



Harvard Undergraduate Science Olympiad India 2024

Open Round

Earth Science Syllabus: 9th-10th Grade

Potential Topics Covered on the Exam:

Atmosphere:

Layers of atmosphere and composition

Fronts

- Air masses and fronts, pressure systems
- Analyzing/predicting weather conditions based on fronts
- Cyclone formation

Humidity and precipitation:

- Relative humidity
- Water cycle
- Precipitation formation mechanism

Circulation

- Winds
- Circulation cells
- Influence on local climate

Stability

- Lapse rate
- Thermal inversions
- Adiabatic heating and cooling
- Vertical structure of atmosphere

Specific phenomena:

- Cloud types and cloud formation
- Local winds
- Thunderstorms and other severe weather
- El Niño and La Niña
- Monsoons
- Hurricanes

Hydrosphere:

Freshwater:

- Discharge calculations
- Stream order calculations
- Flooding and flood prevention
- Erosional and depositional features
- River valley processes
- Lakes and ponds
- Swamps, marshes, bogs, etc.

Oceans:

- Heat fluxes and heat transfer
- Distribution of temperature and salinity
- Surface circulation: wind-driven flow, Ekman transport
- Overturning circulation
- Acidification
- Waves and tides
- Tsunamis
- Coastal geology and erosional features
- Ocean sediment types

Other hydrologic features

- Glaciers
 - Formation
 - Erosional and depositional features
- Karst formation
- Groundwater
 - Aquifers
 - Water table
 - Porosity and permeability

Geosphere:

Geochemistry

- Phase diagrams
- Bowen's Reaction Series
- Minerals
 - Properties: crystal structure, hardness, opacity, fracture and cleavage, mineral habit, etc.
 - Identification (will not be thoroughly tested)

Sedimentary Rocks

- Sedimentary structures
- Depositional environments
- Types of sedimentary rocks

Metamorphic Rocks

- Metamorphic facies and zones
- Types of metamorphism
- Metamorphic grade and index minerals

Igneous Rocks

- Igneous rocks/processes
- Minerals commonly found in igneous rocks
- Magma types and magma differentiation
- Igneous intrusions and extrusive bodies
- Volcanism

Interior

- Layers of the earth
- Earthquakes (types of waves)
- Plate movement and boundaries
- Faults
- Tectonic movement
- Soil Formation and Classification

Dating/Mapping

- Strike/dip calculations
- Interpreting geologic maps
- Relative dating and unconformities
- Radiometric dating

You may be asked questions about the following rocks and minerals. You will not be required to know specific information about any rocks and minerals not listed below.

Minerals:

Mohs Hardness Scale: Talc, Gypsum, Calcite, Fluorite, Feldspar, Apatite, Orthoclase/Microcline, Quartz, Topaz, Corundum, Diamond;

Minerals in Bowen's Reaction Series: Olivine, Pyroxene, Plagioclase, Potassium Feldspar, Biotite, Muscovite,

Other: Albite, Aragonite, Anorthite, Labradorite, Kyanite, Andalusite, Sillimanite, Graphite

Sedimentary Rocks:

Breccia, Coal, Conglomerate, Evaporites, Limestone, Sandstone, Shale.

Metamorphic Rocks:

Amphibolite, Quartzite, Marble, Slate, Schist, Gneiss.

Igneous Rocks:

Andesite, Basalt, Diorite, Gabbro, Granite, Komatiite, Obsidian, Pegmatite, Peridotite.

Preparation for Exam: The following resources may be helpful: *Foundations of Earth Science by Tarbuck*.

This is a great introduction to earth science for anyone who is interested! If you read this book carefully, you will have the necessary knowledge to complete most or even all of the questions.

Practice questions: Past open exams from [USES0](#) will be good practice, though they may be a little more difficult than the questions on the open round of HUSO-India.

HUSO's flagship competition follows the rules of the US-based "[Science Olympiad](#)", which has competitors compete in teams in a variety of events. You may find Science Olympiad tests in the following events helpful: **Dynamic Planet** (freshwater, glaciers, oceanography, tectonics), **Rocks and Minerals**, and **Geologic Mapping**. Tests should be easily findable online.