

## Regents Chemistry: Thermodynamics and Gas Laws Test [Practice]

- \_\_\_\_\_ 1. In a laboratory where the air temperature is  $22^{\circ}\text{C}$ , a steel cylinder at  $100.^{\circ}\text{C}$  is submerged in a sample of water at  $40.^{\circ}\text{C}$ . In this system, heat flows from
- A) both the air and the water to the cylinder  
B) both the cylinder and the air to the water  
C) the air to the water and from the water to the cylinder  
**D) the cylinder to the water and from the water to the air**
- \_\_\_\_\_ 2. As ice melts at standard pressure, its temperature remains at  $0^{\circ}\text{C}$  until it has completely melted. Its potential energy
- A) decreases                      **B) increases**  
C) remains the same
- \_\_\_\_\_ 3. Which kind of energy is stored within a chemical substance?
- A) free energy                      B) activation energy  
C) kinetic energy                  **D) potential energy**
- \_\_\_\_\_ 4. Which statement defines the temperature of a sample of matter?
- A) Temperature is a measure of the total electromagnetic energy of the particles.  
B) Temperature is a measure of the total thermal energy of the particles.  
C) Temperature is a measure of the average potential energy of the particles.  
**D) Temperature is a measure of the average kinetic energy of a particles.**
- \_\_\_\_\_ 5. Which temperature is equal to  $+20\text{ K}$ ?
- A)  **$-253^{\circ}\text{C}$**                       B)  $-293^{\circ}\text{C}$   
C)  $253^{\circ}\text{C}$                       D)  $293^{\circ}\text{C}$
- \_\_\_\_\_ 6. Which temperature represents absolute zero?
- A)  **$0\text{ K}$**                       B)  $0^{\circ}\text{C}$   
C)  $273\text{ K}$                       D)  $273^{\circ}\text{C}$
- \_\_\_\_\_ 7. Which phase change is accompanied by the release of heat?
- A)  $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{g})$   
B)  $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\ell)$   
C)  $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{g})$   
**D)  $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{s})$**

8. Which term is defined as a measure of the disorder of a system?

- A) heat                      **B) entropy**  
C) kinetic energy        D) activation energy

9. The kinetic molecular theory assumes that the particles of an ideal gas

- A) are in random, constant, straight-line motion**  
B) are arranged in a regular geometric pattern  
C) have strong attractive forces between them  
D) have collisions that result in the system losing energy

10. Under which conditions does a real gas behave most like an ideal gas?

- A) at low temperatures and high pressures  
B) at low temperatures and low pressures  
C) at high temperatures and high pressures  
**D) at high temperatures and low pressures**

11. Under the same conditions of temperature and pressure, which of the following gases would behave most like an ideal gas?

- A) He(g)**                      B) NH<sub>3</sub>(g)  
C) Cl<sub>2</sub>(g)                      D) CO<sub>2</sub>(g)

12. A cylinder with a movable piston contains a sample of gas having a volume of 6.0 liters at 293 K and 1.0 atmosphere. What is the volume of the sample after the gas is heated to 303 K, while the pressure is held at 1.0 atmosphere?

- A) 9.0 L                      **B) 6.2 L**  
C) 5.8 L                      D) 4.0 L

13. A gas occupies a volume of 444 mL at 273 K and 79.0 kPa. What is the final kelvin temperature when the volume of the gas is changed to 1880 mL and the pressure is changed to 38.7 kPa?

- A) 31.5 K                      B) 292 K  
**C) 566 K**                      D) 2360 K

14. A sample of gas is held at constant pressure. Increasing the kelvin temperature of this gas sample causes the average kinetic energy of its molecules to

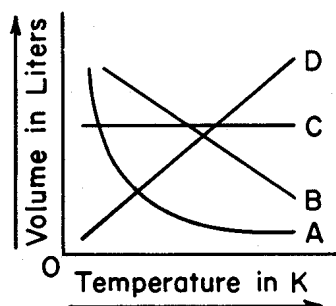
- A) decrease and the volume of the gas sample to decrease  
B) decrease and the volume of the gas sample to increase  
C) increase and the volume of the gas sample to decrease  
**D) increase and the volume of the gas sample to increase**

15. As the temperature of a gas increases at constant pressure, the volume of the gas

- A) decreases                      **B) increases**  
C) remains the same

16. As the volume of a fixed mass of a gas increases at constant temperature, the pressure of the gas

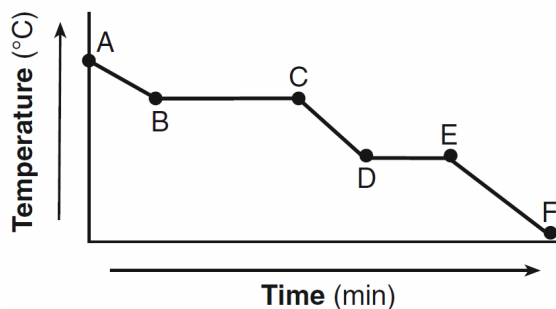
- A) **decreases**      B) increases  
C) remains the same



17. At constant pressure, which curve best shows the relationship between the volume of an ideal gas and its absolute temperature?

