Q1 (b) Use of Cupola Furnace

A cupola furnace is used to melt cast iron for casting. It provides continuous melting and is widely used in foundries.

Q1 (c) Name any 2 manufacturing processes

- Casting
- Welding

Q1 (d) Differentiate Conventional and CNC Lathe Machine

Conventional Lathe: Operated manually. Less precise. Slower

CNC Lathe: Controlled by computer program. High accuracy and repeatability. Faster

Q1 (e) What is the full form of NC machine

NC stands for Numerical Control machine.

Q1 (f) Name any 5 equipments/tools used in casting process

- Moulding box
- Pattern
- Riser
- Sprue
- Trowel

Q1 (g) Name any 4 operations which can be performed on conventional lathe machine

- Turning
- Facing
- Drilling
- Knurling

Q1 (h) Plant Layout

Plant layout is the arrangement of machines, equipment, and other resources in a factory for smooth and efficient workflow.

Q1 (i) Name any 5 pattern materials

- Wood
- Metal
- Plastic
- Wax
- Plaster of Paris

Q1 (j) Welding

Welding is a fabrication process where two or more parts are fused together by heat, pressure, or both to form a joint.

Q1 (k) Name any 5 casting defects

- Blow holes
- Shrinkage
- Cold shut
- Misrun
- Porosity

Q1 (l) Name any 5 welding defects

- Cracks
- Porosity
- Undercut
- Lack of fusion
- Slag inclusion

Q1 (m) Which material is used for glass cutting

Diamond or tungsten carbide is used for glass cutting.

Q1 (n) Rolling Process

Rolling is a metal forming process in which metal is passed through rollers to reduce its thickness.

Q1 (o) Wire Drawing Process

Wire drawing is a process of reducing the diameter of a wire by pulling it through a series of dies.

Q.2 Explain the concept of plant layout along with its advantages and applications.

Plant Layout refers to the physical arrangement of industrial facilities like machinery, equipment, work areas, and service departments within a manufacturing plant.

Types of Plant Layouts:

- Product Layout – Machines are arranged in a line according to the production sequence.
- Process Layout – Machines are grouped by function (e.g., all drilling machines together).
- Fixed-Position Layout – Product remains stationary, and workers/machines come to it (used in ship or aircraft manufacturing).
- Cellular Layout – Groups different machines to produce a family of products.
- Combination Layout – Mix of above types.

Advantages:

- Better productivity and workflow.
- Efficient material handling.
- Reduces production cost and time.
- Easier supervision and maintenance.
- Minimizes material movement and delays.

Applications:

Found in all manufacturing industries like automobile plants, electronics factories, textile industries, etc.

Q.3 Explain the various carpentry tools and their uses.

Carpentry tools are used in wood-based manufacturing and construction.

1. Measuring Tools:
   - Steel Rule – Used for linear measurements.
   - Try Square – Checks right angles.
2. Marking Tools:
   - Marking Gauge – Draws lines parallel to the wood edge.
   - Pencil/Chalk – Basic marking.
3. Cutting Tools:
   - Hand Saw – Cuts wood along the grain.
   - Tenon Saw – For fine, accurate cuts.
4. Shaping Tools:
   - Chisels – Removes small amounts of wood.
   - Planes – Smoothens the wood surface.
5. Holding Tools:
   - Clamps – Holds workpieces during cutting or gluing.
   - Vice – Fixed to the bench to hold wood firmly.
6. Boring Tools:
   - Drill Bit & Brace – For making holes in wood.

Q.4 Discuss the classification of metals and fitting tools.

Classification of Metals:

- Ferrous Metals – Contain iron:

Cast Iron

Mild Steel

High Carbon Steel

Non-Ferrous Metals – No iron content:

Aluminum

Copper

Brass

Zinc

Alloys – Mixture of metals:

Bronze (Copper + Tin)

Brass (Copper + Zinc)

Steel (Iron + Carbon)

Fitting Tools and Their Uses:

Bench Vice – Holds work firmly during fitting.

Files – Removes material and smoothens surface.

Hacksaw – Cuts metal rods and pipes.

Chisels – Removes excess metal.

Calipers – Measures dimensions of workpiece.

Surface Plate – Provides reference flat surface.

Scribers – For marking layout lines.

Q.5 Explain the principle of electric arc welding.

