

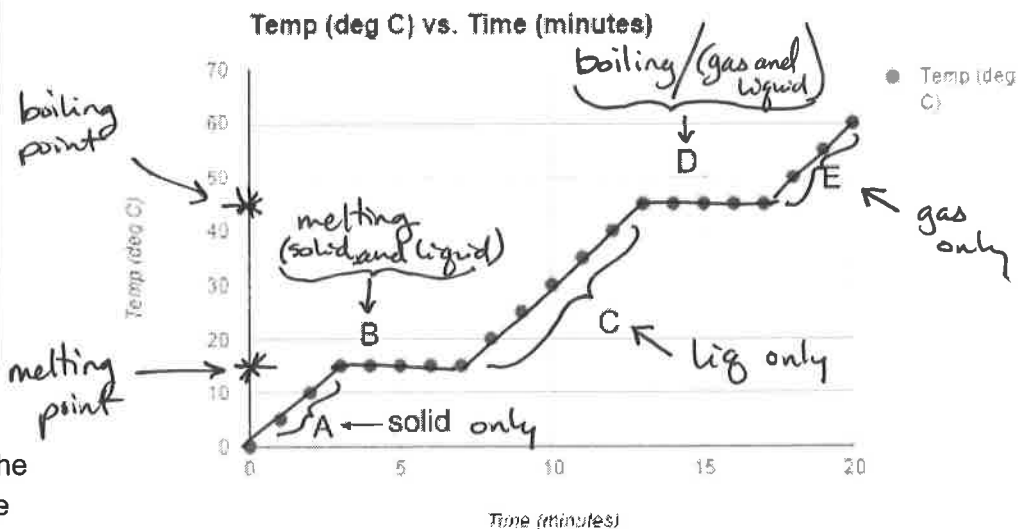
PRACTICE TEST Topic 5: Heating, Cooling, and Phase Diagrams

Directions: Use the heating graph below to answer the following questions.



Known Melting Point Data

Name of Chemical	Melting Points
Lauric Acid	44 deg C
Naphthalene	82 deg C
Benzoic Acid	122 deg C



- Based on the melting and boiling points on the graph above, could the substance that was heated be any of the four substances above? Explain why or why not.

No, the melting point temperature is 15°C and all 3 substances in the table have melting points above 15°C. Same temperature as boiling point

- What is the condensation point temperature for the substance?
 - 0 deg C
 - 15 deg C
 - 35 deg C
 - 45 deg C
 - 60 deg C
- Is the speed of the molecules or the arrangement of the molecules changing during section C?
 - speed
 - arrangement
 - both speed and arrangement
- What is the freezing point temperature of the substance in the graph above?

15°C ... the same temperature as the melting point.
- If you want to move from phase E to phase C, you need to...
 - Add energy
 - Remove energy
 - Keep the energy constant
 - Not change the energy
- If you want to move from phase C to phase E, you need to...
 - Add energy
 - Remove energy
 - Keep the energy constant

7. Using the graph on page #1, what phase or phases are present during each of the sections below?

Section	Phase or phases present
A	Solid only
B	Solid and liquid
C	Liquid only
D	Liquid and gas
E	gas only

8. Four lab groups measured the melting point and boiling point of a substance.

a. average melting point of the substance =

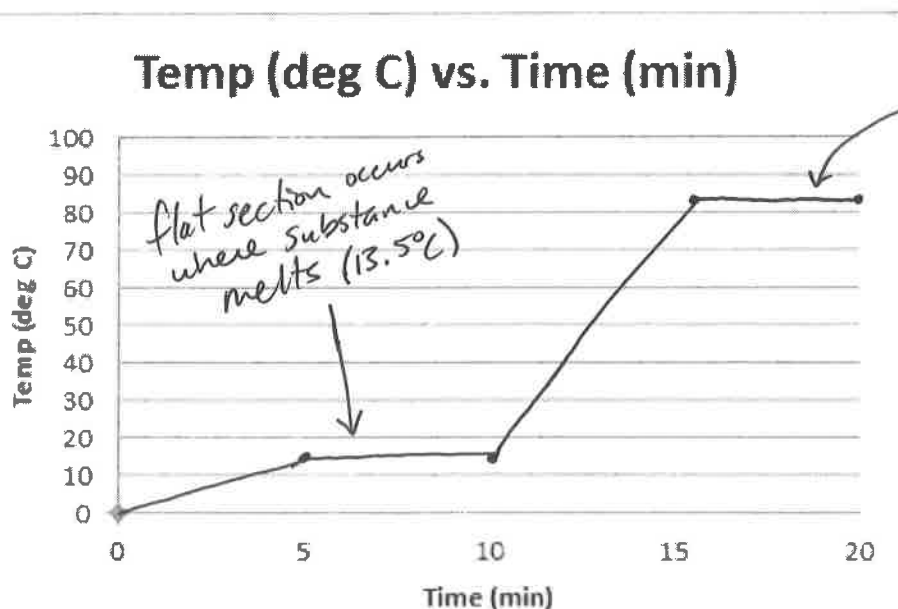
$$\frac{12 + 15 + 13 + 14}{4} = 13.5^{\circ}\text{C}$$

