RTB | RWANDA TVET BOARD

RQF LEVEL 3

BDCCM301 BUILDING CONSTRUCTION

Fundamentals of building materials

TRAINER'S MANUAL

December, 2023

FUNDAMENTALS OF BUILDING MATERIALS

2023

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LIST OF ABBREVIATIONS AND ACRONYMS

% **:** Percentage

AAC **:** Autoclaved Aerated Concrete

AAR **:** Alkali-aggregate reaction

CBET **:** Competence Based Education Training

CSEB : Compressed stabilized Earth block

IS : International Standard

Kg **:** Kilogram

LTD : Limited

OPC **:** Ordinary Portland cement

PPC **:** Portland pozzolana Cement

PPE **:** Personal Protective Equipment

RQF : Rwanda Qualification Framework

RTB : Rwanda TVET Board

TVET **:** Technical and Vocational Education and Training

INTRODUCTION

This Trainer's Manual encompasses all methodologies necessary to guide you to properly deliver the module titled: Fundamentals of Building Materials. Students undertaking this module shall be exposed with practical activities that will develop and nurture their competences. The writing process of this training manual embraced Competency-Based Education and Training (CBET) philosophy by providing practical opportunities reflecting real life situations.

The Trainer's Manual is subdivided into units, each unit has various topics, and you will start by guiding a self-assessment exercise to help students rate themselves on their level of skills, knowledge, and attitudes about the unit.

The Trainer's Manual will give you the information about the objectives, learning hours, didactic materials, and proposed methodologies and crosscutting issues.

A discovery activity follows to help students discover what they already know about the unit.

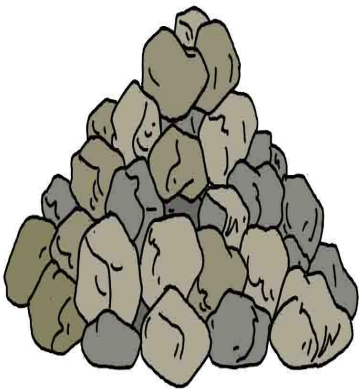
This manual will give you tips, methodologies, and techniques about how to facilitate students to undertake different activities as proposed in their Trainee's Manuals. The activities in this training manual are prepared such that they give opportunities to students to work individually and in groups.

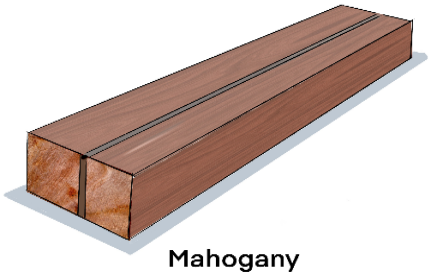
After going through all activities, you shall help students to undertake progressive assessments known as formative and finally facilitate them to do their self-reflection to identify your strengths, weaknesses, and areas for improvements.

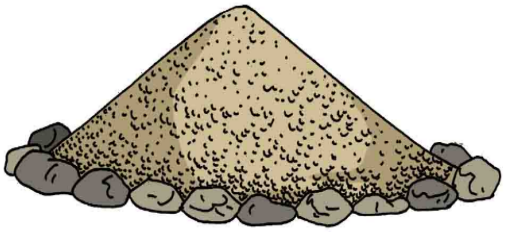
Remind them to read the point to remember section which provides the overall key points and takeaways of the unit.

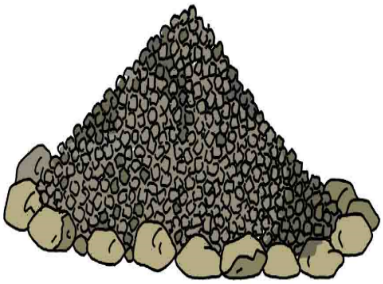
Learning outcomes	Learning Hours	Topics
1. Identify Natural Building Construction Materials	13	1.1. Description of building stone
		1.2 Description of building aggregates
		1.3. Description of water for construction works
		1.4. Description of timber for construction works
2. Identify Industrial Building Construction Materials	15	2.1. Description of cement for construction works
		2.2. Description of metals for construction works
		2.3. Description of paint used in building construction
		2.4. Description of varnish used in building construction
		2.5. Description of plastics for building construction
		2.6. Identification of glass for building construction
3. Identify Prefabricated Building Construction Materials.	12	3.1 Description of soil bricks for construction works
		3.2 Description of soil blocks for construction works
		3.3Description of cement-based building construction products
		3.4. Identification of prefabricated building structure elements

LEARNING OUTCOME 1: IDENTIFY NATURAL BUILDING CONSTRUCTION MATERIALS









Learning outcome 1: Self-Assessment

1. Ask trainees to look at the unit Illustration in their Trainee Manuals and together discuss:

a. What does the illustration show?

b. What activities are performed in the illustration show?

c. What do you think will be topic to be covered under this unit based on the illustration?

2. After the discussion, inform students that this unit is intended to provide them with the knowledge, skills and attitudes to identify natural building construction materials. They will cover description of building stone, description of building aggregates, description of timber for construction works as well as description of water for construction works.

3. Ask trainees to fill out the self-assessment at the beginning of the unit in their Trainee's Manuals. Explain that:

a. The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.

b. There is no right or wrong way to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.

c. They should think about themselves: do they think they have the knowledge, skills or attitudes to do this? How well?

d. They read the statements across the top and put a check in column that best represents their level of knowledge, skills or attitudes.

e. At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, areas of improvement and actions to be taken.

Key Competencies:

Knowledge	Skills	Attitudes
1. List characteristics of good building stone	1. Select good building stone	1. Manage stones efficiently and effectively
2. Identify use of building stone	2. Use building stones	2. Comply with safety precaution measures
3. List qualities of aggregates	3. Select good aggregates	3. Manage aggregates efficiently and effectively
4. Identify uses of aggregate	4. Use aggregates	4. Comply with mixing ratio
5. List qualities of water for construction purposes	5. Select water for construction purpose	5. Treat water to meet the requirements
6. State effects of using improper water for construction works	6. Use proper water for construction purpose	6. Avoid wastage of water
7. State qualities of timber for construction work	7. Select suitable timber for construction work	7. Pay attention to details of the work
8. Identify uses of timber in building construction	8. Use timber in building construction	8. Use timbers effectively and efficiently

Discovery Activity

Task 1:

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to answer their prior experience from their home area regarding fundamentals of building building materials and questions provided under task 1 in their Trainee's Manuals. *Make sure instructions are understood, all the students are actively participating and necessary fundamentals of building building given.*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations or small group presentations, students share their answers to the class. Encourage all students to give their views.

3. After the presentations/sharing session, inform students that this activity was not intended for them to give the right answers but to give them a picture of what they will cover in the unit.

4. Introduce Topic 1.1: Description of building stones

Topic 1.1: Description of Building Stones

Objectives: By the end of the topic, trainees will be able to:

a. Explain the characteristics of good building stone
b. Select good building stone
c. Manage stones efficiently and effectively

Time Required: 3 hours

Learning Methodology: Group discussion, trainer guided, jig saw, brainstorming.