- A) *A*    B) *B*    C) *C*    **D) *D***

18. Given the cooling curve of a substance:



During which intervals is potential energy decreasing and average kinetic energy remaining constant?

- A) *AB* and *BC*      B) *AB* and *CD*  
C) ***DE* and *BC***      D) *DE* and *EF*

19. An 80.0-gram sample of water at 10.0°C absorbs 1680 Joules of heat energy. What is the final temperature of the water?

- A) 50.0°C      **B) 15.0°C**  
C) 5.00°C      D) 4.00°C

20. How many Joules of heat energy are released when 50. grams of water are cooled from 70.°C to 60.°C?

- A) 42 J      B) 210 J  
**C) 2100 J**      D) 4200 J

21. The heat energy required to change a unit mass of a solid into a liquid at constant temperature is called

- A) heat of vaporization  
B) heat of formation  
C) heat of solution  
**D) heat of fusion**

22. What is the minimum amount of heat required to completely melt 20.0 grams of ice at its melting point?

- A) 20.0 J      B) 83.6 J  
**C) 6,680 J**      D) 45,200 J

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23. According to Reference Table *H*, what is the boiling point of ethanoic acid at 80 kPa?

- A) 28°C                      B) 100°C  
C) **111°C**                      D) 125°C

24. How much energy is required to vaporize 10.00 grams of water at its boiling point?

- A) 2.26 kJ                      B) 3.34 kJ  
C) 4.2 kJ                      D) **22.6 kJ**

25. Which phase change at STP represents sublimation?

- A) **CO<sub>2</sub>(s) → CO<sub>2</sub>(g)**  
B) H<sub>2</sub>O(s) → H<sub>2</sub>O(l)  
C) CO<sub>2</sub>(l) → CO<sub>2</sub>(g)  
D) H<sub>2</sub>O(l) → H<sub>2</sub>O(s)

26. What occurs when NaCl(s) is added to water?

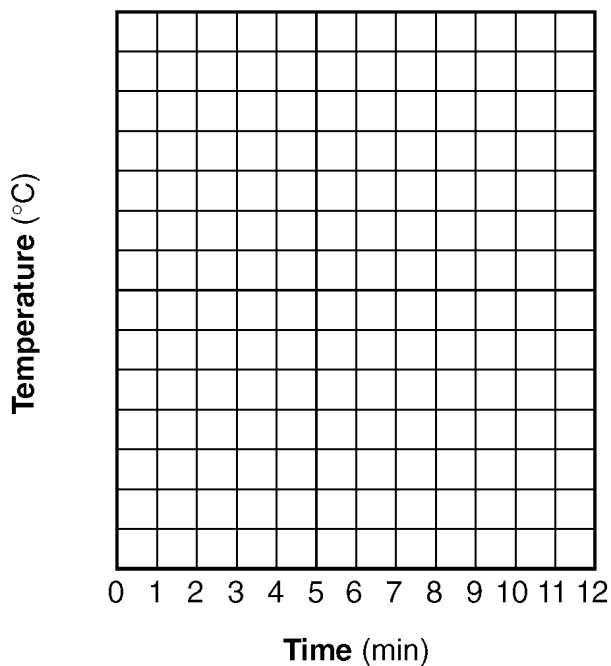
- A) **The boiling point of the solution increases, and the freezing point of the solution decreases.**  
B) The boiling point of the solution increases, and the freezing point of the solution increases.  
C) The boiling point of the solution decreases, and the freezing point of the solution decreases.  
D) The boiling point of the solution decreases, and the freezing point of the solution increases.

Base your answers to questions 27 and 28 on the information below.

A substance is a solid at 15°C. A student heated a sample of the solid substance and recorded the temperature at one-minute intervals in the data table below.

