Answers Written By:

William Docekal

Science Teacher – Retired

STUDENTS

One of the best ways to raise your Earth Science regents grade is to diligently do four previous exams with complete comprehension. When you are done, you will have a working understanding of hundreds of questions and the supporting concepts. Many of the questions, in one way or another, will appear in this year's regents exam. This is the purpose of this review book. But the trick is to do the exams in earnest; taking your time, checking over our brief but concise explanations until it makes sense, and revisiting the ones you answer incorrectly days later to check your understanding of the correct answer.

Timing is essential. Don't wait until the last week. We suggest that you start working on these regents exams early, doing 20 to 30 questions a day. Star the ones you need to revisit, underline important information, and have a good knowledge of what is in the Reference Tables. We suggest that you use the reference tables found in the back of this booklet or one that your teacher might have provided for you. Many points can be gained by knowing where in the reference tables an answer is found.

So as the limestone said to the bedrock; don't take the regents for granite. Rather, work hard and your grade will improve.

The best to you.

PHYSICAL SETTING
REGENTS
EARTH SCIENCE

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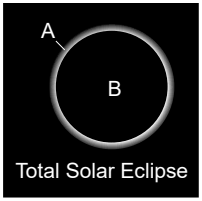
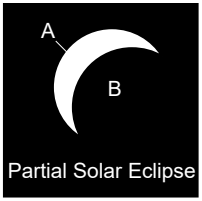
June 2018
Part A
Answer all questions in this part.

***Directions* (1–35): For *each* statement or question, write in the space provided the number of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/ Earth Science*.**

1. The photographs show two types of solar eclipses. Letters *A* and *B* represent two celestial objects.





Which two celestial objects are represented by letters *A* and *B*?
(1) *A*-Moon; *B*-Sun (3) *A*-Sun; *B*-Moon
(2) *A*-Moon; *B*-Earth (4) *A*-Sun; *B*-Earth 1 ____

2. Compared to the terrestrial planets, the Jovian planets
(1) are less massive (3) have greater orbital velocities
(2) are more dense (4) have shorter periods of rotation 2 ____

3. Which event occurred more than 10 billion years ago?
(1) Big Bang (3) Pangaea begins to break up
(2) origin of life on Earth (4) origin of Earth and its Moon 3 ____

4. In 1851, French physicist Léon Foucault used a swinging pendulum to demonstrate that Earth
(1) is rotating (3) has a curved surface
(2) is revolving (4) has a gravitational pull 4 ____

5. Approximately how many degrees does Earth travel in its orbit in one month?
(1) 1° (2) 15° (3) 30° (4) 360° 5 ____

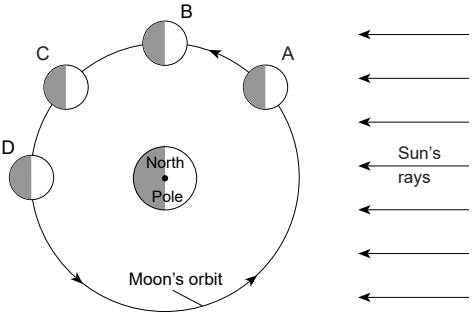
6. What is the relative humidity when the dry-bulb temperature is 16°C and the wet-bulb temperature is 10°C?
(1) 6% (2) 14% (3) 33% (4) 45% 6 ____

7. Boarding up windows would be one emergency action most likely taken to prepare for which natural disaster?
(1) earthquake (2) hurricane (3) flood (4) tsunami 7 ____

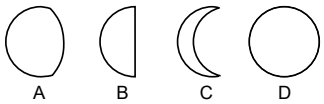
8. Which diagram best represents the general position and direction of flow of the polar front jet stream in the Northern Hemisphere during the winter months?

(1) (2) (3) (4) 8 ____

9. The diagram represents four positions of the Moon, labeled *A* through *D*, as it orbits Earth.

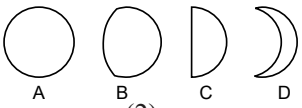


Which diagram best represents the sequence of Moon phases, as seen by an observer in New York State, when the Moon travels from position *A* to position *D* in its orbit around Earth?

