Answer Key
for

Based on the New York State Earth Science Curriculum

TOPICAL REVIEW BOOK COMPANY

Answer Key
for
Physical Setting Earth Science Laboratory Investigation Handbook

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Cover Photo
Depicted is a Cretaceous Seas Diorama found in the Milstein Hall of Ocean Life
AMERICAN MUSEUM OF NATURAL HISTORY
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Lab Investigation 1: Bicycle Race

Essential Question: How can data be illustrated so that one can easily determine relationships?

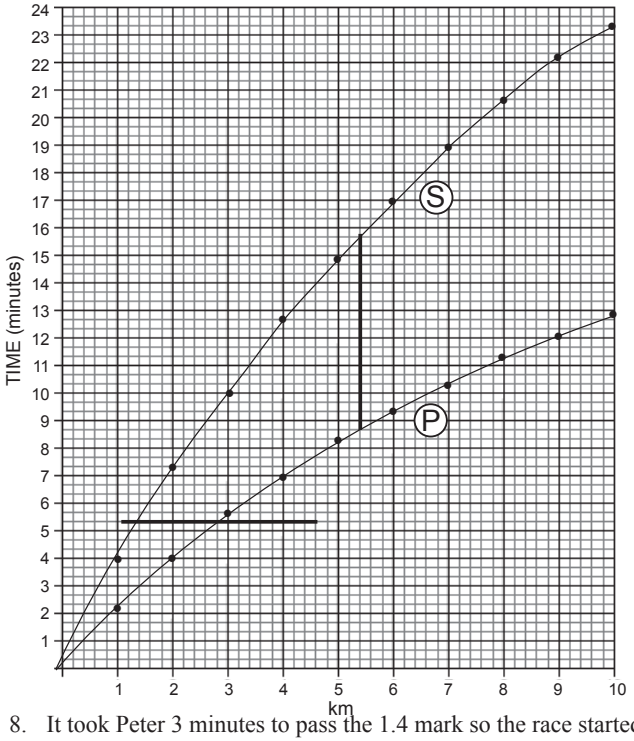
Hypothesis: **If –** data is arranged in a graph
Then – the relationships can easily be determined
Because – the curve is in relation to the *y*-axis.

Variables: **Independent:** Time **Dependent:** Distance

Observations:

1. 12 minutes becomes 720 seconds + 50 seconds equals 770 seconds, divided by 10 km equals 77 seconds per kilometer. Minus 60(1 minute) and the answer is 1 minute 17 seconds.
2. 23 minutes becomes 1380 seconds + 20 seconds equals 1400 seconds, divided by 10 km equals 140 seconds per kilometer. Minus 120 (2 minutes) and the answer is 2 minute 20 seconds.
3. Peter traveled 2 km in 3 minutes. That is a rate of 0.66 km/minute.
4. Steve traveled from 1km to 1.9 km in 3 minutes That's is a distance of 0.9 km. That is a rate of of 0.3 km/minutes.
5. Peter cycled at a faster rate. The graph for Peter's travel is lower, showing a greater distance to time ratio.

6. & 7. Graph



6. Peter: 2.8 km
   Steve: 1.2 – 1.3 km
   Distance: 2.6 – 2.5 km apart

7. Peter's time: 8 min 40 sec
   Steve's time: 15 min 40 sec
   Difference: 7 minutes

8. It took Peter 3 minutes to pass the 1.4 mark so the race started at 12:15 pm.
9. Steve's rate of change has been consistently slower than Peter's. If he had gotten a slow start, he would still be slower with or with out the slow start.
10. The curve in the graph shows Peter's rate of change gets faster as time goes by. In looking at the data table, a rate of change equation would need to be applied.

Lab Investigation: 2 Density of Fluids

Objective: The objective of this laboratory exercise is to determine the density of various fluids.

Essential Question: How can the density of fluid be determined?

Hypothesis: **If –** the mass of the fluid can be determined,
less the vessel it is in, and the volume is known,
Then – density can be determined.
Because – density is the relationship of mass to volume.

Variables: **Independent:** Volume **Dependent:** Mass

	Column 1	Column 2	Column 3	Column 4	Column 5
Liquid in graduated cylinder	**Mass of graduated cylinder with Liquid (g)**	**Mass of Empty graduated cylinder (g)**	**Mass of Liquid (mL)**	**Volume of Liquid (mL)**	**Density of Liquid (g/mL)**
Water	*Answers vary*	*Answers vary*	*40 g*	**40 mL**	*1.0 g/ml*
Oil	*Answers vary*	*Answers vary*	*36 g*	**40 mL**	*0.9 g/ml*

Water Range: Mass of Water correct answer is 40 g 36 – 44 ml acceptable range
Density of Water is acceptable to be 0.9 – 1.1 ml

Oil Range: Mass of Oil correct answer is 40 g 30 – 38 ml acceptable range
Density of Oil is acceptable to be 0.9 – 1.1 ml

Observations:

1. Water has a greater density
2. Ice will float on top of water, but oil will float on top of ice.
3. Answers vary, accept reasonable explanations
4. Liquids will mix but quickly reorganize so that water will be on the bottom, ice in the middle and oil on top.
5. Stays the same
6. Stays the same
7. Ice has a lesser density than liquid water.
8. The units for the metric system for density are g/cm^3 and g/ml.
9. The temperature at which water has a density of $1g/cm^3$ is 3.98°C.

Conclusion:

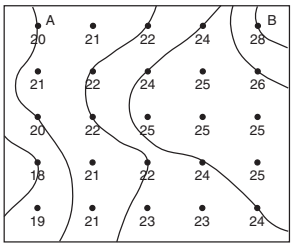
10. Answers should include reference to density differences, comparison of mass to volume, consistency of density regardless of volume, specific gravity, etc.

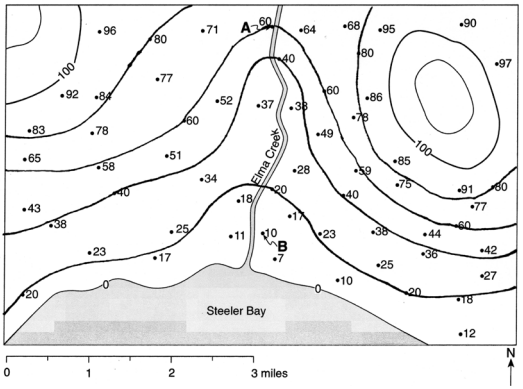
Lab Investigation 3: Isolines

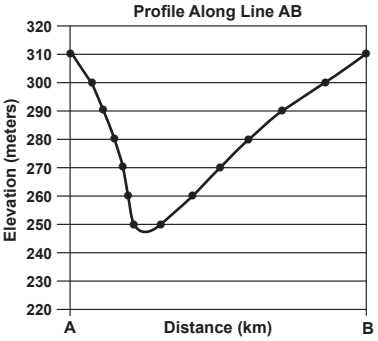
Essential Question: How can isolines be used to illustrate the features of a landform?

Pre-Lab:

1. An isoline is a line of value where all points on that line have equal value.
2. No
3. No







Observations:

1. When isolines are close together, it indicates a steep slope or a sudden change.
2. Not every point can be included because it is a line indicating equal value and a field is an indication of a range.
3. Elma creek flows south into Steeler Bay
4. The lines of elevation indicate that the farther away from the bay, the higher the elevation. The Vs point upstream, which is away from the bay.
5. 310 – 230 = 80 meters
6. 2.65 Kilometers *or* 2.65 km
7. Long Creek is flowing south. This is supported by changes in elevation and Vs.
8. Eastern slope would be a better hike because is more gentle. *or* The west slope would be a better hike because is more challenging
9. East of Long Stream as it is a gentler slope. Accept west if the student indicates that they want a challenging hike.
10. Answers vary, but look for steepness of slope, distance to or away from water, etc

Lab Investigation: 4 – 3-D Topo Map

Essential Question: How can a topographical map be made in 3-D?

Observations:

1. The highest possible elevation of Tall Mountain is 699 ft.
2. The contour interval is 100 ft.
3. The south slope of Tall Mountain has the steepest slope.
4. The filed value of each level is 100 foot range.
5. The feature on the east side of Tall Mountain is a river/stream.
6. The highest possible elevation of Small Hill is 499 ft.
7. The lowest possible elevation of Lost Hollow is 101 ft.
8. Sorry, due to a misprint there is no question # 8 in the 3-D Top Map Observations section.
9. The edge of each layer are all values of equal elevation.
10. As you travel from the peak of Tall Mountain to the lowest possible point of Lost Hollow, you descend 598 ft

Lab Investigation: 5 Latitude, Longitude and Time

Essential Question: Why are there times zones?

