

# Participant Handbook

Sector  
**Gems and Jewellery**

Sub-Sector  
**Cast and diamonds-set  
jewellery**

Occupation  
**Metal Setting**

Reference ID: G&J/Q3103, Version 5.0  
NSQF Level 3



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**Metal Setter  
(Basic)**

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First Edition,

ISBN 978-93-87241-19-0  
Printed in India at

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**Shri Narendra Modi**  
The Prime Minister of India

“ Skilling is building a better India.  
If we have to move India towards  
development then Skill Development  
should be our mission. ”



**COMPLIANCE TO  
QUALIFICATION PACK – NATIONAL OCCUPATIONAL  
STANDARDS**

is hereby issued by the

GEM AND JEWELLERY SKILL COUNCIL OF INDIA  
for

**SKILLING CONTENT : PARTICIPANT HANDBOOK**

Complying to National Occupational Standards of

Job Role/Qualification Pack                   'Metal Setter'                   QP No. G&J/Q3103, NSQF Level 3'

Date of issuance: Nov 17<sup>th</sup>, 2022  
Valid up to\*: Nov 17<sup>th</sup>, 2025

\*Valid up to the next review date of the Qualification Pack or the  
\*Valid up to' date mentioned above (whichever is earlier)

**Authorised Signatory**

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## Acknowledgements

GJSQ would like to thank Vidhya Mazumdar for her contribution in developing this Participant Handbook. We appreciate the endless efforts of our Subject Matter Experts to maintain quality of education and skills. We sincerely thank them for inspiring and facilitating students of the Gem & Jewellery sector across India.

## About this book

This Participant Handbook is designed to enable training for the specific Qualification Pack (QP). Each National Occupational Standards (NOS) is covered across Unit/s. Key learning objectives for the specific NOS mark the beginning of the Unit for that NOS. This book is about Metal Setter as per the design requirement of the jewellery, accessories etc.

The participant will learn to settel metals in the finished and embellished jewellery / accessories frame with minimum damage to metal, jewellery / accessories frame.

## Symbols Used



Key Learning  
Outcomes



Steps



Tips



Notes



Unit  
Objectives



Exercise

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**It is recommended that all the trainings include the appropriate Employability Skills Module.**

**Content for the same is available here:**  
<https://www.skillindiadigital.gov.in/content/list>







# 1. Introduction

Unit 1.1: Gem and Jewellery Sector in India

Unit 1.2: Objectives of the Program

Unit 1.3: Where does Metal Setter fall in the jewellery making process

Unit 1.4: Job Opportunities for Metal Setter



## Key Learning Outcomes

**At the end of this module, you will be able to:**

1. Analyze the gem and jewellery sector in India, and its sub-sectors.
2. Record the role and responsibilities of Metal Setter.

## Unit 1.1: Gem and Jewellery Sector in India

### Unit Objectives

**At the end of this unit, you will be able to:**

1. Analyze the significance of the gem and jewellery sector in India.

### 1.1.1 Significance of Gem and Jewellery Sector in India

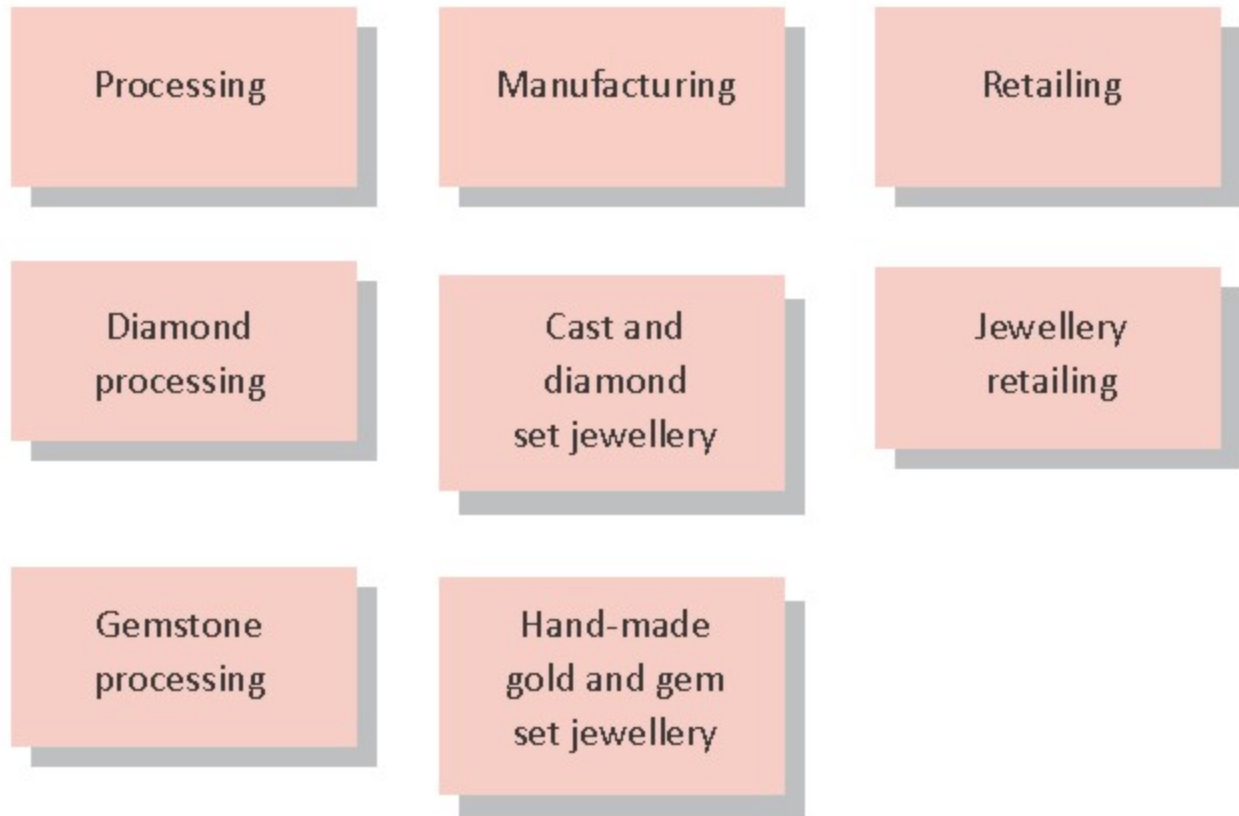
The Gems and Jewellery sector plays a significant role in the Indian economy, contributing to around 6-7 % of the country's GDP. One of the fastest growing sectors, it is extremely export oriented and labour intensive.

Based on its potential for growth and value addition, the Government of India has declared the Gems and Jewellery sector as a focus area for export promotion. The Government has recently undertaken various measures to promote investments and to upgrade technology and skills to promote 'Brand India' in the international market.

India's Gems and Jewellery sector has been contributing in a big way to the country's foreign exchange earnings (FEEs). The Government of India has viewed the sector as a powerful area for export promotion.

- With a market size of almost INR 4,54,100 crore, the sector has a large share of the GDP at ~5.9 %, apart from large-scale employment generation and foreign exchange earnings.
- Market research reveals that jewellery accounts for more than a fourth of the optional spending by consumers in India. This combined with rising income levels in India is a major growth driver.
- India has an estimated 229 crore women aged 20-49. The number of women, the key customer category for jewellery, who are employed in professional sectors is rising very fast.
- With more than 300 million people in the 25-29 age group in the period 2011-21, 150 crore weddings are expected to take place in this period.
- In Tier-3 zones, where landlords and money lenders are the primary source of financial credit, jewellers have emerged as an alternative, providing investment options through gold jewellery.

### Gem and Jewellery industry classification



*Fig 1.1.1.1 Sub-sectors of Gem and Jewellery sector*

Based on economic activities from NIC-2008, major sub-sectors of sector are: processing (diamond and gem stone), manufacturing (cast and diamond set, and handmade and gem set) and retailing.

Scan the QR Code to watch the related video or click on link



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Gem & Jewellery industry Orientation

- With a market size of almost INR 4,54,100 crore, the sector has a sizeable share of the GDP at ~5.9%, apart from large-scale employment generation and foreign exchange earnings.
- The highly labour-intensive nature of the sector with large number of employees in the unorganised space, has led to job creation, employing more than 0.464 million people in the country in 2013.
- This is more than the population of Kolkata, the seventh most populous city in India with a population of 4.5 million; this indicates the high employment generation capacity of this sector.
- Indian markets for diamond processing — Surat, Ahmedabad; for gemstone processing — Bhavnagar and Jaipur; and for handmade gold jewellery — Kolkata, Thrissur and Coimbatore — are among other areas that are known world over for their products.
- Every region of the country has a different unique style of jewellery. Some examples of these traditional jewellery forms include Bikaneri, Dhokra, Minakari and Filigree.
- India is a source for manufacturing all varieties of products; and its presence in the global gems and jewellery sector is of much importance.

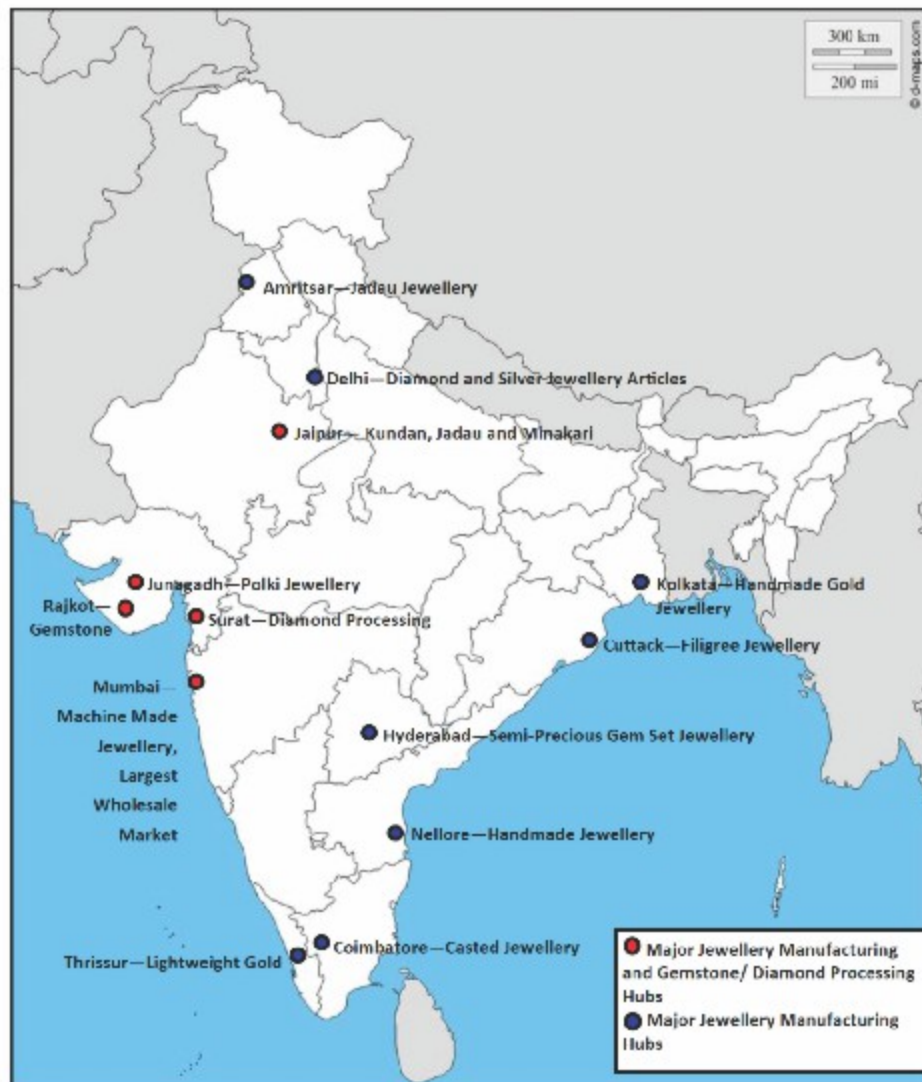
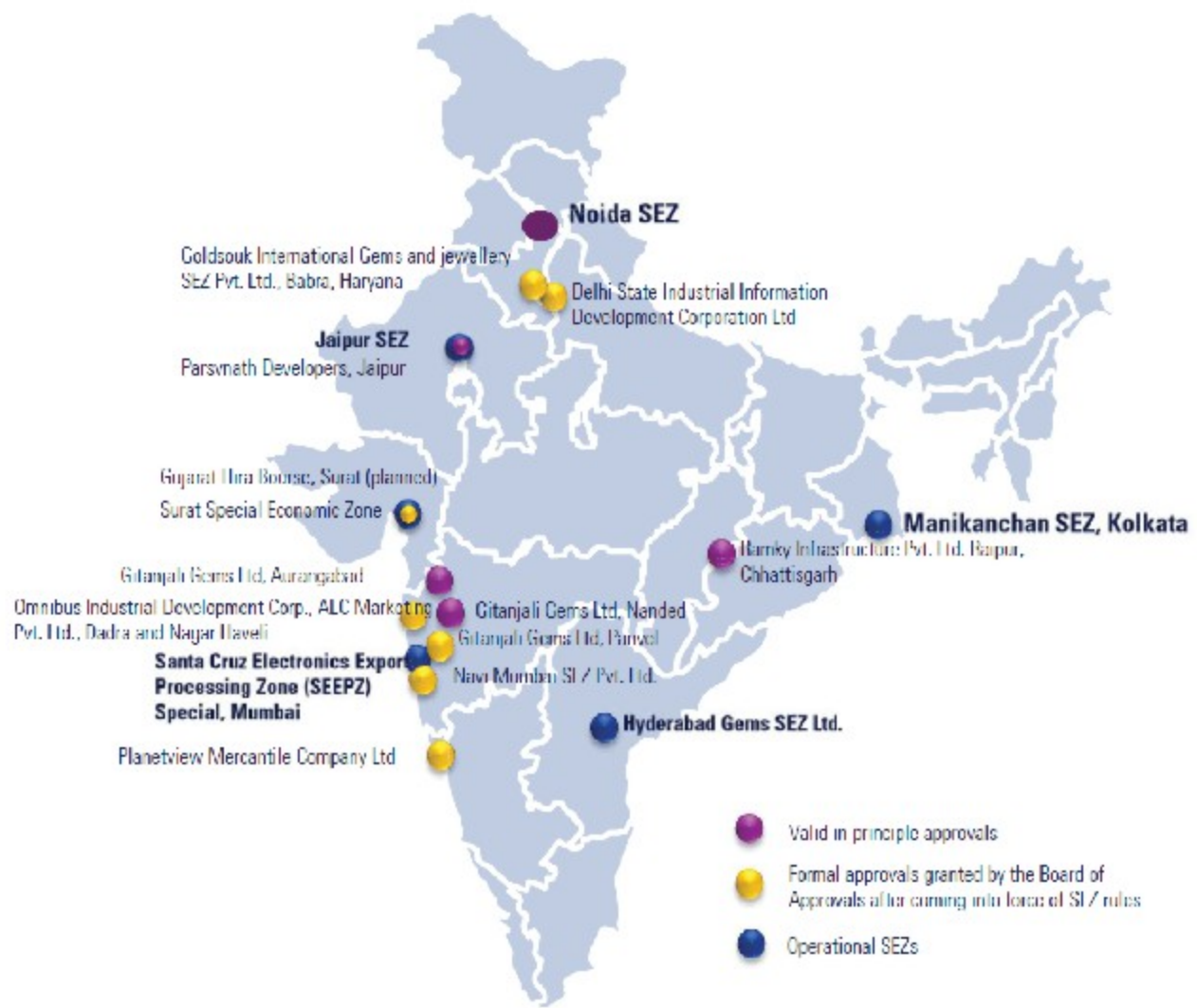


Fig 1.1.1.2 Geographical Markets: Employment Zones in India

- More than two-thirds of the sector work force in India are employed in the processing and manufacturing areas of the value chain.
- These workers are employed in certain zones, as indicated in the map above.
- The retailing work force is spread across the country from metros and Tier – 1 cities to villages in rural areas.

**Processing and Manufacturing Markets:**

- Employment is concentrated in the states of Rajasthan, Gujarat, Maharashtra, West Bengal and the Southern states of Kerala and Tamil Nadu.
- Jaipur and Amritsar are known for Kundan – Jadau jewellery with Minakari work, while Delhi – NCR is known for silver jewellery. Further, Jaipur is also one of the largest coloured gemstone cutting and polishing centre in the world.
- Surat is the world's largest diamond processing centre and processes about 85 percent of the rough diamond imports of India. Surat has a large group of workforce and is also home to the world's leading diamond institute, the Indian Diamond Institute (IDI).
- Mumbai, besides being the largest trading hub and wholesale market in the country, is also a key centre for cast and diamond set jewellery.
- SEEPZ in Mumbai alone accounts for almost a quarter of the jewellery exports to USA, the world's largest jewellery consuming country.
- Thrissur is a hub for lightweight plain gold jewellery, a style traditional to Kerala, while Coimbatore is known for electroformed jewellery.
- Kolkata is known for handmade gold jewellery.
- Its importance also stems from the fact that a large share of the skilled artisans in the country are from this region. However, recent times have seen a decline of this supply due to a reduction in inherited skills.



Source: SLZ India, Ministry of Commerce and Industry, KPMG Analysis

Fig 1.1.1.3 Geographical Markets

- India has multiple operational SEZs focused in the sector and many others expected to operationalise in the coming years.
- Currently, there are about 22 G&J SEZ's approved under the SEZ Act, 2005, throughout India.
- Out of these, 5 are operational, 4 have valid-in-principle approvals and 12 are at the formal approval stage.
- The focus of investment is currently concentrated in Maharashtra, followed by Gujarat and Rajasthan.
- These areas will require skilled manpower and in line with current employment areas indicating that these areas will continue to be employment destinations for manpower supply.



- Incremental human resource requirement (2013-17, 2017-22) and skill gaps.
- Current workforce of 4.64 crore in 2013 is expected to increase to 8.22 crore by 2022.



Fig 1.1.1.4

- The sector currently employs more than 4.64 crore employees and is planning to employ more than 8.23 crore employees by 2022.
- This implies additional creation of ~3.59 crore jobs in the nine-year period.
- The period 2013 – 18 will see a slower rate of growth in employment vis-à-vis 2017 – 22 due to the repercussions of the global recessions of 2008 – 09.
- The sector will bounce back and will require more work-force in the latter period viz. 2017 – 22.

## Unit 1.2: Objectives of the Program

### Unit Objectives

**At the end of this unit, you will be able to:**

1. Analyze the importance of a Metal Setter in the jewellery manufacturing process.

### 1.2.1 Need for Metal Setter

The jewellery making process is a very fine work and it takes great effort to make fine jewellery. All the levels of making jewellery are very important.

The work a Metal Setter does have value and need as it enhances the quality of jewellery and makes it more presentable and appealing. It's needed to understand the design specification and also to correct any defects. A Metal Setter increases the durability of the product as he helps in correcting all the small or big faults that the jewellery would have.

