People's Democratic Republic Of Algeria
Ministry Of Higher Education And Scientific Research

Abderrahmane Mira's University of Béjaia
Faculty of Technologie
Department of Architecture
El-kseur Campus

First-Year University

Chapter 1: Building Materials and Architecture

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Objectives

1- To develop knowledge of material science and behaviour of various building materials used in constructions

2-Identify the construction materials required for the assigned work.

3-Provide procedural knowledge of the simple testing method of cement, lime and concrete

Building Materials and Architecture

Introduction

- **Building materials or Construction materials is a material used for construction;**
- **Materials are an essential factor affecting the design process in Architecture.**
- **The most common building materials used for different aspects of constructions are…..**

- can you tell me some building materials?

Building Materials and Architecture

1.1 Stones

Glatasaray /قلعة سراي

Blue Mosque /المسجد الأزرق

Advantages: Solid-Durable-Insulating- non-combustible - Non-polluting- recyclable – Noble - Beauty and style

Building Materials and Architecture

1.1 Stones

Torre di Pisa

Kabylie Village

Disadvantages : : Heaviness-No-availability-Duration-Lack of technicality-permeability-radioactive

Building Materials and Architecture

1.2 Wood

« Globe de la science» Neuchâtel, Suisse 2004

Advantages: natural, ecological, non polluting-old and modern-Resistance to earthquakes-ventilation-thermal insulation-Beauty and style

Building Materials and Architecture

1.2 Wood

«construction in Canada and Scandinavian countries

Disadvantages : Fire resistance- Low thermal inertia sensitive to humidity-fragile-regular maintenance-sustainability-

Building Materials and Architecture

1.3 Concrete

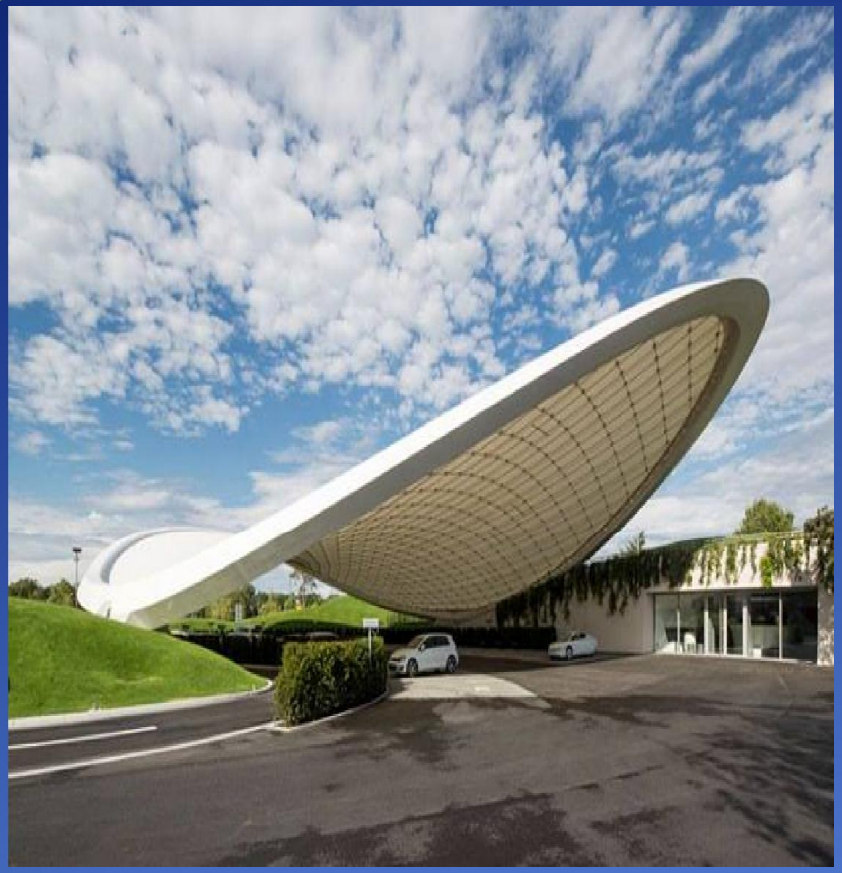
Largest dam Switzerland

Grand Hour / ساعة مكة

Advantages: economical, fluid-durable-ease- Fires resistance and external agent-natural source-available

