Chapter 5: Plastic Technology

Repeated Questions:

1. Injection Moulding:

- **Q.** Explain the Injection moulding process with its principle, advantages, limitations, and applications. **(SUMMER 2022, 7 Marks; WINTER 2022, 4 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks)**

Answer:

- **Principle:** Injection moulding is a cyclic process in which molten thermoplastic is injected under pressure into a closed mould cavity, where it cools and solidifies to form the desired part.

Process Steps:

- **Clamping:** Mould halves are closed and clamped.
- **Injection:** Molten plastic (heated in barrel) is injected into the mould cavity through a nozzle.
- **Cooling:** Plastic solidifies in the mould under pressure.
- **Ejection:** Mould opens; ejector pins push out the solidified part.
- **Repeat:** Cycle repeats for mass production.

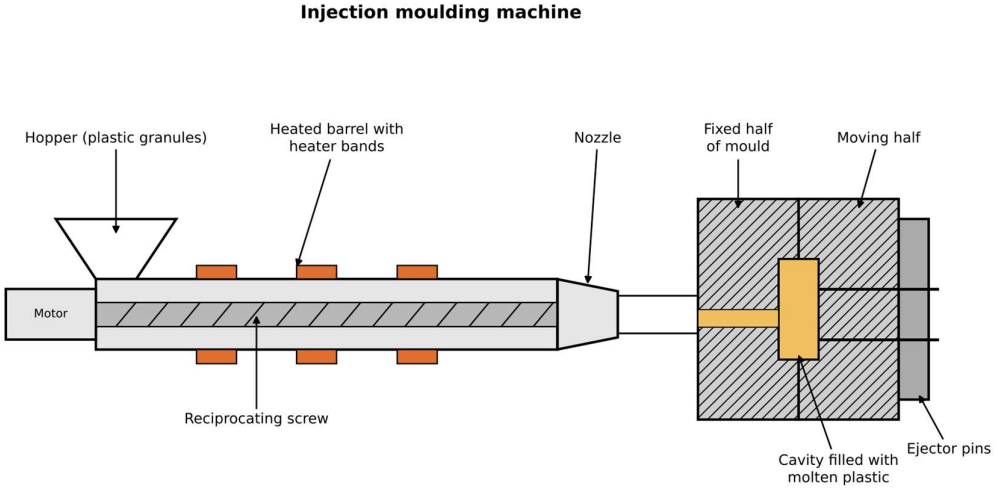
Advantages:

- High production rate; complex shapes with good dimensional accuracy.
- Excellent surface finish; minimal finishing required.
- Suitable for mass production of identical parts.

Limitations:

- High initial mould cost; not economical for small batches.
- Limited to thermoplastics (and some thermosets with special equipment).
- Thick sections may have shrinkage voids.
- **Applications:** Plastic buckets, bottles, automotive parts, housings, toys, medical devices.

Diagram Description: An injection moulding machine with hopper, heated barrel, reciprocating screw, nozzle, and closed mould; molten plastic fills cavity; ejector pins shown for part removal.



2. Thermoplastics and Thermosetting Plastics:

- **Q.** Differentiate between Thermoplastics and Thermosetting plastics. **(SUMMER 2023, 3 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 3 Marks)**

Answer:

Feature	Thermoplastics	Thermosetting Plastics
Behaviour on Heating	Soften and melt; can be remoulded repeatedly	Harden permanently; cannot be remoulded
Structure	Linear or branched polymer chains	Cross-linked three-dimensional network
Examples	PE, PP, PVC, PS, ABS	Epoxy, phenolic, melamine, polyester
Applications	Bottles, containers, pipes	Electrical insulators, adhesives, laminates

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3. Blow Moulding:

- **Q.** Explain the Blow moulding process. **(WINTER 2022, 7 Marks; WINTER 2024, 7 Marks)**

