# Answers Written By: <br> William Docekal <br> 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.
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## PHYSICAL SETTING REGENTS <br> EARTH SCIENCE

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## EXAM

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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 map below shows four major time zones of the United States. The locations of Boston and San Diego are shown.


What is the time in Boston when it is 11 a.m. in San Diego?
(1) $8 \mathrm{a} . \mathrm{m}$.
(2) 2 p.m.
(3) 3 p.m.
(4) noon
1
$\qquad$
2. The diagram below represents the spectral lines from the light emitted from a mixture of two gaseous elements in a laboratory on Earth.


If the same two elements were detected in a distant star that was moving away from Earth, how would the spectral lines appear?
(1) The entire set of spectral lines would shift toward the red end.
(2) The entire set of spectral lines would shift toward the blue end.
(3) The spectral lines of the shorter wavelengths would move closer together.
(4) The spectral lines of the longer wavelengths would move closer together. $\qquad$
3. The accompanying diagram shows Earth in orbit around the Sun, and the Moon in orbit around Earth. $\mathrm{M}_{1}$ and $\mathrm{M}_{2}$ indicate positions of the Moon in its orbit where eclipses might be seen from Earth.

Which table correctly matches each type of eclipse with the orbital position of the Moon and the cause of each eclipse?


| Type of <br> Eclipse | Moon's <br> Position | Cause of <br> Eclipse |
| :---: | :---: | :---: |
| Solar | $\mathrm{M}_{1}$ | Earth's shadow <br> falls on Moon |
| Lunar | $\mathrm{M}_{2}$ | Moon's shadow <br> falls on Earth |

(1)

| Type of <br> Eclipse | Moon's <br> Position | Cause of <br> Eclipse |
| :---: | :---: | :---: |
| Solar | $\mathrm{M}_{1}$ | Moon's shadow <br> falls on Earth |
| Lunar | $\mathrm{M}_{2}$ | Earth's shadow <br> falls on Moon |

( 2 )

| Type of <br> Eclipse | Moon's <br> Position | Cause of <br> Eclipse |
| :---: | :---: | :---: |
| Solar | $\mathrm{M}_{2}$ | Earth's shadow <br> falls on Moon |
| Lunar | $\mathrm{M}_{1}$ | Moon's shadow <br> falls on Earth |

( 3 )

| Type of <br> Eclipse | Moon's <br> Position | Cause of <br> Eclipse |
| :---: | :---: | :---: |
| Solar | $M_{2}$ | Moon's shadow <br> falls on Earth |
| Lunar | $M_{1}$ | Earth's shadow <br> falls on Moon |

(4)

3 $\qquad$
4. The timeline below represents the entire geologic history of Earth. The lettered dots on the timeline represent events in Earth's history.


Which lettered dot best indicates the geologic time when humans first appeared on Earth?
(1) $A$
(2) $B$
(3) $C$
(4) $D$

4 $\qquad$
5. Compared to our solar system, the universe is
(1) younger, smaller, and contains fewer stars
(2) younger, larger, and contains more stars
(3) older, smaller, and contains fewer stars
(4) older, larger, and contains more stars $\qquad$
6. Which motion allows an observer on Earth to view different constellations throughout the year?
(1) Earth orbiting the Sun
(3) Earth orbiting the constellations
(2) constellations orbiting Earth
(4) constellations orbiting the Sun 6
$\qquad$

## Part B-1

Answer all questions in this part.
Directions (36-50): For each statement or question, choose 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. Record your answers in the space provided.

Base your answers to questions 36 and 37 on the graph below and on your knowledge of Earth science. The graph shows changing ocean water levels, over a 3-day period, at a shoreline location at Kings Point, New York on Long Island.

Tides at Kings Point, New York
December 2015

36. Based on the graph, the first low tide on December 26 occurred at approximately
(1) $6 \mathrm{a} . \mathrm{m}$.
(2) 11 a.m.
(3) 6 p.m.
(4) 11 p.m.
36
$\qquad$
37. These Long Island tides show a pattern that is
(1) cyclic and predictable
(3) noncyclic and predictable
(2) cyclic and unpredictable
(4) noncyclic and unpredictable
37 $\qquad$

Base your answers to questions 38 through 41 on the diagram below and on your knowledge of Earth science. The diagram represents Earth orbiting the Sun. Four positions of Earth in its orbit are labeled $A, B, C$, and $D$. Letter N represents the North Pole. Distances are indicated for aphelion (Earth's farthest position from the Sun around July 4) and perihelion (Earth's closest position to the Sun around January 3). Arrows indicate directions of movement.