Building Materials and Architecture

1.3 Concrete



Spectacular shape -Germany

High Constrcution/Dubai Tower

Disadvantages : : Heaviness-Duration- permeability-radioactive-Resistance to earthquakes

Building Materials and Architecture

1.4 Steel

Effel Tower

Restaurant Malaysia

Advantages: Lightweight-inexpensive-dismountable-durable-ease –Earthquakes Resistance

Building Materials and Architecture

1.4 Steel

Fire Harbin Tower , China october 2008

Newport-Bridge-England

Disadvantages : Fires Resistance-corrosion-other materials-R to ex agents-Not available-not economical

Building Materials and Architecture

1.5 Earthen/Soil

Djenné Mosque -Bamaco -Mali

Bam Citadel - Iran

Advantages: Solid-Durable-Insulating- non-combustible - Non-polluting- recyclable – Noble - Beauty and style

Building Materials and Architecture

1.5 Earthen/Soil

Espagne /قصر الحمراء

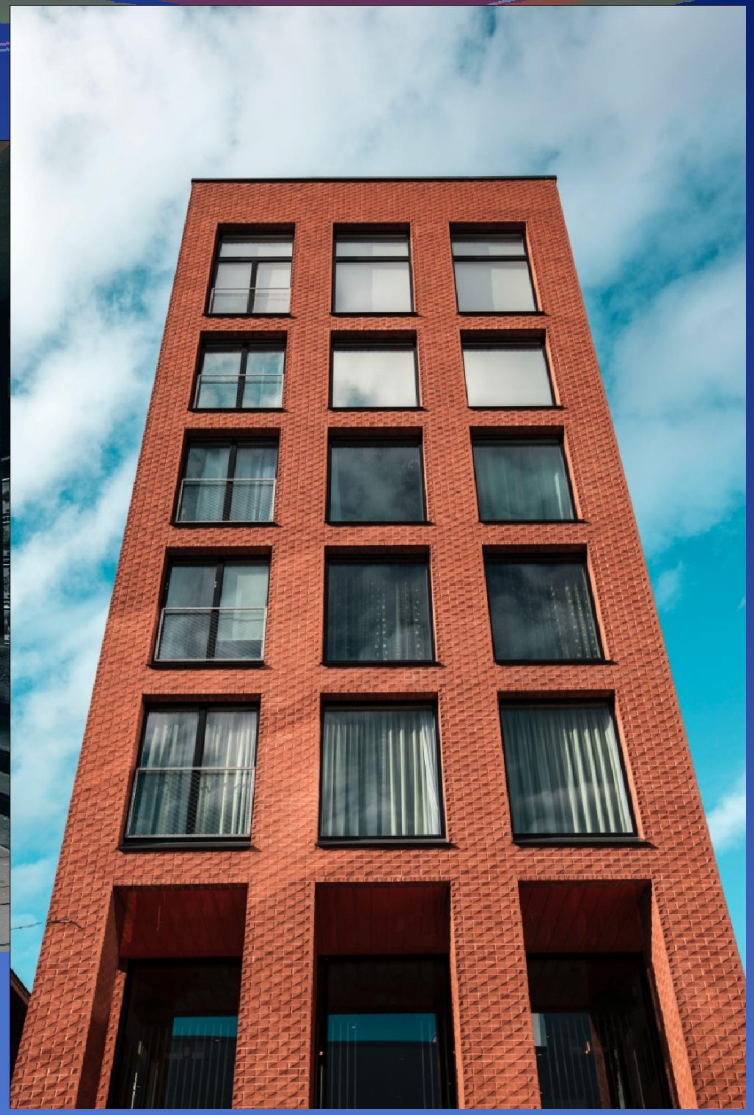
wall of china

Disadvantages : Technicality-permeability-radioactive insulation - earthquakes Resistance – not comfortable

Building Materials and Architecture

1.6 Bricks

Manchister



Advantages: Economical-Insulation- non-combustible - Non-polluting- recyclable – availability – Beauty