b. average boiling point of the substance =

$$\frac{87 + 78 + 83 + 85}{4} = 83.25^{\circ}\text{C}$$

Lab Group #	Measured Melting Point (deg C)	Measured Boiling Point (deg C)
1	12	87
2	15	78
3	13	83
4	14	85

9. Use the data they obtained from number 8 to draw a heating graph. The shape of the graph should correspond to the the melting and boiling data in the table.



flat section occurs where substance boils (83.25°C)

10. What is the average of the boiling points in the table below?

- a. 84
- b. 89
- c. 99
- d. 190

Trial #	Boiling point (degrees C)
1	91
2	90
3	86

$$\frac{91 + 90 + 86}{3} = 89$$

11. Complete the table by determining what is the % Antifreeze for the student's mixture.

Groups	mL of Water	mL of Antifreeze	% antifreeze
1	20	70	77.78%

$$\frac{70}{90} \times 100 = 77.78\%$$

12. A student measures the boiling point of a substance to be 70 degrees Celsius. What is the temperature in Kelvins?

$$70 + 273 = 343\text{K}$$

13. A student finds online that the melting point of a substance 170 K. What is the temperature in Celsius?

$$170 - 273 = -103^\circ\text{C}$$

14. A student collects the following data when melting and boiling water: The true boiling point of water is 373 Kelvin. Calculate the student's percent error for the boiling point.

Measured Melting Point	265 K
Measured Boiling Point	379 K

$$\frac{|373 - 379|}{373} \times 100\% = 1.61\%$$

Use the graph below for carbon dioxide to answer the following questions:

15. What phase would the CO₂ be in if the temperature were 25 deg C, and the pressure was about 5 atmospheres?

- a. solid
- b. liquid
- c. gas

16. What is the boiling point temperature of CO₂ be if it were heated at about 50 atm of pressure?

- a. 19 deg C
- b. 22 deg C
- c. 31 deg C
- d. 60 deg C

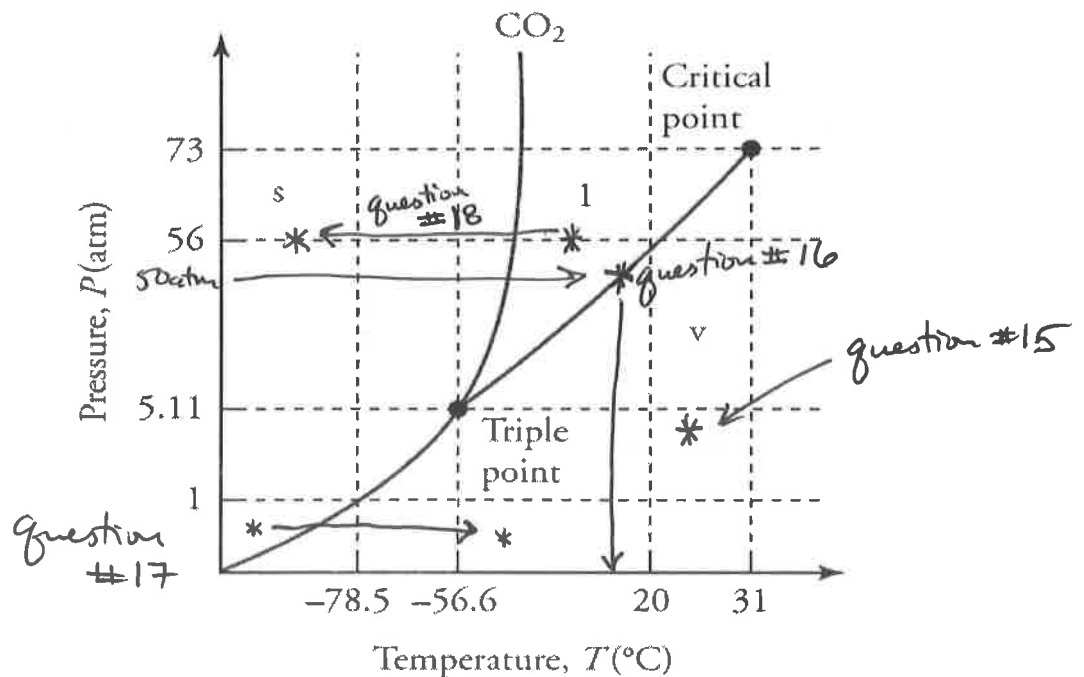
17. Carbon dioxide is kept at 0.5 atm pressure and heated from -100 deg C to degrees 0 deg C. What is the name of the phase change that takes place?

