Earth Science Regents

Dear ___________________________,

Please see the calendar below to determine when your lab test is and when the sit down portion of the exam is during exam week.

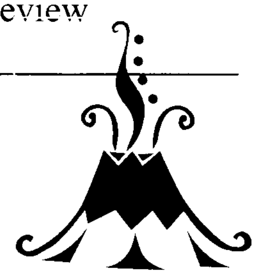
- You must take both parts: the lab test and the exam

Monday	Tuesday	Wednesday	Thursday	Friday
June 2012				June 1
June 4	June 5 **Lab Performance Test** Room 312 During your regular class and lab periods. Bring a pencil.	June 6	June 7	June 8
June 11	June 12 *Last day of regular school*	June 13 *Exams*	June 14 *Exams*	June 15 *Exams* **Earth Science Regents Exam** 12:00 – 3:00 pm Room: check the exam schedule when it comes out ***Bring pen, pencil, and calculator
June 18 *Exams*	June 19 *Exams*	June 20 *Exams*	June 21 *Exams*	June 22 *Exams*

Table of Contents

Earth Science Review Sessions 2012

Date	Room #	Time	Teacher	Topic
Monday, April 23	312	2:05pm – 3:00pm	Weiler	Density, graphing, shape and size of earth, Polaris
Tuesday, April 24	312	2:05pm – 3:00pm	Weiler	Climate
Monday, April 30	204	2:05pm – 3:00pm	Webster	Astronomy
Tuesday, May 8	312	2:05pm – 3:00pm	Weiler	Weather
Tuesday, May 15	020	2:05pm – 3:00pm	Pike	Topographic maps, profiles, calculating gradient
Thursday, May 17	020	2:05pm – 3:00pm	Pike	Plate tectonics, P+S waves
Monday, May 21	020	2:05pm – 3:00pm	Pike	Reference tables
Tuesday, May 22	020	2:05pm – 3:00pm	Pike	Weathering and erosion
Thursday, May 24	204	2:05pm – 3:00pm	Webster	Rocks and minerals
Tuesday, May 29	312	2:05pm – 3:00pm	Weiler Pike Webster	Lab Performance Test Review
Friday, June 1	312	2:05pm – 3:00pm	Weiler	Practice test



To make your review more *efficient*, you should review the topic and have some questions in mind <u>before</u> you attend.

Bring your notebook, reference table, pen, pencil and a calculator to each review session.

OUTLINE OF TASKS

The New York State Regents Examination in Physical Setting/Earth Science is designed to measure achievement in a course of study that emphasizes student laboratory activities and field experiences in an investigatory approach to learning activities. The examination consists of two components, a laboratory performance test and a written test, administered separately. The performance component consists of tasks to be completed at the three stations described below. The time allowed for completing the tasks at each station is 9 minutes.

Station 1 . . *Mineral and Rock Identification*
Using a mineral identification kit, the student will determine the properties of a mineral and will use those properties to identify that mineral from a flowchart. Using rock identification charts from the *2010 Edition Reference Tables for Physical Setting/Earth Science* and the characteristics observed in two rock samples, the student will classify each rock as igneous, sedimentary, or metamorphic.

Station 2 . . *Locating an Epicenter*
Using seismic data, the Earthquake *P*-Wave and *S*-Wave Travel Time graph from the *2010 Edition Reference Tables*, a safe drawing compass, and a map, the student will determine the location of an earthquake epicenter.

Station 3 . . *Constructing and Analyzing an Asteroid's Elliptical Orbit*
Using two pins, a looped string, a metric ruler, and a calculator, the student will construct an ellipse, determine its eccentricity, and apply this information to our solar system.

Note: *Students should be familiar with the concepts and skills being assessed. However, they must* **not** *practice the test, or any of the individual stations as written in this test, before this performance component is administered.*

The University of the State of New York
THE STATE EDUCATION DEPARTMENT

Earth Science Quick Study!

Dimensions of the Earth

- People have observed the stars for thousands of years.
- People have used the stars to find direction.
- People have used the stars to note the passage of time.
- Earth's coordinate system of latitude and longitude is based upon Earth's rotation and our observation or the Sun and stars.
- The equator and prime meridian are reference lines to latitude and longitude.
- The earth rotates on an imaginary axis.
- The earth rotates 15 degrees per hour.
- To people on Earth, this turning of the planet makes it seem as though the Sun, the moon, and the stars are moving around Earth once a day.
- Rotation provides a basis for our system of local time.
- Meridians of longitude are the basis for time zones.
- The Foucault pendulum provides evidence of Earth's rotation.
- The Coriolis effect provides evidence of Earth's rotation.
- Earth's changing position with regard to the Sun and the moon has noticeable effects.
    - Earth revolves around the Sun with its rotational axis tilted at 23.5 degrees to a line perpendicular to the plane or its orbit.
    - The North Pole is aligned with Polaris.
- Topographic maps represent landforms through the use of contour lines.
- Contour lines are isolines connecting points of equal elevation.
- Gradients and profiles can be determined from changes in elevation over a given distance.

Scientific Notation $5400 = 5.4 \times 10^3$

$.000081 = 8.1 \times 10^{-5}$

Density = concentration of matter

↑T, D↓ (indirect relationship) ← The way the graph looks

↑P, D↑ (direct relationship)

-less dense floats, more dense sinks

-same density will stay suspended in middle

mass = 13.5g volume = 4.2ml

$D = \frac{m}{V}$

$= \frac{13.5g}{4.2ml}$

$= 3.124$ g/ml

$= 3.1$ g/ml rounded (tenth)

KEY POINT* - density does not depend on size or shape. No matter how you cut the clay, each piece will have same density.

rate of change:

1958 elevation was 3000 ft.

1998 elevation was 2920 ft.

rate of change = $\frac{\text{change in field value}}{\text{time}}$

$= \frac{3000 ft - 2920 ft}{40 yrs}$

$= \frac{80 ft}{40 yrs}$

$= 2$ ft/yr

deviation

wrong = 23.4g right 24.8g

dev = $\frac{d. f. a. v}{a. v.} \times 100$

$= \frac{24.8g - 23.4g}{24.8g} \times 100$

$= \frac{1.4g}{24.8g} \times 100$

$= 0.0564516 \times 100$

$= 5.64516$

$= 5.6$ % (tenth)

oblate spheroid = shape of Earth ⬭ Looks like a circle ○.

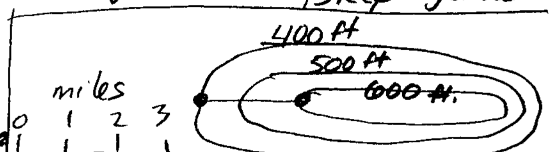
≡ Latitude ||| Longitude 40° = 40°N Latitude

Field = what you've measured (elev, temp, pressure)

Contour interval = what you count by steep gentle

stream

water flowing to the west. Cont. lines make a V that points in the opposite direction



Gradient = $\frac{c. i. f. v}{distance}$

$= \frac{600 ft - 400 ft}{2 miles}$

$= \frac{200 ft}{2 miles}$

$= 100$ ft/mile

profile

observation = using senses

inference = interpretation

classification = grouping based on characteristics

mass = amount of matter (g)

volume = amount of space (ml or cm³)

Minerals and Rocks

- Sediments of inorganic and organic origin often accumulate in depositional environments
- Sedimentary rocks form when sediments are compacted and or cemented after burial or as the result of chemical precipitation from seawater.
- Observation and classification have helped us understand the great variety and complexity of Earth Materials
- Minerals are the naturally occurring inorganic solid elements, compounds, and mixtures from which rocks are made.
- We classify minerals on the basis of their chemical composition and observable properties.
- Rocks are generally classified by their origin (igneous, metamorphic, and sedimentary), texture, and mineral content.
- Rocks and minerals help us understand Earth's historical development and its dynamics.
- Rocks and minerals are important to us because of their availability and properties.
- The use and distribution of mineral resources and fossil fuels have important economic and environmental impacts.
- As limited resources, they must be used wisely.
- Physical properties of minerals are determined by the internal arrangement of atoms.
- Minerals can be identified by well-defined physical properties such as cleavage, fracture, color, density, hardness, streak, luster, and crystal shape.
- Chemical properties of minerals: The mineral Calcite bubbles with acid.
- Chemical composition and physical properties determine how minerals are used by humans.
- Minerals are formed inorganically by the process of crystallization.
- Crystallization is the result of specific environmental conditions: the cooling and solidification of magma
- Precipitation from water caused by such processes as evaporation, chemical reactions, and temperature changes.
- Rearrangement of atoms in existing minerals subjected to conditions of high temperature and pressure.

- Rocks are usually composed of one or more minerals.
- Rocks are classified by their origin, mineral content, and texture.
- Conditions that existed when a rock formed can be inferred from the rock's mineral content and texture.
- The properties of rocks determine how they are used and also influence land usage by humans.

Use Your Reference Tables ★★★

Color = can not tell a mineral by its color (except. Sulfur) too many variations
cleavage = breaking along a smooth/flat plane
fracture = breaking unevenly
hardness = resist. to being scratched
streak = color of powder
luster = the way it reflects light

silicon tetrahedra

★ most are made from the same 9 minerals. Those minerals are called rock forming min.

Igneous - were completely liquid + solidified
- some have vesicules (bubble holes)
- intrusive - cool underground slowly so they have time to form LARGE crystals.
- extrusive - cool above ground quickly so they form small crystals
- super cooling = glassy texture (obsidian)
- magma - below lava - above

Sedimentary - made of pieces, chemical, or biologic activities
- clastic = pieces (compression or cementation)
- chemical = evaporites + precipitates
- from deposition, put down horizontally ☰
- layering is a sedimentary word
- break the easiest
- only type to contain FOSSILS

Metamorphic - rocks that have been changed or recrystallized because of intense heat, pressure, or chemical activity.
- banded - layers of color — dense
- foliation - mineral alignment
- regional - deep, large area contact - small
- Parent Rock - what it used to be.
  limestone → marble granite → gneiss
  sandstone → quartzite

The Dynamic Crust

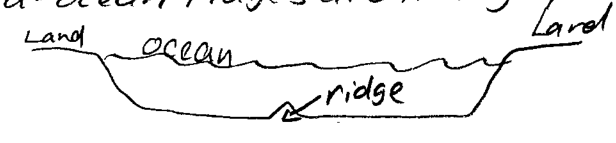
- As we look at Earth, we find clues to its origin.
- As we look at Earth, we find clues to how it has changed through nearly five billion years
- Earth's internal heat engine is powered by heat from the decay of radioactive material, residual (left over) heat from Earth's formation, and friction from plate tectonics.
- Heat flows within Earth's interior cause differences in density.
- Differences in density causes the changes explained by the theory of plate tectonics.
- The theory of plate tectonics includes earthquakes, volcanoes, and the deformation and metamorphism of rocks during the formation of young mountains.
- The Earth's internal structure includes the crust, mantle, inner core, and outer core.
- Properties of Earth's internal structure can be inferred from the analysis of the behavior of seismic waves (including velocity and refraction).
- Analysis of seismic waves allows the determination of the location of earthquake epicenters.
- Analysis of seismic waves allows the measurement of earthquake magnitude.
- Seismic wave analysis leads to inference that Earth's interior is composed of layers that differ in composition and states of matter.
- The outward transfer of the Earth's internal heat drives convective circulation in the mantle.
- Convective circulation in the Earth's mantle moves the lithospheric plates comprising the Earth's surface.
- The lithosphere consists of separate plates that ride on the more fluid asthenosphere.
- Lithospheric plates move slowly in relationship to one another.
- The slow movement of lithospheric plates create convergent, divergent, and transform plate boundaries.
- Lithospheric plate motions indicate that the Earth is a dynamic geologic system.
- These plate boundaries are the sites of most earthquakes, volcanoes, and young mountain ranges.
- Compared to continental crust, ocean crust is thinner and denser.

Focus – point where earthquake happens
Lithosphere – crust + upper mantle
Epicenter – point on surface above focus
Subduction – when denser lithosphere digs into ground

- New ocean crust continues to form at mid-ocean ridges.
- Earthquakes and volcanoes present geologic hazards to humans.
- Loss of property, personal injury, and loss of life can be reduced by effective emergency preparedness.
- Many processes of the rock cycle are consequences of plate dynamics.
- The production of magma (igneous rock formation and contact metamorphism) at both subduction and rifting regions.
- Regional metamorphism within subduction zones,
- The creation of major depositional basins through down-warping of the crust.
- Many of Earth's surface features are a consequence of forces associated with plate motion and interaction.
- Surface feature associated with plate motion and interaction are: mid-ocean ridges, rifts, trenches, subduction zones, island arcs, mountain ranges (folded, faulted, and volcanic), hot spots, and the magnetic and age patterns in surface bedrock
- Plate motions have resulted in global changes in geography, climate, and the patterns of organic evolution.
- Landforms are the result of the interaction of tectonic forces and the processes of weathering, erosion, and deposition.

P-waves – Primary – travels through everything – first to arrive
S-waves – Secondary – only through solids, second
E-quakes – "drop, cover and hold"
Tsunami – giant wave caused by e-quake – evacuate
DD cause CC cause PT
Faults: Normal, Reverse, Transform
Correlation – matching
Divergent – moving away – mid-ocean ridges
Convergent – coming together – mountains, e-quakes
Transform – sliding against – e-quakes, faults

PROOF of plate tectonics
- fitting together of continents
- fossils match up
- rocks match up
- e-quakes + volcanoes at plate boundaries
- mid-ocean ridges are moving apart



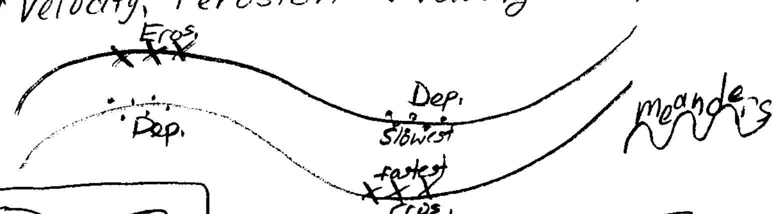
Surface Processes and Landscapes

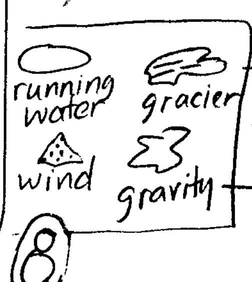
- Precipitation results from the external heat engine's weather system.
- Precipitation supplies moisture to the Earth's surface that contributes to the weathering of rocks.
- Running water erodes mountains that were originally uplifted by Earth's internal heat engine.
- Running water transports sediments to other locations, where they are deposited.
- Deposited sediments may undergo the processes that transform them into sedimentary rocks.
- Landforms are the result of the interaction of tectonic forces and the processes of weathering, erosion, and deposition.
- Climate variations, structure, and characteristics of bedrock influence the development of landscape features.
- Landscape features include mountains, plateaus, plains, valleys, ridges, escarpments, and stream drainage patterns.
- Weathering is the physical and chemical breakdown of rocks at or near the Earth's surface.
- Soils are the result of weathering and biological activity over long periods of time.
- Natural agents of erosion are generally driven by gravity.
- Natural agents of erosion remove, transport, and deposit weathered rock particles.
- Each agent of erosion produces distinctive changes in the material that it transports.
- Each agent of erosion creates characteristic surface features and landscapes.
- In certain erosional situations, loss of property, personal injury, and loss of life can be reduced by effective emergency preparedness.
- The natural agents of erosion include:
- Streams (running water)
- Gradient, discharge, and channel shape influence a stream's velocity.
- Gradient, discharge, and channel shape influence the erosion and deposition of sediments
- Sediments transported by streams tend to become rounded as a result of abrasion.

