

# 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 that atoms 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 = 1 gm/cm<sup>3</sup> = 1 gm/ml.**  
Ex., gold = 19.3, aluminum = 2.7, iron = 7.8

### MOH'S SCALE

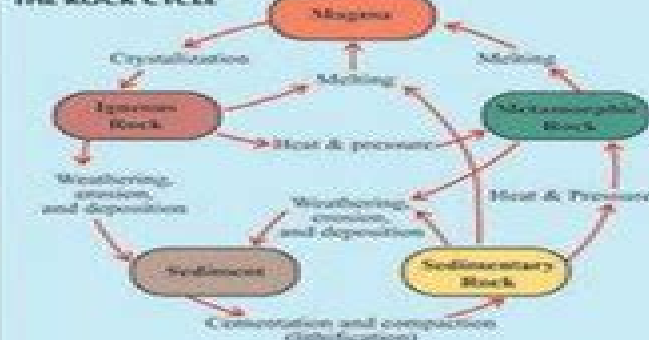
Hardness	Mineral
10	Diamond
9	Corundum
8	Topaz
7	Quartz
6	Feldspar
5	Apatite
4	Fluorite
3	Calcite
2	Gypsum
1	Talc

### C. Mineral Groups

1. **Silicates:** Minerals with silicon and oxygen
  - a. **Silicon** is a semi-metal which forms a pyramid-shaped structure with oxygen.
  - b. Other forms include single tetrahedrons (olivine), chains (amphib), sheets (mica), 3-D structures (feldspar 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 produce limestone (marble) and marble (decorative stone)
  - c. **Oxides:** Oxygen based solids, i.e., iron
  - d. **Sulfides:** Sulfur (FeS<sub>2</sub>), bismuth (Bi<sub>2</sub>S<sub>3</sub>), PbS
  - e. **Hallite:** Mineral form of salt
  - f. **Gypsum:** Plaster, calcium
  - g. **Native metals:** Iron, zinc, gold, silver, nickel

## ROCK TYPES

### THE ROCK CYCLE



### IGNEOUS ROCKS

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. Composed 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
4. **Lava**
  - a. Similar to magma
  - b. Most gaseous elements have escaped
  - c. Produces extrusive (volcanic) igneous rocks
5. **Structure**
  1. **Crystallization** (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
6. **Classifying Igneous Rocks**
  1. By texture, size and arrangement of interlocking crystals
    - a. **fine-grained**
      - i. Forms 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. Some magma can create rocks of varying mineral content.
    - c. As magma cools, certain minerals crystallize first (at very high temperatures).

### METAMORPHIC ROCKS

1. **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:** Gneiss becomes rock
  6. **Diagenesis:** 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
2. **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. **Schist:** 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:** Silty, 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

1. 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 silicate 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).



# Earth Science High School Essential Question

**Science Teachers Association of New  
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## **Earth Science High School Essential Question:**

**Teaching Discipline-Specific Literacies in Grades 6-12** Vicky I. Zygmouris-Coe, 2014-10-30 Comprehensive timely and relevant this text offers an approach to discipline specific literacy instruction that is aligned with the Common Core State Standards and the needs of teachers students and secondary schools across the nation It is essential that teachers know how to provide instruction that both develops content and literacy knowledge and skills and aims at reducing student achievement gaps Building on the research supported premise that discipline specific reading instruction is key to achieving these goals this text provides practical guidance and strategies for prospective and practicing content area teachers and other educators on how to prepare all students to succeed in college and the workforce Pedagogical features in each chapter engage readers in digging deeper and in applying the ideas and strategies presented in their own contexts Classroom Life real 6 12 classroom scenarios and interviews with content area teachers Common Core State Standards Connections College Career and Workforce Connections Applying Discipline Specific Literacies Think Like an Expert habits of thinking and learning specific to each discipline Digital Literacies Differentiating Instruction Reflect and Apply Questions Extending Learning Activities The Companion Website includes Lesson plan resources Annotated links to video files Annotated links to additional resources and information Glossary Flashcards For Instructors All images and figures used in the text provided in an easily downloadable format For Instructors PowerPoint lecture slides *The Mastery Learning Handbook* Jonathan Bergmann, 2022-10-14 Mastery learning is an instructional approach that empowers every student to progress with confidence Using flexible pacing and targeted supports teachers guide students through a cyclic process of preparation demonstration and formative feedback until there is a mutual agreement between teacher and student that the student is ready to advance In this book educator Jonathan Bergmann a pioneer of the flipped classroom movement walks you step by step through the mastery learning cycle explaining what it entails and providing the templates models and rubrics you need to start using it in your own classroom You ll learn how to Set meaningful measurable and transferable learning objectives that target essential knowledge skills and dispositions Develop a mastery rubric to check for student levels of proficiency Create an assessment plan that ensures positive learning experiences for all Plan and deliver units that incorporate both time shifted direct instruction and collaborative application activities within the classroom space Provide timely differentiated support based on students individual learning needs Informed by trial and error in his own classroom and by discussions with other expert practitioners Bergmann shares commonsense solutions to the major challenges of mastery learning implementation everything from how to manage pacing to how to create multiple versions of tests determine grades and get stakeholder buy in *The Mastery Learning Handbook* is both an introduction to this exciting instructional approach and a practical resource that K 12 teachers can turn to again and again See for yourself just how effective enjoyable and transformative mastery learning can be *Resources in Education* ,1992 Serves as an index to Eric reports microform