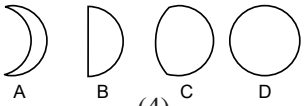


(1)

(3)

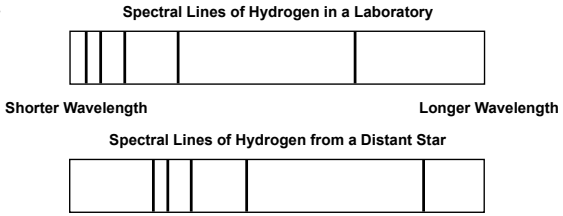


(2)



(4) 9 ____

10. The diagrams below represent spectral lines of hydrogen gas observed in a laboratory and the spectral lines of hydrogen gas observed in the light from a distant star.

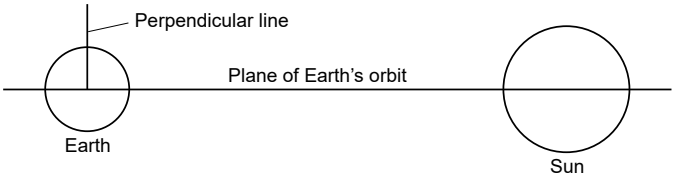


Compared to the spectral lines observed in the laboratory, the spectral lines observed in the light from the distant star have shifted toward the

(1) red end of the spectrum, indicating the star's movement toward Earth
(2) red end of the spectrum, indicating the star's movement away from Earth
(3) blue end of the spectrum, indicating the star's movement toward Earth
(4) blue end of the spectrum, indicating the star's movement away from Earth

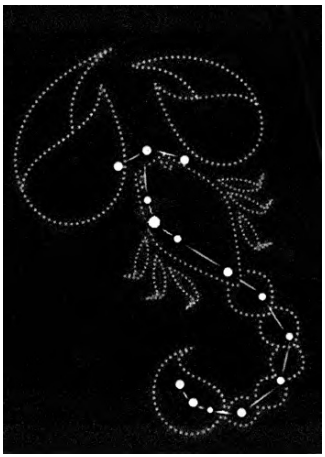
10 ___

11. The diagram below represents a cross-sectional view of the plane of Earth's orbit around the Sun. A line drawn perpendicular to the plane of Earth's orbit is shown on the diagram.



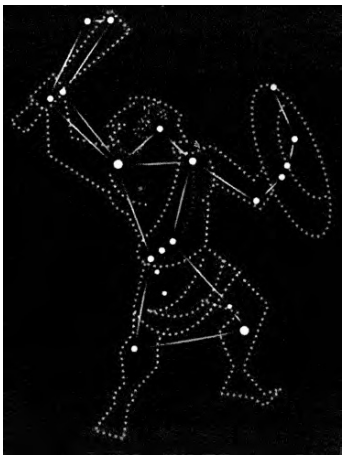
How many degrees is Earth's rotational axis tilted with respect to the perpendicular line shown in the diagram?
(1) 15° (2) 23.5° (3) 90° (4) 180° 11 ___

12. The larger white dots in the diagrams below represent stars in the constellations Scorpius and Orion. Information indicating when these constellations are visible from New York State is provided below the diagrams.



Scorpius

Visible in the New York State nighttime sky during July; not visible at all in January



Orion

Visible in the New York State nighttime sky during January; not visible at all in July

Which statement best explains why these two constellations are visible in the night sky in the months identified?
(1) Earth spins on its axis at a constant rate during a 24-hour period.
(2) Earth spins on its axis at a variable rate during the year.
(3) The nighttime side of Earth is facing different parts of our galaxy as Earth orbits the Sun.
(4) The nighttime side of Earth is facing different parts of our galaxy as the stars orbit Earth. 12 ___

Part C

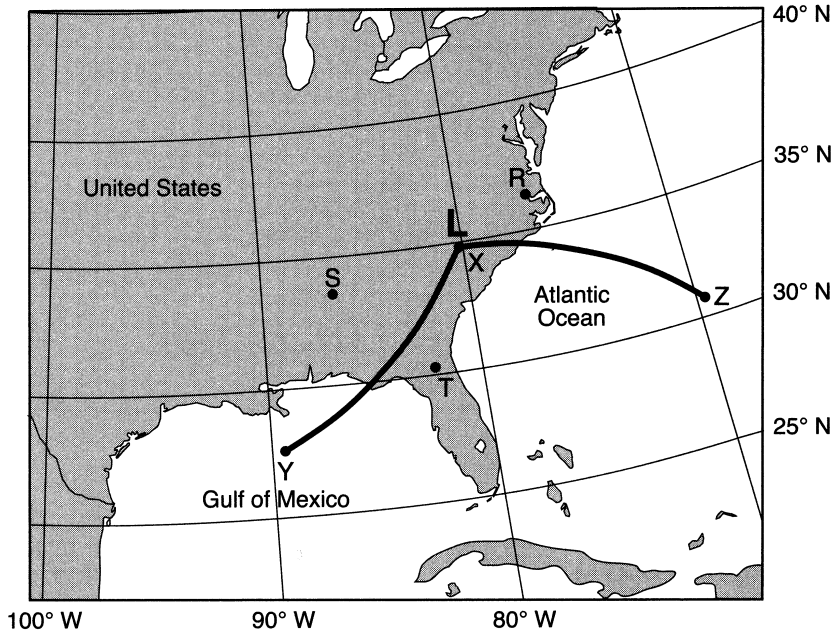
Answer all questions in this part.