chemical weathering = warm + moist | physical weathering = cool + moist

- Stream features include V-shaped valleys, flood plains, and meanders.
- A watershed is the area drained by a stream and its tributaries.
- Glaciers (moving ice)
- Glacial erosional processes include the formation of U-shaped valleys, parallel scratches, and grooves in bedrock.
- Glacial features include moraines, drumlins, kettle lakes, Finger Lakes, and outwash plains.
- Wave action - Erosion and deposition cause changes in shoreline features.
- Shoreline features include beaches, sandbars, and barrier islands.
- Wave action rounds sediments as a result of abrasion.
- Waves approaching a shoreline move sand parallel to the shore within the zone of breaking waves.
- Wind - Erosion of sediments by wind is most common in arid climates and along shorelines.
- Wind-generated features include dunes and sandblasted bedrock.
- Mass Movement - Earth materials move downslope under the influence of gravity.
- Patterns of deposition result from a loss of energy within the transporting system.
- Patterns of deposition are influenced by the size, shape, and density of the transported particles.
- Sediment deposits may be sorted or unsorted.
- Sediments of inorganic and organic origin often accumulate in depositional environments

Frost Action - water freezes in crack, water expands when frozen, makes crack bigger
↑ surface area, ↑ weathering
↑ velocity, ↑ erosion ↓ velocity = ↑ deposition





Sorting - separating by size
- water + wind
- G+G are unsorted

Earth's History

- As we look at Earth, we find clues to its origin.
- As we look at Earth, we find clues to how it has changed through nearly five billion years
- As we look at Earth, we find clues to the evolution of life on earth.
- Impact events have been correlated with mass extinction and global climatic change.
- Impact craters can be identified in Earth's crust.
- Earth's early atmosphere formed as a result of the outgassing of water vapor, carbon dioxide, nitrogen, and lesser amounts of other gases from its interior.
- Earth's oceans formed as a result of precipitation over million of years.
- The presence of an early ocean is indicated by sedimentary rocks of marine origin, dating back about four billion years.
- Earth has continuously been recycling water since the outgassing of water early in its history.
- The evolution of life caused dramatic changes in the composition of Earth's atmosphere.
- Free oxygen did not form in the atmosphere until oxygen-producing organisms evolved.
- The pattern of evolution of life-forms in Earth is at least partially preserved in the rock record.
- Fossil evidence indicates that a wide variety of life-forms has existed in the past.
- Fossil evidence indicates that most of these forms have become extinct.
- Human existence has been very brief compared to the expanse of geologic time.
- Geologic history can be reconstructed by observing sequences of rock types and fossils to correlate bedrock at various locations.
- The characteristics of rocks indicate the processes by which they formed.
- The characteristics of rocks indicate the environments in which these processes took place.
- Fossils preserved in rocks provide information about past environmental conditions.
- Geologists have divided Earth history into time units based upon fossil record.

- Age relationships among bodies of rocks can be determined using principles of original horizontality, super position, inclusions, cross-cutting relationships, contact metamorphism, and unconformities.
- The presence of volcanic ash layers, index fossils, and meteoritic debris can provide additional information.
- The regular rate of nuclear decay (half-life time period) of radioactive isotopes allows geologists to determine the absolute age of materials found in some rocks.

Relative Age = compares younger/older
- Superposition - youngest at top
- Younger than the rocks that they alter: intrusion, extrusions, folds and faults.

Fossils - naturally preserved remains or impressions of once living things
- Hard parts are preserved

Index Fossils - used to identify a specific age. (1) brief period of time (2) wide geographic area (3) easily distinguished
* volcanic ash too

Correlation = matching up rock layers to see which is younger/older.

outgassing = gas produced from chemical processes

orogeny = process of mountain building

unconformity = buried erosional surfaces
- gaps in the rock record

Absolute age - actual age

isotopes - elements that have a different than usual number of neutrons

half-life - time required for one-half of an elements atoms in a sample to change into the decay product.

How old is this rock?  25% U^{238} 75% Pb^{206}

(1) How many ½ lives have past? → 2

	0	1	2	3
I	100	50	25	12½
D	0	50	75	87½

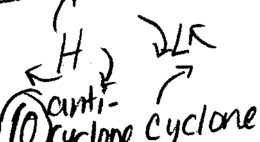
(2) How many yrs per half life?
4.5×10^9 (on ESRT)

(3) multiply $4.5 \times 10^9 \times 2 = 9.0 \times 10^9$ yrs old

Meteorology

- Temperature variations within the atmosphere cause differences in density.
- Differences in density within the atmosphere cause atmospheric circulation.
- Atmospheric circulation is affected by Earth's rotation.
- The interaction of these (radiation, conduction, evaporation, convection, density differences, atmospheric circulation, and Earth's rotation) results in the complex atmospheric occurrence known as weather.
- Precipitation results from the external heat engine's weather system.
- Earth systems have internal and external sources of energy, both of which create heat.
- Transfer of heat energy within the atmosphere, the hydrosphere, and Earth's interior results in the formation of regions of different densities.
- Density differences between regions results in motion.
- Weather patterns become evident when weather variables are observed, measured, and recorded.
- Weather variables include: air temperature, air pressure, moisture (relative humidity and dewpoint), precipitation (rain, snow, hail, sleet, etc.), wind speed, wind direction, and cloud cover.
- Weather variables are measured using instruments such as thermometers, barometers, psychrometers, precipitation gauges, anemometers, and wind vanes.
- Weather variables are interrelated.
- Temperature and humidity affect air pressure and probability of precipitation.
- Air pressure gradient controls wind velocity.
- Air temperature, dewpoint, cloud formation, and precipitation are affected by the expansion and contraction of air due to vertical atmospheric movement.
- Weather variable can be represented in a variety of formats including radar and satellite images, weather maps (including station models, isobars, and fronts), atmospheric cross-sections, and computer models.
- Atmospheric moisture, temperature and pressure distributions, jet streams, wind, air masses and frontal boundaries, and the movement of cyclonic systems and associated tornadoes, thunderstorms, and hurricanes occur in observable patterns.
- Loss of property, personal injury, and loss of life can be reduced by effective emergency preparedness.

Sunshine = insolation
↑ cloud cover during day = cooler temp.
↑ cloud cover at night = warmer temp.
dark + rough surfaces absorbs heat faster
↑ Pressure = fair weather, blue sky
↓ Pressure = stormy weather
Warm air can hold more water vapor
Moist air is less dense than dry air.
Land Breeze - Night from Land to Sea
Sea Breeze - Day from Sea to Land
Air flows from high to low pressure.
Coriolis = N. Hem = curves to right due to rotation
Precipitation removes dust/dirt/pollution from the atm.
Synoptic - looking at the total picture
isobars - connect points of equal elevation.
isotherms - connect points of = temp.
isolines - connect points of = values.
Air mass - large region of air with same moisture + temperature
Fronts - boundaries between air masses
cold - pushes warm air up, precipitation
warm - warm air forced up, precipitation
Stationary - cold / warm, precipitation
occluded - when a cold air mass runs into another cold air mass, warm air ↑, precip



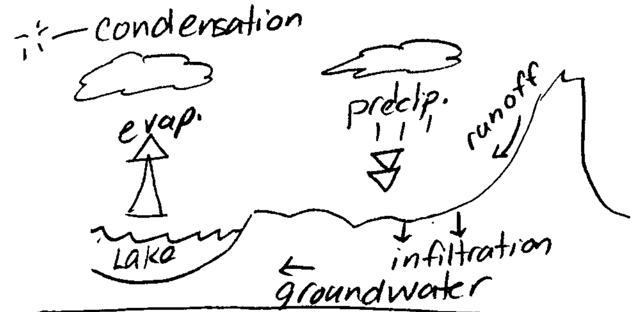
Tornado	Hurricane
-small	-large
-couple minutes	-couple weeks
-over land	-over water
-faster winds	-slower winds
-spring/summer	-summer/fall
	-lose energy on land

Water, Energy, and Climate

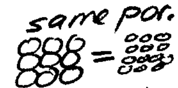
- During Earth's one-year period of revolution, the tilt of its axis results in changes in the angle of incidence of the Sun's rays at a given latitude.
- The changes in the angle of incidence of the Sun's rays at a given latitude cause variation in the heating of the surface
- The variation in heating of the surface of Earth produces seasonal variations in weather.
- Approximately 70% of Earth's surface is covered by a relatively thin layer of water.
- The constant recirculation of water at and near Earth's surface is described by the hydrologic (water) cycle.
- Water is returned from the atmosphere to Earth's surface by precipitation.
- Water returns to the atmosphere by evaporation or transpiration from plants.
- A portion of the precipitation becomes runoff over the land or infiltrates into the ground.
- Infiltrated water becomes stored in the soil or groundwater.
- Groundwater is water below the water table.
- Soil capillarity influences these processes.
- The amount of precipitation that seeps into the ground or runs off is influenced by climate, slope of the land, soil, rock type, vegetation, land use, and degree of saturation.
- Porosity, permeability, and water retention affect runoff and infiltration.
- Earth may be considered a huge machine driven by two engines, one internal and one external.
- Internal and external heat engines convert heat energy into mechanical energy.
- Earth's external heat engine is powered primarily by solar energy and influenced by gravity.
- Nearly all the energy for circulating the atmosphere and oceans is supplied by the Sun.
- As insolation strikes the atmosphere, a small percentage is directly absorbed, especially by gases such as ozone, carbon dioxide, and water vapor.
- Clouds and Earth's surface reflect some energy back to space.
- Earth's surface absorbs some energy.
- Energy is transferred between Earth's surface and the atmosphere by radiation, conduction, evaporation, and convection.
- Average temperatures on Earth are the result of the total amount of insolation absorbed by Earth's surface and its atmosphere and the amount of long-wave energy radiated back to space.
- Throughout geologic time, ice ages occurred in the middle latitudes.
- Average temperatures may have been significantly warmer at times in the geologic past.
- Periods of warmer and cooler temperatures suggests that Earth had climate changes that were most likely associated with long period of imbalances of its heat budget.
- Global climate is determined by the interaction of solar energy with Earth's surface and atmosphere.
- The energy transfer between solar energy and the Earth's atmosphere and surface is influenced by dynamic processes such as cloud cover and Earth rotation, and the positions of mountain ranges and oceans.
- Seasonal changes can be explained using concepts of density and heat energy.
- Seasonal changes include the shifting of global temperature zones, the shifting of planetary wind and ocean current patterns, the occurrence of monsoons, hurricanes, flooding, and severe weather.
- Insolation (solar radiation) heats the Earth's surface and atmosphere unequally due to variations in:
- The intensity caused by differences in atmospheric transparency and angle of incidence, which vary in time of day, latitude, and season.
- Characteristics of the materials absorbing the energy such as color, texture, transparency, states of matter, and specific heat.
- Duration (length of time) varies with seasons and latitude.

Water, Energy, and Climate (continued)

- The transfer of heat energy within the atmosphere, the hydrosphere, and Earth's surface occurs as the result of radiation, convection, and conduction.
- Heating of the Earth's surface and atmosphere by the Sun drives convection within the atmosphere and oceans, producing wind and ocean currents.
- A location's climate is influenced by latitude, proximity to large bodies of water, ocean currents, prevailing winds, vegetative cover, elevation, and mountain ranges.
- Temperature and precipitation patterns are altered by:
- Natural events such as El Niño and volcanic eruptions
- Human influences including deforestation, urbanization, and the production of greenhouse gases such as carbon dioxide and methane



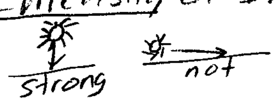
↑ slope, ↑ runoff, ↓ infiltration
Porosity = % of open space
↑ Porosity = ↑ infiltration



Permeability = ability of water to flow throu[gh]
Capillarity = attractive force between water + soil, works against gravity
↓ particle size, ↑ capillarity

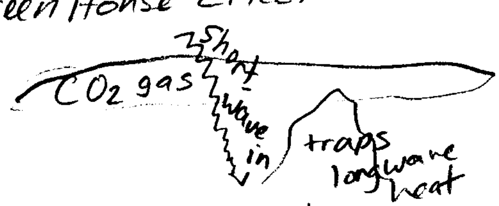
↑ vegetation, ↑ infiltration
Runoff = when more comes down than can soak in
= when ground is already satura[ted]
= too steep, frozen

Stream Discharge = volume of water
Insolation = sunshine = solar radiation = short wave radiation
Intensity of Insolation = how strong



Duration of Insolation = length of time
June 21 - most hours
Dec. 21 — least hours

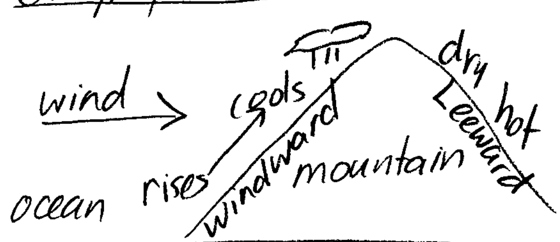
Specific heat = amount of energy it takes to raise one cm³ one degree C
Water has a ↑ S.H.. That's why it takes so long to heat up,
Terrestrial Radiation = long wave = ground = infrared
Earth always gives off terrestrial rad.
Green House Effect



↑ CO_2 - deforestation
- burning fossil fuels
- ↑ population

Climate = long term weather, moisture + temp
↓ latitude, ↑ temperature
Bodies of water moderate climate
↑ elevation, ↓ temperature

Orographic Effect



radiation = energy moving through air
conduction = energy moving from one atom to another
convection = energy moving because of density differences
evaporation - liquid to gas water gains 540 cal/gram.
condensation - gas to liquid water loses 540 cal/gram.

