



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Coimbatore-35

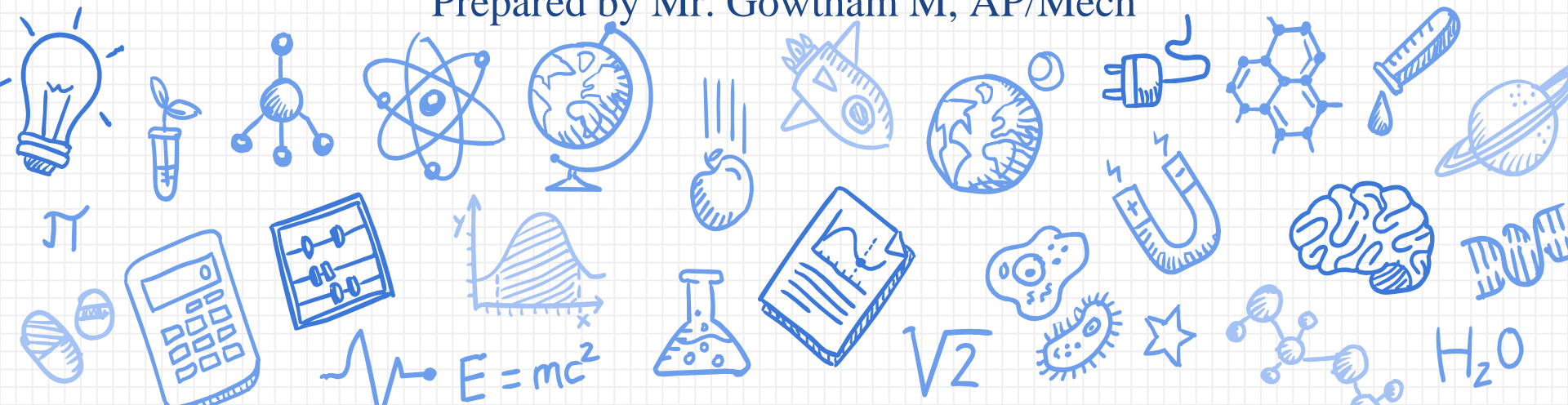


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19MET202 – MANUFACTURING TECHNOLOGY

Prepared by Mr. Gowtham M, AP/Mech



MET, UNIT-2, LESSON-3

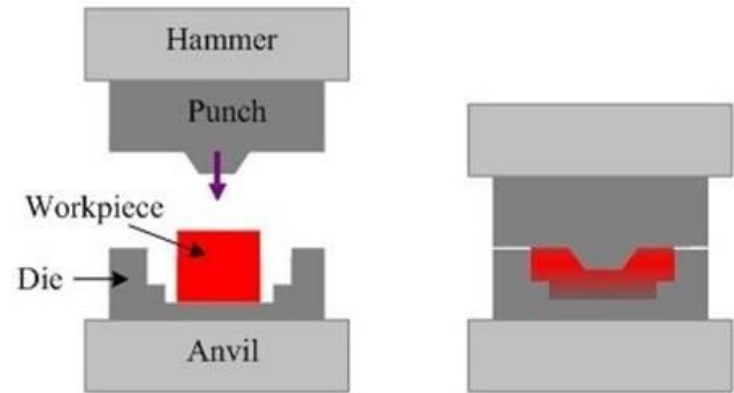
FORGING, TYPES AND OPERATIONS



<https://tinyurl.com/y36s6g2j>

FORGING

- Deformation process in which work is compressed between two dies
- Oldest of the metal forming operations
- –Dates from about 5000 BC
- Products: engine crankshafts, connecting rods, gears, aircraft structural components, jet engine turbine parts



