Unit 1

“Shapes and Properties”

JEM/ENG
Mesleki Yabancı Dil

(Professional English)

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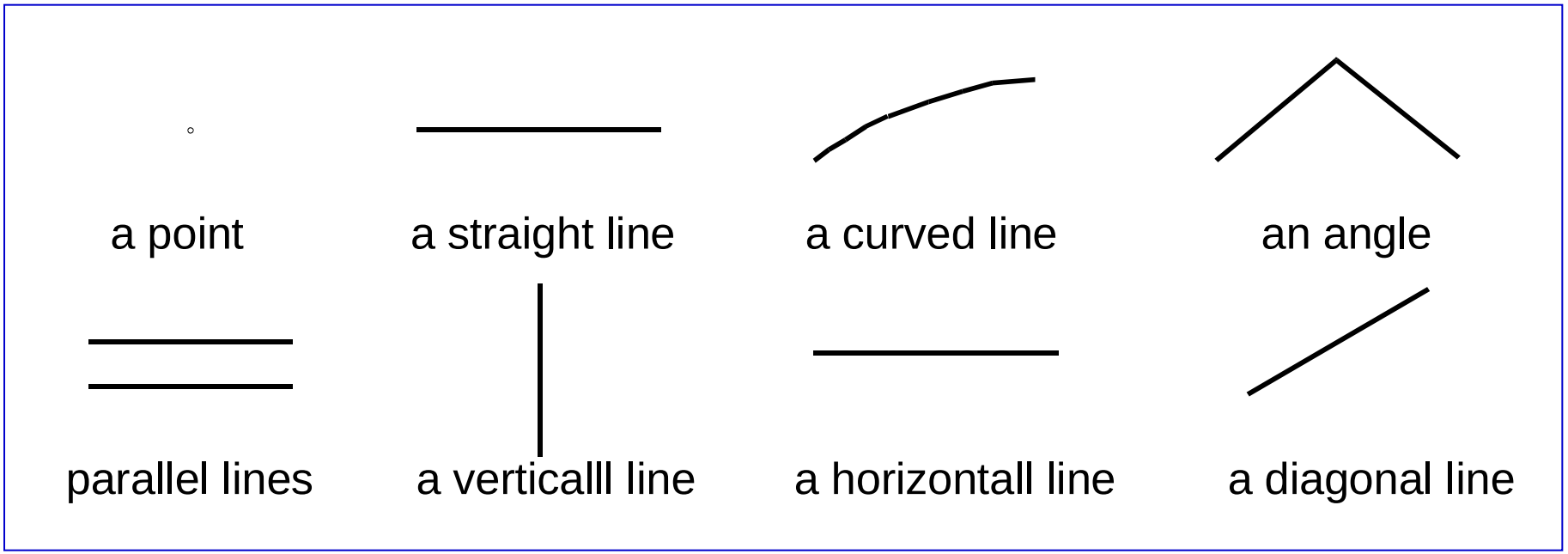
Mühendislik Fakültesi
Jeoloji Mühendisliği Bölümü

TAG

One- and two-dimensional shapes

Look at these:



One- and two-dimensional shapes

Example:

The letter "E" has one vertical line and three horizontal lines.

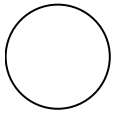
It has also four angles.

Which of these described below?

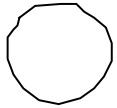
D, M, C, H, F, L, Z, B

a) A letter with 2 horizontal lines and vertical line.
b) A letter with 1 curved line and no straight lines.
c) A letter with 2 curved lines and 1 vertical line.
d) A letter with 2 parallel vertical lines, 1 horizontal line and 4 angles.
e) A letter with 2 vertical lines and 2 diagonal lines

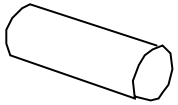
One- and two-dimensional shapes



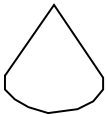
This is *circular* in shape.



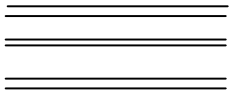
This is roughly *circular* in shape.



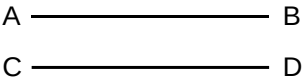
This is *cylindrical* in shape.



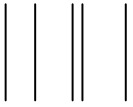
This is *conical* in shape.



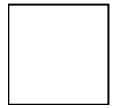
These are *horizontal* lines.



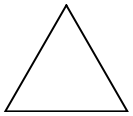
AB is *parallel to* CD.



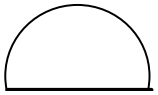
These are *vertical* lines.
They are also parallel to each other.