Electric Arc Welding is a fusion welding process where an electric arc is generated between an electrode and the workpiece to melt and join metals.
Principle:

When current passes through air gap between electrode and workpiece, an arc is formed.

The arc's temperature (~3500°C) melts base and filler metal.

Upon cooling, metals fuse to form a strong joint.

Key Components:

Power Source (AC or DC)

Electrode Holder

Ground Clamp

Protective Shielding (slag or gas)

Types:

Shielded Metal Arc Welding (SMAW)

Gas Metal Arc Welding (MIG)

Gas Tungsten Arc Welding (TIG)

Q.6 Discuss various welding defects with neat and clean diagram.
Common Welding Defects:

Porosity – Gas pockets trapped in weld metal.

Cracks – Can occur during or after welding; very dangerous.

Incomplete Penetration – Weld doesn’t reach the root of joint.

Lack of Fusion – Inadequate fusion between base and filler metal.

Undercut – Base metal melts away, leaving groove at toe.

Slag Inclusion – Non-metallic particles trapped in weld.

[In exam: Draw simple diagrams of each defect – cross-section of weld bead, clearly labeling each issue.]

Q.7 Discuss the different types of machine tools used in manufacturing processes.
1. Lathe Machine:

Used for turning, facing, drilling, threading.

Rotates workpiece against cutting tool.

2. Milling Machine:

Rotating cutter removes material.

Used for flat, irregular, and contoured surfaces.

3. Drilling Machine:

Makes round holes using drill bits.

Can also perform reaming, tapping.

4. Grinding Machine:

Finishing tool that provides smooth surface finish.

Used for precise machining.

5. Shaper Machine:

Straight-line reciprocating tool movement.

Cuts flat surfaces.

6. CNC Machines:

Controlled by computer program.

High precision and repeatability.

Q.8 Explain Oxy-Acetylene Gas welding in detail.

Oxy-Acetylene Welding uses a flame from burning oxygen and acetylene to melt and join metals.
Working Principle:

Oxygen and acetylene gases are mixed in a welding torch.

Flame temperature reaches around 3200°C.

Suitable for steel, aluminum, and copper.

Equipment:

Oxygen cylinder (black)

Acetylene cylinder (maroon)

Pressure regulators

Welding torch

Hose pipes

Goggles and gloves

Types of Flame:

Neutral Flame (1:1) – Balanced flame, most used.

Carburizing Flame – Excess acetylene.

Oxidizing Flame – Excess oxygen.

Q.9 Differentiate hot working and cold working process.

Hot Working	Cold Working
Performed above recrystallization temp	Done below recrystallization temp
Metal is softer, easy to deform	Metal is hard, more force required
No strain hardening occurs	Strain hardening improves strength
Better ductility and grain structure	Higher surface finish and accuracy
Examples: Rolling, Forging	Examples: Drawing, Bending, Stamping

Q.10 Explain Cupola furnace with neat sketch.
Definition:

A cupola furnace is a vertical shaft furnace used to melt cast iron and sometimes bronze. It’s widely used in foundries for continuous melting.
Construction:

Shell: Cylindrical steel body lined with refractory bricks.

Charging Door: At the top, used to charge raw materials.

Tuyeres: Small holes near the bottom for air blast (from blower).

Slag Hole: Removes non-metallic impurities.

Tap Hole: Removes molten metal.

Drop Bottom Door: Opens to remove leftover coke after shutdown.

Working:

Charging: Alternate layers of coke, metal (pig iron/scrap), and flux (limestone) are charged from the top.

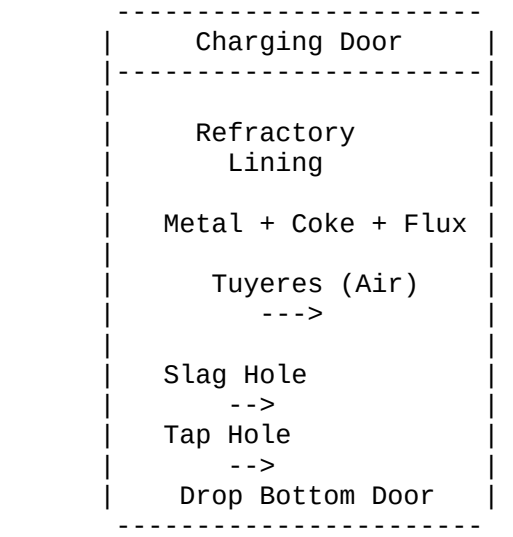
Ignition: Coke is ignited, and air blast through tuyeres increases temperature (up to 1600°C).

