Earth Science **Name** ________________________

END OF THE YEAR REVIEW PACKET — Answers

RELATIONSHIPS – DENSITY - COORDINATE SYSTEMS

Earth Science contains many relationships involving two variables which can be graphed. If both variables are increasing, a Direct relationship results, in which the plotted line goes up. An example of this relationship is people vs. pollution; the more people the more pollution. If one variable is increasing while the other variable is decreasing, an indirect relationship is produced. This is shown on a graph with a decreasing line. Gravity and distance from the Earth is an inverse relationship; the further one is from the Earth the less the force of gravity will be. A cyclic relationship shows a repeating pattern that is predictable. Examples are the moon phases, seasons, sunspots, and tides which occur twice a day. A straight horizontal line on a graph shows a relationship that remains the same. A radioactive element's half-life is a good example of this relationship. Radiation will become weaker in time, but the element's half-life will remain the same.

distance
direct
cyclic
moon
radiation
pollution
inverse

The first layer of our atmosphere is called the troposphere. Since all the water vapor is located in this layer, weather occurs here! The next atmospheric layer is the Stratosphere. In this layer the temperature increases. In the atmosphere, as the altitude increases, the pressure always decreases. This is because there are less air molecules higher up. All atmospheric layers and their properties can be found in the Earth's Atmosphere Chart located in the reference tables. The liquid sphere is called the hydrosphere. This sphere covers close to 70% of our planet. It has a density close to 1.0 /cc. The ocean is the largest part of this sphere. The solid Earth consisting of rocks and the plates is called the lithosphere. This sphere is the densest of the three. Looking closer at density, the equation is D = m/v. If a rock is broken into two smaller pieces, the density will remain the same. Density of a gas does change by heating it or changing the pressure on the gas. When the atmosphere is heated, it expands causing a decrease in its density and the air rises. When air becomes colder, it contracts and sinks. A density relationship involving a gas can be stated.."If the volume increases, the density will decrease".

stratosphere
weather
hydrosphere
lithosphere
troposphere
M/V
heating
decreases
expands

Our Earth is almost perfectly round. Therefore, the altitude of polaris will appear to increase when traveling north in the Northern Hemisphere. The altitude of Polaris always equals the observer's latitude. For example, if a person observes the altitude of Polaris to be 55 degrees, then his latitude is 55 degrees. Polaris will appear to be at an altitude of 0 degrees at the equator and 90 degrees at the North Pole. Latitude is measured N and S from the equator, and it is 90 degrees at the most. All lines of latitude are parallel. If a person travels east or west on a latitude line, the altitude of Polaris will remain the same. However, a person will enter new time zones. Longitude is measured E and W from the Prime Meridian and is 180 degrees at most. Every 15 degrees of longitude equals one time zone. This is based on the Earth's rotational speed of 15 degrees per hour. If a person is 60 degrees away from the Prime Meridian, the time difference will be 4 hours. All lines of longitude meet at the poles. If a person travels north on a longitude line the time zone will not change but the altitude of Polaris will change. A degree of latitude and longitude can be further subdivided into minutes. One degree is equal to 60 minutes. This coordinate system enables us to accurately locate positions on our round planet.

latitude
east
west
parallel
Polaris
Prime
minutes
15
90
0
4
180
time
poles

FIELDS – ISOLINES

A field is a region of space where there is a measurable quantity of a given property. Equal values within a field are connected by lines called isolines. Equal temperature values are connected by isotherms. Equal air pressure readings are connected by______________. Contour lines connect points of equal elevation. A contour map, or topography map, shows the shape of the Earth's surface. The contour interval is the difference in height between two adjacent contour lines. When contour lines are very close, the gradient is steep and may show a cliff. To find the gradient, take the difference of the two elevations (change in field) and divide by the horizontal distance. In a depression, the elevation drops as you move inward like the top of a volcano. On a contour map, the highest a hill can be is one foot less than the next line. So, if the contour interval is 40 feet and the last contour line shown is 620 feet, the highest the hill could be is 659 feet. Whenever contour lines cross a stream they will form a V that points upstream. Streams always flow down-slope eventually reaching the ocean at an elevation of zero. A side view, or profile is the shape of the land between two points.

isotherms
depression
gradient
isolines
profile
interval
isobars
659
upstream
distance

ROCKS AND MINERALS

Minerals make up rocks. Minerals can be pure elements like lead (Pb) or compounds like halite (NaCl). Minerals that contain a profitable amount of metal are known as ores. These resources are non-renewable, and we must use them wisely. A mineral is identified by its physical and chemical properties. Metallic and non-metallic are examples of a mineral's luster, the way light reflects off the mineral. A streak test shows the mineral's powder color when rubbed on an unglazed porcelain plate. Crystal structure, the shape that the minerals take as they cool, is an excellent property. Hardness is rated on Mohs'scale of hardness with 1 being talc, the softest mineral, and 10 being diamond, the hardest. This scale is based on the minerals' ability to scratch another mineral. Certain minerals show cleavage, the way it splits into smooth planes. The property opposite this is called fracture; the mineral breaks unevenly. The internal atomic arrangement of minerals controls many of the above properties. Density is a good property, but mass and volume alone do not help us identify the mineral. Many minerals and their properties are given on the last page of the reference tables. This chart is organized into groups according to the luster of the minerals. This chart shows that magnetite and pyrite are two minerals that have Fe as an element in their composition.

luster
physical
crystal
non-renewable
streak
ores
scratch
elements
volume
fracture
pyrite
cleavage
atomic

Igneous, or the "Fire Rocks," are made as the molten material cools and solidifies to produce this type of rock. Igneous rocks are either extrusive or intrusive and can be recognized as such by studying their texture. Intrusive igneous rocks will show coarse texture, or crystal size, indicating slow cooling deep within the Earth. Extrusive igneous rocks show fine or glassy texture indicating quick cooling near the surface. The Igneous Rock Chart lists the different igneous rocks and gives the minerals found in these rocks. Granite will contain the mineral quartz while basalt will contain the mineral pyroxene. The composition of igneous rocks is felsic or mafic. Felsic igneous rocks contain Al, while mafic igneous rocks contain the elements Fe and Mg. Remember, any rock that solidifies from magma or lava must be igneous.