This is a *square.*

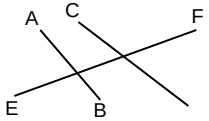


This is a *triangle.*

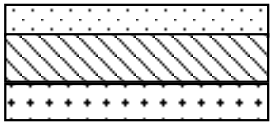


This is a *semi-circle.*

This is a *rectangle.*

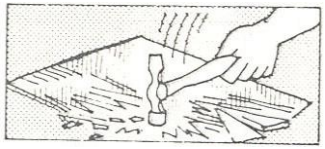


EF *cuts across* AB and CD

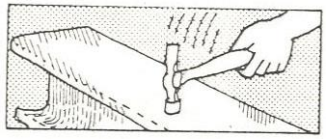


This is the overlying layer.
This is the middle layer.
This is the underlying layer.

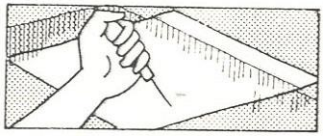
Properties of Materials



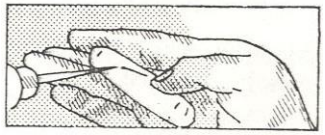
A *brittle* material *breaks* easily; e.g. glass,



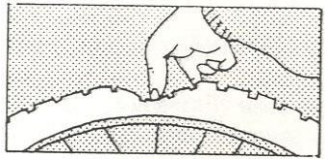
A *tough* material does not break easily; e.g. steel,



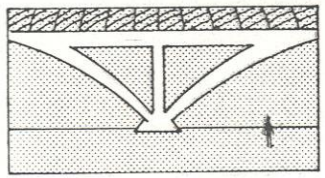
A hard material is difficult to *scratch*; e.g. glass,



A *soft* material is easy to scratch; e.g. chalk

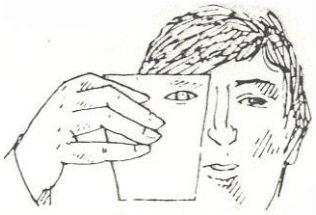


A *flexible* material bends easily; e.g. rubber

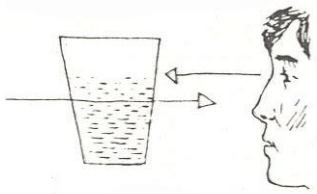


A *rigid* material does not bend easily; e.g. concrete,

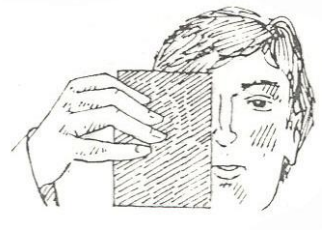
Properties of Materials



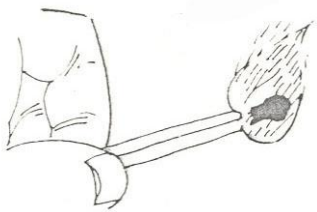
You can see through *transparent* materials; e.g. water,



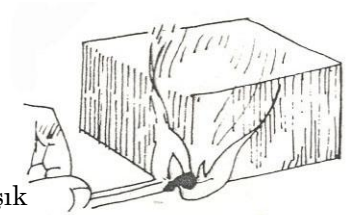
You cannot see through *translucent* materials but the light passes through them; e.g. dirty water,



You cannot see through *opaque* materials and the light cannot pass through them; e.g. metal,



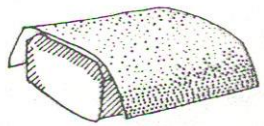
Combustible materials *burn* easily; e.g. wood,



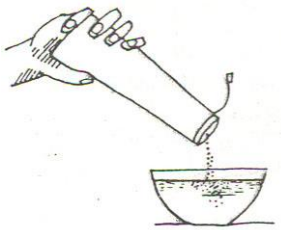
Non-combustible material do not burn; e.g. stone,

Properties of Materials

Some materials have a smooth surface:
they produce little *friction* when they are rubbed; e.g. ice,



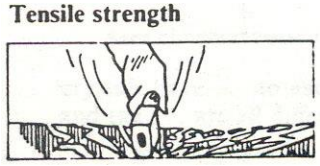
Some materials have a rough surface and
produce a lot of *friction:* e.g. sandpaper,



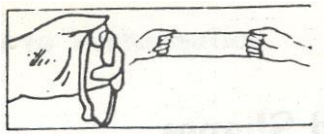
Materials which are *soluble* in water dissolve easily; e.g. salt,

Materials which are *insoluble* do not dissolve; e.g. glass,

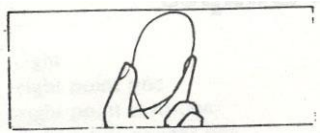
Properties of Materials



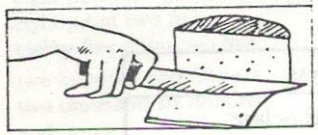
Glass is *brittle*. It breaks easily.



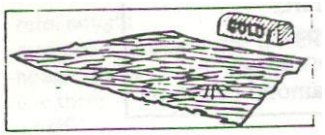
Rubber is *elastic*. It stretches and returns to the same shape.