**Strategies for Teaching Boys and Girls -- Secondary Level** Michael Gurian, Kathy Stevens, Kelley King, 2011-01-06 In his best selling classic *Boys and Girls Learn Differently* Michael Gurian explained the origin and nature of gender differences in the classroom His important book explored the behavior teachers observed and the challenges they faced with both boys and girls in their classrooms Taking the next step *Strategies for Teaching Boys and Girls Secondary level A Workbook for Educators* offers teachers a hands on resource that draws on the Gurian Institute s research and training with secondary schools and school districts The workbook presents practical strategies lessons and activities that have been field tested in real classrooms and developed to harness boys and girls unique strengths The workbook is designed to help teachers build a solid foundation of learning and study habits that their students can use in the classroom and at home It covers the key curricular areas and offers proven techniques to make learning no matter what the subject more engaging for all students The workbook is an essential resource for all teachers who want to improve their practice and get the most from all students whatever their gender

*Developing Learning Communities Through Teacher Expertise* Giselle O. Martin-Kniep, 2003-10-14 Learn practical methods for developing a collaborative environment where teachers and administrators work together to enhance teachers practices increase student learning and produce valuable school processes

**Science Curriculum Resource Handbook** ,1992

**Intersections of Formal and Informal Science** Lucy Avraamidou, Wolff-Michael Roth, 2016-03-10 Science learning that takes place between and at the intersections of formal and informal science environments has not been systematically reviewed to offer a comprehensive understanding of the existing knowledge base Bringing together theory and research this volume describes the various ways in which learning science in various settings has been conceptualized as well as empirical evidence to illustrate how science learning in these settings can be supported

Sg Essentials Geology Wicander, 2001-09      Manual of Standards and Suggestions on Organization for the High Schools of Ohio Ohio. Department of Education, 1921      *Resources in Education* ,1992      *The Lincoln Library of Essential Information an Up to Date Manual for Daily Reference, for Self Instruction, and for General Culture Named in Appreciative Remembrance of Abraham Lincoln, the Foremost American Exemplar of Self Education* ,1924      Proceedings of the Department of Superintendence of the National Educational Association ... National Education Association of the United States. Department of Superintendence, 1909      Interdisciplinary Approaches to Teaching Art in High School Pamela G. Taylor, 2006 The authors present works of art artmaking skills and ways of knowing as catalysts for learning across the traditional disciplinary boundaries in high school Both timely and enduring this is the book that will inspire and support the work of veteran new and pre service high school art teachers The book includes issues theories and practices related to high school curriculum advocacy classroom management assessment cultural understanding idea based instructional strategies team teaching technology visual culture and student initiated learning The authors draw upon their own experiences and those of other high school art teachers to create a motivating and provocative text that challenges readers to critically and

continually reflect collaborate read and research their own interdisciplinary thinking teaching and learning processes

Publisher     **Proceedings of the ... Annual Conference** Science Teachers Association of New York State,1904

**Oklahoma Teacher** ,1922     **The School Journal** ,1903     New York School Journal ,1899     High School  
Department Bulletins University of the State of New York,1900 Contains proceedings of various teachers associations  
academic examination papers etc     **The Lincoln Library of Essential Information** ,1924     School Science and  
Mathematics ,1915

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