Base your answers to questions 1 through 4 on the topographic map below. Points X, Y, and Z are locations on the map. Elevations are expressed in meters.



4. Which profile best represents the topography along the dashed line from point X to point Y?





- 5. The altitude of the ozone layer near the South Pole is 20 kilometers above sea level. Which temperature zone of the atmosphere contains this ozone layer?
 - A) stratosphere
 - C) mesosphere
- B) troposphere
- D) thermosphere

- 6. The Earth's actual shape is most correctly described as
 - A) an oblate sphere B) a circle
 - C) a perfect sphere
- - D) an eccentric ellipse

7. Base your answer to the following question on the topographic map below that represents a location in North America. A grid system of letters and numbers along the edges of the map is provided to assist in finding locations. Elevations are expressed in feet.



What is a possible elevation at point *X* (grid location **3-D**)?

B) 548 ft A) 488 ft C) 558 ft D) 598 ft

8. The graph below shows temperature readings for a day in 10. The graph below shows the changes in height of ocean April.



The average rate of temperature change, in Fahrenheit degrees per hour, between 6 a.m. and noon was

B) 8°/hr C) 3°/hr A) $6^{\circ}/hr$ D) 18°/hr

9. An empty 250-milliliter beaker has a mass of 60 grams. When 100 milliliters of oil is added to the beaker, the total mass is 140 grams. The density of the oil is approximately

A) 1.	4 g/ml	B)	1.7	g/ml
C) 0.	6 g/ml	D)	0.8	g/ml

water over the course of 2 days at one Earth location.



Which statement concerning these changes is best supported by the graph?

- A) The changes are cyclic and occur at predictable time intervals.
- B) The changes are cyclic and occur at the same time every day.
- C) The changes are noncyclic and may occur at any time.
- D) The changes are noncyclic and occur at sunrise and sunset.
- 11. At which location will the highest altitude of the star *Polaris* be observed?
 - A) Arctic Circle
 - B) Tropic of Cancer
 - C) central New York State
 - D) Equator

Base your answers to questions 12 hrough 15 on the topographic map below. Elevations are in feet. Point A and B are locations on the map.





C) decreases, then increasesD) increases, then decreases

Base your answers to questions 19 through 24 on the topographic map below. Points *A* through *I* are locations on the map. Elevations are shown in meters.



A) 150 m/km B) 25 m/km C) 100 m/km D) 50 m/km

- 25. The North Star (*Polaris*) can be used for navigation in Earth's Northern Hemisphere because
 - A) the position of *Polaris* changes with the seasons
 - B) *Polaris* is located directly over the Tropic of Cancer
 - C) *Polaris* is the brightest and most easily located star
 - D) the altitude of *Polaris* is equal to the observer's latitude
- 26. The topographic map below shows a hill. Points *X* and *Y* represent locations on the hill's surface. Elevations are shown in meters.



What is the gradient between points *X* and *Y*?

- A) 120 m/km B) 100 m/km
- C) 40 m/km D) 80 m/km

Base your answers to questions 27 through 31 on the contour map below. Points *A* through *F* represent locations on the map.



27. Which location has the same elevation as location D?

A) A B) E C) C D) F

- 28. What is the most likely elevation of the surface of Sunfish Lake?
 - A) 55 mB) 151 mC) 140 mD) 28 m
- 29. Which diagram best represents the topographic profile from location *A* to location *F*?
 - A)
 B)

 C)
 D)
- 30. Which statement about hill *C* is best supported by the map?
 - A) Hill *C* is located approximately 2 km west of Cedar River.
 - B) Hill C has been shaped by glaciers.
 - C) The highest possible elevation of hill C is 179 m.
 - D) The steepest slope of hill *C* is on the western side.
- 31. If no elevation values were given, which general rule could be used to establish that Cedar River flows into Sunfish Lake?
 - A) Contour lines bend upstream when crossing a river.
 - B) A large body of water is generally the source of water for a river.
 - C) Rivers always flow toward large bodies of water.
 - D) Rivers shown on maps generally flow southward.
- 32. An observer recorded the times of three successive high tides at one Earth location as:
 - 7:12 a.m.
 - 7:38 p.m.
 - 8:04 a.m.