The Earth in Space

- The Earth and celestial phenomena can be described by principles of relative motion and perspective.
- People have observed the stars for thousands of years.
- People have used the stars to find direction.
- People have used the stars to note the passage of time.
- People have used the stars to express their values and traditions.
- As our technology has progressed, so has understanding of celestial objects and events.
- Theories of the universe have developed over many centuries.
- Although to a casual observer celestial bodies appeared to orbit a stationary Earth, scientific discoveries led us to the understanding that Earth is one planet that orbits the sun.
- The sun is a typical star in a vast and ancient universe.
- We now infer an origin and an age of the universe.
- We now infer and evolution of the universe.
- We speculate about the future of the universe.
- As we look at Earth, we find clues to its origin.
- Most objects in the solar system are in regular and predictable motion.
- The regular and predictable motions of the objects in the solar system explain such phenomena as the day, the year, seasons, phases of the moon, eclipses, and tides.
    - Gravity influences the motions of celestial objects.
    - The force of gravity between two objects in the universe depends on their masses and the distance between them.
- Nine planets move around the Sun in nearly circular motion.
    - The orbit of each planet is an ellipse with the Sun located at one of the foci.
    - Earth is orbited by one moon and many artificial satellites.
- The earth rotates on an imaginary axis.
- The earth rotates 15 degrees per hour.
- To people on Earth, this turning of the planet makes it seem as though the Sun, the moon, and the stars are moving around Earth once a day.
- The Foucault pendulum provides evidence of Earth's rotation.
- The Coriolis effect provides evidence of Earth's rotation.
- Earth's changing position with regard to the Sun and the moon has noticeable effects.
- Earth revolves around the Sun with its rotational axis tilted at 23.5 degrees to a line perpendicular to the plane or its orbit.
- The North Pole is aligned with Polaris.
- During Earth's one-year period of revolution, the tilt of its axis results in changes in the angle of incidence of the Sun's rays at a given latitude.
- The changes in the angle of incidence of the Sun's rays at a given latitude cause variation in the heating of the surface
- The variation in heating of the surface of Earth produces seasonal variations in weather.
- Seasonal changes in the apparent positions of constellation provide evidence of Earth's revolution.
- The Sun's apparent path through the sky varies with latitude and season.
- The large percentage of water on Earth's surface responds to the gravitational attraction of the moon and the Sun with a daily cycle of high and low tides.
- The universe is vast.
- The universe is estimated to be over ten billion years old.
- The current theory is that the universe was created from an explosion called the Big Bang.
- Evidence for the Big Bang includes:
    - Cosmic background radiation
    - A red-shift (the Doppler effect) in the light from very distant galaxies.
- Stars form when gravity causes clouds of molecules to contract until nuclear fusion of light elements into heavier ones occurs.
- Fusion releases great amounts of energy over millions of years.
- The stars differ from each other in size, temperature, and age.
- Our Sun is a medium-sized star.
- Our Sun is within the Milky Way Galaxy.

The Earth in Space

(continued)

- The Milky Way Galaxy is a spiral galaxy of stars.
- Our galaxy contains billions of stars, and the universe contains billions of such galaxies.
- Our solar system formed about five billion years ago from a giant cloud of gas and debris.
- Gravity caused the Earth and the other planets to become layered according to density differences in their materials.
- The characteristics of the planets of the solar system are affected by each planet's location in relationship to the Sun.
- The <u>terrestrial</u> planets are small, rocky, and dense.
- The <u>Jovian</u> planets are large, gaseous, and of low density.
- Asteroids, comets, and meteors are components of our solar system.
- Impact events have been correlated with mass extinction and global climatic change.
- Impact craters can be identified in Earth's crust.

<u>Red Shift</u> - moving away <u>Blue</u> - towards

<u>Galaxies</u> elliptical, spiral, irregular

<u>Stars</u> $H_2 \rightarrow He_2$ produces energy
- form when gravity pulls gases in
- stop shining when no He_2 left

<u>Milky Way</u> - our solar system

<u>Meteor</u> - object falling through the atm.

<u>Rotation</u> - spinning on axis

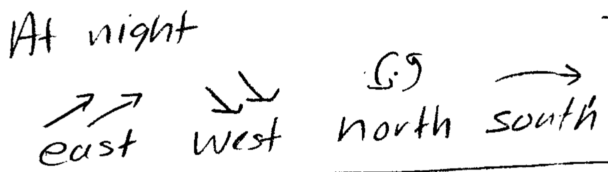
<u>Revolution</u> - moving around

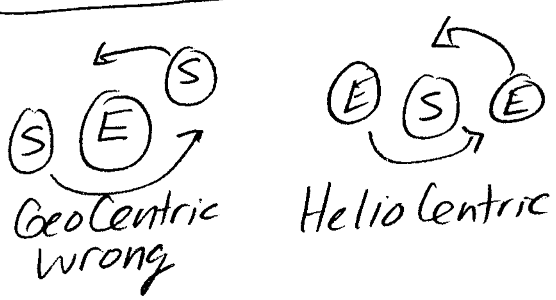
<u>Eccentricity</u> = how oval an orbit is

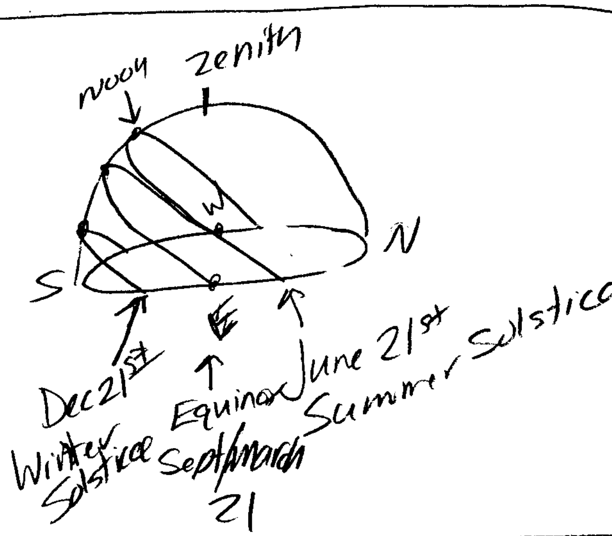
$$Ecc = \frac{dbf}{l\,oma} = \frac{1.2\,cm}{2.1\,cm} = .57$$

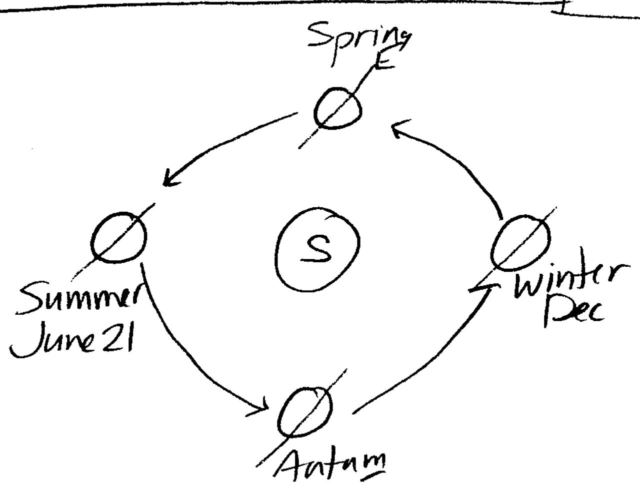
If answer = 1 then straight line
= 0 then circle

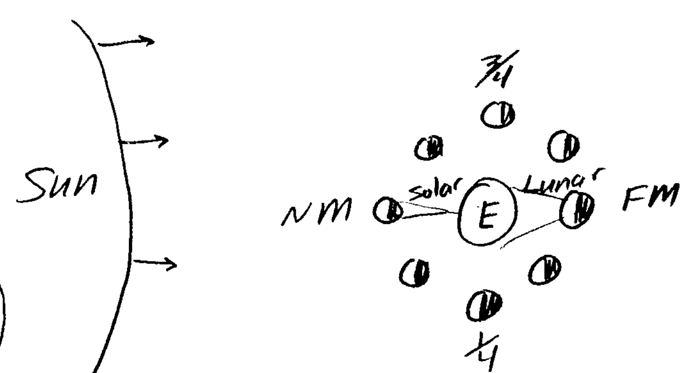
Celestial Object = object in sky
Celestial Sphere = dome of air above you
Celestial Objects = appear to move E → W











If you were to break a piece of wood, what happens to it's density?

If you increase the pressure on something, what happens to the density?

As temperature increases, the density _______.

When water freezes, it _______.

What does cyclic mean?

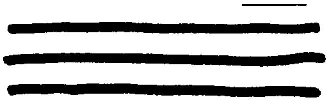
What is the true shape of the Earth?

What is the best model of the Earth's shape?

The altitude of Polaris is equal to an observer's ___.

Define Polaris

These are lines of ____.



These are lines of ____.

___ is based on observations of the Sun.

The closer the isolines, the _____ the slope (or gradient).

The Earth rotates from the __ to the ___.

All celessial objects appear to rise in the _____.

Decreases	The density increases.	Nothing, the density stays the same.
It is an Oblate Spheroid. Tiny bit bigger around the equator. But looks like a perfect circle to your eyes.	It happens over and over again in a pattern.	Expands
The North Star, it's on our axis of rotation so it doesn't appear to move across the sky.	latitude	A sphere – like a globe
longitude	Longitude. They measure degrees East or West of the Prime Meridian.	Latitude. They measure degrees North or South of the Equator.
East A celestial object is something that appears to move through our sky.	West to the East	Steeper

Dec 21st, the Northern Hemisphere is tipped away from the sun, less hours of daylight for us, sun is lower in the sky

June 21st, the Northern Hemisphere is tipped towards the sun, more hours of daylight for us, sun is higher

We see different phases (light and dark parts) of the moon because of the angle at which we view the moon as it revolves (orbits) us.

How high the Sun is above the horizon. How many degrees.

Longer.

March 21st and Sept 21st, the Earth isn't tipped towards or away from the Sun, 12 hrs of daylight and 12hrs of darkness everywhere on Earth.

Faster. That means it will have a higher orbital velocity. Because the gravity of the Sun will have a greater pull.

Winter. It's winter for the Northern Hemisphere because we are tipped away from the Sun at that time.

1.Foucault pendulum appears to change its direction of swing.
2.Coriolis effect deflects fluids to the right in the Northern Hemisphere.

To spin on an axis. It takes the Earth about 24 hours to rotate once. 15 degrees per hour.

The correct theory that states that the Sun is the center of our solar system and everything revolves around us.

An incorrect theory that states that the Earth is the center of our solar system and everything revolves around us.

A way that energy is transferred from molecule to molecule. Handle of a pan feels hot because of this.

Dark-colored and rough – textured heat up quicker. They also cool down quicker.

To move around another object in an orbit. It takes the Earth one year to revolve around the Sun.

Why does the moon have different phases?	What do you know about the summer solstice?	What do you know about the winter solstice?
What do you know about the Equinoxes?	The lower the altitude of the Sun, the ____ shadow it casts.	What does: altitude of the Sun mean?
List two proofs (evidences) that the Earth rotates.	The Earth is closer to the sun in the ________.	The closer a planet is the the sun (in its orbit), the ____ it moves.
What is the geocentric model of the solar system?	What is the heliocentric model of the solar system?	To rotate means to
To revolve means to	Which types of surfaces absorb heat energy the quickest?	What does conduction mean?

What does convection mean?

What does radiation mean?

Name two Greenhouse gases.

What is water vapor?

What is the Greenhouse Effect?

What is terrestrial radiation?

What is insolation?

Why is the hottest part of the year in July and August and not June 21st when the sun is the highest in the sky?

If the air temperature increases, the air pressure__.

As the amount of water vapor in the air increases, the density ___.

Warm air can hold __ water vapor than cold air.

Describe the type of weather associated with a High Pressure system.

Describe the type of weather associated with a Low Pressure system.

Why does the wind blow?

Winds blow from high to ___ pressure.

Carbon Dioxide and water vapor.	It's a way energy is moved through the air. Like the air feels hot next to the hot stove.	It's a way energy is moved through fluids. Hot rises and cold sinks. Like the water boiling in a pot on the stove.
The name of the heat/energy that the Earth gives off. Also called long-wave radiation	The heating up of the Earth because of extra CO2 and water vapor. The gases don't let terrestrial radiation escape into outer space.	It is water that is in the form of a gas.
Decreases. Hot air is less dense.	Heat keeps building up through the summer.	Incoming Solar Radiation, sunshine, short-wave radiation
High Pressure systems bring cool air, dry air and blue skies.	More. That's why it's more humid in the summer.	Decreases. Wet air (air with water vapor in it) weighs less than dry air.
Low. (It rhymes.)	Differences in air pressure causes air to move.	Low Pressure systems bring moist air, warm air and cloudy skies.

What does vertical ray mean?

What dates will people in the United States have the vertical ray?

What parts of the Earth get the vertical ray and when?

Wind is named for the direction it is _____.

The seasons in the Southern Hemisphere are __ our seasons.

How does the air flow around a High pressure system?

How does the air flow around a Low pressure system?

If the air temperature and dew point temperature are very similar, there is a _____ chance of precipitation.

What is dew point?

What is condensation?

What conditions are necessary for condensation to occur? (to make clouds and dew)

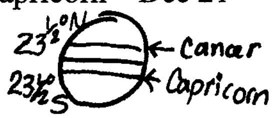
Which direction do weather systems usually move across the United States?

What does relative humidity mean?

What happens during a cold front?

What happens during a warm front?

Tropic of Cancer – June 21
Equator – March and Sept 21
Trop. of Capricorn – Dec 21



No Dates. People who live in the US will never have the sun directly overhead. Only people who live in the tropics will.

It means that the sun is directly overhead and the sunshine is coming straight down – vertically.

Air flows out of a High and the air moves clockwise.

Opposite -because of the tilt of the Earth, when one hemisphere tilts towards the sun, the other tilts away

Coming from. A north wind is blowing from the north to the south – bringing cold air.

It is the temperature needed to have dew form (temperature needed for consendation)

Greater chance of precipitation.

Air flows into a Low and the air moves counter clockwise.

Weather moves from West to East across the US. That's the way the planetary winds happen to blow across our latitudes.

Lots of water vapor, air temperature decreasing to the dew point and condensation nuclei (something for drop to form on)

It's a process that changes water vapor (gas) into a liquid droplet.

Warm air pushes in. The warm air moves over colder air. Clouds form and there is precipitation.

Cold air pushes in. The warmer air is pushed up and clouds form and there is precipitation.

Relative humidity is the amount of water vapor the air is holding compared to the amount it could hold. %

What happens when an occulded front approaches?

What happens when a stationary front is in an area?

When any type of weather front is in an area there will be ___.

Which type of weather front moves the fastest?

What does porosity mean?

What does permeability mean?

What is capillarity?

Large bodies of water have an ________ effect on the temperature.

What is the Orographic Effect?

Which force is responsible for all erosion?

Which agent of erosion moves the most sediment?

List four agents of erosion.

What does a stream's velocity depend on?

The velocity is ___ on the outside of a curve of a stream (meander).

What type of particles will settle out first (fastest) in water?

Precipiation – which means water in any form falling from the sky

There is cold air under warmer air for a couple of days. Clouds and precipitation form.

Cold air pushes warm air up and pushes into another cold air mass. Clouds and precipitation form.

Permeability is the ability of water to flow through a rock. It depends on how well connected the pores are.

Porosity the amount of pore space. (Particle size does not affect porosity. – shape and sorting does)

Cold fronts. The colder the air – the faster it moves.

Wind blows on one side of a mountain (windward side). The wind rises, cools, clouds form and precipitation results. When wind goes down other side (leeward side) it is hot and dry.

Moderating effect. That means that the winters aren't as cold and summers aren't as warm. Keeping from extremes.

It's the attractive force between small particles that moves watter upward through the soil. Smaller particles have more capillarity.

Wind, water, gravity and glaciers.

Streams move the most sediment.

Running Water

Gravity is responsible for rock pieces being moved.

Heavy, dense, round particles drop through water quicker.

Faster – that's where there will be erosion (water breaking rock and moving pieces away)

Slope – steeper the slope the faster the water (higher velocity)
Dishcharge – the more water there is in the stream, the faster it will flow

What is vertical sorting?	Describe glacial deposits.	Both glaciers and streams make valleys. How are the valleys different?
What type of rock is deposited in layers?	Describe extrusive igneous rocks.	Describe intrusive igneous rocks.
What type of rocks show banding and distorted structures?	What type of rocks have fossils?	The physical properties of minerals are determined by the ______.
What is the silicon-oxygen tetrahedron?	What is isostacy?	What forms the mid-ocean ridges?
How do ocean trenches form?	What do you know about P-waves?	What do you know about S-waves?

