Name: _____ Class: _____ Date: _____ ID: A

Mapping Study Guide

Modified True/False
Indicate whether the sentence or statement is true or false. If false, change the identified word or phrase to make the sentence or statement true.

____ 1. Lines of latitude are parallel. _____

____ 2. The Topex/Poseidon satellite allows its users to determine their exact position on Earth. _____

____ 3. The science of mapmaking is called cartography. _____

____ 4. The prime meridian represents 0° longitude. _____

____ 5. The International Date Line is another name for the equator. _____

____ 6. A Mercator projection distorts areas near the poles. _____

____ 7. A contour line on a world map connects points of equal elevation. _____

____ 8. A map legend explains what the symbols on a map represent. _____

____ 9. The wavelength of an electromagnetic wave is the number of waves that pass a particular point each second. _____

____ 10. Satellites in the Global Positioning System help users determine their exact weight. _____

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 11. What is the longitude of the prime meridian?
a. 0° c. 90° west
b. 90° east d. 180°

____ 12. Which of the following is used by navigators to plot great-circle routes?
a. Mercator projection c. gnomonic projection
b. conic projection d. topographic map

____ 13. Which of the following is used extensively for navigation by airplanes and ships?
a. depression contour line c. Topex/Poseidon satellite
b. Landsat satellite d. Global Positioning System

____ 14. What is the latitude of the north pole?
a. 0° north c. 180° north
b. 90° north d. 360° north

____ 15. Each degree of latitude or longitude is divided into 60 smaller units called ____.
a. meridians c. seconds
b. grids d. minutes

____ 16. Which statement about lines of longitude is true?
a. They converge at the equator.
b. They converge at the poles.
c. They are parallel.
d. They locate positions in north and south directions.

____ 17. Into how many time zones is Earth divided?
a. 12
b. 15
c. 24
d. 360

____ 18. All flat maps distort either the shapes or the areas of landmasses because ____.
a. the boundaries of landmasses are not known with certainty
b. such large structures cannot be drawn accurately
c. lines of latitude are not perfectly parallel
d. Earth is a curved, three-dimensional object

____ 19. On a topographic map, the difference in elevation between two side-by-side contour lines is called the ____.
a. contour interval
b. index contour
c. depression contour
d. hachure

____ 20. What is a graphic scale?
a. a statement that expresses distance, such as one centimeter equals one kilometer
b. a ratio that expresses distance, such as 1:50 000
c. a line broken into sections that represent units with each section representing a distance on Earth's surface
d. a diagram that shows the elevation of the hills and valleys of an area

____ 21. GPS satellites can relay information about all of the following except ____.
a. position
b. elevation
c. direction
d. weather

Completion
Complete each sentence or statement.

22. If you were traveling _____ across the International Date Line, you would advance your calendar one day.

23. The speed of light in a vacuum is _____ km/s.

Matching

Match each item with the correct statement below.
a. cartography
b. contour line
c. map legend
d. map scale
e. remote sensing
f. topographic map

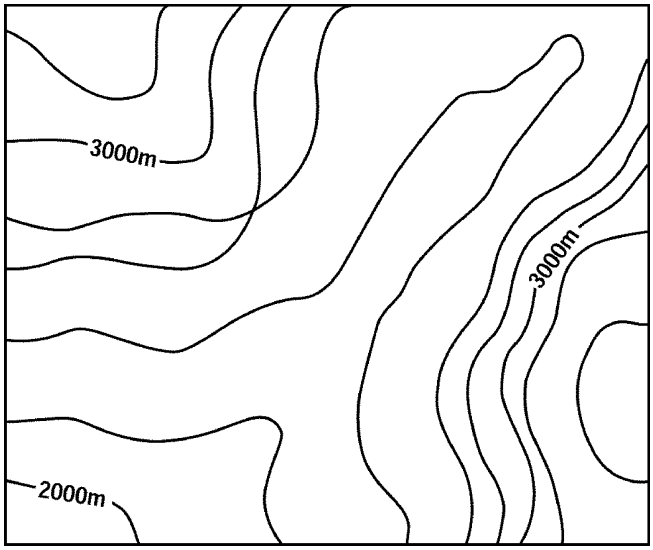
____ 24. The process of collecting data about Earth from far above Earth's surface
____ 25. Explains what the symbols on a map represent