38. During which season in the Northern Hemisphere is Earth at aphelion?
(1) winter
(2) spring
(3) summer
(4) fall
38
$\qquad$
39. Between which pair of lettered positions is the Sun's vertical ray moving from the equator southward to the Tropic of Capricorn?
(1) $A$ and $B$
(2) $B$ and $C$
(3) $C$ and $D$
(4) $D$ and $A$
39
$\qquad$
40. Approximately how many times does Earth rotate as it moves in its orbit from position $A$ back to position $A$ ?
(1) 1 time
(2) 15 times
(3) 24 times
(4) 365 times
40
$\qquad$
41. What is the tilt of Earth's rotational axis relative to a line perpendicular to the plane of Earth's orbit?
(1) $15^{\circ}$
(2) $23.5^{\circ}$
(3) $66.5^{\circ}$
(4) $90^{\circ}$
41
$\qquad$
Base your answers to questions 42 through 44 on the map and on your knowledge of Earth science. The map shows a composite of Doppler radar images. Darker shadings indicate the precipitation pattern of a large storm system over the eastern United States.
42. The surface wind circulation pattern around the center of this storm system is

(1) inward and clockwise
(3) outward and clockwise
(2) inward and counterclockwise
(4) outward and counterclockwise 42
$\qquad$
43. The best evidence on a weather map to indicate high-speed winds near the center of this storm system would most likely be
(1) cloud cover of $100 \%$
(3) temperature and dewpoint values
(2) type of precipitation
(4) isobars drawn close together

43 $\qquad$
44. As this storm system follows a normal storm track, it will most likely move toward the
(1) southeast
(2) southwest
(3) northeast
(4) northwest
44
$\qquad$
Base your answers to questions 45 through 48 on the passage and map below and on your knowledge of Earth science. The map shows the location of the epicenter (*) of a major earthquake that occurred about 1700 years ago. Point $A$ represents a location on a tectonic plate boundary. Plates $X$ and $Y$ represent major tectonic plates. The island of Crete; the Anatolian Plate, which is a minor tectonic plate; and the Hellenic Trench have been labeled. Arrows indicate the relative directions of plate motion.

## Crete Earthquake

Scientists have located the geological fault, off the coast of Crete in the Mediterranean Sea, that likely shifted, causing a huge earthquake in the year 365 that devastated life and property on Crete. The southwestern coastal region of Crete was uplifted, as evidenced by remains of corals and other sea life now found on land 10 meters above sea level. Scientists measured the age of these corals to verify when this event occurred. This earthquake caused a tsunami that devastated the southern and eastern coasts of the Mediterranean Sea. It is estimated that earthquakes along the fault, associated with the Hellenic Trench, may occur about every 800 years.

45. Which type of plate boundary is represented at point $A$ ?
(1) divergent
(2) convergent
(3) transform
(4) complex
45

## 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 models below and on your knowledge of Earth science. The models represent cutaway views of four planets in our solar system, showing their inferred interior structures. Each planet is shown in relation to the size of Earth.

66. Determine how many times larger Jupiter's equatorial diameter is, compared to Earth's equatorial diameter. [1] $\qquad$ times larger
67. Explain why Jupiter appears brighter in the night sky than Mercury, despite Jupiter's greater distance from Earth. [1]
68. Identify two terrestrial planets shown in the models. Explain why they are considered terrestrial planets. [1]

Terrestrial planets: $\qquad$ and $\qquad$
Explanation: $\qquad$
82. On the accompanying grid, construct a profile along line $A B$ by plotting the lake depth of each isoline that crosses line $A B$. Connect all plots with a line to complete the profile. [1]

Lake Depth

83. Determine the gradient, in meters per kilometer, between points $C$ and $D$. [1] $\qquad$ $\mathrm{m} / \mathrm{km}$
84. Determine one possible depth, in meters, of Crater Lake at location $X$. [1] $\qquad$ meters
85. Line $Y Z$ on the diagram below represents the mineral composition of an andesitic rock taken from the bottom of Crater Lake.


