Section-3. Q2 Ans →

(1) ⇒ Resistance Welding :-

- Resistance welding is a group of welding processes wherein coalescence is produced by the heat obtained from resistance of the work to the flow of electric current in a circuit of which the work is a part and by the application of pressure.
- No filler metal is needed.

- Resistance welding also one of the types of pressure welding process during which the pressure is applied.

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** It is the process of joining metal pieces together by raising the temp. of the pieces to fusion point & applying a mechanical pressure to join them.

- In this, the pieces to be joined are held together & a strong electric current (A.C.) of high amperage & low voltage is passed through them.
- This current comes across a certain resistance in passing from one piece to the other & it is this resistance offered to the flow of current which results in raising the temp. of the two pieces to fusion or melting point at their junction.
- Resistance welding is employed mainly for mass production.
- It is easily adapted to those components which can be moved to the m/c & arc light.
- The operation is extremely rapid & simple.
- This process is suited to nearly all metals except tin, lead, zinc etc. which exhibit many problems.
- The voltage can be low, typically 0.5 to 10V, but current is very high.

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⇒ Application :- This is used for joining sheets, tubes, aircraft & automobile parts, just wise fabrics, grills & containers.

- Basic working principle of resistance welding depends upon :-

$H = I^2 R T$

- H → (Heat Generated)
- I → (Current Required during welding)
- R → (Resistance)
- T → (Time in second during which current flows)

⇒ Types of Resistance Welding :-

(i) Spot welding.
(ii) Seam welding.
(iii) Projection welding.
(iv) Percussion welding.
(v) Flash Butt welding.
(vi) Resistance Butt welding.

⇒ Advantage of Resistance Welding :-

(i) No filler rod or electrode is required.
(ii) High rate of production.
(iii) Semi-skilled operator can perform welding very easily.
(iv) No part warping or distortion.
(v) No need of edge preparation.

⇒ Disadvantage of Resistance Welding :-

- All type of metal cannot be welded.
- Complex shapes & bigger jobs cannot be joined.
- Welding joint is not so strong.
- Initial cost of equipment is high.

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(2) HAZ in Welding :-

- Heat Affected Zone (HAZ) formed during welding is an area in which some structural changes in the welded material take place as the result of experienced temp.

- The knowledge of a whole area and of subareas of the HAZ is important from practical point of view, since as shown. fine-grained HAZ is in a critical place in terms of creep strength & thermal fatigue.

- HAZ is the portion near the weld metal zone which is composed of parent metal and did not melt but heat to a enough high temp. for a sufficient period. Due to this, heating, mechanical properties and microstructure of this zone have been changed.

- The HAZ in low carbon steel of normal structure welded in one run with coated electrode or by submerged arc welding process comprises of following three metallurgical different types :-

(ii) Grain Growth Region :-

- This region is immediately adjacent to the weld metal zone.
- In this zone, base metal is heated to a temp. well above the upper critical temp. This results in grain growth and coarsening of the structure.