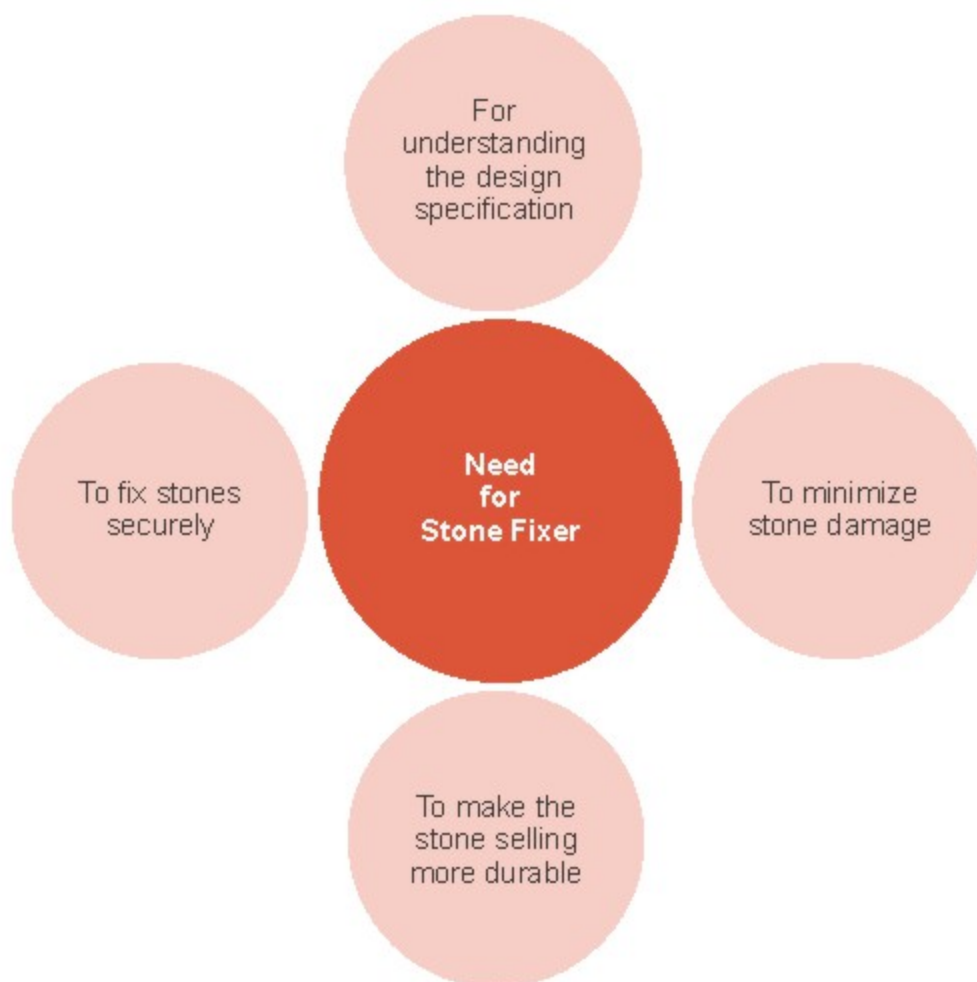


Fig 1.2.1.1 Need for Metal Setter

## Unit 1.3: Where does Metal Setter fall in the jewellery making process

### Unit Objectives

At the end of this unit, you will be able to:

1. Understand where a Metal setter falls in the jewellery making process.

### 1.3.1 Jewellery Making Process

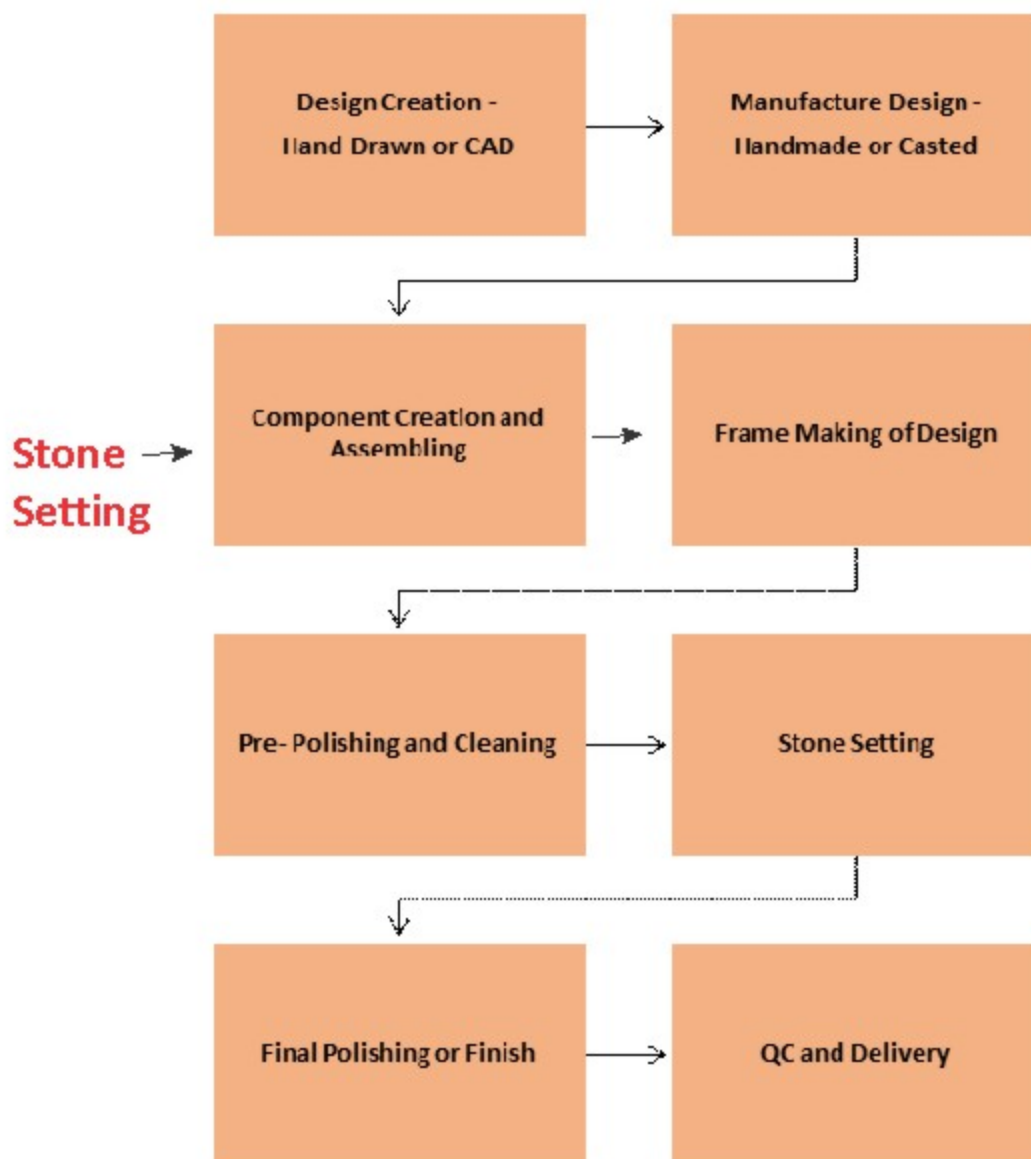


Fig 1.3.1.1

## Unit 1.4: Job Opportunities for Metal Setter

### Unit Objectives

**At the end of this unit, you will be able to:**

1. Understand the job opportunities for a Metal Setter in the gem & jewellery Industry.

### 1.4.1 Job Opportunities for Metal Setter

- Metal setting or stone setting is a major and indispensable part of jewellery and the object of this process is to hold the gemstone securely as well as enhance the brilliance of a gemstone by showing its cut, clarity & colour.
- Metal Setter is also known as 'Artisan' or 'Bench-Worker' in the industry.



*Fig 1.4.1.1 Job Opportunities for Metal Setter*

### 1.4.2 Personal Qualities Required in a Metal Setter

The Metal Setter is required to have a lot of patience while working to repair or weld jewellery as it's a work of great precision. One is also required to have coordination between hands and eye movement along with having focus in the work. A Metal Setter is also required to work in small groups in an enclosed area and also work well with sharp tools with minimum hazards. The job also requires him to sit for long hours thus integrity and patience are a necessity for the work.

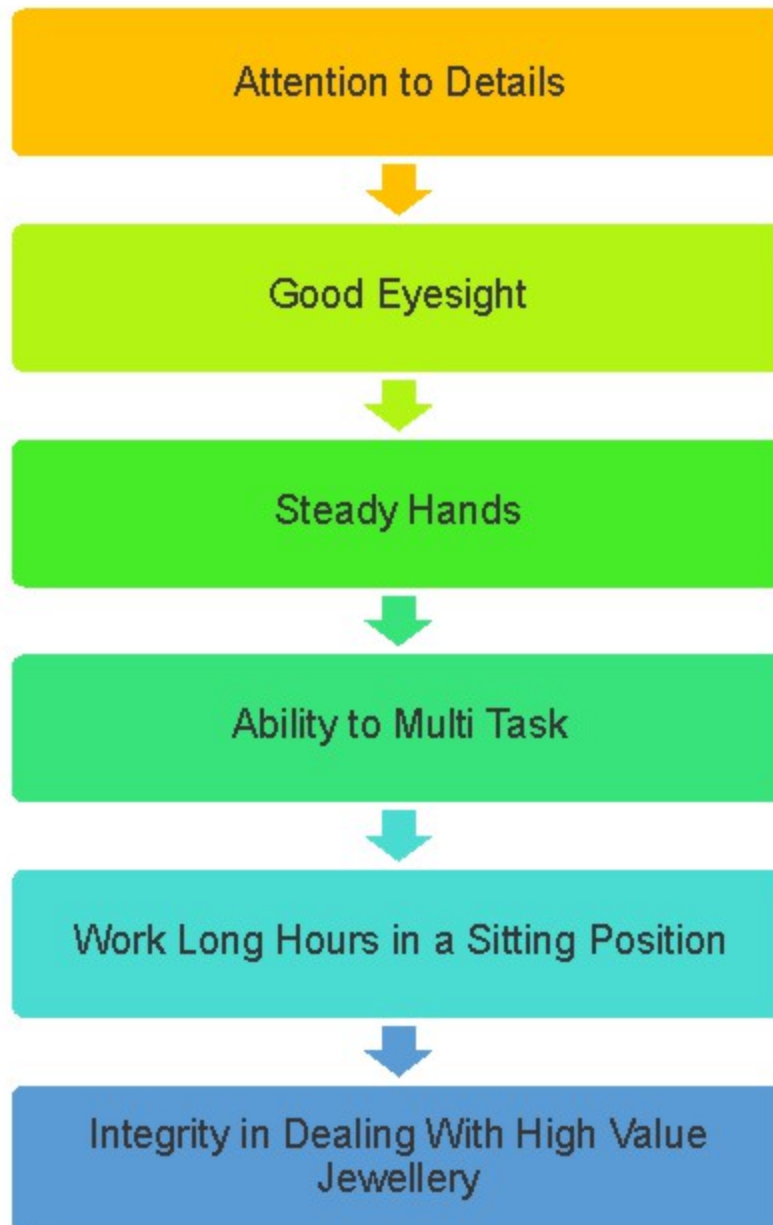


Fig 1.4.2.1 Personal qualities

## Exercise

1. Write three job responsibilities of a Metal Setter.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  
2. List three personal qualities required for a Metal Setter.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_



## 2. Set diamond and gemstone in precious metal jewellery piece

- Unit 2.1 - Introduction to Precious Metals
- Unit 2.2 - Metal Alloys
- Unit 2.3 - Types of Jewellery
- Unit 2.4 - Type of Gemstone used in Studdeed Jewellery
- Unit 2.5 - Types of Settings
- Unit 2.6 - Tools and Equipment Required for Stone Setting
- Unit 2.7 - Setting a Gemstone in Jewellery
- Unit 2.8 - Handling of Diamonds and Gemstones to Avoid Damage to Stones
- Unit 2.9 - Check for Defects



## Key Learning Outcomes

**At the end of this module, you will be able to:**

1. Analyze the Imitation jewellery making process.
2. Inspect the job work of Metal Setter.
3. Analyze the importance of Imitation jewellery in the Indian market.
4. Analyze and inspect the metals and their properties.
5. Read the job sheet and understand the job requirements.
6. Analyze the various types of jewellery including the Indian jewellery categories.
7. Analyze and inspect the different types of stones used in Imitation jewellery and their characteristics.



## Unit 2.1: Introduction to Precious Metals

### Unit Objectives

**At the end of this unit, you will be able to:**

1. Understand the properties of metals.
2. Understand the physical and chemical properties of gold.

### 2.1.1 Metal Properties

#### Physical Properties of Metals

- All metals show certain characteristic properties such as ductility, lustre, and malleability.
- Metals differ in terms of ductility and malleability with gold being the most ductile while lead and tin being least ductile and malleable.
- Metals differ widely in:
  - **Hardness**
    - Ability of a material to resist plastic deformation, usually by dent on metal, permanent change in shape, meaning that a metal that does not lose its shape or get scratched when worked on.
  - **Ductility**
    - Ability of being drawn into wire, meaning gold can be made into wires without breaking.
  - **Malleability**
    - A substance which can be beaten to make sheets, meaning gold can be beaten to a thin sheet without it breaking or tearing.
  - **Tensile Strength**
    - Ability of a material to resist tearing, meaning the metal can be beaten or drawn into a wire or sheet without tearing.
  - **Density**
    - Density is the mass of an object per unit of volume, meaning platinum is a heavier metal than silver, hence it has a higher density.
  - **Melting Point**
    - The temperature at which it changes state from solid to liquid at atmospheric pressure.



Fig 2.1.1.1 Metal properties

## 2.1.2 Physical Properties of Gold

- It is a soft, yellow, corrosion-resistant element, the most malleable and ductile metal.
- A good thermal and electrical conductor, gold is generally alloyed to increase its strength.
- 28 grams of gold can be beaten up to a 300 square feet sheet, due to its malleability.
- **Physical Properties of Gold** are as follows:
  - **Colour:**
    - Bright Yellow
  - **Lustre:**
    - It has a shine or glow.
  - **Ductility:**
    - It can be beaten into extremely thin sheets of gold leaf, most ductile amongst noble metals.
  - **Malleability:**
    - Capable of being shaped or bent, most malleable amongst noble metals.
  - **Conductivity:**
    - Good electrical conductor
  - **Solubility:**
    - Soluble (ability to be dissolved)
  - **Hardness:**
    - Relatively soft metal, gold is usually hardened by alloying with copper, silver, or other metals.
  - **Density:**
    - It is a dense metal.
  - **Melting point:**
    - Melts at 1065°C.
  - **Boiling point:**
    - Boils at 2000 °C



Fig 2.1.2.1 Gold sheet – Malleability property of gold

### 2.1.3 Chemical Properties of Gold

- Chemical properties determine how gold will react with other substances or change from one substance to another.
- Chemical properties are only observable during a chemical reaction.
- Reactions to substances such as alloys can be noticed if burning, rusting, heating, exploding, tarnishing etc. are observed on the jewellery piece.
- **Chemical Properties of Gold** are as follows:
  - **Chemical Formula:**
    - Au
  - **Activity:**
    - Pure gold is chemically inactive, it's extremely resistant to chemical reaction.
  - **Compounds:**
    - Auric chloride and chloro-auric acid are its most common compounds.
  - **Reactivity with acids:**
    - Aqua Regia, a mixture of nitric and hydrochloric acids, has the ability to dissolve gold.
  - **Reactivity with Non-metals:**
    - Gold does not react with the Non-metals, except for halogens, with which it forms halides.
  - **Alloys:**
    - Silver, platinum alloys, copper most commonly used.



Fig 2.1.3.1 Gold dissolving in aqua regia

## 2.1.4 Silver

- Silver usually occurs in massive form as nuggets or grains, although it may also be found in wiry tree like aggregates.
- Silver is used in many types of Indian jewellery and is not an expensive metal compared to gold or platinum.
- **Silver Properties:**
  - When newly mined or recently polished, silver has a bright, silver white colour and metallic lustre making it ideal for jewellery.
  - Silver is the lightest in terms of density amongst the three precious metals.
  - Silver is easily fashioned into jewellery as it is medium heavy, ductile and malleable.
  - Melting point of silver is 960°C and specific gravity is 10.56.
  - On exposure to oxygen or sulphurous fumes in air, a black layer of silver oxide quickly forms on the silver surface, thus tarnishing it.
  - Silver in its pure or native form is too soft to be used in jewellery thus it is often alloyed with other metals or given a covering of gold.
  - To increase its hardness, silver is often alloyed with copper, zinc and cadmium.



Fig 2.1.4.1 Fine silver 999 purity

## 2.1.5 Platinum

- Platinum is a dense, expensive, and relatively rare, silvery-white metal.
- Unlike many elements, platinum can be found in its pure metallic form in nuggets, alloyed with other platinum metals, or as part of a mineral ore.

- **Platinum Properties:**

- Heavy, soft, malleable (easy to work—only silver and gold are easier to shape), and ductile (easy to draw into wires).
- Density: 21.5 g/cc
- Melting point: 1768.3°C
- Boiling point: 3825°C
- Non-reactive to chemicals.
- Does not react with oxygen in air so does not rust or tarnish.
- Reasonably resistant to attack from acids.



Fig 2.1.5.1 *Platinum in rough form*



## Unit 2.2: Metal Alloys

### Unit Objectives

At the end of this unit, you will be able to:

1. Understand what alloys are, uses and annealing of alloyed metal.

### 2.2.1 What is an Alloy?

- Pure gold, also known as fine gold, is a soft gold often available in bullion form.
- Alloy is a metal made by combining two or more metallic elements, especially to give greater strength or resistance to corrosion.
- Gold alloy is gold mixed with other metals for making it harder and more durable, and this is used in jewellery.
- The amount of gold in the mix determines the karat number, for example 18 karat gold contains only 18 parts of gold out of 24 parts.
- The process of alloying that is mixing other metals with pure 24 karat gold makes gold more durable as well as aids in changing its colour.
- Technically there is no such thing as 'White Gold.'
- The colour of Gold can be made light by combining it with lighter metals however, most jewellery pieces are plated with Rhodium; a member of the platinum family and the whitest precious metal after silver.



Fig 2.2.1.1 Gold alloys, alloy mixing and alloyed gold

## 2.2.2 Annealing and Cooling Alloyed Metal

- The further one reduces the metal thickness the harder it gets and less malleable it becomes.
- If not annealed properly, the metal will break or become too hard to work with.
- Before annealing gold or silver, the metal should be coated with boric acid and alcohol.
- This flux coating will reduce oxidation and help minimize clean-up.
- The secret to proper annealing is to bring the metal up to a hot enough temperature long enough to cause annealing.
- Many times, either the metal was not taken to a high enough temperature or the temperature was not held long enough.
- The accurate annealing can be done in a pre-heated furnace for approximately 15 minutes at the below suggested temperatures.
- For ideal malleability, karat gold alloys will require cooling in one of several different methods:
  - Reduce from red heat
  - Air cool
  - Reduce from black heat
  - Black heat is a description used for when the work part is no longer glowing red (840°F – 930°F)
  - Cool by any method
- There are several choices for cooling the medium.
- All 10K alloys and 14K white gold should be cooled in water, water plus desaturated alcohol or a pickle solution based on sodium bisulphate.
- Cooling low karat and 14K white alloys into dilute acid solutions may result in stress corrosion.
- All other alloys may be cooled with the above or dilute acid solutions such as 10% sulfuric acid or 5% nitric acid.

Metal – Alloy	Annealing Temperature
10k Yellow, Green	648°C
10k White, Red	704°C
14k Yellow, Green	704°C
14k White, Red	760°C
18k Yellow	704°C
18k White	760°C



Fig 2.2.2.1 Cooling or quenching of metal



## 2.2.3 Alloyed Gold Types

### 1. White Gold

- Other than copper, all other gold alloying metals will whiten the colour hence it is possible to make white karat gold also.
- Additions of any white metal to gold could potentially bleach it's colour.
- Normally, nickel and platinum are strong 'bleachers' of gold; silver and zinc are moderate bleachers and silver and zinc are moderate bleachers and all other metals have moderate to weak effect on gold.
- This is divided into 2 basic types of white gold - the Nickel whites and the Platinum white.
- At 9 karat (37.5% pure gold), the gold-silver alloy is somewhat white, ductile although soft and is used for jewellery purposes.
- White gold is available up to 21 karat.



Fig 2.2.3.1 White gold vs other gold colour

## 2.2.3 Alloyed Gold Types

### 2. Nickel White Gold

- Nickel alloying additions form hard and strong white gold up to 18 karat.
- They are difficult to work and suffer from so-called 'fire cracking'.
- This copper addition affects colour, and white gold alloys are not a good white colour - more a slight yellow/ brown tint, particularly if nickel content is also low.
- As a result, white gold jewellery is usually electroplated with rhodium (a platinum metal) which is tarnish resistant and gives a good white colour.
- Unfortunately many people are allergic to nickel in when it comes in contact with the skin and this can give rise to skin rash or irritation.
- In Europe, nickel white gold is being replaced by platinum white gold.
- The USA is taking a more relaxed approach, requiring jewellery to be labelled as nickel-containing, and most jewellery in the West these days is marketed as 'non-allergenic' or 'nickel-free'.



Fig 2.2.3.2 White gold vs other gold colour

## 2.2.3 Alloyed Gold Types

### 3. Palladium White Gold

- Additions of about 10 -12% palladium to gold gives a good white colour.
- However, palladium is an expensive metal.
- Jewellery in palladium white gold will be more expensive than identical pieces in nickel whites for 2 reasons: firstly, the cost of the palladium and secondly, the impact of density.
- Palladium white gold is much denser making the jewellery heavier as it contains more gold.
- It is also more difficult to process as the melting temperatures are substantially higher.
- Many commercial palladium white gold only contain about 6-8% palladium plus silver, zinc and copper.
- These may also have a lesser white colour and may require rhodium plating.
- Palladium white gold tend to be softer and more ductile compared to nickel whites and so will not wear as well.
- They are available in all karatages up to 21 karat.
- It is not possible to have a 22 karat white gold.



Fig 2.2.3.3 Palladium white gold vs standard white gold and platinum

### 2.2.3 Alloyed Gold Types

Metal (Symbol)	Function	Melting Point (°C)	Color
Palladium (Pd)	Reduces corrosion and tarnish Improves mechanical properties	1554	White
Platinum (Pt)	Raises melting temperature Improves hardness and elasticity	1772	Blue-white
Copper (Cu)	Hardens and strengthens the alloy Allows heat-treatment properties	1083.4	Reddish
Silver (Ag)	Hardens gold alloy Counters copper's redness	961.9	Silver
Zinc (Zn)	Acts as oxygen scavenger during casting process	419.6	Blue-white
Indium (In)	Used as a replacement for zinc	156.6	Gray-white
Nickel (Ni)	Seldom used. Increases hardness and strength	1453	White
Tin (Sn)	Acts with palladium and platinum to harden the alloy	232	White
Gallium (Ga)	Forms oxides for bonding ceramic to metal	29.8	Gray-white
Iridium (Ir)	Improves yield strength by creating smaller grains	2410	Silver-white
Ruthenium (Ru)	Improves yield strength by creating smaller grains	2310	White

KARAT	GOLD	PALLADIUM	SILVER	COPPER	ZINC	NICKEL
18K	75	20	5			
	75	15	10			
	75	10	15			
	75	10	10.5	3.5	0.1	0.9
	75	6.4	9.9	5.1	3.5	1.1
	75	15		3.0		7.0
14K	58.3	20	6	3	1	
	58.5	5	32.5	20.5	1.4	
10K	37.5		52	4.9	4.2	1.4

Fig 2.2.3.4 Gold alloy charts with colours

## 2.2.4 How to Make Gold Alloy

- Weigh the metals carefully in the proportions as per the listing in the gold alloying tables (the larger the amount prepared, the more accurate the karat the resulting gold alloy will be).
- Soak all the metals to make sure they are all thoroughly cleaned.
- Mix the metals, except the gold, in a crucible fluxed with borax.
- Melt the metals with a reducing flame (starting with the highest melting point of metal).
- Do not bring the metal to a boil.
- Stir constantly with a carbon stirring rod.
- Keep the metal molten and add the fine gold.
- Pour the molten gold alloy into an ingot mould or dent made in a charcoal block.
- If the resulting gold alloy is brittle when later worked, this will indicate impurities.
- Streaks of colour will indicate that the alloy was not mixed properly and may have to be re-melted and remixed with a carbon stirring rod.