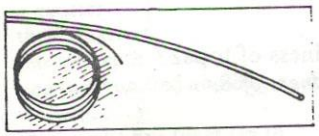
A piece of wire is *flexible*. It bends.



Cheese is *sectile*. A knife cuts it into thin pieces.



Gold is *malleable*. It forms thin sheets when it is hammered.



Copper is *ductile*.
It forms thin wire when it is heated and pulled.

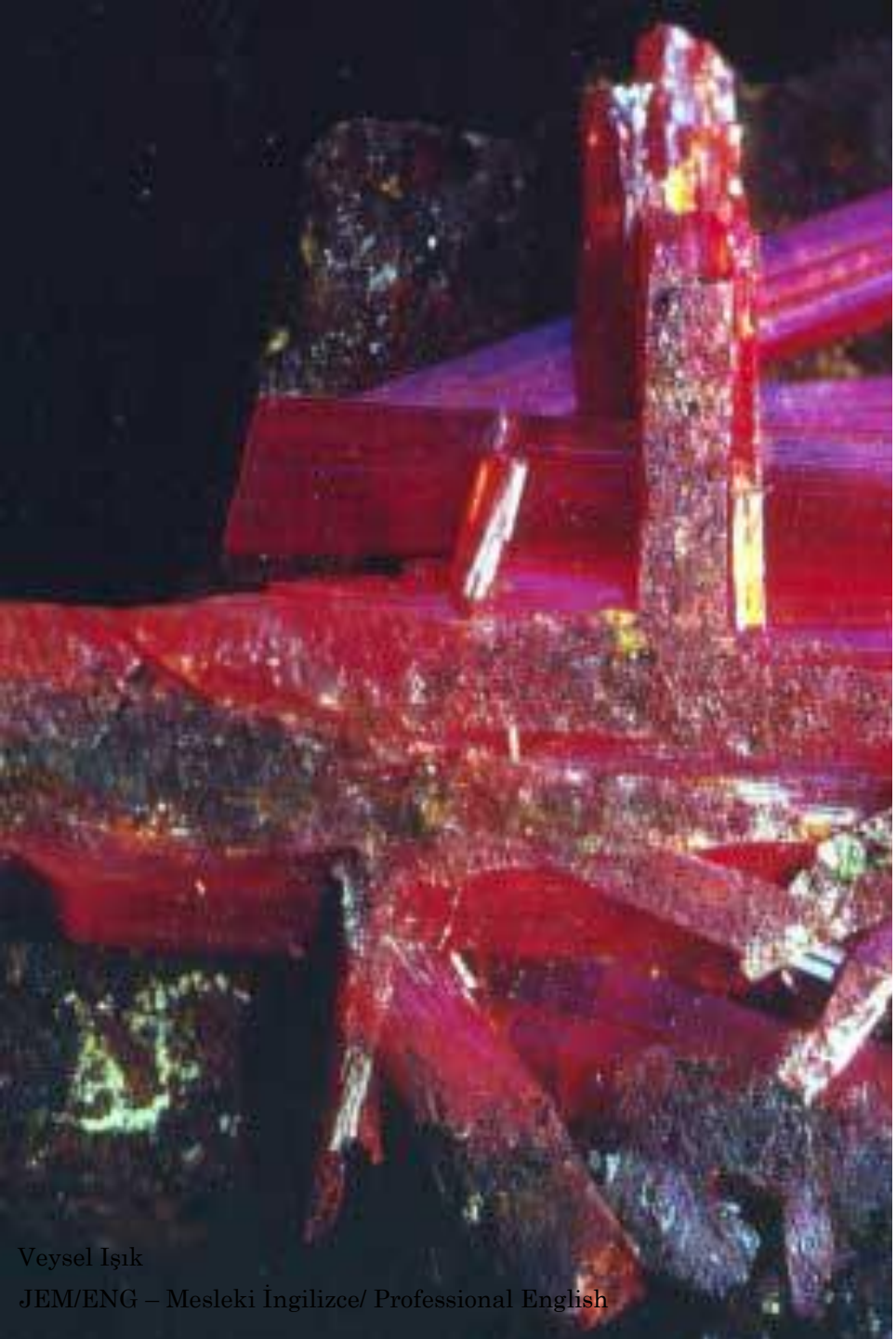
Minerals

More than 3,500 different minerals have been recognized in nature.

A mineral is a **naturally occurring**, **solid**, **inorganic combination (compound) of one or more elements**, **whose atoms are arranged in an orderly fashion** (crystallinity), and has an established **chemical composition** that can vary slightly within specific limits.

a material must be/have the following characteristics to be classified as a mineral:

1. be naturally occurring (not man-made).
2. be solid.
3. be inorganic (not compounds that can be produced only by living organisms).
4. have a geometric arrangement of its atoms—crystallinity.
5. have a chemical composition that can vary only according to specific limits.

