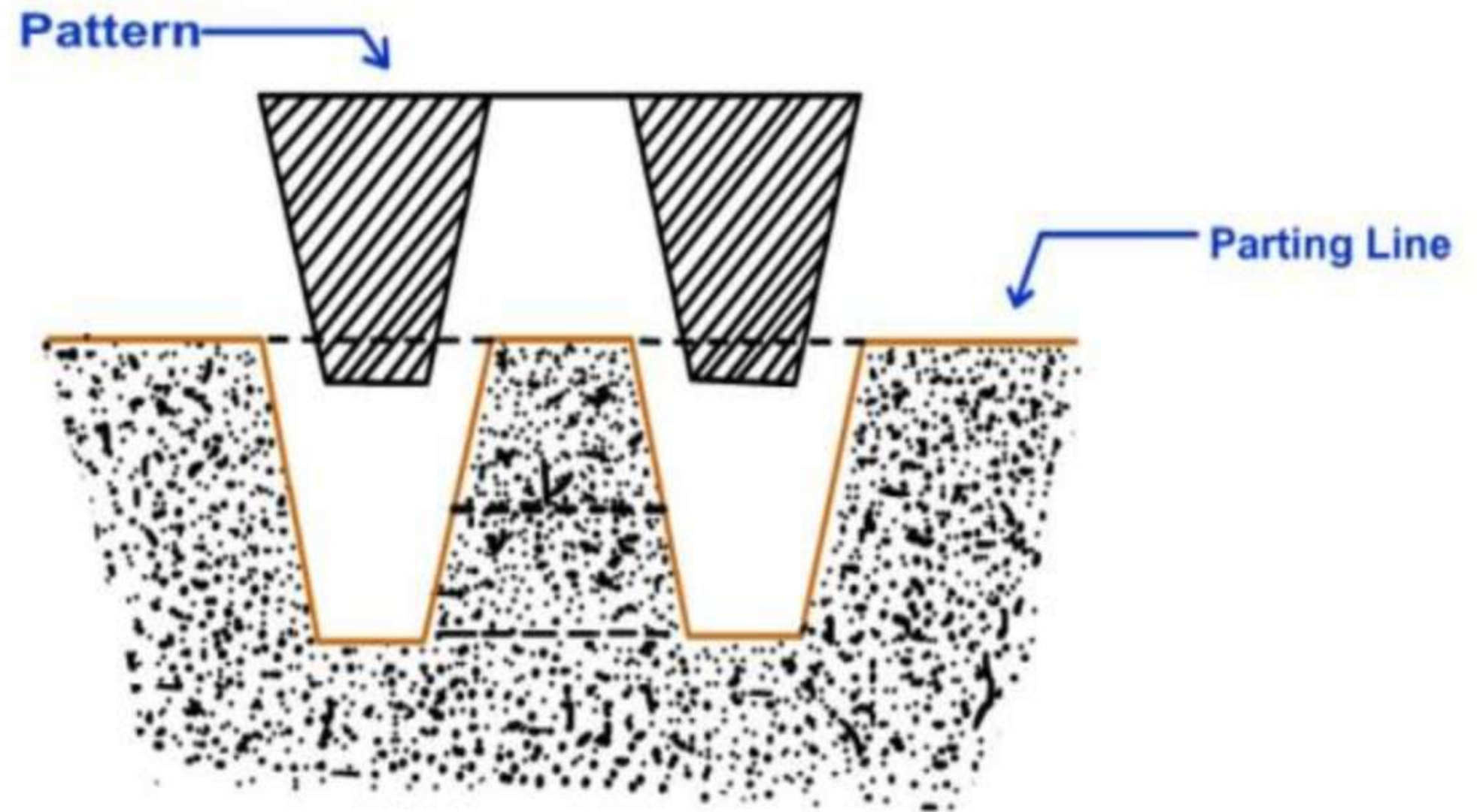
Q H.W

Gray cast iron blocks of size $100 \text{ mm} \times 50 \text{ mm} \times 10 \text{ mm}$ with a central spherical cavity of diameter 4 mm are sand cast. The shrinkage allowance for the pattern is 3% . The ratio of the volume of the pattern to volume of the casting is