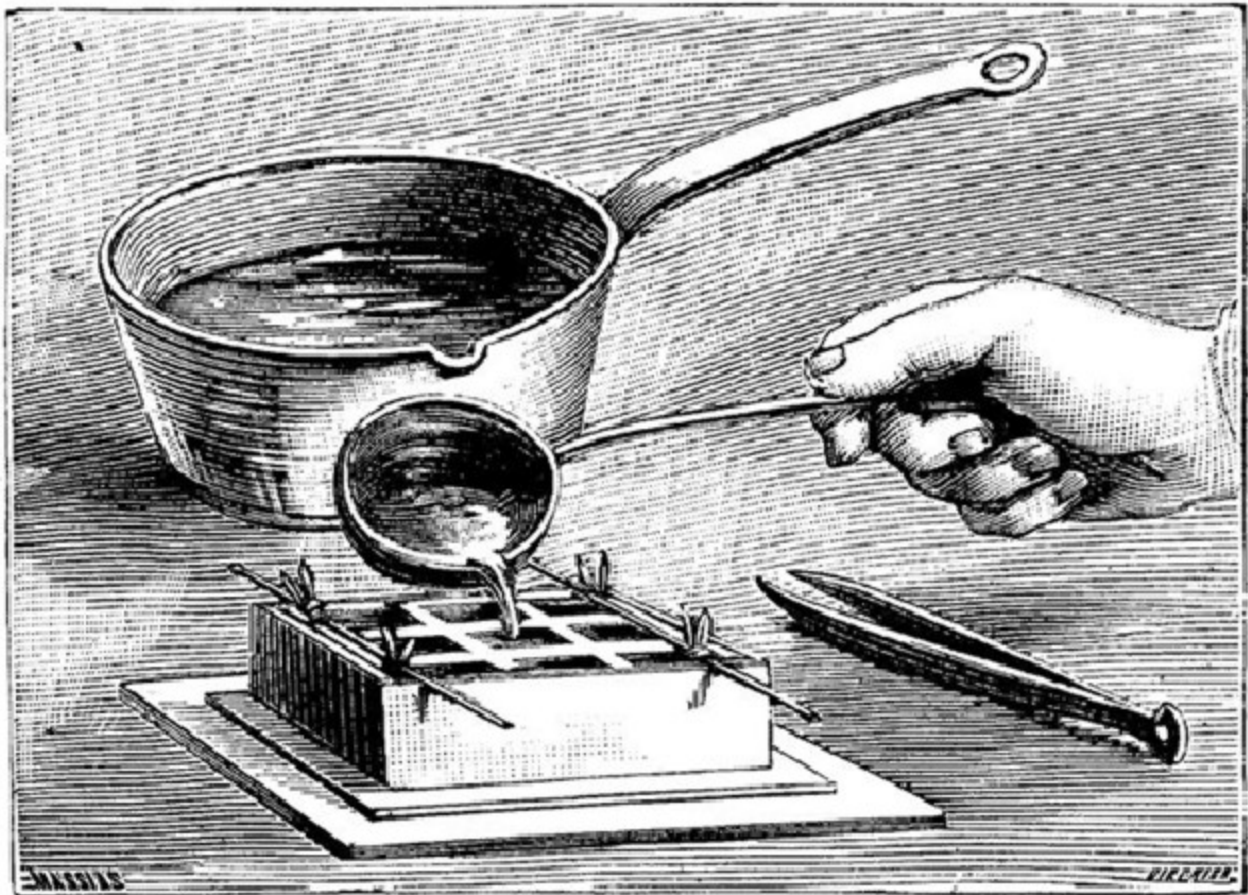


Fig 2.2.4.1 Making gold alloy

## 2.2.5 How to Increase or Decrease Gold Karat

### A. Formula for Raising Karat

$$\frac{((K1 - K2) \times W)}{(24 - K1)} = \text{Amount of pure gold required to be added}$$

1. Weigh the gold you want to increase the karat for (W).
2. Subtract the starting karat (K2) from the preferred karat (K1).
3. Multiply the result of step 2 by the starting weight, W.
4. Subtract the desired karat (K1) from 24 (for 24 karat).
5. Divide the result of step 3 by the result of step 4.
6. You now have the amount of 24K gold you need to add to your original karat gold to increase it.
7. For example:
  - How much 24K gold do you need to add to 7 grams of 10K gold to increase its karatage to 14K?
  - $\frac{((14 - 10) \times 7)}{(24 - 14)} = 2.8$  grams of 24k

### B. Formula for Lowering Karat

$$\frac{((W \times K1) - (W \times K2))}{K2} = \text{Amount of alloy you need to add to}$$

to lower the karatage of gold

1. Weigh the gold whose karatage needs to be lowered (W).
2. Multiply this weight, W by its karat (K1).
3. Multiply the starting weight, W by the desired karat (K2).
4. Subtract the result of step 3 from the result of step 2.
5. Divide the result of step 4 by the desired karat (K2).
6. You now know how much alloy needs to be added to the gold to lower its karat.
7. For example:
  - If you need to lower the karatage of a 6 grams 18k gold piece to 10k, how much alloy do you need to add?
  - $\frac{((6 \times 18) - (6 \times 10))}{10} = 4.8$  grams of alloy

## 2.2.6 Silver Alloy

- Sterling silver contains 92.5% silver, and the rest is copper and zinc.
- Britannia silver contains 95.8% silver, and the rest is copper and zinc.
- Coin silver contains 90% silver and 10% copper.
- Vermeil and German silver are some other silver alloys used in jewellery.
- Vermeil is a combination having the inside core of pure sterling silver and the outside is a solid coating of finely crafted 14 karat gold.

Silver Purity or Fineness	Also Termed As:
<b>999.9</b>	<b>Ultra Fine Silver</b>
<b>999</b>	<b>Fine Silver or Pure Silver</b>
<b>958</b>	<b>Britannia Silver</b>
<b>950</b>	<b>French 1<sup>st</sup> Standard, Mexican Silver</b>
<b>925</b>	<b>Sterling Silver</b>
<b>900</b>	<b>Coin Silver</b>
<b>830</b>	<b>Scandinavian Silver</b>
<b>800</b>	<b>German Silver, Egyptian Silver</b>



Fig 2.2.6.1 Silver alloy

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Introduction to Precious metal

## 2.2.7 Platinum Alloy

- To enhance its characteristics and durability, platinum is alloyed with copper and cobalt along with 'platinum group' metals, such as palladium, rhodium and iridium.
- The main advantage of platinum as a metal for jewellery is its resistance to tarnish and its strength.
- Pure platinum melts at 1769°C.
- Ruthenium, rhodium, palladium, osmium, iridium, and platinum together make up the platinum group of metals.

### Common Platinum Alloys by Volume

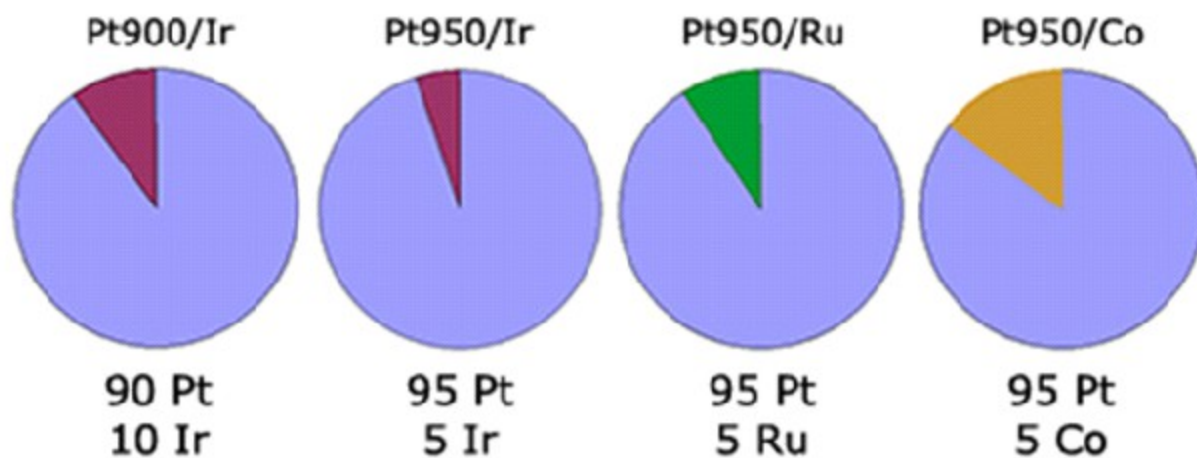


Fig 2.2.7.1 Platinum alloys

### Tips



1. Always remember that pure 24 karat gold is very soft to work with and needs to be mixed with alloy to make it stronger and durable to be used in jewellery.
2. Different colours are achievable with different alloys.
3. Always cool the mixed metal before working on it as per the table above to avoid any metal defects.



## Unit 2.3: Types of Jewellery

### Unit Objectives



At the end of this unit, you will be able to:

1. Analyze the different types of Indian jewellery.

### 2.3.1 Types of Indian Jewellery

#### Antique Jewellery

Antique Jewellery is loved by most and look elegant and beautiful. This kind of jewellery has a dull and rough look. Antique jewellery comes in numerous forms, like meenakari, kundan work, jadau etc.



Fig 2.3.1.1 Antique jewellery

## 2.3.1 Types of Indian Jewellery

### Bead Jewellery

During ancient times, people used to make beads out of gold, silver, copper, clay, ivory and even wood. Beads made out of copper, silver, other base metals, glass and plastic are very popular in India and are worn by all age group people.

Beads of various sizes are used in Imitation jewellery. The metal beads are normally plated with gold and silver.



Fig 2.3.1.2 Bead jewellery



## 2.3.1 Types of Indian Jewellery

### Custom or Customized Jewellery

Custom or customized jewellery gives total freedom to the customer to make the jewellery according to what they want. Like readymade jewellery, in customized jewellery too there are a number of options, like gold plated jewellery, silver plated jewellery, diamond look alike jewellery, kundan jewellery, gemstone jewellery, minakari jewellery, bead jewellery, imitation pearl jewellery, etc.

In readymade jewellery, the jeweller helps the customer to choose according to what the latter wants but the jewellery is not changed or altered and the customer chooses it from a catalogue. The jeweller also gives his or her personal suggestions, to help the customer choose from a wide variety.

In custom made jewellery the customer and craftsman together decide what design has to be made. Often, the customer knows what he or she desires and takes this idea to the jeweller, in the form of a sketch or picture or sample.



Fig 2.3.1.4 Custom or customized jewellery

## 2.3.1 Types of Indian Jewellery

### Filigree Jewellery

Filigree also known as Filagree and earlier was also written as filigrene or filigrann is a form of intricate metalwork used in jewellery making and also other forms of metal work.

Filigree Jewellery is a unique piece that includes handcrafted and twisted threads of precious metal into a design. This metal is then soldered with gold or silver jewellery taking the shape of a symmetrical art work.

What does Filigree involve?

Filigree work involves lots of precision and details, and requires great amount of patience and an eye for minute details. Base metals are made into very thin wires, by passing it through a wire drawing machine or by hammering. After this, the two thinnest wires are heated and twisted around a rotating wheel machine, known as "Charkha". They are then flattened again, to make it as a single wire. This wire is bent in different ways, to give it many different forms and shapes. The jewellery is plated with gold or silver to resemble the precious metals.



Fig 2.3.1.5 Filigree jewellery

### 2.3.1 Types of Indian Jewellery

#### Plain Gold Plated Jewellery

The Plain Gold Plated Jewellery is a type that Some major gold plated jewellery of India includes necklaces, nose rings, earrings, hair clips, waistbands or toe rings etc., all popular among Indian women. The 1-gram gold jewellery is actually gold plated jewellery with another base metal.



*Fig 2.3.1.6 Plain gold plated jewellery*

## 2.3.1 Types of Indian Jewellery

### Imitation Jadau Jewellery

In Imitation Jadau jewellery, stones resembling precious and semi-precious gemstones, crystals and beads are used which are embedded in metal, which is first melted a bit. When the metal becomes flexible, the stones are set on it with great precision and artistry. After that, it is allowed to cool down and the stones get fixed on it without any glue or carvings. The chiterias make the basic design, ghaarias are responsible for engraving and making holes, Minakari or enamelling is done by the enameller and the goldsmith takes care of the kundani or the gold. Uncut glass resembling uncut diamonds (polki or vilandi) are used as the central stone. Minakari or art work done at the back of the jewel is purely for beautifying purposes. The stone setters first set the stone in silver foil then combine with a finishing of gold plating.



Fig 2.3.1.7 Imitation jadau jewellery

### 2.3.1 Types of Indian Jewellery

#### Imitation Kundan Jewellery

Imitation kundan jewellery has glass studded on one side and colourful minakari on the back side. The entire technique of Kundankari lies in the skilful setting of stones in metal, which is rarely solid. Holes are cut for the stones, engraving is carried out and the pieces are enamelled. The main part of the ornament is made out of lac, a natural resin. Later, lac is inserted into the hollow parts and is then visible from the front, through the holes left for the stones. Refined metal is used to cover the lac and stones are then pushed into the metal. To increase the strength of the joints and to give it a smooth finish, more metal is applied.



*Fig 2.3.1.8 Imitation kundan jewellery*



### 2.3.1 Types of Indian Jewellery

#### Lac or Lacquer Jewellery

Another type of Indian Jewellery is Lac or Lacquer Jewellery. The process of making lac or lacquer jewellery is complex. Glass beads, flower shaped mirrors and decorative wire are also used for the enhancement of beauty of the jewellery.

The bangles of lac consist of an inner area that has a covering of thin layer of superior quality lac. Main lac, when mixed with a material similar to white clay, strengthens the bangle. The heating, mixing, pressing, and hammering of the dried ingredients takes place repeatedly and soft dry paste is formed. Once this paste is heated, it is shaped further and the expansion of the lac makes up for the required thickness, resulting in thickening of bangle. Next, a flat-shaped tool is used to roll the bangle across the flat surface, which gives it a proper thickness. The shaping is done by controlling the lac into grooves (coloured) on every side of the mould. The lac takes the shape of the groove into which it is forced. This process requires great precision.



Fig 2.3.1.9 Lac or lacquer jewellery

## 2.3.1 Types of Indian Jewellery

### Minakari or Meenakari Jewellery

In Meenakari jewellery, stones are set and then enamelled with metal. As it is generally done on the reverse side of kundan jewellery, meenakar has to work with craftsman, engraver or ghaaria, designer or chiteri as well as jadiya. The art requires high skill and its difficulty for application requires a technical mind set. In Meenakari, the piece of metal on which the work is to be done, is fixed on a lac stick. Designs of flowers, birds, fish etc. are engraved on it. This creates walls or grooves, to hold colour. Enamel dust, of required colour, is then poured into the grooves and each colour is put under fire individually. The heat of the furnace melts the colour and the coloured liquid spreads equally into the groove. This process is repeated with each colour. Colours which are most heat resistant are applied first, as they are re-heated with each additional colour. Once the last colour has been heated, the material is cooled and polished with agate. The depth of the grooves, filled with different colours, determines the play of light.

Metal is used for the base of Meenakari. Choice of colours, in case of silver colour metal, has to be green, yellow or blue, as these are the colours which stick with it. As for gold colour metal, all the colours can be applied to it and this is also the reason why the metal is preferred for Meenakari jewellery.



Fig 2.3.1.10 Minakari or meenakari jewellery

## 2.3.1 Types of Indian Jewellery

### Dokra or Dhokra Jewellery

Dokra is the art of metal crafts amongst some native tribes of eastern India. Basically, bronze melted with lac and resin is solidified into alloyed wires and rods, sometimes plates. Then the models are made with them and the designs created. They are handcrafted, therefore, the shapes are not perfect, and the symmetries are not mirror image produced like in computer graphics.

The themes and subjects of Dokra or Dhokra jewellery are usually nature and animals.

Dokra jewellery sets are heavy in weight especially if made with heavy metals such as copper or bronze. To create Dokra jewellery, the craftsman starts preparing the casting furnace and the wax image. The wax and the resin (dhuna) should be correctly mixed with oil to make the necessary lump. The image to be made must be clearly visualized by the craftsman, until it is ready to be modelled in the prepared lump of wax. When the wax-image is done it has to be purified with pancha - varna or the five powdered pigments. The joints of the component parts of the wax model should be strengthened with copper rods or nails before being covered by the clay mould. These supports may be removed after the wax model melts due to the heat of furnace. The craftsman then pours molten metal into a hole in the mould, breaks away the clay, brings out the object and finally smoothens and polishes it. The most important rule, in this metal craft is created by non-metals like wax, resin and clay and the artistic work is done with them.



Fig 2.3.1.11 Dokra or dhokra jewellery

## 2.3.1 Types of Indian Jewellery

### Fusion Jewellery

Fusion jewellery is a combination of traditional and modern designs. They are designed keeping in mind the current Imitation trends of the industry. They are very bold, bright and colourful but also rooted to the origins.



Fig 2.3.1.12 Fusion jewellery

## 2.3.1 Types of Indian Jewellery

### Imitation Thewa Jewellery

Yet another type of Indian Jewellery is the Imitation Thewa Jewellery. Thewa is a special art of jewellery making which involves embossing of intricately designed sheet of metal on molten glass. It literally means "setting". Thewa is the art of combining soft metal with multi-coloured glass. Each unit consists of a flat piece of transparent glass of different colours suggesting ruby (red), emerald (green) and sapphire (blue). The piece of glass is wrapped in a frame of gold plated silver wire. A paper-thin sheet of metal, of the same size as the glass, is cut and a free hand sketch of floral or historical motifs is made on it, by special tools. It is then dipped in acid for a while and washed thoroughly with water. A mixture of cinnamon oil (dalchini tel) and another material known as 'Ratti' is brushed at the back, to prevent the metal from melting. The glass is then semi melted and the gold pattern is carefully slipped over the edge and pressed onto the surface of the glass. The piece is reheated, till the gold and glass join firmly together. A thin silver foil is fixed on the other side, in order to give it a uniform lustre.



Fig 2.3.1.13 Imitation thewa jewellery

## 2.3.2 Categories of Jewellery

- There are various categories of jewellery such as head ornaments, neck ornaments, hand ornaments, body ornaments, leg and feet ornaments.
- Each of these are further divided as below:
  - Head Ornaments:
    - Maang Tikka
    - Sarpech (worn on turban by bridegroom)
  - Neck Ornaments:
    - Necklace
    - Choker
    - Chains
  - Hand and Arm Ornaments:
    - Bracelets
    - Bangles
    - Arm Band
    - Ring
    - Cufflinks
  - Body Ornaments:
    - Tie Pins
    - Brooch
    - Waistband (Kamarpatta)
  - Leg and Feet Ornaments:
    - Anklets (payal, jhanjhaar, paijab)
    - Toe Rings

### Categories of Jewellery



Fig 2.3.2.1 Categories of jewellery



## Unit 2.4: Type of Gemstone used in Studdeed Jewellery

### Unit Objectives

**At the end of this unit, you will be able to:**

1. Understand the basics of diamonds and gemstones and care to be taken while setting them in metal.

### 2.4.1 Diamonds



Fig 2.4.1.1 Diamonds

1. Diamonds are the hardest material on earth.
2. They are made of carbon (the lead of a pencil is also made of carbon).
3. Diamonds are graded for 4Cs:
  - Clarity
  - ♦ Colour
  - ♦ Cut
  - Carat
4. When matching diamonds for wax setting, please read the job sheet for the 4Cs requirements.
5. Although diamonds are the hardest, they can break if they are not handled carefully.
6. If you drop a diamond, ask your supervisor to check for any damages.
7. Diamonds can become milky when temperatures of 800°C and more touch them.
8. Diamonds can damage other gemstones, so do not keep them together on the stone tray.