What was the time of the next high tide?

A)	9:04 p.m.	B)	8:12 p.m.
C)	8:38 p.m.	D)	8:30 p.m.

- 33. In which two temperature zones of the atmosphere does the temperature increase with increasing altitude?
 - A) troposphere and mesosphere
 - B) stratosphere and thermosphere
 - C) troposphere and stratosphere
 - D) mesosphere and thermosphere
- 34. What is the approximate altitude of *Polaris* at Syracuse, New York?

A) 43° B) 47° C) 76° D) 90°

35. The maps below show the odor fields from a neighborhood hamburger barbecue. An *X* marks the exact location of the barbecue grill. The wind was blowing from the northeast when map *A* was drawn. Map *B* represents the same area drawn 1 hour after map *A* was drawn.



Which conclusion about what happened during the hour is best supported by comparing these two maps?

- A) The wind direction remained constant.
- B) The odor became stronger in the western section of the map area.
- C) The size of the field grew.
- D) The field values changed at many places.



38. The graph below shows the relationship between mass and volume for three samples, *A*, *B*, and *C*, of a given material.



What is the density of this material?

A)	1.0 g/cm^3	B)	5.0 g/cm^{3}
C)	10.0 g/cm^3	D)	20.0 g/cm ³

39. Which term is best defined as a measure of the amount of space a substance occupies?

A)	density	B)	volume
C)	weight	D)	mass

Base your answers to questions 40 through 43 on the diagrams below, and your knowledge of Earth science. The diagrams represent five substances, A through E, at the same temperature. Some mass, volume, and density values are indicated for each substance. Substance C is a liquid in a graduated cylinder. [Note that 1 cubic centimeter = 1 milliliter. Objects are not drawn to scale.]



40. Which two substances could be made of the same material?

A) A and B B) B and E C) C and D

41. Water (*W*) was added to the graduated cylinder containing liquid *C*. Objects *A* and *D* were then dropped into the cylinder. Which diagram most accurately shows the resulting arrangement of these substances?

D) A and E



44. The contour map below shows elevations recorded in meters. Line AB is a reference line on the map.



Contour interval = 100 m

Which graph best represents the profile from point A to point B?



45. A classification system is based on the use of

- A) the human senses to observe properties of objects
- B) instruments to observe properties of objects
- C) inferences to make observations
- D) observed properties to group objects with similar characteristics
- 46. The use of a triple-beam balance to determine the mass of a rock is an example of measuring by using
 - A) inferences and interpretations
 - B) all of the five senses
 - C) a combination of dimensional quantities
 - D) a direct comparison with a standard

47. Which graph best represents the relationship between the density of a substance and its state of matter (phase) for most earth materials, *excluding* water?

[Key: S =solid, L =liquid, G =gas]



48. A student collected and recorded measurements of the amount of carbon monoxide in the air at the same location each day for one week. The data are shown below.

Day	Time	Carbon Monoxide (parts per million)
1	9:10 a.m.	0.20
2	3:10 p.m.	0.38
3	10:45 a.m.	0.40
4	7:20 a.m.	1.15
5	6:00 a.m.	0.95
6	6:00 p.m.	0.65
7	7:15 p.m.	0.14

The student concluded that the amount of carbon monoxide in the air increased and then decreased during the week. A source of error in the student's investigation is that the student failed to

- A) state the method of measurement
- B) identify the days of the week
- C) identify the month
- D) collect data at the same time each day
- 49. A group of students observed and measured various characteristics of a stream for one day. Which statement about the stream is most likely an inference?
 - A) The water level of the stream will rise after the next rainfall.
 - B) The stream water is dark brown.
 - C) The velocity of the stream is greatest near the outside of a meander.
 - D) The stream's depth is different at various distances from the streambank.

- 50. A 1,000.0-gram sample of dry rock fragments was placed in a container of water, shaken for 3 minutes, and strained through a wire screen. The mass of the sample after shaking was 1,002.1 grams. Which statement best explains this result?
 - A) Some of the original rock fragments were lost when the sample was strained.
 - B) The rock fragments became wet when they were shaken.
 - C) The rock fragments formed new minerals that were more dense.
 - D) The rock fragments were broken into smaller pieces, resulting in additional mass.
- 51. Which graph best represents the relationship between mass and volume of a material that has a density of 5 grams per cubic centimeter?