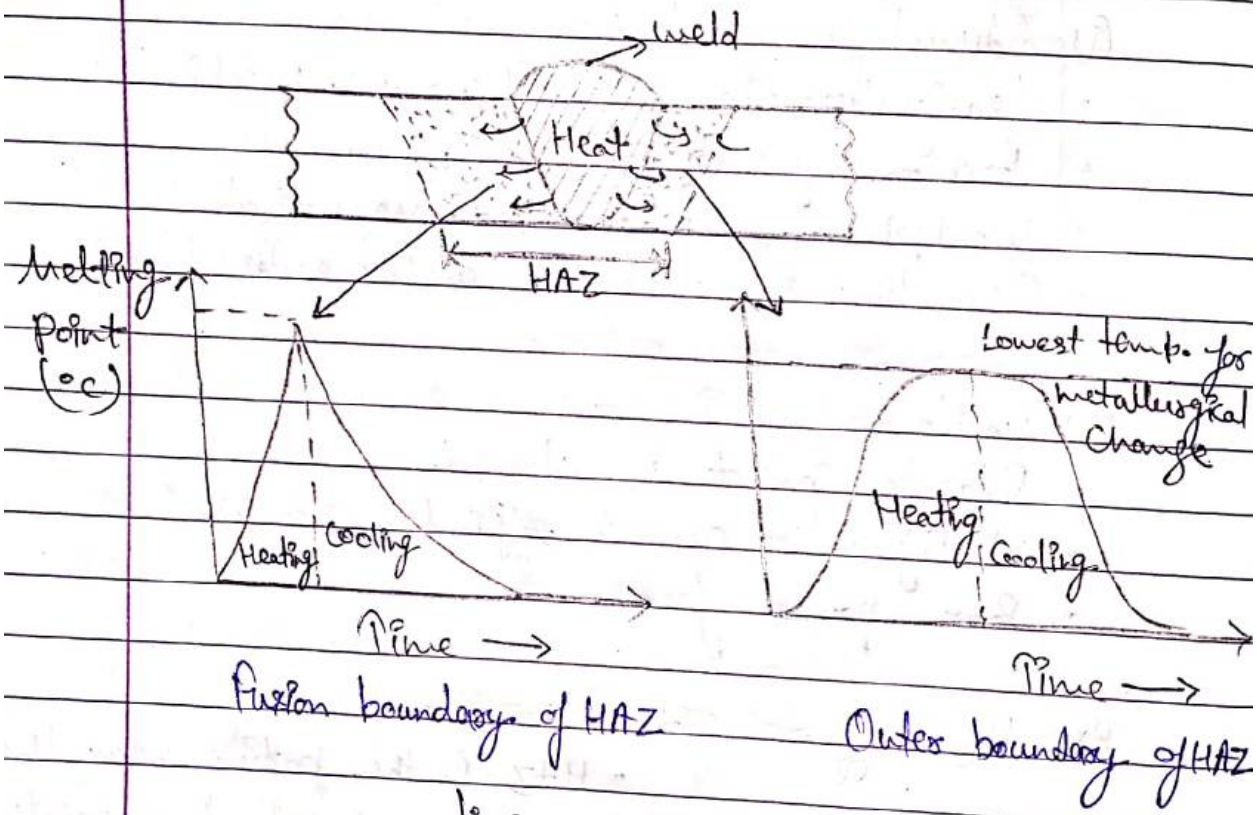

fig :- HAZ Boundary

(iii) Grain Refined Region :-

- This region is adjacent to the grain growth region. In this region, base metal is heated just above the upper critical temp. whose grain refined is completed & finest grain structure exists.

(3) Submerged Arc welding :- (SAW)

- It is basically an Arc-welding process in which the arc is struck blw a consumable metal electrode & the wlp.

- The process derives its name from the fact that the arc remains submerged (shielded) inside a layer of Granular & Fusible Flux.

- The arc is not visible to the welder. Other names given to this process are Hidden-arc welding, Submerged-melt welding.

- Subarc welding & Flux Covered Arc welding.
The process can be Automatic or semi-automatic.

- In this kind of welding, the flux begins for depositing on the joint to be welded. Whenever the flux is cold, then it acts as an insulator.