Identify the percent by volume of each of the three minerals in this andesitic rock. [1]

Plagioclase feldspar: $\qquad$ \%
Biotite: $\qquad$ \%

Amphibole: $\qquad$ \%

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. Which two characteristics classify Jupiter as a Jovian planet?
(1) low density and large diameter
(2) low density and small diameter
(3) high density and large diameter
(4) high density and small diameter $\qquad$
2. As observed from Earth, the wavelengths of light from the most distant galaxies are usually
(1) blue shifted due to an expanding universe
(2) blue shifted due to a contracting universe
(3) red shifted due to an expanding universe
(4) red shifted due to a contracting universe

2 $\qquad$
3. The rate of Earth's revolution around the Sun is approximately
(1) $1 \% /$ day
(2) $15^{\circ} /$ day
(3) $24 \%$ day
(4) $360 \%$ day
3 $\qquad$
4. Different star constellations are observed from Earth at different times during the year because
(1) constellations spin on an axis
(2) constellations travel in an orbit around the Sun
(3) Earth spins on its axis
(4) Earth travels in an orbit around the Sun

4 $\qquad$
5. The apparent change in the direction of swing of a Foucault pendulum provides evidence of Earth's
(1) rotation
(2) revolution
(3) tilted axis
(4) elliptical orbit
5
$\qquad$
6. The Milky Way can best be described as
(1) an elliptical galaxy
(2) a collection of stars orbiting the Sun
(3) a star that originated 4600 million years ago
(4) one of billions of galaxies in the universe

6 $\qquad$
7. How much heat energy is required to change five grams of ice to liquid water at $0^{\circ} \mathrm{C}$ ?
(1) 334 joules
(3) 2260 joules
(2) 1670 joules
(4) 11,300 joules

7 $\qquad$

Base your answers to questions 83 through 85 on the diagram below and on your knowledge of Earth science. The diagram represents temperatures that occur on either side of a mountain. Elevations are recorded in meters (m) above sea level and air temperature is recorded in degrees Celsius $\left({ }^{\circ} \mathrm{C}\right)$. Letters $A$ and $B$ represent reference lines on the diagram.

83. On the diagram above, draw one arrowhead on reference line $A$ and one arrowhead on reference line $B$ to indicate the direction of air flow on each side of the mountain. [1]
84. Compared to the air temperature and moisture conditions on the western side of the mountain at sea level, describe how the air temperatures and moisture conditions on the eastern side of the mountain at sea level are different. [1] Air temperature: $\qquad$ Moisture: $\qquad$
85. State the most probable air temperature that would occur on the west side of the mountain at 1500 meters and the most probable air temperature on the east side of the mountain at 1500 meters. [1]