Materials, tools and equipment needed:

- **Materials:** Chalk, pen, different types of building stones
- **Tools:** Book, internet, handout, ink pen
- **Equipment**: Projector, PPE, wheelbarrow, sign post

Preparation:

- ❑ Preparation of workshop for building stones selection
- ❑ Connect with construction project managers to organize field site visit related to selection of different building stones
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of building stones
- ✓ Promote standardization culture among students through realizing the need/importance of selecting standards building stones

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Chemistry (stones properties);

✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 2

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the pictures showing examples of building stone and answer the questions provided under task 2 in their Trainee's Manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views*.

3. After the sharing session, refer students to **Key facts 1.1a,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Task 3

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the statement and answer the questions provided under task 3 in their trainee manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 1.1b,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 4

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and complete the table provided under task 4 in their Trainee's Manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 1.1 and 1.1b,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 5

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.
2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field of the scenario and make a report of the description of the building stones which should include:
    a. Type of building stone selected.
    b. Characteristics of good building stone to be selected.
    c. Uses of each type of building stone selected.
    d. Possible defects of building stone to avoid.
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class
5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 1.2: Description of Building Aggregates

Objectives:

By the end of the topic, trainees will be able to:

a. Explain the qualities of aggregates
b. Manage aggregates efficiently and effectively
c. Select good aggregate

Time Required: 3 hours

Learning Methodology: Group discussion, trainer guided, jig saw, brainstorming.

Materials, tools and equipment needed:

- **Materials:** Chalk, pen, different types aggregates
- **Tools:** Book, internet, handout, ink pen
- **Equipment**: Projector, PPE, wheelbarrow, sign post

Preparation:

- ❑ Preparation of workshop for building aggregates selection
- ❑ Connect with construction project managers to organize field site visit related to selection of different building aggregates
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of building aggregates
- ✓ Promote standardization culture among students through realizing the need/importance of selecting standards building aggregates

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Chemistry (properties of aggregates);
- ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 6

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 6 in their Trainee's Manuals*. Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*
2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*
3. After the sharing session, refer students to **Key facts 1.2** and discuss them while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 7

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 7 in their Trainee's Manuals*. Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*
2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, standardization culture, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 1.2,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 8

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.
2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field of the scenario and make a report of the description of the building aggregates which should include:
    a. Type of building aggregates selected.
    b. Characteristics of good building aggregates to be selected.
    c. Uses of each type of building aggregates selected.
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices

4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class
5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 1.3: Description of Water for Construction Works

Objectives:

By the end of the topic, trainees will be able to:

a. Explain the qualities of water for construction purposes
b. State effects of using improper water for construction works
c. Use proper water for construction purpose

Time Required: 2 hours

Learning Methodology: Group discussion, trainer guided, jig saw, brainstorming.

Materials, tools and equipment needed

- **Materials:** Chalk, pen, pure water.
- **Tools:** Book, internet, handout, ink pen
- **Equipment**: Projector, PPE, bucket, sign post

Preparation:

- ❑ Preparation of workshop for building aggregates selection
- ❑ Connect with construction project managers to organize field site visit related to selection of water for construction
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of water for construction
- ✓ Promote standardization culture among students through realizing the need/importance of selecting standards water for construction

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Chemistry (properties of water);
- ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 9

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 9 in their trainee manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 1.3,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 10

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 10 in their trainee manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, standardization culture,

financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 1.3,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 11

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.
2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the description of the water which should include:
    a. Quality of water for construction works.
    b. Effects of using improper water for construction works.
    c. Function of water in building construction works.
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class

5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 1.4: Description of Timber for Construction Works

Objectives:

By the end of the topic, trainees will be able to:

a. Explain the qualities of timber for construction work
b. Select suitable timber for construction work
c. Use timbers effectively and efficiently

Time Required: 2 hours

Learning Methodology: Group discussion, trainer guided, jig saw, brainstorming.

Materials, tools and equipment needed

- **Materials:** Chalk, pen, types of timber needed.
- **Tools:** Book, internet, handout, ink pen
- **Equipment:** Projector, PPE, bucket, sign post

Preparation:

- ❑ Preparation of workshop for building timber selection
- ❑ Connect with construction project managers to organize field site visit related to selection of timber for construction
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all

- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of timber for construction
- ✓ Promote standardization culture among students through realizing the need/importance of selecting standard timber for construction

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Chemistry (properties of timber);
- ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 12

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 12 in their Trainee's Manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used.*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 1.4 a,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Task 13

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 13 in their Trainee's Manuals.

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 1.4 b,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 14

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and complete the table provided under task 14 in their Trainee's Manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used.*

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, standardization culture, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 1.4 a and b** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 15

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask the permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.
2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the description of the building timber which should include:
    a. Types of building timber selected.
    b. Characteristics of good building timber to be selected.
    c. Uses of each type of building timber selected.
    d. Possible defects of building timber to avoid.
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class
5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Formative Assessment

I. Read carefully and answer the following questions

1. Define the following terms as used in construction:
   a) Stone
   b) Aggregates
   c) Water
   d) Timber

Answer:

Stone, or rock, is a natural substance that is quarried and mined from the earth and used in a variety of applications in construction such as building foundations, walls, initial pavement cladding and so on…

a) Aggregates are raw materials that are produced from natural sources and extracted from pits and quarries, including gravel, crushed stone, and sand.
b) Water is one of the most important elements in construction and is required for the preparation of mortar, mixing of cement concrete and for curing work etc
c) Timber is wood that is used for building houses and making furniture.

2. Differentiate sedimentary stones from metamorphic stones as types of stones

Answer:

Sedimentary Stones are these stones that are formed through the accumulation and compaction of sediment over time. Examples include limestone, sandstone, and shale. While **Metamorphic Stones** are these stones are formed from the transformation of existing rocks through heat and pressure. Examples include marble, slate, and quartzite.

3. Differentiate between coarse aggregates from fine aggregates as types of aggregates

Answer:

coarse aggregate is the aggregate retained on the 4.75 mm sieve. while **fine aggregate** is the aggregate passing through a 4.75 mm sieve

4. State at least 3 qualities of timber for construction works

Answer:

a. A good timber should be durable enough to resist the actions of chemical agents, biological agents, physical agencies, etc.
b. A good timber should not fail easily and it should be strong enough to take loads acting on it.
c. A good timber should not absorb more than 8 to 12% of water by its weight when placed in water.
d. Good timber should be hard and workable.
e. A good timber should be tough enough to resist sudden impact loads and vibrations.
f. A good timber should be elastic.
g. Good timber is easily workable. It should not damage or block the teeth of the saw during cutting.
h. The timber should be as heavy as it looks. Timber is said to be good if it weighs heavy. Lightweight timbers are less in strength and unsound.
i. The fibers of timber should be straight and firm.
j. Should be free from defects caused by natural forces such as burls, knots, shakes, etc. And also it should be free from various fungal defects such as blue stain, dry rot, wet rot. Etc.
k. Should resists to fire
l. Good timber should not deteriorate easily against mechanical wear or abrasion.
m. The appearance of a good timber should be shiny when it is freshly sawed

