Mech

UNIT-II

Welding

- Joining two pieces of metal, by the application of heat with or without the application of pressure or filler material

- permanent joint

Plastic welding (Pressure welding)

- pieces that are to be joined, heated in molten state;
  ↓
  allowed to solidify

- with ↓ → Pressure
- without → ~~pressure~~ & filler.

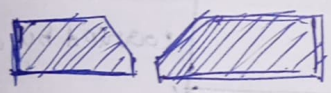
eg: Forge welding, Resistance welding

Fusion welding (Non-Pressure welding)

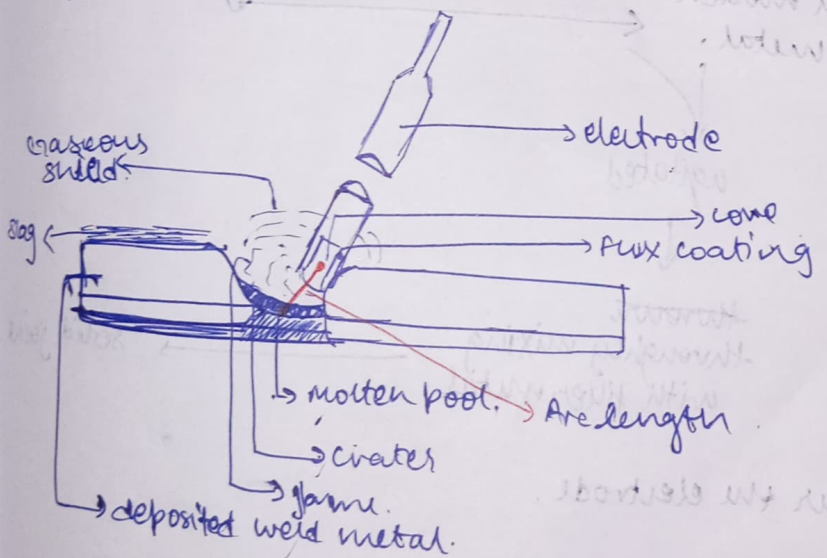
heated in molted state
↓
- without pressure
- with filler.

↓ Arc welding
↓ Gas welding

Arc welding:

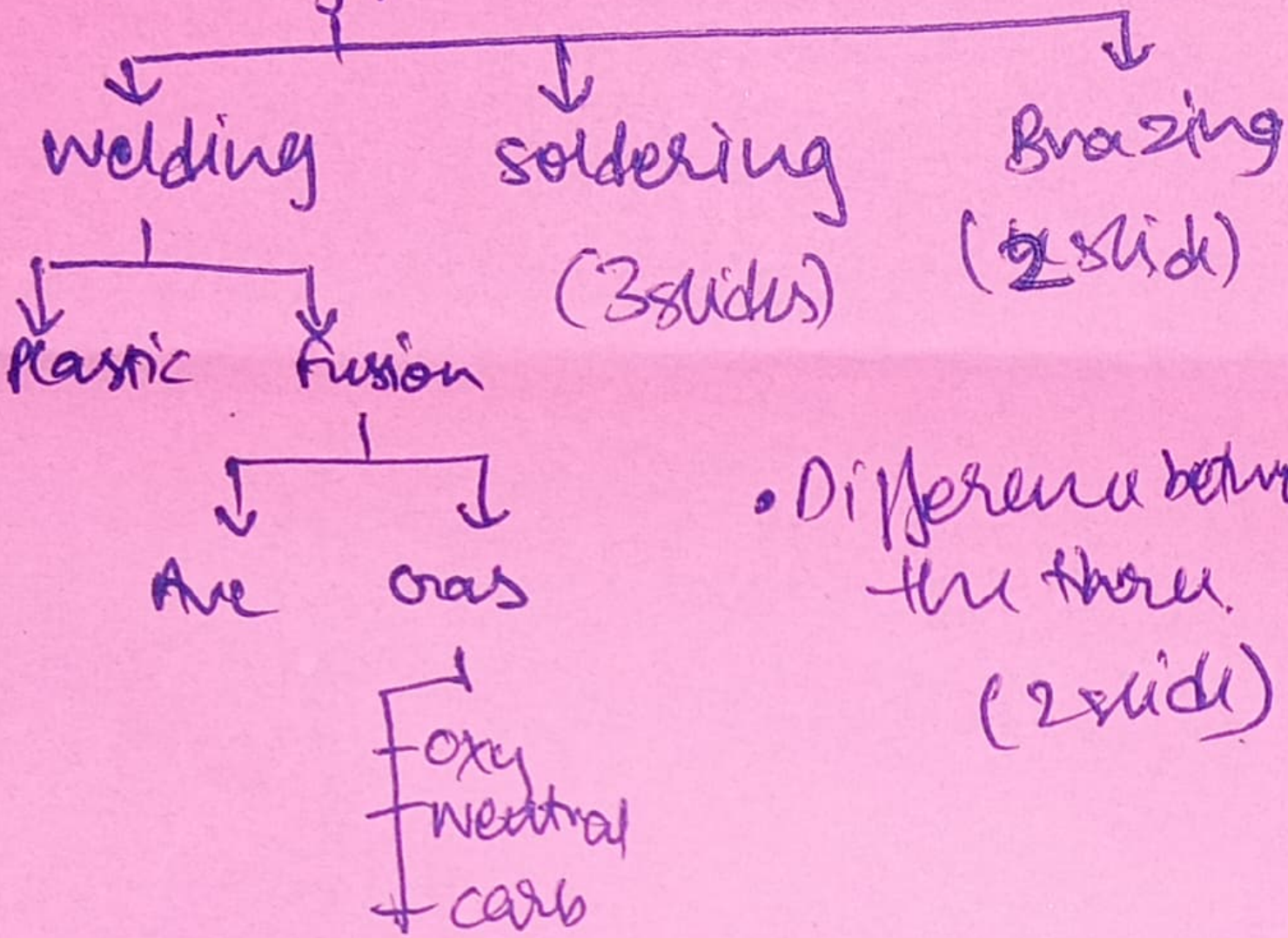


Before



After

- Joining process



- objects in welding.

Principal

- two conductors (charge carrying)
  - ↓
  - touched momentarily
  - ↓
  - separated
  - ↓
  - Electric Arc is formed

Safety Devices

1) Welding shields → IR / UV rays
2) Gloves → Spark, Insulate
3) Chipping hammer & brush
4) Apron.
5) Earthing clamp

- High heat density (5000-6000°C) → throughout the length of arc.
- circuit → 2 poles (electrodes)
  - → ① parts to be welded
  - → ② electrode held by the operator.

Procedure

- Arc
  - ↓
  - melts work piece metal (directly under the arc)
  - ↓
  - forms small molten pool of metal.
  - ↓
  - agitated
  - ↓
  - ~~thorough~~ throughly mixing with filler metal

simultaneously

tip of the electrode (at the arc)
↓
melts
↓
carried by arc

cools → solid joint

- flux coating over the electrode.
  - ↓
  - produces inert gas atmosphere
  - ↓
  - to prevent oxidizing of molten metal.

welding machine

- function → low voltage (40-50 V) & high current (50 A - 300 A).

AC arc → step down transformer is used
- polarity changes every cycle.
- req. high voltage coz it acquire OV twice a cycle. 220/440 V → 80 to 100 V.
- high current 100 to 400 A.

DC arc → work piece (+) → straight polarity, high heat is required.
electrode (−)
→ reversed when less heat is required.

electrodes

→ used is consumable type and is coated with flux.

→ coating → lime, ferro manganese, cellulose, starch, iron powder.

→ flux forms slag
→ removed by chipping hammer and wire brush.

→ purpose of coating → protect molten metal from oxidizing
→ prevent rapid cooling of metal
→ to maintain arc.
→ Addition of alloying elements.

Flux

→ slag producing elements → china clay, mica
→ gas shield producing " → cellulose, wood, starch, $CaCO_3$.
(electrode end, arc, weld pool)
→ Deoxidizing elements → ferro manganese.
→ Alloying elemets → ferro alloys of Mo, Mn → strength
→ Iron powder → improves arc behaviour,
travel speed.
metal deposition rate,
bead appearance.

Gas welding

- fusion method of welding, which a strong gas flame is used to raise the temperature of work piece to melt them.
- ↳ Oxygene & Acetylene
  ↳ oxygen & Hydrogen.