Melting: Metal melts, impurities rise as slag.

Tapping: Molten metal is tapped from the bottom for casting.

Slag Removal: Slag is removed from slag hole periodically.

Neat Sketch (to draw in exam):



Advantages:

Continuous melting

High productivity

Simple construction

Applications:

Melting cast iron in foundries

Used in mass production of cast products

Q.11 Discuss various sheet metal operations with help of sketches.

Sheet metal operations involve cutting, forming, and joining thin metal sheets.
1. Shearing Operations (Cutting):

Blanking: Cutting a flat shape (blank) from sheet.

Punching: Creating holes in sheet.

Trimming: Removing unwanted edges.

Nibbling: Making complex contours by series of overlapping punches.

2. Bending Operations:

V-Bending: Bending sheet in a V-die.

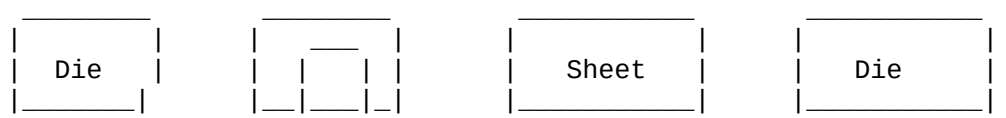
U-Bending: Bending in a U-shape.

Edge Bending: One edge is bent to form a flange.

3. Drawing Operations:

Deep Drawing: Sheet is pulled into a die cavity to form a cup-like shape.

Neat Sketch (to draw in exam):



Applications:

Automobile bodies

Kitchen appliances

Enclosures for electronics

Q.12 Explain the working principle of lathe machine. Also discuss parts of lathe machine with neat sketch.
Working Principle:

A lathe machine works on the principle of rotating the workpiece against a fixed cutting tool to perform operations like turning, facing, knurling, etc.
Main Parts of Lathe Machine:

Bed – Base of machine, supports all parts.

Headstock – Contains motor and spindle.

Tailstock – Supports the other end of long workpieces.

Carriage – Moves the cutting tool.

Chuck – Holds and rotates the workpiece.

Tool Post – Holds cutting tools.

Common Operations:

Turning – Reduces diameter.

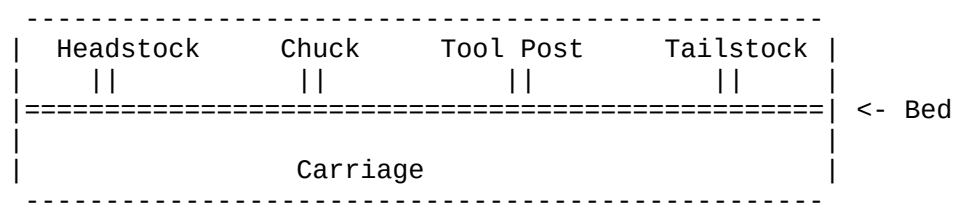
Facing – Creates flat surface at end.

Knurling – Creates patterns on surface.

Drilling – Makes holes using drill bit.

Threading – Makes screw threads.

Neat Sketch (draw this in exam):



Applications:

Machining cylindrical parts

Used in repair shops, tool rooms, and factories

Q.13 Describe the principle of Arc welding. Also explain MIG welding and its application with neat sketch.
Principle of Arc Welding:

Arc welding involves generating heat through an electric arc between electrode and base metal to melt and join them.

Temp: Around 3500°C

Filler Material: Electrode melts to fill joint

Protection: Shielded by slag or inert gas

MIG Welding (Metal Inert Gas Welding):

Also known as GMAW (Gas Metal Arc Welding)

Uses a consumable wire electrode fed continuously.

Shielding gas (like Argon or CO_2) protects weld from air.

Working:

Wire electrode fed automatically.

Arc forms between wire and base metal.

Shielding gas flows through nozzle.

Weld pool forms and solidifies.

Sketch to draw:

Advantages:

- High welding speed
- Clean and strong weld
- Less post-weld cleaning

Applications of MIG Welding:

- Automotive industries
- Fabrication of steel structures
- Home and hobby welding