5. List 5 effects of using improper water for construction works

Answer:

a. Reduction of structural strength

b. Efflorescence and Staining: When water with high levels of dissolved salts evaporates from the surface of concrete or masonry, it can leave behind unsightly white deposits known as efflorescence. This can also cause staining and discoloration on the surface, diminishing the aesthetic appeal of the construction.

c. Adverse Effects on Plaster and Finishes: Poor-quality water can have detrimental effects on plaster and finishes applied to walls and surfaces. It can result in poor adhesion, cracking, blistering, or peeling of paints, coatings, or decorative finishes. This not only compromises the visual appearance but also reduces the longevity of the finishes.

d. Reduced Workability and Construction Delays: Water that is excessively hard or contains excessive impurities can affect the workability of concrete and mortar. It may hinder proper mixing, impair the flow, and make the material difficult to handle and place. This can lead to construction delays and inefficiencies.

e. Damage to Plumbing and Sanitary Systems: Poor-quality water with high levels of hardness, sediments, or corrosive elements can cause damage to plumbing and sanitary systems within the building. It can result in scaling, clogging of pipes, reduced water flow, and increased maintenance requirements.

f. Environmental Impact: Improper water, particularly if contaminated with pollutants or chemicals, can have detrimental effects on the environment. It can contaminate soil, groundwater, and nearby water bodies, posing risks to ecosystems and human health.

II. Respond the following questions with True for the correct statement and False for the incorrect statement

1. Stratified, unstratified and foliated rocks are types of stones based on chemical characteristics

Answer:

False. Correct answer: based on physical characteristics

2. Delamination refers to the separation or splitting of layers within a stone.

Answer:

True

3. Natural and artificial aggregates are types of aggregates based on their shape.

Answer:

False. Correct answer: based on their origin

4. Water used in construction activities should be tasteless, odorless, clear, free from impurities and colorful.

Answer:

False. Correct answer: it must be colorless not colorful

5. Softwoods have lesser strength in compression and shear compared to hard woods.

Answer:

True

III. Match the elements of the second column with the third column

1. Put the letter corresponding to the right answer in the first column(answers) by matching the elements of the second column containing defects of stones with their appropriate explanations in the third column.

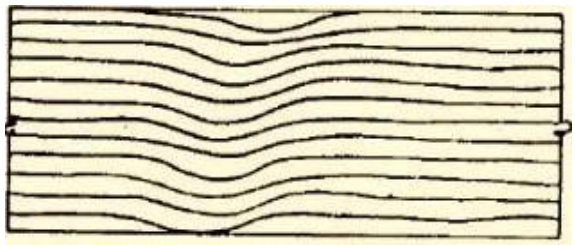
Answers	Defects of stones	Explanations
1……	**1.** Weathering	a) is the white crystalline deposit that appears on the surface of stones when soluble salts from within the stone or adjacent materials are transported to the surface by moisture. It can detract from the stone's appearance and indicate underlying moisture-related issues.
2……	**2.** Fissure and cracks	b) due to the presence of minerals, organic matter, chemical reactions, or exposure to pollutants. Stains can affect the aesthetic appeal of the stone.
3……	**3.** Porosity	c) is the deterioration of stones due to exposure to natural elements such as sunlight, rain, wind, and temperature changes? It can result in erosion, cracking, spalling, discoloration, and loss of surface texture.

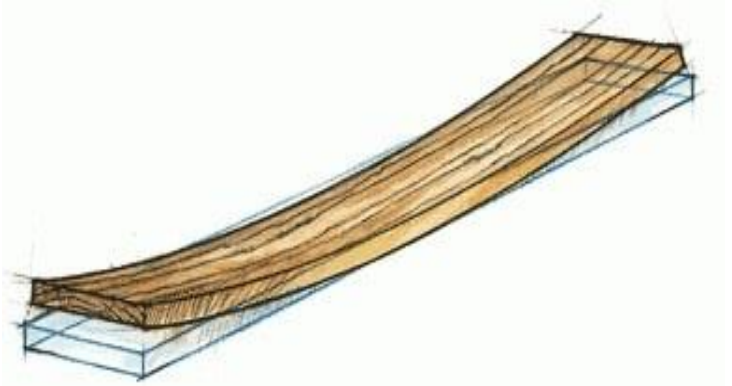
4……	**4.** Staining	d) These defects can be natural features of the stone or occur during quarrying, transportation, or installation. They can propagate and expand over time, leading to further damage.
5…….	**5.** Efflorescence	e) allows water to penetrate and accumulate, leading to problems such as efflorescence, staining, freeze-thaw damage, and accelerated weathering.

Answer:

1. **C**
2. **D**
3. **E**
4. **B**
5. **A**

2. Put the letter corresponding to the right answer in the first column(answers) by matching the elements of the second column containing defects of timbers with their corresponding pictures in the third column.

Answers	Defects of stones	Explanations
1……..	1 Upsets	A. 
2……	2 Burls	B. 

3……..	3 Callus	C. 
4……	4 Heart rot	D. 
5……..	5 Bow	E. 

Answer:

1. **B**
2. **A**
3. **D**
4. **E**
5. **C**

Points to Remember

- Before performing any activity related to building construction, always wear appropriate PPEs.
- Do not use dirty water in mixing mortar or curing to avoid loss of strength of the structure.
- Remember that any successful construction work requires selection of good quality materials free from defects.
- When selecting good natural materials for construction, pay much attention to details of the work.

Self-Reflection

1. Ask learners to retake the self-assessment at the beginning of the unit. They should then fill in the table in their Trainee's Manual to identify their areas of strength, areas for improvement and actions to take to improve.
2. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).