- 52. A gravity meter is used to measure the amount of gravitational pull at the Earth's North Pole and at the Earth's Equator. How would these readings of gravitational pull compare? [Assume both readings are taken at sea level.]
 - A) The reading would be lower at the North Pole than at the Equator.
 - B) The reading would be higher at the North Pole than at the Equator.
 - C) The readings would be the same at the North Pole and at the Equator.
- 53. As air on the surface of Earth warms, the density of the air
 - A) decreases
 - B) increases
 - C) remains the same

54. Base your answer to the following question on the topographic map below. Points *A*, *B*, *C*, *D*, and *X* represent locations on the map. Elevations are measured in feet.



55. What time is it in Greenwich, England (at 0° longitude), when it is noon in Massena, New York? 56. Which event is most predictable?

B) 7 a.m.

D) 5 p.m.

A) noon

C) 10 p.m.

- A) A meteorite falls to Earth.
- B) Coral fossils are found on mountaintops.
- C) An earthquake occurs.
- D) The Sun rises.

- 57. Oxygen is the most abundant element by volume in Earth's
 - A) crust
- B) troposphereD) inner core
- C) hydrosphere D)
- 58. During a laboratory activity, four students each determined the density of the same piece of granite. The results are shown in the table below.

Student	Density Determined
1	2.69 g/cm ³
2	2.71 g/cm ³
3	2.72 g/cm ³
4	2.69 g/cm ³

The accepted value for the density of granite is 2.70 grams per cubic centimeter. Therefore, the results of this activity indicate that

- A) the balance used by student 3 was broken
- B) the accepted density of granite is incorrect
- C) each student determined the exact accepted value for the density of granite
- D) the density determined by each student contains a small error

Base your answers to questions **59** and **60** on the diagrams below, which represent two different solid, uniform materials cut into cubes A and B.



Mass of A = 320 g Volume of A = 64 cm³

Density of B = 3 g/cm³ Volume of B = 27 cm³

(Not drawn to scale)

59. What is the density of cube *A*?

A)	5.0 g/cm ³	B) 12.8 g/cm^3
C)	0.2 g/cm ³	D) 64.0 g/cm ³

60. What is the mass of cube *B*?

A) 9 g B) 27 g C) 3 g D) 81 g

61. The graph below shows world population beginning in the year 1800 and projected to the year 2000.



The graph shows the greatest increase in population between

- A) 1975 and 2000 B) 1875 and 1900
- C) 1925 and 1950 D) 1825 and 1850
- 62. The graph below represents percentage of elements by volume.



This graph best represents the elements of the Earth's

- A) lithosphere B) troposphere
- C) hydrosphere D) stratosphere
- 63. At an altitude of 95 miles above Earth's surface, nearly 100% of the incoming energy from the Sun can be detected. At 55 miles above Earth's surface, most incoming x-ray radiation and some incoming ultraviolet radiation can no longer be detected. This missing radiation was most likely
 - A) reflected by the troposphere
 - B) absorbed in the thermosphere
 - C) reflected by the stratosphere
 - D) absorbed in the mesosphere

Base your answers to questions **64** and **65** on the topographic map below. Points A and B represent locations on the map. Elevations are shown in meters.



65. Which map would best represent this area if sea level were to rise 10 meters?



66. An observer recorded the barometric pressure while traveling up the west side of a mountain and down the other side. Which graph best represents the probable air pressure changes that were observed?



- 67. A quantity of water is frozen solid and then heated from 0°C to 10°C. Which statement best describes the properties of the water during this time?
 - A) Mass and volume change.
 - B) Volume and density change.
 - C) Mass changes but volume remains constant.
 - D) Volume changes but density remains constant.

68. The topographic map below shows a stream crossing several contour lines and passing through points *X* and *Y*. Elevations are measured in feet.



What is the approximate gradient between point *X* and point *Y*?