Hypothesis: **If –** there are different areas that have a local noon
Then – time must appear differently
Because – the earth is spherical.

Variables: **Independent:** Longitude **Dependent:** Time

Pre-Lab:

1. 360° are in a circle
2. There are 24 hours in a day
3. 360 / 24 = 15
4. The sun appears to travel at a rate of 15° per hour

City	Latitude	Longitude	Time
London, England	51° N	0° W	Noon
Reykjavík, Iceland	64° N	21°W	*10:00 am*
Rio de Janeiro, Brazil	22° S	43° W	*9:00 am*
Cape Town, South Africa	33° S	18° E	*1:00 pm*
New York City, United States	40° N	74° W	*7:00 am*
Sydney, Australia	33° S	151° E	*10:00 pm*
Yucatán, Mexico	20° N	89° W	*6:00 am*
Christchurch, New Zealand	43° S	172° E	*11:00 pm*
Vancouver, Canada	49° N	123° W	*4:00 am*
Puerto Williams, Chile	54° S	67° W	*8:00 am*

Observations:

1. The Sun rises in the east
2. An eastern city would see the Sun first because the Sun rises in the east.
3. Time zones should be 15° apart because that is about how far apart areas would be from seeing local noon.
4. Our time zone is Eastern Time Zone, (in New York State).
5. Rio de Janerio will see the Sun rise first
6. The time difference will be two hours.
7. The difference in degrees from Yucatán to London, England is 89°.
8. Cape Town would see sun rise first.
9. If Japan just rang in the New Year, then it is 7:00 am, December 31 in Los Angeles, California.
10. We have time zones because the Earth has solar noon only in a small area. We have to separate these areas into arcs of 15° because the earth rotates at a speed of 15° / hour.

Lab Investigation: 6 United States Time Zones

Essential Question: Why do we have time zones in the United States?

Hypothesis: **If** – we know that the United States exceeds 15°,
Then – we must have time zones
Because – the sun appears to travel in a 15° arc in one hour.

Variables: **Independent:** Longitude **Dependent:** Local Time

City	Latitude & Longitude	Time Zones
New York, New York	40° 43′ N 74° 00′ W	*Eastern*
Dallas, Texas	32° 78′ N 98° 80′ W	*Central*
Denver, Colorado	39° 44′ N 104° 59′ W	*Mountain*
San Francisco, California	37° 46′ N 122° 26′ W	*Pacific*

Pre-Lab:

1. New York, New York is the northernmost city.
2. The cities are approximately 15° apart.
3. The residents of Dallas, TX would have to wait until 10:00 pm to see the baseball game because the two cities are about 30° apart

Observations:

1. The difference between the two locations is 11°.
2. There is no difference in times zones.
3. The difference is four hours.
4. The longitudinal difference between Lubec and Key West is 15°.
5. There is no delay; both cities are in the same time zone.
6. The eastern most longitude for New York State is east of 41°.
7. The longitude for Ripley, New York is west of 79° and 45′.
8. The longitudinal difference is 7 and one half degrees.
9. Montauk, New York will see the Sun rise a half an hour before Ripley, New York will.
10. The students in the two schools will have to report to school at the same time because all on New York is in the Eastern Time Zone.

Lab Investigation 7: Crystal Growth

Essential Question: How can one observe crystals' properties?

Hypothesis: **If** – crystals are observed over time,
Then – the properties can be seen
Because – the growth over time more clearly shows observable patterns.

Observations after 3 days:
1. Students will express that there might be seeing small deposits on the string.
2. Answers will vary. Should be described in terms of crystals.
3. Answers will vary. Should be described in terms of crystals.
4. Answers will vary. Should be described in terms of crystals.
5. Answers will vary. Students should indicate that the crystals would be larger as time goes by.

Observations after 7 days:
6. Crystals should be larger.
7. The crystals that formed out of solution are called precipitate.
8. Answers will vary. If using a slat based power, students should be seeing cubic structures.
9. Students should indicate that there is a relationship with the length of time that crystals have to form and the size of the crystal.
10. Students should gather that crystals grow larger when given the proper amount of time.

Lab Investigation 8: Mineral Identification

Essential Question: How can minerals be identified using the mineral identification kits and the Earth Science Reference Tables.

Observations:
1. Minerals can most easily be identified using the mineral's hardness
2. No.
3. Many minerals have colors in common.
4. You need to scratch minerals to determine the hardness of minerals. Since we know the hardness of the scratching materials, we can extrapolate the hardness of the mineral.
5. Answers will vary, should include cleavage, color, texture and/or luster
6. No, hematite's streak does not match its color, neither does pyrite.

Conclusions:
7. Minerals have unique hardness. So minerals that have colors in common can be differentiated.
8. Minerals have many colors and some minerals look like other minerals, an example is gold and pyrite. Pyrite is also known as fool's gold.
9. The main difference between graphite and diamond is the internal arraignment of atoms.
10. Answers should include explanations about scratching, unique properties of minerals, and other features such as cleavage.

Lab Investigation 9: Igneous Identification

Essential Question: How can minerals be identified?

Observations:

1. The difference between granite and rhyolite is the grain size, which is the result of its origin of formation.
2. Granite and gabbro are both formed in a magma chamber but granite is felsic and gabbro is mafic which means there is a difference in mineral content; granite has potassium feldspar and gabbro has pyroxene and olivine.
3. Vesicular means it has holes. The holes are the result of gas leaving the lava as it is cooled and solidified into rock.
4. Mafic rocks are more dense than felsic rocks
5. The differences are color and density and composition.
6. Diorite is composed of quartz, plagioclase feldspar, biotite and amphibole.
7. Vesicular Rhyolite is made of potassium feldspar, quartz, plagioclase feldspar, biotite and amphibole.
8. Dunite is unique on this chart because it is monomineralic, meaning it is made of one mineral.
9. The elements that make mafic rocks so dense are magnesium and iron.
10. By knowing how rocks are formed and the properties of the composition of different materials, one can easily differentiate the rocks by origin and mineral content.

Lab Investigation 10: Sedimentary Rock Identification

Essential Question: How can sedimentary rocks be identified?

Observations:

1. These rocks are made from pieces of other rocks; sediments.
2. The different grain size of the rock helps one to identify the different sedimentary rocks.
3. The fundamental difference between siltstone and shale is the grain size of the rock.
4. Conglomerate has rounded particles (clasts) while breccia's fragments are angular. (This indicates that conglomerate was deposited in running water, as the particles were rounded.)
5. Clastic sedimentary rocks are formed form rocks that are felsic in nature. Most commonly referred to as granitic rocks.

Conclusions:

6. Crystalline rocks are mostly made of one mineral. (monomineralic)
7. 75% of the exposed earth's surface is made of sedimentary rock.
8. Limestone is made of mostly of calcite which dissolves in acid. Acid is found in rain as the result of water mixing with carbon dioxide in the atmosphere creating carbonic acid.
9. Sedimentary rocks are formed by materials depositing and cementing together. Igneous rocks are formed from melted minerals which would destroy any remains and metamorphism would distort and then destroy any remains that were in a rock
10. Build your house on sandstone, shale is not strong and is prone to collapse.

Lab Investigation 11: Metamorphic Rock Identification

Essential Question: How can metamorphic rocks be identified?

Observations:

1. The two types of metamorphic rocks are foliated and non-foliated.
2. Foliation refers to the way in which the minerals align as the result of metamorphism.
3. Metamorphic rocks are transformed by heat and pressure from all other types of rocks including metamorphic rocks.
4. The type of rock you will get from the metamorphism of limestone is marble, a non-foliated rock.
5. The type of rock you get over a large area is called regional metamorphism, associated with mountain building.
6. Gneiss will have discreet sections of minerals with coarse grains.
7. Gneiss is that rock that has undergone the most intense heat and pressure as evidenced by the banding.
8. Gneiss is a higher grade of metamorphic rock than schist. Both gneiss and schist have similar composition but gneiss might have garnets, a metamorphic produced mineral.
9. Horfels is a rock formed exclusively from contact metamorphism.
10. Phyllite is a rock that is extremely flaky and breaks easily.

Lab Investigation 12: Earthquake Location

Essential Question: How can an earthquake be located?

Hypothesis: **If** – seismic data is gathered,
Then – we can locate an earthquake
Because – seismic waves are predictable.