Further Information for the Trainer

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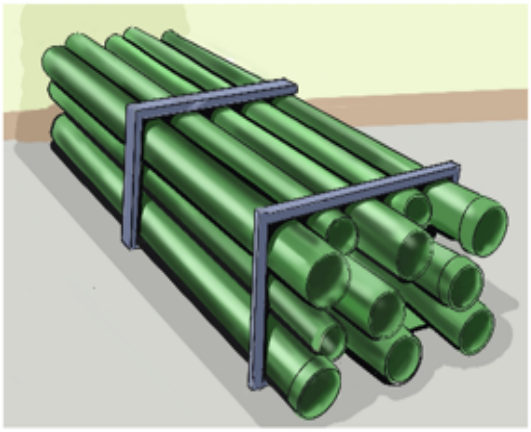
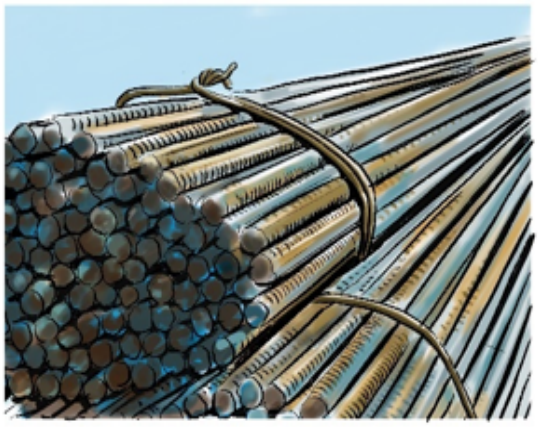
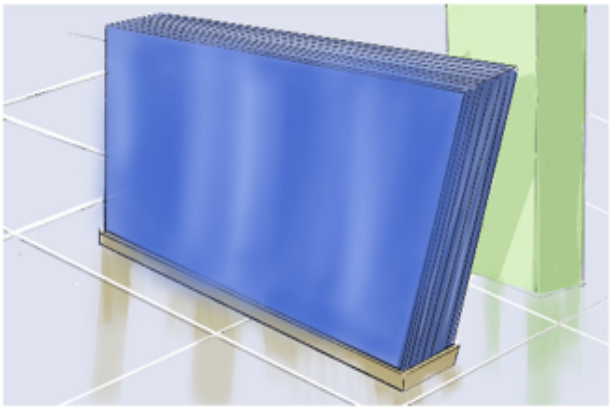
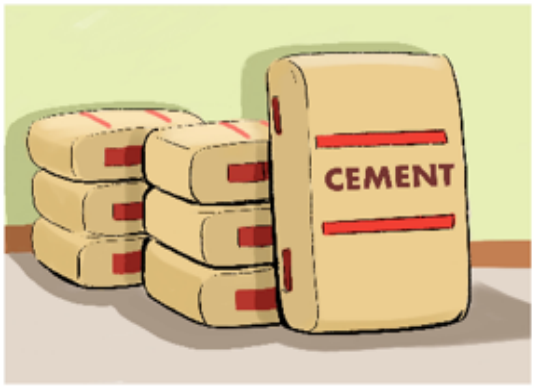
LEARNING OUTCOME 2: IDENTIFY INDUSTRIAL BUILDING CONSTRUCTION MATERIALS









Learning outcome 2: Self-Assessment

1. Ask trainees to look at the unit Illustration in their Trainee's Manuals and together discuss:

a. What does the illustration show?

b. What materials are shown in the illustration?

c. What topics do you think will be topics to be covered under this unit based on the illustration?

2. After the discussion, inform students that this unit is intended to provide them with the basic knowledge, skills and attitudes to identify natural building construction materials. They will cover description of building stone, description of building aggregates, description of timber for construction works as well as description of water for construction works.

3. Ask trainees to fill out the self-assessment at the beginning of the unit in their Trainee's Manuals. Explain that:

a. The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.

b. There is no right or wrong way to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.

c. They should think about themselves: do they think they have the knowledge, skills or attitudes to do this? How well?

d. They read the statements across the top and put a check in column that best represents their level of knowledge, skills or attitudes.

e. At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, areas of improvement and actions to be taken.

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe the composition of cement used in building construction	1. Select good cement used in building construction	1. Manage cement efficiently and effectively
2. Describe the types of cement used in building construction	2. Select the type of cement used in building construction	2. Comply with mixing ratio, strength and durability
3. Explain the storage of cement used in building construction	3. Perform cement storage process	3. Manage cement storage efficiently and effectively
4. Describe the defects of metal used for construction works	4. Assess the defects of building stone	4. Pay attention to details of the work
5. Identify the uses of metal in construction works	5. Uses metal in building construction	5. uses metal effectively and efficiently
6. Describe the qualities of paints used in building construction	6. Select good paints used in building construction	6. Comply with mixing ratio
7. Describe the type of paints used in building construction	7. Select the type of paints used in building construction	7. Manage type of paints efficiently and effectively
8. Describe the uses of paint in construction works	8. Use paint in building construction	8. Comply with mixing ratio, strength and durability

Knowledge	Skills	Attitudes
9. Describe the composition of the varnish	9. Identify the composition of the varnish	9. Be Detail-oriented
10. Outline the properties of varnish	10. Summarize the properties of varnish	10. Have Attention to detail
11. Describe the types of varnish	11. Select the types of varnish	11. Manage type of varnish efficiently and effectively
12. Describe the qualities of varnish	12. Select good varnish used in building construction	12. Comply with mixing ratio, strength and durability
13. Describe the uses of varnish	13. Use varnish in building construction	13. Use varnish effectively and efficiently
14. Describe the qualities of plastics	14. Select good plastics used in building construction	14. Comply with strength and durability
15. Describe the uses of plastic materials	15. Use plastic materials	15. Use plastic materials effectively and efficiently
16. Describe the qualities of glass	16. Select the good glass used in building construction	16. Have Attention to detail
17. Describe the types of glass	17. Distinguish the types of glass	17. Have critical thinking
18. Describe the uses of glass	18. Use glass in building construction	18. Being organized to achieve the required result
		19. Use glass effectively and efficiently

Discovery Activity

Task 16

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze scenario and answer the questions provided under task 16 in their trainee manuals. Make sure instructions are understood, all the students are actively participating and necessary materials/tools are given.

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Encourage all students to give their views.

3. After the presentations/sharing session, inform students that this activity was not intended for them to give the right answers but to give them a picture of what they will cover in the unit.

4. Introduce Topic 2.1: Description of cement for construction works

Topic 2.1: Description of Cement for Construction Works

Objectives:

By the end of the topic, trainees will be able to:

a. Describe the composition of cement used in building construction
b. Describe the types of cement used in building construction
c. Select good cement used in building construction
d. Select the type of cement used in building construction

Time Required: 2 hours

Learning Methodology: Group discussion, trainer guided, Jig saw, Role play, large group discussions

Materials, tools and equipment needed

- **Materials:** Chalk, pen, types of cement needed.
- **Tools:** Book, internet, handout, ink pen
- **Equipment:** Projector, PPE, bucket, sign post

Preparation:

- ❑ Preparation of video for process of manufacturing cement
- ❑ Preparation of different types cement used in building construction
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of types of cement
- ✓ Promote standardization culture among students through realizing the need/importance of cement manufacturing process

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Chemistry (cement properties);
- ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 17

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 17 in their Trainee's Manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 2.1 a,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Task 18:

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 18 in their Trainee's Manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used.*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 2.1 b,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 19:

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and complete the table provided under task 19 in their Trainee's Manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 2.1 a and 2.1 b,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 20

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.

2. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

3. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the description of the cement used in construction works which should include:
   a) Type of cement used in building construction.
   b) Storage of cement used in building construction.
   c) Process of manufacturing cement.
4. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices

5. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class

Topic 2.2: Description of Metals for Construction Works

Objectives:

By the end of the topic, trainees will be able to:

a. Explain the uses of metal in construction works
b. Describe the defects of metal used for construction works
c. Explain the types of metal used for building construction

Time Required: 2 hours

Learning Methodology: Trainer guided, Jig saw, Role play, large group discussions

Materials, tools and equipment

- **Materials:** Chalk, pen, types of metals needed.
- **Tools:** Book, internet, handout, ink pen
- **Equipment:** Projector, PPE, wheelbarrow, sign post

Preparation:

- ❑ Preparation of different examples of metals (as ferrous metal, Non-Ferrous metal)
- ❑ Preparation of different types metal used in building construction
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during classification of metals
- ✓ Promote standardization culture among students through realizing the need/importance of metals used in construction

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 21

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 21 in their trainee manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 2.2,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 22

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 22 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. Encourage all students to give their views.