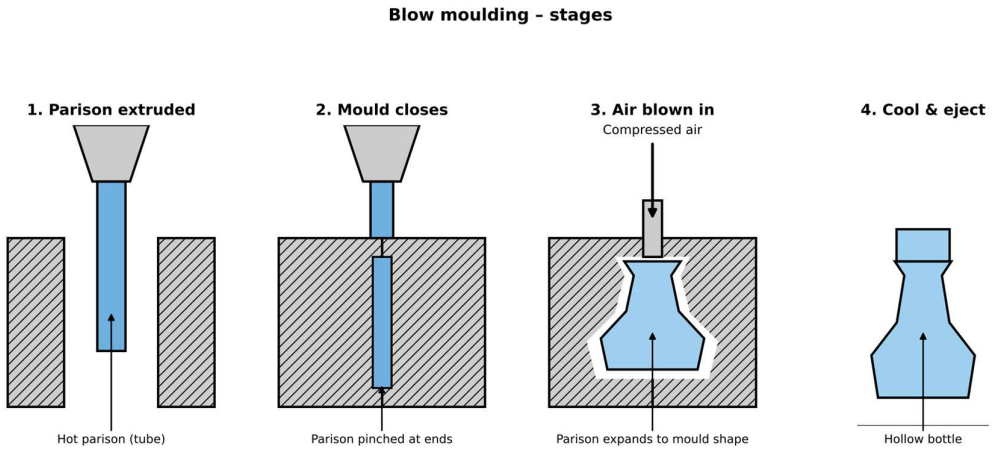
Answer:

- **Principle:** Blow moulding is used to produce hollow plastic articles by inflating a heated plastic parison (tube) inside a mould cavity.

Process Steps:

- **Parison Formation:** A heated plastic tube (parison) is extruded or injection moulded.
- **Mould Closing:** The parison is placed between two mould halves, which close around it.
- **Blowing:** Compressed air is blown into the parison, expanding it against the mould walls.
- **Cooling:** Plastic cools and solidifies in the mould shape.
- **Ejection:** Mould opens; hollow part is ejected.
- **Types:** Extrusion blow moulding, Injection blow moulding, Stretch blow moulding.
- **Advantages:** Produces seamless hollow parts; low tooling cost; high production rate.
- **Limitations:** Limited to hollow shapes; wall thickness control is difficult.
- **Applications:** Plastic bottles, containers, jars, drums, toys.

Diagram Description: Extruded parison hanging between open mould halves; mould closes; air nozzle blows air to expand parison against mould walls; cooled bottle ejected.



4. Properties of Plastics:

- **Q.** Discuss the general properties of plastics. **(WINTER 2022, 3 Marks; SUMMER 2024, 3 Marks; WINTER 2025, 3 Marks OR)**

Answer:

General Properties of Plastics:

- **Lightweight:** Low density compared to metals; good strength-to-weight ratio.
- **Corrosion Resistance:** Resist chemicals, moisture, and atmospheric attack.
- **Electrical Insulation:** Excellent dielectric properties; used in electrical components.
- **Formability:** Easy to shape by moulding, extrusion, and forming; low processing temperature.
- **Low Thermal Conductivity:** Good insulation; used in handles and housings.
- **Limitations:** Low heat resistance, creep under load, and environmental degradation.

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5. Calendering:

- **Q.** Explain the calendering process. **(SUMMER 2022, 4 Marks; SUMMER 2025, 4 Marks)**

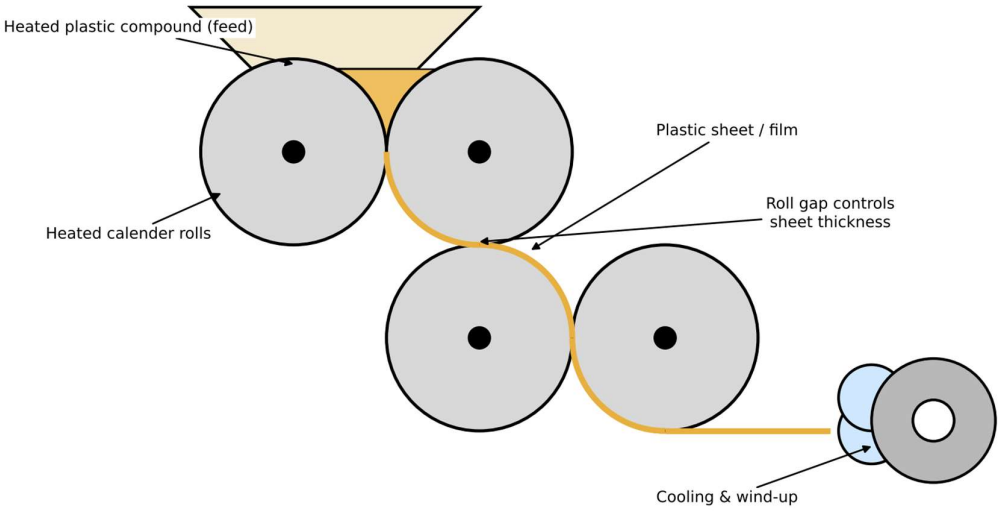
Answer:

Calendering Process:

- Continuous process for producing thin sheets/films of thermoplastic by passing heated plastic through a series of rolls.
- **Steps:** Plastic compound is heated and fed between rolls; rolls compress and flatten into sheet; thickness controlled by roll gap; sheet cooled and wound.
- **Materials:** PVC, PE, rubber compounds.
- **Products:** Plastic sheets, films, floor coverings, artificial leather.
- **Advantages:** High production rate, uniform thickness, good surface finish.

Diagram Description: Series of horizontal rolls with plastic sheet passing through; heated rolls reduce thickness; cooling rollers and winding drum shown.

Calendering process



Other Important Questions:

1. Plastic Processing Methods:

- **Q.** Name the processes used for making: Plastic bottles, buckets, etc. **(SUMMER 2023, 3 Marks)**

Answer:

Processes:

- **Plastic bottles:** Blow moulding (extrusion, injection, or stretch blow moulding).
- **Buckets:** Injection moulding.
- **Plastic pipes:** Extrusion.
- **Plastic sheets/films:** Calendering or extrusion.
- **Plastic toys:** Injection moulding.
- **Plastic containers:** Thermoforming or blow moulding.

- **Q.** Describe the thermoforming process. What are its applications? **(SUMMER 2023, 7 Marks)**

Answer:

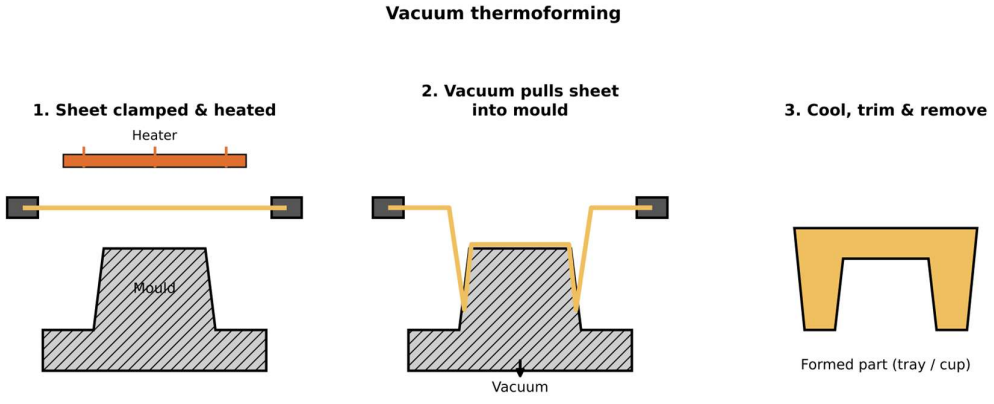
Thermoforming Process:

- A thermoplastic sheet is heated to its softening point and then formed into a desired shape using vacuum, pressure, or mechanical force against a mould.

Steps:

- **Heating:** Plastic sheet is heated (e.g., infrared heaters) until soft.
- **Forming:** Soft sheet is drawn over/into a mould by vacuum, air pressure, or plug assist.
- **Cooling:** Sheet cools and retains mould shape.
- **Trimming:** Excess material is trimmed; part removed.
- **Types:** Vacuum forming, pressure forming, plug-assist forming, drape forming.
- **Advantages:** Low tooling cost; suitable for large parts; fast cycle.
- **Limitations:** Limited to thin sheets; not for complex undercuts; trimming required.
- **Applications:** Packaging trays, disposable cups, refrigerator liners, automotive interior panels, signs.

Diagram Description: Heated plastic sheet clamped over a mould; vacuum applied through mould to draw sheet against cavity; cooled part removed.



