# MATERIAL SCIENCE

**UNIT CODE:** ENG/CU/TXP/CC/06/5/A

**Relationship to Occupational Standards**
This unit addresses the unit of competency: **Apply material science principles**

**Duration of Unit:** 85 hours

**Unit Description:**
The learner will be introduced to performing material testing. It involves analysing properties of engineering materials, performing extraction processes, producing iron materials, ceramics, composites and alloys, performing heat treatment, material testing and identifying corrosion and its prevention

**Summary of Learning Outcomes**

1. Analyse properties of engineering materials
2. Perform ore extraction processes
3. Produce iron materials
4. Produce alloy materials
5. Produce non-ferrous materials
6. Produce ceramics materials
7. Produce composite materials
8. Utilise other engineering materials
9. Perform heat treatment
10. Perform material testing
11. Prevent material corrosion



**Learning Outcomes, Content and Suggested Assessment Methods**

| Learning Outcome | Content | Suggested Assessment Methods |
|---|---|---|
| 1. Analyse properties of engineering materials | • Engineering materials is identified as per the procedures<br>• Physical properties of engineering material<br>• Mechanical properties of engineering materials<br>• Crystal structure of materials | • Written tests<br>• Oral questioning<br>• Assignments<br>• Supervised exercises |

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| 2. Perform ore extraction processes | • Safety measures in metal extraction<br>• Method of metal extraction<br>• Procedure in metal extraction processes<br>• Storing of metal Extraction by-products<br>• Disposing extraction by- products | • Written tests<br>• Oral questioning<br>• Assignments<br>• Supervised exercises |
| 3. Produce iron materials | • Ore smelting processes.<br>• Composition of iron<br>• Method of producing iron material<br>• Refinement processes | • Assignments<br>• Oral questioning<br>• Supervised exercises<br>• Written tests |
| 4. Produce alloy materials | • Tools and equipment for alloy production<br>• Alloy formation process<br>• Testing alloy products quality | • Assignments<br>• Oral questioning<br>• Practical tests<br>• Observation<br>• Supervised exercises<br>• Written tests |
| 5. Produce non-ferrous materials | • Extraction of Non-ferrous materials<br>• Smelting and purifying of extracted non-ferrous material<br>• Testing Non-ferrous material<br>• Identifying Alloying elements for non-ferrous materials<br>• Alloy formation process<br>• Testing of Alloys for non-ferrous material | • Assignments<br>• Supervised exercises<br>• Written tests<br>• Practical test |
| 6. Produce ceramics materials | • Composition of ceramic materials<br>• Manufacturing process for ceramics<br>• Production of Ceramic materials<br>• Finishing processes for ceramic materials | • Assignments<br>• Supervised exercises<br>• Written tests<br>• Practical test |
| 2. Produce composite materials | • Types of composites<br>• Elements involve in composite formation<br>• Formation process of composites<br>• Testing of composite materials | • Assignments<br>• Supervised exercises<br>• Written tests<br>• Practical test |
| 3. Utilise other engineering materials | • Identifying and selecting engineering materials<br>• Developing operation plan<br>• Setting up production machine<br>• Setting production parameters | • Assignments<br>• Supervised exercises<br>• Written tests<br>• Practical test |

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| | • Production process for engineering materials | |
| 4. Perform heat treatment | • Safety practices procedures<br>• Heat treatment processes<br>• Procedure in heat treatment processes<br>• Operations of heat treatment of metals | • Assignments<br>• Supervised exercises<br>• Written tests<br>• Practical test |
| 5. Perform material testing | • Material testing methods<br>• Procedure of material testing<br>• Analysing material testing results<br>• Material testing equipment are taken care of and maintained. | • Assignments<br>• Supervised exercises<br>• Written tests<br>• Practical test |
| 6. Corrosion and its prevention | • Safety observation during corrosion prevention<br>• Corrosion type is identified<br>• Causes of corrosion<br>• Methods of corrosion prevention<br>• Corrosion prevention | • Assignments<br>• Supervised exercises<br>• Written tests<br>• Practical test |

**Suggested Methods of Instruction**

- Demonstration by trainer
- Discussions
- Practical work by trainee(s)
- Exercises
- Industrial visits
- YouTube for teaching/learning and inspiration
- Simulation
- Power point presentation



**Recommended Resources**

- Measuring tools and gauges
- Marking out tools
- Inspection tools and equipment
- Dressing tools
- Firefighting equipment
- PPEs –dust coat, dust masks, ear muffs, goggles
- First Aid kit
- Brooms and cleaning stuff
- Cleaning detergents
- Drawing papers