5. After the sharing session, refer students to **Key Facts 2.2,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 23

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.

2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the description of the metals which should include:
    a. Type of defects of metals.
    b. Causes of defects of metals.
    c. how to prevent the defects of metals?

3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class
5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 2.3: Description of Paint Used in Building Construction

Objectives:

By the end of the topic, trainees will be able to:

a. Describe the qualities of paints used in building construction
b. Describe the type of paints used in building construction
c. Describe the uses of paint in construction works
d. Select good paints used in building construction

Time Required: 1 hour

Learning Methodology: Trainer guided, Jig saw, Role play, large group discussions

Materials, tools and equipment

- **Materials:** Chalk, pen, types of paint needed.
- **Tools:** Book, internet, handout, ink pen
- **Equipment:** Projector, PPE, bucket, jercan, sign post

Preparation:

- ❑ Preparation of different examples of paint (as Oil paint, Emulsion Paint, Enamel Paint)
- ❑ Preparation of different types paint used in building construction
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during type of paints
- ✓ Promote standardization culture among students through realizing the need of paints in construction

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Environmental impact issues
- ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 24

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 24 in their trainee manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*
2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*
3. After the sharing session, refer students to **Key facts 2.3,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 25

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 25 in their trainee manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*
2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.
3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*
5. After the sharing session, refer students to **Key Facts 2.3** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 26

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.
2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the description of the metals which should include:
    a. Types of paints that can be used in the market (internal and external of the building).
    b. Factors affecting the selection of types of paints that can be used in the market.
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class
5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 2.4: Description of Varnish Used in Building Construction

Objectives:

By the end of the topic, trainees will be able to:

a. Describe the composition of the varnish
b. Select good varnish used in building construction
c. Describe the uses of varnish
d. Describe the properties of varnish
e. Describe the types of varnish
f. Describe the qualities of varnish

Time Required: 1 hour

Learning Methodology: Group discussion, Jig saw,

- **Materials needed**

  Chalk, pen, types of varnish needed.

- **Tools needed**

  Book, internet, handout, ink pen

- **Equipment needed**

  Projector, PPE, bucket, sign post

Preparation:

- ❑ Preparation of different types of varnish used in construction
- ❑ Preparation of video or pictures of varnish used in construction
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all

- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of types of varnish used in construction
- ✓ Promote standardization culture among students through realizing the need/importance of selecting standards varnish for construction works

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Chemistry (Composition of varnish;
- ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 27

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 27 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*
2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*
3. After the sharing session, refer students to **Key facts 2.4,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 28

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 28 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*
2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.
3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference*. Encourage all students to give their views.*
5. After the sharing session, refer students to **Key Facts 2.4,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 29

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.

2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the description of the building aggregates which should include:
    a. Types of varnish used in construction works.
    b. Process of applying varnish to the furniture.
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class
5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 2.5: Description of Plastics for Building Construction

Objectives:

By the end of the topic, trainees will be able to:

a. Select good plastics used in building construction
b. Describe the uses of plastic materials
c. Describe the qualities of plastics

Time Required: 2 hours

Learning Methodology: Large group discussion**,** Brainstorming**,** Group discussion, Jig saw,

Materials. Tools and equipment needed:

- **Materials:** Chalk, pen, types of plastic needed.
- **Tools:** Book, internet, handout, ink pen
- **Equipment:** Projector, PPE, wheel barrow, sign post

Preparation:

- ❑ Preparation of video or pictures of different types of plastics used in construction
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of types of plastics used in construction
- ✓ Promote standardization culture among students through realizing the need/importance of selecting standards of plastics in building construction

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Physical course(properties)
- ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 30

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 30 in their trainee manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*
2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*
3. After the sharing session, refer students to **Key facts 2.5,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 31

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 31 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*
2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.
3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference*. Encourage all students to give their views.*
5. After the sharing session, refer students to **Key Facts 2.5,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 32

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.
2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the description of the plastic materials which should include:
    a. Properties of plastic materials,
    b. Qualities of plastics,
    c. Classifications of plastic materials,
    d. Uses of plastics,
    e. Effects of using plastics on environment.
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class

5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 2.6: Identification of Glass for Building Construction

Objectives:

By the end of the topic, trainees will be able to:

a. Describe the qualities of glass
b. Describe the types of glass
c. Describe the uses of glass
d. Select the good glass used in building construction

Time Required: 2 hours

Learning Methodology: Group discussion, trainer guided, Role play, large group discussions

Materials. Tools and equipment needed:

- **Materials:** Chalk, pen, types of plastic needed.
- **Tools:** Book, internet, handout, ink pen
- **Equipment:** Projector, PPE, wheel barrow, sign post

Preparation:

- ❑ Preparation of workshop for glass selection
- ❑ Connect with construction project managers to organize field site visit related to selection of glass for construction
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of glass for construction
- ✓ Promote standardization culture among students through realizing the need/importance of selecting standard glass for construction

Prerequisites:

- ✓ Safety, Health and environment measures;
- ✓ Chemistry (properties of glass);
- ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem-Solving

Task 33

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 33 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 2.6,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 34

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and complete the table provided under task 34 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 2.6,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 35

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.

2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the description of the glass which should include:
   a) Types of glass selected for the modern house,
   b) Characteristics of good glass to be selected,
   c) Uses of glass in construction works.

3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices

4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class

5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Formative Assessment

1. Describe ingredients of cement

Answer:

No	Composition of cement	Percentage	Functions
1.	Lime	62 %	a) Binding property strength b) Excess makes cement unsound c) Deficiency quick setting of cement
2.	Silica	22 %	a) Contribute the strength in the cement b) Prolong the setting time of cement
3.	Alumina	5 %	a) imparts quick setting property b) Act as a flux to reduce clinkering temperature (2000oC to 1500oC) c) Produce more heat at time of hydration
4.	Gypsum	4 %	a) increase the initial setting time b) Added to rotary kiln at time of final grinding
5.	Iron oxide	3 %	Imparts color, Hardness and strength
6.	Other chemical elements like (Magnesia, Sulphur, Alkalis)	4 %	Increase the strength of cement

2. Explain the 5 (five) proper storage of cement

Answer:

a. Cement should be stored off the ground in a well-aired, clean, dry place and closed
b. The Arrangement of Cement Bags should possess a wooden platform of height 150 to 200 mm prepared above the floor of the storage shed to avoid direct contact between the floors and cement bags
c. The stack of cement should not touch the walls of the shed and it should be considerably 300 mm away from the external walls.
d. Each stack of cement should be closely connected to avoid the circulation of air, to prevent collapsing of high stacks, cross arrangement of bags one above the other is preferable.
e. All the stacks of cement are covered with a waterproof layer for long-term protection.
f. The cement bags should be taken out in such a way that the bag first placed in the storage shed should be withdrawn first.
g. It is preferred that the cement should not be stored for more than 3 months. However, if it is stored for more than 3 months the strength of cement should be tested before using it.