Directions (66-85): Record your answers in the spaces provided. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Earth Science*.

Base your answers to questions 66 through 68 on the weather map and data table below, and on your knowledge of Earth science. The map shows the center of a low-pressure system (**L**). Lines *XY* and *XZ* represent two fronts associated with this low-pressure system. Points *R*, *S*, and *T* represent locations on Earth's surface. The data table lists weather conditions at these three locations.

Weather Data

Weather Condition	Location R	Location S	Location T
Temperature (°F)	65	55	82
Dewpoint (°F)	64	36	72
Cloud cover (%)	100	0	50
Wind from the	E	NW	SW
Wind speed (knots)	10	20	10



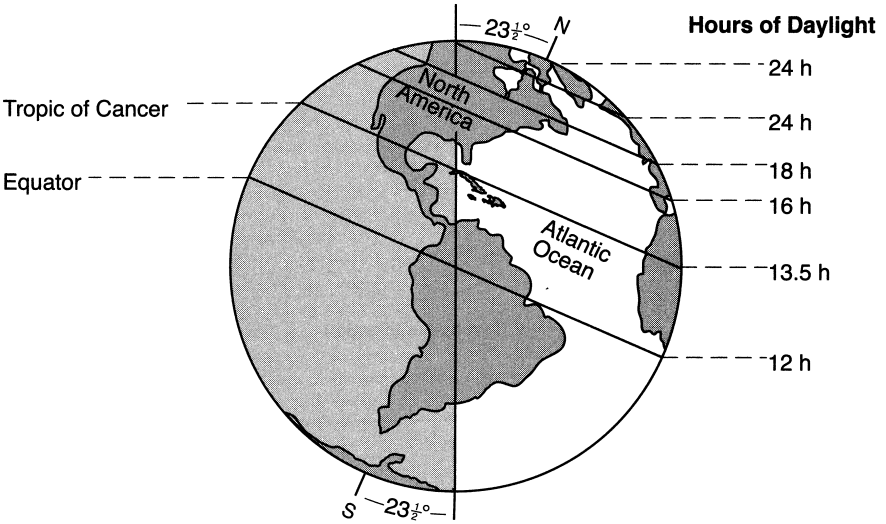
66. On the weather map above, draw weather-front symbols on the correct sides of both line *XY* and line *XZ* to show the most probable type and direction of each moving front. [1]

67. On the weather station model, using the proper format, record the *five* weather conditions shown in the data table for location *R*. [1]

68. Identify the compass direction toward which the center of this low-pressure system will move if it follows a normal storm track. [1]

_____

Base your answers to questions 69 and 70 on the diagram, which shows Earth on June 21, when the Northern Hemisphere experiences the most hours of daylight in a 24-hour period. The shaded area represents nighttime.



69. On the diagram above , place an **X** on Earth's surface at the latitude where the vertical ray of the Sun would be directly overhead on June 21. [1]

70. State *one* cause for the different lengths of daylight shown on June 21 at these different northern latitudes. [1]

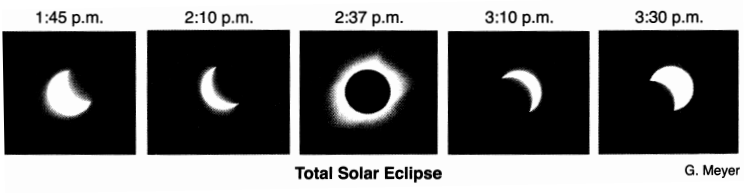
_____

_____

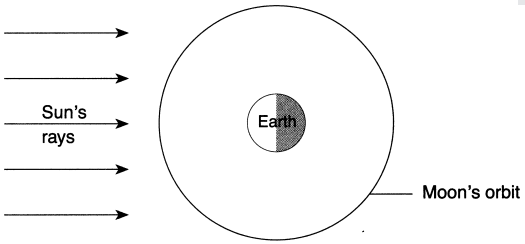
Base your answers to questions 71 through 74 on the passage and photographs below and on your knowledge of Earth science. The photographs show two celestial objects before, during, and after a total solar eclipse that was observed in Kingston, Tennessee at 2:37 p.m., on August 21, 2017, taken from a fixed position.