- a. melting
- b. boiling
- c. sublimation
- d. freezing

solid → gas

18. Carbon dioxide is kept at 56 atm of pressure and is cooled from 15 deg C to -100 deg C. What is the name of the phase change that takes place?

- a. melting
- b. freezing
- c. deposition
- d. condensation



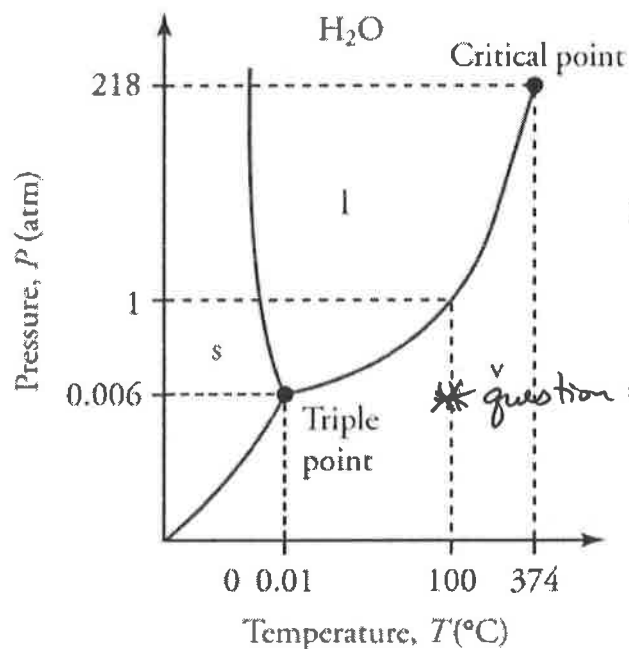
Use the triple point graph below for water to answer the following questions.

19. What phase would water exist if the pressure was at 20 atm and the temperature was at 400 deg C?

- a. solid
- b. liquid
- c. gas

20. What phase would water exist if the pressure was 0.006 atm and the temperature was 100 deg C?

- a. solid
- b. liquid
- c. gas



21. Which statement below describes the relationship between the boiling point temperature and pressure?

- a. As pressure increases, the boiling point temperature increases.
- b. As pressure increases, the boiling point temperature decreases.
- c. As pressure increases, the boiling point temperature stays constant.
- d. As pressure increases, the boiling point temperature fluctuates up and down.

22. What is the lowest pressure that water can exist as a liquid?

0.006 atm (triple point)

Directions: A student conducted an experiment where she heated up a sample of water. Her heating curve is below. Use it as well as the phase diagram to answer the next set of questions.