solidifies
igneous
Al
texture
coarse
quartz
glassy

(Rocks and Minerals - continued)

If rocks are subjected to heat and pressure, but do not melt, metamorphic rocks are produced. The two types of metamorphism are contact and regional metamorphism. Contact amorphism involves a small area and is caused by the heat of magma or lava. In regional tamorphism large areas of rocks are changed by great pressure and heat. They are usually found in mountainous areas. Because of the intense pressure on these rocks, the original shape or structure becomes distorted. In gneiss, a metamorphic rock, the black minerals line up in rows known as Banding. The Metamorphic Rock Chart shows that with metamorphism sandstone becomes quartzite and limestone becomes marble. Metamorphic rocks that have a foliated texture will have flattened and lined up grains. This causes these rocks to be easily split.

marble
distorted
contact
foliated
metamorphic
banding
quartzite

What are the clues for sedimentary rocks? Their origin is underwater, so look for water evidence like fossils, layers, and sediments. Sedimentary rocks, as the name implies, are composed of sediments that are compacted and cemented. These sediments can be from any type of rock, but once cemented it belongs to this family. Inorganic, land derived, sedimentary rocks are classified by the size of their sediments. conglomerates contain the largest sediments, a true mixture of unsorted sizes. Clay, the smallest size sediment, produces the sedimentary rock shale. Some sedimentary rocks have a bioclastic texture; the sediments came from once living organisms. An example of this texture is limestone which is formed from cemented shell fragments. An acid test is used to identify this rock, since it contains the mineral calcite that reacts with the acid. At times, because of climate changes, a sea will evaporate leaving rock salt or halite. These rocks and minerals that are left from an ancient sea are called evaporites. The rock cycle (found in the reference tables) shows the different changes rocks can undergo as they experience weathering, erosion, melting, etc.

conglomerates
cemented
bioclastic
underwater
weathering
rock
shale
evaporites
limestone
halite

EARTHQUAKES –EARTH'S INTERIOR - PLATE TECTONICS

Our dynamic Earth produces earthquakes that give off seismic waves. The fastest wave is the P wave which can pass through solids, liquids, and gases. This seismic wave arrives first, but does little damage. The S wave, or secondary wave, is slower but does more damage. It is stopped by liquids. To determine the distance to the epicenter of an earthquake you must get the separation time between arrival of the P and S waves. Using the Earthquake Travel Time Chart, fit the separation travel time between the P and S wave lines to obtain the distance. one seismogram reading will give you the distance, but not location of the earthquake. To get the location three seismograms are needed. The intersection of three circles drawn with the correct distances from the seismic stations will locate the epicenter of the earthquake. Earthquakes and Volcanos are found in specific zones. The most famous zone is the "Ring of Fire" found around the pacific Ocean. After plotting many earthquakes and volcanoes, plate boundaries were identified.

Studying seismic waves has enabled scientists to infer the properties of the interior of the Earth. As seismic waves travel within the Earth they are refracted, reflected and absorbed as they enter new layers. The largest layer within the Earth is the solid mantle. The Asthenosphere is top plastic-like section of this layer. The outer core is liquid because this layer stops the S waves. From the study of seismic waves and meteorites, scientists believe the inner core is made up of iron and nickel. As distance within the Earth increases, temperature, density, and pressure all increase. These values and other valuable information can be located on the Inferred Properties of Earth's Interior Chart.

plate
one
seismic
liquids
P
three
epicenter
volcanoes
asthenosphere
pressure
iron
mantle
Pacific
S
reflected

(Plate Tectonics - continued)

Major crustal activities are found near the boundaries of plates. At a divergent or spreading plate boundary an ocean ridge system is produced. Here the plates move apart as the new lava cools producing the youngest ocean floor. The most famous divergent boundary is the Mid-Atlantic Ridge. As one travels away from this ridge, the ages of the ocean rocks increase. At a convergent plate boundary, two plates are moving toward each other and colliding. The thinner, denser ocean plate will subduct or dive under the thicker continental plate producing an ocean trench. The subducting plate will eventually be melted within the upper mantle. Many mountains and volcanoes are located along convergent plate boundaries. The third type of plate boundary occurs at a transform fault. Along a transform fault boundary, major earthquakes are experienced when two plates slide past each other. This is happening in California along the San Andreas fault. Huge convection currents within the mantle are believed to be the force that moves the plates over the asthenosphere. These currents are powered by heat from the decay of radioactive material and heat from the Earth's formation. At times the plates move over a Hot spot causing volcanic activity. The Hawaiian Island chain was formed as the pacific plate moved over a hot spot. Your reference tables show many of these hot spots as well as plate boundaries and their relative motions. The Earth is a very dynamic geologic system in which volcanoes, earthquakes, and mountain systems are all interconnected.