Solar Eclipses and the Saros Cycle

Solar eclipses occur between two and five times a year somewhere on Earth, but are rare for any one location. The plane of the Moon's orbit is tilted approximately 5° to Earth's orbit around the Sun. So, even though the Moon is in the correct phase, New Moon, to produce a solar eclipse, the Moon's shadow usually falls above or below Earth's position in its orbit. To produce a total solar eclipse, the Moon in its orbit must be at or near its closest point to Earth, making it appear large enough to cover the Sun. Solar eclipses follow specific, cyclic patterns called Saros Cycles. A Saros Cycle lasts 18 years, 11 days, and 8 hours. Since eight hours is approximately one-third of Earth's daily rotation, it takes three Saros Cycles (54 years and 34 days) for a solar eclipse to return to the same section of Earth.



71. On the diagram, place an **X** on the Moon's orbit to indicate the Moon's position on August 21, 2017. [1]



72. The plane of the Moon's orbit is tilted approximately 5° to Earth's orbit around the Sun. Explain how the tilt of the Moon's orbit prevents a solar eclipse from occurring every month. [1]

_____

_____

73. Predict the next year after 2017 when the total solar eclipse path associated with this Saros Cycle will return to the same section of Earth. [1]

_____

74. State the number of days that it takes the Moon to go from one New Moon phase to the next New Moon phase as viewed from Earth. [1] _____ days

PHYSICAL SETTING

EARTH SCIENCE

ANSWERS AND EXPLANATIONS

An Earth Science Reference Table is quoted throughout this section. The Earth Science Reference Tables can be found in the back of this booklet.

June 2018
Part A

1. 3 A solar eclipse occurs when the new moon (object *B*) temporarily blocks the Sun (object *A*). We cannot see the new moon because it is up during the day being outshined by the Sun. When the new moon is in the proper orbital plane with the Sun and Earth, a total solar eclipse occurs. Just outside the total eclipse zone, a partial solar eclipse would be observed.

2. 4 Open to the Solar System Data chart. This chart shows that the giant gaseous Jovian planets (Jupiter, Saturn, Uranus and Neptune) rotate faster than the smaller, denser, terrestrial planets (Mercury, Venus, Earth and Mars). Choice 3 is wrong for the Jovian planets, which are farther from the Sun, making for a longer period of revolution.

3. 1 The Big Bang theory assumes that all matter of the Universe was concentrated into an extremely small position or point. In time, the unbalanced forces within caused a massive explosion that moved all matter outward at tremendous speeds, producing the Universe. Scientists estimate from observable evidence that this explosion occurred approximately 13.7 billion years ago.

4. 1 A long heavy swinging pendulum (Foucault pendulum) will appear to change direction over time. This apparent change in direction is caused by the Earth rotating under it. This is one of the acceptable proofs that the Earth rotates.

5. 3 The Earth takes 365.26 days to complete one revolution (see the Solar System Data chart – Period of Revolution). One complete orbit, making a full circle, equals 360°. Therefore, the Earth's orbital speed is very close to 1 degree per day, or 30° in one month. Remember, the Earth's rotational speed is 15°/h.

6. 4 Open to the Relative Humidity (RH) chart. The wet-bulb temperature is 10°C, and the dry-bulb temperature is 16°C, making a difference of 6°C. From the RH table, go down the 6°C Difference column until intersecting the Dry-Bulb Temperature row of 16°C. At this intersection position, the RH is 45%.

7. 2 A hurricane is a very powerful L pressure system. The high winds within can cause much destruction, especially to windows. If time permits, people should protect their homes/businesses by boarding up windows.

8. 1 The polar front jet stream flows across the Northern Hemisphere from west to east affecting our weather. Open to the Planetary Wind and Moisture Belts in the Troposphere chart. Here it shows the estimated polar front position, but this position shifts during the seasons (see the reading below the chart's title). During the winter, it shifts further south moving many L pressure systems from the southwest to the northeast.

9. 4 As the Moon revolves around the Earth, different amounts of reflected light are observed from Earth. This produces the different phases of the Moon. From position *A* through *D*, the moon phases will be waxing, increasing in illumination. As observed from Earth, the right side of the Moon will become more visible as it travels from waxing crescent phase (*A*) towards the full moon phase (*D*).