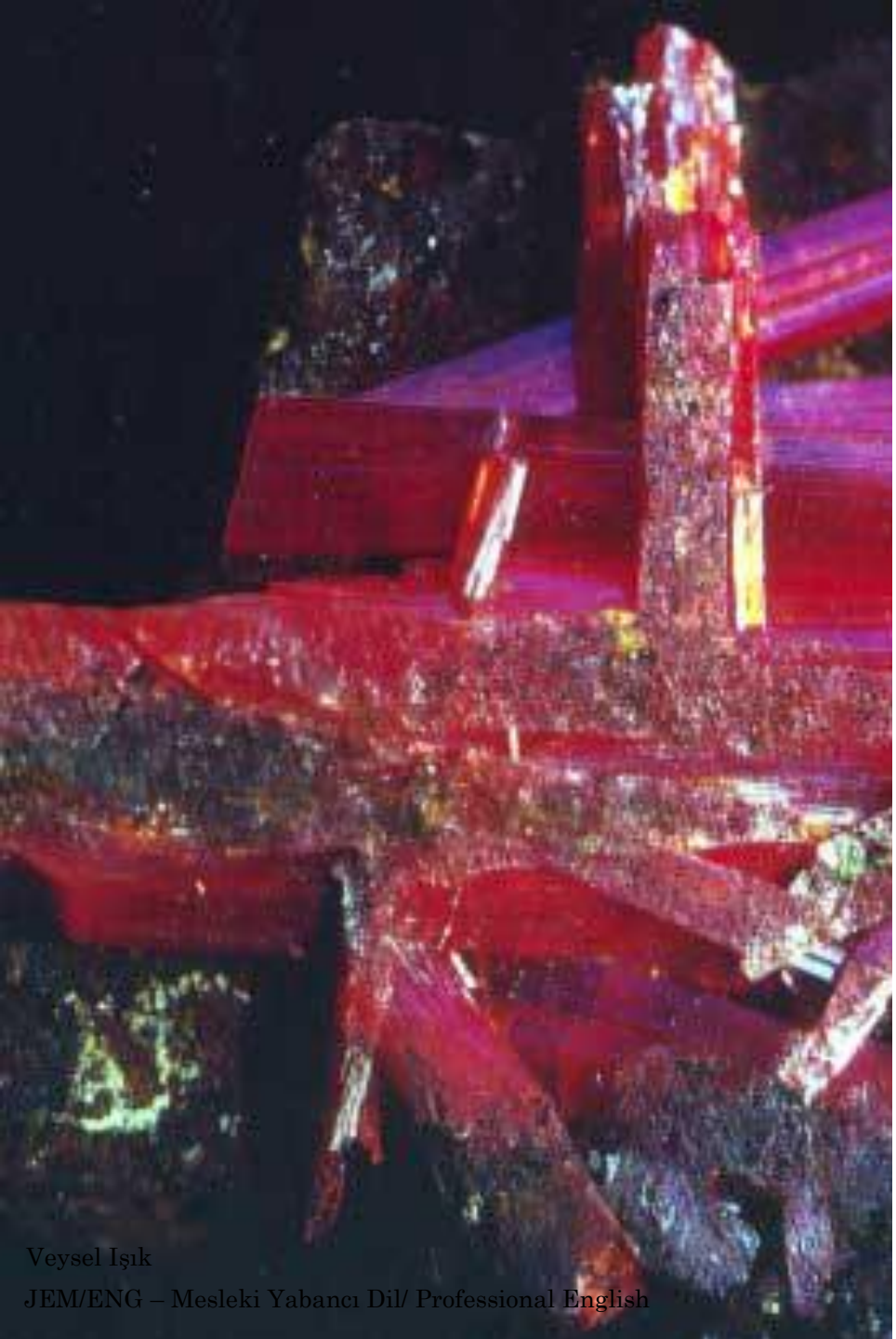


Physical Properties of Minerals

All minerals have a set of distinctive physical properties that can be used to identify them.

A group of physical properties leads to a more accurate identification.

The more important physical properties which are helpful in mineral identification follow:



Crystal Form

Crystal form is the geometric arrangement of plane ("flat") surfaces on the outside of a mineral that reflect the internal crystallinity of the mineral.

Crystal systems are groups of crystals based on the symmetry of crystal faces.