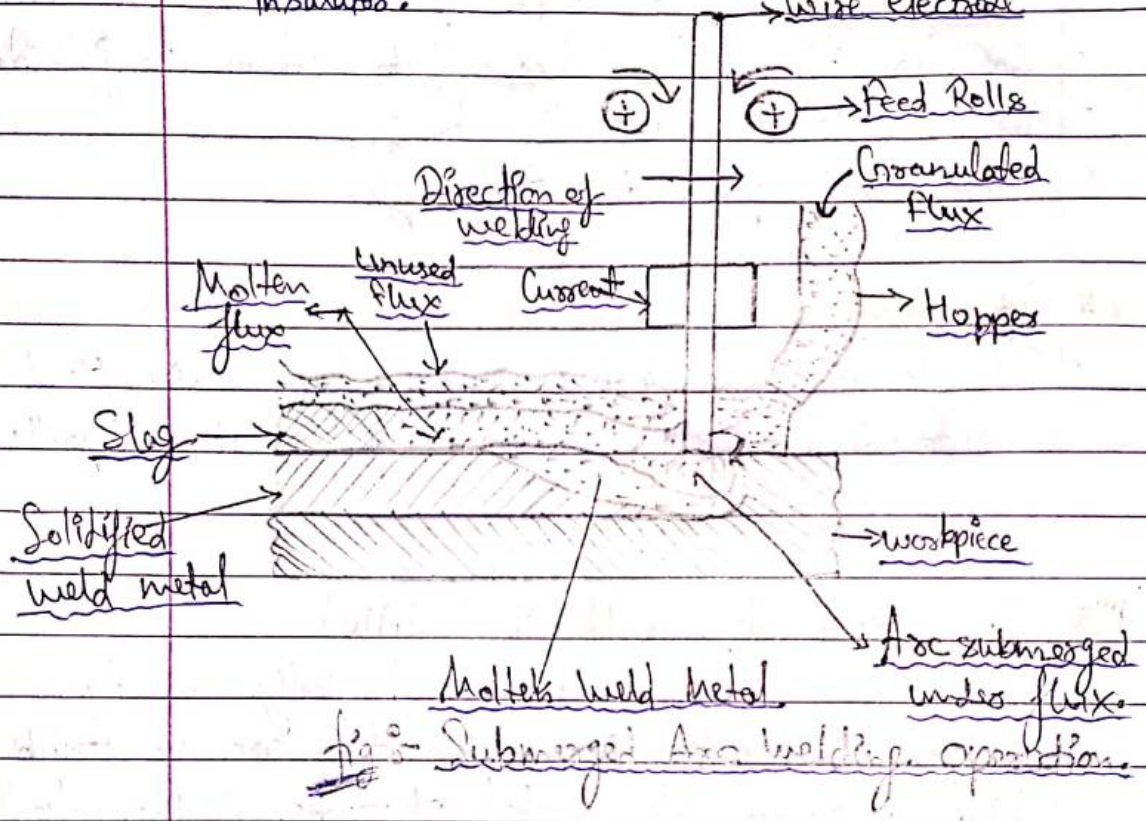

fig :- Submerged Arc welding operation.

- Once the flux is melted by the heat of the arc, then it will become highly conductive.
- The At a fixed speed, the electrode from the roll is constantly fed toward the joint to be linked.
- With the help of the self-adjusting arc principle, the length of the arc is kept stable. When the arc length reduces, the arc voltage will inc.(res) as this will inc.(res) the arc.
- This result in the welding of the wp.

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* Advantage of SAW :-

- Deep weld penetration.
- Sound welds are readily made with good process design & control.
- High speed welding of thin sheet at over 2.5m/min is possible.
- Minimal welding fume or arc light is emitted.

* Disadvantages :-

- Limited to ferrous (steel or stainless steels) & some nickel based alloys.
- Normally limited to long straight seams or rotated pipes or vessels.
- Requires relatively troublesome flux handling systems.
- Flux & slag residue can present a health & safety issue.
- Requires inter-pass & post weld slag removal.

* Application :-

- Fabrication of pipe, penstocks, pressure vessels, boilers, structural shapes, rail road, & earth moving equipment, cranes, bridge girders & under str. of railways coaches & locomotives.
- Automotive, Aviation, ship-building & nuclear power industry.
- For welding metals like mild steel, medium & high tensile low alloy steels.

(4)

Soldering :-

- It is a method of joining two or more pieces of metal sheets by means of a fusible alloy or metal, called solder.
Applied in the molten state.

- The melting pt. of the filler metal is above 427°C.
- Soldering operation is performed by bringing molten solder in contact with the preheated surface & heating the joint area to a good wetting temp. about 55 to 80°C above the melting pt of soldering alloy.
- Solder is then left to cool & freeze as quickly as possible to avoid development of internal cracks in the joint.
- Due to molecular attraction surface molecules of solder enter within the present metal molecules and form a strong bond.

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* Disadvantages of Soldering :-
- large sections cannot be joined.
- Fluxes may contain toxic components.
- Low strength of joints.

* Application of Soldering :-
- Connections in wireless set, TV sets, & wiring joints in electrical connections, batteries
- Drain water gutters & pipes.
- Radiator brass tube for motor car.
- When halved bearings are to be line with Babbitt metal.
- Copper tubing carrying liquid fuel, gas or air used in engine.

4) Brazing :- Brazing is used for joining the two similar or dissimilar metal pieces together by heating the surface & by using a non-ferrous filler metal having its melting point above 427°C but below the melting pt. of metal to be brazed.

- The molten filler metal is distributed blw the joint surfaces by the capillary action which on cooling results in a sound joint.
- The main advantage of Brazing process is joining of dissimilar metals & thin sections.

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⇒ Advantages of Brazing :-
- Cast and wrought material can be joined easily.
- Metallurgical properties of the base material are not seriously distributed.
- Assemblies can be brazed in a stress free conditions.
- Material of different thickness can be joined easily.
- Little or no finishing is required by the brazed joints.

⇒ Disadvantages of Brazing :-
- It requires tightly mating parts and proper cleaning.
- Joints are not successful at elevated temp.
- Colour of the filler metal may not match that of the base metal.
- High degree of skills is required.

⇒ Application of Brazing :-
- Parts of bicycles such as frame & rims.
- Pipe joints subjected to vibrations.
- Exhaust pipe in motor engine.
- Band saws and tipped tool.

(4)

Soldering	Brazing
• The melting pt. of filler rod is lower than 427°C.	• Melting pt. of filler rod is greater than 427°C.
• Soldering joints is weaker in strength.	• Brazing joints is stronger in strength.