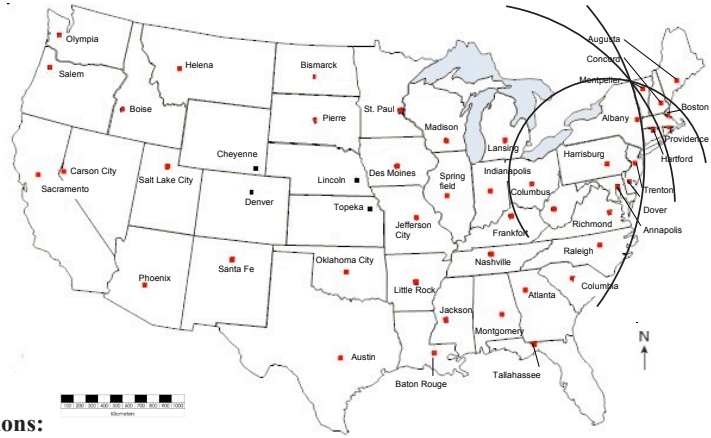
Variables: **Independent:** Time **Dependent:** Distance

Report Sheet # 1

Station Time	P-Wave Travel Time	Distance to Epicenter	S-Wave Travel Time	Distance to Epicenter
Palisades, NY,	00:03:20	*1600* km	00:06:00	*1600* km
Newport, VA	00:07:50	*4600* km	00:14:00	*4600* km

Report Sheet #2

Seismic Station	"P" Arrival	"S" Arrival	"S" minus "P"	"P" Travel	Distance Epicenter
Annapolis, MD	12:01:00	12:02:30	00:01:30	00:01:40	800
Oklahoma City, OK	12:04:00	12:08:00	00:04:00	00:05:00	2600
Des Moines, IA	12:03:00	12:06:00	00:03:00	00:03:40	1800



Observations:

1. The epicenter is located in New York State.
2. Plattsburgh is the closest city to the epicenter.
3. One seismograph can only show how far the seismograph is to the epicenter.
4. Two seismographs can show two possible points as to where the epicenter might be.
5. If one did not have a drawing compass, one might look at the seismogram and find where the P-wave arrival is closest to the S-wave arrival.
6. The rate at which S-waves travel, slows as time passes.
7. Seismic stations can record seismic waves on the other side of the planet because seismic waves pass through the Earth.
8. There is a shadow zone between 104° and 140° from the focus of an earthquake. S-waves cannot travel through liquid outer core and P-waves get refracted.
9. Seismographs can record nuclear testing, building collapse, and construction.
10. Scientists use seismograms to detect the internal structures of the Earth.

Lab Investigation 13: Volcano Location

Observations:

1. A volcano is an area where there is a fracture in the earth's crust and where magma comes to the surface and becomes lava.
2. Composite volcanoes are the most common type of active volcanoes.
3. A composite volcano is made of alternating layers of debris, cinders, and hardened lava.
4. The three types of volcanoes are cinder, composite and shield.
5. There is a pattern of volcanoes around the planet.
6. Volcanic distribution around the planet are along plate boundaries, most clearly around subducting zones, the volcanoes are offset from the plate, while the volcanoes are directly on the divergent plate boundary.
7. Composite volcanoes are associated with convergent plate boundaries.
8. Subducting plate boundaries are most closely associated with volcanic activity.
9. New York State students should answer that volcanoes are not likely to form in their area.
10. Earthquakes occur along plate boundaries, which cause fractures in the crust. As plates diverge, a gap in the crust forms, as one plate subducts under another, the former plate melts and rises through the overriding crust.

Lab Investigation 14: Pangea

Essential Question: How can Pangea be reconstructed using geologic evidence?

Observations:

1. Fossils and rock types
2. The shape of the continents helps to line up Pangea.
3. The continents did not fit perfectly; weathering and erosion changed the shoreline.
4. Pangea existed approximately 200 million years ago.
5. Some ways in which the idea of Pangea first came about was noticing that the shore lines of western Africa and eastern South America fit together.
6. Continents changed shape over time.
7. Africa
8. North America is moving toward Asia as the Pacific shrinks.
9. North America is moving away from Europe.
10. 1

Pangea cutout page

Lab Investigation 15: Chemical Weathering

Essential Question: How can we infer information about chemical weathering?

Hypothesis: **If** – chemical weathering rates differ,
Then – we can test the weathering rates,
Because – chemical reactions would be different.

Variables: **Independent:** Time in minutes **Dependent:** Particle size

Observations:

1. The material in the beaker eroded.
2. The material in the beaker eroded.
3. The material in Beaker B weathered faster
4. They both bubbled, they both smelled bad.
5. The material in Beaker B reacted more quickly.
6. Answers will vary
7. Students should note that the smaller the particle size, the faster the weathering rate.
8. Limestone is a rock rich in calcite, a component of chalk.
9. One would associate chemical weathering with limestone. (good point to discuss karst topography)
10. Rocks can be weathered by physical weathering such as root action and by chemical weathering such as chemicals secreted by roots. Rocks can be damaged by acid rain and frost wedging.

Lab Investigation 16: Physical Weathering

Essential Question: How can physical weathering be modeled in the classroom?

Hypothesis: **If** – water gets into cracks and freezes,
Then – rocks will break
Because – water expands when it freezes.

Variables: Independent: Time in minutes **Dependent:** Volume of water in test tube

Observations:

1. The water inside the test tube froze. It also expands.
2. The water froze and expanded.
3. (This depends on the students' equations)
4. The water appears lighter in color (keep in mind that there is food coloring in the water). Some students find that the vortex frozen at the top of the test tube fascinating.
5. Rocks would crack due to the expansion of ice.
6. Places where the temperature reaches the point at which water freezes.
7. Places need water to seep into the rocks in order to freeze. Arid climates don't have a lot of water.
8. Potholes form when water seeps into the road and cracks the rock.
9. This experiment shows that water expands when it freezes.
10. Seal driveways, repair cracks, etc.

Lab Investigation 17: Rock Abrasion

Essential Question: How can rock's weathering be demonstrated?

Hypothesis: **If** – river stones are weathered by tumbling
Then – it can be demonstrated without using water
Because – water is not necessary for the weathering of the rocks.

Variables: Independent: Time in minutes **Dependent:** Shape of object.

Observations:
1. The shape of the objects at the beginning of the exercise is cubic.
2. The shape of the objects at the end of the exercise is spherical.
3. Answers will vary depending on how much energy was exerted.
4. The cubes banging into each other caused the cubes to change shape.
5. The cubes relate to the stones as rocks tumble past each other and the tumbling action breaks the cubes/rocks together.
6. If the objects were shaken less vigorously, the rocks would have rounded less slowly.
7. If less energy were put in the effort, the objects would not have rounded that quickly.
8. If the objects were shaken more vigorously, the objects would have rounded more rapidly.
9. If more energy were put into the effort, the material would have eroded more rapidly.
10. River stones are formed by rocks tumbling past one another, their bumping into each other cause them to break and the sharp or round edges come off and smooth out.

Lab Investigation 18: Settling Rate

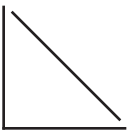
Essential Question: How would glass beads of different sizes settle in a liquid?

Hypothesis: **If** – glass beads were dropped in a liquid,
Then – there would be a settling rate difference
Because – size is a factor in the particle test.

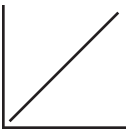
Variables: Independent: settling rates in seconds **Dependent:** Particle size

Observations:
1. The largest bead dropped the fastest.
2. The medium size bead had the greatest variance.
3. The larger the bead, the faster the settling.
4. Larger objects such as boulders, cobbles, pebbles will settle out of moving water faster than sand, silt or clay.
5. Larger particles settle first.
6. (b) Decreases, should indicate an inverse relationship graph.
7. (a) Increases, should indicate a direct relationship graph.
8. (a) Increases, should indicate a direct relationship graph.

6)



7 and 8)



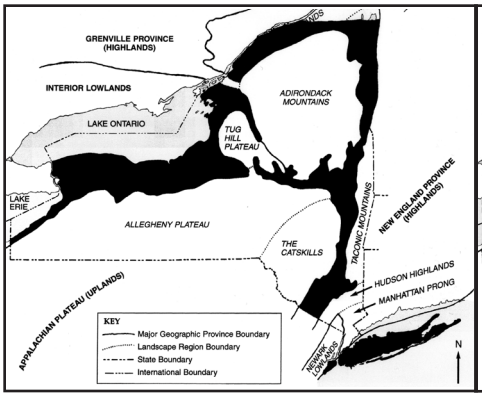
9. (c) As the size of the glass beads increase, the density remains the same.
10. As the particle size increase, the rate of deposition increases.