Mid-Atlantic
increase
converge
divergent
trench
oceanic
convection
transform
Pacific
hot
radioactive

WEATHER

Weather occurs in the troposphere, the layer of our atmosphere that contains water vapor. Atmospheric weather variables include: air temperature, dew point, air pressure, cloud cover, current weather, wind speed and direction, etc. These variables are placed on a station model which represents the weather of a certain city. This model contains only numbers and symbols. No units are used. On a station model the wind direction is always the direction that the wind is coming from. The wind shown here, O would be coming from the NE. Atmospheric variables are measured with specific instruments. A sling psychrometer can determine the dew-point and Relative humidity values by subtracting the wet bulb reading from the dry bulb reading and using the appropriate charts found in the reference tables. So, if the dry bulb is 20° C and the wet bulb is 14° C, the difference is 6° C. Go to the Dewpoint Temperatures Chart and find 6 on the Difference between Wet-bulb and Dry-Bulb temperature column. Reading down to the intersection of the Dry -Bulb temperature of 20 gives us the answer of 10° C as the dew-point temperature. The same procedure is used to find the RH value and using that chart. An anemometer measures the wind speed, and a barometer measures the air pressure. A barometric reading on a station model is abbreviated by dropping the 10 or 9 and the decimal. So a 1001.2 mb reading will be 012 and 998.7 mb will be 987 .

units
tropospi
station
anemometer
Dry
pressure
NE
relative

Solar energy causes evaporation, resulting in moisture entering the air. This causes an increase in the relative humidity. When warm air rises it expands, cools, and may reach the dew-point temperature. When the Dew point and air temperatures get closer together the relative humidity increases. When these two temperatures are the same the RH is 100 %, and the air is Saturated. Condensation (G→L) can begin producing, clouds, fog, or dew. In a cloud, very small "floating dew drops" gather together, increase in size and weight, and may fall as precipitation. This part of the water cycle removes pollution from the atmosphere, cleaning it.

dew-point
evaporation
pollutants
precipitation
saturated
clouds

(Weather - continued)

A barometer records changes in the weight or pressure of the atmosphere. On a weather map ual barometric pressure readings are connected by _isobars_. When isobars are close the ssure _gradient_ is strong. This causes high winds. Altitude, temperature, and the amount of moisture in the air affects the air pressure. When _moisture_ moves into an area the air will contain more water vapor molecules. These molecules are relatively light and produce _lower_ pressure. Thus a low (L) pressure system contains much moisture, and will usually produce precipitation. Many L pressure systems travel up from the Gulf of Mexico. High (H) pressure systems usually are drier and contain colder air. Since cold air _sinks_ it helps to produce this _higher_ pressure. A High pressure system usually brings clear, sunny skies. Many H pressure systems originate in _Canada_. The winds in a high pressure system blow _clockwise_ and outward, while the winds in a low pressure system blow _counter-clockwise_ and inward. Review. When the barometer starts to rise, a high pressure system is moving in. This will bring relatively clear skies and possible colder temperatures. A falling barometer indicates a _low_ pressure system is moving in bringing precipitation.

moisture
clockwise
lower
sinks
low
gradient
higher
isobars
Canada
counter-clockwise

An _air_ mass is a large body of air with almost the same temperature, humidity, and pressure throughout. The air mass _origin_ is the place where it started and where it picked up its properties. Air masses that form over water are labeled m - _maritime_. Those formed over land are labeled c - continental. An air mass temperature can be labeled P for polar, T for _tropical_, or cA for very cold arctic conditions. Thus, an air mass forming over the Gulf of _Mexico_ would be labeled _mT_. This air mass would be relatively warm and moist. Many air masses travel across the USA from the west toward the northeast bringing a change in weather conditions. When two air masses collide, a _front_ is formed. Along the frontal boundary less dense warm air rises over the colder air. This results in clouds and ventually produces precipitation. The cold air is always _behind_ the cold front, and the varmer air is always found behind the warm front. A _stationary_ front does not move and precipitation usually lasts a long period of time. An occuluded front is associated with heavy precipitation. When a front passes, the winds change direction, the _pressure_ rises, and temperature changes. The overall weather should improve with the passage of a front. All four front symbols can be found in the weather section of the reference tables.

maritime
air
front
stationary
origin
Mexico
mT
pressure
behind
tropical,

The strongest Low system is a hurricane. As it develops from a tropical storm, the _barometric_ pressure drops significantly and _isobars_ on a weather map become closer together. This lower pressure results in very strong winds that move counterclockwise around the _eye_ of the hurricane. Many hurricanes travel from the east to the west over the warm Atlantic Ocean. It is this _warm_ water, which gives the hurricane much of its energy. If they pass over the Gulf of Mexico they usually increase in strength before making landfall. Over _land_ it loses its strength and quickly gets downgraded to a tropical storm. Torrential rains still occur producing much flooding. Hurricanes are very dangerous storms, and proper emergency procedures must be followed. _Coastal_ areas must be evacuated when a warning is issued. Tornadoes are another dangerous weather feature. Unlike a hurricane, a tornado is not a major weather system. They usually develop along a _cold_ front. These twisters are relatively short-lived and small in size. However, they contain the fastest winds known. Early warning systems and seeking proper shelter can save many lives.

isobars
barometric
eye
coastal
land
cold
warm

WATER CYCLE

The energy source for evaporation is the Sun. Most evaporation is produced from surface waters, such as lakes, streams, and the oceans, the largest source. Through the process of transpiration, plants release water into the atmosphere. Water vapor eventually condenses and precipitates back to the Earth, mostly as rain. This water may take one of the following paths: evaporate into the atmosphere, infiltrate or move into the ground, or become runoff and enter streams and lakes. Runoff occurs for a number of reasons, including: when the soil is saturated; when the slope of the ground is too steep; when the ground is impermeable; when there is lack of vegetation in the area. Vegetation will slow down the movement of water, giving it time to enter the ground. If the ground is saturated all the pore spaces are filled, and additional water cannot enter the ground. Some conditions making the ground impermeable are: frozen ground; solid bedrock; a covering of concrete or blacktop. When the ground is permeable, water will enter the soil through pore spaces and cracks found in the bedrock. Porosity is the percent of air spaces within ground material. The greater the porosity of a soil sample, the easier it is for water to flow through. Water retention is the amount of water that is held back or "soaked up" by the soil. This water is absorbed by plant and tree roots. As water is removed from the soil, more water slowly moves upward by the process of capillary action. This upward migration of water works better with smaller sediments. As more water infiltrates the ground, most moves downward stopping at an impermeable layer. This water then moves upward, filling pore spaces, becoming groundwater. The top of this groundwater is called the water table. This level will fluctuate during heavy rainfall or drought conditions. Groundwater is a primary source of drinking water and must be protected from pollution. Once it becomes polluted, it is very difficult to clean.