Procedure

- Oxy-acetylene flame — right proportion of O_2 and $HC{\equiv}CH$ are mixed.
- Temp → 3200°C → melt all commercial flames metals

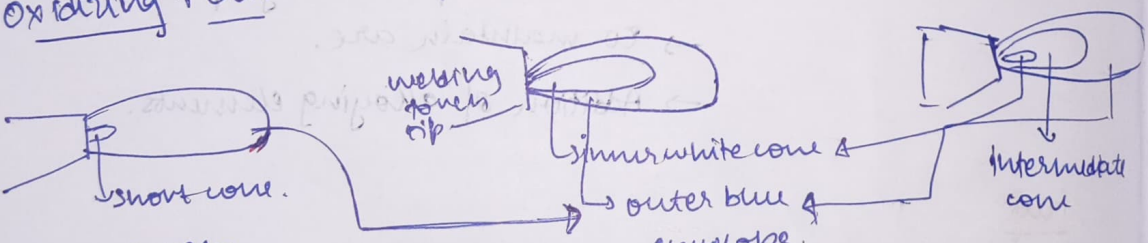
equipment

→ 2 large steel cylinders (high P)
  → oxygen → black
  → $HC{\equiv}CH$ → Maroon,
  (dissolved, at high P)

→ rubber tubes, pressure regulators

→ O_2 & $CH{\equiv}CH$ are supplied separately to the blow torch
  ↳ mixed at the nozzle of blow torch.

Oxidizing flame | Neutral flame | Carburizing flame



- excess oxygen. (1.5 : 1)
- inner white cone is shorter.
- used to weld Nickel and non ferrous material
- used for oxy-acetylene cutting. and not suitable for welding, since the weld metal will be oxidized

- equal volumes of oxygen and acetylene
- 1:1 ratio
- inner whitish cone surrounded by a blue flame.
- Most of the welding work is done using this flame.

- excess acetylene
- $O_2 : (CH)_2 = 0.9 : 1$
- It has an intermediate cone between inner cone and blue envelope
- used for welding alloy steels, cast iron and Al to protect from oxidizable elements

Defects in welding (LUPIC)

- Lack of fusion. – less heat, fast traversing of the welding torch
- Porosity. – when gases are trapped in the weld metal
- Inclusions – when slag is not removed, before running another weld
- cracking – when there is thermal shrinkage.
- undercut – excess melting of parent metal reduces strength of the joint.

Soldering

- when 2 or more metal items are joined together by melting and pouring a filler metal (solder) into the joint.
- $MP_{filler\ metal} < MP_{work\ piece}$. (1500°C – 3000°C)
- soldering does not involve melting of work piece.
- $ZnCl_2$ → flux → to clean the surface
  → to prevent oxidation.
- soldering iron → apply heat produced from electrical source
- Pb + Sn → soft solder → sheet metal work (150°C – 300°C)
  → plumbing
  → electrical junctions
- Cu + Sn + Ag → Hard solder. (600°C to 900°C)

Tools

1. Soldering iron.
2. Soldering station.
3. iron tips
4. iron stand
5. solder.
6. sponge
7. Helping hand

Method

1) Clean the surface
2) Application of flux → rosin or borax.

3) Tinning of surfaces → to remove the tin that forms on the cu bit

4) Heating.

5) Final clean up. → steel wool → remove the left over flux.

Brazing

- Joining process that relies on melting, flow and solidification of a brazing filler metal to form a leak tight seal, a strong structural bond, between the material.
- produces the coalescence of materials by heating them to the brazing temperature in the presence of a brazing filler metal that has a liquidus temp above 450°C and below the base materials.
- Metallurgical bond → is formed by the melting

MAKE Brazing notes.
It never comes in exam.
usually

Difference between Welding, Soldering and Brazing

	Welding	Soldering	Brazing
strength	Strongest joints strength of joint is more than that of base metal.	weakest usually only to make electrical contact and not bear load.	in between can bear load to some extent
temp.	3800°C	450°C	600°C
Heating of work pieces	work pieces are heated till their MP	it is not required.	heated below the MP.
change in mech. proper	Mech. prop. of base metal may change at the joint due to heating and cooling	No change in mech properties.	Negligible change in mech prop.
Heat treatment	is req. to eliminate undesirable qualities of welding	No heat treatment	No heat treatment
Preheating of work piece.	No preheating of work piece is req. as it is carried out at high temp	preheating of workpiece is req. to make good quality joint.	is desirable to make a strong joint

Vision system

- Types of vision system.

Image segmentation.