____ 26. The science of mapmaking
____ 27. Connects points of equal elevation on a map
____ 28. Type of map that shows changes in elevation of Earth's surface
____ 29. The ratio between distances on a map and actual distances on the surface of Earth

Short Answer

30. Contrast the distortion that is produced by a Mercator projection, a conic projection, and a gnomonic projection.

31. There is a mistake in the topographic map shown in the figure below. Identify the mistake and explain why it is wrong.



32. Which of the remote-sensing satellites discussed in Chapter 2 would be most likely to detect a large fire burning on Earth's surface? Explain your reasoning.

Compare and contrast each pair of related terms or phrases.

33. latitude, longitude

34. conic projection, gnomonic projection

35. Landsat satellite, *Topex/Poseidon* satellite

36. Time zone boundaries do not always line up perfectly with lines of longitude. Why?

37. Why does a Mercator projection exaggerate the areas of landmasses near the poles?

38. Why do contour lines never cross?

39. Why are map scales useful?

40. How does the *Topex/Poseidon* satellite collect data?

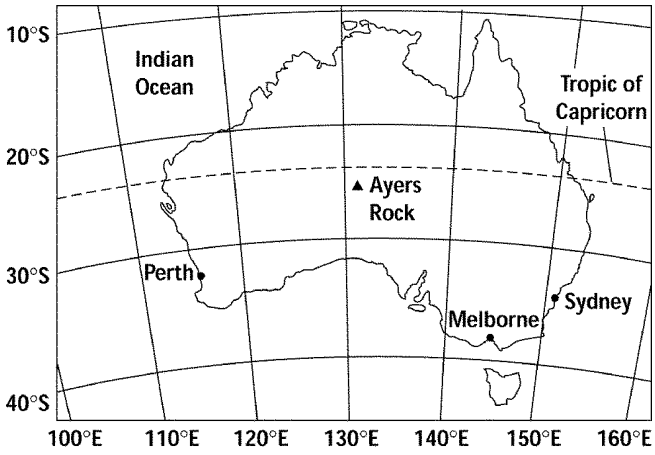
Use the table to answer the following questions.

City	Latitude	Longitude
Cape Town, South Africa	34°S	18°E
Pontianak, Indonesia	0°	109°E
Nome, Alaska	65°N	165°W
Quito, Ecuador	0°	79°W
Stockholm, Sweden	59°N	18°E
Wellington, New Zealand	41°S	175°E

41. Which city is closest to the International Date Line?
42. Which city is farthest from the equator?
43. What is the approximate distance between Stockholm and Cape Town? Explain your answer.
44. What is the approximate distance between Pontianak and Quito? Explain your answer.
45. When it is Thursday in Wellington, what day is it in Nome? Explain your answer.
46. Suppose you were given a topographic map that did not show index contours. What would the map indicate about the terrain of the area shown? What would the map not indicate?

Problem

47. Look at the map of Australia. The table below lists the longitude and latitude for several locations in Australia. Complete by using the map to fill in the missing coordinates.



Latitude	Longitude	Location
_____	131°E	Ayers Rock
38°S	_____	Melborne
32°S	_____	Perth
_____	151°E	Sydney

LATITUDE	LONGITUDE	LOCATION
a. _____	131°E	Ayers Rock
38°S	b. _____	Melbourne
32°S	c. _____	Perth
d. _____	151°E	Sydney

Table 2-1

48. Point A is located at 40°N, 75°W. Point B is located at 35°N, 120°W. When it's 10 P.M. at point A, what time is it likely to be at point B?