Time (min)	0	1	2	3	4	5	6	7	8	9	10	11	12
Temperature (°C)	15	32	46	53	53	53	53	53	53	53	53	60	65

Heating Curve



27. On the grid above, mark an appropriate scale on the axis labeled "Temperature (°C)." An appropriate scale is one that allows a trend to be seen. ( 2 points)

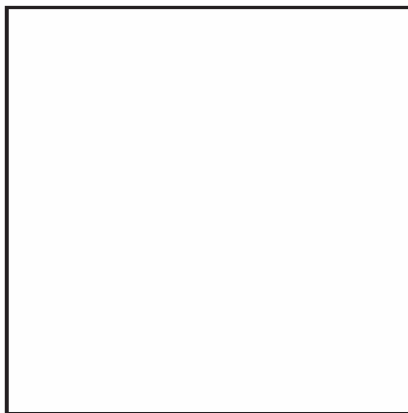
28. Based on the data table, what is the melting point of this substance?

Answer : \_\_\_\_\_ ( 1 point)

29. Base your answer to the following question on the information below and on your knowledge of chemistry.

Paintball is a popular recreational activity that uses a metal tank of compressed carbon dioxide or nitrogen to launch small capsules of paint. A typical tank has a volume of 508 cubic centimeters. A 340.-gram sample of carbon dioxide is added to the tank before it is used for paintball. At 20.°C, this tank contains both  $\text{CO}_2(\text{g})$  and  $\text{CO}_2(\ell)$ . After a paintball game, the tank contains only  $\text{CO}_2(\text{g})$ .

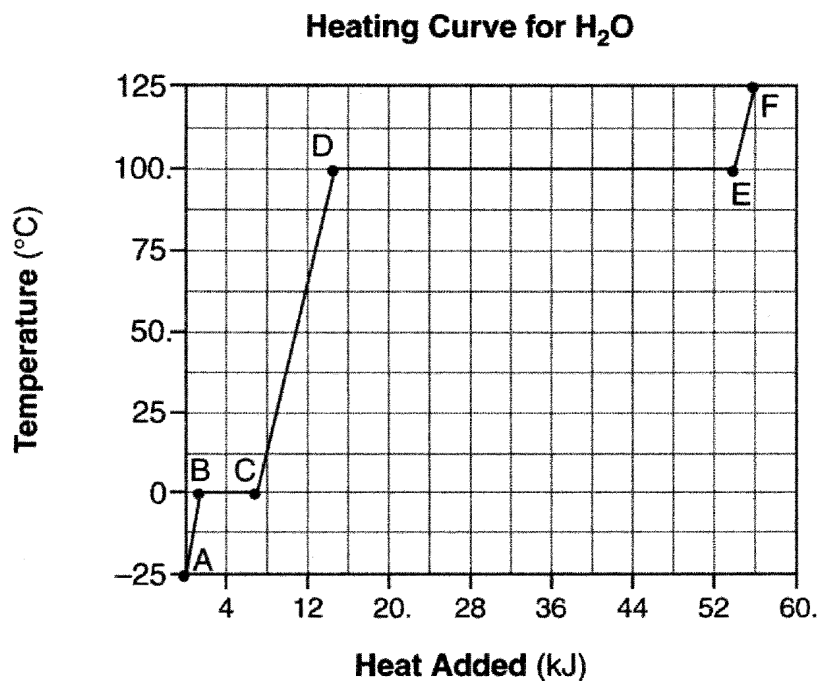
Key
○ = $\text{CO}_2$ molecule



In the box above, use the key to draw a particle diagram to represent the two phases of  $\text{CO}_2$  in a newly filled tank. Your response must include *at least six molecules of  $\text{CO}_2$  in each phase.*

30. Base your answer to the following question on the information below and on your knowledge of chemistry.

Starting as a solid at  $-25^{\circ}\text{C}$ , a sample of  $\text{H}_2\text{O}$  is heated at a constant rate until the sample is at  $125^{\circ}\text{C}$ . This heating occurs at standard pressure. The graph below represents the relationship between temperature and heat added to the sample.



Explain, in terms of heat of fusion and heat of vaporization, why the heat added during interval  $DE$  is greater than the heat added during interval  $BC$  for this sample of water.





**Answer Key**  
**ThermoExam2\_Eng**

- 1. **D**
- 2. **B**
- 3. **D**
- 4. **D**
- 5. **A**
- 6. **A**
- 7. **D**
- 8. **B**
- 9. **A**
- 10. **D**
- 11. **A**
- 12. **B**
- 13. **C**
- 14. **D**
- 15. **B**
- 16. **A**
- 17. **D**
- 18. **C**
- 19. **B**
- 20. **C**
- 21. **D**
- 22. **C**
- 23. **C**
- 24. **D**
- 25. **A**
- 26. **A**

30. –The heat of vaporization of water is 2260 J/g and the heat of fusion for water is only 334 J/g.  
–The heat of fusion of water is much less than its heat of vaporization.

28. 53°C