3. Enumerate 4 (four) types of reinforcement used in construction

Answer:

a. Hot rolled deformed steel bars
b. Cold worked steel bars
c. Mild steel plain bars
d. Prestressing steel bars

4. State 5 (five) mechanical properties of metals used in construction

Answer:

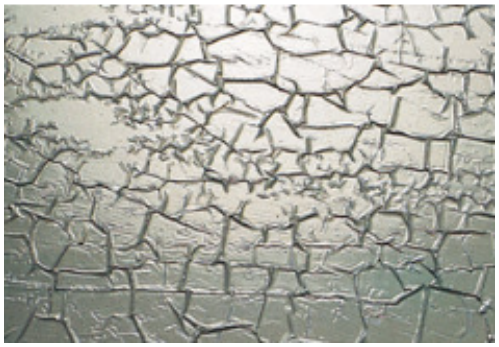
a. Hardness
b. Brittleness
c. Malleability
d. Ductility:
e. Elasticity

5. Explain any five functions of paints

Answer:

a. Act as a protective coating against climatic changes
b. For pleasing appearance
c. Check/stop penetration of water
d. Check the formation of bacteria and fungus
e. Check corrosion of structures
f. Provides a smooth surface for easy cleaning.

6. Based on the defects of paints complete the following table.

Figures showing the defects of paints	Name of paints defects	causes
	Flaking	It occurs when the bond between surface and paint film is poor. To prevent this, the surface should be cleaned and rubbed with abrasive paper before applying paint
	Wrinkling	Wrinkling occurs when a thick layer of paint is to be coated on the surface. In this case, the paint film shrinks and develops crawls on the surface as shown in the picture.
	Peeling	paints occur when the painted surface is exposed to chemicals such as alkalis. In this defect, soap patches are formed on the paint surface and paint film gets peeled off from the surface Paint containing strong solvents. Re-coat dirty walls. Excess Moisture

Figures showing the defects of paints	Name of paints defects	causes
	Running	When a thin layer of paint is coating on a glossy and smooth surface the paint may run back and sometimes leaves small areas of surface uncovered.

Points to Remember

- Cement is a binder composed mainly of lime, silica, Alumina, Gypsum, Iron oxide and other chemical elements, each providing a particular set of functions on properties of cement.
- There are different types of cement selected depending on the specific uses in construction works. They include colored cement, white cement, quick setting cement, rapid hardening cement, low heat cement, pozzolana cement etc.
- Metals are incredibly strong, durable, ductile, and malleable. It is a fantastic conductor and can be recycled.
- The main types of defects of cement are classified as: contamination, deformation, deterioration, discontinuity, displacement, and loss of material.
- Good paints used in construction should be easy to clean, environmentally friendly and should be durable
- There are different types of paint and they are selected depending on the specific uses in construction works. They include Oil paint, emulsion paint enamel paint, anti-corrosive paint
- Varnishes provide protective coatings for wooden surfaces, paintings, and various decorative objects. Varnish protects and enhances the appearance of wooden floors, interior wood panelling and trim, and furniture.

- Plastic materials in construction should possess good appearance finish, resistance to moisture and chemicals, sufficient ductility, low weight, etc. Good glass should have enough hardness, brittleness, weather resistance, transparent, etc.
- Glass is used in building construction as an insulation material, as a structural components, as external glazing and cladding material, etc.
- Remember to check the durability and compressive strength of industrial materials before used

Self-Reflection

1. Ask learners to retake the self-assessment at the beginning of the unit. They should then fill in the table in their Trainee's Manual to identify their areas of strength, areas for improvement and actions to take to improve.
2. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).

Areas of strength	Areas for improvement	Actions to be taken to improve
1.	**1.**	**1.**
2.	**2.**	**2.**
3.	**3.**	**3.**

Further Information for the Trainer

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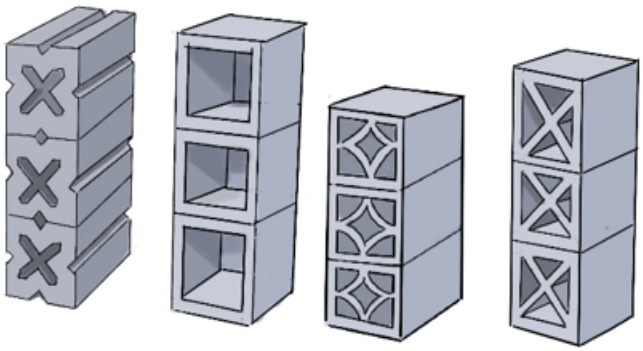
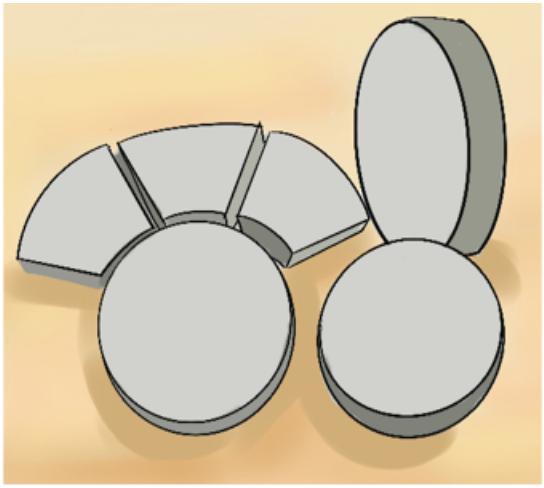
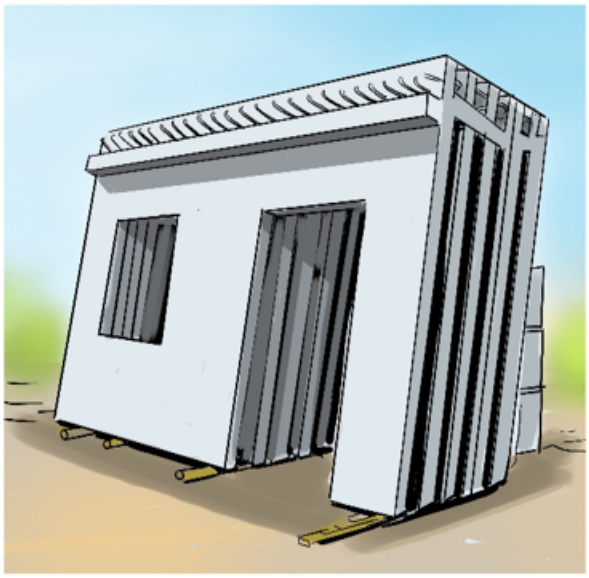
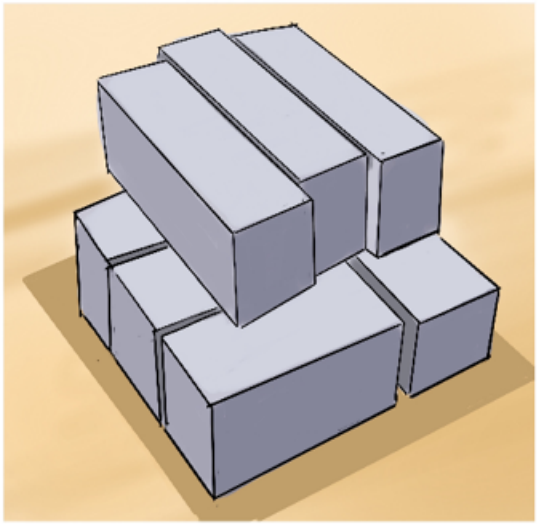
LEARNING OUTCOME 3: IDENTIFY PREFABRICATED BUILDING CONSTRUCTION MATERIALS.