- **Q.** Distinguish between thermoforming and extrusion process for plastics. **(SUMMER 2022, 7 Marks)**

Answer:

Feature	Thermoforming	Extrusion
Process Type	Forming heated sheet into shape	Continuous shaping by forcing molten plastic through a die
Product Shape	Hollow/open shapes from sheet	Continuous lengths (pipes, rods, films)
Material State	Sheet heated to softening	Molten plastic
Tooling Cost	Low (moulds inexpensive)	Moderate to high (dies)
Applications	Packaging trays, cups, panels	Pipes, profiles, films, wire insulation

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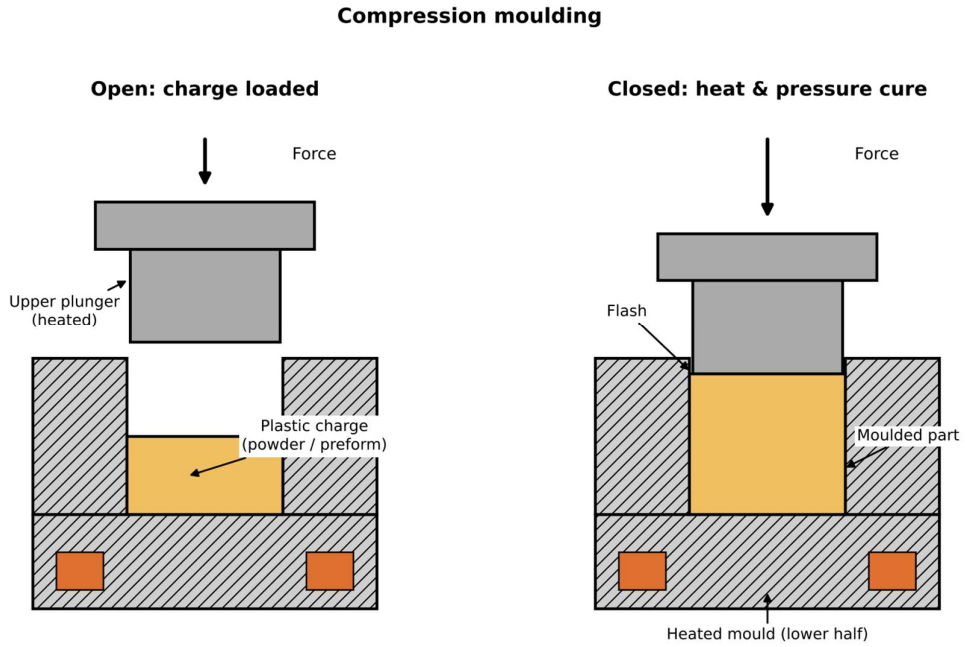
- **Q.** Write short note on compression molding. **(WINTER 2025, 4 Marks)**

Answer:

Compression Moulding:

- A thermosetting plastic (e.g., phenolic, melamine) is placed in a heated mould cavity; the mould is closed under pressure; heat and pressure cure the plastic into shape.
- **Steps:** Charge placed in lower mould; upper mould closes; heat and pressure applied; curing; part ejected.
- **Advantages:** Simple, low cost, suitable for large parts; good for thermosets.
- **Limitations:** Slow cycle; limited to thermosets; flash may require trimming.
- **Applications:** Electrical switches, handles, dinnerware, automotive parts.

Diagram Description: Two-part heated mould with plastic charge in cavity; upper mould descends under pressure; cured part removed.



- **Q.** List various plastic molding methods. Explain any one in brief. **(SUMMER 2026, 3 Marks)**

Answer:

Plastic Moulding Methods:

- Injection moulding
- Blow moulding
- Compression moulding
- Transfer moulding
- Extrusion
- Thermoforming
- Rotational moulding
- Calendering

Brief Explanation – Injection Moulding:

- Molten thermoplastic is injected under pressure into a closed mould cavity; part cools and is ejected. Used for mass production of complex parts (buckets, housings).

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2. Physical Properties of Plastics:

- **Q.** Elaborate on various physical properties of plastic. **(SUMMER 2026, 3 Marks)**

Answer:

Physical Properties of Plastics:

- **Density:** Low (0.9–2.2 g/cm³); lightweight.
- **Thermal Properties:** Low thermal conductivity; high thermal expansion; limited heat resistance.
- **Electrical Properties:** Excellent insulation; low dielectric constant.
- **Optical Properties:** Can be transparent, translucent, or opaque.
- **Moisture Absorption:** Generally low; some plastics (nylon) absorb moisture.
- **Mechanical Properties:** Vary widely; can be flexible or rigid, brittle or tough.