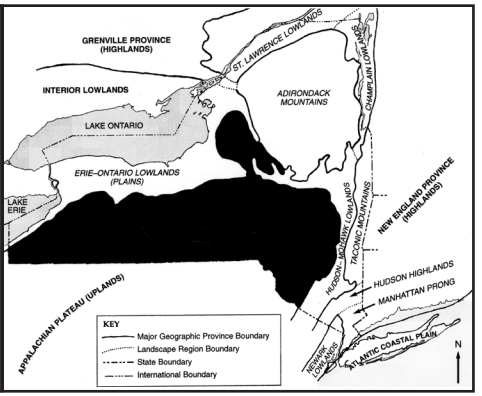
Lab Investigation 19: Landscapes

Essential Question: How can information about landscapes help to gain an understanding of the topography of New York State?

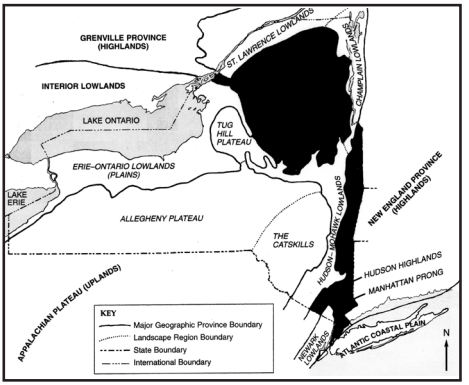
Plains Regions - colored in blue

Plateau Regions - colored in green





Mountain Regions - colored in red



Observations:

1. The type of bedrock in a mountainous region in New York State is metamorphic rock. (The result of folding.)
2. The student should have chosen one of the landscape regions that are mountainous; Adirondack Mountains, Taconic Mountains, Hudson Highlands or Manhattan Prong.
   Why? – Because the bedrock is metamorphosed.
3. Sedimentary Rock
4. The student should have chosen one of the landscape regions that are plateaus; Allegheny Plateau, Catskills, or Tug Hill Plateau.
   Why? – Because of the high elevations and horizontal strata of sedimentary rock.
5. The type of bedrock in a plains region is sedimentary rock of flat strata. or unconsolidated sediment.
6. The student should have chosen one of the landscape regions that are plains; Erie-Ontario Lowlands, Hudson-Mohawk Lowlands, Newark Lowlands, or Atlantic Coastal Plain. (Long Island is an acceptable answer.)
   Why? – Because of the low elevations and horizontal strata of sedimentary rock or unconsolidated bedrock.
7. One would find intensely metamorphosed rock in a mountainous region in New York State.
8. The term Catskill Mountains is misleading because the Catskills are part of the Allegheny Plateau. It is not mountainous, just an area of high elevation
9. New York is not a mountainous state. After looking at the map, plateau is the most common landscape.
10. Answers will vary.

Lab Investigation 20: Local Water

Pre-Lab:

Water cycle: Repeated movement of water between the earth's surface and the atmosphere.
Porosity: The number of pores in a material compared with its volume.
Capillarity: The ability of a soil to draw water upward into tiny spaces between soil grains.
Permeability: The ability of a soil to transmit water.
Infiltration: Water seeping in to the ground.

Essential Question: How can one find the quality of the drinking water for one's entire watershed?

Observations:

1. Answers will vary
2. Water is essential to life.
3. Geology determines where local water is stored because permeable rock will have ground water, impermeable rock will have above surface reservoirs.
4. Answers will vary
5. Answers will vary
6. Students will express monitoring systems and interstate governing agencies, possible federal governing agencies.
7. Answers will vary. Can include;
   animal, human waste – runoff from roads – industrial waste
8. Communities can leave larger areas around drinking sources to protect against runoff, regulate industry and recreational areas such as golf courses.
9. Answers will vary
10. Answers will vary

Lab Investigation 21: Stream Beds

Essential Question: How can depositional patterns be observed in streambeds?

Hypothesis: **If** – streambeds are manipulated,
Then – we can observe depositional patterns
Because – the patterns in streambeds depend on steepness of slope.

Variables: **Independent:** Steepness of streambed measured in degrees
Dependent: Sorting of sediment

Observations:

1. The steepest angle will have the greatest water velocity.
2. The stream with the straightest channel will have the deepest channel.
3. (The sides got pulled into channel – deposition on the inside of the meander / erosion on the outside of the meander)
4. Raise the angle of the stream table. Manipulate the coarseness of the sediment.
5. The minimum stream velocity to transport sand is approximately .50 cm/sec.
6. The largest particle that can be transported in a stream traveling at 100 cm/sec is a pebble.
7. As the water slows to still water, larger particles will settle first in a sorted column.
8. (3)
9. The larger particles deposit as a stream slows to flow into a larger body of water.
10. Type 1: Stream channels will most likely mimic exercise 1.
    Type 2: Can be like either exercise 2 or 3.
    Type 3: Can be like either exercise 2 or 3.

Lab Investigation 22: Geologic Profiles

Essential Question: How do strtographic layers help one to determine the events that occurred in the past?

Geologic Profiles:

Profile 1

A. Deposition
B. Intrusion
C. Intrusion
D. Deposition

Profile 2

A. Deposition
B. Intrusion
C. Erosion
D. Deposition
E. Extrusion
F. Deposition

Profile 3

A. Deposition
B. Folding
C. Intrusion
D. Erosion
D. Erosion
(Line D was repeated inadvertently)
E. Deposition
F. Intrusion

Observations:

1. In an undisturbed layer, the bottom layer is the bottom according to the Law of Superposition.
2. Sedimentary rock are primarily deposited flat because minerals and organic particles settle, accumulate, and deposit within a body of water.
3. We base these Earth processes are the same processes have not changed based on the Theory of Uniformitarianism.
4. Sedimentary rocks are almost always deposited a flat strata because they are frequently deposited in water.
5. Some parts of the rock layers are missing because of erosion.
6. The missing parts of the rock record are called unconformities.
7. All of these events are occurring in the world today. Deposition, erosion, volcanism and earthquakes occur today.
8. The Unconformity was formed during the middle Devonian period.
9. One other feature that each fossil must have in order to be considered an index fossil is that it was widely spread around the planet.
10. The type of environment that the organisms existed, based on the rock type, is a marine environment. This is because the sedimentary rocks are deposited in flat strata.

Lab Investigation 23: Geologic Calenders

EVENT:	YEARS AGO:	Scale: 1 cm = 10 million years
Formation of the Earth	4.6 billion (4600 million)	**460 cm**
Oldest rocks	4.3 billion (4300 million)	*430 cm*
First plant (algae)	3.2 billion (3200 million)	*320 cm*
Abundant stromatolies	1.3 billion (1300 million)	*130 cm*
First animal (jellyfish)	580 million	*58.0 cm*
Start of Paleozoic	**542 million**	*54.2 cm*
First vertebrate animal	500 million	*50 cm*
First land plants	440 million	*44 cm*
First insects	420 million	*42 cm*
First reptiles	350 million	*35.0 cm*
Start of Mesozoic	**251 million**	*25.1 cm*
First dinosaurs	225 million	*22.5 cm*
First mammals	210 million	*21 cm*
Break-up Pangaea	200 million	*20 cm*
First birds	150 million	*15 cm*
Dinosaurs extinction	66 million	*6.6 cm*
Start of Cenozoic	**65.5 million**	*6.55 cm*
First man-like animals	4 million	*0.4 cm*
Ice Ages Start	1 million	*0.1 cm*
First Neanderthal man	0.11 million	*0.011 cm*
Today	0.00 million	*0.0 cm*

Observations:

1. The longest era is the pre-Cambrian era.
2. The New York State fossil is the Eurypterid.
3. Humans and dinosaurs lived 65 million years apart.
4. The time-line indicates that the dinosaurs died off before the rise of humans.
5. Geologic Scale was originally constructed based on the life that existed on earth at different times.
6. The student should indicate that they fit in at the end of the time scale.
7. The rocks in the Adirondacks began to metamorphose 1300 million years ago.
8. The Palisades Sill formed because of the break up of Pangea.
9. The peak period of the New York State fossil was the early Silurian.
10. The earliest appearing creature whose species is still alive today are the jellyfish.