49. A mapmaker has given you a map to complete. The map already has a graphic scale and a verbal scale. The verbal scale reads, "One centimeter equals 40 kilometers." The mapmaker wants you to add the correct fractional scale. What should you write? Show your reasoning.

50. The wavelength of electromagnetic radiation is inversely related to the radiation's frequency. In other words, radiation with a long wavelength has a low frequency, and radiation with a short wavelength has a high frequency. The amount of energy in electromagnetic radiation increases with frequency. Use this information to explain which of the forms of radiation in the table below has the most energy.

Radiation	Wavelength (m)
Radio wave	8×10^{2}
Microwave	7×10^{-2}
Blue light	5×10^{-7}
X-ray	3×10^{-11}

Mapping techniques can be used on other planets besides Earth. In 1996, the National Aeronautics and Space Administration (NASA) launched a satellite called the *Mars Global Surveyor* toward Mars. One of the purposes of the satellite was to collect data about the surface of Mars. The satellite reached Mars in 1997 and then gradually slowed into a low, circular orbit around the planet. It finally began mapping the surface of Mars in 1999, a process that was scheduled to last nearly two years.

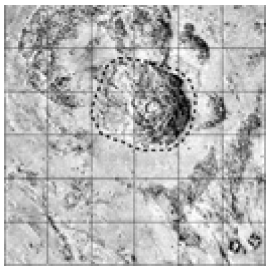
The *Mars Global Surveyor* carries a camera that can distinguish objects on the surface of Mars that are less than 1.5 m across. It also has an instrument that measures surface elevation as well as sensors that analyze the heat radiating from the planet's surface. These sensors provide data about the composition of different areas of the planet. All of the information collected by the *Mars Global Surveyor* is transmitted to Earth in the form of radio waves. The satellite will continue to orbit Mars for at least 50 years after its mission is completed. It does not carry enough propellant to return to Earth.

51. The distance from Earth to Mars ranges between 78 000 000 km and 380 000 000 km, depending on the time of year. The speed of light is 300 000 km/s. Calculate the minimum and maximum time it takes for data transmitted by the *Mars Global Surveyor* to reach Earth.

52. What are the advantages of using a satellite for this project instead of sending a team of astronauts to Mars to map the surface?

53. It takes Mars 24.6 hours to rotate once on its axis. How wide in degrees is a time zone on Mars if each time zone represents a different hour? (Hint: Like Earth, Mars is a sphere.)

This map was prepared from data collected by the *Mars Global Surveyor*. The dashed lines on the map surround the base of the Martian volcano Olympus Mons.



54. In which hemisphere is the area on the map?

55. The circumference of Mars is 21 200 km. What is the approximate distance of each degree of latitude on Mars?

56. How far does the base of Olympus Mons stretch from north to south? (Hint: Use your answer from question 5 to convert degrees to kilometers.)

57. Can you estimate how far the base of Olympus Mons stretches from east to west with the same accuracy? Explain why or why not.

58. The top of Olympus Mons is the highest point on Mars. It is 27 km above the average elevation on Mars. (Because Mars has no oceans, its elevations cannot be defined with respect to sea level.) By comparison, the highest point on Earth, Mt. Everest, is 8850 m above sea level. How many times higher than Mt. Everest is Olympus Mons?

Mapping Study Guide
Answer Section

MODIFIED TRUE/FALSE

1. T
2. F, Global Positioning System
3. T
4. T
5. F, 180° meridian
6. T
7. F, topographic
8. T
9. F, frequency
10. F, position