23. What is the melting point temperature of the water in her sample?

0°C

24. What is the boiling point temperature of the water in her sample?

100°C

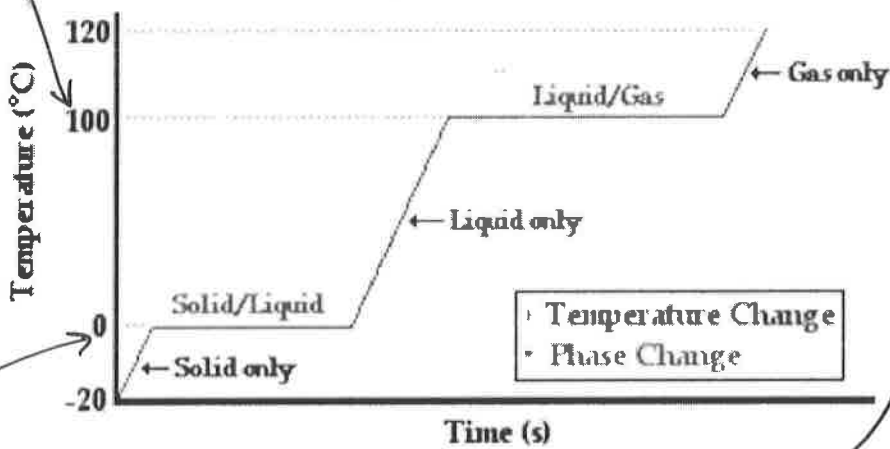
25. Compare her melting point and boiling points to the phase diagram. What was the pressure when she was conducting her experiment?

760 mmHg

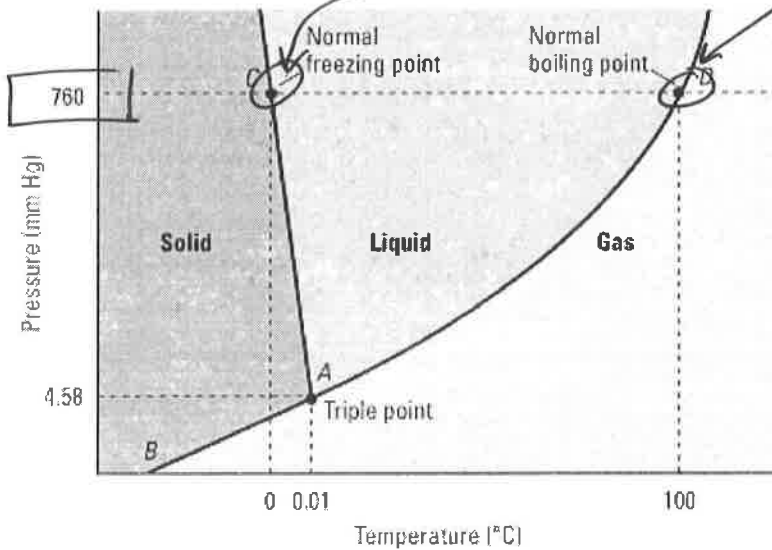
*Since
mp is 0°C
bp is 100°C*

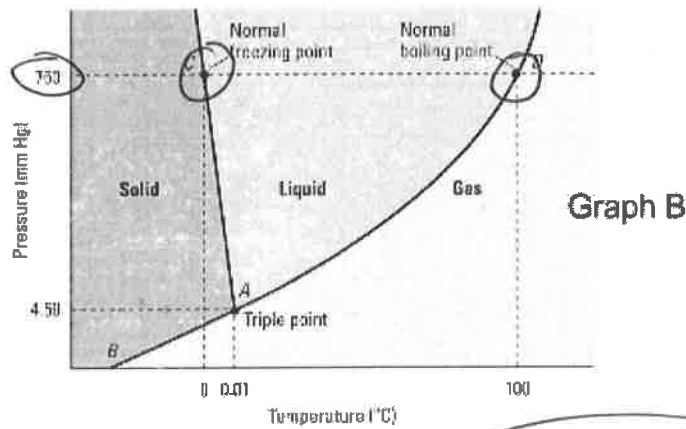
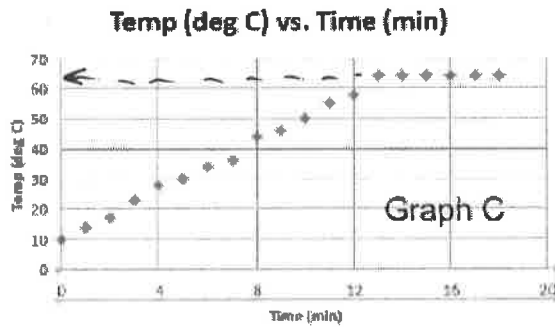
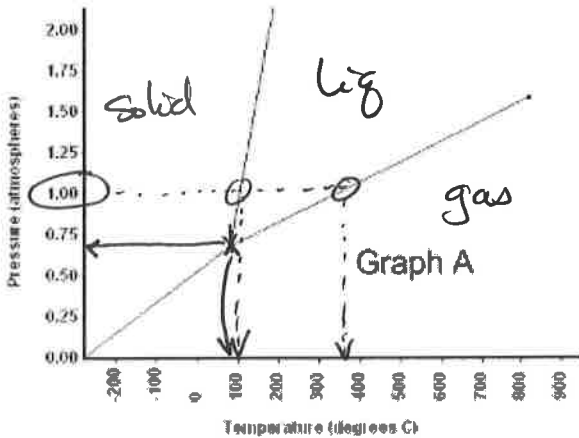
boiling point
melting point