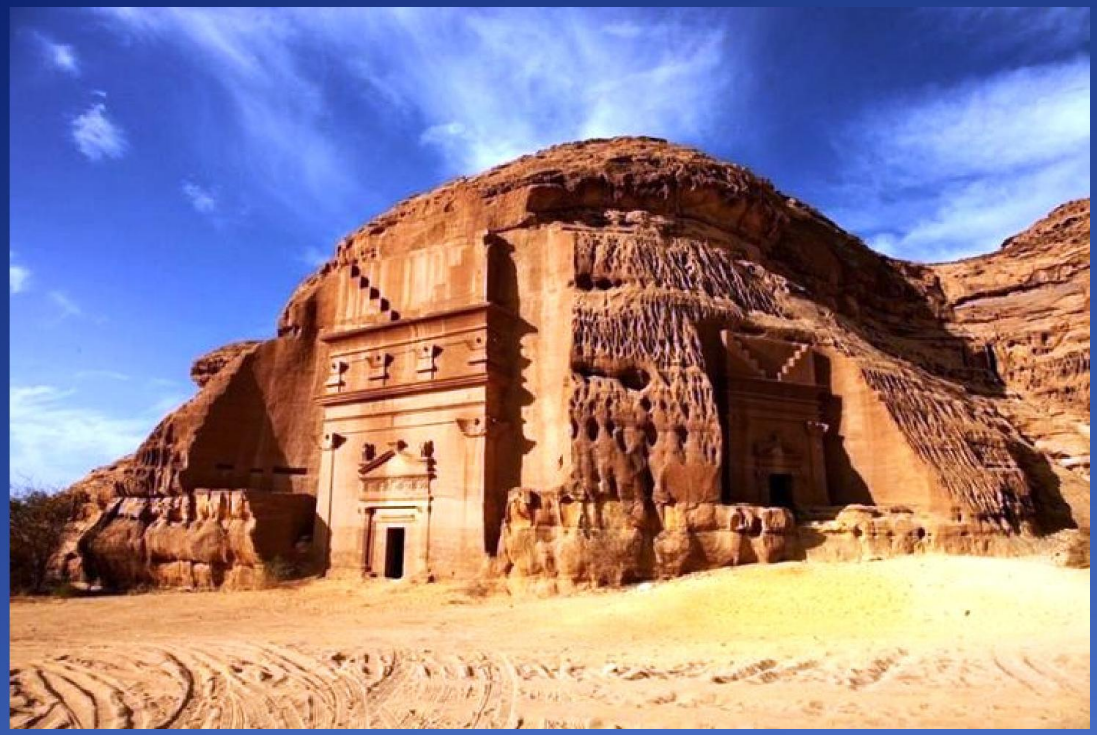
Building Materials and Architecture

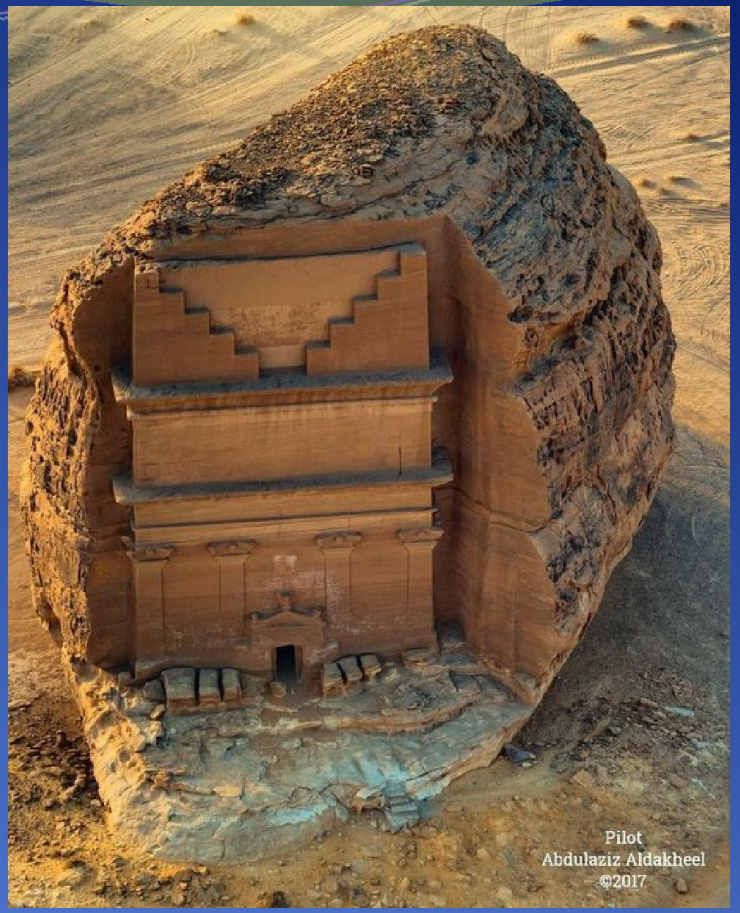
1.6 Bricks

Disadvantages : Technicality-permeability-radioactive - earthquakes Resistance – Duration-