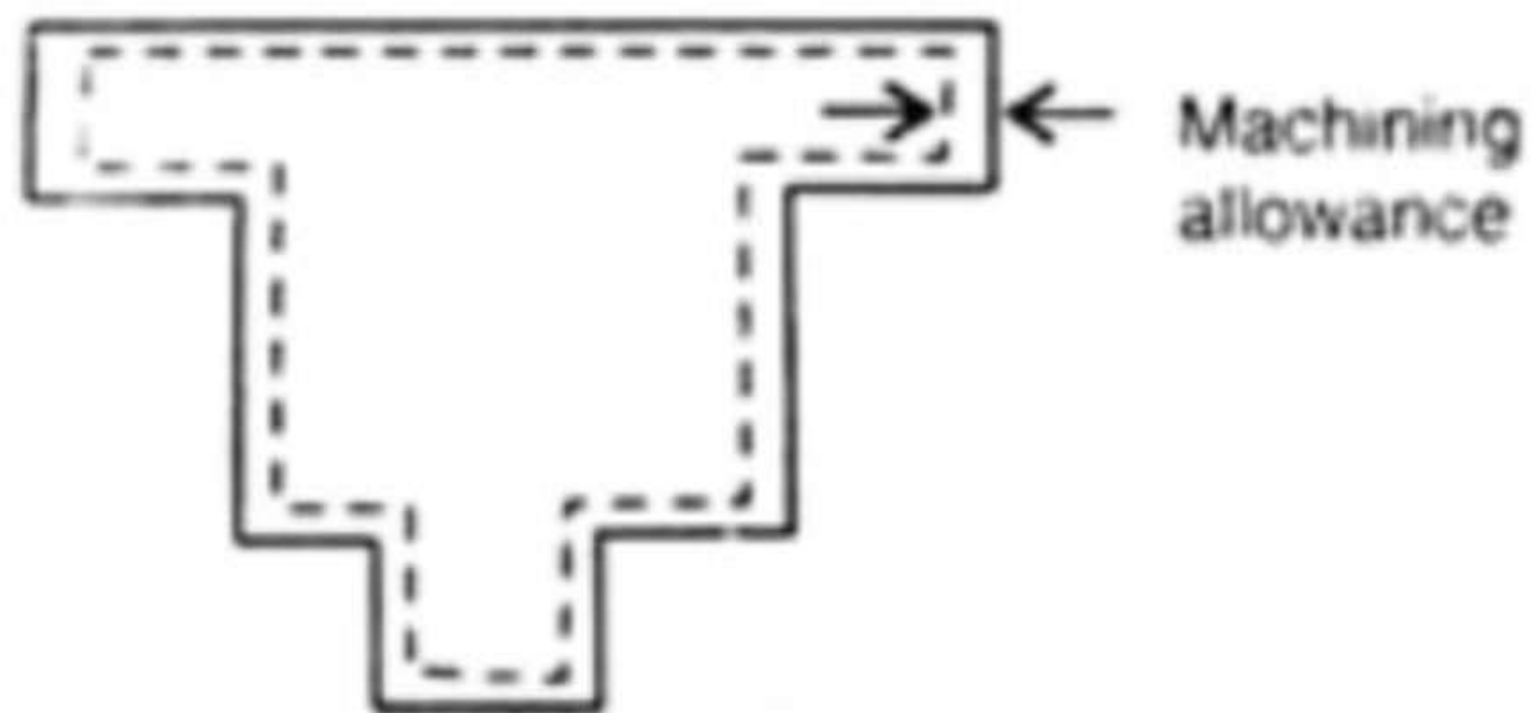
Draft or Taper Allowances



Ad



Machining or Finish Allowance



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Calculate dimensions of the pattern for the casting shown below by considering machining allowances of 1mm on surface