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Click Here  
Diversity in Indian Jewellery



Click Here  
Categories of Indian Jewellery



## 2.4.1 Diamonds

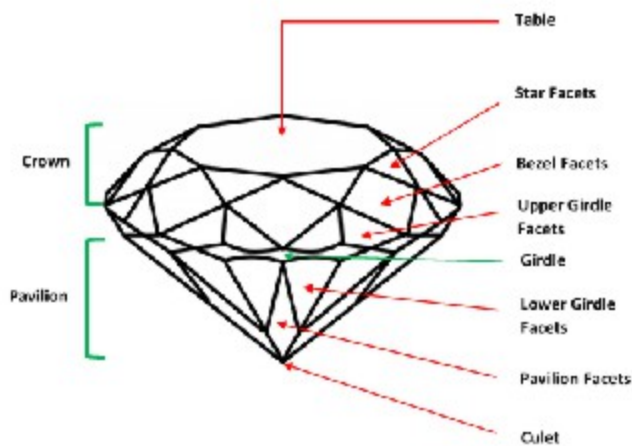


Fig 2.4.2.2 Parts of a Cut Diamond and Gemstone

1. The table is the biggest facet (face of the stone).
2. When setting a stone, the table of the stone should face upwards.
3. The girdle is the main area where the metal setting secures the stones.
4. When picking up a stone with a setting tool, setting stick or vacuum tweezer, always place the tool on the table facet.
5. The girdle of a diamond can break if not handled properly especially if it is extremely thin in size.

Color	Carat / Weight	Clarity	Cut
Colorless D E F	0.25 0.50 1.00	FL / IF VVS1 / VVS2	Emerald Pearl
Near Colorless G H I J	1.25 1.50 1.75	VVS1 / VVS2 SI / S1c	Marquise Oval
Faint Yellow K L M	2.00 2.50 3.00	I1 I2 I3	Heart Finnesse Round
Very Light Yellow N O P Q R			
Light Yellow S T U V			

Fig 2.4.1.3 4Cs of Diamonds

1. Check your job sheet for the 4Cs of diamonds to be used for setting.
2. Match the diamonds given to you for setting as per job sheet.
3. Carat or diamond size is the most important 'C' while wax setting.
4. If a stone is not of correct size, report it to your supervisor.
5. Do not mix stones on your own without asking your supervisor.
6. If you put a wrong stone, remove it and put the correct stone.

## 2.4.1 Diamonds



Fig 2.4.1.4 Cuts and shapes for diamonds

## 2.4.2 Gemstones



Fig 2.4.2.1 Gemstones (Coloured Stones)

1. Gemstones are also called coloured stones.
2. In the market, they are divided into Precious and Semi-Precious.
3. In wax setting, only gemstones having a hardness of more than 9 are used.
4. Gemstones having hardness below 9 will get damaged.



Fig 2.4.2.2 Various gemstones used in Metal Setting

- Diamond
- Ruby
- Sapphire
- Garnet
- ◆ CZ (Cubic Zirconia; American Diamond)
- Synthetic Diamond
- Synthetic Ruby
- Synthetic Sapphire
- ◆ Synthetic Moissanite

## 2.4.2 Gemstones



Fig 2.4.2.3 Various gemstones used in Metal Setting

- ◆ Emerald
- ◆ Pearls (natural and cultured)
- ◆ Opal
- ◆ Coral
- ◆ Jade
- ◆ Amethyst
- ◆ Peridot
- ◆ Synthetic Emerald
- ◆ Aquamarine
- ◆ Topaz
- ◆ Tourmaline
- ◆ Lapis Lazuli
- ◆ Turquoise
- ◆ Onyx



Fig 2.4.2.4 Cuts and shapes for gemstones

**Tips**

1. Diamonds are the hardest materials on earth.
2. Diamonds are graded for 4Cs:
  - a. Clarity
  - b. Colour
  - c. Cut
  - d. Carat
3. The table is the biggest facet (face of the stone).
4. The girdle of a diamond can break if not handled properly especially if it extremely thin in size.
5. Gemstones are also called Coloured Stones.
6. Gemstones having hardness below 9 will get damaged.
7. Check for any missing or damaged stones when assembling the frame work especially if the piece has been sent after wax setting, if you find any missing or damaged, inform your supervisor.

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Common features & Diamond

## Unit 2.5: Types of Settings

### Unit Objectives

At the end of this unit, you will be able to:

1. Analyze which are the different types of basic and advanced settings for Metals.

### 2.5.1 Types of Settings

Prong setting uses a stone between two or more claws and is commonly used with gem stones or diamonds. This is the setting that allows maximum light inside the stone among all the types of jewellery settings. They are used in single stones or clusters. Single, double, triple, V-Prong/Chevron and decorative double are the prong settings.

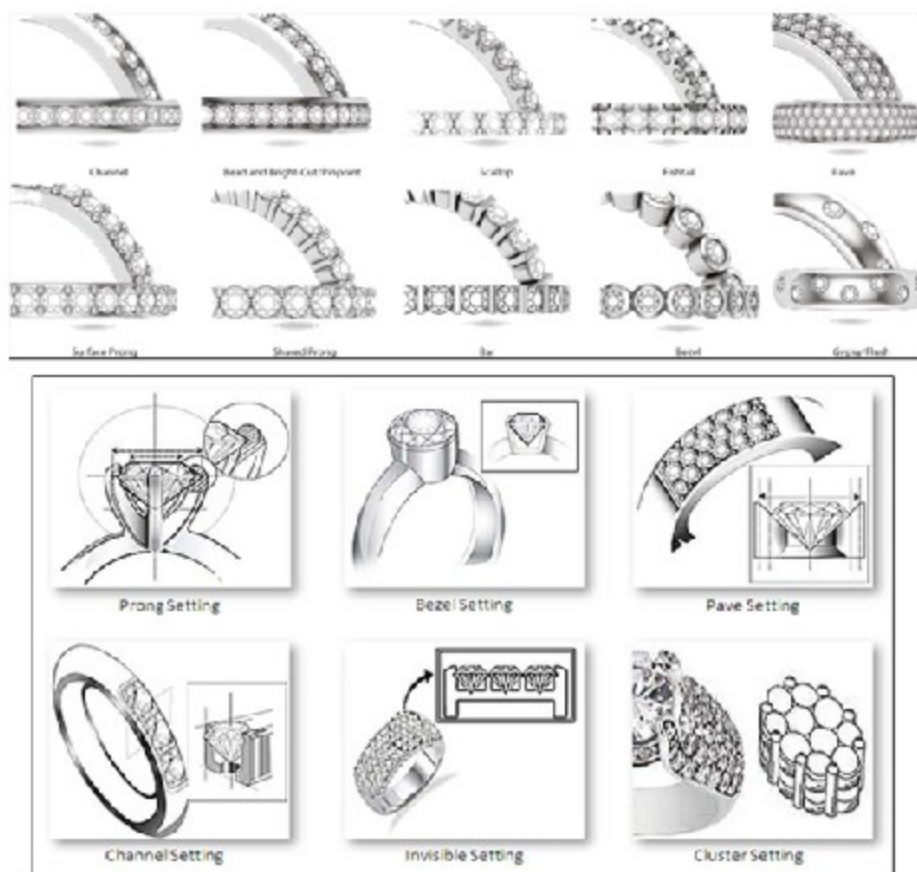


Fig 2.5.1.1 Different setting styles

## 2.5.1 Types of Settings

### Prong Setting

- Prong or Claw setting is the most common setting.
- It is also known in India as “Nakun Setting”, “Sutti Setting”.
- There are some advance prong settings like Triple and Decorative Double.

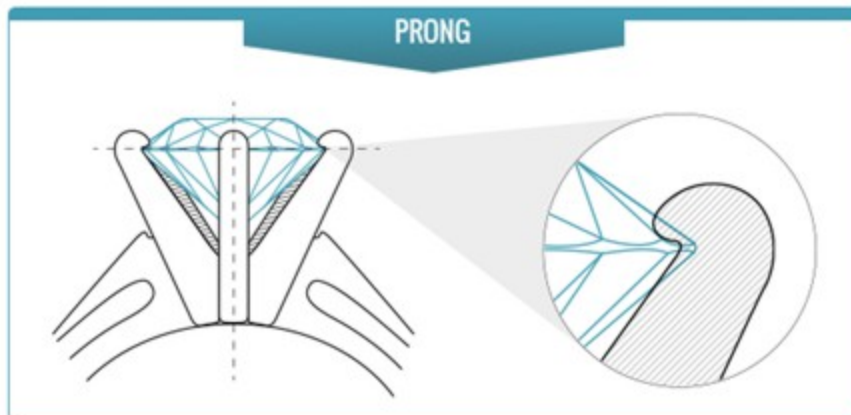
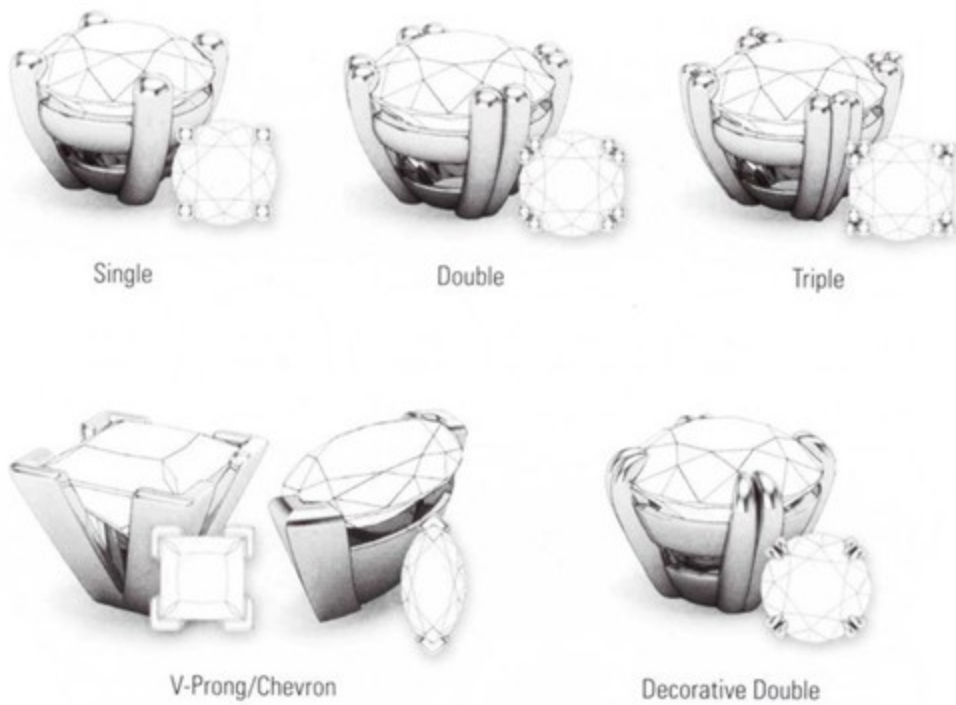


Fig 2.5.1.2 Prong setting

## 2.5.1 Types of Settings

### Other Settings

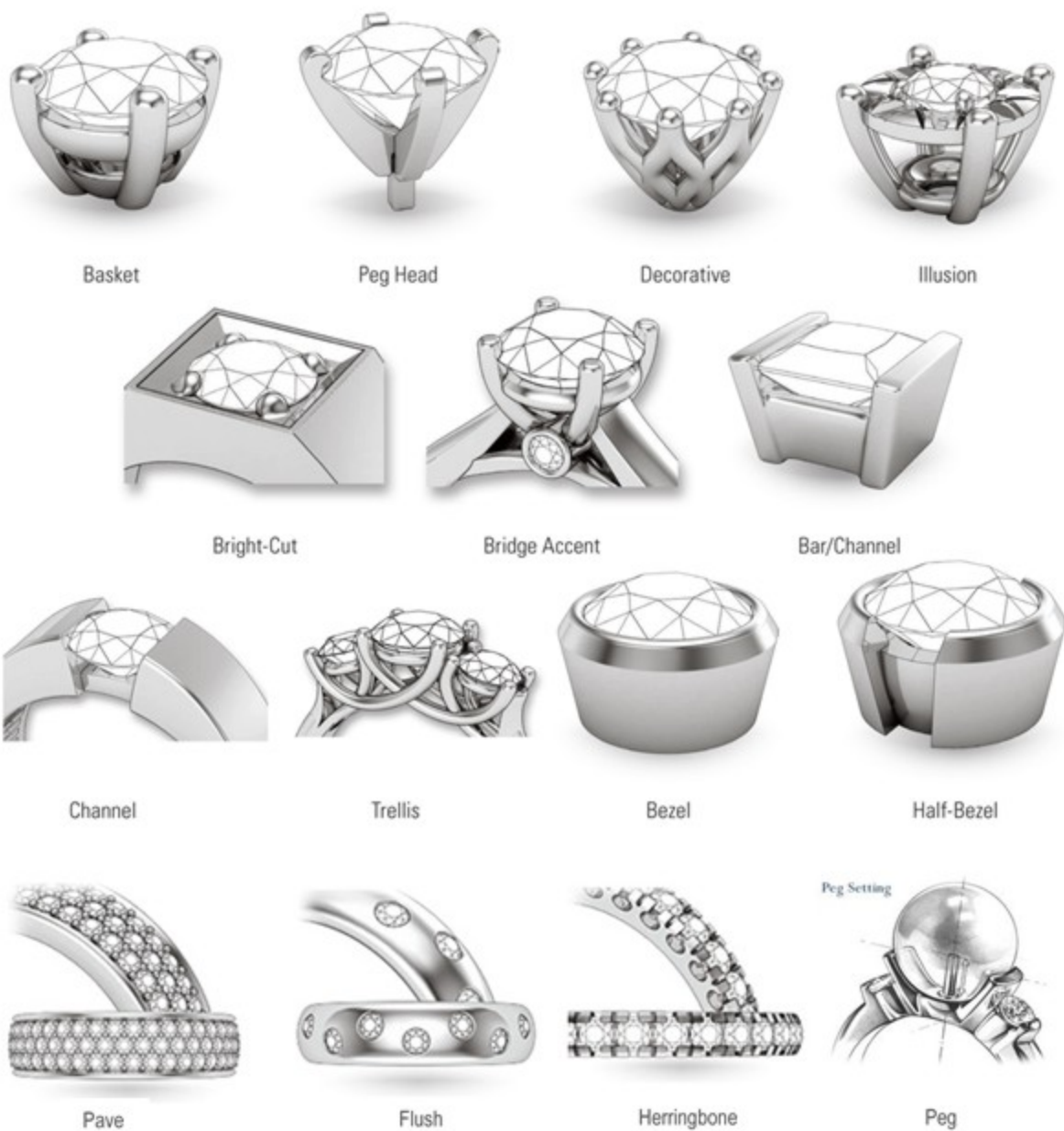


Fig 2.5.1.3 Other settings including prong setting





## Exercise

1. Identify bead jewellery.



2. Write the names of two head and two neck ornaments.

3. Name the setting shown in the image given below.

- a) Pave
- b) Bezel
- c) Channel
- d) Prong



## Unit 2.6: Tools and Equipment Required for Stone Setting

### Unit Objectives

**At the end of this unit, you will be able to:**

1. Analyze the various tools and equipment required for stone setting or fixing.

### 2.6.1 Tools and Equipment Required for Stone Setting

- The stone setting or fixing process involves the requirement of different types of tools and equipment.
- These include flex shaft, beading tools, burnisher, lac stick, ring clamp etc.



*Fig 2.6.1.1 Stone setting or fixing tools and equipment*

## 2.6.1 Tools and Equipment Required for Stone Setting

### Saw Frame and Blades

- Saw frames and blades are used for cutting the metal frame or settings when required.
- Be careful when using the blades as they can cut into your fingers.
- Use gloves whenever possible while using saw blades.



*Fig 2.6.1.2 Saw Frame and Blades*

## 2.6.1 Tools and Equipment Required for Stone Setting

### Needle Files

- Needle files are used to file the metal and help to make create better fitting stone settings.
- They can be used to file down the height of a bezel to make it fit the stone neatly.
- They can also be used to make the file the inside of the bezel setting to make it easier to push the stone.
- They can be used to file rough edges on metal beads and findings.
- Their small size also makes them ideal for getting into small spaces.



*Fig 2.6.1.3 Needle files*

## 2.6.1 Tools and Equipment Required for Stone Setting

### Burnisher

- This is a tool that gives a high shine and professional finish to your stone setting.
- When rubbed onto softer metals such as copper, a burnisher smoothens and shines the metal.
- It can be used to remove tool marks during the stone setting process.



*Fig 2.6.1.4 Burnisher*

## 2.6.1 Tools and Equipment Required for Stone Setting

### Bezel, Prong Pusher and Roller

- Used for pushing bezels, prongs or crown points around stones when mounting and setting stones or in jewellery.
- The polished "V" groove in the tip sets and pushes the bezel against the stone for a secure mount.
- The bezel roller is used for rolling the bezel setting over the stones especially cabochon cuts in pre-setting heads such as bezel cups.
- The bezel roller prevents creases or unsightly marks on the metal.
- To use the bezel roller, push the bezel around the gemstone, working from all sides and gently rocking back and forth with downward pressure until the stone is secure.
- The prong pusher is a tool used when setting faceted gemstones.
- It is particularly useful when working with setting heads as you can use the pusher to push the claws over the top of the stone.
- The square metal rod is slightly rounded on the corners and polished at the end to minimise setting marks and scratches.



Fig 2.6.1.5 Bezel, Prong Pusher and Roller

## 2.6.1 Tools and Equipment Required for Stone Setting

### Prong Lifter

- This highly tempered opener allows the setter to easily open small prong set rings.
- Helps eliminate damage to prongs or stones.



*Fig 2.6.1.6 Prong lifter*



## 2.6.1 Tools and Equipment Required for Stone Setting

### Millgrain Set

- The millgrain set is used for forming decorative edges on settings and bezels.



Fig 2.6.1.7 Millgrain Set

## 2.6.1 Tools and Equipment Required for Stone Setting

### Stone Setting Pliers

- The stone setting pliers is used to set or tighten side stones in a basket setting as well as on other type of mountings.
- One side of the pliers has a slot for the wire under the stone and the other side has a beading tool cup on it.
- To use it, simply slip the post through the slotted side and bring the beading tool down on the prong.
- This is extremely useful for setting the tightening side stones surrounding the centre stones.



*Fig 2.6.1.8 Stone setting plier*

## 2.6.1 Tools and Equipment Required for Stone Setting

### Beading Toolset

- The beading toolset is used for pave and bead setting
- Each cone has a different measurement which is used for rounding the metal for the various bead setting styles.



Fig 2.6.1.9 Beading toolset

## 2.6.1 Tools and Equipment Required for Stone Setting

### Lac or Shellac with Wooden Stick

- Lac or Shellac has amazing holding and sticking properties.
- To create the lac or shellac stick, you need
  - A piece of round or flat wood depending on the size of the object you would like to hold.
  - Place some shellac pieces onto the wood and start melting with a small soldering torch.
  - Cover the wood with approximately 10 to 20mm of shellac (depending on the depth of your piece) ensuring the edges are overlapping.
  - Use a pair of tweezers to secure the item in place and apply heat pushing the piece into the shellac.
  - Once the piece is fixed into the shellac to allow it to cool for between five and ten minutes, the piece is now ready to work on.
  - To release the piece from the shellac heat the item on the shellac (to melt) and remove with a pair of tweezers.



Fig 2.6.1.10 Lac or Shellac with wooden stick

## 2.6.1 Tools and Equipment Required for Stone Setting

### Ring Clamp

- The ring clamp is used for holding rings by the shank while setting the stones in them.
- The ring is held securely by the jaws which have leather attached to them to avoid scratches on the metal.



Fig 2.6.1.11 Ring clamp

## 2.6.1 Tools and Equipment Required for Stone Setting

### Setting Burs

- Setting burs are useful tools for creating a setting seat for the stones.
- Setting seats help in keeping the stone secure in the setting.
  - Use with a pin vice to drill in dry metal clay for clean, precise seats for setting stones in place.
  - Use these burs to cut a seat for faceted stones in bone dry clay or lac.
  - Cuts very easily by hand with a few turns, or put in a pin vise for a better grip.
  - First drill a pilot hole for a light hole and then cut the seat with the bur.
  - Stone table should sit below the surface by a small amount so the clay shrinks around the girdle.
  - Choose the bur that matches the stone size you wish to set.
  - To set stones in metal, install bur in a flex shaft and lubricate with Cut Lube and use a slow speed.
  - Top quality burs should be treated with care.
  - Do not overheat with high speed or the bur will lose its ability to cut.



Fig 2.6.1.12 Setting Burs

## 2.6.1 Tools and Equipment Required for Stone Setting

### Loupes and Magnifying Lens

- Loupes and magnifying lens are very important tools for a Metal Setter.
- These are available as head gears or as hand tools.
- The loupe is available in 10 times magnification (10x), 20x and 30x.
- Loupes are held with one hand and can be easy if you know how to use it.
- Loupes are held in front of one eye while checking the setting.
- Magnifying lens such as the head lens or the Optivisor are attached with the head band to your forehead.
- They come with additional lens for higher magnification.
- The head magnifying lens can help you work with both your hands while magnifying the jewellery piece or frame.
- Many would also use a microscope for setting styles such as micro pave setting.