Glacial valleys are U-shaped.

Stream valleys are V-Shaped.

When glaciers melt they drop sediment. It is unsorted (mixed-sizes) and scratched up. A lot of NY State soils are like this because we had glaciers here.

Sediments are sorted out by size. Large on the bottom and small on the top. Happens when sediments are dumped into water.

They form slowly because the magma was below ground. Because the rocks cooled slowly, they have large crystals.

They form quickly because the lava was above ground. Because the rocks cooled quickly, they have small crystals.

Sedimentary rocks are deposited in flat layers (called strata).

Internal arrangement of atoms. Physical properties are hardness, streak, luster, cleavage, color…

Sedimentary

Metamorphic

Plate tectonics. That's where the plates are moving apart and new rock is being formed.

A condition of balance in the lithosphere. As many rocks are being formed as being destroyed. Same as dynamic equilibrium.

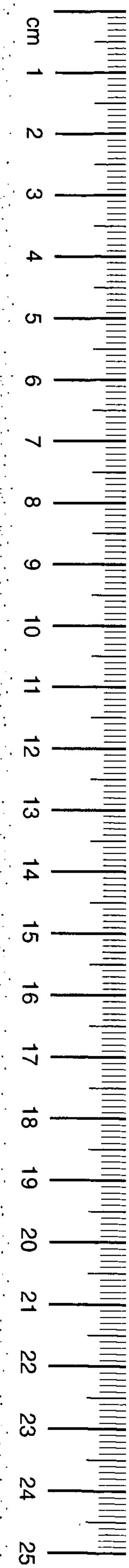
It is the basic unit for a lot of minerals (called silicates). It looks like a pyramid with an oxygen in the middle.

S-waves move slower than P-waves and can only travel through solids.

P-waves move the fastest. P-waves can travel through anything.

Plate tectonics. That's where plates dig into the Earth (subduction). Rocks are destroyed.

Reference Tables for Physical Setting/EARTH SCIENCE



Radioactive Decay Data

RADIOACTIVE ISOTOPE	DISINTEGRATION	HALF-LIFE (years)
Carbon-14	$^{14}C \rightarrow {}^{14}N$	5.7×10^{3}
Potassium-40	$^{40}K \rightarrow {}^{40}Ar$, $^{40}K \rightarrow {}^{40}Ca$	1.3×10^{9}
Uranium-238	$^{238}U \rightarrow {}^{206}Pb$	4.5×10^{9}
Rubidium-87	$^{87}Rb \rightarrow {}^{87}Sr$	4.9×10^{10}

Specific Heats of Common Materials

MATERIAL	SPECIFIC HEAT (Joules/gram • °C)
Liquid water	4.18
Solid water (ice)	2.11
Water vapor	2.00
Dry air	1.01
Basalt	0.84
Granite	0.79
Iron	0.45
Copper	0.38
Lead	0.13

Equations

$$\text{Eccentricity} = \frac{\text{distance between foci}}{\text{length of major axis}}$$

$$\text{Gradient} = \frac{\text{change in field value}}{\text{distance}}$$

$$\text{Rate of change} = \frac{\text{change in value}}{\text{time}}$$

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Properties of Water

Heat energy gained during melting . . . . 334 J/g
Heat energy released during freezing . . . . 334 J/g
Heat energy gained during vaporization . . . . . 2260 J/g
Heat energy released during condensation . . . 2260 J/g

Density at 3.98°C . . . . 1.0 g/mL

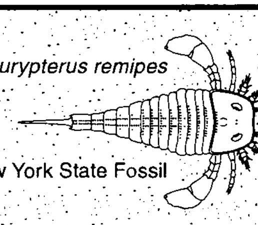
Average Chemical Composition of Earth's Crust, Hydrosphere, and Troposphere

ELEMENT (symbol)	CRUST		HYDROSPHERE	TROPOSPHERE
	Percent by mass	Percent by volume	Percent by volume	Percent by volume
Oxygen (O)	46.10	94.04	33.0	21.0
Silicon (Si)	28.20	0.88		
Aluminum (Al)	8.23	0.48		
Iron (Fe)	5.63	0.49		
Calcium (Ca)	4.15	1.18		
Sodium (Na)	2.36	1.11		
Magnesium (Mg)	2.33	0.33		
Potassium (K)	2.09	1.42		
Nitrogen (N)				78.0
Hydrogen (H)			66.0	
Other	0.91	0.07	1.0	1.0

2010 EDITION

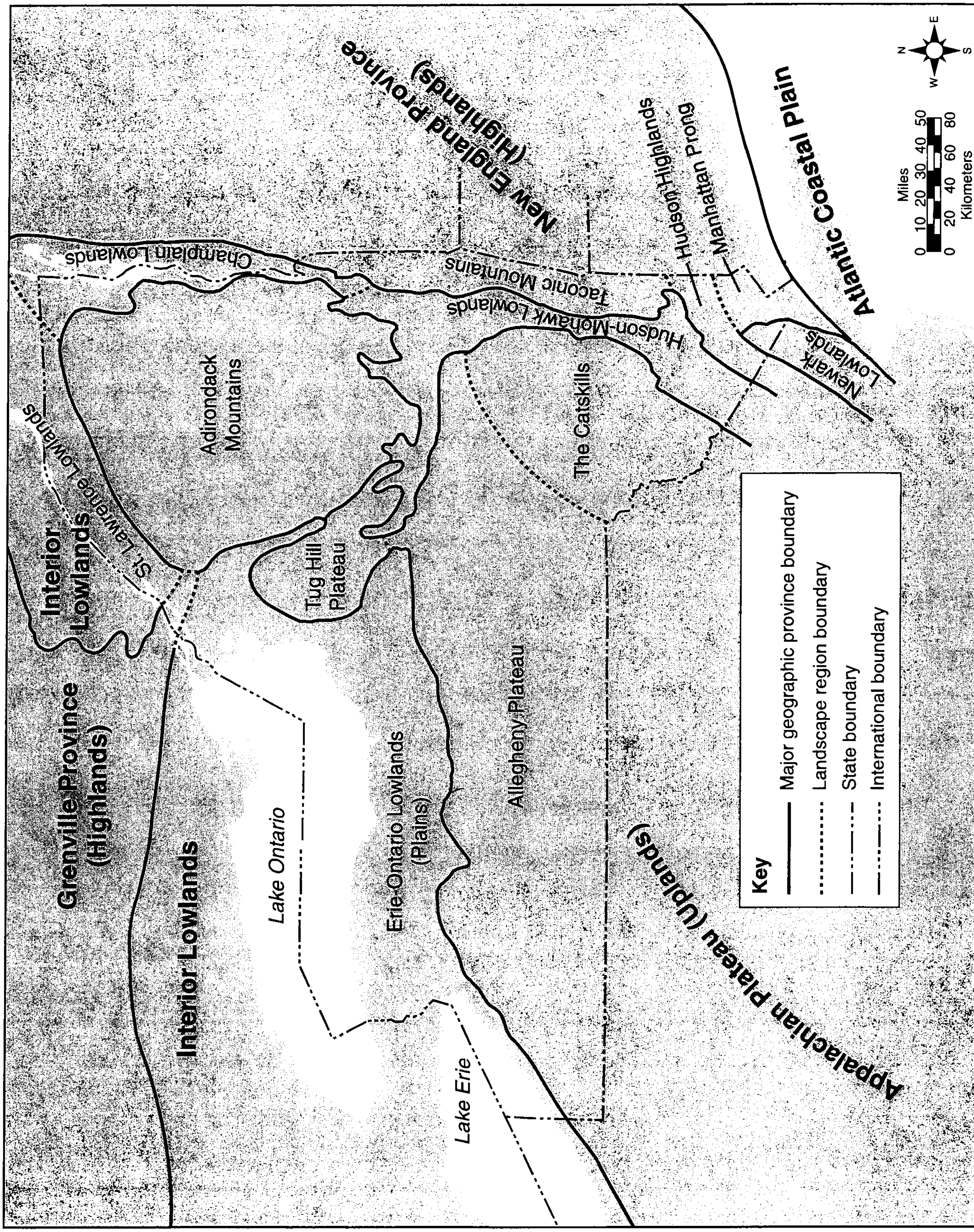
This edition of the Earth Science Reference Tables should be used in the classroom beginning in the 2009–2010 school year. The first examination for which these tables will be used is the January 2010 Regents Examination in Physical Setting / Earth Science.

Eurypterus remipes



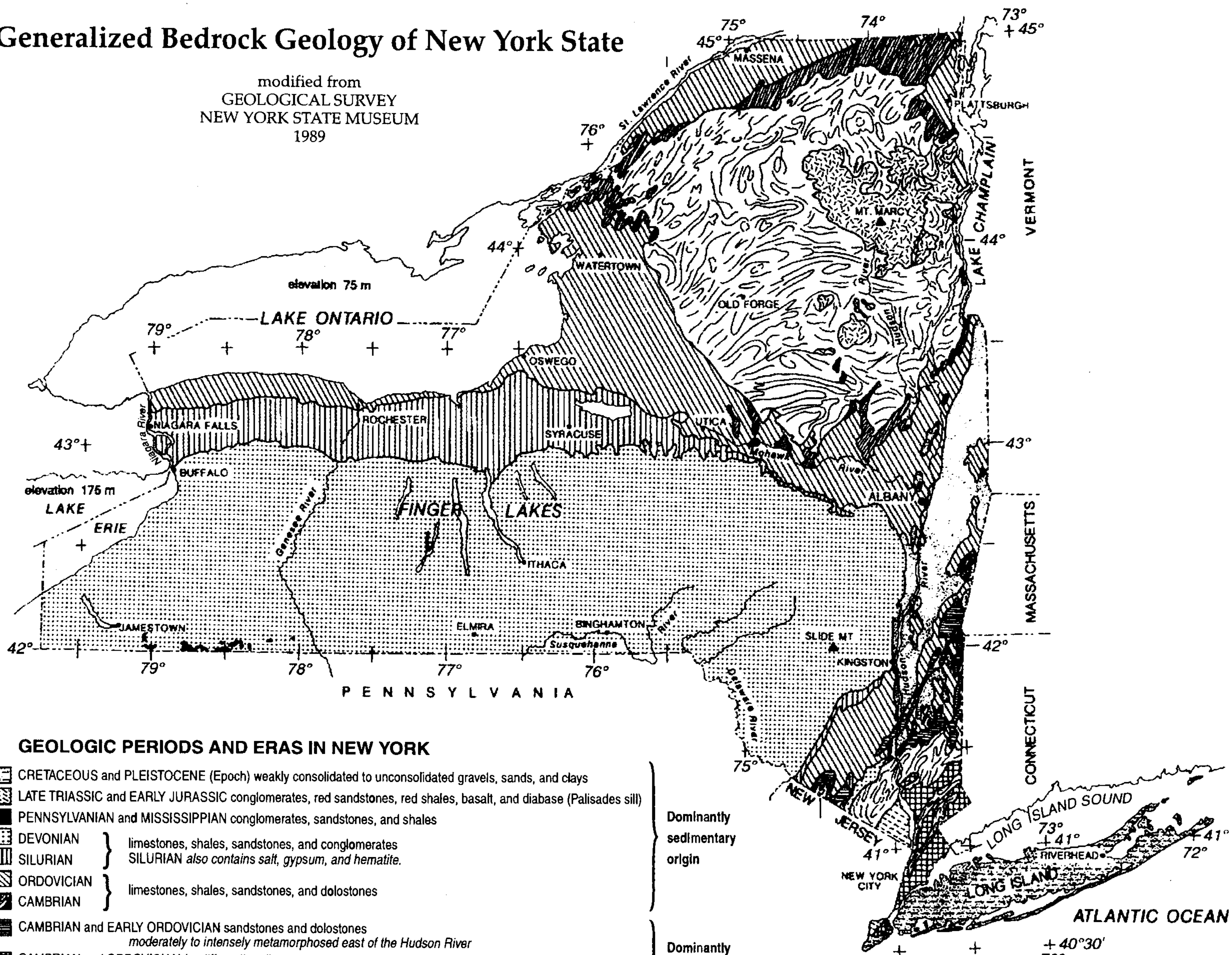
New York State Fossil

Generalized Landscape Regions of New York State



Generalized Bedrock Geology of New York State

modified from
GEOLOGICAL SURVEY
NEW YORK STATE MUSEUM
1989



GEOLOGIC PERIODS AND ERAS IN NEW YORK

Dominantly sedimentary origin

- CRETACEOUS and PLEISTOCENE (Epoch) weakly consolidated to unconsolidated gravels, sands, and clays
- LATE TRIASSIC and EARLY JURASSIC conglomerates, red sandstones, red shales, basalt, and diabase (Palisades sill)
- PENNSYLVANIAN and MISSISSIPPIAN conglomerates, sandstones, and shales
- DEVONIAN, SILURIAN: limestones, shales, sandstones, and conglomerates. SILURIAN *also contains salt, gypsum, and hematite.*
- ORDOVICIAN, CAMBRIAN: limestones, shales, sandstones, and dolostones

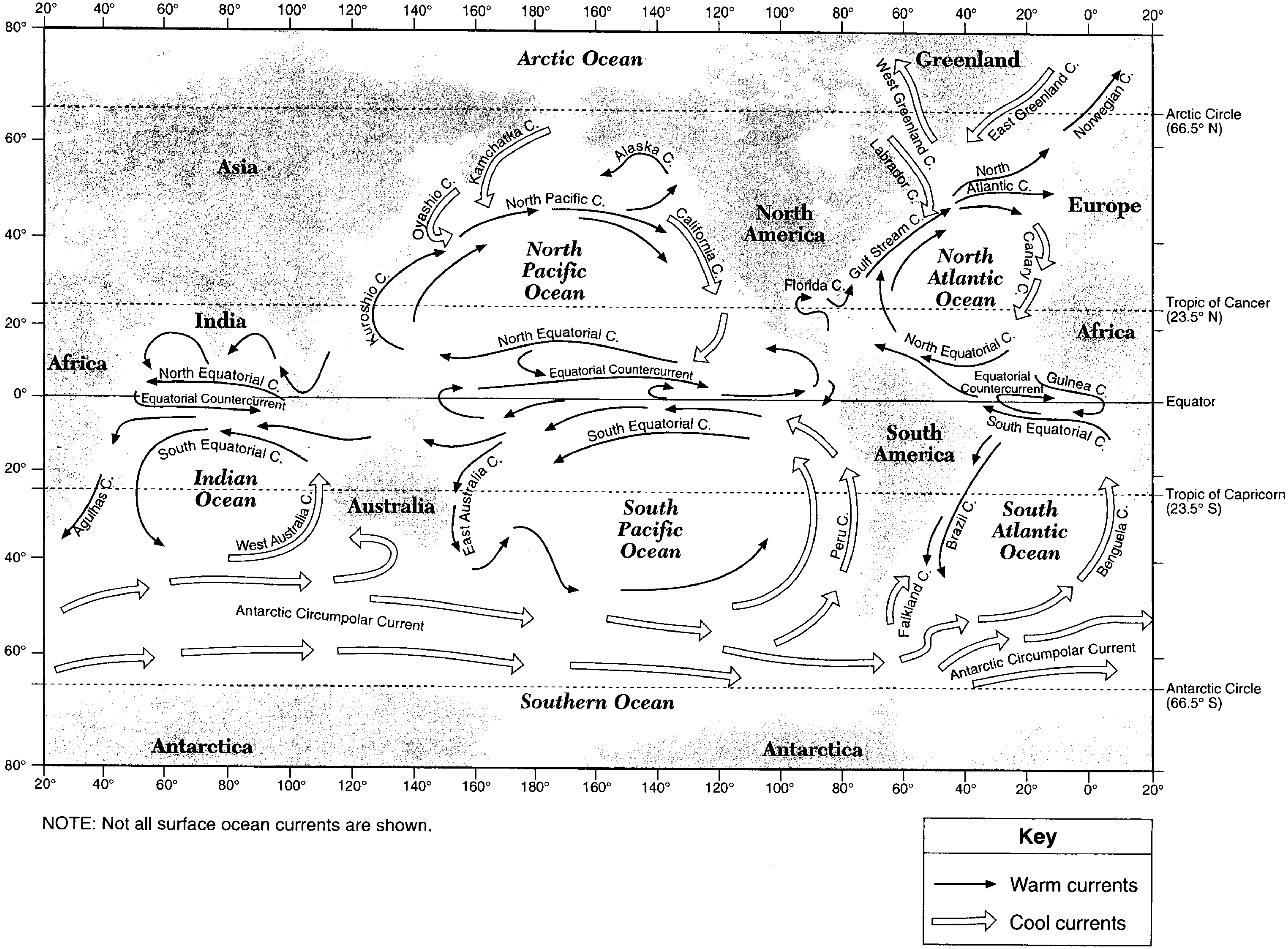
Dominantly metamorphosed rocks

- CAMBRIAN and EARLY ORDOVICIAN sandstones and dolostones *moderately to intensely metamorphosed east of the Hudson River*
- CAMBRIAN and ORDOVICIAN (undifferentiated) quartzites, dolostones, marbles, and schists *intensely metamorphosed; includes portions of the Taconic Sequence and Cortlandt Complex*
- TACONIC SEQUENCE sandstones, shales, and slates *slightly to intensely metamorphosed rocks of* CAMBRIAN *through* MIDDLE ORDOVICIAN *ages*

Intensely metamorphosed rocks (regional metamorphism about 1,000 m.y.a.)