A)	10 ft/mi	B)	20 ft/mi
C)	40 ft/mi	D)	80 ft/mi

69. Base your answer to the following question on the world map below. Letters *A* through *D* represent locations on Earth's surface.



At which location could an observer not see Polaris in the night sky at any time during the year?



70. Base your answer to the following question on the contour map below, which shows a hill formed by glacial deposition near Rochester, New York. Letters *A* through *E* are reference points. Elevations are in feet.



Which description best compares the gradients of this hill?

- A) CE and AE have the same gradient.
- B) AE and EB have the same gradient.
- C) *CE* has a steeper gradient than *ED*.
- D) AE has a steeper gradient than EB.

71. Base your answer to the following question on the latitude and longitude system shown below. The map represents a part of the Earth's surface and its latitude-longitude coordinates. Points *A* through *F* represent locations in this area.



90°W 80°W 70°W 60°W 50°W 40°W

How are latitude and longitude lines drawn on a globe of the Earth?

- A) Longitude lines are parallel and latitude lines meet at the Equator.
- B) Latitude lines are parallel and longitude lines meet at the poles.
- C) Latitude lines are parallel and longitude lines meet at the Equator.
- D) Longitude lines are parallel and latitude lines meet at the poles.
- 72. In the diagrams below, the dark zone at the surface of each wedge-shaped segment of the Earth represents average ocean depth. Which segment is drawn most nearly to scale?



- 73. A black hole is a celestial feature believed to have a mass millions of times the mass of our Sun and a diameter less than the diameter of Earth. An object of such high mass and small volume would have
 - A) an elliptical orbit with Earth at one focal point
 - B) a very low density
 - C) an elliptical orbit with the Sun at one focal point
 - D) a very high density
- 74. If an observer on Earth views *Polaris* on the horizon, the observer is located at the
 - A) Tropic of Cancer (23.5° N)
 - B) equator (0°)
 - C) Tropic of Capricorn (23.5° S)
 - D) North Pole (90° N)
- The diagram below shows latitude measurements every 10 degrees and longitude measurements every 15 degrees.



What is the latitude and longitude of point *X*?

A) 75° N 30° E	B) 50° N 45° W
C) 60° S 30° W	D) 40° S 45° E

- 76. As altitude increases from the tropopause to the mesopause, the atmospheric temperature will
 - A) decrease, only
 - B) increase, only
 - C) decrease, then increase
 - D) increase, then decrease

Base your answers to questions 77 through 79 on the maps below. Points *A*, *B*, *C*, *X*, and *Y* are locations on the topographic map. The small map identifies the New York State region shown in the topographic map.



C) 250 ft/mi

- 79. What is the approximate gradient between point *X* and point *Y*?
 - A) 1,000 ft/mi B) 500 ft/mi
- 80. The solid rock material that directly underlies the sediments on the ocean floor is part of the Earth's
 - A) outer core B) troposphere
 - C) lithosphere D) hydrosphere

Base your answers to questions **81** and **82** on the diagram below, which represents a solid material of uniform composition.



81. The mass of this piece of material is approximately

A) 4.4 g	B) 0.23 g
C) 32 g	D) 9.3 g

- 82. If this material is heated and expands, the density of the material will
 - A) decrease B) increase
 - C) remain the same
- 83. The diagrams below represent two solid objects *A* and *B*. with different densities.



D) Both objects will sink.

D) 100 ft/mi

- 84. Compared to the weight of a person at the North Pole, the weight of the same person at the Equator would be
 - A) slightly more, because the person is closer to the center of Earth
 - B) slightly less, because the person is farther from the center of Earth
 - C) slightly more, because the person is farther from the center of Earth
 - D) slightly less, because the person is closer to the center of Earth
- 85. The Earth is slightly flattened from a perfect spherical shape because of
 - A) the pull of the sun and moon
 - B) its molten core
 - C) storms on the sun's surface
 - D) its rotation
- 86. The data table below shows the mass and volume of three samples of the same mineral. [The density column is provided for student use.]

Data	Table

Sample	Mass (g)	Volume (cm ³)	Density (g/cm3)
А	50	25	
В	100	50	
С	150	75	

Which graph best represents the relationship between the density and the volume of these mineral samples?