Fig 2.6.1.13 Loupes and Magnifying Lens

## 2.6.1 Tools and Equipment Required for Stone Setting

### Wax Jewel-Setting Stick

- Wax jewel setting sticks are used for placing the stone in the setting head.
- One can use the traditional clay setting stick or then the new paraffin wax stick.
- Both are easy to use.
- When picking up the stones, be sure you pick it from the table (largest facet of a stone), so that you can place the stone correctly.
- These wax jewel setting sticks will not damage a stone, but if you do not pick up the stone correctly, you may drop the stone and it will get damaged.



Fig 2.6.1.14 Wax jewel-setting stick



## 2.6.1 Tools and Equipment Required for Stone Setting

### Flex Shaft and Tools

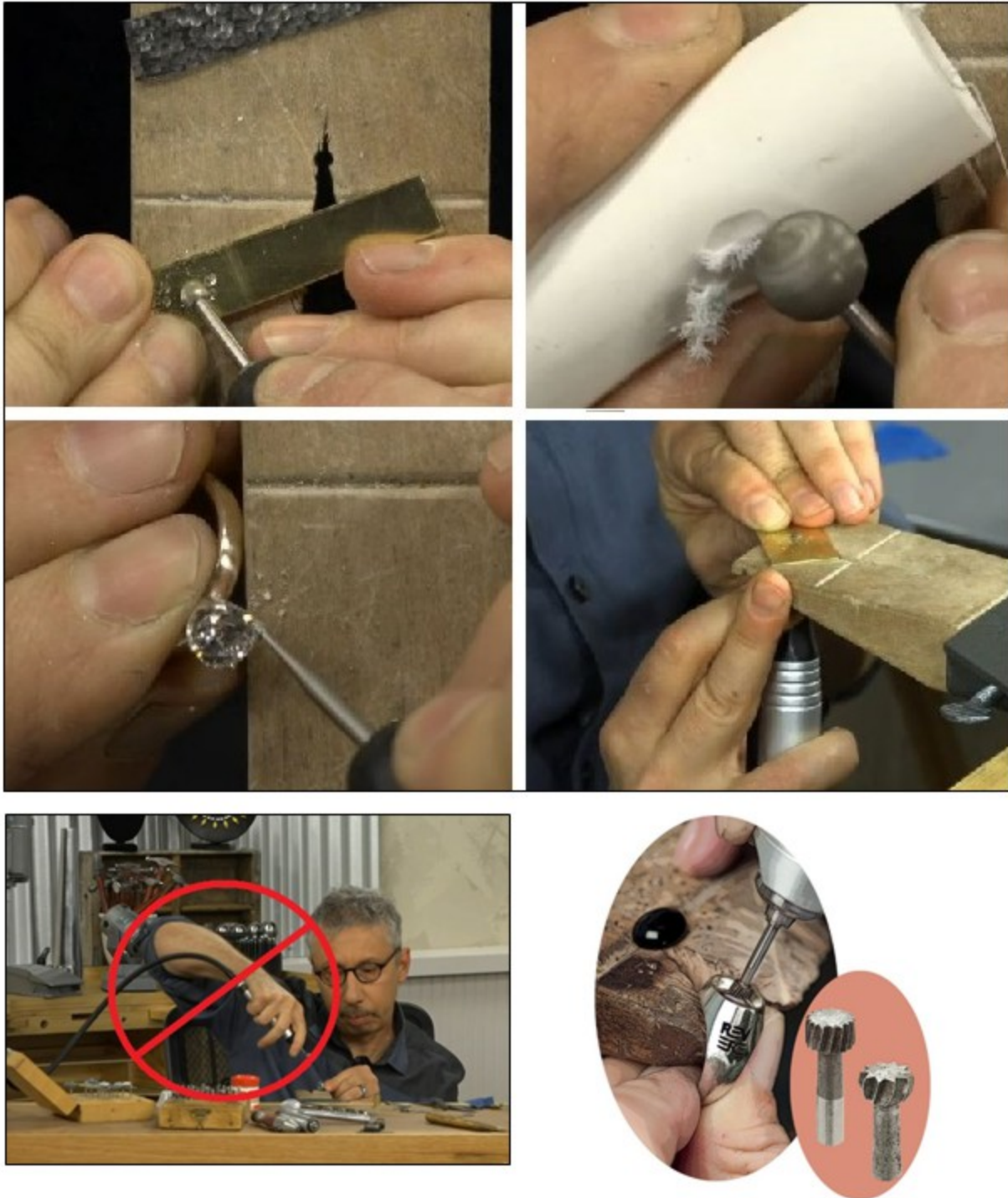


Fig 2.6.1.15 Using the flex shaft and tools

## 2.6.1 Tools and Equipment Required for Stone Setting

### Bench Pin

- A bench pin is a removable tool which is attached to the edge of the bench.
- Depending on the type of work, the bench pin can be changed.
- Bench pins are used for pre-polishing, setting, cutting and holding the ring clamp.

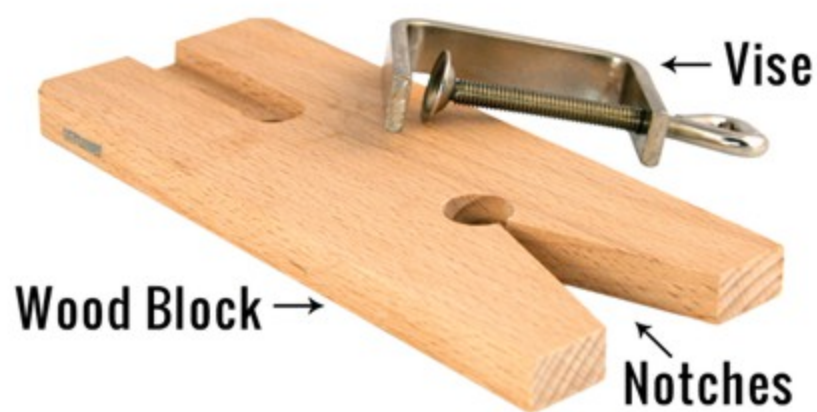


Fig 2.6.1.16 Bench pin

## 2.6.1 Tools and Equipment Required for Stone Setting

### Callipers or Measuring Gauges

- Callipers or measuring gauges are used for measuring the length, width and thickness of metal.
- It is also used for measuring setting components and stones.
- There are different types of callipers and measuring gauges available in the market, use the ones that you are comfortable with and which give you the accurate reading.



Fig 2.6.1.17 Callipers or Measuring Gauges

## 2.6.1 Tools and Equipment Required for Stone Setting

### Hand Drills and Small Drill Bits

- Hand drills and small drill bits are used for drilling holes in the metal manually.
- In India, we use the bow drill for the same purpose.
- However, the advanced flex shafts available today, can also drill holes.



Fig 2.6.1.18 Hand Drills and Small Drill Bits

## 2.6.1 Tools and Equipment Required for Stone Setting

### Tweezers

- Tweezers are tools that make a jeweller's work easy and are a constant in the bench.
- There are different types of tweezers used in jewellery making and it is not limited to any one department.
- These tools keep you safe from chemicals that are used in jewellery making.
- Tweezers are also used to pick up the stones and place them in the setting heads.



Fig 2.6.1.19 Tweezers



## Unit 2.7: Setting a Gemstone in Jewellery

### Unit Objectives

**At the end of this unit, you will be able to:**

1. Analyze the parts of a jewellery piece.
2. Record how to fix or set a stone using the right tool.
3. Record the appropriate steps to fix a stone correctly.

### 2.7.1 Introduction to Metal setting or Hand setting Porcess

#### HAND SETTING

This is an operation in the jewellery manufacturing process, where diamonds or color stones (precious/semi precious) are manually set by hand in metal castings. Hand setting is an extremely high skilled operation and the artisans have to undergo intense training and lots of practice to learn the skills of the setting art. Initially, the trainees are given practice on brass plates with imitation stones, till they have gained confidence and honed their skills. Only after their teacher is satisfied with their progress, the trainees are given actual gold pieces and real diamonds. Simple designs are given to the new setters, so that they gain more confidence.

During the incoming inspection when the pieces arrive in the setting department, the setting QC checker will inspect the pieces thoroughly, as per the check list mentioned below. Only after the pieces are found okay, are they given to the setters for setting.

- The correct design as per the sales work order and batch card.
- The pieces are within the metal weight and size tolerance.
- The pieces have been thoroughly cast cleaned in and around the setting area.
- There are no broken or damaged prongs/pave/channel/bezel areas.

## 2.7.2 Parts of a Jewellery Piece

- Before setting stones in the frame or jewellery, you must know the parts of the jewellery.
- For learning the parts, we will use the ring as an example.
- Arrange the stones as per size required for the different parts of the design.
- Remember, every design will have different setting requirements, always read your job sheet before starting.

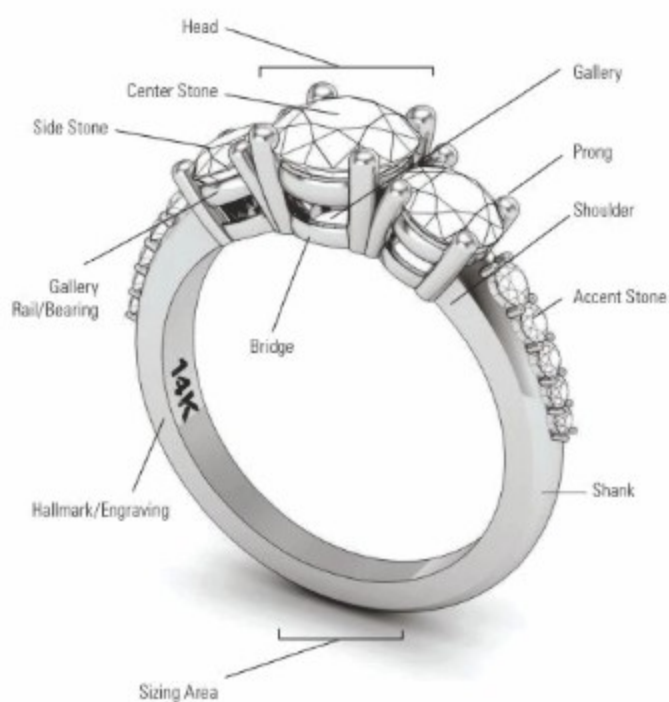


Fig 2.7.2.1 Parts of a Jewellery Piece



### 2.7.3 Various Metal Settings

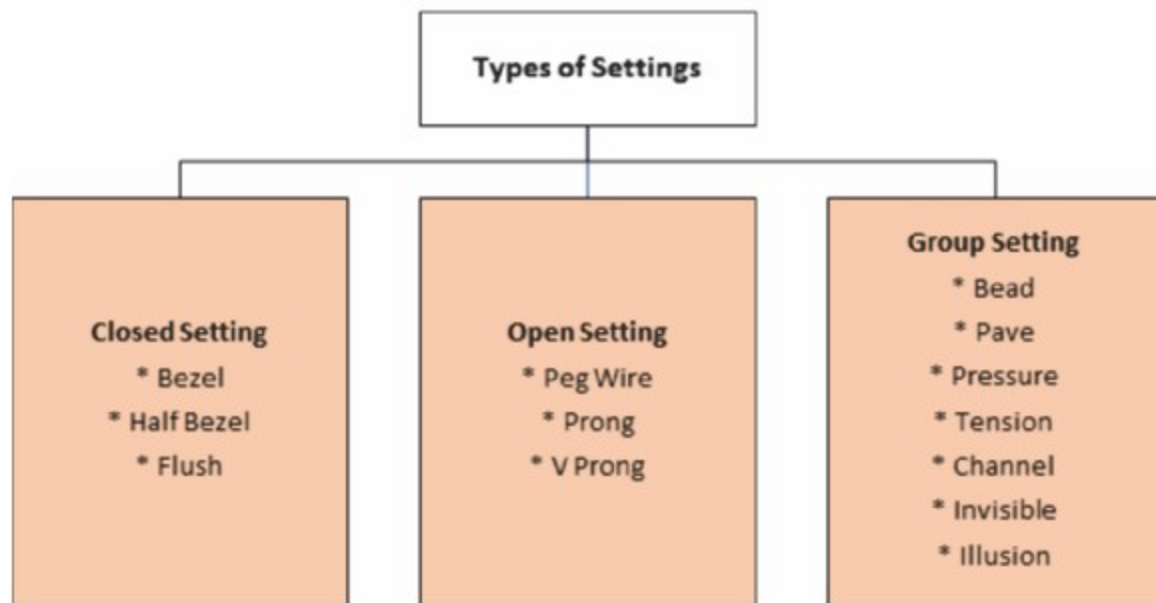


Fig 2.7.3.1 Types of settings

- Before starting the process of the stone fixing or setting, it is important to know the types of settings.
- In the Closed Setting category:
  - A metal sheet surrounds the stone either completely, half or then the stone is set on the level of the metal such as Flush setting.
- In the Open Setting category:
  - Metal wires are used to securely hold the stone in place.
  - The number of metal wires can increase depending on the design and the size of the stone.
- In the Group Setting category:
  - Bead and pave have shared metal beads which secure the stone.
  - In pressure and illusion setting, the central stone is surrounded by other smaller stones.
  - In tension setting, the stone is placed between two metal groove which are the only support that holds the stone in place.
  - In channel setting, the stones do not have metal between them, the stones are placed in a grooved channel next to each other, where the metal is on the opposite side.
  - In invisible setting, the side stones have metal holding them from the side whereas the stones in the central area are held in place by metal wires from the bottom side.

## 2.7.3 Various Metal Settings

### a) Prong Setting

This type of setting is generally in design patterns that take diamonds in single or multiple rows. Prongs are wires that secure the stone from the girdle. Prongs can be placed on a plate of metal in the desired sequence. There is a hole or counter sunk cavity exactly in the centre of the prongs, so that the cu let of the stone does not touch the metal below. This type of setting is called "plate prong setting".

Prongs can also be placed on around a wire seat in the required setting sequence. This type of setting is called "wire prongs" or "collect".

"Single common prongs" is a type of setting where there is only a single prong that holds and supports two stones. These single prongs are almost double the width of the regular prongs because they have to support two stones instead of one stone. The single common prong setting really looks nice but does not give full security to the set stones, as the stones are only held at two points and can come loose after wear and tear. Stones set in single common prongs are generally preferred to be wax set for better security.

To set stones in any form of prong setting, the setter lifts the stone to be set with bee's wax and gently places the stone, table up, in the pre-cut of the prongs. The setter ensures the girdle level of the stone is in perfect alignment with all the other stones set in the sequence and only then does he push the prongs to secure the stone tightly. The setter also ensures that all the prongs are also in perfect alignment with each other. After all the stones have been securely set in the piece, the setter clips, or files the prongs down to the table level of the diamonds. After all the stones have been equally filed down to the required level, the setter selects the correct size cup bur and goes on to evenly cup all the prong tips. This cupping operation is a mandatory requirement as it gives an even and rounded shape to all the prongs. Even if a single prong is out of place or shape, the piece will fail the quality inspection.



Fig 2.7.3.2 Prong Setting

Scan the QR Code to watch the related video or click on link



Click Here  
Prong Setting

## 2.7.3 Various Metal Settings

### b) Full Bezel Setting & Half Bezel Setting

#### Full Bezel Setting

Bezel setting is generally used to set single larger stones. However, single smaller stones are also set in bezel but generally these small stones are set in wax and then casted in metal. A bezel is a very fine strip of metal that runs around, covering the girdle of the stone. The similar guidelines of channel setting are used for setting single stones in a bezel setting. The bezel insides have a pre-determined pre-cut (guideline indicators showing the exact level where the stones have to be set). The setter selects the correct size of 'Hart burr' and deepens the pre-cut, so that the stone to be set can be angled into the pre-cut notch. The setter then pushes the stone into place from the opposite end so that the stone locks into place at the correct level. After all the stones are set in the channel, the setter carefully hammers the top of the bezel with an air hammer (pneumatic hammer). Gold being malleable, is easily hammered down and tightens the stones securely in the bezel setting. After the hammering process is completed, the setter selects a rubber wheel buff and finishes the top of the bezel surface, giving the bezel a smooth and even finishing. The final finishing requires the setter to clean any extra metal burr from inside of the bezel rim with a sharp knife graver. The result is a very fine thin perfectly round metal rim around the girdle of the stone set. The main criteria and points to follow carefully in channel hand setting is...

- The stone in the bezel must be set at the same required level.
- The bezel height must be equal from end to end. The table of the stones must always be slightly below the bezel top surface. In case the table of the stones set is visible above the bezel top, it indicates the bezel has been over worked and the piece can get rejected.
- The metal thickness of the bezel around the stone set must be the same. In case the bezel is uneven in thickness, the piece will fail the QA check.
- The setter must ensure the bezel is finished exactly as required in the design. There are different types of bezels. A) The donut shaped bezel. B) The bevel angled bezel. C) The very fine thin metal rim bezel.

#### Half Bezel Setting

The only difference between a full bezel and half bezel is that there is a break in the continuity of the metal rim in a half bezel. The break in continuity is always at the location of 3 O'clock and 9 O'clock.

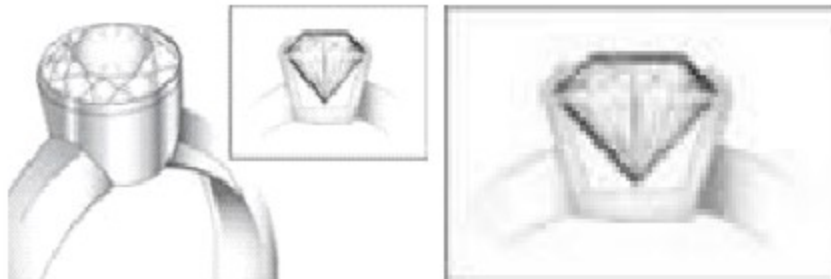


Fig 2.7.3.3 Full Bezel Setting & Half Bezel Setting

Scan the QR Code to watch the related video or click on link



Click Here  
Bezel Setting

## 2.7.3 Various Metal Settings

### c) Flush Setting

This type of setting is generally preferred in the European countries, where the climate is very cold and people wear woollen apparel that can get entangled in jewellery that has prongs, beads or sharp edges. As the name suggests, the stones to be set in any sequence required by the design is totally embedded into a flat metal surface and only a portion of the stone's crown and table are visible when viewed from the top. The setter uses the correct size of round burr on the metal surface to drill a half cup, in which the stone sets flush till the girdle height. The stone to be set is tightly pressed into the cup till the girdle is slightly below the metal edge of the drilled cup. The setter gently hammers the metal around the girdle of the stone till the girdle of the stone is fully covered by metal and the stone is tight and secure. The setter selects a rubber wheel and gently flattens and smoothens the hammered metal around the girdle of the set stone. The setter finally finishes the operation by taking a sharp knife graver and cutting away any extra metal from the inside of the flush setting. The 'Flush Setting' is the most secure type of setting, as the stone has no chance to come loose or fall off from its setting. The disadvantage of this form of setting is that it looks too metallic and the stones set are not clearly visible due to all the extra metal around the stones.



Fig 2.7.3.4 Flush Setting

## 2.7.3 Various Metal Settings

### d) Nick Setting

This type of setting is generally used to give an illusion of more and larger stones set in a channel. The entire process of channel setting is replicated for 'Nick Setting' with a few changes.

- The channel height in Nick Setting is slightly increased to accommodate the nicks to tighten and secure the stones to be set.
- There is a solid flat base with drilled holes where the stones will set. The flat base is brightly pre-polished before setting the stones.
- The insides of the channel after pre-polishing is slightly lesser than the stone size to be set.
- There are holes made in the base that have a fixed distance between each other. The pre-polished base is visible between each stone set and this is what gives the illusion of many stones set when seen at a distance with the naked eye.

The setter gently deepens the notch in the channel where the girdle of the stone is going to set with the correct size 'Hart burr. The setter places the stone in the notch at an angle and presses the stone from the opposite end till it tightly locks in place between both the channels. The setter takes a sharp #4 half round graver to draw nicks over the girdle of the set stone from both the channels. The nicks have to be exactly on the girdle and in centre of the stone. Since the stone is tightly set in the base plate, the two nicks ensure the set stone does not come loose and fall off. The heightened channel ensures that there is no direct impact on the nick set stones.

### e) Invisible Setting

The main concept of invisible setting is to cleverly group together, (girdle to girdle) a set of princess cut diamonds without showing any supporting metal like prongs or channel etc.,. The result is that the bunch of princess cuts give the impression of one big single stone. The most common stone shape used in 'Invisible Setting' is the Princess cut. The four stone quad, the six stone rectangle and the nine stone square are the most popular shape preferences. The stone sizes may vary to achieve different carat weights but the number of stones have to be within the four, six and nine stone benchmark. Each stone size has to be perfectly calibrated to match the final dimensions. The invisible setting is the most complex forms of setting and it is generally done in wax. The design and model are made after carefully planning the number of princess cuts to be used and also the exact size of princess cuts to be used.

The CAD designer completes structuring the design just like any other design. However, when the CAD designer is working on the setting area of a design that takes invisible setting, supports for the grid that will house the princess cuts girdle to girdle has to be precisely measured to the exact mm size. In case there is a slight deviation from size, the stones will not set properly and that can lead to breakage or heavy metal reflection after casting. The model for the invisible setting design is cleverly made, so that when the princess cuts are placed girdle to girdle in the grid sequence, no metal will be visible from the top.