Learning outcome 3: Self-Assessment

1. Ask trainees to look at the illustration in their trainee's manuals and together discuss:

a. What does the illustration show?

b. What materials are shown in the illustration above?

c. What do you think will be topics to be covered under this unit based on the illustration?

d. After some brainstorming, share the main topics.

2. Ask trainees to fill out the self-assessment at the beginning of the learning outcome in their Trainee's Manuals. Explain that:

a. The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.

b. There is no right or wrong way to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.

c. They should think about themselves: do they think they have the knowledge, skills or attitudes to do this? How well?

d. They Read the statements across the top. Put a check in the column that best represents their level of knowledge, skills or attitudes.

e. At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, area of improvement and actions to be taken

f. Fill in and complete the self-assessment table below to assess your level of knowledge, skills and attitudes under this unit.

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe the types of soil bricks	1. Distinguish each type of soil brick	1. Pay attention to details
2. Describe the qualities of soil bricks and blocks	2. Select good soil bricks and blocks	2. Manage resources efficiently and effectively
3. Describe the qualities of cement-based products	3. Select good cement-based products	3. Manage resources efficiently and effectively
4. Describe the manufacturing process of soil-based products	4. Manufacture soil-based products	4. Comply with mixing ratio
5. Describe the manufacturing process of cement-based products	5. Manufacture cement-based products	5. Pay attention to details of the work
6. Describe the manufacturing process of pre-fabricated elements	6. Manufacture pre-fabricated elements	6. Manage resources efficiently and effectively

Task 36:

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to answer the questions provided under task 36 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are given.*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. *Encourage all students to give their views*.

3. After the presentations/sharing session, inform students that this activity was not intended for them to give the right answers but to give them a picture of what they will cover in the unit.

4. Introduce Topic 3.1: Description of soil bricks for construction works

Topic 3.1: Description of soil bricks for construction works

	**Objectives:** By the end of the topic, trainees will be able to: a. Identify the composition of soil brick b. Classify soil brick per use, stabilizer, manufacturing process and composition c. Identify the types of soil bricks Based on materials, on weight and on shape d. explain the qualities of soil bricks e. Assess the defects of soil bricks
	**Time Required:** 3 hours
	**Learning Methodology:** Group discussion, trainer guided, Role play, large group discussions
	**Materials. Tools and equipment needed** • **Materials:** Chalk, pen, types of soil bricks needed. • **Tools:** Book, internet, handout, ink pen • **Equipment:** Projector, PPE, wheel barrow, sign post
	**Preparation:** ❑ Preparation of workshop for soil bricks ❑ Connect with construction project managers to organize field site visit related to making of soil bricks ❑ Prepare the required PPE for all trainees and other safety tools and equipment.
	**Cross Cutting Issues:** ✓ Ensure gender balance while forming groups, allocating tasks and during presentations

	✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all ✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of soil bricks ✓ Promote standardization culture among students through realizing the need/importance of selecting soil bricks
	**Pre-requisites:** ✓ Safety, Health and environment measures; ✓ Chemistry (soil types, composition and properties); ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem Solving

Task 37:

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the pictures showing examples of soil bricks and answer the questions provided under task 37 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views*.

3. After the sharing session, refer students to **Key facts 3.1a,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Task 38

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the statement and answer the questions provided under task 38 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 3.1b,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 39

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 39 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views*.

5. After the sharing session, refer students to **Key Facts 3.1 a and 3.1 b,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 40:

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.

2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the selection of the soil bricks which should include:
    a. Uses,
    b. Stabilizers,
    c. Based on Materials,
    d. Based on Weight,
    e. Based on Shape,
    f. Qualities of the bricks,
    g. Defects of soil bricks to avoid.
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices

4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class

5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to

apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 3.2: Description of soil blocks for construction works

Objectives:

By the end of the topic, trainees will be able to:

a. Identify the composition of soil block
b. Explain the qualities of soil blocks
c. Assess the defects of soil blocks

Time Required: 2 hours

Learning Methodology: Group discussion, trainer guided, Role play, large group discussions

Materials. Tools and equipment needed

- **Materials:** Chalk, pen, types of soil blocks needed.
- **Tools:** Book, internet, handout, ink pen
- **Equipment:** Projector, PPE, wheel barrow, sign post

Preparation:

- ❑ Preparation of workshop for soil blocks selection
- ❑ Connect with construction project managers to organize field site visit related to selection of soil blocks
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all

	✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of soil blocks ✓ Promote standardization culture among students through realizing the need/importance of selecting soil blocks
	**Pre-requisites:** ✓ Safety, Health and environment measures; ✓ Chemistry (types, composition and properties of soil); ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem Solving

Task 41

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 41 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 3.2,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 42

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and perform the tasks provided under task 42 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference*. Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 3.2,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 43

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.

2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the selection of the soil blocks which should include:
    a. Soil blocks selected,
    b. Qualities of soil blocks,
    c. Defects of soil blocks.
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class
5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 3.3: Description of cement-based building construction products

Objectives:

By the end of the topic, trainees will be able to:

a. identify the list of cement-based products
b. Identify the composition of cement-based products
c. Explain the qualities of cement-based products
d. Assess the defects of cement-based products

Time Required: 2 hours

Learning Methodology:

Group discussion, trainer guided, Role play, large group discussions

Materials. Tools and equipment needed

- **Materials:** Chalk, pen, types of based building product needed.
- **Tools:** Book, internet, handout, ink pen
- **Equipment:** Projector, PPE, wheel barrow, sign post

Preparation:

a. Preparation of workshop for cement-based products selection
b. Connect with construction project managers to organize field site visit related to selection cement-based products
c. Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

a. Ensure gender balance while forming groups, allocating tasks and during presentations
b. Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
c. Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of cement-based products

	d. Promote standardization culture among students through realizing the need/importance of selecting cement based products
	**Pre-requisites:** ✓ Safety, Health and environment measures; ✓ Chemistry (properties of cement, water and sand); ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem Solving

Task 44

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 44 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 3.3,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 45

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 45 in their trainee's manuals.

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 3.3,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 46

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.

2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of the selection of cement based products which should include:
    a) Cement based products used in wall elevation,

b) Cement based products used in ventilation,

c) Cement based products used in pavement,

d) Defects of cement-based products identified and avoided.

