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Quick Study ACADEMIC

EARTH SCIENCE

INTRODUCTION

COMPONENTS OF STUDY

1. **Geology**: Both physical & historical
2. **Meteorology**: Weather & climate
3. **Oceanography**: The oceans
4. **Astronomy**: What is external to the atmosphere

THE FOUR SPHERES (See The Water Cycle)

1. **Lithosphere**: The solid earth
2. **Hydrosphere**: The liquid earth
3. **Atmosphere**: The gaseous earth
4. **Biosphere**: Where life exists

CONCERNS IN OUR PHYSICAL ENVIRONMENT

1. Resources: Water, soil, metallic & non-metallic elements, sunlight, wind, etc.
2. Per-capita use of metallic and non-metallic elements is 11 tons per year
3. Renewable vs. non-renewable resources
4. Environmental and population problems

MINERALS

- A **mineral** is a naturally occurring, inorganic, solid material with a definite atomic structure.
- An **ore** is a useful metallic mineral.

A. Atoms and Forces

1. Atom, in ancient Greek, means "no-cut," i.e., the Ancients believed the atom to be the smallest particle of matter.
2. Atoms are composed of neutrons, protons and electrons.
   a. **Atomic number**: Number of protons in nucleus
   b. **Atomic weight**: Average weight of an atom
   c. **Isotope**: Forms of an element with identical atomic numbers, but different numbers of neutrons in the nucleus
3. **Forces**: Strong, weak, electromagnetic and gravity

B. Properties of Minerals

1. Luster: Appearance or quality of light from surface
2. Color: Nature of light and cause of color
3. Streak: Color of material in powdered form
4. Hardness: Moh's Scale (See Figure below)

Scratch Test: Higher numbered materials can scratch lower numbered materials.

5. Shape is determined by cleavage, crystal form and fracture.
6. **Specific Gravity**
   a. The ratio of the weight of a mineral to the weight of an equal volume of water
   b. **Density of water = 1gm/cm³=1g/ml**
      i.e., lead = 7.7, aluminum = 2.7, osmium = 22

MOH'S SCALE

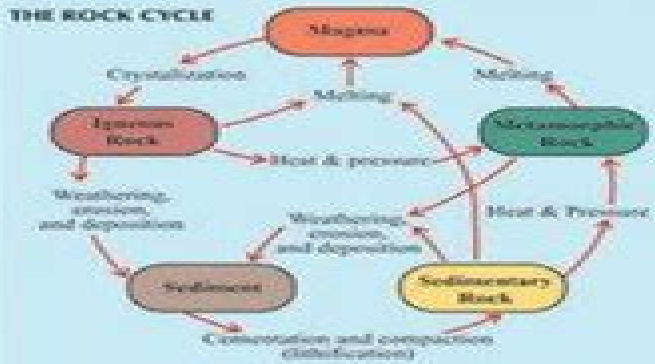
		MINERAL
Hardest	10	Diamond
	9	Corundum
	8	Topaz
	7	Quartz
	6	Feldspar
	5	Apatite
	4	Fluorite
	3	Calcite
	2	Gypsum
Softest	1	Talc

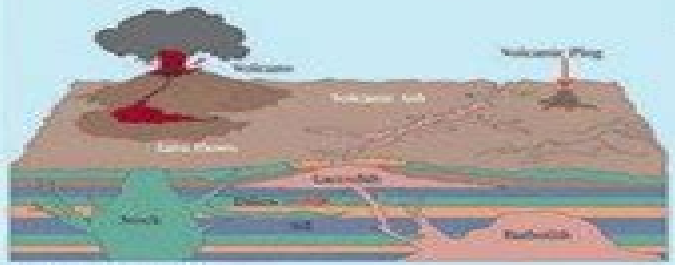
C. Mineral Groups

1. **Silicates**: Minerals with silicone and oxygen
   a. **Silicon** is a semi-metal which forms a pyramid-shaped structure with oxygen.
   b. Other forms include single tetrahedrons (olivine), chains (augite), sheets (micas), 3-D structures (feldspars and quartz)
2. **Non-Silicates**
   a. Make up one-fourth of continental crust
   b. **Carbonates**: Minerals with carbon and oxygen including calcite, from which we present limestone (roads) and marble (decorative slabs)
   c. **Oxides**: Oxygen-based solids, i.e., ice
   d. **Sulfides (S), sulfates (SO4), halides (Cl, F)**
   e. **Halite**: Mineral form of salt
   f. **Gypsum**: Plaster, calcium
   g. **Native metals**: Iron, zinc, gold, silver, nickel