Heating Curve for Water



Phase Diagram for Water





26. What is the freezing point of the substance in **Graph A** at standard pressure?

about 100°C

27. At what temperature would condensation occur for the substance in **Graph A** at 1.0 atm of pressure?

about 350°C

28. What is the melting point of the substance in **Graph B** at standard pressure?

0°C

1 atm
760 mm Hg

29. At what temperature would condensation occur in **Graph B** at 760 mm Hg of pressure?

100°C

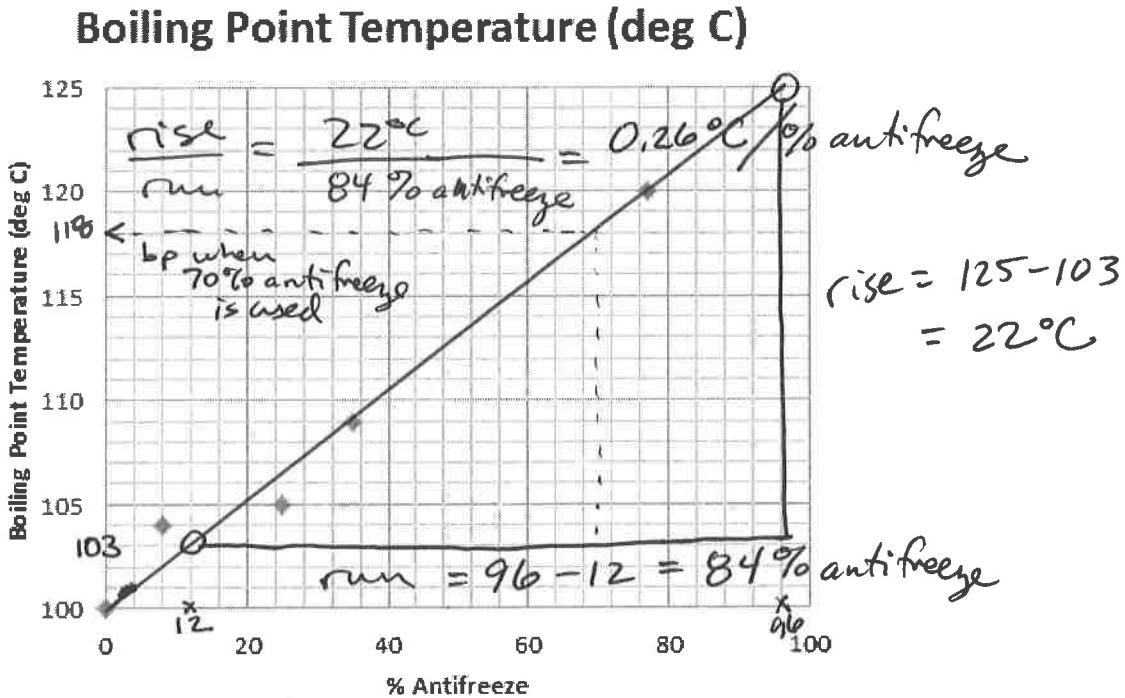
30. The substance in **Graph C** starts out at room temperature as a solid. What is the melting point of the substance in **Graph C**?

65°C

31. At what pressure and temperature does the triple point occur for the substance in **Graph A**?

about 90°C and about 0.70 atm

Directions: Draw a best fit line and calculate the slope of the best fit line. Write a "For every..." statement that explains what the graph shows about how % antifreeze affects boiling point temperatures.



32. What is the slope of the graph?

$0.26\text{ }^{\circ}\text{C} / \% \text{ antifreeze}$

33. Write a "For every..." statement for the graph.

~~For~~ For every 1% antifreeze used the boiling point temperature increases by $0.26\text{ }^{\circ}\text{C}$.

34. What is the relationship between the boiling point and the % antifreeze?

~~As~~ Boiling point temperature increases as % antifreeze used increases.

35. What would you predict the boiling point would be for a 70% solution of this antifreeze?

$118\text{ }^{\circ}\text{C}$