Lab Investigation 24: M & M Life Lab

Essential Question: How can half life be demonstrated?

Hypothesis: **If** – M&Ms were flipped,
Then – 50% would turn over
Because – of the probability

Observations:

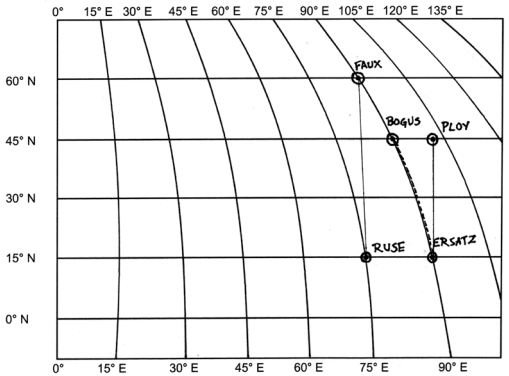
1. All of the atoms were changed at the end of the experiment.
2. Approximately one half of all of the atoms changed after each trial.
3. The half-life of each atom is 500 years.
4. The half-life of Carbon^{14} is 5700 years.
5. Not all of the atoms of Carbon^{14} will eventually disappear because it is constantly being recreated in the atmosphere when nitrogen reacts with charged particles from the sun.
6. Answers may include the following: not regular change of M & Ms, irregular time periods, eating your lab materials.
7. Carbon^{14} has a half-life of 5700 years. The material that might have once existed in the Pre-Cambrian period no longer exists.
8. Carbon^{14} cannot be used to date quartz because quartz does not contain carbon.
9. If you have a sample of Cacium^{40} as a decay product, the parent material might have been Potassium^{40}.
10. In 4.5×10^9 years, you will have ½ kilogram of lead.

Lab Investigation 25: Coriolis Effect

Pre-Lab:

1. The planetary winds between 40°30′ N and 45° N have South West global wind patterns.
2. A "change in the weather" would be tracking from the southwest or the west.
3. A student in Miami, Florida would expect their global wind patterns to be the North East Winds.
4. A student in Miami, Florida would expect their global wind patterns to be from the north east.

Coriolis Effect



Observations:

1. The difference between the intended target and the actual target is approximately 10°.
2. From the perspective of Ersatz, the projectile curved to the right.
3. The terrestrial coordinates for the City of Ploy is 45° N and ~100° E. (± 3°)
4. From the point of view of Faux, the projectile curved to the right.
5. The terrestrial coordinates of Ruse are 15° N 75° E.
6. The southwest planetary winds are traveling northeast.
7. The winds of the southwest planetary winds are curving to the right.
8. The Gulf Stream Ocean current is curving to the right in the Atlantic Ocean.
9. The California Current in the Pacific Ocean off the western coast of North America is apparently curving to the right.
10. The atmosphere and hydrosphere do not move at the same rate as the lithosphere because as the Earth is heated by the Sun, there is an uneven heating, creating convection currents in the atmosphere and hydrosphere. Since the atmosphere and hydrosphere are in motion, they are more effected by Earth's rotation.

Lab Investigation 26: Atmosphere Pressure and Cyclones

Essential Question: Is there a relationship to atmospheric mass of dry and moist air and atmospheric pressure?

Hypothesis: **If** – 100 molecules of air were measured,
Then – then we would see a difference in the mass of the dry and moist air
Because – of the different molecules in each sample.

Hypothesis: If atmospheric mass can be determined then a relationship between atmospheric mass, pressure and movement can be correlated because these can all be calculated.

Variables: **Independent:** Amount of atmospheric water vapor
Dependent: Atmospheric pressure

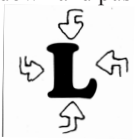
Molecule	Molecular Formula	Molecular Weight
Carbon Dioxide – CO_2	1 carbon, 2 oxygen	12 + 16 + 16 = 44
Oxygen – O_2	2 oxygen	16 + 16 = 32
Nitrogen – N_2	2 nitrogen	14 + 14 = 28
Water Vapor – H_2O	2 hydrogen 1 oxygen	16 + 1 + 1 = 18

Name of Gas	% of Gas in the Atmosphere	(Multiply)	Molecular Weight *	Total
Carbon Dioxide	1	X	44	4
Nitrogen	78	X	28	2184
Oxygen	21	X	32	672
			TOTAL	2900

1 Name of Gas	2 % of Gas in the Atmosphere	3 Multiply by .05	4 (-) column 3 from 2	5 Molecular weight *	6 TOTAL
Carbon Dioxide	*1*	*0*	*1*	*44*	*44*
Nitrogen	*78*	*4*	*74*	*28*	*2078*
Oxygen	*21*	*1*	*20*	*32*	*640*
Water Vapor	*5*			*18*	*90*
				TOTAL	*2846*

Observations:

1. Dry air has a greater mass than moist air.
2. $D = m \div v$ $D = 2900g \div 1\ cm^3$ $D = 2900g/cm^3$
   $D = m \div v$ $D = 2846 \div 1\ cm^3$ $D = 2846\ g/cm^3$
3. Less dense air will rise in relation to more dense air.
4. Dry air will have greater pressure than moist air.
5. As the bristles of the paintbrush are pushed down, the bristles spread out. This is what high pressure air does, it pushes down and pushes out.
6. 

7. 

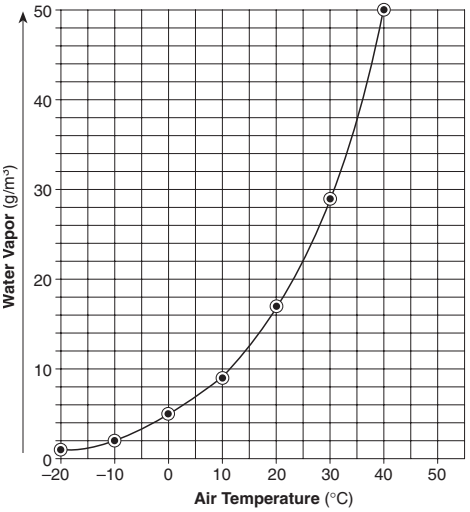
8. Water slowly trickled down, but mainly stayed in top bottle.
9. Water rushed down to the lower bottle, leaving the top bottle creating a vortex as it rushed past the air rising.
10. In this investigation, water represents colder, dense air descends as warmer air, represents warm air rushing upward. The ensuing vortex represents a tornado that is created in this event.

Lab Investigation 27: Dewpoint and Humidity

Essential Question: How can one determine the relative humidity and dew point in the atmosphere at a given time?

Hypothesis: **If** – one had a psychrometer,
Then – one can determine the relative humidity and dew point
Because – the there is a relationship between the dry air temperature and the wet bulb temperature.

Variables: **Independent:** Amount of atmospheric water vapor
Dependent: Humidity and Dewpoint



Observations:

1. Warm air can hold more water vapor than cold air.
2. The saturation level of water vapor at 20°C is 17 g/cm^3.
3. Summer weather has more humidity because the air is warmer.
4. The answers will vary. Generally, indoors is drier than outdoors.
5. The longer the psychrometer is spun, the greater the evaporation is, therefore the lower the humidity and dewpoint.
6. The answers will vary. Generally, indoors is drier than outdoors.
7. The longer the psychrometer is spun, the greater the evaporation is, therefore the lower the humidity and dewpoint.
8. The humidity and dewpoint might be different because the two different places have different air qualities; indoors might have heat on that lowers relative humidity.
9. Dewpoint indicates the likelihood of precipitation.
10. As the dewpoint temperature approaches the air temperature, the relative humidity approaches 100%. This increases the risk of precipitation.

Lab Investigation 28: Clouds

Essential Question: How do clouds form?

Hypothesis: **If** – there were moisture and condensation nuclei
Then – clouds could be made
Because – these are the components of clouds.

Variables: **Independent:** Time in days
Dependent: Weather variables

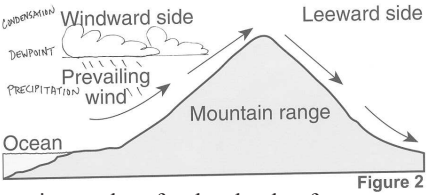


Figure 2

Observations:
1. The smoke in the bottle served as the condensation nucleus for the cloud to form.
2. Water was swished in the bottle to cause the air to become moist.
3. The expansion of the bottle will expand the air in the bottle, cooling the air causing condensation.
4. Clouds need particulates, water vapor and cooling.
5. Clouds form by the expansion of moist air, which cools the moist air below the dewpoint and the moisture condenses onto the particulates, the condensation nuclei.
6. Some clouds are composed of ice crystals because they are at a point in the atmosphere where the temperature is below the point at which water begins to freeze.
7. The air is warming on the leeward side of the mountain.
8. The clouds evaporate as the air mass descends the mountain.
9. The climate on the windward side of the mountain would be dry and warm.
10. The leeward side of the mountain would have a moist rainy climate.