vegetation
infiltrate
transpiration
oceans
impermeable
runoff
capillary
porosity
sediments
pore
retention
water

CLIMATE

Climate is the average weather over a long period of time. The two variables that determine climate are temperature and precipitation. In a humid climate, an area receives much precipitation. In an arid, or desert area, there is little precipitation and the area is dry. Many factors affect the climate of an area. Distance from the equator is the most important one. The further one is from the equator, the more indirect the Sun's rays are. These rays produce less heating power. Oceans and large bodies of water have an affect on climate as well. During the winter, the oceans are still slowly releasing heat, warming the surrounding air. During the summer, the cooler ocean water will cool the warmer surrounding air. These processes will modify the climate for coastal cities. This is possible because water heats up and cools down slower than land. Inland cities will have a colder winter and hotter summer when compared with coastal cities on the same latitude. The windward side of mountains will be cool and humid due to air that moved up the mountain. This rising air expands, cools to the dew point temperature, causing condensation and eventually rain. The side of the mountain where air is descending is called the leeward side. On this side the drier air moves down the mountain and heats up by compression. The leeward side is the location of many deserts or semi-arid areas.

coastal
distance
temperature
indirect
land
water
windward
compression
leeward

Ocean currents can affect the climate of coastal areas, depending upon whether the area is influenced by a warm or cold current. The California current is a Cold Pacific Ocean current, while the Gulf Stream is a Warm Atlantic Ocean current. Planetary wind belts, also known as the prevailing winds, influence climate. If the prevailing winds come off the oceans, they will be moist. We live in a wind belt called the westerlies. These winds move air masses causing a change in our weather, and they are the cause for the Surface ocean currents. Nature as well as man can alter the climate. El Nino, a Pacific Ocean disturbance, and major volcanic eruptions are examples of natural events that cause disruptions in climatic conditions. Man has had a negative influence on our global climate. Possible global climate changes have been attributed to continuing mass removal of trees, called deforestation, burning fossil fuels, which release much carbon dioxide and urbanization. There is much debate about the extent to which we have changed our climatic environment. Even a small change can have major impacts!

planetary
fossil
cold
warm
surface
deforestation
westerlies
volcanic

SOLAR – ENERGY

The Tropics is the area between 23.5° N and 23.5° S. This area receives direct (90°) rays of sunlight sometime during the year. On June 21st, the direct rays are on the Tropic of Cancer, 23.5° N. After this date, the direct rays move south and reach the equator on September 23rd. This also occurs on March 21st. These two dates are known as the equinoxes (spring/fall), because everyone experiences equal hours of day and night (12/12hrs). On these two dates, the Sun rises and sets exactly (due) east and west respectively. Likewise, on Dec 21st, the Sun is the furthest south, and the direct rays fall on the Tropic of Capricorn, 23.5° S. On this date, NYS is experiencing the most indirect rays. These rays spread out and lose much of their heating ability. After December 21st, the Sun's direct rays move slowly north for the next six months. This cyclic movement of direct sunlight is caused by the tilt of our axis and revolution. During the winter months, the northern axis points away from the Sun, and the Northern Hemisphere experiences indirect rays. Six months later in the summer, the northern axis points toward the Sun, producing more direct rays. In NYS, the Sun takes its highest and longest path during the summer. This produces the greatest duration of insolation about 15 hours. At this time (in the summer), the North Pole experience 24 hours of sunlight. Throughout the year the Sun's path appears to change. If observed in NYS, the summer Sun will rise in the NE and set in the NW. The winter Sun will rise in the SE and set in the SW taking a very low path. This produces the least duration of insolation, only around 9 hours. Since our latitude in NYS is higher than 23.5°N, the noon Sun is never directly overhead, thus we never receive direct sunrays.

north
south
revolution
March 21
December 21
equator
direct
indirect
summer
insolation
duration
NE
SE

Sunlight that enters our atmosphere may be reflected, refracted, scattered, or absorbed by atmospheric dust, gases, and clouds. The sunlight that reaches the Earth's surface interacts with the surface material it strikes. Dark, rough surfaces are the best absorber of solar energy. Light, smooth surfaces absorb the least amount of energy. Different materials heat up and cool down at different rates. The Specific Heat Chart shows this relationship. Any substance with a number less than 1 will heat up and cool down faster than Water. Lead has the lowest number (.03), so it will heat up faster than other substances on this chart. Land surfaces heat up about 4 times faster than water. When water absorbs energy, it may evaporate. It takes 540 calories to evaporate one gram of water. One gram of water will release 80 calories when it freezes. This and additional information is given in the Properties of Water Chart found on page 1 of the reference tables. When a substance absorbs energy, it may transfer this energy by one of three methods: radiation, conduction, or convection. Radiation is the only method of heat transfer that can pass through space, a vacuum. The Sun is our major source of radiation.

Specific
smooth
absorbed
rough
land
radiation
water
80
540

Conduction is when heat is moved by molecular collisions. Solids transfer heat by this method. In convection, liquids and gases warm up, become less dense, and rise as the more dense substance sinks. This produces a convection current which is due to differences of temperature and density. These convection currents can be found in our atmosphere, the oceans, and within the mantle. These currents inside the Earth cause the movement of plates.

mantle
conducti...
convectio...