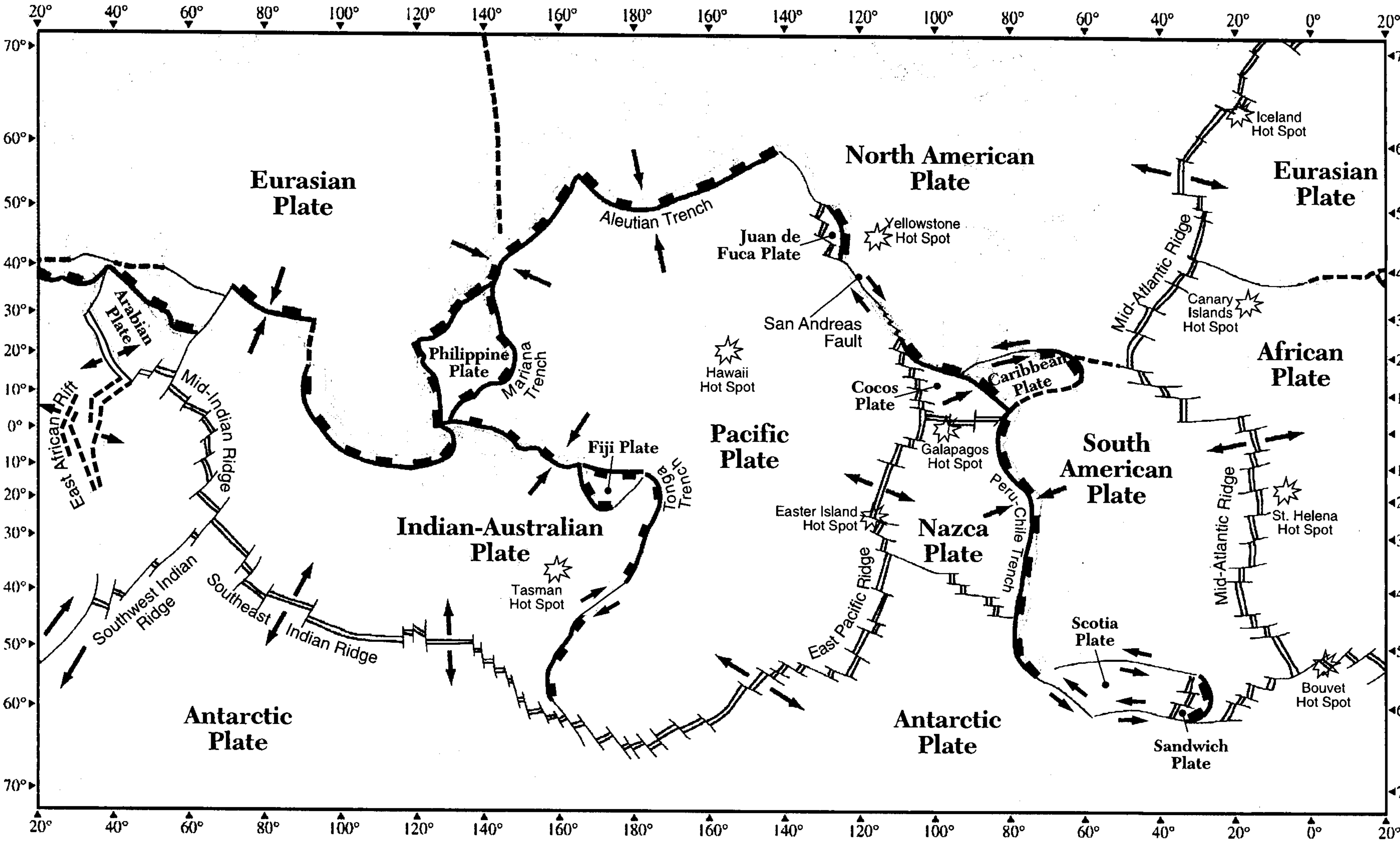
- MIDDLE PROTEROZOIC gneisses, quartzites, and marbles *Lines are generalized structure trends.*
- MIDDLE PROTEROZOIC anorthositic rocks

Surface Ocean Currents



NOTE: Not all surface ocean currents are shown.

Tectonic Plates



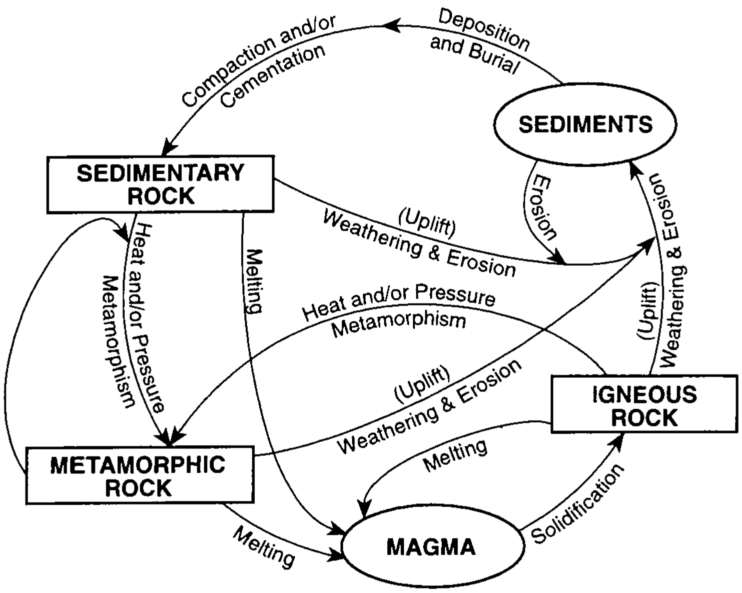
Key

- Relative motion at plate boundary
- Transform plate boundary (transform fault)
- Divergent plate boundary (usually broken by transform faults along mid-ocean ridges)
- Convergent plate boundary (subduction zone) — overriding plate; subducting plate
- Complex or uncertain plate boundary
- Mantle hot spot

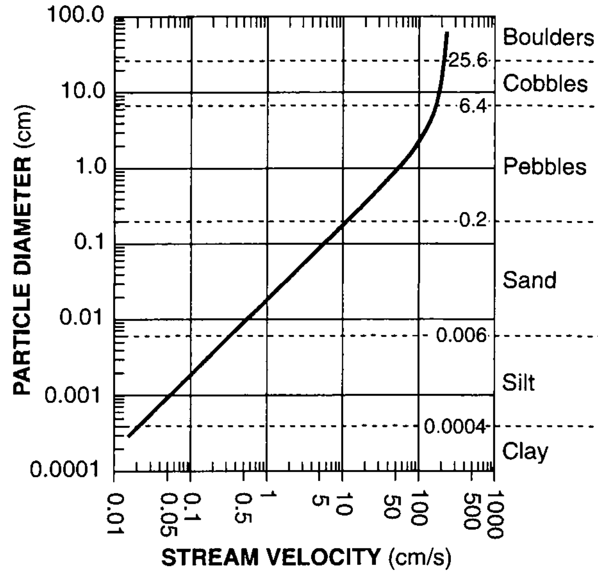
NOTE: Not all mantle hot spots, plates, and boundaries are shown.

(31)

Rock Cycle in Earth's Crust

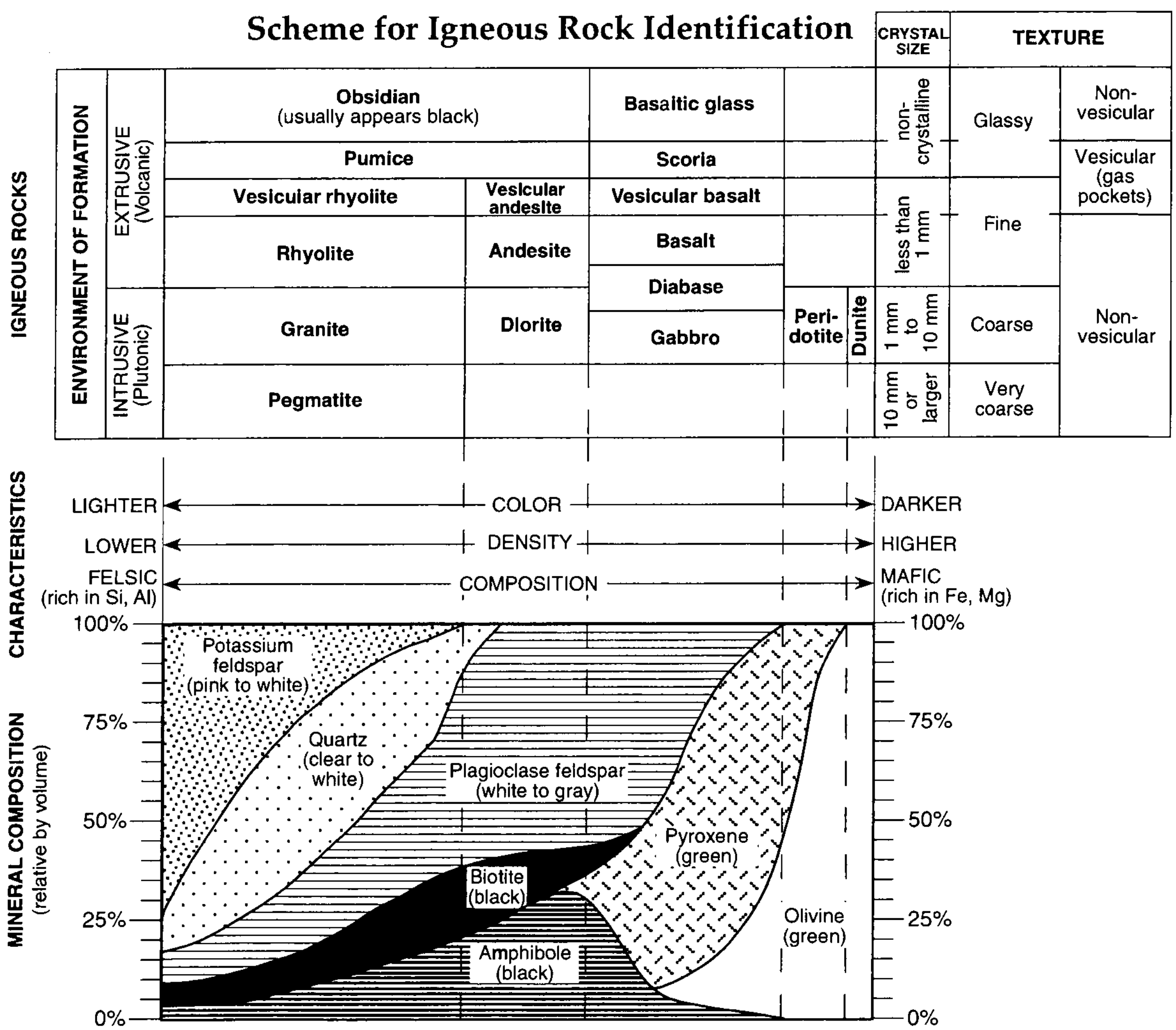


Relationship of Transported Particle Size to Water Velocity



This generalized graph shows the water velocity needed to maintain, but not start, movement. Variations occur due to differences in particle density and shape.