Lab Investigation 29: Cloud Height

Essential Question: How can cloud height be determined?

Hypothesis: If one can find the dewpoint then the cloud height can be determined because clouds can only form when the air temperature is at the dewpoint.

Hypothesis: **If** – air temperature and humidity are determined,
Then – cloud height can be found
Because – clouds do not form below the dewpoint line.

Variables: **Independent:** Temperature **Dependent:** Altitude

Observations:
1. Air temperature is found by looking at the dry bulb on the psychrometer.
2. Answer will vary. (Check the dry bulb temperature)
3. Answer will vary. (Use the scale to determine the cloud height)
4. Pilots might want to know cloud height.
5. Some clouds appear to be flat bottomed because anything below that line is above the dewpoint and the cloud would evaporate.
6. Answer will vary.
7. Answer will vary.
8. The elevation of the cloud when the humidity is 100% would be 0.
9. The type of cloud would be fog, a stratus cloud.
10. Clouds are described by the area in which they were formed.

Lab Investigation 30: Station Models

Essential Question: How can station models assist to predict the weather based on data?

Observations:

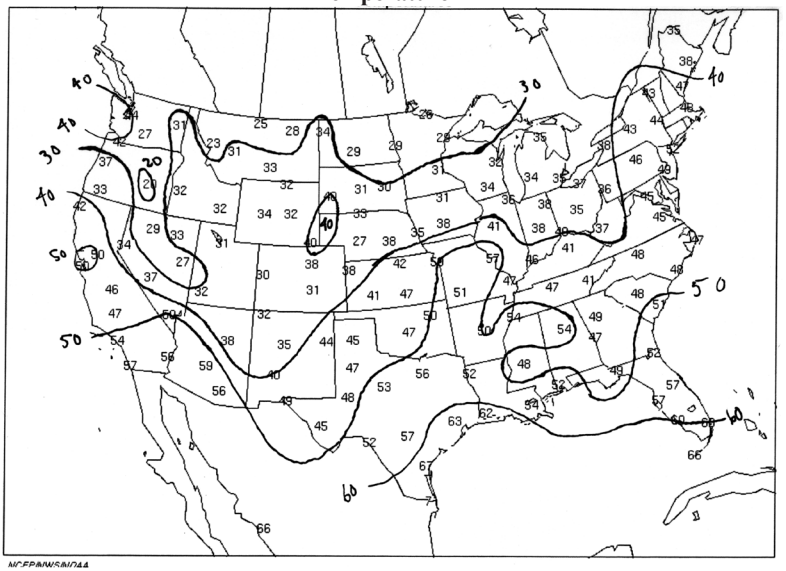
1. Answers will vary.
2. Answers will vary.
3. The relationship for humidity and dewpoint is that as the dewpoint gets closer to air temperature the humidity increases.
4. As dewpoint temperature approaches the air temperature, the humidity increases.
5. As humidity increases, cloud cover increases.
6. Station models summarize weather data through a series of shorthand symbols.
7. Station models condense all data so that a map of a large region can see the graphic representation of the weather and changes across the map.
8. The wind is a northeast wind in the morning. The wind shifted in the early afternoon and abruptly shifted to a south wind.
9. The clouds cleared by at noon.
10. The clouds became thicker approximately two hours after the wind shift.

Lab Investigation 31: Weather Map

Pre-Lab:

1. Two ways of showing precipitation on a weather map is by either having a field indicating precipitation such as a marked field or markers on the station models.
2. Areas of low pressure are called cyclones or zones of convergence.
3. Areas of high pressure are also called anti-cyclones.

Temperature



Observations:

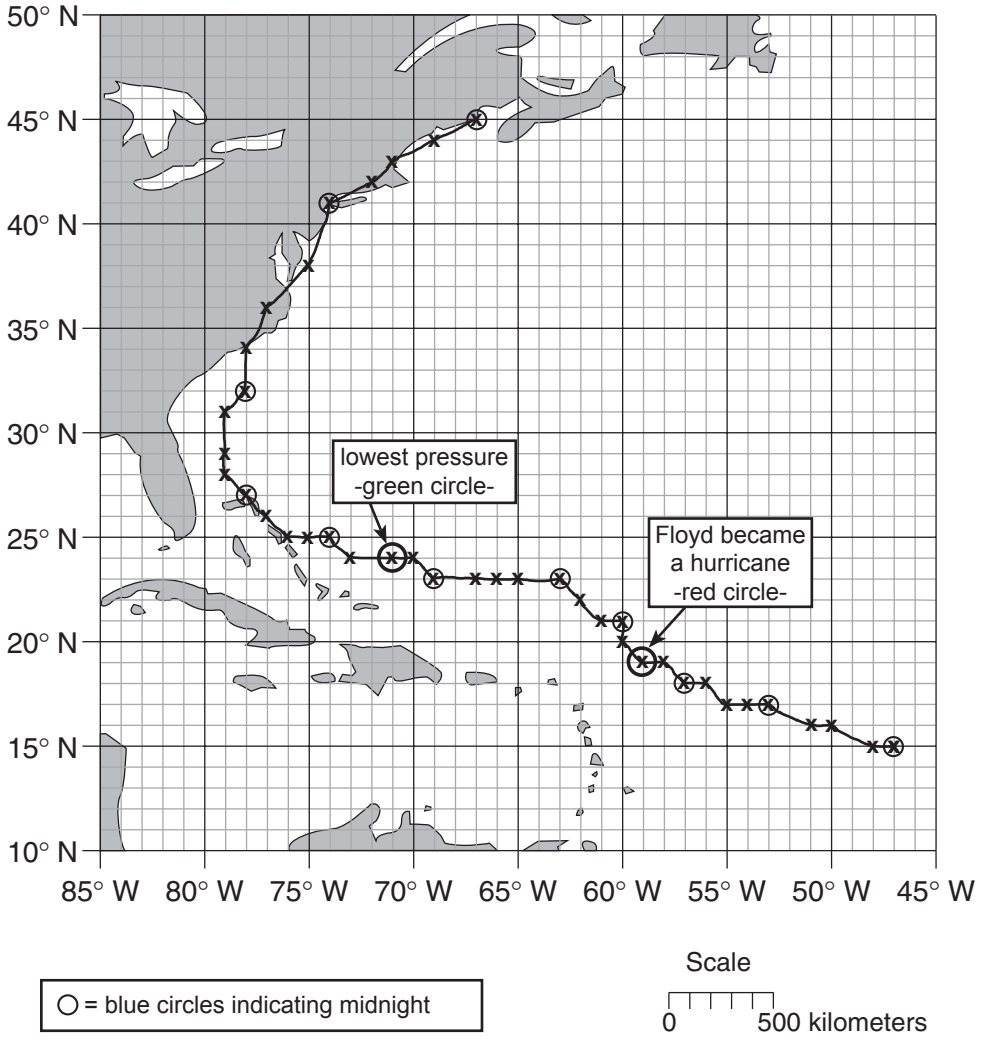
1. Weather Map
2. Thermometer
3. Reduces *or* decreases
4. Areas of high temperatures are over the southern part of the country.
5. Areas of high temperatures are over the western part of the country.
6. Areas that are have had a longer amount of insulation will have higher temperatures.
7. Answers will vary.
8. The wind was a south wind.
9. The wind direction changed about noon.
10. In the late afternoon, the wind changed direction and the although the dew point dipped slightly, the dew point rose away from the temperature, indicating a drop in relative humidity and a high pressures system.

Lab Investigation 32: Hurricanes

Essential Question: Is there a pattern to the path and velocity of hurricanes in the Atlantic Basin?

Hypothesis: **If** – hurricane data is plotted,
Then – a relationship can be determined
Because – hurricanes follow the surface ocean currents.