10. 2 Scientists tell us that distant galaxies, as well as stars within our Milky Way galaxy, are moving away from us and each other at tremendous speeds. Evidence of this is supported by studying the redshift of spectral lines of celestial objects. These spectral lines will be shifted toward the red end of the spectrum when objects are moving away from the observer. A blue shift indicates that the object is moving toward the observer.

11. 2 Our Earth's axis is tilted 23.5° to the plane of its orbit, and the axis is always aligned with, or pointed at, Polaris (the North Star). It is the tilt of our axis and the motion of revolution that causes seasons.

12. 3 Due to the motion of revolution of the Earth around the Sun, different constellations are seen at different times of the year. These are called seasonal constellations, of which Orion, The Hunter, is a famous winter one. Six months later, the Earth revolves to the opposite position of its orbit, (the summer position) causing Orion to be up during the day, making it invisible, being outshined by the Sun. But at this time and position in our orbit, new constellations will be visible at night such as the constellation Scorpius.

13. 2 Open to the Inferred Properties of the Earth's Interior. On the Depth axis, go to the 4,000 km position. From this depth, move directly up until intersecting the Interior Temperature line. Reading to the left from this position, 5,700°C is obtained. At the same depth, the melting point line is positioned at the 5,400°C reading. A substance is a liquid if its temperature is higher than its melting point.

14. 4 Carbon dioxide, water vapor and methane are major greenhouse gases. These gases have increased in concentration in our atmosphere as a by-product of burning fossil fuels and cutting down trees that would have removed CO_2 from the atmosphere. Greenhouse gases absorb or trap infrared radiation that is radiated from the Earth, causing an increase in the atmospheric temperature, adding to global warming.

15. 2 Open to the Surface Ocean Currents chart. Locate the southeastern tip of Africa. Here is shown the Agulhas Current, and its dark arrow identifies it as a warm current.

16. 1 Humans have existed a relatively short period of time compared to the age of Earth. Open to the Geologic History of NYS chart. In the Pleistocene Epoch, which started about 1.8 million years ago, " Humans" is mentioned in the Life on Earth column. This span of time is less than 1.0% of the total Earth's geologic time period, which spans 4600 million years (see bottom left section of chart).

17. 1 When a large volcanic eruption occurs, much volcanic ash is released into the atmosphere, which is spread over a large area by prevailing winds. Within a year (being a relatively short period of time), almost all of the ash has settled out, producing a thin layer of volcanic ash. This layer may be preserved in future sedimentary rocks or within glacial ice (as found in Greenland). Now, it acts as a "time marker" that can be used in matching or correlating different layers of bedrock or glacial ice.

18. 4 Location *A* is on the windward side of the mountain. Here rising air expands, cools, and reaches its dewpoint temperature. Condensation now occurs, forming clouds and precipitation. Location *B* is on the leeward side of the mountain. Here the descending dry air is being compressed, which causes the air to warm up. The climate on the leeward side is generally hot and dry.

19. 3 Open to the Scheme for Sedimentary Rock Identification chart and the Rock Cycle in Earth's Crust chart. These charts show that sedimentary rocks are composed of sediments that have been deposited and have undergone compaction and/or cementation. Thus, the sediments were originally there, being older, then later dissolved minerals precipitated out of the water cementing the sediments forming new sedimentary rocks.

20. 4 Choice 4 matches up the correct terms to their processes/positions in the diagram. Remember that transpiration is water vapor that is released from plants and trees.

21. 2 Open to the Planetary Wind and Moisture Belts in the Troposphere chart. On the globe are given the relative moisture amounts (dry, wet) for specific latitude zones. Choice 2 correctly matches the climate conditions to the appropriate latitudes.

22. 2 Abrasion is the grinding and wearing away of rocks. Water, either running water or wave action, is the main agent that transports or moves rocks, but it is the collision with other sediments that chips away the sharp edges of rocks making the sediments smoother, rounder and smaller.

23. 3 Intrusions are always younger than the rock unit they enter. Rock unit *C* was the preexisting rock in which the two intrusions entered. This makes *C* the oldest rock unit. Intrusion *B* cuts across intrusion *A*, making *B* younger than *A*.