Electromagnetic energy travels at the speed of light. The EM spectrum consists of waves with different wavelengths. Ultraviolet and visible light waves have shorter wavelengths compared to Infrared waves. The Earth absorbs mostly short waves then radiates longer, infrared waves. These longer wavelengths, (infrared) can be absorbed by water vapor, methane, and carbon dioxide (CO_2). These gases are considered to be greenhouse gases. Many climate experts believe our atmosphere is undergoing a greenhouse effect resulting in warmer global temperatures. As the amount of greenhouse gases, especially CO_2 increases the global temperature increases. Another aspect of global warming is the thinning of the ozone layer. This gas absorbs the most harmful ultraviolet rays. Destruction of this gaseous layer will cause more harmful UV waves to reach our planet. This may increase global temperatures and cause more skin cancer. There are many other complex factors involved with global warming. The Ice Ages are reminders that our planet has not always been in radiation balance.

greenhouse
infrared
ultraviolet
CO_2
spectrum
ozone

WEATHERING - EROSION - DEPOSITION

Weathering is the physical and chemical breakdown of rocks near the Earth's surface. Weathering wears away the engraving on tombstones, it slowly disintegrates statues, and over time forms underground caves. For weathering to occur, rocks must be exposed to air and water over a long period of time. In chemical weathering, the rock's chemical composition is changed. Water, natural acid, and pollution producing acid rain are responsible for a great deal of chemical weathering. In physical weathering, rocks are broken down into smaller sediments, but their chemical composition is not changed. Frost action is a major physical weathering process. This action occurs when water expands as it solidifies to ice forcing rock cracks to widen. As weathering continues, rocks are broken down into smaller and smaller sediments. Soil is the end product of many years of weathering. The top layer of soil is organically rich due to biological activity. Bugs, worms, and bacteria decomposed leaves, and other organic material making soil fertile. An area's climate determines the type of weathering it will experience. Hot, humid areas experience more chemical weathering. Moist, colder, mountainous areas experience more physical weathering.

physical
chemical
frost
water
expands
humid
biological
soil

Erosion involves two processes: transportation and deposition. Sediments and soil are eroded or transported from their place of origin and deposited elsewhere. The main agents of erosion are: glaciers, gravity, wind, wave action, and water, which move the most sediments. Gravity is the main force that moves most of the agents of erosion. As water transports sediments, they become rounder and smaller by the action of abrasion. The velocity of the stream determines the size of the sediments that it can carry. The faster a stream flows, the larger the size of sediments it can transport. A stream's velocity is controlled by the stream's gradient and its discharge (volume). In the youthful stage of a stream, water will produce a V-shaped valley. As the gradient becomes more level the stream velocity will decrease causing the stream to meander and eroding sideward, developing a curving stream channel.

meander
abrasion
deposited
V
decrease
gradient
water

(Weathering-Erosion-Deposition - continued)

A stream channel is always deepest where the water is moving the fastest. Within a straight stream channel the middle of the stream has the fastest water, thus the deepest channel. In a curved stream channel the fastest water is located on the outside of the curve, and much erosion occurs here. On the inside curve, water slows down causing deposition. Overtime this action can produce small islands and oxbow lakes. As the gradient becomes less, sediments start to deposit, dropping the largest sediments first and the smallest (clay) last in a sorted manner. Deposition of sediments in water is controlled by particle size, shape, and most importantly, density. For deposition to occur, the stream velocity must decrease. Most deposition occurs when a stream loses its energy as it enters a lake or ocean. As deposited sediments build up at the mouth of a stream a delta is formed. A floodplain is a broad flat depositional area adjacent to a stream. This area, in time, will experience flooding that can cause serious damage to housing settlements. The land area that a stream receives its water from is referred to as its watershed. A major stream and its tributaries drain this area. A divide separates watersheds. The Mississippi is the largest watershed in America.

deposition
density
fastest
decrease
erosion
delta
floodplain
sorted
watershed

Wind can pick up only the lightest sediments such as sand, silt and clay. These suspended sediments will act like a sandblaster, pitting the surface of the material it hits. Wind erosion is more prevalent in arid climates and along beaches. A wind-generated feature is sand dunes. Overtime, these hills of deposited sand migrate, or move, as wind erodes them. Mass movements such as rock slides landslides, and mudflows are sediments that moved rapidly down-slope under the influence of gravity. These movements are accelerated with high slopes and soil that is saturated with water. Earthquakes can trigger a deadly mass movement. Creep is a slow form of mass movement causing once vertical objects to become tilted over time.

slopes
sand
earthquakes
arid
rockslides
clay
gravity

A large mass of ice that does not melt each year is known as a glacier. During the Ice Age the climate remained cold and continental glaciers, with the help of gravity, moved throughout most of Canada and northern USA including NYS. These large sheets of ice eroded, and dissected the area it traveled over, changing the landscape. The glaciers in NY have long since disappeared, but the evidence of their erosional action is still present. Valleys were carved wider by the ice taking on a U-shaped appearance. Sediments from sand to boulders were easily carried in the ice. They polished, scratched, and grooved the underlying bedrock. A glacial feature found on Long Island is a terminal moraine. This is a large hill composed of unsorted glacial sediments that shows the most forward position of the ice sheet. Other glacial features include: drumlins, smaller hills usually running N and S; kettle lakes, produced from large ice chunks; and outwash plains, found on Long Island, where melted rushing water deposits sediments in a sorted manner. Deposited glacial sediments may dam up U-shaped valleys, producing valley lakes like our famous Finger Lakes. In mountainous areas, hanging valleys with many waterfalls and sharp, angular looking peaks are evidence of the erosional work of glaciers. Many glaciers are presently melting and retreating. This is an indicator of a warming global climate.