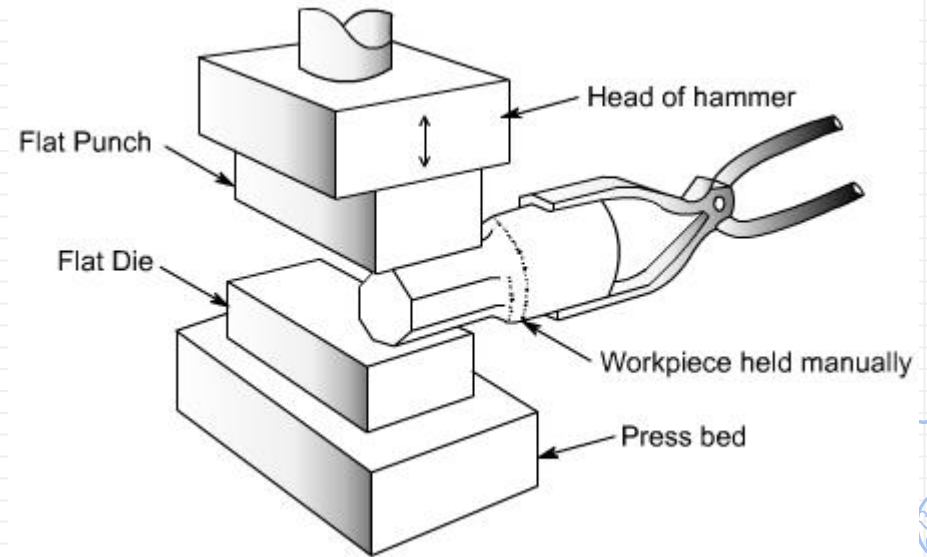
DROP FORGING

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FORGING

Classification of Forging Operations

- Cold vs. hot forging:
- –Hot or warm forging –advantage: reduction in strength and increase in ductility of work metal
- –Cold forging –advantage: increased strength due to strain hardening
- Impact vs. press forging:
- –Forge hammer -applies an impact force
- –Forge press -applies gradual force



<https://tinyurl.com/y4zpcmdz>

FORGING

Types of Forging Operations

- •Open-die forging -work is compressed between two flat dies, allowing metal to flow laterally with minimum constraint
- •Impression-die forging -die contains cavity or impression that is imparted to work part
- –Metal flow is constrained so that flash is created
- •Flash less forging –work part is completely constrained in die
- –No excess flash is created



<https://tinyurl.com/y3qwo5d9>

TYPES OF FORGING

Open-Die Forging

- Compression of work part between two flat dies
- –Deformation operation reduces height and increases diameter or width of work
- –Common names include *upsetting or upset forging*

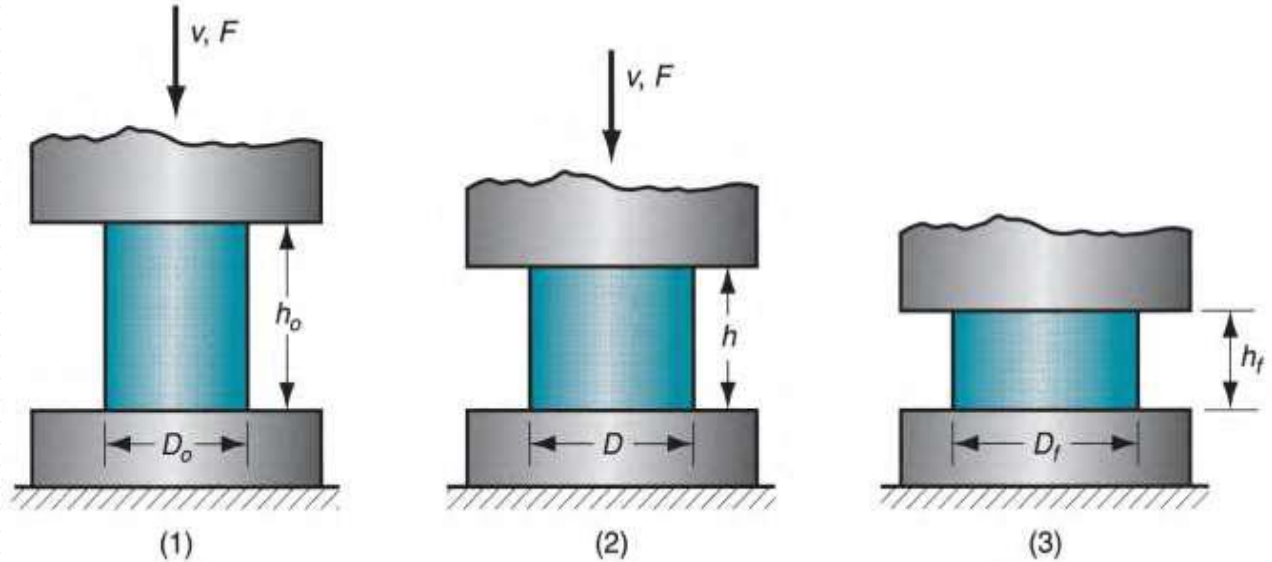
Practically all forgeable ferrous and non-ferrous alloys can be open-die forged, including some exotic materials like age-hardening super alloys and corrosion-resistant refractory alloys.