Base your answers to questions 87 and 88 on

the contour map below. Points A, B, C, D, X, and Y are locations on the map. Elevations are expressed in feet. The maximum elevation of Basket Dome is indicated at point X.



87. In which general direction does Tenaya Stream flow?

- A) southeast to northwest B) southwest to norheast
- C) northwest to southeast
- D) northeast to southwest
- 88. The highest elevation of Basket Dome 40 years ago was measured at 7,600 feet. What is the rate of change in elevation for this area?
 - A) 40 in/yr B) 1.7 in/yr C) 24 in/yr D) 0.6 in/yr

89. The polar circumference of the Earth is 40,008 kilometers. What is the equatorial circumference?

- A) 12,740 km B) 25,000 km
- C) 40,008 km D) 40,076 km

90. A contour map is shown below. Elevations are shown in 93. Base your answer to the following question on the map feet.



What is the contour interval of this map?

A) 25 ft B) 15 ft C) 10 ft D) 20 ft

91. Which graph shows the most probable effect of environmental pollution on the chances of human survival?



- 92. In the classroom during a visual inspection of a rock, a student recorded four statements about the rock. Which statement about the rock is an observation?
 - A) The rock dates from the Precambrian Era.
 - B) The rock cooled very rapidly.
 - C) The rock formed deep in the Earth's interior.
 - D) The rock is black and shiny.

below, which shows the latitude and longitude of five observers, A, B, C, D, and E, on Earth.



Which two observers would be experiencing the same apparent solar time?

A) B and C	B) A and C
C) D and E	D) B and E

94. As shown below, an empty 1,000.-milliliter container has a mass of 250.0 grams. When filled with a liquid, the container and the liquid have a combined mass of 1,300. grams.



A)	1.00 g/mL	B) 1.05 g/mL
C)	1.30 g/mL	D) 0.95 g/mL

95. Base your answer to the following question on the two tables below and on your knowledge of Earth science. Table 1 shows the composition, hardness, and average density of four minerals often used as gemstones. Table 2 lists the minerals in Moh's Scale of Hardness from 1 (softest) to 10 (hardest). Table 2

Table 1			
Gemstone Mineral	Composition	Hardness	Average Density (g/cm ³)
emerald	$Be_3Al_2(Si_6O_{18})$	7.5–8	2.7
sapphire	AI_2O_3	9	4.0
spinel	MgAl ₂ O ₄	8	3.8
zircon	ZrSiO ₄	7.5	4.7

KEY		
AI =	aluminum	O = oxygen
Be =	beryllium	Si = silicon
Mg =	magnesium	Zr = zirconium

Moh's Scale of Hardness		
1	talc	
2	gypsum	
3	calcite	
4	fluorite	
5	apatite	
6	feldspar	
7	quartz	
8	topaz	
9	corundum	
10	diamond	

If the mass of a spinel crystal is 9.5 grams, what is the volume of this spinel crystal?

A)
$$36.1 \text{ cm}^3$$
 B) 2.5 cm^3 C) 5.7 cm^3 D) 0.4 cm^3

96. Base your answer to the following question on the diagram below, which represents latitude and longitude lines on Earth. Points A through E represent locations on Earth. Arrows represent direction of rotation.



What is the approximate latitude and longitude of location A?

A)	160° N, 15° E	B)	15° N, 160° W
C)	160° S, 15° W	D)	15° N, 160° E

- 97. The lines on which set of views best represent Earth's latitude system?



98. The diagram below is a cross section of an ice-covered lake in New York State during the month of January. Points *A*, *B*, *C*, and *D* are locations at various levels in the lake. The temperature of the water at location *D* is 4°C.



Which graph best represents the relationship between location and density of the ice or water?



99. The topographic map below shows a lake and two rivers.



In which direction does each of the rivers flow?

- A) The Sapphire River and the Garnet River both flow west.
- B) The Sapphire River flows east and the Garnet River flows west.
- C) The Sapphire River and the Garnet River both flow east.
- D) The Sapphire River flows west and the Garnet River flows east.
- 100. A contour map is shown below. Elevations are shown in feet.



Which side of Amethyst Hill has the steepest slope?A) west B) north C) east D) south