U
bedrock
moraine
landscape
glacier
kettle
Ice
global
waterfalls
Finger

Beach erosion and deposition occur within the zone of breakers, where wave action is present. Waves approach the beach at a slight angle producing a long-shore current that runs parallel to the shore. This current will transport and deposit sand, parallel to the shore. Over time these deposits produce sand bars or larger landmasses called barrier islands. Man builds expensive houses on these temporary islands that may be seriously damaged by erosion during major storms.

parallel
barrier
breakers
long-shore

GEOLOGIC HISTORY

Forces that acted upon the Earth in the past continue to act upon the Earth today. Using this principle, geologists assume that today's rivers erode and deposit sediments the same way they did billions of years ago. Thus, sedimentary layers located on the bottom of an outcrop are older than those on top. This type of dating sequence, which uses the terms younger and older, is known as relative dating. Faults are always younger than the layers they cut. An igneous intrusion is younger than the layers it affects. An intrusion will produce contact metamorphism on layers magma touches. This will include the layer above the intrusion. To distinguish an intrusion from a buried extrusion, check for contact metamorphism on the top of the intrusion. Correlation is the matching of strata or bedrock from one location to another. The best technique for this process is the identification of index fossils. This fossil was an organism that lived for a relatively short period of time, was abundant, and widespread. Other excellent time markers used in correlating strata are: volcanic ash and meteoritic fragments. An erupting volcano releases large quantities of ash that is widely distributed and quickly settled. This will act as a marker that can help date and correlate layers. The same is true with meteoritic fragments. Fossils are found in sedimentary rocks. They are considered to be the same age as the rock layer they are found in. Sedimentary layers are deposited horizontally underwater. Later, these layers may become folded, faulted, or tilted by forces within the Earth. An unconformity is produced when uplifted layers are eroded, and eventually submerged underwater, where new layers are deposited. Later, uplift brings this eroded "time gap" to the surface of the Earth. On a diagram an unconformity is identified by a darkened wavy line.

In absolute dating, radioactive elements are used to obtain actual dates. This is done by studying the half-life of radioactive elements. Half-life is the length of time necessary for half of a radioactive sample to become non-reactive. As a radioactive element decays, its half-life remains the same, but the amount of radiation decreases. After one half-life, the % of the radioactive element (R) to non-radioactive element (NR) is 50-50%. After two half-lives, the R is 25 % and the NR is 75%. Carbon-14 is used to date relatively young organic material such as bones and tree fragments which are less than 50,000 years old. The decay product of C-14 is N-14. Uranium has a very long half-life, and is used to date very old rocks. The Radioactive Decay Data Chart contains much of this information. By studying and dating fossils, scientists observe changes or adaptations within species. These changes occur as the organisms adapt to environmental stresses. From fossils, scientists determined that there are many organisms that have become extinct throughout the history of our planet. Using fossil evidence, the Geologic Time Line was developed. The Precambrian era is, by far, the longest time span of any era. It started 4.6 billion years ago, the estimated age of our Earth and solar system. There is not much information from this era because many of the rocks and fossils have been changed or destroyed by processes shown in the rock cycle. During this stage in geologic history, there were many erupting volcanoes that released enormous amounts of gas and steam. Geologists believe that our early atmosphere and oceans were made by this volcanic outgassing. Over millions of years, as our planet cooled, the water vapor condensed and precipitated to produce the oceans. In this era, most life forms were single - celled animals which were not well preserved.

contact
index
sedimentary
intrusion
older
abundant
relative
correlation
ash
unconformity
fossils
meteoritic
underwater

1 word
non-radioact
Carbon-14
absolute
uranium
fossil
decreases
condensed
adaptations
Precambrian
rock
Geologic
single
outgassing

(Geologic History - continued)

The Paleozoic era was the age of sea life. Trilobites, fish, insects, amphibians, and reptiles made their presence by evolving from the seas. During this era, there were many mountain-building episodes called orogenies. This era is divided into 6 periods. The Cambrian is the oldest, occurred 544 million years ago. During the last period, the Permian, many kinds of marine animals, including trilobites, became extinct.
The Mesozoic era was the age of the dinosaurs. This era is divided into 3 periods: the Triassic, the Jurassic, and the Cretaceous periods. During these periods dinosaurs roamed the land. The earliest birds and flowering plants appeared. At this time, rifting occurred and the continental plates spread apart to form the Atlantic Ocean. This era came to an end with the extinction of the dinosaurs some 65 million years ago. The youngest era, the age of the mammal, is the Cenozoic era. This is the shortest era, but included the advance and retreat of the last Ice Age and uplift of the Adirondack region. At the end of this era, man arrived. Answers to any questions on time span of eras and periods, life on Earth, fossils, important geologic events in NY, and plate movements are located in the center pages of the reference tables.

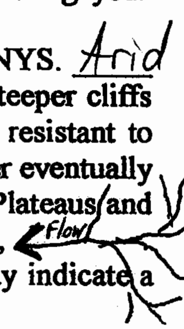
rifting
Paleozoic
Jurassic
Cambrian
orogenies
dinosaurs
man
Cenozoic

LANDSCAPES

A landscape is a region of the Earth's surface in which physical features such as hills, valleys, and streams produce common topography. The landscape of a region is mainly determined by the area's climate, surface bedrock, and the interaction of uplift and erosional forces. Mountainous areas have the highest relief with folded or tilted bedrock. The Adirondack Mountains are NYS's highest mountainous landscape region containing very old metamorphic rocks. Plateaus are elevated horizontal layers with moderate relief. Over time, plateaus may be dissected, or cut, into hills and valleys by agents of erosion, especially by water and glaciers. This is what occurred on the Allegheny Plateau, NYS's largest plateau region. This is especially evident throughout the catskills which contain some very high hills. The Tug Hill Plateau is a small-elevated area on the eastern end of Lake Ontario. Due to its elevation and location, moist air is forced to rise up over the plateau. The air cools, condensing the water vapor, which results in large amounts of lake effect snow. Plains, known as lowlands, show the least relief. They are generally flat areas. The Erie-Ontario Lowlands are found next to Lake Ontario. Long Island is considered to be a coastal plain. Glacial sediments that were deposited during the Ice Age formed Long Island. As one travels around NYS the different landscapes are easily recognized, but bring your reference tables along to identify them.

relief
plateaus
climate
glaciers
condensing
Allegheny
Catskills
Erie-Ontario
Lowlands