24. 1 Open to the Tectonic Plates map and locate choice *A* on this map. At the East African Rift Valley, the continental crust is being pulled apart by divergent forces of tectonic motion. This action results in faulting and volcanic activity along with step-like block features creating a rift valley. Continuation of this process might eventually produce a shallow sea. This could lead to a mid-ocean ridge as the plates drift farther apart.

25. 4 Open to the Earthquake *P*-Wave and *S*-Wave Travel Time graph. Follow the 11 min. axis to the right, until the intersecting of the *P*-wave line. This intersection point is at the 7600 km position. From this distance, move straight up to the *S*-wave line, the intersection occurs at the 20 min. line.

26. 2 Elevated horizontal sedimentary bedrock is classified as a plateau landscape. Open to the Generalized Landscape Regions of NYS map. This map shows that The Catskills is part of the Allegheny Plateau. Over millions of years, this raised bedrock area has been subjected to much weathering and erosion, dissecting the plateau into large rolling hills, mistakenly called the Catskill Mountains.

27. 3 Open to the Relationship of Transported Particle Size to Water Velocity chart. On the Particle Diameter axis, locate the 0.1 cm position. Follow this line to the right until intersecting the graph line. Reading down to the Stream Velocity Axis gives the stream velocity of 5 cm/s.

28. 4 Open to the Sedimentary Rock Identification chart and, in the Rock Name column, locate Rock salt. In the Composition column, it states halite. When water evaporates, the minerals it contains, like halite, become more concentrated and eventually precipitate out, producing a crystalline salt rock deposit. These sedimentary rocks are classified as evaporates.

29. 4 Open to the Average Chemical Composition of Earth's Crust, Hydrosphere, and Troposphere chart. Here it shows that within the crust, oxygen (O) and silicon (Si) are the two most abundant elements by volume and mass.

30. 1 Solid bedrock starts weathering at the surface due to the action of rain, frost action, acid attack, root action, etc. As years progress, and with the addition of organic material, soil develops. Eventually as weathering works downward, different horizons or layers of soil becomes evident. But, it is the top layer (Horizon *A*) that has the richest soil (topsoil) due to extensive weathering and the organic material within.

31. 1 Open to the Generalized Bedrock Geology of NYS map. As shown, Utica is located on Ordovician surface bedrock. The Key section for Ordovician gives the surface bedrock composition as listed in choice 1.

32. 1 A stream drainage pattern of a region is dictated by the topography and bedrock of the landscape region. One must match the shape of the landscape to obtain the correct drainage pattern. Diagram 1 shows stream paths that take a circular direction, leading to an exiting stream flowing downward. Drainage pattern #1 would be correct for the diagrammed represented landscape.

33. 3 From 1980 to 2011, the diagrams show that the amount of Arctic Sea ice decreased. Documented global warming is responsible for the global receding sea ice and continental glaciers.

34. 1 A delta is produced when a river enters a large body of water causing it to lose its energy. With less energy, deposition of sediments occurs. Eventually, over many years, new land is made from these deposited sediments. The Mississippi Delta is one of the largest in the world, extending far out into the Gulf of Mexico. Wave action and longshore currents pick up sand-size particles and transport them. Some of the sand gets carried forward onto the beach, while other particles get deposited offshore, parallel to the shoreline, building a sandbar or a larger depositional feature known as a barrier island.

35. 2 Metamorphic rocks are made from preexisting rocks that have undergone high pressure and high temperatures. These processes may cause the mineral crystals to line up or to show mineral alignment producing a texture known as banding. Open to the Metamorphic Rock Identification chart. This texture of banding is given for the metamorphic rock gneiss.

Part B-1

36. 2 The average low tide level is shown to be 0′. At noon on January 24, the graph shows the height of water was 1.6′ above the average low tide level.

37. 1 Tides are cyclic and predicable as shown by the graph, with each high and low tide being approximately 12 hours apart. Many newspapers give the times of these tides for the week in advance.

38. 4 The gravitation attraction between the Moon and Earth is the primary cause of tides. The Moon's gravity produces a slight bulb in the ocean's height creating high tide. Opposite this is the low tide ocean level. The rotating Earth causes the 12 hour cyclic pattern.

Relationships

Within Earth Science we find certain relationships between two variables that are always constant and thus can be represented by one of four graphs: a direct or proportional graph; an inverse or indirect graph; a cyclic graph and a graph that remains the same. In a direct or proportional graph both variables are increasing and the resulting line will always slope up; in a inverse graph one variable is increasing while the other is decreasing producing a graph with the line sloping down; in a cyclic graph one variable is repeating and the line shows a repeating, predictable pattern; and if one of the two variables is not changing we get a graph with a straight horizontal line producing a graph representing no change.