Larger parts over 100 Tonnes and 30 Meters in length can be hammered or pressed into shape this way.

TYPES OF FORGING

Open-Die Forging

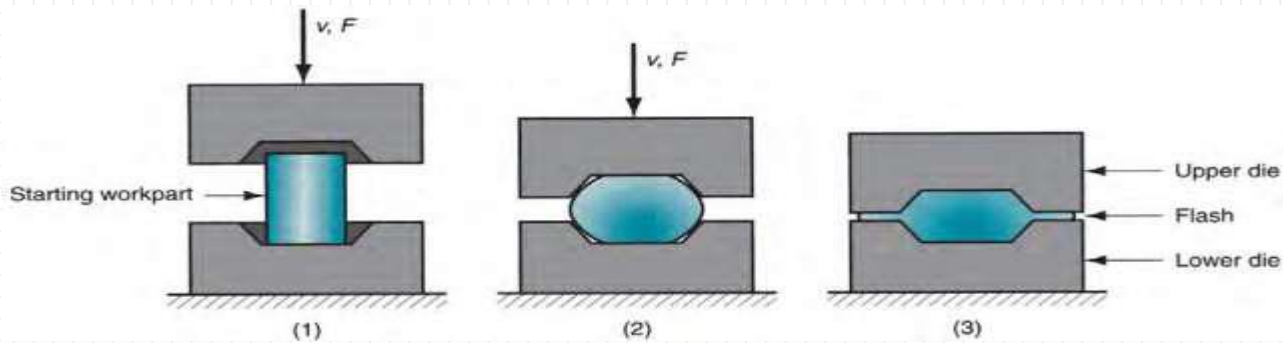
- (1) Start of process with work piece at its original length and diameter,
- (2) partial compression, and
- (3) final size



TYPES OF FORGING

Impression-Die Forging

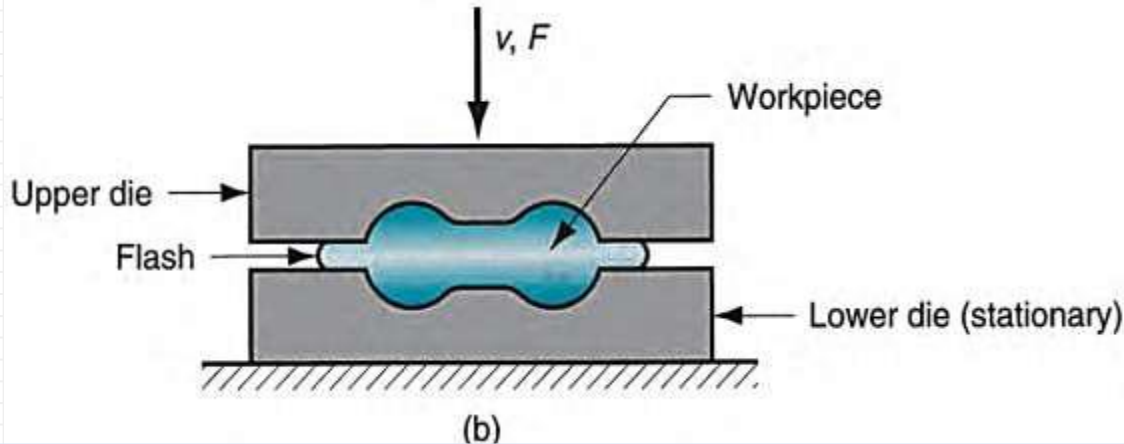
- Compression of work part by dies with inverse of desired part shape
- •Flash is formed by metal that flows beyond die cavity into small gap between die plates
- •Flash must be later trimmed, but it serves an important function during compression:
- –As flash forms, friction resists continued metal flow into gap, constraining metal to fill die cavity