3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class
5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 3.4: Identification of prefabricated building structure elements

Objectives:

By the end of the topic, trainees will be able to:

a. Identify the list of prefabricated building structure elements
b. Discuss the composition of prefabricated building structure elements
c. Explain the advantages of prefabricated building structure elements
d. Explain the disadvantages of prefabricated building structure elements

Time Required: 3 hours

Learning Methodology

Group discussion, trainer guided, Role play, large group discussions

Materials. Tools and equipment needed

- **Materials:** Chalk, pen, types of based building structural elements needed.
- **Tools:** Book, internet, handout, ink pen
- **Equipment:** Projector, PPE, wheel barrow, sign post

Preparation:

- ❑ Preparation of workshop for prefabricated building structure elements selection
- ❑ Connect with construction project managers to organize field site visit related to selection of prefabricated building structure elements
- ❑ Prepare the required PPE for all trainees and other safety tools and equipment.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all

	✓ Promote environment and sustainability by emphasizing the need/importance of protecting and being cautious of the environment during selection of prefabricated building structure elements ✓ Promote standardization culture among students through realizing the need/importance of selecting prefabricated building structure elements
	**Pre-requisites:** ✓ Safety, Health and environment measures; ✓ Chemistry (properties of cement); ✓ Mechanic (behavior of metallic tools and equipment)

Activity 1: Problem Solving

Task 47

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 47 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views*.

3. After the sharing session, refer students to **Key facts 3.4,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 48

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and complete the table provided under task 48 in their trainee's manuals. *Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used*

2. During the task, students should be given a degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as *Why? What? How?* to enable them to come to informed responses.

3. While students are still performing the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 3.4,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 49

1. Explain to trainees that the following task links them to the world of work. Ask them to choose one facility in the school neighborhood, fix an appointment with a technician, ask permission to assist him/her for that particular day and upon completion, elaborate a short report preferably one-half page on experience they will have gained on workplace exposure.

2. Using an appropriate methodology such as individual work, pairs, or small groups trainees perform the task on the field and make a report of their selection which should include:
   a) The construction structures that can be built using prefabricated materials
   b) The prefabricated elements that will be used to construct the structures in (a)
3. Give more guidance or instruction on what they will do. Link what they have done in the classroom to what they should do in the workplace. Then they can compare best practices and limitations in the workplace. You can also ask them to go to another facility to compare practices
4. Tell trainees that each one will share his/her experience gained from workplace with the rest of the class
5. This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Formative Assessment

I. Read carefully and answer the following questions

1. Define the following terms as used in construction
    a) Soil brick
    b) Ventilation block

Answer

A soil brick used in construction of walls is a building material made primarily from soil, along with other additives or stabilizers, to enhance its properties.

Ventilation blocks, also known as breeze blocks or cinder blocks, are specialized concrete blocks designed with decorative cutouts or perforations to allow airflow and ventilation

2. Differentiate load-bearing brick from non-load-bearing brick as types of bricks

Answer

Load-bearing Bricks: Bricks that are strong enough to support the weight of the structure and carry the loads from the floors and roof. Typically used for load-bearing walls in buildings. While **Non-Load Bearing Bricks: Bricks** used for partition walls or infill walls that do not carry any structural load.

3. State at least 3 qualities of soil blocks for construction works

Answer

a. Soil blocks are a **fireproof**
b. Soil blocks are **durable** yet **biodegradable**
c. Soil blocks are **non-toxic** building material
d. Soil blocks provide sufficient **thermal mass** to buildings to ensure excellent thermal performance.

4. List 5 elements in which cement-based products are made from.

Answer

a. **Portland Cement:** The primary binding agent in most cement-based products is Portland cement. It is a fine powder derived from limestone, clay, and other

minerals that are heated in a kiln and ground to a fine powder. Portland cement reacts with water to form a paste that hardens over time, providing the strength and cohesion to the product.

b. **Aggregates:** Aggregates are inert granular materials, such as sand, gravel, crushed stone, or lightweight aggregates, which are mixed with cement to form concrete and mortar. Aggregates provide bulk to the mixture and contribute to the overall strength and stability of the product.
c. **Water:** Water is a crucial ingredient in cement-based products as it initiates the chemical reaction between cement and water, known as hydration. This hydration process causes the mixture to harden and gain strength.
d. **Admixtures:** Admixtures are chemical additives used in cement-based products to modify specific properties. Common admixtures include water reducers, accelerators, retarders, air-entraining agents, and plasticizers. They can improve workability, setting time, durability, and other aspects of the product.
e. **Coloring Agents**: For decorative purposes, cement-based products like pavers, tiles, and decorative concrete may include coloring agents to achieve specific colors or patterns.

II. Respond the following questions with True for the correct statement and False for the incorrect statement

1. Cracks are defects of soil blocks.

Answer

True

2. Stabilizers are added to the soil to improve the strength, durability, and other engineering properties of the soil bricks.

Answer

True

III. Match the elements of the second column with the third column

1. Put the letter corresponding to the right answer in the first column(answers) by matching the elements of the second column containing defects of soil bricks with their appropriate explanations in the third column.

Answers	Defects of soil bricks	Explanations
1……..	**1.** High Water Absorption	A. Soil bricks may develop cracks during the drying process if they are not adequately cured or if the stabilizer-to-soil ratio is incorrect. Cracks can weaken the bricks and reduce their load-bearing capacity.
2……	**2.** Cracking	B. If soil bricks are not properly stabilized, they may have high water absorption rates. This defect can lead to reduced strength, increased weathering, and potential damage during freeze-thaw cycles.
3……..	**3.** Dimensional Variations	C. Poorly stabilized soil bricks may lack long-term living, leading to premature degradation and the need for frequent repairs or replacements.
4……	**4.** Inadequate Durability	D. Variability in soil composition and curing conditions can lead to dimensional inconsistencies among the bricks. Non-uniform sizes can complicate the construction process and result in an uneven wall surface.
5……..	**5.** Poor Weather Resistance	E. Soil bricks that lack proper stabilization may be susceptible to erosion, disintegration, and degradation when exposed to heavy rain, strong winds, or harsh weather conditions.

Answer

ANSWERS
1……B……
2……A……..
3……D……..
4……C……..
5……E…….

2. Put the letter corresponding to the right answer in the first column(answers) by matching the elements of the second column containing cement-based products with their corresponding pictures in the third column.

Answers	Cement based products	Pictures
1……..	1 Ventilation block	A. 
2……..	2 Cement based pavers	B. 
3……..	3 Cement based bricks	C. 

4……	4 Cement based blocks	D. 

Answer

ANSWERS
1……D……
2……C……..
3……A……..
4……B……..

Points to Remember

- A soil brick is a building material made primarily from soil, along with other additives or stabilizers, to enhance its properties
- Soil bricks can be classified based on various factors, such as their composition, manufacturing process, and intended use
- Soil/Adobe Block is Air dried masonry unit made from puddled earth/soil mixture of clay, sand and silt with or without organic materials. It sometimes contains fibers and/or stabilizers
- It should be free from Soluble salts, soaps, oils, and other chemicals which may negatively impact adobe block strength
- The composition of cement-based products can vary depending on the specific product and its intended use. However, in general, cement-based products typically contain Cement, Aggregates, Water, Admixtures etc.
- Cement-based products possess several qualities that make them highly valuable in the construction industry such as Strength, Durability, Durability, Adhesion, Weather Resistance, Sound Insulation, Thermal Mass, Cost-Effectiveness, etc.

Self-Reflection

1. Ask learners to retake the self-assessment at the beginning of the unit. They should then fill in the table in the Trainee's Manual to identify their areas of strength, areas for improvement and actions to take to improve.
2. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).

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