ROCK TYPES

THE ROCK CYCLE





IGNEOUS ROCKS

A. Formation

1. **Extrusive** (igneous rocks are formed in volcanic eruptions at surface
2. **Intrusive** (or plutonic) igneous rocks are produced within the earth.
3. **Magma**
   a. Consists mainly of silicate materials
   b. Has gases, such as water vapor
   c. Originates from as deep as 200 km
   d. Differs in rate of cooling, chemical composition, and amount of gases
   e. Produces intrusive (plutonic) igneous rocks
4. **Lava**
   a. Similar to magma
   b. Most gaseous elements have escaped
   c. Produces extrusive (volcanic) igneous rocks

B. Structure

1. **Crystalline** (ordered pattern of ions)
   a. The rate of cooling strongly affects crystal size
   b. slow cooling = large crystals
   c. quick cooling = small crystals
2. **Amorphous** (unordered pattern of ions)
   a. occurs with instant cooling (quenching)
   b. produces rocks referred to as glass

C. Classifying Igneous Rocks

1. By texture, size and arrangement of interlocking crystals
   a. **fine-grained**
      i. form at surface or within upper crust
      ii. openings left by gas bubbles are called vesicles
   b. **coarse-grained** - formed deep within the interior
   c. **porphyritic** - large crystals embedded in matrix of smaller crystals
2. By mineral composition
   a. Depends on composition of magma and cooling
   b. Same magma can create rocks of varying mineral content
   c. As magma cools, certain minerals crystallize first (at very high temperatures)

METAMORPHIC ROCKS

A. Formation

1. **Metamorphic**: To change form
2. **Regional metamorphism**: Material under intense stresses, high temperatures
3. **Contact (thermal) metamorphism**: Changes caused by proximity to magma
4. **Low grade metamorphism**: Shale becomes slate
5. **High grade metamorphism**: Fossils become rock
6. Often form during mountain building
7. Most metamorphic rocks are harder than sedimentary rocks.
8. **Metamorphism** changes texture
9. Low-grade metamorphism makes material more compact, more dense.
10. **Foliated texture**: Particles of material are brought into line with one another

B. Agents of Metamorphism

1. **Heat**
   a. most important agent
   b. provides energy for chemical reactions
   c. For example, clay recrystallizes into a mineral at great temperature
2. **Pressure**
3. **Chemical Activity**: Most common chemical agent is water

C. Types of Metamorphic Rocks

1. **Hornfels**: Fine grained, dark flinty rock with randomly arranged minerals
2. **Slate**: Fine grained, often gray, foliated rock split easily along cleavage, planes of mica flakes aligned by pressure
3. **Marble**: Granular or sugary-textured rock formed from limestone
4. **Phyllite**: Silky, foliated rock more coarsely grained than slate
5. **Schist**: Foliated rock, more coarsely grained and of higher metamorphic grade than Phyllite
6. **Gneiss**: Foliated, banded rock of the highest metamorphic grade
7. **Quartzite**: Very hard, granular quartz rock, formed from sandstone

BOWEN'S REACTION SERIES

If a mineral, which has already formed, remains in the magma, it will react with the remaining magma to produce the next mineral in the sequence. For example, olivine forms first; olivine then reacts with remaining magma to form pyroxene.

A. Right Side of the Bowen Series

1. Calcium rich parts of the magma form small crystals of feldspar.
2. These react with sodium in the magma to become more and more sodium rich.

B. End of Cooling

1. When everything is almost cool, remaining magma will have high silicone content, and quartz will form.
2. When cooling is complete, everything that cooled at the same time will usually be close to one another (feldspar, mica and quartz cool near one another to make granite).

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Earth Science High School Essential Question

Raffaela Di Napoli

Earth Science High School Essential Question:

The Top Books of the Year Earth Science High School Essential Question The year 2023 has witnessed a noteworthy surge in literary brilliance, with numerous compelling novels captivating the hearts of readers worldwide. Lets delve into the realm of top-selling books, exploring the fascinating narratives that have enthralled audiences this year. Earth Science High School Essential Question : Colleen Hoovers "It Ends with Us" This touching tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover expertly weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can triumph. Earth Science High School Essential Question : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This spellbinding historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids captivating storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This evocative coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens weaves a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These popular novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of engaging stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a masterful and gripping novel that will keep you wondering until the very end. The novel is a cautionary tale about the dangers of obsession and the power of evil.

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