MULTIPLE CHOICE

11. A
12. C
13. D
14. B
15. D
16. B
17. C
18. D
19. A
20. C
21. D

COMPLETION

22. west
23. 300 000

MATCHING

24. E
25. C
26. A
27. B
28. F
29. D

SHORT ANSWER

30. In a Mercator projection, the areas of landmasses near the poles are exaggerated. In a conic projection, there is very little distortion along one line of latitude, but the areas and shapes of landmasses near the top and bottom of the projection are distorted. In a gnomonic projection, the direction and distance between landmasses are distorted.
31. Two contour lines cross in the upper left part of the map. This is wrong because each contour line should represent one elevation. If two lines cross, it means that the point where they cross has two elevations, which is impossible.
32. Landsat satellites would be most likely to detect a large fire. These satellites detect electromagnetic radiation related to warmth.
33. Both are used to precisely locate positions on Earth. Latitude is the distance in degrees north or south of the equator. Longitude is the distance in degrees east or west of the prime meridian.
34. Both are ways of making a flat map by projecting points and lines from a globe. In a conic projection, the points and lines are projected onto a cone. In a gnomonic projection, the points and lines are projected onto a piece of paper that touches the globe at a single point.
35. Both collect data about Earth by remote sensing. A Landsat satellite detects energy related to the warmth of surface features. The *Topex/Poseidon* satellite uses radar to map features on the ocean floor.
36. The boundaries are adjusted in local areas to avoid the confusion that would result if, for example, a city was split by a time zone.
37. Lines of longitude converge as they approach the poles, but a Mercator projection shows these lines as being parallel. Making the lines parallel stretches the area between them, especially near the poles.
38. Each contour line represents one elevation. If two lines crossed, it would mean that the point where they crossed had two elevations, which is impossible.
39. They show the relationship between distances on a map and actual distances on the surface of Earth, which enables the map reader to measure distances.
40. The satellite sends radar waves to the ocean's surface and picks up the echo that is reflected off the water. The distance to the water's surface is calculated using the speed of light and the time it takes the signal to reach the surface and return. Variations in time indicate the presence of certain features on the ocean floor.
41. Wellington, New Zealand
42. Nome, Alaska
43. Because both cities have the same longitude, the distance between them equals their difference in latitude multiplied by 111 km. The cities are on opposite sides of the equator, so their latitudes are added. distance = (59° + 34°) × (111 km/°) = 10 323 km
44. Because both cities are on the equator, the distance between them equals their difference in longitude multiplied by 111 km, which is the value for longitude at the equator. distance = (109° + 79°) × (111 km/°) = 20 868 km
45. Wednesday; Nome is east of the International Date Line, so the calendar moves back one day.
46. The map would indicate which points on the map were higher than others and which areas were steeper. It would not indicate the actual elevation of any point.

PROBLEM

47. a. 25°S, b. 145°E, c. 115°E, d. 34°S
48. The difference in longitude between points A and B = 120° – 75° = 45°. Each time zone represents 1 hour and is roughly 15° wide; 45° ÷ 15° = 3 time zones or 3 hours separating points A and B. Point A is east of point B, so it is 3 hours ahead of point B. Therefore, it is likely to be 7 P.M. at point B.
49. Since: 100 cm/m × 1000 m/km = 100 000 cm/km
    And: 100 000 cm/km × 40 km = 4 000 000 cm
    Then the fractional scale is 1:4 000 000.
50. The X-ray has the shortest wavelength, so it has the highest frequency and therefore the most energy.
51. Minimum: 78 000 000 km ÷ 300 000 km/s = 260 s
    Maximum: 380 000 000 km ÷ 300 000 km/s = 1267 s
52. Answers may vary. Space flight is dangerous, and the astronauts would be risking their lives to travel to a planet that humans have not visited. It would be much more expensive to send humans to Mars and bring them back than it is to send a satellite and leave it in orbit. A satellite can collect more data more quickly while in orbit than people could on the surface. Accept all reasonable answers.
53. 360° ÷ 24.6 h = 14.68°/h
54. northern hemisphere
55. 21 200 km ÷ 360° = 58.9 km/°
56. The base stretches approximately 10° from north to south. 10° × 58.9 km/° = 589 km
57. No; lines of longitude get closer together as they approach the poles, but this map shows the lines as being parallel. Therefore, the map distorts distances in the east-west direction.
58. 8850 m = 8.850 km; 27 km ÷ 8.850 km = 3; Olympus Mons is three times higher than Mt. Everest.