TYPES OF FORGING

Impression-Die Forging Practice

- •Several forming steps are often required
- –With separate die cavities for each step
- •Beginning steps redistribute metal for more uniform deformation and desired metallurgical structure in subsequent steps
- •Final steps bring the part to final geometry



TYPES OF FORGING

Impression-Die Forging:

Most engineering metals and alloys can be forged via conventional impression-die processes, among them:

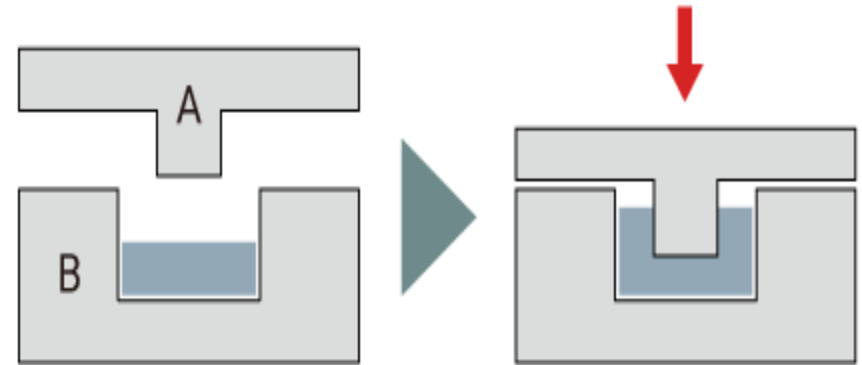
carbon and alloy steels, tool steels, and stainless, aluminum and copper alloys, and certain titanium alloys.

Strain-rate and temperature-sensitive materials (magnesium, highly alloyed nickel-based super alloys, refractory alloys and some titanium alloys) may require more sophisticated forging processes and/or special equipment for forging in impression dies.

TYPES OF FORGING

Advantages compared to machining from solid stock:

- –Higher production rates
- –Less waste of metal
- –Greater strength
- –Favorable grain orientation in the metal
- •Limitations:
- –Not capable of close tolerances
- –Machining is often required to achieve accuracies and features needed



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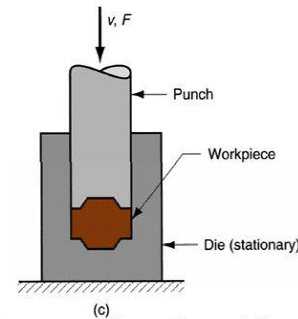
TYPES OF FORGING

Flash less Forging:

- Compression of work in punch and die tooling whose cavity does not allow for flash
- Starting work volume must equal die cavity volume within very close tolerance
- Process control more demanding than impression-die forging
- Best suited to part geometries that are simple and symmetrical
- Often classified as a *precision forging process*

TYPES OF FORGING DIES

FLASHLESS FORGING



Compression of work in punch and die tooling whose cavity does allow for flash

Starting workpart volume must equal die cavity volume within very close tolerance.