While selecting the stones, the assorter has to select exact calibrated stones with perfect 4C's matching. The princess cuts are bagged and each individual bagging is separately sent for grooving.

Grooving the princess cuts is an extremely high skilled operation where the artisan places a single princess cut diamond horizontally in a spring dye in the grooving machine. A vertical grooving blade that is perfectly aligned in the centre of the spring dye is ready to cut the groove, just under the girdle of the princess cut stone. The artisan carefully aligns the tip of the blade to the exact point where the groove has to be made on the princess cut. Once the alignment is perfect, the artisan switches on the blade and cuts a perfect 'V' groove under the girdle of the princess cut. After the grooving is done, the grooved diamonds are boiled in an acidic solution to remove any residue of grit from inside the groove. Any form of grit or residue left inside the groove can cause reflection after casting.

### 2.7.3 Various Metal Settings

The wax setter who sets the princess cuts in invisible setting is also a very high skilled artisan. The wax setter places the calibrated and grooved princess cuts in the wax grid, girdle to girdle and ensures that all the stones are perfectly levelled and aligned with each other to form the required plus. When satisfied with the levelling and alignment of the princess cuts that are now sitting girdle to girdle, the wax setter takes a solder iron and applies heat on the table of the princess cuts. The heat from the solder iron tip, melts the wax grid below the princess cuts and the melting wax begins to flow into the grooves that are just below the girdle of the princess cuts. The wax cools within the grooves and bonds the princess cuts in wax. The wax set pieces are put on a wax tree and invested in a flask for casting. During the burn out cycle in the furnace, all the wax melts out from the baking flask in a hot controlled heat program. On completion of the burn out cycle, the flask is placed in a casting machine and the metal of choice (perfect metal requirement) is melted in the casting machine crucible and casted at the correct temperature. Molten metal flows into the cavities of the burnt out wax and sets in. On cooling down, the exact metal replica of the earlier invested wax tree is revealed from the flask. Metal that has flown into the grooves below the girdles of the princess cuts securely hold the stones in place. The pieces follow the normal production process but with extra care and precautions.



Fig 2.7.3.5 Invisible Setting

After the final polishing and rhodium treatment, the princess cuts in perfect sequence really look like one big single stone, as no metal is visible between the stones. Invisible setting is also done to set fancy cut shapes like the nine stone Emerald, the round Pie cut, the Cushion cut, the Asher cut etc.,. However, the most preferred shape in these fancy cuts is the nine stone Emerald cut. Nine thin diamond Maces lattices (flat rough diamonds) are individually cut in the shape of an emerald cut in perfect measurements and dimensions. All the nine stones have to match up with each other perfectly from girdle to girdle. After they match up with each other, the nine stones are fixed together and mounted up on a special dop (dye) and faceted together as if they are one single stone. The end result is indeed a spectacular nine stone combination of stones that looks exactly like one big emerald cut stone.

## 2.7.3 Various Metal Settings

### f) Micro Split Setting

In current trends, the micro split setting is the most preferred setting type that gets selected by the designers and the customers like this form of setting as it clearly displays each stone very distinctly and gives the piece a full non metallic diamond look. The micro spit prongs/pave are very tiny, so when the jewellery is finally polished and rhodiumed, you can only see the brightly shining diamonds. Due to the micro prongs/pave being very tiny, the setting is done under microscopic magnification that allows the setter to clearly see the stone he is setting and also to split and divide the grain in an equal 'V', using the correct size of flat graver. The 'V' split securely holds two stones that have been set and when all the grain have been split, each stone is individually secured by 4 grain/micro prongs. The micro grain can be finished in two ways. The 'Flat grain' is achieved by lightly buffing the grain tips with hard polymer wheel buff. The 'Flat grain' is generally used for commercial jewellery. The flat grain does give the jewellery a slight metallic look in comparison to a 'Grain tool' finish. The 'Beaded grain' is achieved by moving a grain tool that is fixed in the hand piece of a micro motor. The grain tool rotates over the grain tips and finally results in a perfectly round beaded grain. The grain tool finish is used for higher end bridal jewellery.

## 2.7.3 Various Metal Settings

### g) Channel Setting

When diamonds or precious/semi precious stones are set and secured between two metal walls, that setting is called 'Channel setting'. To design a style for channel setting, the designer has to consider the diamond sizes that are going to be used and he/she will proportionally construct the channel length, width and height accordingly. Channel setting is generally done in wax. However, certain higher end jewellery customers clearly instruct to set all their diamonds, precious and semi precious stones by hand setting. The channel insides have a pre-determined pre-cut (guideline indicators showing the exact level where the stones have to be set). The setter selects the correct size of 'Hart burr' and deepens the pre-cut, so that the stone to be set can be angled into the pre-cut notch. The setter then pushes the stone into place from the opposite end so that the stone locks into place at the correct level. After all the stones are set in the channel, the setter carefully hammers the top of the channel with an air hammer (pneumatic hammer). Gold being malleable is easily hammered down and tightens the stones securely in the channel setting. After the hammering process is completed, the setter selects a rubber wheel buff and finishes the top of the channel surface, giving the channel a smooth and even finishing. The final finishing requires the setter to clean any extra metal burr from inside of the channel with a sharp knife graver and smoothing any rough metal inside the channel area with a paper disc. The main criteria and points to follow carefully in channel hand setting is ...

Channel Setting



Fig 2.7.3.6 Channel Setting

### h) Tension Setting

The tension setting is named for the tension of the metal band that secures the diamond in place; the result is that the diamond appears suspended between the two sides of the shank.

With the help of lasers used to calibrate the exact dimensions of the diamond, the jeweler expertly cuts tiny grooves into the sides of the band, or shank, so that the diamond, or other precious stone, is literally held by the pressure of the custom-designed metal band pushing into the sides of the stone.

Tension-style settings feature a comparable look of diamond suspension but are less expensive and complicated to make. The tension-style settings are not as secure as the other settings since they do not employ a prong or bezel setting on the side or underneath the diamond to anchor the diamond firmly in place.



## 2.7.3 Various Metal Settings

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### Tension Setting

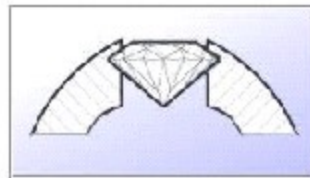


Fig 2.7.3.7 Channel Setting



Fig 2.7.3.8 Tension Setting Ring

## 2.7.3 Various Metal Settings

### 1) Pave Setting

The pavé setting, pronounced “pah-vay,” comes from the French word “to pave,” as in paved with diamonds. By closely setting small diamonds together with minimal visibility of the tiny metal beads or prongs holding the stones in place, the effect is one of continuous sparkle.

The jeweler typically drills holes into the ring, carefully places the diamonds into the holes, and finally forms tiny beads, or mini-prongs, around each diamond to secure them into the holes.

This setting is also known as a bead setting and in the case of especially small stones, may be called a micro-pavé setting. Diamonds are said to be pavé-set when they are as small as .01-.02 carats and any smaller than that could be called micro-pavé.

Pave Setting



Fig 2.7.3.9 Pave Setting



Fig 2.7.3.10 Pave Setting Ring

Scan the QR Code to watch the related video or click on link



Click Here  
Pave setting

## 2.7.3 Various Metal Settings

### j) Other Setting Types

#### Illusion setting

A 3.0 Carat Transitional Round Brilliant-Cut Diamond Sparkles in this Illusion Style Engagement Ring



Fig 2.7.3.11 Illusion Setting

#### Pressure stone setting

In this stone setting one centre stone is hold down by the other side stones girdles and comm on prongs.



Fig 2.7.3.12 Pressure stone setting

#### Fish tail setting

In this stone setting Prongs are created in the shapes of Fish Tails.



Fig 2.7.3.13 Fish tail setting

#### Star setting

In this stone setting stone is secured by grains and star rays are created around it.



Fig 2.7.3.14 Star setting

## Tips



1. Check for any missing prongs, check if they can be repaired, if it is not possible inform your supervisor.
2. Check for damaged setting heads which need repairing.

## Notes



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## Unit 2.8: Handling of Diamonds and Gemstones to Avoid Damage to Stones

### Unit Objectives

**At the end of this unit, you will be able to:**

1. Understand what is the meaning of hardness in stones
2. Understand how to handle diamonds and gemstones so that they do not get damaged while setting them in wax.

### 2.8.1 Mohs Scale of Hardness

1. The Mohs scale of mineral hardness is a scale that defines the scratch resistance of various minerals through the ability of a harder material to scratch a softer material.
2. Diamond is the hardest at no.10 followed by Corundum (Ruby, Sapphire) at no.9.
3. When handling diamonds and gemstones, it is recommended to use stones having hardness of 9 and more.
4. However, please remember that diamonds can break in weak areas, so handle diamonds with care.












Mohs Hardness Scale			
	Mineral Name	Scale Number	Common Object
↑ Increasing Hardness	 → Diamond	10	
	 → Corundum	9	←  Masonry Drill Bit (8.5)
	→ Topaz	8	
	 → Quartz	7	←  Steel Nail (6.5)
	→ Orthoclase	6	
	 → Apatite	5	←  Knife/Glass Plate (5.5)
	→ Fluorite	4	
	 → Calcite	3	←  Copper Penny (3.5)
	→ Gypsum	2	
	 → Talc	1	←  Fingernail (2.5)

Fig 2.8.1.1 Mohs scale of hardness

## 2.8.2 Handling of Diamonds



Fig 2.8.2.1 Handling of diamonds – Correct way of holding princess cut diamond

1. Hold the diamond correctly to avoid any damage.
2. If you are using a tweezer and matching the princess cut diamonds, hold it as shown in the picture above.
3. Princess cut diamonds often break on the points or corners; this can change the clarity grade.
4. Pear, Marquise cut diamonds also might break if held tightly at the points, this can change the clarity grade.
5. Check the bottom also called culet for any damage (also shown in the following pictures).

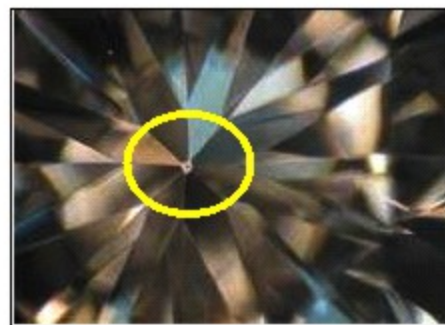
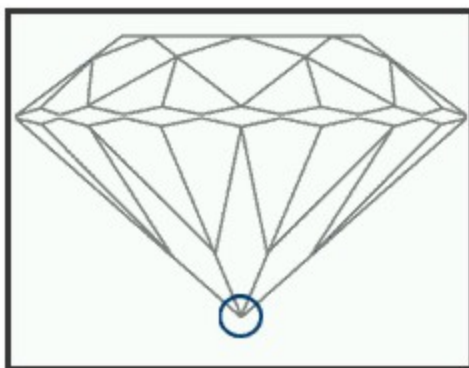


Fig 2.8.2.2 Culet and broken culets

1. The bottom point or culet can break if handled wrongly.
2. Always check before setting and after setting if the culet is broken or not.
3. If the culet is broken after setting, report it to your supervisor.
4. Broken culets can change the clarity grade, therefore, be careful with culets.

## 2.8.2 Handling of Diamonds

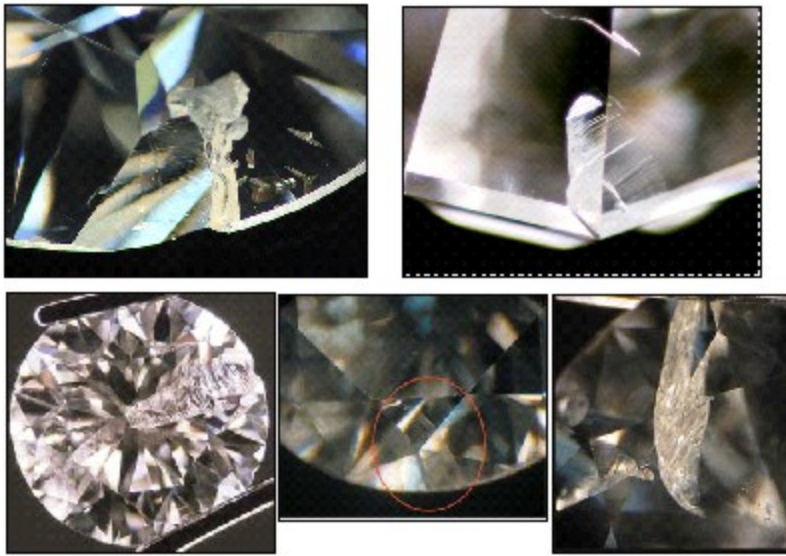


Fig 2.8.2.3 Dangerous feathers, chips and cavity in diamonds

1. Diamonds with dangerous feathers (jeerum), chips, cavity (khad) should be handled with care.
2. If handled wrongly, they can break the diamond or become bigger and change the clarity grade of the diamond.



Fig 2.8.2.4 Broken diamonds



Fig 2.8.2.5 Scratches on diamonds

1. Scratches on diamonds can be caused because of the tools we use.
2. If diamonds rub against each other, they will scratch each other.

### 2.8.3 Handling of Gemstones

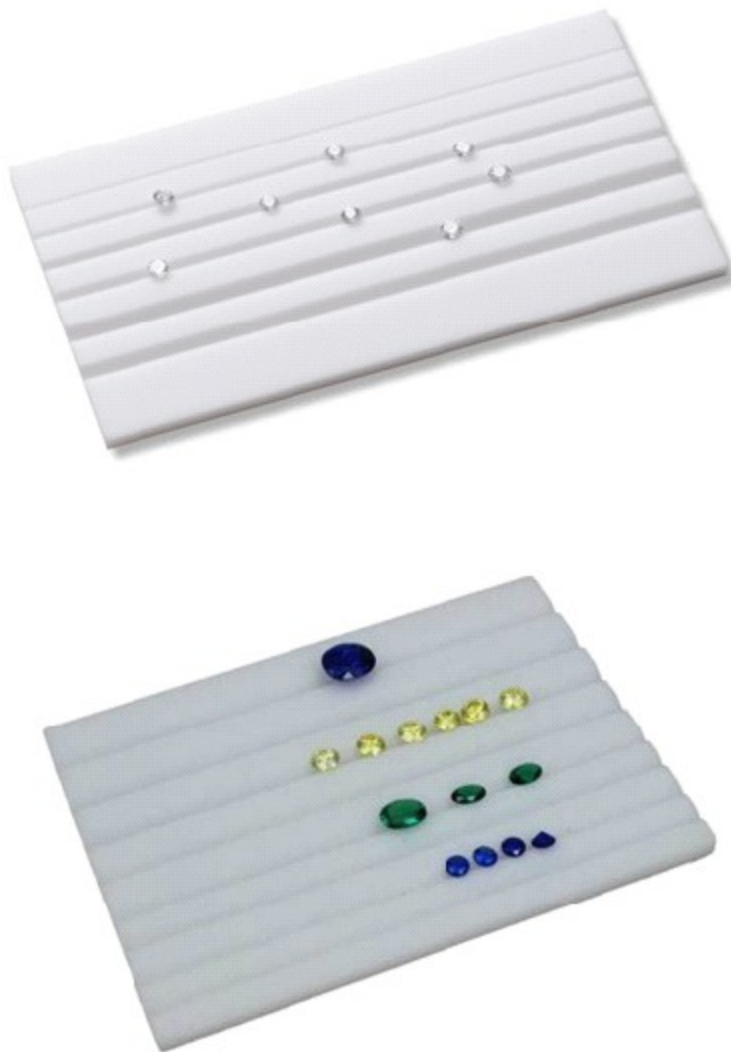


*Fig 2.8.3.1 Gemstones damaged during handling*

1. Similar to diamonds, gemstones can also get damaged.
2. Gemstones having hardness less than 9 are not used in wax setting.
3. If a gemstone is broken during handling or before it came to you, inform your supervisor.
4. Gemstones can be picked up with a tweezer or by hand.



## 2.8.4 Handling of Diamonds and Gemstones



*Fig 2.8.4.1 Use matching trays to keep stones separate*

1. Use matching trays to keep diamonds and gemstones separate.
2. This will help the stones from touching each other and getting scratched or damaged.
3. The tray will also help in keeping a count on the number of stones and also in matching the stones.
4. Use a tweezer when you use the matching tray.
5. When placing the stones on the matching tray, keep the table facet facing upwards.
6. Placing the table facet upwards will not allow the stones to move or fall.

**Tips**



1. Diamonds are the hardest but not the toughest, they can break if not handled properly.
2. Gemstones will get damaged if not handled carefully.
3. If there are any broken stones that you find in the diamond or gemstone packet, inform your supervisor about them.
4. Keep stones on a sorting or matching tray when you are wax setting so that they don't fall and get damaged.
5. Diamonds can scratch other diamonds and gemstones, keep each diamond slightly away from each other without letting them touch each other, especially if you are working with high clarity stones.

**Notes**



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## Unit 2.9: Check for Defects

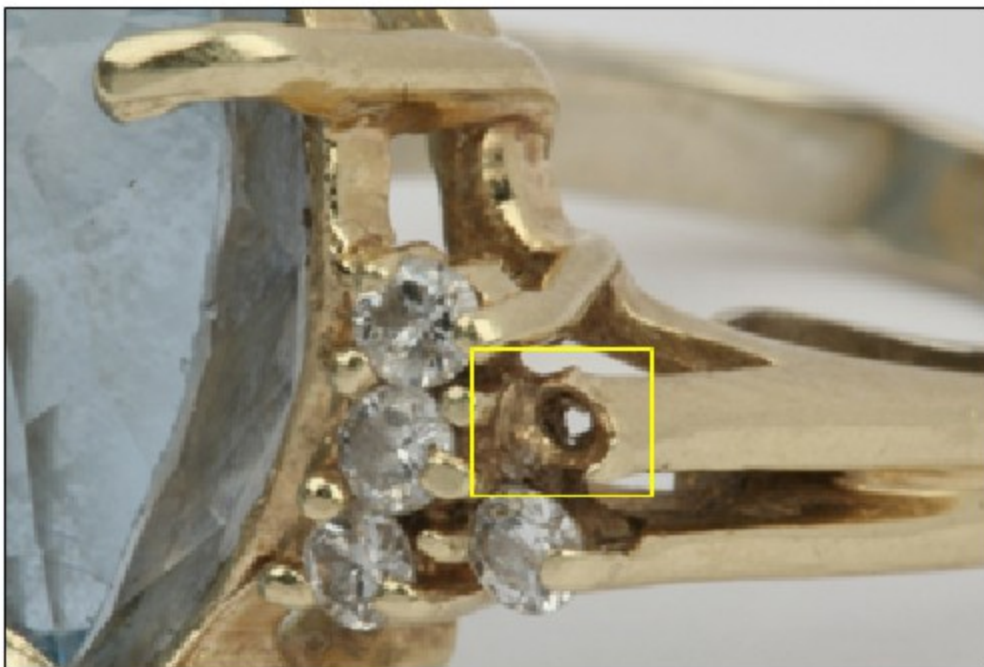
### Unit Objectives

**At the end of this unit, you will be able to:**

1. Inspect the common setting defects.
2. Analyze the impact of defect.
3. Analyze defects in the products.
4. Record and avoid damage to the stones.