Scheme for Igneous Rock Identification



Scheme for Sedimentary Rock Identification

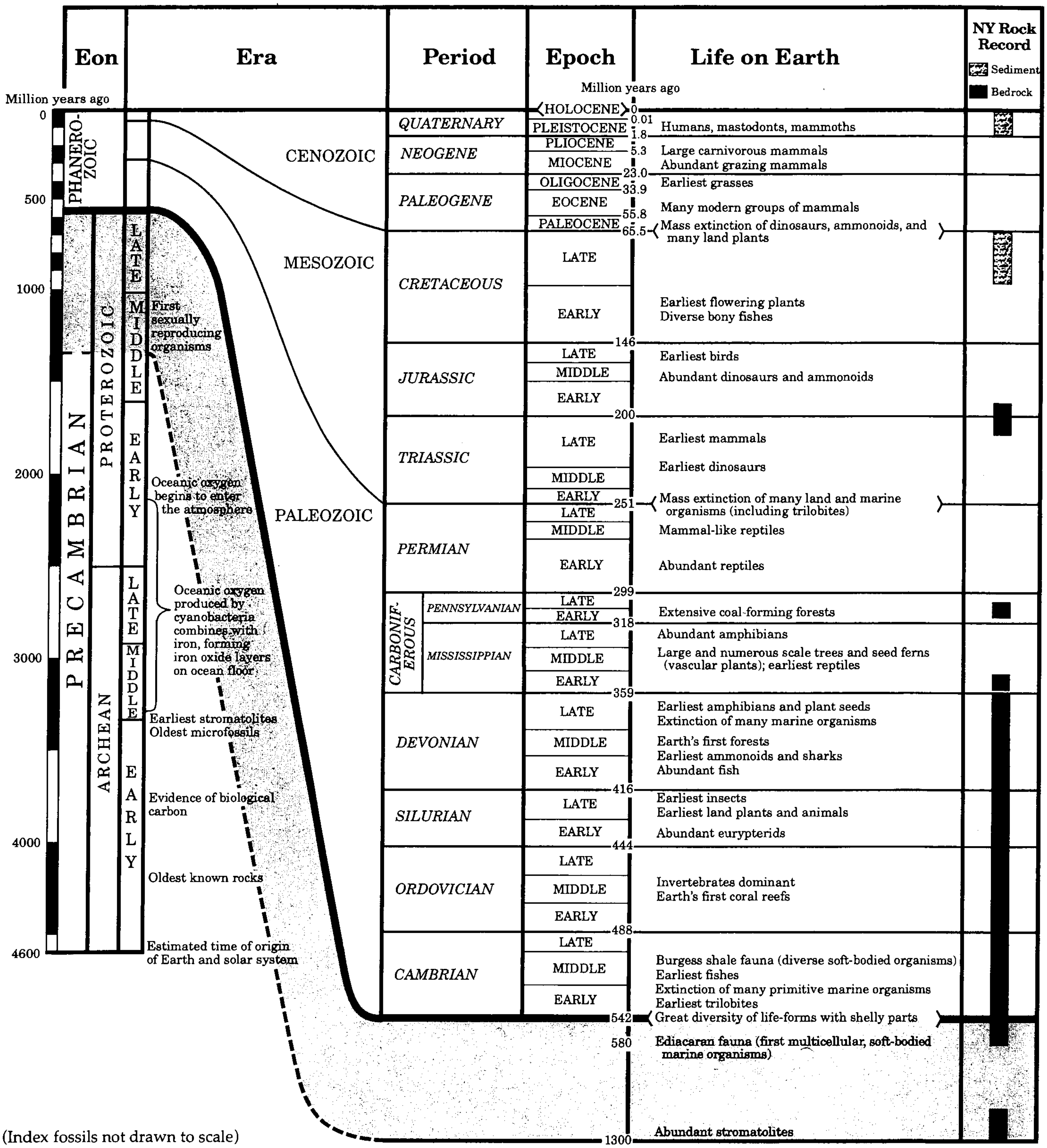
INORGANIC LAND-DERIVED SEDIMENTARY ROCKS					
TEXTURE	**GRAIN SIZE**	**COMPOSITION**	**COMMENTS**	**ROCK NAME**	**MAP SYMBOL**
Clastic (fragmental)	Pebbles, cobbles, and/or boulders embedded in sand, silt, and/or clay	Mostly quartz, feldspar, and clay minerals; may contain fragments of other rocks and minerals	Rounded fragments	**Conglomerate**	
			Angular fragments	**Breccia**	
	Sand (0.006 to 0.2 cm)		Fine to coarse	**Sandstone**	
	Silt (0.0004 to 0.006 cm)		Very fine grain	**Siltstone**	
	Clay (less than 0.0004 cm)		Compact; may split easily	**Shale**	

CHEMICALLY AND/OR ORGANICALLY FORMED SEDIMENTARY ROCKS					
TEXTURE	**GRAIN SIZE**	**COMPOSITION**	**COMMENTS**	**ROCK NAME**	**MAP SYMBOL**
Crystalline	Fine to coarse crystals	Halite	Crystals from chemical precipitates and evaporites	**Rock salt**	
		Gypsum		**Rock gypsum**	
		Dolomite		**Dolostone**	
Crystalline or bioclastic	Microscopic to very coarse	Calcite	Precipitates of biologic origin or cemented shell fragments	**Limestone**	
Bioclastic		Carbon	Compacted plant remains	**Bituminous coal**	

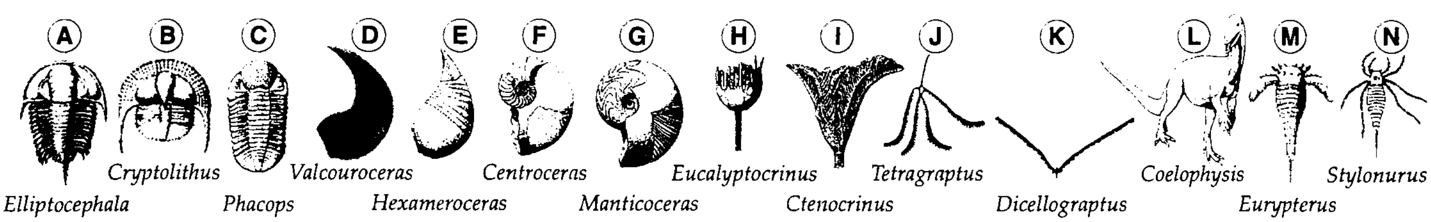
Scheme for Metamorphic Rock Identification

TEXTURE		**GRAIN SIZE**	**COMPOSITION**	**TYPE OF METAMORPHISM**	**COMMENTS**	**ROCK NAME**	**MAP SYMBOL**
FOLIATED	MINERAL ALIGNMENT	Fine	MICA	Regional (Heat and pressure increases)	Low-grade metamorphism of shale	**Slate**	
		Fine to medium	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET		Foliation surfaces shiny from microscopic mica crystals	**Phyllite**	
			MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE		Platy mica crystals visible from metamorphism of clay or feldspars	**Schist**	
	BANDING	Medium to coarse	MICA, QUARTZ, FELDSPAR, AMPHIBOLE, GARNET, PYROXENE		High-grade metamorphism; mineral types segregated into bands	**Gneiss**	
NONFOLIATED		Fine	Carbon	Regional	Metamorphism of bituminous coal	**Anthracite coal**	
		Fine	Various minerals	Contact (heat)	Various rocks changed by heat from nearby magma/lava	**Hornfels**	
		Fine to coarse	Quartz	Regional or contact	Metamorphism of quartz sandstone	**Quartzite**	
			Calcite and/or dolomite		Metamorphism of limestone or dolostone	**Marble**	
		Coarse	Various minerals		Pebbles may be distorted or stretched	**Metaconglomerate**	

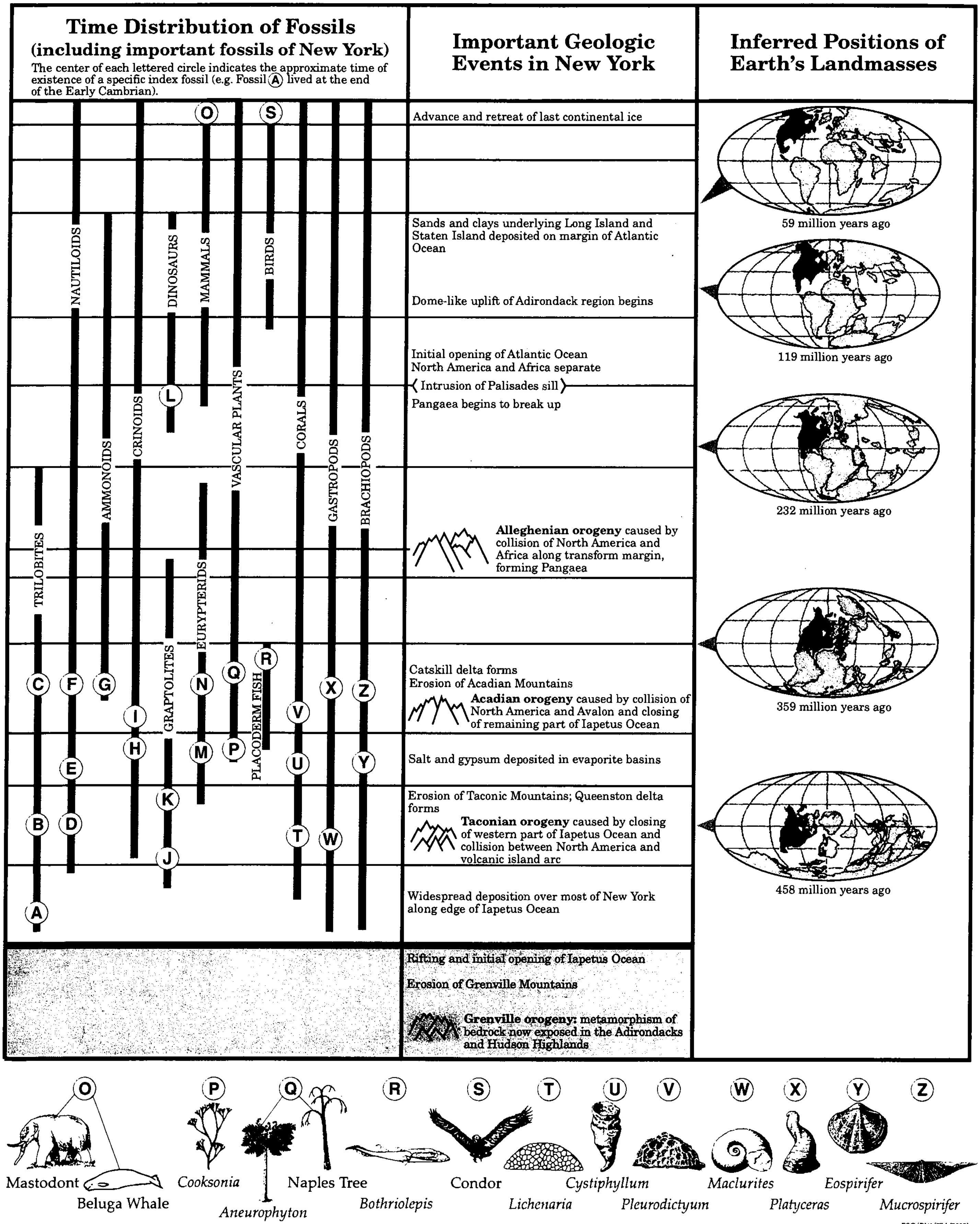
GEOLOGIC HISTORY



(Index fossils not drawn to scale)

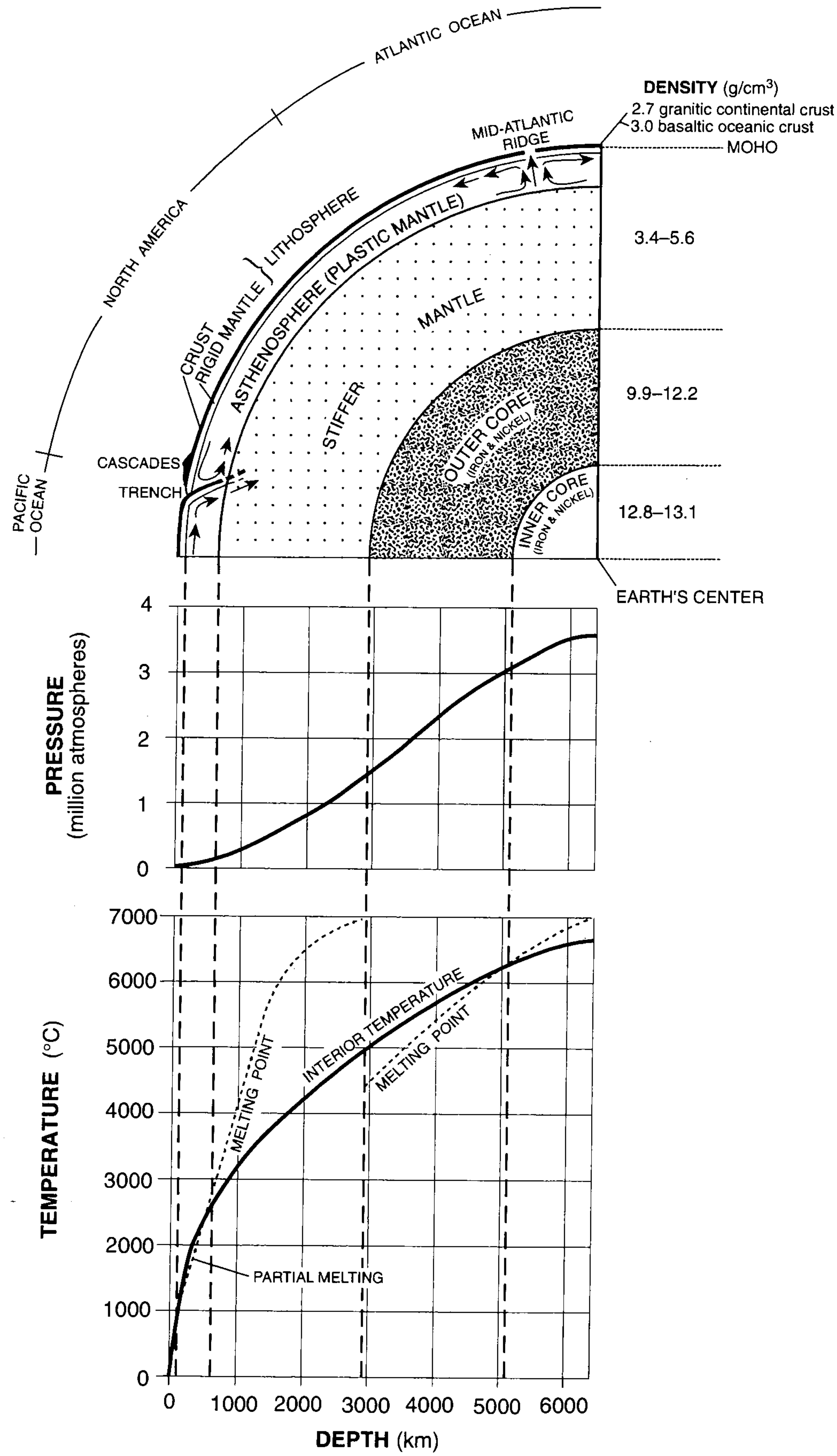


OF NEW YORK STATE

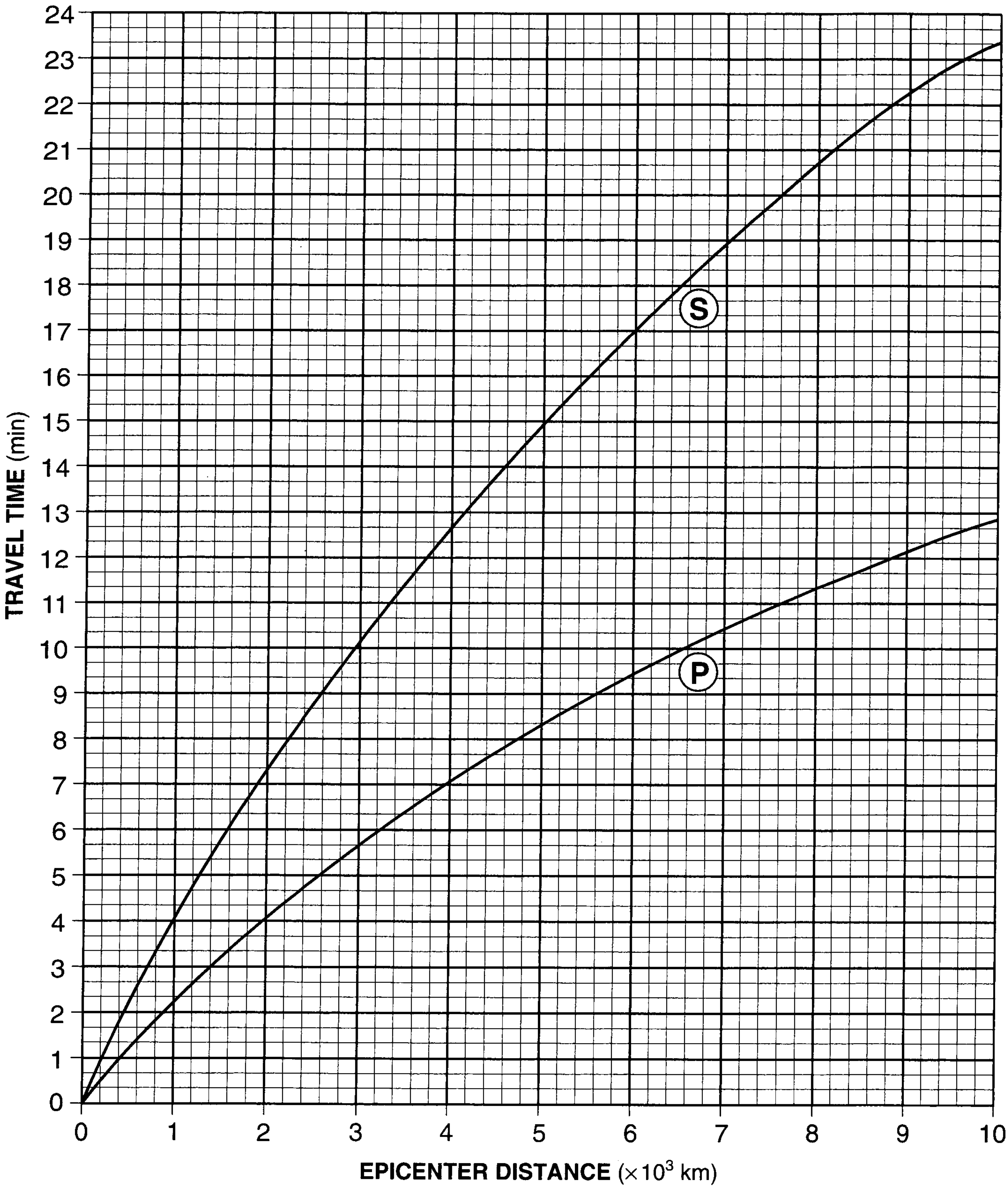


ESC/BW/TN (2009)