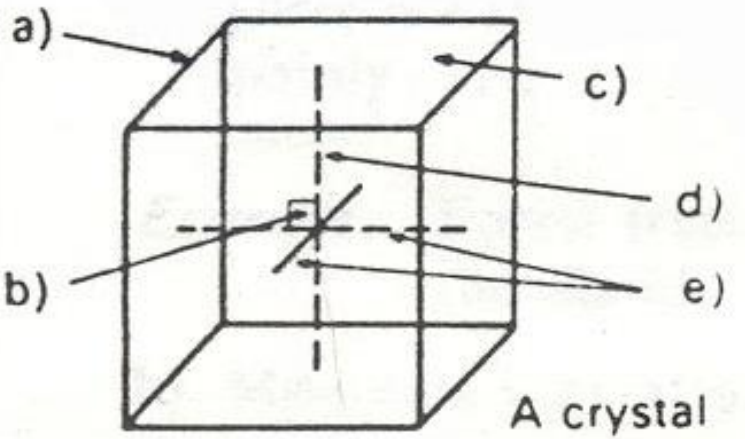
The six crystal systems are **cubic (isometric), hexagonal, tetragonal, orthorhombic, monoclinic**, and **triclinic**.

Crystals

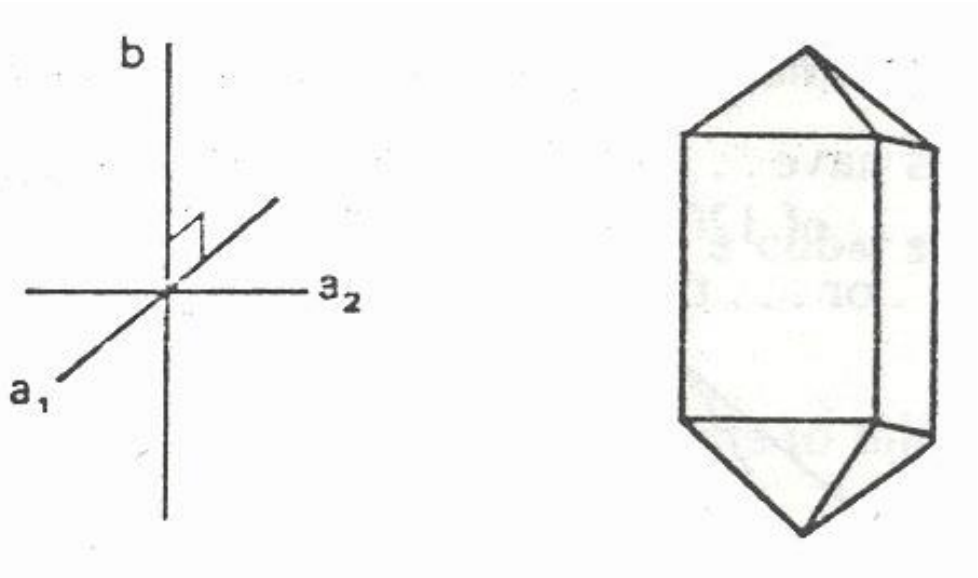
When minerals solidify and grow they usually form symmetrical shapes known as crystals. The planes that form the outside of the crystals are known as faces. Every crystal forms one of seven (six) groups of shapes, called systems. Each crystal system is different because the arrangement of the atoms or ions within the crystal is different. Thus, the sodium and chlorine ions in halite form cubes and therefore the mineral crystallizes in cubes. Each crystal has one vertical axis and two or three horizontal axes, which extend through the center of the crystal. In each crystal system, the length of the axes and the angle of intersection are different.

Now label this diagram, using the following words:

Horizontal axis
Face
Vertical axis
Right angle
Edge



The Classifications of Crystal

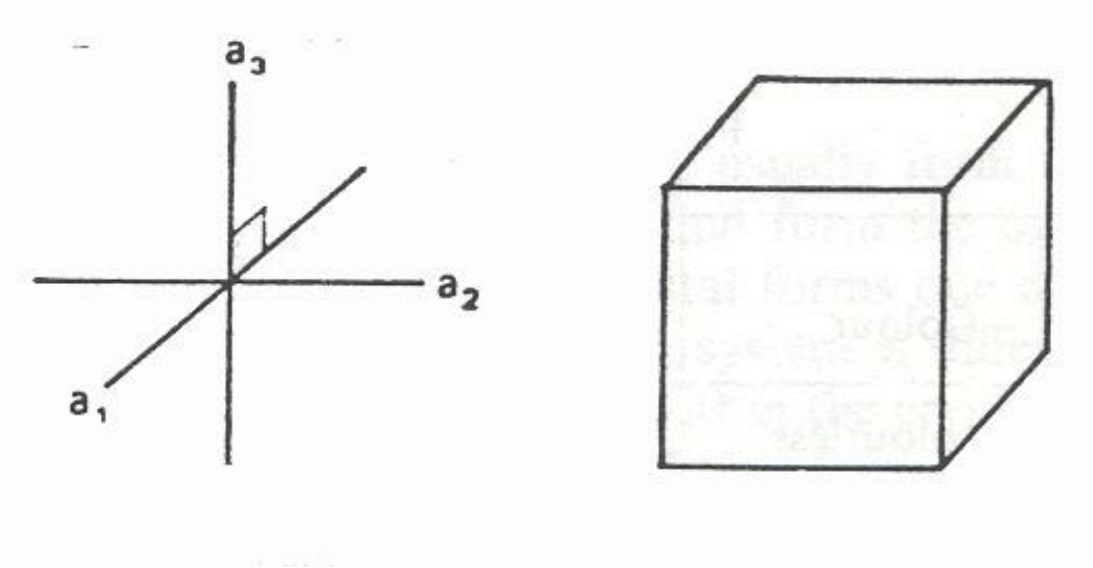


Tetragonal crystal system

Tetragonal crystals have three axes perpendicular to each other, i.e. they intersect at right angles (90°). The two horizontal axes are equal in length and the vertical axis is either longer or shorter than these. An example of a tetragonal crystal is zircon.

The Classifications of Crystal

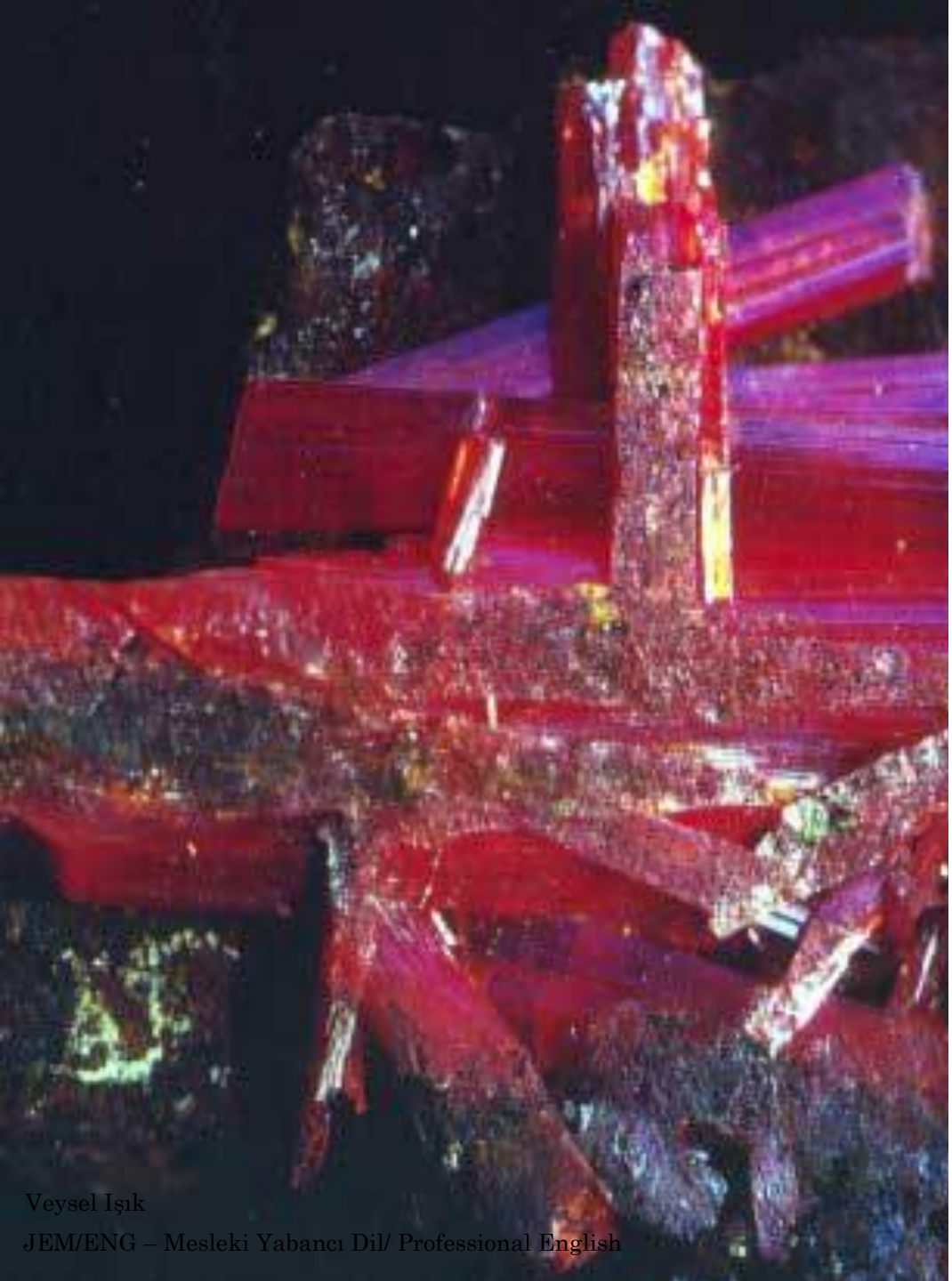
Cubic crystal system



Cubic crystals have three axes perpendicular to each other, i.e. they interse at right angles (90°). The two horizontal axes and the one axis are equal in lenth An example of a cubic system is pyrite.