Variables: **Independent:** Terrestrial Coordinates **Dependent:** Wind velocity



Observations:

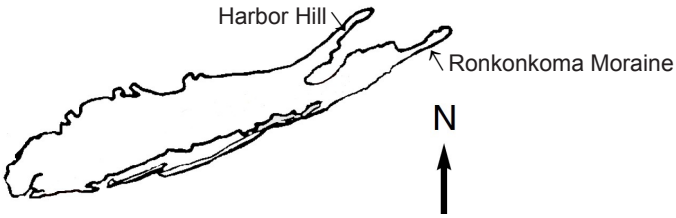
1. The atmosphere gains 2260 joules/gram of water as a result of vaporization.
2. Floyd traveled west in its initial stage.
3. No, Floyd's wind speed did not remain constant. It slowed down at night.
4. No, Floyd's speed of travel did not remain constant. It slowed down at night.
5. Floyd's rate of travel decreased across the ocean from day to night. The ocean does not evaporate as much at night as it does during the day.
6. Floyd changed direction at approximately 28° north.
7. The path that Floyd traveled along is consistent with following the ocean currents.
8. Floyd traveled along the North Equatorial Current.
9. Tropical Storm and Hurricane Floyd traveled along North Equatorial Current and Gulf Stream Current.
10. The ocean currents are consistent with planetary winds.

Lab Investigation 33: A Tale of Two Lighthouses

Essential Question: What are some coastal processes?

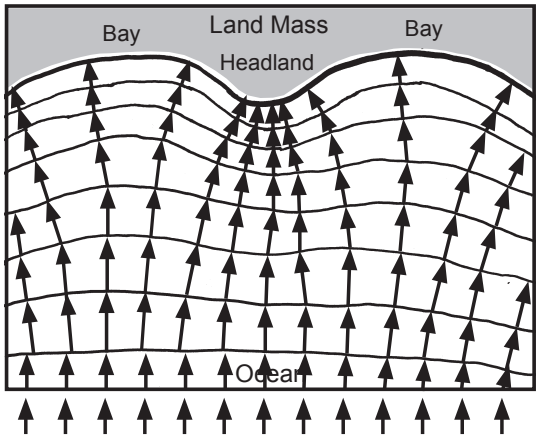
Pre-Lab:

a. The bedrock is unconsolidated material deposited from the last major glaciations.
b. Larger clasts and larger materials than in the outwash plain.
c. The outwash plain would have particles, with sizes between 0.1 and 0.01.
d.



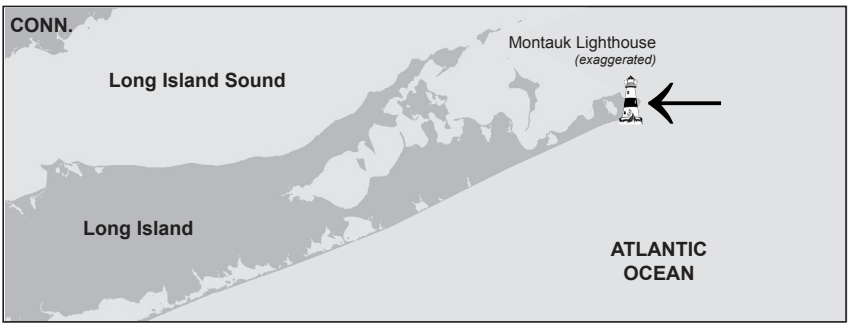
Wave Action

a. The energy is focused at the headland.
b. There is an increase of erosion at this point of energy focus.
c. The waves refract form the beach area.
d. The point of refraction will see an increase in deposition.
e. The shoreline will eventually level out.



Erosion

a. Winter storm winds track from the northeast.
b.



c. Montauk is a point of erosion.
d. If the waves were to approach from the southwest deposition would occur.
e. Answer will vary. Include groins and/or jetties.

Deposition

a. The island is "moving" at a rate of one mile per 25 years.
b. The island is moving according to littoral drift. The sand is being pulled off shore and onto the western end of the island.
c. The Fire Island Lighthouse was originally build on the west end of the island at Democrat Point which is now 6 miles inland.
d. If the waves were to approach from southwest, erosion would be dominant over deposition at the west end of the island.
e. Answers will vary. Include dredging.

Observations:

1. When ocean waves approach the beach, they start to refract because of the friction as the waves touch the bottom of the shore.
2. The headland will receive more energy as the wave energy gets focused at the headland.
3. This area will receive more energy because the waves get refracted to this area.
4. When depositional forces become equal with erosional forces it is called dynamic equilibrium.
5. Montauk Lighthouse is in danger of falling in to the ocean because erosion has been destroying the headland at which the lighthouse sits.
6. Erosion is more prevalent in Montauk because it is a headland in the ocean, first point of contact for Nor'easters, and is the eastern most point on a south facing beach, making it susceptible to littoral drift.
7. Winter sand is eroded sediment from eroded material from eastern Long Island.
8. If unchecked, Fire Island inlet will close.
9. The bedrock of Long Island is unconsolidated till. This is material left behind by glaciers. Material was deposited from glaciers and now erosional and depositional forces from the ocean are shaping the land.
10. This region of New York can continue to move westward. Look for smoothing of features, closing inlets, destruction of eastern end of island.

Lab Investigation 34: Seasons

Season Chart

	Season	Date of First Day of Season	Latitude of Vertical Solar Ray	Name of Latitude
Vernal Equinox	*Spring*	*March 22*	*0°*	*Equator*
Summer Solstice	*Summer*	*June 21*	*23° N*	*Tropic of Cancer*
Autumnal Equinox	*Fall*	*September 22*	*0°*	*Equator*
Winter Solstice	*Winter*	*December 21*	*23° S*	*Tropic of Capricorn*

Equator
Spring and/or Autumn equinox

Answers will vary (New York latitudes are between 40°30′ N and 45° N)

Observations:

1. There are different paths for the different times of the year because of the tilt of the Earth on its axis.
2. The Winter Solstice
3. Because the angle of isolation is the same for both equinoxes.
4. Yes, there was a significant difference in the distance traveled. The higher, summer path is longer.
5. In looking at the path traveled by both equinoxes, we saw that the Sun's path was 12 hours. We also looked the rate of arc of insolation. The arc of the Sun's apparent travel is 15° per hour.
6. The time it takes for the Sun to track during the equinox at the equator is twelve hours.
7. Summer has the longest amount of sunlight. (Summer includes June 21, so it has longer insolation than Spring.)
8. In the Winter, the Sun's path rises south of east.
9. In the Summer, the Sun's path rises north of east.
10. The Sun is below the horizon at 6:00 pm on December 21.

Lab Investigation 35: Electromagnetic Spectrum

Essential Question: What are the properties of the electromagnetic spectrum?

Hypothesis: **If** – different areas of the electromagnetic spectrum are studied,
Then – then its properties can be determined
Because – because light is merely different wavelengths.

Station One Set-Up: Students, near a window can look indirectly at sunlight and then look up at the overhead lights.

Station One:

	Colors observed (indicate if you cannot see all colors)
1. Sunlight	*Shows a continues spectrum of the rainbow*
2. Fluorescent light	*Shows a broken spectrum, heavy on the green light*

Observe: the sunlight is continuous, the other light is not. Additional attention should be made to the colors and distribution of colors.

Infer: Florescent light does not emit all of the wavelengths of the visible spectrum.

Station Two Set-Up: Beads should be checked for color change before assigning to a group. It is also a good idea to have different colors for different groups. The beads have pigments in them that react with ultraviolet light. It is also a good idea to use fluorescent minerals and twenty dollar bills have a security stripe in them.

Observe: The previously white beads should have a color change.

Infer: The beads have pigments in them that react with ultraviolet light. The UV therefore, is the wavelength that will react with the pigments.

Station Three Set-Up: Remotes work on certain infrared signals. Cameras in most phones can "see" infrared. iPhone 4S or later cannot be used. iPads I and II can "see" infrared as well. Most web cameras can be used for this.

Station Three:
Students will not see light.

Repeated with "camera" will see light emitted from the end of the remote. Remotes flash light even when held steady.

Station Four:
1. 10 cm to 25 cm
    a. The right hand moved away from your left hand.
    b. The wavelength increases as it is pulled away from your left hand.
    c. The color shifted to red.
2. 10 cm to 5 cm
    a. The right hand went toward the right hand.
    b. The wavelength decreases as it is pushed to your left hand.
    c. The color is shifted to blue

Station Five Set-Up: There should be four squares of material. The rough material should be felt. The smooth material should be a satin type material. The same color rough and dark material should be afixed to one another either by glue or batting material ironed together in a rectangle of four x eight. The rectangles should then be cut in half. This way, the quality of the material is as uniform as possible. There should be at least two sets for this lab so that one set can cool before the next group gets a reading. A heat lamp should be positioned overhead.