Process control more demanding than impression-die forging

Best suited to part geometries that are simple and symmetrical

Often classified as a *precision forging process*

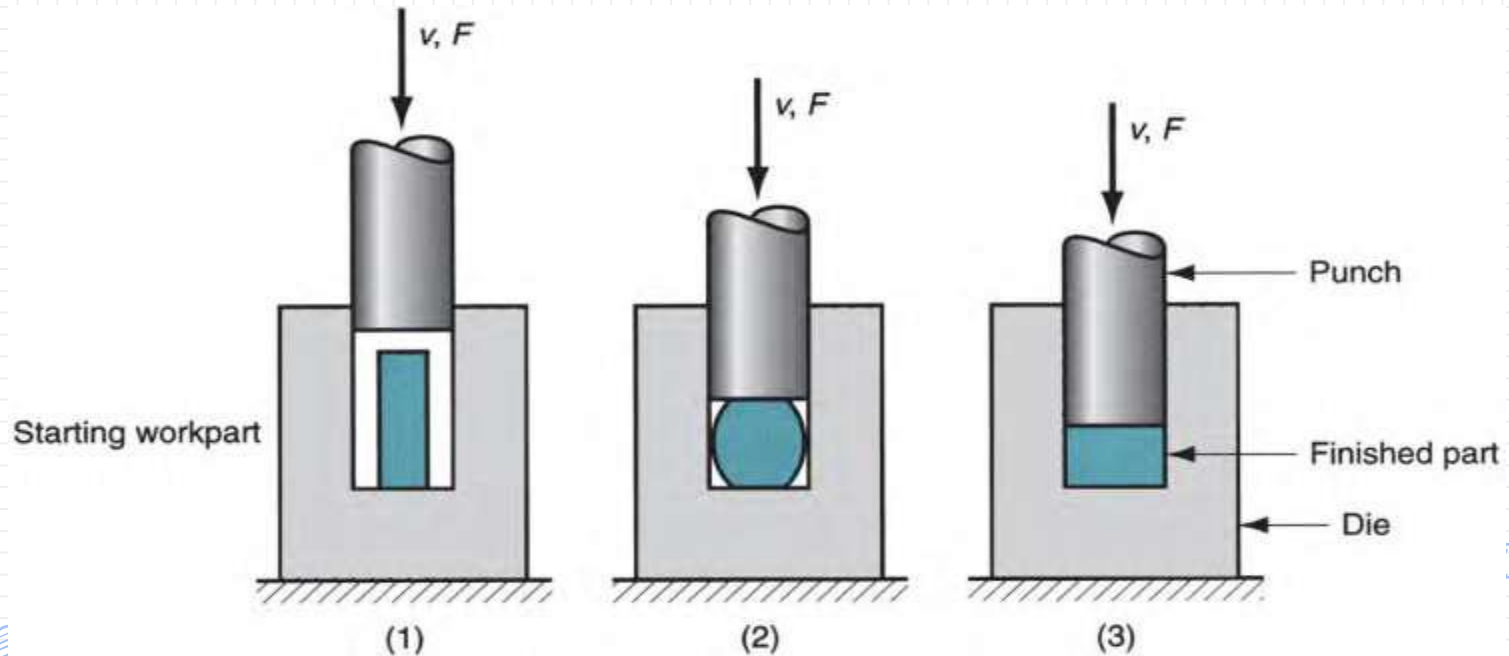
Flashless forging:

- (1) just before initial contact with workpiece,
- (2) partial compression, and
- (3) final punch and die closure

<https://slideplayer.com/slide/3603659/>

TYPES OF FORGING

- **Flash less Forging or Closed Forging:**
- (1) Just before contact with work piece, (2) partial compression, and (3) final punch and die closure



TYPES OF FORGING

Closed Die Forging:

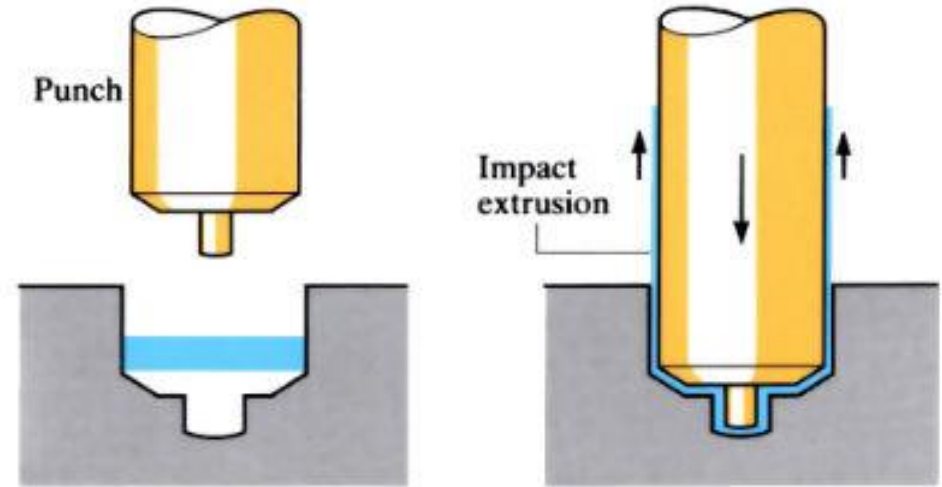
- -Work piece is completely trapped in the die and no flash is generated; die design and process variables must be carefully controlled



TYPES OF FORGING

Cold Forgings:

Cold forging encompasses many processes -- bending, cold drawing, cold heading, coining, extrusions and more, to yield a diverse range of part shapes. The temperature of metals being cold forged may range from room temperature to several hundred degrees.