Building Materials and Architecture

1.7.Roche/sculpture





Madâin Sâlih- Saoudia Arabia

وَلَقَدْ كَذَّبَ أَصْحَابُ الْحِجْرِ الْمُرْسَلِينَ (80) وَآتَيْنَاهُمْ آيَاتِنَا فَكَانُوا عَنْهَا مُعْرِضِينَ (81) وَكَانُوا يَنْحِتُونَ مِنَ الْجِبَالِ بُيُوتًا آمِنِينَ (82)

Advantages: Solid-Durable-Insulating- non-combustible - Non-polluting- Noble - Beauty and style

Building Materials and Architecture

1.7. Rock/sculpture

El-petra Jordan- البتراء

Disadvantages : : Heaviness-Non-availability-Duration-technicality-permeability-lack of production site

Building Materials and Architecture

1.8. Waste

House built from waste – Brighton University-England

Advantages: Economical-Ecological-Aesthetic-earthquakes Resistance

Building Materials and Architecture

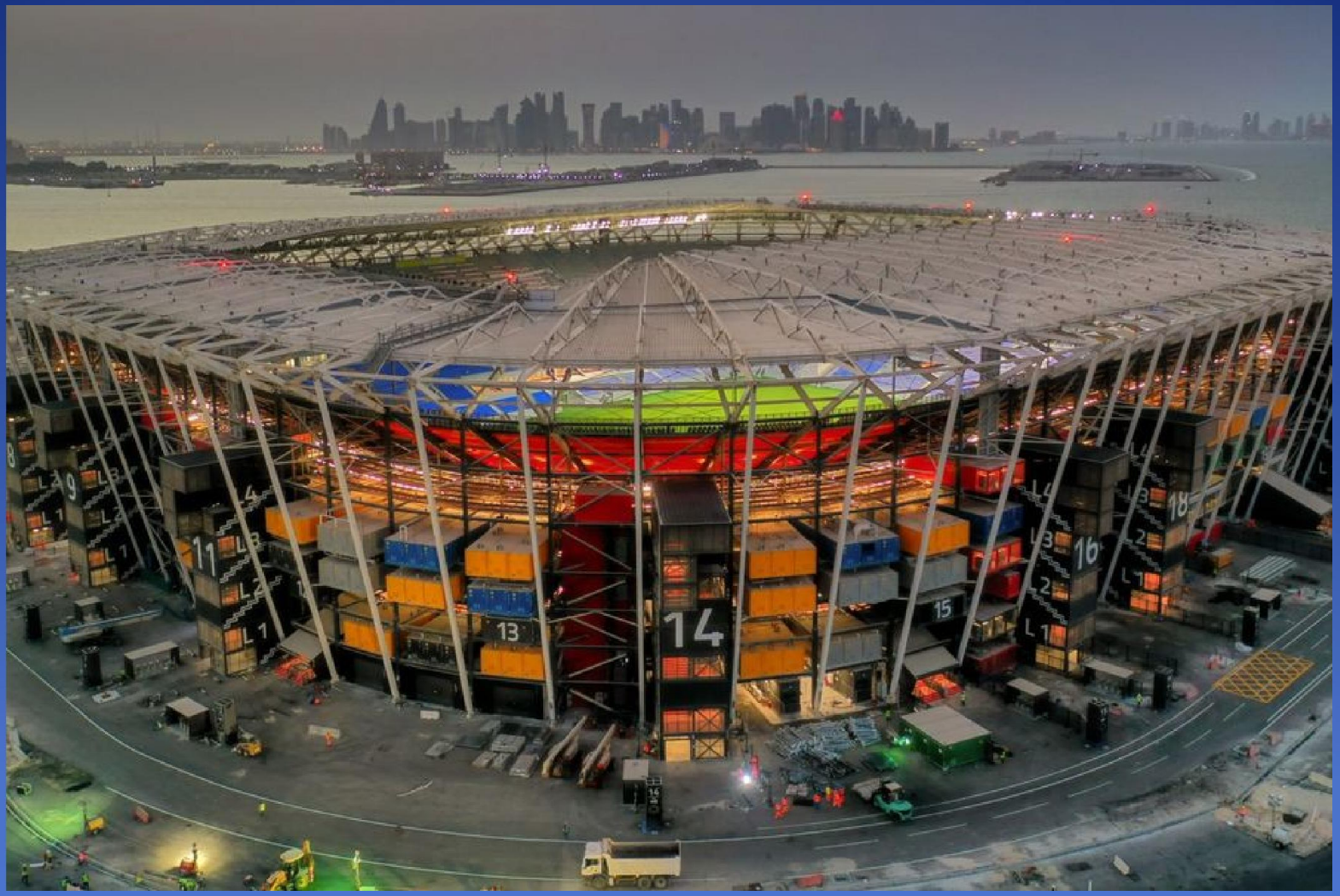
1.8. Waste

Ecological houses made from waste - Texas

Disadvantages : Diseases - Treatment problem - unknown behavior - lack of resources