Hexagonal, Orthorhombic, Monoclinic, and Triclinic

Veysel Işık



Cleavage

When some minerals fracture, they break along certain planes in the crystal structure.

Cleavage is the tendency of a mineral to break in a systematic way

The bonding between along certain planes is weaker than bounding in other crystallographic directions.

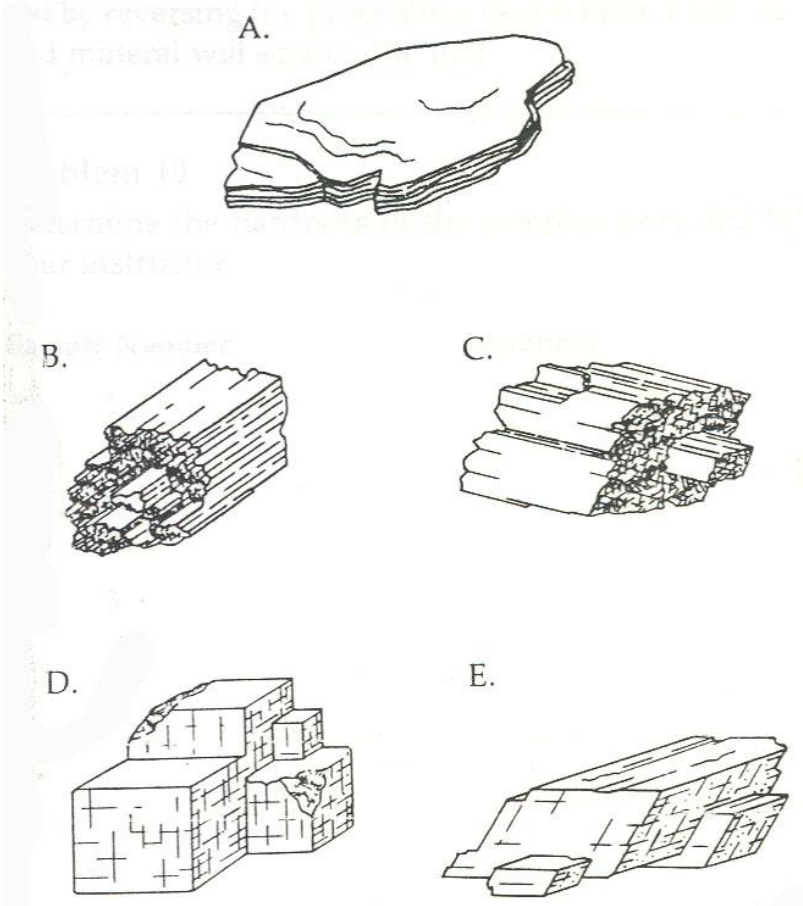
The preferred direction of breakage in a crystal is called **cleavage**.

Like crystal form, cleavage reflects the internal structure of the mineral.

Unfortunately, cleavage and crystal form are easily confused.

Some minerals have one cleavage direction. Some minerals have more than one cleavage direction.

In many cases the angle between cleavage planes is used to distinguish one mineral from a similar.



Cleavage in minerals.
A. Cleavage in one direction (micas).
B. Cleavage in two directions, at right angles (feldspars, pyroxenes).
C. Cleavage in two directions, not at right angles (amphiboles).
D. Cleavage in three directions, at right angles (halite, galena).
E. Cleavage in three directions, not at right angles (calcite, dolomite).