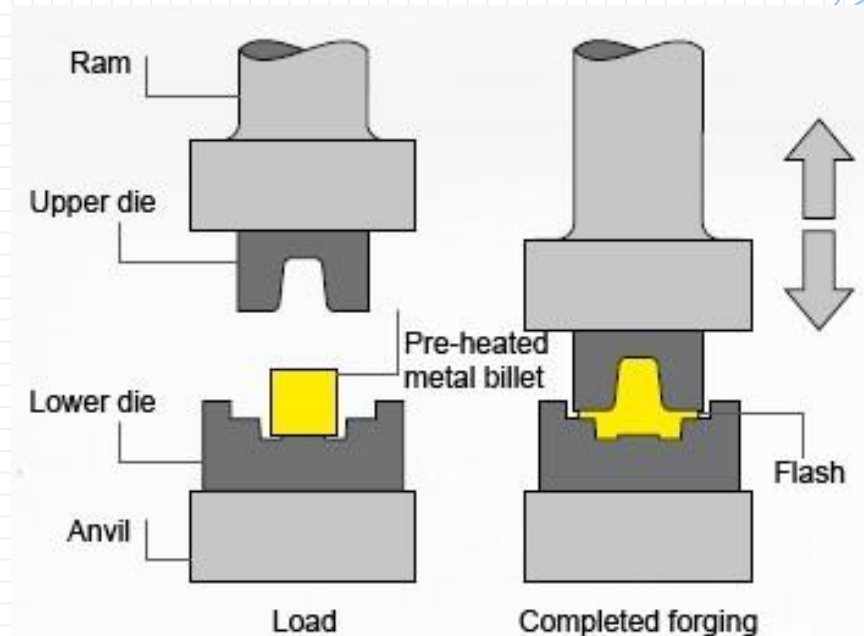


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TYPES OF FORGING

Cold Forgings:

- With cold forging of steel rod, wire, or bar, shaft-like parts with 3-plane bends and headed design features are not uncommon.
- Typical parts are most cost-effective in the range of 5 Kgs or less; symmetrical parts up to 3 Kgs readily lend themselves to automated processing. Material options range from lower-alloy and carbon steels to 300 and 400 series stainless, selected aluminum alloys, brass and bronze.



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TYPES OF FORGING

Cold Forgings:

Often chosen for integral design features such as built-in flanges and bosses, cold forgings are frequently used in automotive steering and suspension parts, antilock-braking systems, hardware, defense components, and other applications where high strength, close tolerances and volume production make them an economical choice.



<https://tinyurl.com/y4cbpw8k>

ASSESSMENT

1. Forging is carried out at which temperature?
 - a) Below re-crystallization temperature
 - b) Above re-crystallization temperature
 - c) Below or above re-crystallization temperature
 - d) Above melting point

2. In which of the following forging process poor material utilization occurs?
 - a) Open die
 - b) Closed die
 - c) Impression dies
 - d) Hold dies

ASSESSMENT

3. In which of the following forging operation instead of repeated hammering gradual force is applied?

- a) Drop forging
- b) Smith forging
- c) Coining
- d) Press forging

4. The extra metal which settles down in the gutter is known as?

- a) Flash
- b) Slag
- c) Flux
- d) Barrelling

The slide features a light blue grid background. The corners are decorated with various hand-drawn science icons in blue and purple. Top-left: a yellow gear with a lightning bolt, a beaker with 'H2O', a lightbulb, and a rocket. Top-right: a smartphone, a globe, a microscope, and the text 'SNS INSTITUTIONS'. Bottom-left: a lightbulb, a brain, a graph, and a rocket. Bottom-right: a globe, a microscope, a planet, and a rocket.

THANK YOU