Building Materials and Architecture

1.8. Waste



Stadium 974-Qatar

Building Materials and Architecture

1.8. Waste

Stadium 974-Qatar

Building Materials and Architecture

1.8. Waste

Stadium 974-Qatar

Building Materials and Architecture

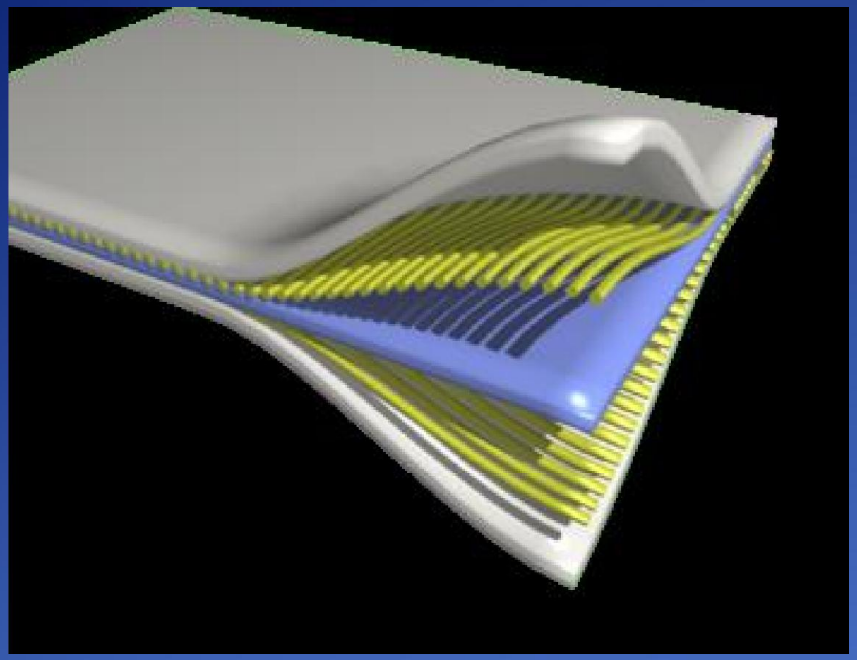
1.9. Les Igloo

Building Materials and Architecture

1.9. Les Igloo

Building Materials and Architecture

1.10. Composite materials



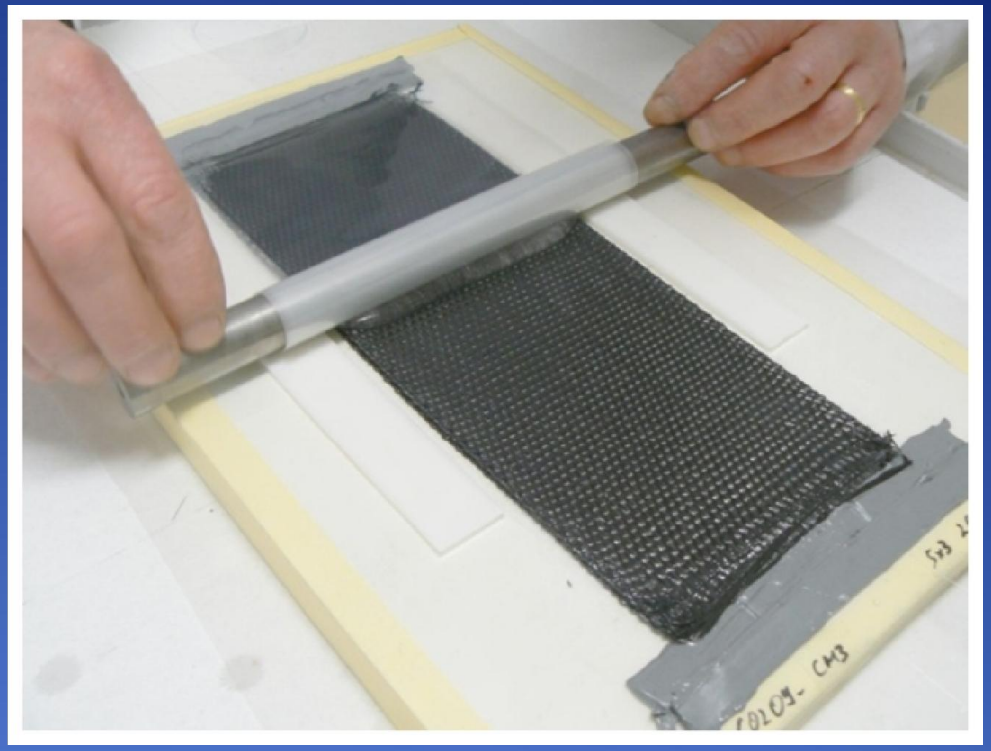
Advantages:
Strength-
Ductility-
Lightness –
- Multi use-

A composite material is a combination of two materials with different physical and chemical properties. When they are combined they create a material which is specialised to do a certain job, for instance to become stronger, lighter, strength

Building Materials and Architecture

1.10. Composite materials

In construction: used for reinforcement works; Repair ; comfort;



Disadvantages : Availability – Economy-Quantity

Building Materials and Architecture

1.10.Composite materials

reinforcement

Classification of Building Materials

- In materials science, it is possible to classify basic materials into according to areas of employment and main characteristics.

The main properties Building materials can be generally divided into several groups as (Four (4) groups:

- Physical properties
- Mechanical properties
- Chemical properties
- Mineral properties

Classification of Building Materials

1-Physical properties

The characteristics of the building materials that can be observed and measured without changing its chemical identity

- Density
- Unit weight/Specific weight
- Specific gravity
- Porosity
- Water absorption
- Coefficient of softening
- Permeability
- Hygroscopicity
- Fire resistance
- Frost resistance
- Chemical resistance
- Heat conductivity
- Durability