Inferred Properties of Earth's Interior



Earthquake P-Wave and S-Wave Travel Time



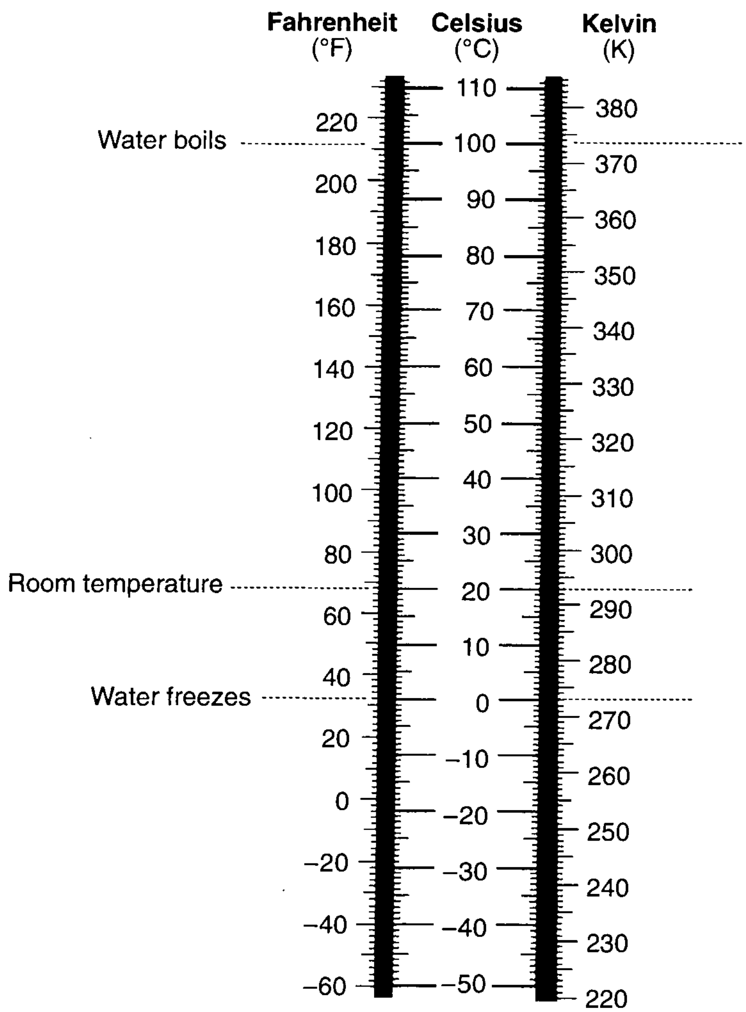
Dewpoint (°C)

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
−20	−20	−33														
−18	−18	−28														
−16	−16	−24														
−14	−14	−21	−36													
−12	−12	−18	−28													
−10	−10	−14	−22													
−8	−8	−12	−18	−29												
−6	−6	−10	−14	−22												
−4	−4	−7	−12	−17	−29											
−2	−2	−5	−8	−13	−20											
0	0	−3	−6	−9	−15	−24										
2	2	−1	−3	−6	−11	−17										
4	4	1	−1	−4	−7	−11	−19									
6	6	4	1	−1	−4	−7	−13	−21								
8	8	6	3	1	−2	−5	−9	−14								
10	10	8	6	4	1	−2	−5	−9	−14	−28						
12	12	10	8	6	4	1	−2	−5	−9	−16						
14	14	12	11	9	6	4	1	−2	−5	−10	−17					
16	16	14	13	11	9	7	4	1	−1	−6	−10	−17				
18	18	16	15	13	11	9	7	4	2	−2	−5	−10	−19			
20	20	19	17	15	14	12	10	7	4	2	−2	−5	−10	−19		
22	22	21	19	17	16	14	12	10	8	5	3	−1	−5	−10	−19	
24	24	23	21	20	18	16	14	12	10	8	6	2	−1	−5	−10	−18
26	26	25	23	22	20	18	17	15	13	11	9	6	3	0	−4	−9
28	28	27	25	24	22	21	19	17	16	14	11	9	7	4	1	−3
30	30	29	27	26	24	23	21	19	18	16	14	12	10	8	5	1

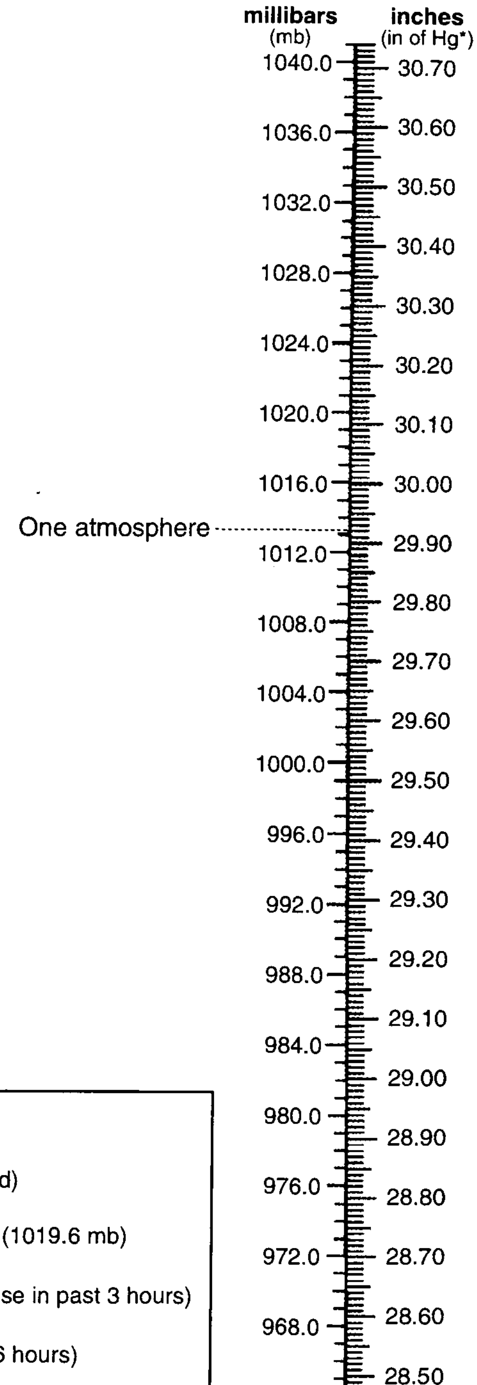
Relative Humidity (%)

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
−20	100	28														
−18	100	40														
−16	100	48														
−14	100	55	11													
−12	100	61	23													
−10	100	66	33													
−8	100	71	41	13												
−6	100	73	48	20												
−4	100	77	54	32	11											
−2	100	79	58	37	20	1										
0	100	81	63	45	28	11										
2	100	83	67	51	36	20	6									
4	100	85	70	56	42	27	14									
6	100	86	72	59	46	35	22	10								
8	100	87	74	62	51	39	28	17	6							
10	100	88	76	65	54	43	33	24	13	4						
12	100	88	78	67	57	48	38	28	19	10	2					
14	100	89	79	69	60	50	41	33	25	16	8	1				
16	100	90	80	71	62	54	45	37	29	21	14	7	1			
18	100	91	81	72	64	56	48	40	33	26	19	12	6			
20	100	91	82	74	66	58	51	44	36	30	23	17	11	5		
22	100	92	83	75	68	60	53	46	40	33	27	21	15	10	4	
24	100	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4
26	100	92	85	77	70	64	57	51	45	39	34	28	23	18	13	9
28	100	93	86	78	71	65	59	53	47	42	36	31	26	21	17	12
30	100	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16

Temperature



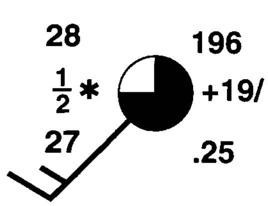
Pressure



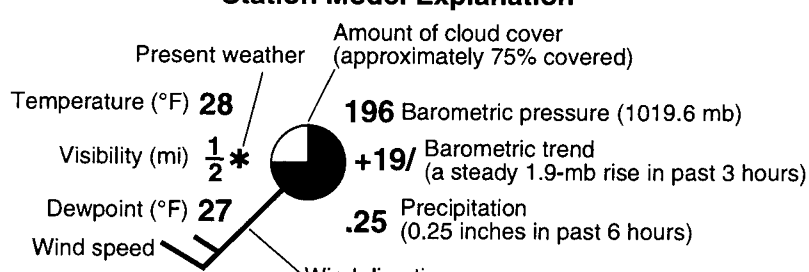
*Hg = mercury

Key to Weather Map Symbols

Station Model



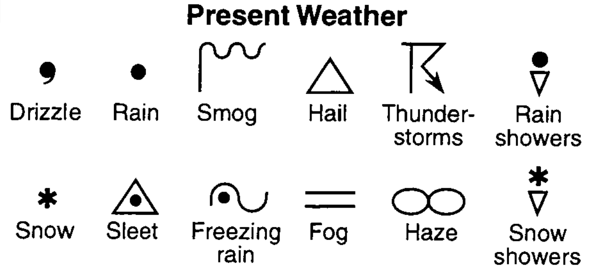
Station Model Explanation



whole feather = 10 knots
half feather = 5 knots
total = 15 knots

(1 knot = 1.15 mi/h)

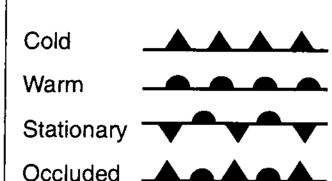
Present Weather



Air Masses

cA continental arctic
cP continental polar
cT continental tropical
mT maritime tropical
mP maritime polar

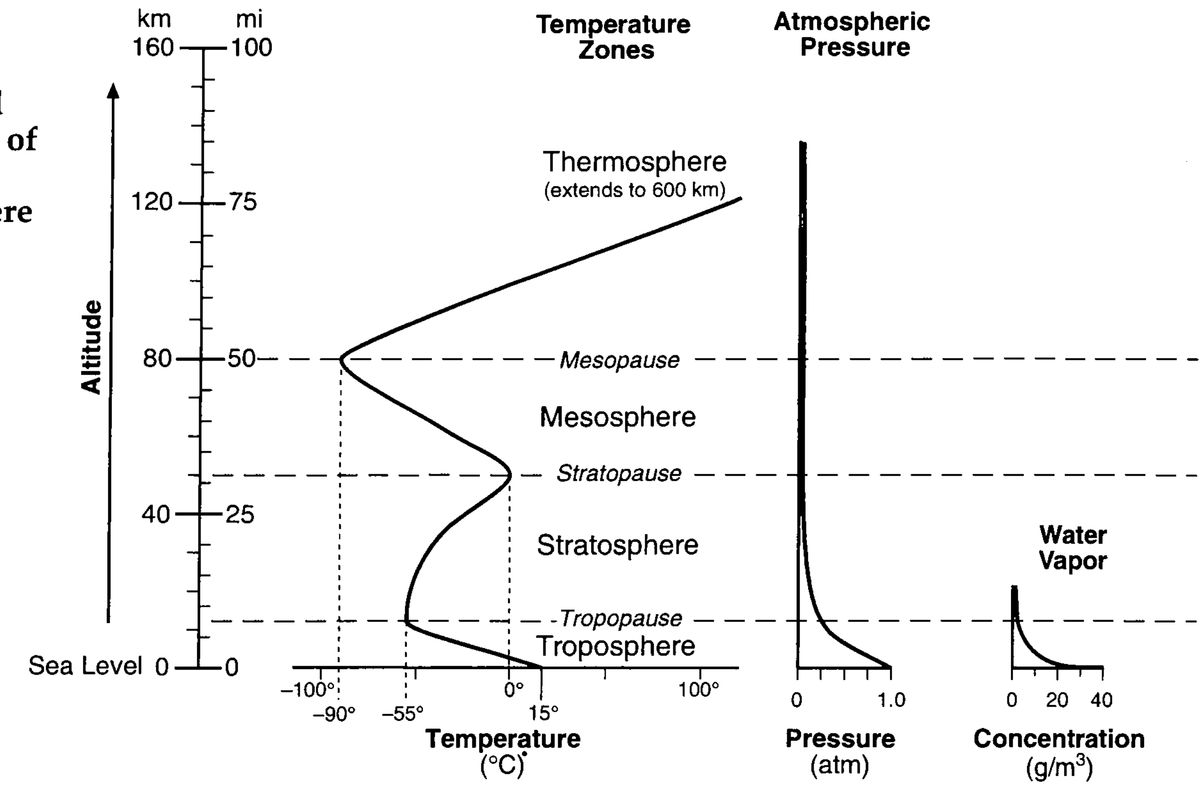
Fronts



Hurricane

Tornado

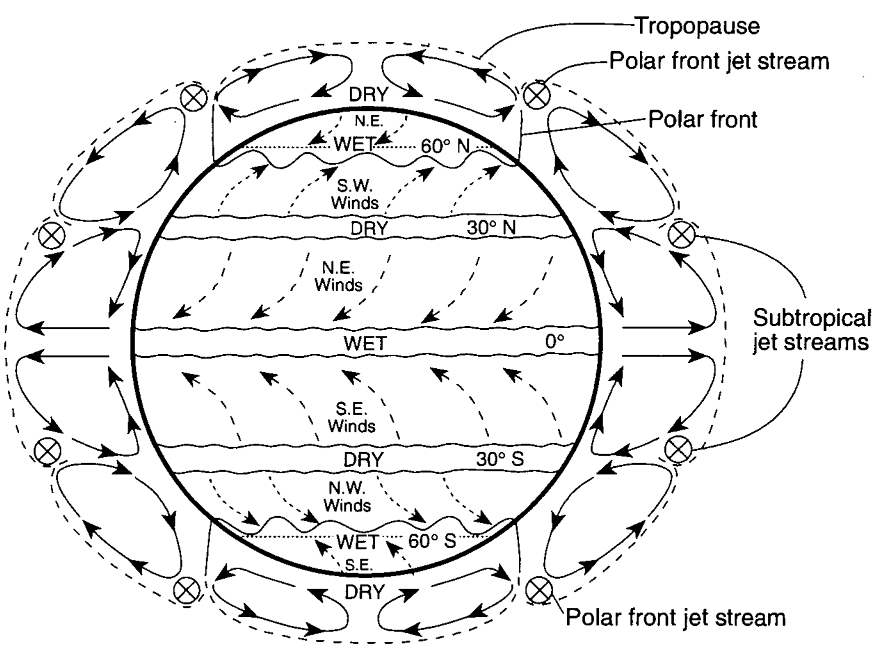
Selected Properties of Earth's Atmosphere