### 2.9.1 Check and Identify Defects

- Checking for defects is done after the setting process is completed. Once the defects are identified, the same should be repaired. If there are defects which cannot be repaired, then the same should be informed to the supervisor so that the entire piece can be remade.
- **Common defects include:**
  - Broken prongs
  - Broken heads
  - Missing prongs
  - Stone missing
  - Damaged stones
  - Gaps between stones in channel setting and invisible setting
  - Stone is loose in the setting
  - Too metal has been removed in bead and pave setting
  - Incomplete setting



*Fig 2.9.1.1 Broken prongs*

## 2.9.1 Check and Identify Defects



*Fig 2.9.1.2 Prongs without seats*



*Fig 2.9.1.3 Uneven prongs*

### 2.9.1 Check and Identify Defects

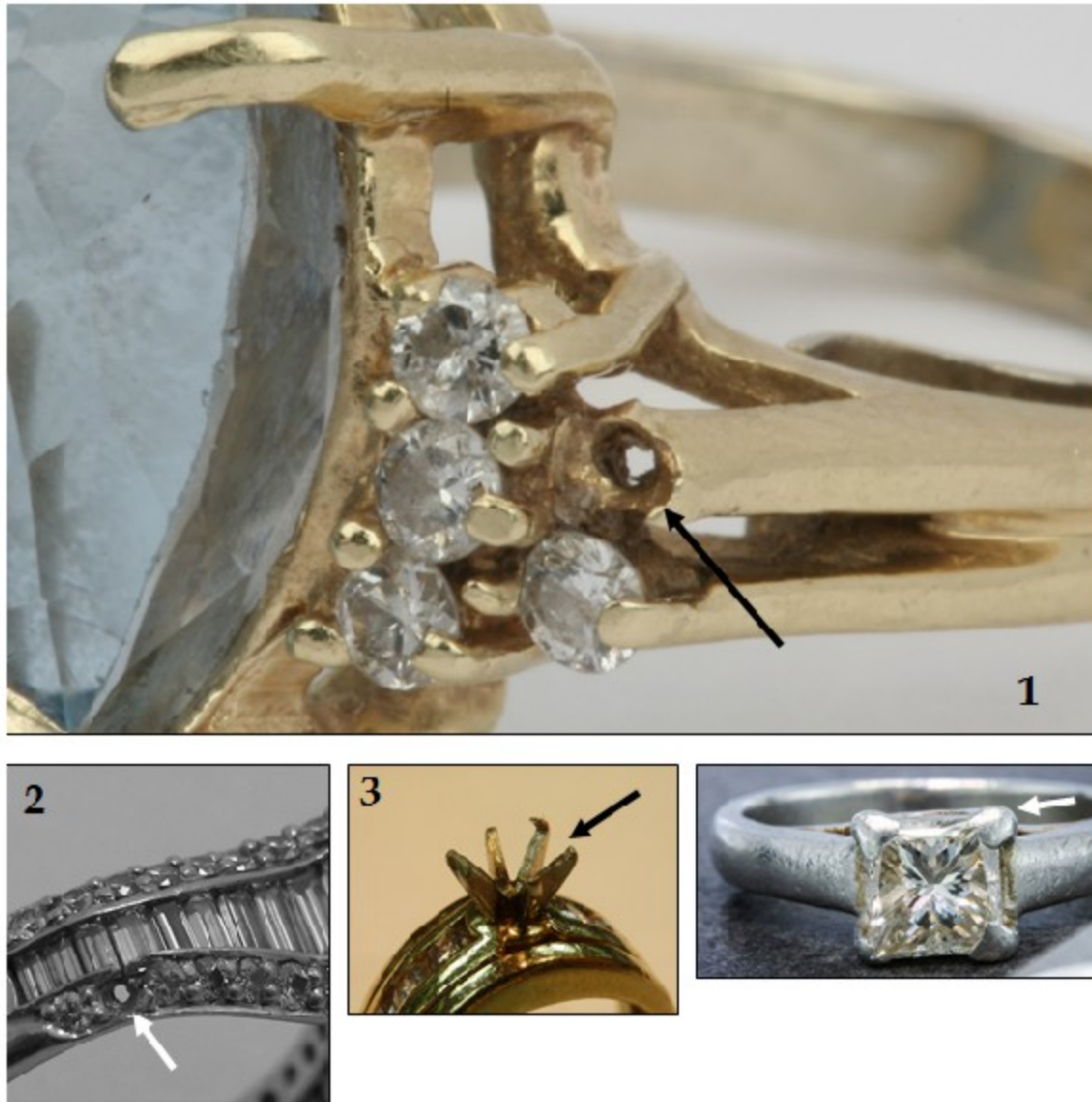


Fig 2.9.1.4 Various defects

- If there are pieces which cannot be repaired, report to your supervisor.
- 1st picture – Stone missing
- 2nd picture – Stone missing
- 3rd picture – Broken prongs, hence stone missing
- 4th picture – Setter put too metal around the stone, hence stone points will get damaged

## 2.9.1 Check and Identify Defects



*Fig 2.9.1.5 Incomplete setting*

- Setter has not closed the channel setting wall.
- This could damage the stones or they may fall down and go missing.



*Fig 2.9.1.6 Stone not secure*

- The stone is not set properly on the groove hence it is not secure.
- Due to this defect, the stone will get damaged or might fall off.

## 2.9.1 Check and Identify Defects



*Fig 2.9.1.7 Stone has got damaged due to rough use of setting tools*



*Fig 2.9.1.8 Soft stone has got cracked and damaged due to rough use of setting tools*

## 2.9.1 Check and Identify Defects



*Fig 2.9.1.9 Soft stone has got completely damaged due to rough use of setting tools*

Scan the QR Code to watch the related video or click on link



Click Here  
Quality check and recitification of defect









## 3. Maintain Health and Safety at Workplace

Unit 3.1 - Potential Sources of Accidents

Unit 3.2 - Safety Signs and Appropriate Requirements to be Safe

Unit 3.3 - Ergonomics or Bad Posture of Body

Unit 3.4 - Fire Safety Rules

Unit 3.5 - How to Deal with Emergency Situations



## Key Learning Outcomes

**At the end of this module, you will be able to:**

1. Inspect safety procedures.
2. Inspect potential hazards.
3. Analyze what to do in an emergency situation.
4. Analyze how to use the fire extinguisher by identifying the appropriate fire.
5. Analyze how complying with company safety rules and regulations can be safe for you.

## Unit 3.1: Potential Sources of Accidents

### Unit Objective

**At the end of this unit, you will be able to:**

1. Analyze the potential sources of accidents in a workplace.

### 3.1.1 Potential Sources of Accidents

Accidents are unpleasant events that happen unexpectedly, causing damage, injury or sometimes even death. Working people spend most of the time in work, thus accidents at work can happen unexpectedly.

Accidents or hazards mean an incident involving loss of life inside or outside the workplace, suffering injuries internally and/or externally, or release of toxic chemical or explosion or fire, or spilling of hazardous chemical resulting in 'on-site' or 'off-site' emergencies or damage to equipment leading to stoppage of process or adverse effects to the environment.

- Accidents or hazards usually occur due to: Faulty equipment
- Improper working conditions
- Faulty inspection or repairing equipment or tool without the proper instructions
- Irregular maintenance of equipment and tools
- Repairing of faulty equipment by someone who is not qualified to repair
- Lack of concentration or bringing personal tensions to work
- Unsafe practices such as plugging wires directly into sockets without a plug
- Not reading voltage instructions for imported equipment
- Improper or insufficient safety training
- Smoking in non-smoking zones
- Storage of chemicals near heat emitting machines
- Improper storage of chemicals
- Improper work clothing or lack of protective gears
- Exposed wire or wires bitten by rats or other animals
- Wires with bad insulation
- Improper electric connections
- Using wrong tools and equipment in wrong place or plugging into wrong socket
- Using too many wires in one spike guard or electric socket
- Bad housekeeping which includes wet floors, sweeping not done, papers thrown on floor, dustbins not covered or emptied
- Tools and equipment not stored properly after work
- Not unplugging tools and equipment after work or during breaks
- Leaving main switch ON of tools and equipment after work
- Non reporting of hazards to supervisor or ignoring potential dangers

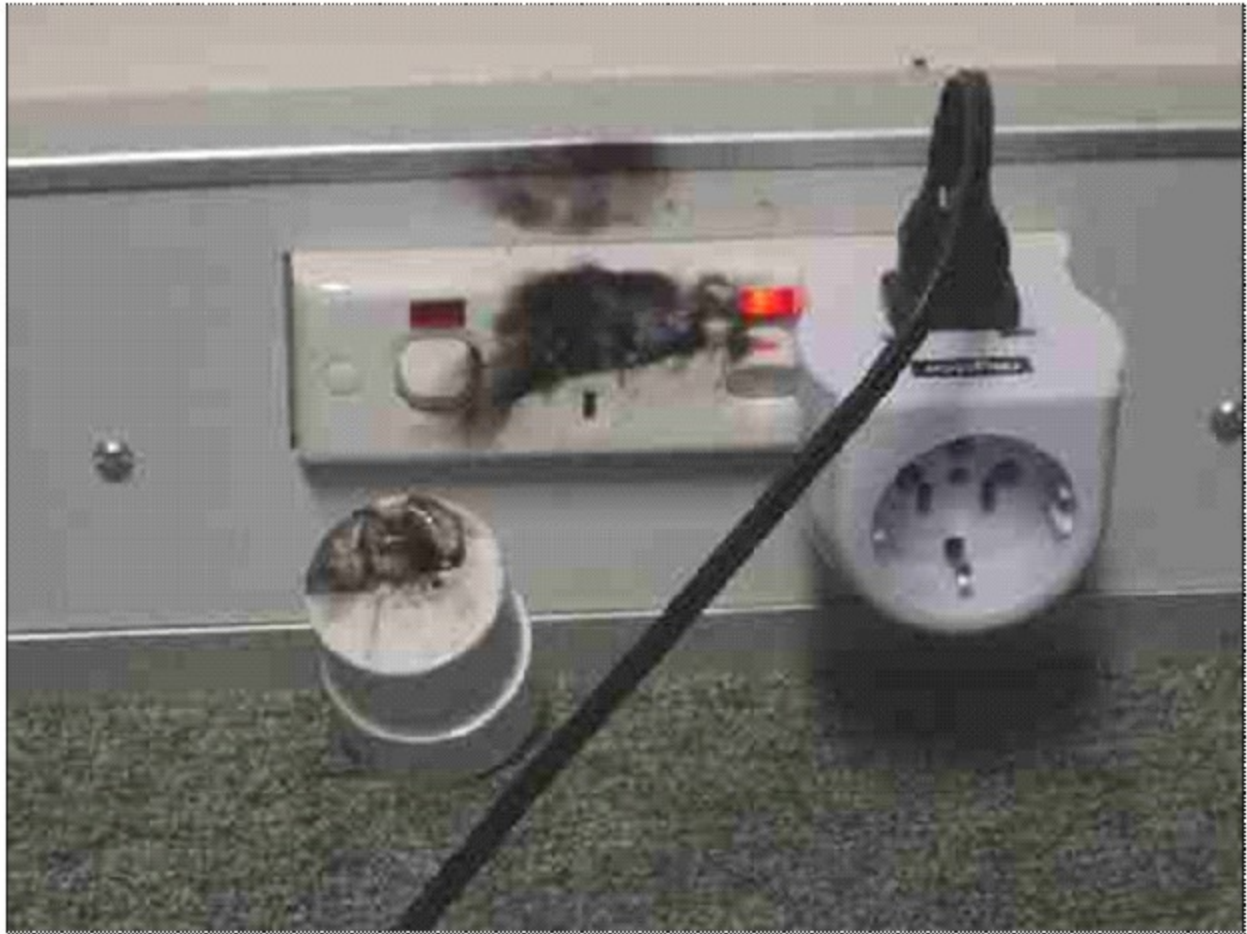
### 3.1.1 Potential Sources of Accidents

The below figure clearly shows an exposed wire that can be hazardous to anyone who accidentally touches or comes in contact with it.



*Fig 3.1.1.1 Exposed Wire*

### 3.1.1 Potential Sources of Accidents



*Fig 3.1.1.2 Burned Socket – Not advised to use the working plug*

### 3.1.1 Potential Sources of Accidents

In the picture it is clear that the floor is wet with equipment lying on it. This can lead to serious accident and the workers should be very careful.



*Fig 3.1.1.3 Liquid spilled on carpet floor with tools and equipment around*



### 3.1.1 Potential Sources of Accidents



*Fig 3.1.1.1 Causes of Accidents*



## Unit 3.2: Safety Signs and Appropriate Requirements to be Safe

### Unit Objective

**At the end of this unit, you will be able to:**

1. Analyze the safety signs and appropriate requirements to be safe and to make the workplace safe for yourself and others.

### 3.2.1 Safety Signs

Safety Signs are some very important tips that you see around when you need some help in any situation where safety is required. You are just required to keep your mind alert during work and to look for any safety sign for your use. These are signs that cannot be avoided and are especially useful when nobody else is around to help.



Fig 3.2.1.1 Safety Sign - 1

### 3.2.1 Safety Signs



Fig 3.2.1.2 Safety Sign - 2

### 3.2.1 Safety Signs



Fig 3.2.1.3 Safety Sign - 3



Fig 3.2.1.4 Safety Sign - 4

### 3.2.1 Safety Signs



Fig 3.2.1.5 Safety Sign - 5



Fig 3.2.1.6 Safety Sign - 6

### 3.2.1 Safety Signs

In the figure you can see various signs explaining physical hazards and health hazards that you need to check around yourself. These are majorly warning signs that alert you beforehand.

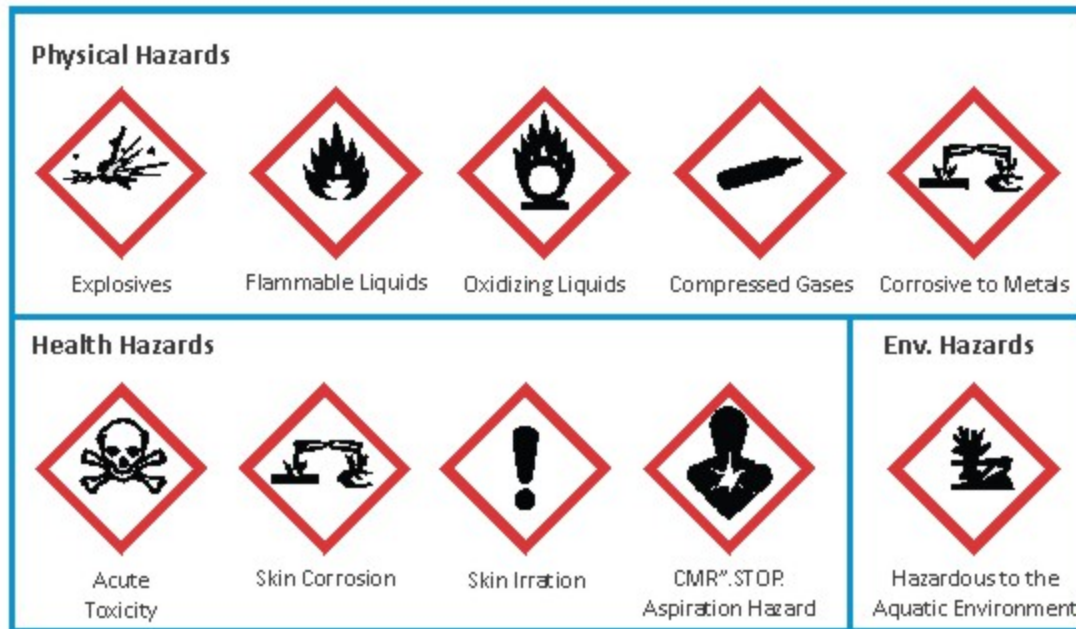


Fig 3.2.1.7 Safety Sign – 7

### 3.2.2 Safety First

<b>DOUBLE HEARING PROTECTION</b> 	<b>EYE &amp; EAR PROTECTION</b> 	<b>DUST MASK</b> 	<b>RESPIRATOR</b> 
<b>EAR PROTECTION</b> 	<b>SAFETY GOGGLES</b> 	<b>HARDHAT</b> 	<b>GLOVES</b> 
<b>EAR PLUGS</b> 	<b>SAFETY GLASSES</b> 	<b>APRON</b> 	<b>PROTECTIVE SUIT</b> 
<b>FACE SHIELD</b> 	<b>HAIR NET</b> 	<b>SAFETY SHOES</b> 	<b>BOOTS</b> 

Fig 3.2.2.1 Safety gears to be worn while working with tools and equipment

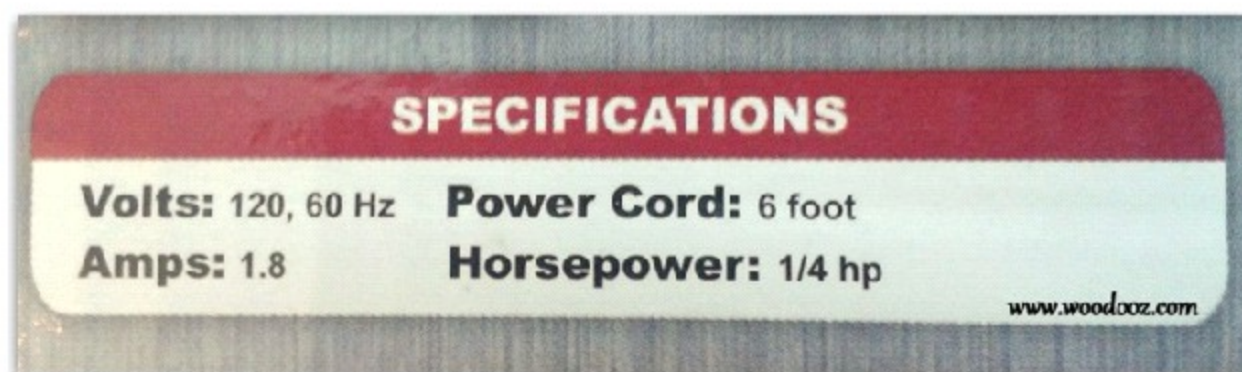


Fig. 3.2.2.2 Refer to voltage mentioned on equipment and machines before plugging in socket to avoid short circuit



### 3.2.2 Safety First



Fig 3.2.2.3 Housekeeping rules for every employee

### 3.2.2 Safety First

**Just say no to electrical hazards.**

**Before you turn it on, make sure that you say no the following:**

- Are outlets, motors, or circuits overloaded?
- Are the electric wires passing near water or heat sources?
- Are cords twisted or tangled?
- Do I see sparks or smoke?
- Are my hands wet?
- Am I wearing any metal jewellery?

## Tips



1. If you follow proper housekeeping rules and the other mentioned rules, you can avoid accidents or hazards in your workplace.
2. Always work as a team when it comes to the workplace.

## Notes



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## Unit 3.3: Ergonomics or Bad Posture of Body

### Unit Objective

At the end of this unit, you will be able to:

1. Develop the right body posture required while carrying out any kind of work.
2. Analyze how to relax your body more and put less strain on your body.

### 3.3.1 Ergonomics or Bad Posture of Body

IN SOME CASES TOOLS CAN BE CHANGED TO  
KEEP THE ARMS LOW AND ELBOWS IN  
BAD DESIGN



SOLDERING IRON WITH BENT HANDLE ALLOWS  
ELBOW TO BE LOWERED AND WRIST STRAIGHTENED  
GOOD DESIGN



Fig 3.3.1.1 Straining elbows can strain the shoulder leading to body pain

### 3.3.1 Ergonomics or Bad Posture of Body

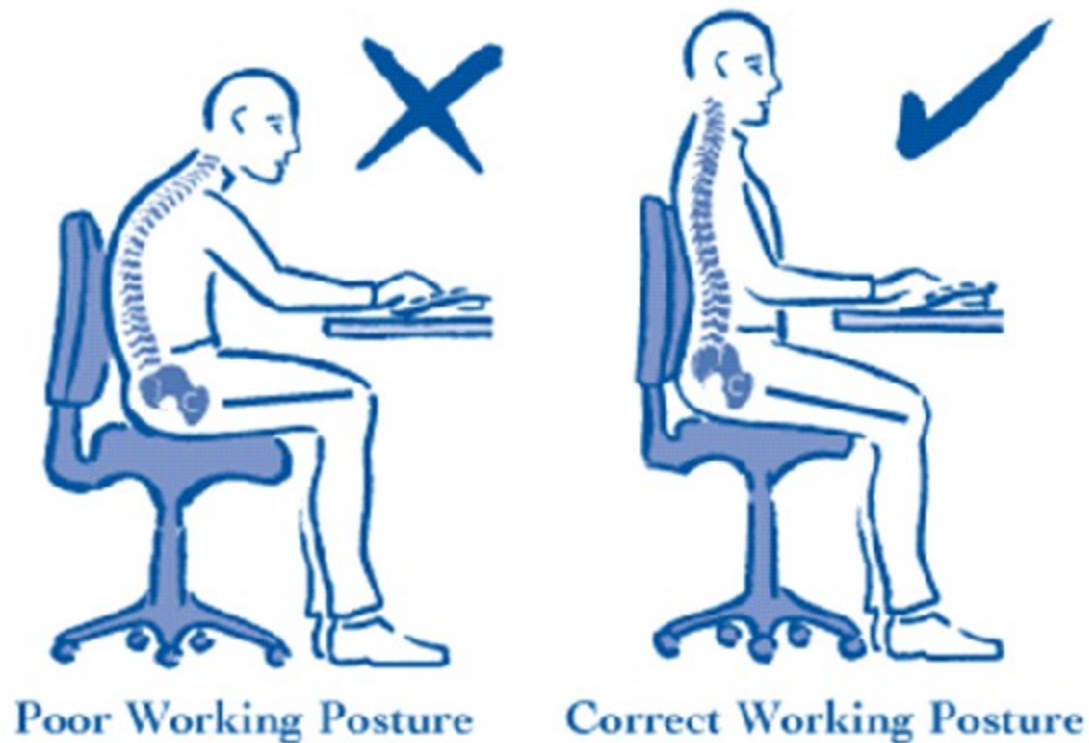


Fig 3.3.1.2 Wrong and right way to sit



Fig 3.3.1.3 Right way to work on computer

### 3.3.1 Ergonomics or Bad Posture of Body



Fig 3.3.1.4 Problems to avoid

## Tips

1. The right body posture will benefit you in keeping many health problems away.
2. The wrong body posture can create health problems such as stiff neck, pain in the entire body, stiff shoulders, cervical spondylitis and many other problems.
3. Also drink a lot of water to keep yourself hydrated.