Classification of Building Materials

2-Mechanical properties

The properties of building materials which opposes the deformation or breakdown of the material in presence of external force or load

- Strength
- Elasticity
- Hardness
- Plasticity
- Brittleness
- Fatigue
- Impact strength
- Creep

Classification of Building Materials

3-Chemical properties

If a chemical change or reaction occur then, the observed characteristic is called chemical property.

- Chemical composition
- Acidity
- Alkalinity
- Corrosion resistance
- Solubility

Classification of Building Materials

4-Mineral properties

Minerals can be identified using a number of properties. such as colour , electrical conductivity, magnetism, radioactivity and fluorescence..

Classification of Building Materials

1-Physical properties

1-1-Density

Density **(ρ) is the mass of a unit volume of homogeneous material denoted by**

$$\rho = \frac{M}{V} \text{ g/cm}^3$$

where M = mass (g)

V = volume (cm^3)

Density of some building materials is as follows:

Material	*Density (g/cm^3)*
Brick	2.5–2.8
Granite	2.6–2.9
Portland cement	2.9–3.1
Wood	1.5–1.6
Steel	7.8–7.9

There are several types of densities; in our course we are interested in two types:

Classification of Building Materials

1-Physical properties

1-1-Density

1-2- Apparent (Bulk) density : Is the ratio between the mass of substance per unit of apparent volume (including the empty)

-It is usually expressed in grams per cubic centimeter (g/cm^3, Kg/m^3, t/m^3).

Classification of Building Materials

1-Physical properties

1-1-Density

2-Absolute density : It is the ratio between the mass and the unit volume of the material, without the voids which may exist between grains.

-It is usually expressed in grams per cubic centimeter (g/cm^3, Kg/m^3, t/m^3).

Merci pour votre attention