Graph examples

Direct | Inverse | Cyclic | Remains the same

Examples of some **direct relationships** in Earth Science

Pollution – As the population increases, so does the amount of pollution

Permeability – As the grain size increases, so does the permeability.

Gravity – As the mass of two objects increase, so will the gravitational attraction increase.

Evaporation – As the temperature goes up, so will the evaporation rate.

Polaris – As latitude increases, the altitude of Polaris increases.

Chemical weathering – As the temperature goes up, the rate of chemical weathering increases.

Coriolis effect – As the speed of rotation of a planet increases, so will the Coriolis effect.

Pressure within the Earth – The deeper within the Earth, the greater the pressure.

Density within the Earth – The deeper within the Earth, the greater the density.

Streams – The steeper the gradient, the faster the stream's velocity.

Runoff – The greater the runoff, the faster the stream's velocity will be.

Greenhouse effect – The more greenhouse gases (carbon dioxide, water vapor, methane, etc.), the warmer the atmosphere will become.

PHYSICAL SETTING
EARTH SCIENCE — REFERENCE TABLES
2011 EDITION

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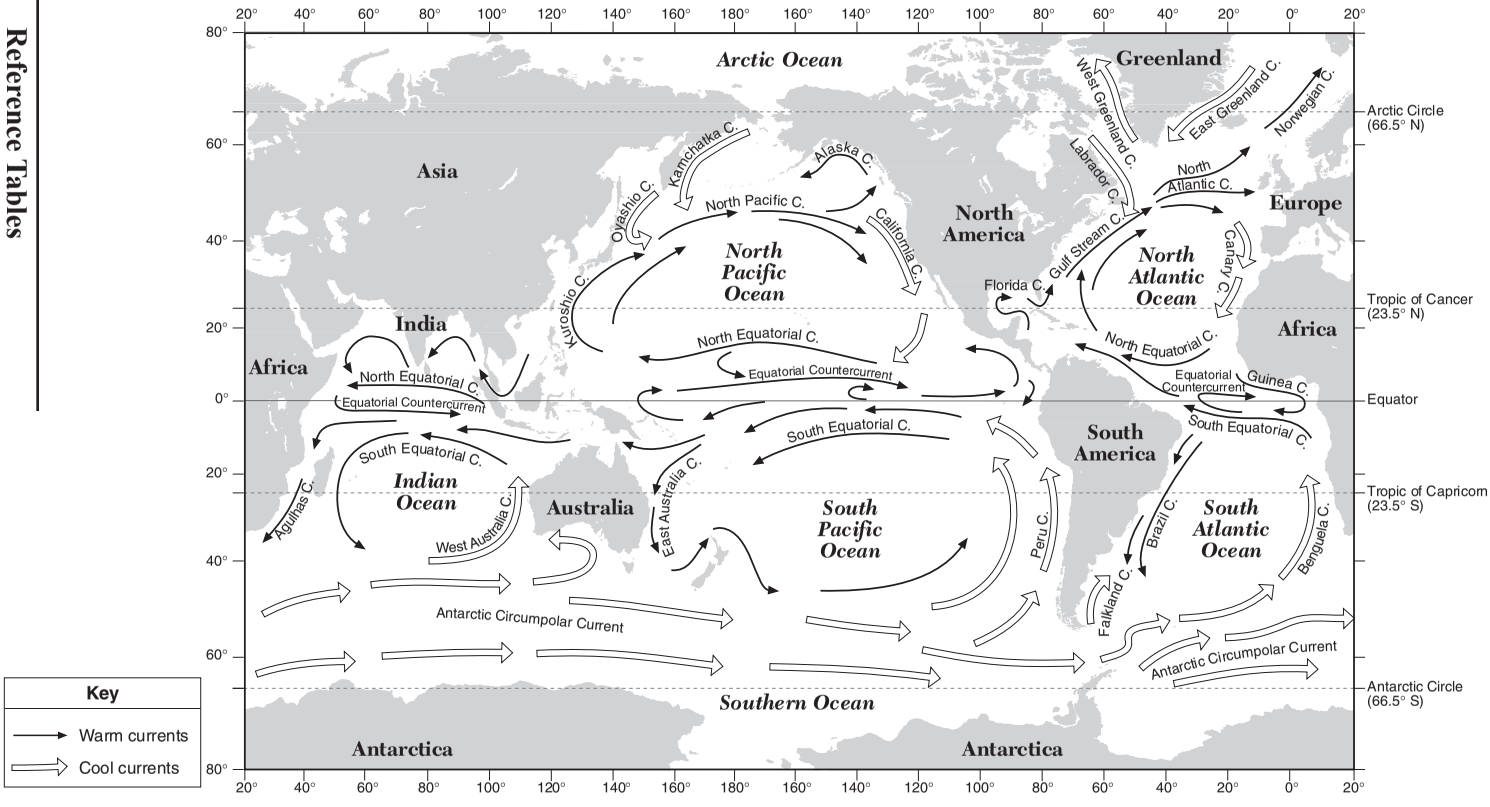
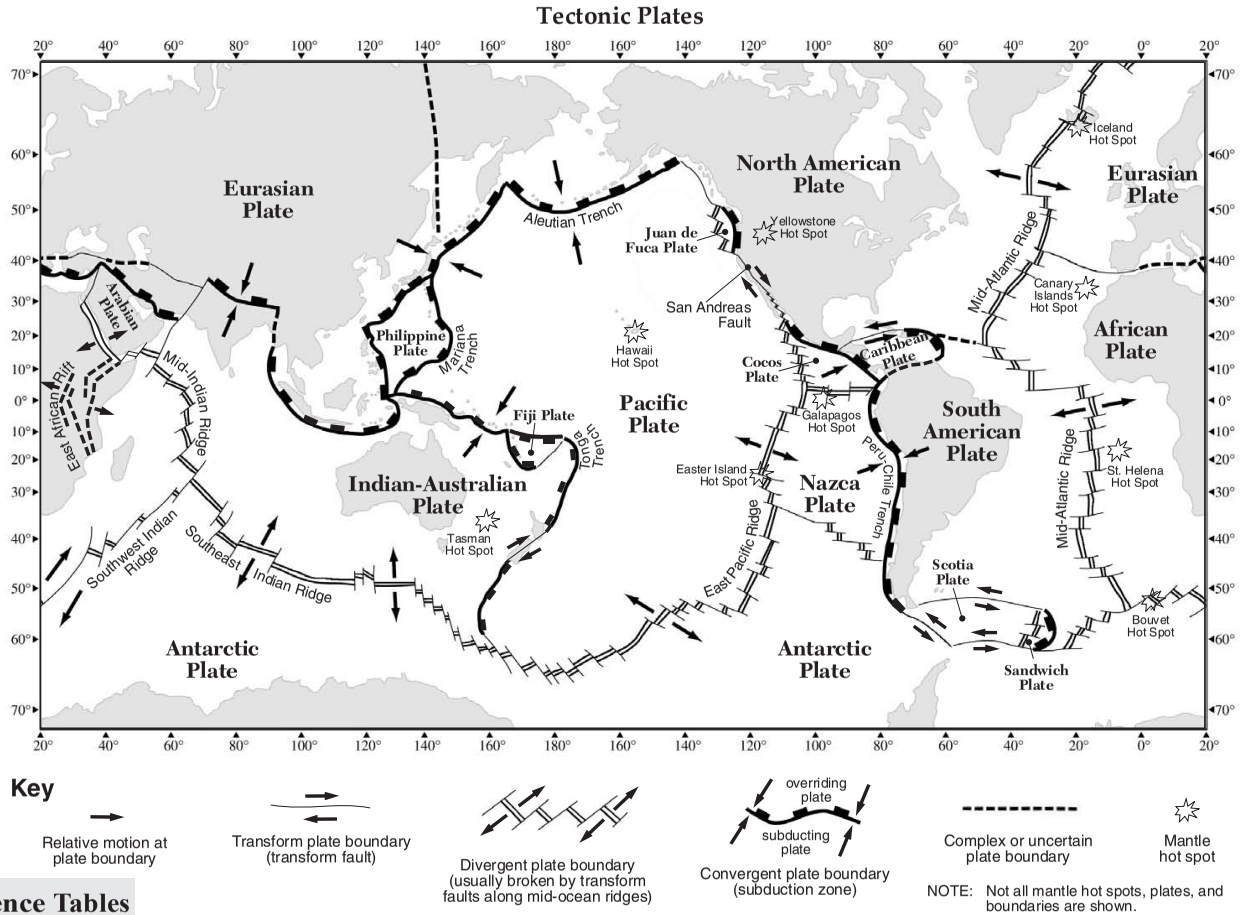
Surface Ocean Currents



NOTE: Not all surface ocean currents are shown.



Reference Tables

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