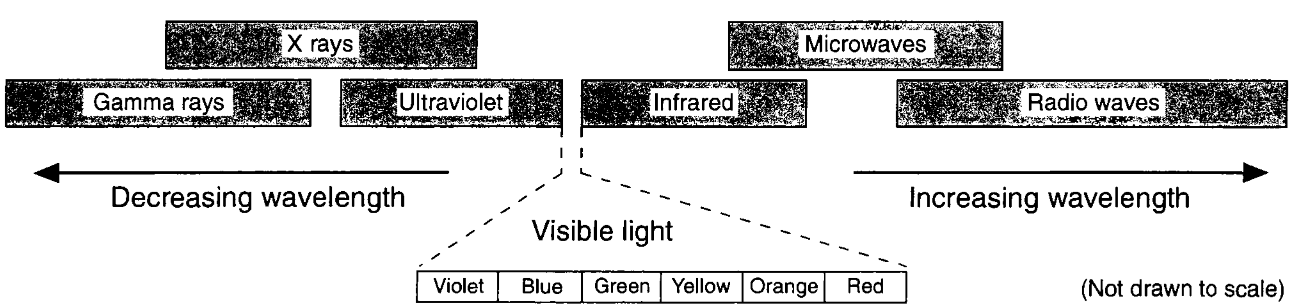
Planetary Wind and Moisture Belts in the Troposphere

The drawing on the right shows the locations of the belts near the time of an equinox. The locations shift somewhat with the changing latitude of the Sun's vertical ray. In the Northern Hemisphere, the belts shift northward in the summer and southward in the winter.

(Not drawn to scale)

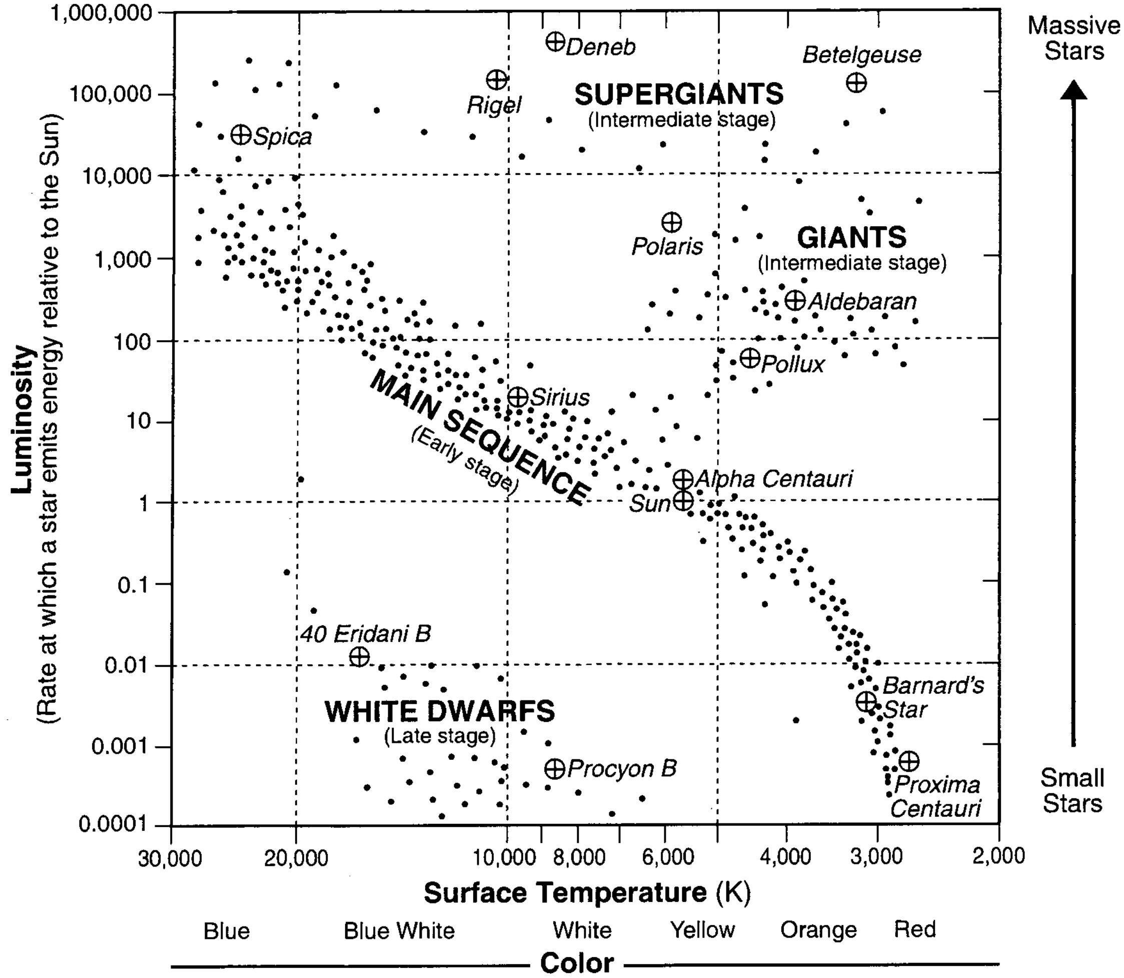


Electromagnetic Spectrum



Characteristics of Stars

(Name in italics refers to star represented by a ⊕.)
(Stages indicate the general sequence of star development.)



Solar System Data

Celestial Object	Mean Distance from Sun (million km)	Period of Revolution (d=days) (y=years)	Period of Rotation at Equator	Eccentricity of Orbit	Equatorial Diameter (km)	Mass (Earth = 1)	Density (g/cm³)
SUN	—	—	27 d	—	1,392,000	333,000.00	1.4
MERCURY	57.9	88 d	59 d	0.206	4,879	0.06	5.4
VENUS	108.2	224.7 d	243 d	0.007	12,104	0.82	5.2
EARTH	149.6	365.26 d	23 h 56 min 4 s	0.017	12,756	1.00	5.5
MARS	227.9	687 d	24 h 37 min 23 s	0.093	6,794	0.11	3.9
JUPITER	778.4	11.9 y	9 h 50 min 30 s	0.048	142,984	317.83	1.3
SATURN	1,426.7	29.5 y	10 h 14 min	0.054	120,536	95.16	0.7
URANUS	2,871.0	84.0 y	17 h 14 min	0.047	51,118	14.54	1.3
NEPTUNE	4,498.3	164.8 y	16 h	0.009	49,528	17.15	1.8
EARTH'S MOON	149.6 (0.386 from Earth)	27.3 d	27.3 d	0.055	3,476	0.01	3.3

Properties of Common Minerals

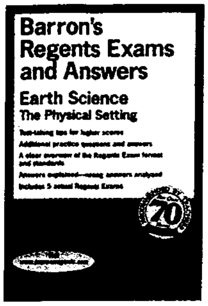
LUSTER	HARD-NESS	CLEAVAGE	FRACTURE	COMMON COLORS	DISTINGUISHING CHARACTERISTICS	USE(S)	COMPOSITION*	MINERAL NAME
Metallic luster	1–2	✔		silver to gray	black streak, greasy feel	pencil lead, lubricants	C	**Graphite**
Metallic luster	2.5	✔		metallic silver	gray-black streak, cubic cleavage, density = 7.6 g/cm^3	ore of lead, batteries	PbS	**Galena**
Metallic luster	5.5–6.5		✔	black to silver	black streak, magnetic	ore of iron, steel	Fe_3O_4	**Magnetite**
Metallic luster	6.5		✔	brassy yellow	green-black streak, (fool's gold)	ore of sulfur	FeS_2	**Pyrite**
Either	5.5 – 6.5 or 1		✔	metallic silver or earthy red	red-brown streak	ore of iron, jewelry	Fe_2O_3	**Hematite**
Nonmetallic luster	1	✔		white to green	greasy feel	ceramics, paper	$Mg_3Si_4O_{10}(OH)_2$	**Talc**
Nonmetallic luster	2		✔	yellow to amber	white-yellow streak	sulfuric acid	S	**Sulfur**
Nonmetallic luster	2	✔		white to pink or gray	easily scratched by fingernail	plaster of paris, drywall	$CaSO_4 \cdot 2H_2O$	**Selenite gypsum**
Nonmetallic luster	2–2.5	✔		colorless to yellow	flexible in thin sheets	paint, roofing	$KAl_3Si_3O_{10}(OH)_2$	**Muscovite mica**
Nonmetallic luster	2.5	✔		colorless to white	cubic cleavage, salty taste	food additive, melts ice	NaCl	**Halite**
Nonmetallic luster	2.5–3	✔		black to dark brown	flexible in thin sheets	construction materials	$K(Mg,Fe)_3 AlSi_3O_{10}(OH)_2$	**Biotite mica**
Nonmetallic luster	3	✔		colorless or variable	bubbles with acid, rhombohedral cleavage	cement, lime	$CaCO_3$	**Calcite**
Nonmetallic luster	3.5	✔		colorless or variable	bubbles with acid when powdered	building stones	$CaMg(CO_3)_2$	**Dolomite**
Nonmetallic luster	4	✔		colorless or variable	cleaves in 4 directions	hydrofluoric acid	CaF_2	**Fluorite**
Nonmetallic luster	5–6	✔		black to dark green	cleaves in 2 directions at 90°	mineral collections, jewelry	$(Ca,Na)(Mg,Fe,Al)(Si,Al)_2O_6$	**Pyroxene** (commonly augite)
Nonmetallic luster	5.5	✔		black to dark green	cleaves at 56° and 124°	mineral collections, jewelry	$CaNa(Mg,Fe)_4(Al,Fe,Ti)_3Si_6O_{22}(O,OH)_2$	**Amphibole** (commonly hornblende)
Nonmetallic luster	6	✔		white to pink	cleaves in 2 directions at 90°	ceramics, glass	$KAlSi_3O_8$	**Potassium feldspar** (commonly orthoclase)
Nonmetallic luster	6	✔		white to gray	cleaves in 2 directions, striations visible	ceramics, glass	$(Na,Ca)AlSi_3O_8$	**Plagioclase feldspar**
Nonmetallic luster	6.5		✔	green to gray or brown	commonly light green and granular	furnace bricks, jewelry	$(Fe,Mg)_2SiO_4$	**Olivine**
Nonmetallic luster	7		✔	colorless or variable	glassy luster, may form hexagonal crystals	glass, jewelry, electronics	SiO_2	**Quartz**
Nonmetallic luster	6.5–7.5		✔	dark red to green	often seen as red glassy grains in NYS metamorphic rocks	jewelry (NYS gem), abrasives	$Fe_3Al_2Si_3O_{12}$	**Garnet**

*Chemical symbols:

Al = aluminum	Cl = chlorine	H = hydrogen	Na = sodium	S = sulfur
C = carbon	F = fluorine	K = potassium	O = oxygen	Si = silicon
Ca = calcium	Fe = iron	Mg = magnesium	Pb = lead	Ti = titanium

✔ = dominant form of breakage

Great Resources for you to do some serious studying!!



Best Review book:

- Barron's Earth Science Review
- About $9.00 at your local book store
- It gives practice tests and explains the answer to each question.

Best test prep websites:

- http://regentsprep.org/
- http://reviewearthscience.com/

Best teacher websites for notes, PowerPoint's and animation:

- http://secondary.rcsdk12.org/20182052711144543/site/default.asp
  - Digital copy of ESRT
  - PowerPoint presentations of all the topics covered
  - Notes for all topics covered
- http://www.eram.k12.ny.us/education/components/docmgr/default.php?sectiondetailid=23561 (or search for eram interactive earth science exam)
  - This is a site that will allow you to take an interactive regents earth science exam)
- http://www.eram.k12.ny.us/education/components/docmgr/default.php?sectiondetailid=17500&&PHPSESSID=ca1d632de9b3e4455bfd24babd2e2d4a (or search for eram earth science visual animation)
  - This is a site that will allow you to see the visual animations of many earth science processes)

Earth Science Final Exam

What is the Earth Science Regents Final?

The Earth Science: Physical Environment Regents Examination is a standardized assessment given to students enrolled in New York State schools. The examination is based on the Earth Science: Physical Environment Core Curriculum that is based on Standard 4 of the New York State Learning Standards for Mathematics, Science and Technology. These content-based questions test your ability to apply, analyze, synthesize and evaluate information from the Earth Science Core Curriculum.

When is the Earth Science Regents Final offered?

The Earth Science Regents is offered in June and August of each year.

The next exam is June 15^{h}, 2012 at 12:00 p.m.

How is the Earth Science Regents Test Structured?

The Earth Science Exam consists of four parts:

- **Part A** consists of content-based multiple-choice questions that assess your ability to apply, analyze, synthesize and evaluate core curriculum material. It counts for approximately 30 – 40 % of the exam.
- **Part B** is made up of content-based question. There are multiple-choice and short constructed-response items. The questions assess your ability to apply, analyze, synthesize and evaluate content material and scientific inquiry skills. Part B is approximately 25-35 percent of the exam.
- **Part C** consists of extended constructed-response and/pr constructed-response items that assess your ability to apply knowledge of science concepts and skills to real-world conditions. Students will examine three to five situation recounted in maps, newspaper or magazine articles, and similar formats. They will apply scientific concepts, formulate hypotheses, make prediction or use other scientific inquiry techniques in their responses to the questions presented. Part C is approximately 15 – 25% of the exam.
- **Part D** is the laboratory performance test. It is taken prior to the written examination. You will complete hands-on tasks based on the content and skills students studied in Earth Science class. The laboratory performance test makes up approximately 15 % of the exam.

Who can take the Earth Science Regents Final?

All students who have successfully completed 1200 lab credit minutes in Regents Earth Science are eligible.

What topics are included in the Earth Science Curriculum?

The following topics are included in the Earth Science Core Curriculum:

Density, percent deviation, graphing, shape and size of Earth, Polaris measurements, rotation and revolution, longitude, latitude, time zones, topographic maps, minerals, rocks, rock cycles, earth quakes, plate tectonics, volcanoes, weathering, erosion, deposition, stream development, landscape regions, relative dating, geologic time, evolution, radioactive dating, weather variables, weather forecasting, water cycle, insolation, terrestrial radiation, greenhouse effect, climate, galaxies, solar system, stars, planets, apparent motion, the moon and eclipses.

What about review?

The Earth Science teachers are providing 11 review sessions listed on page 3 of this packet.