Infer: Darker colors should have absorbed more heat. The rough textures should have absorbed more heat.

Infer: Energy is lost as a result of reflection.

Station Six:
1. The color emitted by the atmosphere is blue.
2. The colors that get scattered by the atmosphere as the wavelengths lengthen the colors scattered in the atmosphere are orange and red.
3. The atmospheric scattering is called Rayleigh scattering.
4. The sky is blue because the atmosphere absorbs all wavelengths except that it emits the wavelength that is blue.

Observations:
1. The fundamental differences of the segments of the various lights of the electromagnetic spectrum is wavelength.
2. The wavelength of visible light is 4.0×10^{-5} to 7.0×10^{-5}.
3. Infrared has longer rays than ultraviolet rays.
4. Rainbows are made by the water in the atmosphere splitting sunlight into its component spectra.
5. What is light emitted from when astronomers see stars moving away from them are red.
6. Ultraviolet can show colors not normally visible to our vision. Security is a good use for this.
7. What is light emitted from when astronomers see stars moving toward them are blue.
8. A good absorber of light energy is a dark rough surface
9. A good reflector of light energy is a light smooth surface.
10. Students should express that wavelengths are the difference between the different wavelengths.

Lab Investigation 36: Where is Our Sun?

Essential Question: What is the angle of the Sun?

Hypothesis: **If** – we can measure the angle of the Sun
Then – we can calculate time
Because – the sun appears to arc at 15° per hour.

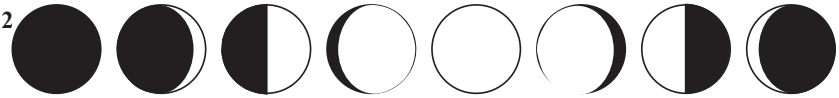
Variables: **Independent:** Angle of the Sun **Dependent:** Solar Time

Observations:
1. Magnetic declination is the difference from magnetic north and true north.
2. Magnetic declination is written on the USGS map.
3. Gnomon is the shadow cast by the sun dial.
4. The length will be measured.
5. Answers will vary.
6. The sun appears to travel 15° in an hour.
7. Answers will vary.
8. Local solar time is dependent on its position in the time zone.
9. The difference in local solar time and standard time is due to the imprecise materials to make measurements. And the lab might well have been conducted during daylight savings time.
10. If we know our time and Greenwich Mean Time we would know our longitude.

Lab Investigation 37: Lunar Orbits and Phases

Essential Question: How can a pattern of Lunar phases be determined?

Figure 2



1. New Moon
2. Waxing Crescent
3. First Quarter
4. Waxing Gibbous
5. Full Moon
6. Waning Gibbous
7. *Last Quarter*
8. Waning Crescent

Lunar Calendar:
1. New Moon: July 1/July 30
2. New Crescent: July 4/5
3. July Quarter: July 8
4. New Gibbous: July 12, 13
5. Full Moon: July 18
6. Old Gibbous: July 19/20
7. Last Quarter: July 23
8. Old Crescent: July 26/27

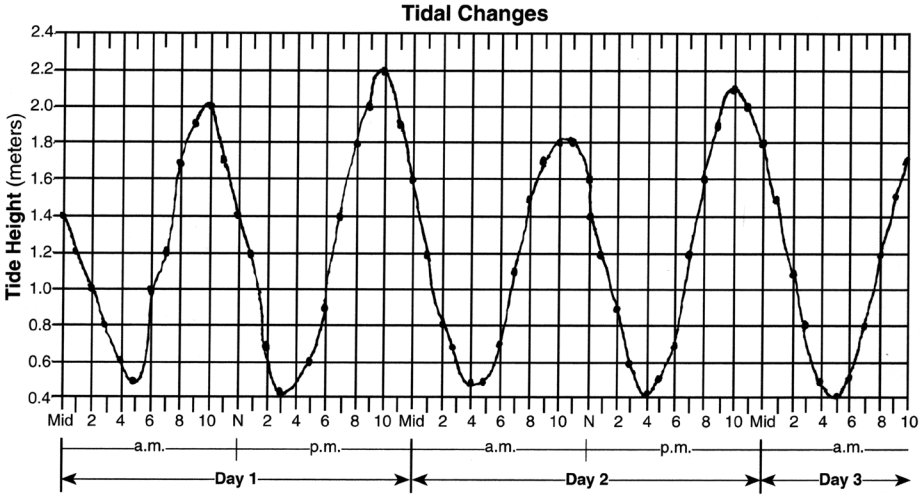
Observations:
1. A synodic month is 29.5 days long.
2. The Moon's shadow does not change relative to the Sun.
3. When the Moon is waxing or getting larger.
4. The right side is appear to be lit.
5. We see only 50% of the Moon lit at the full moon phase.
6. There is a difference between a sidereal and synodic month because the earth is moving in its orbit and the moon must travel farther to catch up.
7. The next first quester should appear on August 6.
8. The phase that should occur on July 19 is the Old Gibbous.
9. The Moon rotates at the same rate that is revolves around the Earth.
10. Answers will very.

Lab Investigation 38: Tides and Time

Essential Question: Is there a pattern for tides?

Hypothesis: **If** – data is available and plotted
Then – a pattern could be determined
Because – the tides would appear cyclical.

Variables: **Independent:** Time in hours **Dependent:** Water height



Observations:

1. The graph shows a cyclic pattern.
2. There are approximately 12 hours between high tides.
3. Yes, because tides are mostly related to the Moon's gravitational pull.
4. There are five tide cycles on the graph.
5. The first low tide on your graph is at 5:00 am.
6. The average tidal range on your chart is 2.0 meters.
7. The tidal range is decreasing.
8. The gravitational relationship of the Sun and the Moon pull on the hydrosphere making it bulge out thus making tides.
9. The Earth rotates through the bulge in the hydrosphere.
10. Since the tidal range is at its maximum, we can infer that the lunar phase was either full or new.

Lab Investigation 39: Newton's Laws

Essential Question: How we can prove Newton's Law of Motion using rocket engines.

Observations:

1. The second trial released greater energy than the first.
2. A-Class Engines 1.26 – 2.50 Newton-seconds. D-Class Engines are 10.01 – 20.00 Newton-seconds
3. The more Newtons exerted the greater the force.
4. Answers may vary.
5. Friction acts to slow objects.
6. As one pushes down on the gym floor, the floor "pushes" back causing an opposite reaction.
7. As one pushes down on the gym floor, the floor is exerting more Newton's than the person pushing down on it. The person is experiencing a reaction of an equal and opposite force.
8. When braking on ice, one is trying to stop a force in motion, but there is little friction to slow the process of forward momentum.
9. The planets orbit the sun because unless they are acted upon by an outside force, inertia will keep the planets moving.
10. Gravity keeps the planets orbiting the Sun.

Lab Investigation 40: Kepler's Laws of Motion

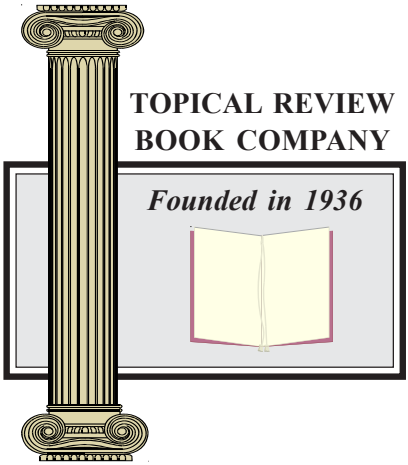
Essential Question: How can Kepler's Laws of Motion be demonstrated.

Hypothesis: **If** – we know the distance between the foci and the length of the major axis,
Then – we can create an ellipse
Because – eccentricity is the relationship of foci and axis in ellipses.

Variables: **Independent:** Distance between the foci
Dependent: Eccentricity of the Ellipse

Observations:

1. The length of the major axis is 9.5 cm ± 1 cm.
2. The distance between the foci is 6.5 cm ± 0.5 cm.
3. The eccentricity of the ellipse is 0.68. ± 0.05
4. The length of the major axis is 15.5 cm ± 1 cm.
5. The distance between the foci is 4.0 ± 0.5 cm.
6. The eccentricity of the ellipse is 0.26 ± 0.05.
7. Figure 1 is more oval than figure 2.
8. Both ellipses are similar in that they are both ovals.
9. The ellipse in figure 2 is closer to being a circle than the ellipse in figure 1.
10. One can determine how the ellipse is without seeing it by calculating its eccentricity.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