## Notes

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## Unit 3.4: Fire Safety Rules

### Unit Objectives

At the end of this unit, you will be able to:

1. Inspect the fire safety rules.
2. Develop the skills on how to use a fire extinguisher.

### 3.4.1 Fire Safety Rules






CLASSES OF FIRES	TYPES OF FIRES	PICTURE SYMBOL
<b>A</b>	Wood, paper, cloth, trash & other ordinary materials.	
<b>B</b>	Gasoline, oil, paint and other flammable liquids.	
<b>C</b>	May be used on fires involving live electrical equipment without danger to the operator.	
<b>D</b>	Combustible metals and combustible metal alloys.	
<b>K</b>	Cooking media (Vegetable or Animal Oils and Fats)	

Fig 3. 4.1.1 Know the different types of fire with classification codes and symbols



### 3.4.1 Fire Safety Rules



Fig 3.4.1.2 Know your fire extinguisher code



Fig 3.4.1.3 Know the refill date on the fire extinguisher

### 3.4.1 Fire Safety Rules

#### UNDERSTAND BASIC FIRE FIGHTING CONCEPTS

## RACE

upon discovery of fire or smoke

- R** **Rescue:** Remove persons in immediate from danger
- A** **Alarm:** Alert others and Emergency Services
- C** **Contain:** Contain fire and smoke (close doors)
- E** **Extinguish:** Extinguish &/or Evacuate

Fig 3.4.1.4 Basic fire fighting steps



Fig 3.4.1.5 Do not use elevator or lift when there is a fire

### 3.4.2 Using the Fire Extinguisher

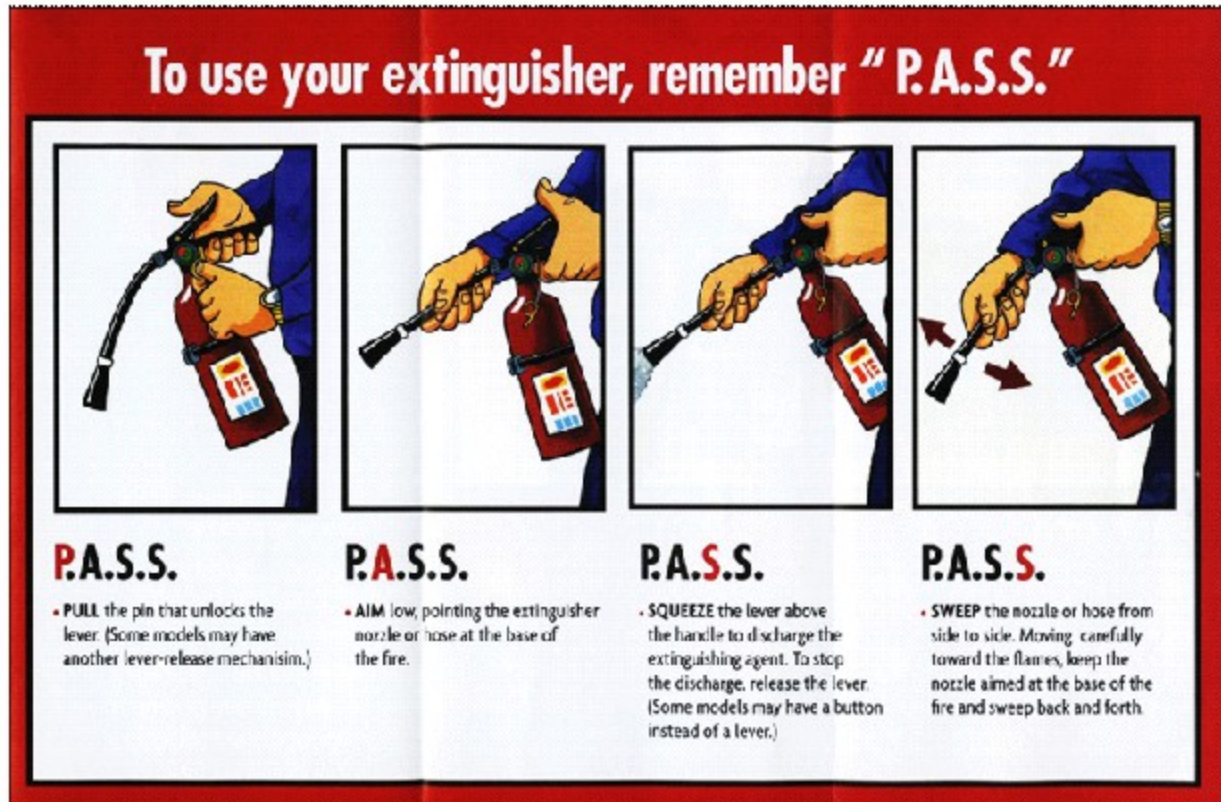


Fig 3.4.2.1 Steps to use the fire extinguisher – use the right extinguisher for the fire

### Tips



- 1. Always recognize the type of fire before using the fire extinguisher.
- 2. The fire extinguisher has a code on it and that code will tell you for which fire that extinguisher can be used.
- 3. Do not use the lift or elevator when there is a fire.
- 4. Use wet blankets or napkins to cover your mouth so that you do not inhale the smoke.
- 5. Call the fire brigade and pull the fire alarm.

### Notes



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## Unit 3.5: How to Deal with Emergency Situations

### Unit Objective

At the end of this unit, you will be able to:

1. Analyze an emergency situation and how to deal with it.

### 3.5.1 Emergency Situations



Fig 3.5.1.1 Emergency situations

### 3.5.2 Dealing with Emergency Situations

#### Evaluate Situation

- Check the surroundings.
- Evaluate the situation.
- Are there things that may place you in danger or harm?
- Are you or the victim endangered by fire, harmful smoke or gasses, an unstable construction, live electrical wires or alternative dangerous scenario?
- Don't rush into a situation wherever you may find yourself as a victim?
- If approaching the victim will endanger your life, seek professional help immediately; they have higher levels of training and know how to handle these situations.
- First aid becomes useless if you can't safely perform it without hurting yourself.



Fig 3.5.2.1 Evaluate situation

## 3.5.2 Dealing with Emergency Situations

### Call for Help

- Call for help.
- Call the appropriate authorities or emergency services immediately if you feel someone is seriously injured.
- If you are the only person on the scene, try to check if the person is breathing before calling for help.
- Do not leave the victim alone for an extensive amount of time.

### Take Care of the Person

- Take care of the person.
- A person who has just gone through a serious trauma requires to be taken care of including providing emotional support and physical treatment such as first aid.
- Always remember to remain calm and try to reassure the person about help arriving.

### Check for Response

- Determine responsiveness.
- If a person is unconscious, try to wake them by gently tickling their bare hands and feet or by speaking to them.
- If they do not respond to activity, sound, touch or other stimulation, check if they are breathing.

### 3.5.2 Dealing with Emergency Situations

#### Conducting CPR OR First Aid

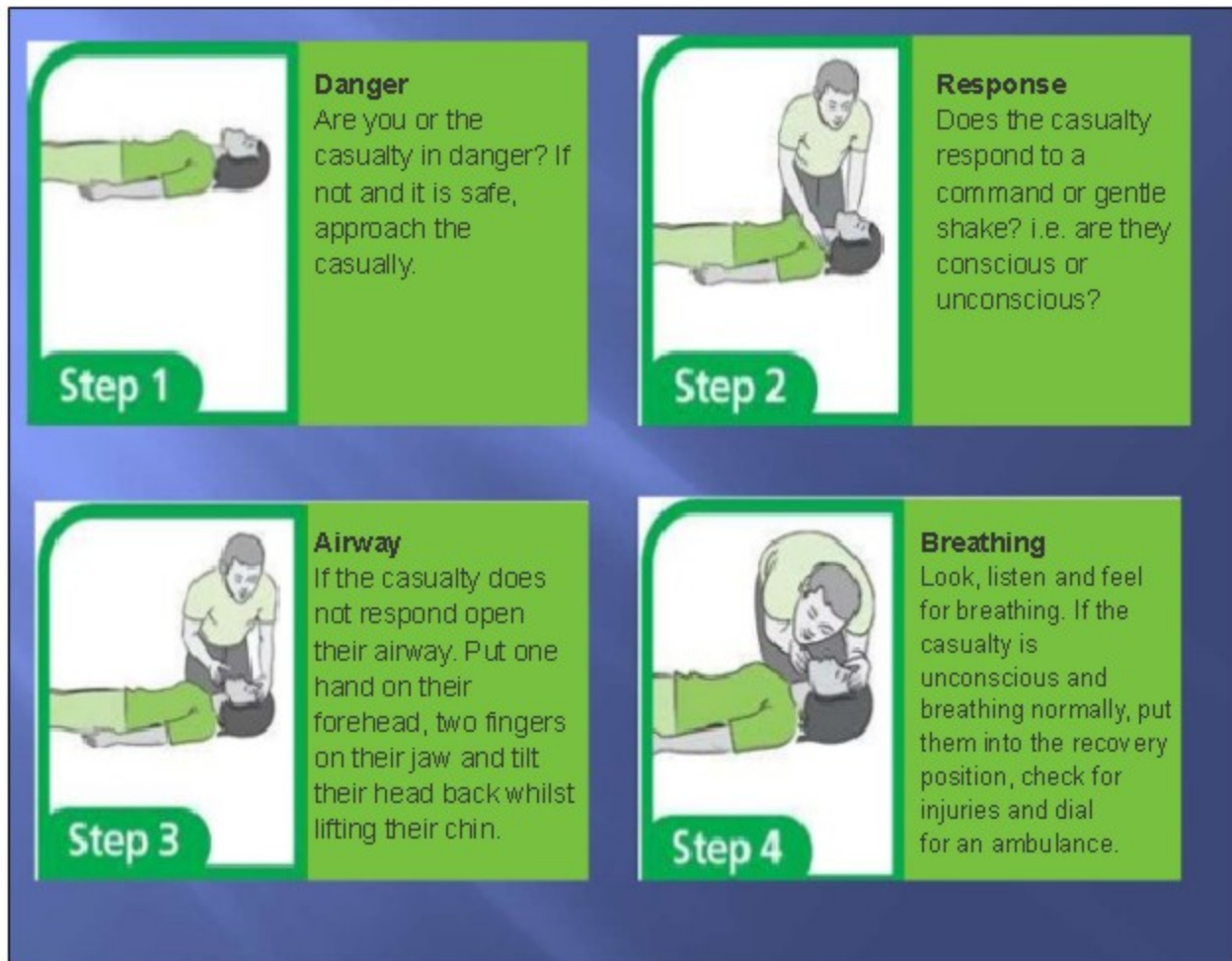


Fig 3.5.2.1 Conducting CPR or first aid

#### EMERGENCY NUMBERS IN INDIA

- 100 for Police
- 102 for Ambulance
- 101 for Fire
- 108 for Disaster management
- 181 for Women's helpline



### 3.5.3 Solving the Issue



Fig. 3.5.3.1 Incident Priorities

## Tips



1. Always participate in emergency drills organized by your company, you may never know when the knowledge will come in use.
2. Ask your company for a live demonstration of first aid administration.
3. Check with your company the contents of the first aid box and where it is kept.
4. Always report an incident to your supervisor or others, rather than hiding it.
5. Always care for others in an emergency situation.

## Exercise

1. Write the full form of RACE.
2. Identify the meaning of the safety signs.

Safety Sign	Meaning of Safety Sign
	
	
	

3. Identify the following emergency numbers.
  - a. 100: \_\_\_\_\_
  - b. 101: \_\_\_\_\_
  - c. 102: \_\_\_\_\_
4. Accidents or hazards usually occur due to-
  - a) Faulty equipment
  - b) Smoking in non-smoking zones
  - c) Improper electric connections
  - d) All of these
5. If you find that someone is stuck in an emergency situation, how will you deal with it? Write in short.



## 4. Respect and Maintain IPR

Unit 4.1 - Scope of IPR

Unit 4.2 - Types of IPR



## Key Learning Outcomes



**At the end of this module, you will be able to:**

1. Respect and maintain IPR.
2. Understand the company's policies on IPR and plagiarism.
3. Understand Patents and IPR laws.
4. Observe IPR violation and order leaks.
5. Prevent leak of new designs to competitors.
6. Become aware of the company's product and copyright.
7. Report to the supervisor if you find the same product in the market used by any other organisation.
8. Become aware about copyright clauses.

## Unit 4.1: Scope of IPR

### Unit Objective

At the end of this unit, you will be able to:

1. Understand the scope of IPR.

### 4.1.1 Scope of IPR

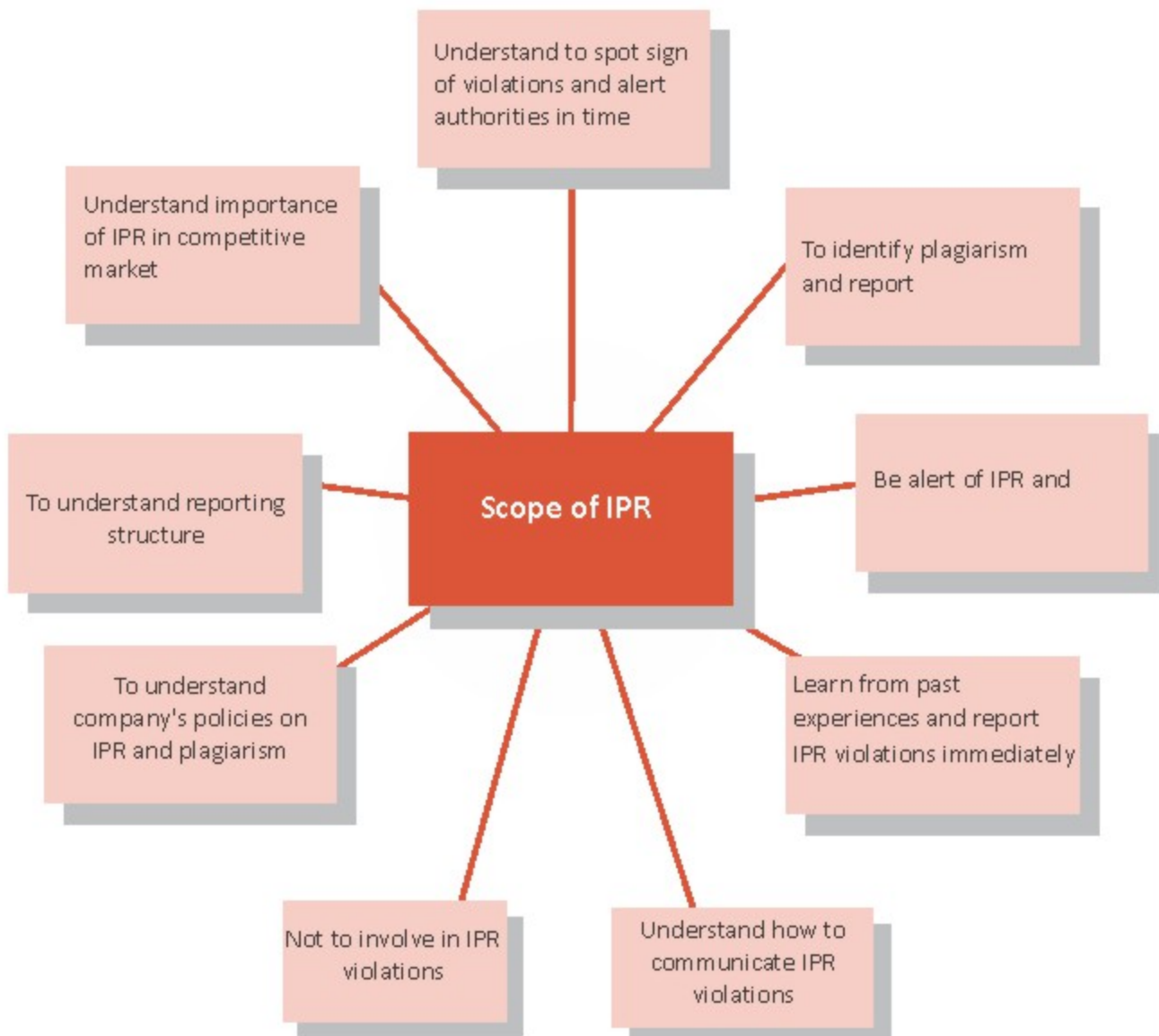


Fig. 4.1.1.1

## Unit 4.2: Types of IPR

### Unit Objective

At the end of this unit, you will be able to:

1. Understand types of IPR.

### 4.2.1 Intellectual Property (IPR)

1. Intellectual Property or IPR is very important for an organization.
2. One should restrict or avoid giving such information to outsiders including customers of the company unless decided by the management otherwise.

Type of Intellectual Property	Rights Covered
<b>Copyright</b>	Use or performance of original works of any type including any form of expression and literature
<b>Patent</b>	The use, manufacture or the sale of company inventions
<b>Trademark</b>	The use of symbols, words, names, pictures, designs, logo or combination of all the above used by companies to identify particular products, brands or services
<b>Trade Secrets</b>	The privacy of data, documents, formulas or anything that is mentioned or maintained as confidential information






Fig. 4.2.1.1

### 4.2.1 Intellectual Property (IPR)



Fig. 4.2.1.2

## Annexure: Chapter wise QR codes

Chapter No.	Unit No.	Topic Name	Page No.	Url	QR code (s)
1. Introduction	Unit 1.1: Gem and Jewellery Sector in India	1.1.1 Significance of Gem and Jewellery Sector in India	4	<a href="https://www.youtube.com/watch?v=nKY1AbPz668&amp;t=1s">https://www.youtube.com/watch?v=nKY1AbPz668&amp;t=1s</a>	 Gem & Jewellery industry Orientation
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.2: Metal Alloys	2.2.6 Silver Alloy	12	<a href="https://drive.google.com/file/d/1eWzT-AO66CBSbpcdkpl6cLY8qXMseP25/view?usp=sharing">https://drive.google.com/file/d/1eWzT-AO66CBSbpcdkpl6cLY8qXMseP25/view?usp=sharing</a>	 Introduction to Precious metal
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.4: Type of Gem stone used in Studdeed Jewellery	2.4.1 Diamonds	48	<a href="https://drive.google.com/file/d/1Reg-5FCnxLzJkTj9NfecrL8EYnNNv6nA/view?usp=sharing">https://drive.google.com/file/d/1Reg-5FCnxLzJkTj9NfecrL8EYnNNv6nA/view?usp=sharing</a>	 Diversity in Indian Jewellery
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.4: Type of Gem stone used in Studdeed Jewellery	2.4.1 Diamonds	48	<a href="https://drive.google.com/file/d/1szE3LWEmzgsT1xGopymE3shRhDCwpLqf/view?usp=sharing">https://drive.google.com/file/d/1szE3LWEmzgsT1xGopymE3shRhDCwpLqf/view?usp=sharing</a>	 Categories of Indian Jewellery
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.4: Type of Gem stone used in Studdeed Jewellery	2.4.2 Gem stones	53	<a href="https://drive.google.com/file/d/1hu_xQdhi02jklckOyMfPuv2VweuUCifX/view?usp=sharing">https://drive.google.com/file/d/1hu_xQdhi02jklckOyMfPuv2VweuUCifX/view?usp=sharing</a>	 Common features & Diamond



Chapter No.	Unit No.	Topic Name	Page No.	Url	QR code (s)
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.5: Types of Settings	2.5.1 Types of Settings	57	<a href="https://drive.google.com/file/d/1_2XPTcEapET9ICY4n0IJ_BaRTmWX1c3q/view?usp=sharing">https://drive.google.com/file/d/1_2XPTcEapET9ICY4n0IJ_BaRTmWX1c3q/view?usp=sharing</a>	 <p>Types of Gem stone Settings</p>
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.6: Tools and Equipment Required for Stone Setting	2.6.1 Tools and Equipment Required for Stone Setting	78	<a href="https://youtu.be/iu0S3Hj05N8">https://youtu.be/iu0S3Hj05N8</a>	 <p>Sharpening of Graver</p>
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.6: Tools and Equipment Required for Stone Setting	2.6.1 Tools and Equipment Required for Stone Setting	78	<a href="https://youtu.be/hAPf-mS4soM">https://youtu.be/hAPf-mS4soM</a>	 <p>Using Vernier Caliper</p>
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.6: Tools and Equipment Required for Stone Setting	2.6.1 Tools and Equipment Required for Stone Setting	78	<a href="https://youtu.be/W5JRLBif3Bw">https://youtu.be/W5JRLBif3Bw</a>	 <p>Using of TOOLS</p>
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.7: Setting a Gem stone in Jewellery	2.7.3 Various Metal Settings	82	<a href="https://youtu.be/eyiYxTHvGkw">https://youtu.be/eyiYxTHvGkw</a>	 <p>Prong Setting</p>

Chapter No.	Unit No.	Topic Name	Page No.	Url	QR code (s)
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.7: Setting a Gem stone in Jewellery	2.7.3 Various Metal Settings	83	<a href="https://youtu.be/w88i2wx1GNI">https://youtu.be/w88i2wx1GNI</a>	 Bezel Setting
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.7: Setting a Gem stone in Jewellery	2.7.3 Various Metal Settings	90	<a href="https://youtu.be/_bY99F12BT0">https://youtu.be/_bY99F12BT0</a>	 Pave setting
2. Set diamond and gem stone in precious metal jewellery piece	Unit 2.9: Check for Defects	2.9.1 Check and Identify Defects	104	<a href="https://youtu.be/GCM3BudeZkQ">https://youtu.be/GCM3BudeZkQ</a>	 Quality check and recitification of defect
Employability Skills				<a href="https://www.skillindia.digital.gov.in/content/list">https://www.skillindia.digital.gov.in/content/list</a>	 Employability Skills





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