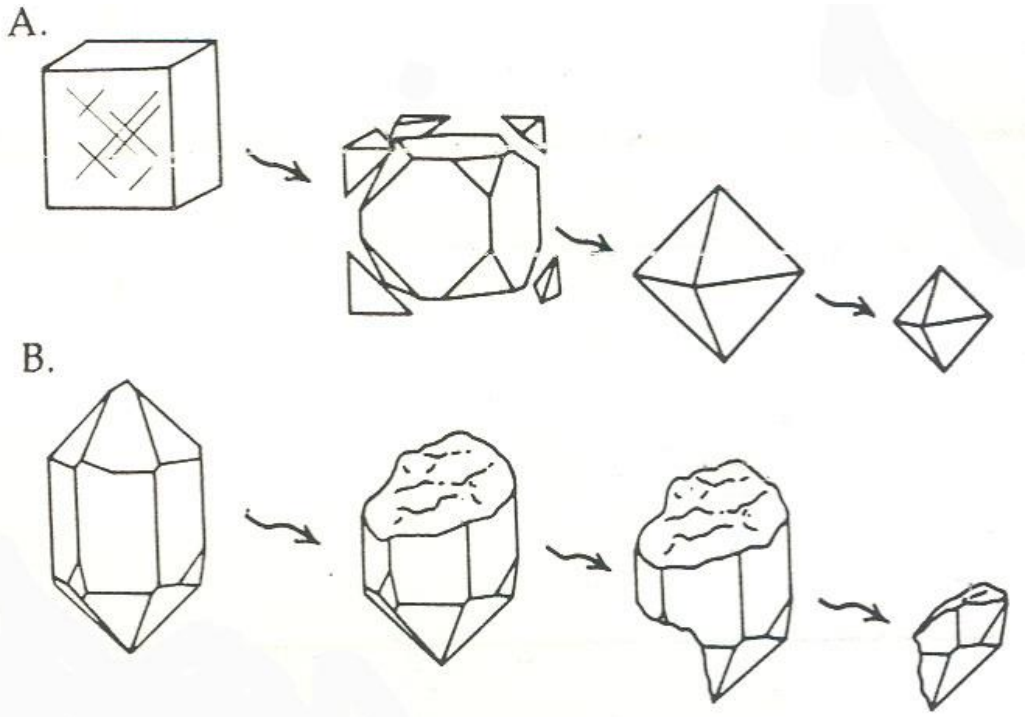
TAG

Fracture

Fracture is the nonsystematic and irregular way some minerals break.

The fracture surface is rough or uneven, unlike cleavage planes, which are smooth and flat.

Common types of fracture are **conchoidal** as in quartz, or fibrous, as in **asbestos**.



Cleavage and fracture. A. Cleavage (fluorite). B. Fracture (quartz).

Hardness

Hardness is a mineral's resistance to being scratched.

Some minerals are soft enough that they can be scratched with a fingernail, while others are hard enough to scratch glass.

Mohs Hardness Scale

10	Diamond		
9	Corundum		
8	Topaz		
7	Quartz		
6	Orthoclase Feldspar	5.5	Steel Nail/Knife Glass Plate
5	Apatite		
4	Fluorite	3.5	Copper Penny
3	Calcite	2.5	Fingernail
2	Gypsum		
1	Talc		

Friedrich Mohs, a German mineralogist of the nineteenth century, devised a scale on which minerals are ranked by hardness.

This scale has been arranged from 1 (the softest) to 10 (the hardest) using minerals representative of each category.

Look at this Table:

Mohs Hardness Scale

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4	Fluorite	3.5	Copper Penny
3	Calcite	2.5	Fingernail
2	Gypsum		
1	Talc		

Example:

What is the hardness of topaz?

Topaz has a hardness of 8.

Look at this Table:

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4	Fluorite	3.5	Copper Penny
3	Calcite	2.5	Fingernail
2	Gypsum		
1	Talc		

Example:

Topaz has a hardness of 8, i.e. it scratches quartz but does not scratch corundum.

Write sentences like this for:

Gypsum, Fluorite, Orthoclase

Look at this Table:

Mohs Hardness Scale

10	Diamond		
9	Corundum		
8	Topaz		
7	Quartz		
6	Orthoclase Feldspar	5.5	Steel Nail/Knife
5	Apatite		Glass Plate
4	Fluorite	3.5	Copper Penny
3	Calcite	2.5	Fingernail
2	Gypsum		
1	Talc		

Now look at this example:

Hematite has a hardness of 6.5.

What does this mean?

This mean that it scratches orthoclase but it does not scratch quartz.

Make similar questions and answers for the following:

A steel knife / 5.5

A copper coin / 3

A fingernail / 2.5

Zircon / 7.5

Color

Color is a function of how the surface of a mineral reflects or absorbs white light.

It is one of the least helpful physical properties of minerals because very few have a consistent color.

Both calcite and quartz are good examples of how color is varies within a mineral. They can be green, yellow, red, brown, blue, clear, etc.

* Luster
* Streak
* Specific Gravity
* Parting
* Tenacity (*brittle, flexible, elastic, malleable, sectile, ductile*)
* Reaction with hydrochloric acid
* Magnetism
* Diaphaneity
* Striations
* Taste
* Sticks to tongue
* Odor
* Sound
* Fell

Example

Calcite—Calcite is usually white to colorless, but may be yellow, green, blue, red, black, etc. due to impurities. Calcite has perfect rhombohedral cleavage (see photo), hexagonal crystal form (if present), a white to gray streak, and a vitreous to earthy luster.

Hardness is 3 on the Mohs scale. Specific gravity is 2.71. Calcite is soluble in dilute hydrochloric acid with a strong **effervescence** (**fizz**). Double refraction is visible through colorless rhombs. Crystal system: hexagonal. Chemical formula: CaC03 (calcium carbonate).

effervescence : köpürmek