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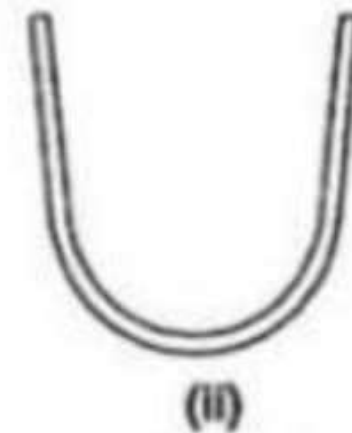
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Shake or Rapping Allowances

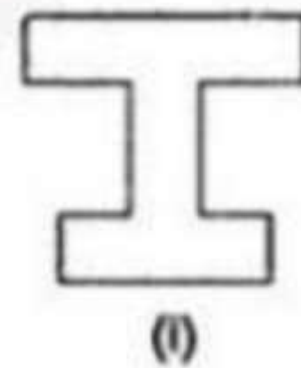
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Distortion or camber Allowances



(a) U-shaped Casting

- (i) Required shape of casting
- (ii) Casting produced with **distortion**
- (iii) Pattern provided with Camber **allowance**



(b) I-section Casting

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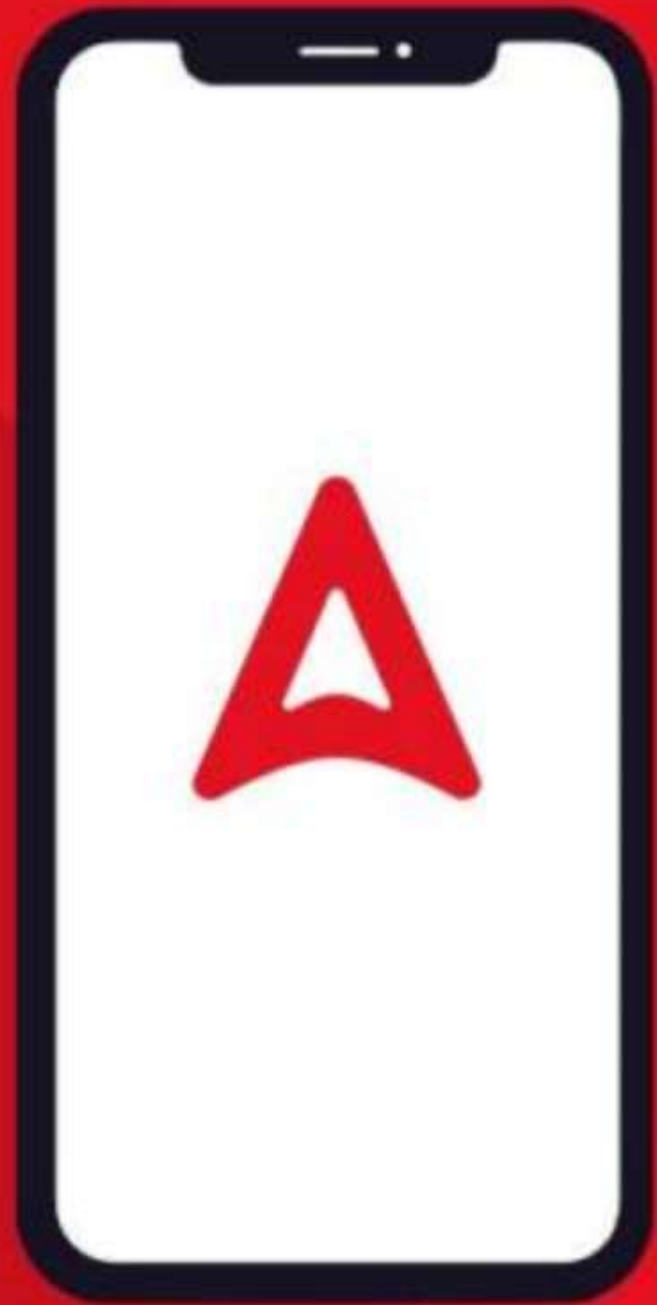
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Types of pattern

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