Landscapes in moist climates generally produce round hills, as found within NYS. Arid areas, that contain less vegetation experience more erosion, and develop sharp, steeper cliffs like those found out west, (like the Grand Canyon). A bedrock layer that is resistant to erosion may produce a cliff. The softer bedrock layers are eroded away faster eventually exposing the cliff. Certain stream patterns result from specific landscape types. Plateaus and other flatter regions usually develop a dendritic drainage pattern, as illustrated here,



Radial drainage patterns in which streams running away from the center area, may indicate a landscape containing volcanoes. This is illustrated here:

In all landscape areas, uplift and erosional forces work against each other over a long period of time. If the erosional forces are more dominant in a landscape region, the gradient will eventually become more level. If uplifting forces, like volcanoes and plate collisions, are more dominant the area will increase in elevation.

bedrock
volcanoes
uplifting
moist
arid
erosional
cliff

ASTRONOMY AND DEEP SPACE

Our day is based on the rotation, or spin of the Earth. A swinging Foucault pendulum provides proof of this daily motion. A swinging pendulum will appear to slowly change direction due to the rotating Earth. Another proof of rotation is the Coriolis effect, which causes moving objects to get deflected to the right in the Northern Hemisphere. Projectiles, oceans, and wind currents demonstrate this action. Our year is based on the Earth's period of revolution, the time needed to complete one orbit. Proofs of revolution are seasons and seasonal stars. If the Earth did not revolve we would experience only one season, since the direct rays would not move to other positions on the Earth. During the winter nights, we see the constellation Orion (a group of seasonal stars). Six months later, due to revolution, Orion is out during the day. This constellation is not visible due to the bright sun. There are two models of motion for celestial (sky) objects: the geocentric model, and the heliocentric model. In the geocentric model the earth was considered to be the center of the Universe. In the correct model, knowwas the heliocentric model, the Sun is the center of the solar system. All planets orbit the Sun due to the gravitational attraction of the Sun. The size of the force of gravity depends on the mass of two objects and the distance between them. As the mass of the objects increase, the gravitational attraction increases. As the distance between the two objects increases, the gravitational attraction decreases. This is why Mercury's period of revolution is so fast (88 days) and Pluto's orbit, is so slow (247.7 years). This relationship can be stated; the closer a planet is to the Sun the shorter it's period of revolution.

Coriolis
Foucault
revolutio
rotation
heliocentric
constellation
Earth
decreases
mass
gravitational
distance

The inner planets are rocky and dense. Thus, they are given the name terrestrial planets. The Jovan planets: Jupiter, Saturn, Neptune, and Uranus are the giant gaseous, low-density planets. Venus is the hottest planet because of its runaway greenhouse effect in which clouds and CO_2 trap heat. Venus is also unique because its period of rotation is longer than its period of revolution. This causes its day to be longer than its year. Celestial objects that do not have an appreciable atmosphere will contain many impact craters. Earth's atmosphere burns up most entering objects. The moon, with no atmosphere, has many craters. Kepler explained how all planets travel in elliptical orbits with the star (sun) in position at a focus. Eccentricity is found by dividing the distance between foci by the length of the major axis. The eccentricity (e) number will always be between 0 and 1 and has no units. The lower the e number, the rounder the orbit. Neptune, with an e of .009, would have a very round orbit. Mercury, with an e of .206, would be much more elliptical. Since all planets revolve in an elliptical orbit, their orbital speed increases as they get closer to the Sun and the gravitational attraction increases. The Earth is closer to the Sun in the winter. Thus, it has its greatest orbital speed during this season. Its orbital speed decreases in the summer because it is further from the Sun. Within our Solar System there are meteoroids, comets, asteroids, dust, gases, and lots of space.

impact
elliptical
winter
axis
terrestri
comets
greenhouse
lower

Our moon is controlled by the Earth's gravitational attraction. It shows different phases as it revolves around the Earth. The phases of the moon are caused by the amount of reflected sunlight we see from the moon as the moon revolves around the Earth. There are 8 phases of the moon, they include: ~~new~~ crescent, first quarter, ~~new~~ waxing gibbous, full, ~~old~~ waning gibbous, third quarter, ~~old~~ crescent, and new moon. This sequence of phases takes approximately 29 days, very close to a month, to complete. There are two eclipses: the solar eclipse in which the new moon blocks the Sun, and the lunar eclipse in which the full moon moves into the Earth's shadow. Remember the name of the eclipse is the object that is being blocked.

gibbous
crescent
lunar
moon
new
solar

(Astronomy- continued)

Our Sun is a medium-size star whose gravity controls all objects within the Solar System. Our Solar System is located on an arm of our spiral galaxy known as the Milky Way. The Milky Way is one of billions of galaxies that is found in our Universe. Astronomers tell us that the Universe started from an explosion, estimated to have occurred over ten billion years ago, called the Big Bang. Astronomers tell us that the Universe is still expanding outward from that explosion. Evidence for the Big Bang theory includes: left over measurable background cosmic radiation, and a shift of spectral lines known as the red shift. Light from distant galaxies can be spread out into spectral lines. Studying these visible lines, they were all found to have shifted towards the red end of the visible light spectrum. This occurs if a radiating object is moving away from the observer at high speed. This proof has lead astronomers to the conclusion that our Universe is still expanding. Because of gravity, material in space, consisting of gases, dust, molecules, and atoms, form enormous clouds called nebulae. As the material contracts, the temperature increases and the cloud rotates faster. As the cloud gets smaller, the center part heats up to a temperature so high that nuclear fusion begins. In this process lighter elements, especially hydrogen, are combined to form heavier elements, especially helium. This nuclear reaction releases great amounts of energy and a star is born. The color of a star indicates its temperature; red stars are the coolest and blue stars are the hottest. In the Luminosity and Temperature of Stars Chart, found in the reference tables, stars are placed according to temperature and brightness. The main sequence is an area on this chart where most stars are clustered. Blue supergiants are the most massive. Red dwarfs are among the coolest and small stars.

spectral
red
galaxy
away
Universe
nebulae
supergiants
hydrogen
color
blue
dwarfs
red
fusion
sequence
helium