West: $\qquad$ ${ }^{\circ} \mathrm{C}$ East: $\qquad$ ${ }^{\circ} \mathrm{C}$

## June 2019 <br> Part A

1. 2 Traveling eastward into a new time zone, the time becomes one hour later. If it is 11 a.m. in San Diego, it would be 12 p.m. in Mountain time zone, 1 p.m. in Central time zone and 2 p.m. in Eastern time zone. There are 24 time zones, all based on the rotational speed of the Earth, $15^{\circ} / \mathrm{hr}$.
2. 1 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 elements within 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.
3. 2 A Solar eclipse occurs when the New Moon temporarily blocks the Sun. We cannot see the New Moon as it is up in the day sky being out-shined by the Sun. Position $M_{1}$ is the New Moon phase and might produce a solar eclipse. A lunar eclipse (position $M_{2}$ ) occurs when the Moon is on the opposite side of the Earth from the Sun and is on the correct plane, causing the Earth's shadow to fall on the Full Moon.
4. 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 shown to have our beginning. This span of time is less than $1.0 \%$ of the total geologic time period, which is 4600 million years (see bottom left section of chart).
5. 4 Scientists have determined that the formation of our universe by the Big Bang theory occurred approximately 13.7 billion years ago. The estimated time for the origin of our solar system is 4.6 billion years ago. Our solar system only consists of one star, our Sun, where the universe consists of an estimated of 100 billion trillion stars.
6. 1 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.
7. 2 Open to the Tectonic Plates map. Locate the Tasman Hot Spot in the western section of the Pacific Plate. Notice, it is located in the Southern Hemisphere, having a latitude of $36^{\circ} \mathrm{S}$. Its longitude is close to $160^{\circ} \mathrm{E}$. Remember, the maximum value of longitude is $180^{\circ} \mathrm{E}$ or W .
8. 3 Open to the Selected Properties of Earth's Atmosphere chart. As shown by the Altitude scale, the stratosphere layer extends from 7 miles ( 12 km ) to 32 miles ( 50 km ). Most atmospheric ozone is concentrated in a layer within the stratosphere,
9. 4 Objects that travel long distances over the Earth's surface (e.g., winds and ocean surface currents) will experience a deflection or curvature due to the rotation of the Earth. This is known as the Coriolis effect. In the Northern Hemisphere, objects get deflected to the right of the path of travel.
10. 1 Open to the Tectonic Plate map. This map shows the major tectonic plates of the Earth. (Minor plates are constituents of the major plates, e.g. the Anatolian Plate). The Hellenic Trench, a subduction zone, separates the major African and Eurasian Plates.
11. 4 Open to the Geologic History of NYS chart. Locate the Time Distribution of Fossils section. On the coral bar are listed species U, V, and T. These three corals are diagrammed and labeled at the bottom of this chart.
12. 3 An earthquake on the ocean floor may cause a sudden, large ocean-floor displacement that releases much energy. This energy may produce a large, destructive wave called a tsunami. When a tsunami warning is sounded, immediately, coastal residents must immediately seek higher ground. An approved evacuation plan needs to be in place to assure this occurs quickly and efficiently.
13. 1 This photograph, shows the action of wind abrasion. This process of erosion is caused by sand particles moved by the blowing wind that strike solid objects. Over time this sandblasting action causes the base of rock formations to thin out and eventually collapse. Wind abrasion is prevalent in arid climates.
14. 2 Open to the Sedimentary Rock chart. The information states that this is a sandstone feature. The range of grain sizes for sand is given as 0.006 cm to 0.2 cm . Remember, sand is a particle size, not a type of rock.

## Part B-1

51. Answer: See graph below. Credit is awarded if all six points plotted points are within or touch the circles shown and are correctly connected with a line that passes within or touch each circle.


Explanation: Accurately plot the points in their correct positions. Connect your plotted points with a smooth best fit line, passing through each point.
52. Answer: potassium- 40 K or ${ }^{40} \mathrm{~K}$ or $\mathrm{K}-40$

Note: No credit is awarded for potassium or K alone because potassium has more than one isotope.
Explanation: When an isotope has decayed to its first half-life, the percentages of the radioactive isotope and the disintegration product are each $50 \%$. The given data table shows these percentages occur in 1.3 billion years $\left(1.3 \times 10^{9}\right)$. Open to the Radioactive Decay chart. The radioactive isotope potassium $-40 \mathrm{~K}\left({ }^{40} \mathrm{~K}\right)$ has a half-life of $1.3 \times 10^{9}$ years.

## 53. Answer: 37.5 g

Explanation: Method 1: The chart shows that after 3.9 billion years, $12.5 \%$ (.125) of the isotope remains radioactive. Solution: amount $(\mathrm{g})=0.125 \times 300 \mathrm{~g}=37.5 \mathrm{~g}$
Method 2: In all radioactive elements, radiation gets weaker in time but the halflife stays the same (being constant) during the decay process. The half-life of potassium- 40 is $1.3 \times 10^{9} \mathrm{y}$. For each passing half-life, the mass of the original radioactive material $(300 \mathrm{~g})$ is cut in half. Therefore, after the $1^{\text {st }}$ half-life or $1.3 \times 10^{9} \mathrm{y}, 150 \mathrm{~g}$ is radioactive, after $2^{\text {nd }}$ half-life or $2.6 \times 10^{9} \mathrm{y}, 75 \mathrm{~g}$ is radioactive, and after $3^{\text {rd }}$ half-life or $3.9 \times 10^{9} \mathrm{y}, 37.5 \mathrm{~g}$ would be radioactive.

## PHYSICAL SETTING <br> EARTH SCIENCE - REFERENCE TABLES 2011 EDITION

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