Part B and C of the Exam

These two parts, which are worth 35 points, are so important. Each question demands that you take your time, reading the question slowly and carefully. When a diagram is given, make sure you study it, looking over all its details. Do this first, even before you go to the questions. For some problems, you will use an equation, found on the front page of the reference tables. You may be asked to substitute into the equation; make sure you do this before you solve for the correct answer. For all equations the correct units must be shown or you will lose credit. The major exception is the eccentricity equation in which the answer does not have any units. For the Rate of Change equation, the change in field value is found on a graph. This is then divided by time. In the gradient equation, change in field value is divided by distance. You will be expected to read scientific articles. This must be done slowly for good comprehension. Refer back to the article for important clues or information to use within your answer. You might have to state a relationship between two variables. Many times the relationship is shown by a graph. Take time and understand the variables for both axes. There is a very good chance that you might have to draw a profile (a side view) from a contour map. Using a piece of scrap paper, mark all the points where the contour lines meet the profile base line. Transfer these markings over to the given profile sheet. Your beginning and ending profile points are critical. Don't forget them when connecting the elevation points.

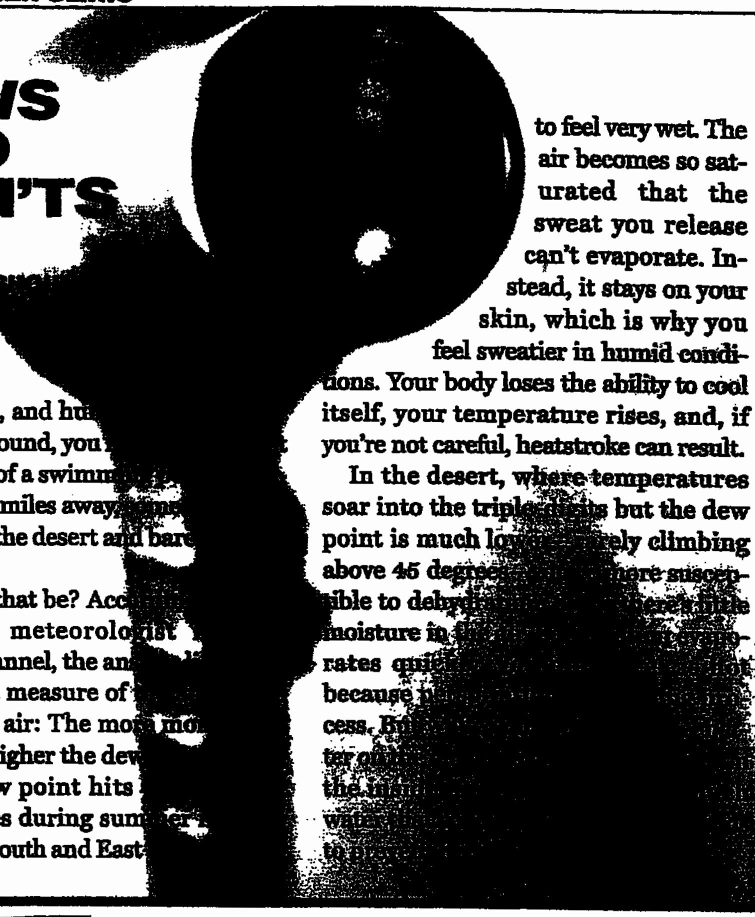
So take my advice and study hard, reading over this packet many times. Do 3 to 4 practice exams understanding the answer for each question. If you do this, and worked hard throughout the year and during the review lessions, you will pass. So enjoy the summer, but take my advice, always use sunscreen.

Good luck, your Earth Science teacher

field
distance
graph
gradient
eccentricity
study
variables
clues
time
contour
sunscreen
profile

DEWS AND DON'TS

WHAT YOU [...] ABOUT DR[...] HUMIDITY



It's hazy, hot, and hu[...] ishing your round, you [...] stepped out of a swimm[...] while, 2,500 miles away[...] teeing off in the desert and bare[...] ing a sweat.

How can that be? Acc[...] McClellan, meteorologist [...] Weather Channel, the an[...] dew point, a measure of [...] water in the air: The mo[...] the air, the higher the dew[...]

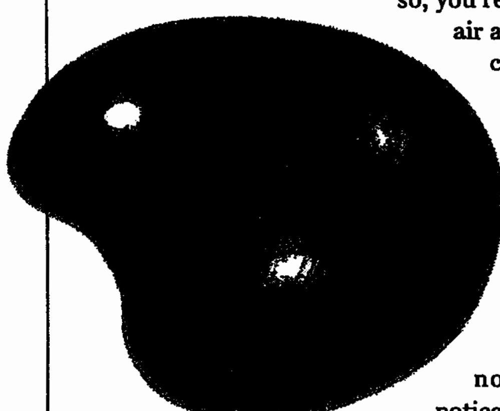
If the dew point hits [...] which it does during sum[...] parts of the South and East[...] to feel very wet. The air becomes so saturated that the sweat you release can't evaporate. Instead, it stays on your skin, which is why you feel sweatier in humid conditions. Your body loses the ability to cool itself, your temperature rises, and, if you're not careful, heatstroke can result.

In the desert, where temperatures soar into the triple[...] but the dew point is much lo[...]ely climbing above 45 degree[...] susceptible to dehyd[...] moisture in [...] rates qui[...] because [...] cess. Bu[...] ter [...] the [...]

ONE LESS EXCUSE

HOT, HUMID AIR WON'T SLOW YOUR BALL DOWN

Worried that humidity hampers ball flight? Think that the ball has a harder time pushing its way through dense air? If so, you're all wet. Hot, humid air actually is lighter than cold, dry air. And water vapor is lighter than dry air, so on a humid day the air is actually less dense, providing less resistance. That means a golf ball will fly farther on a humid day—but not enough that you'll notice a difference.



Our conclusion: Don't sweat it.