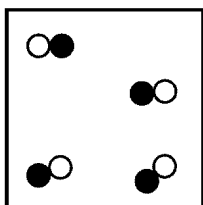


1. Which statement best describes the shape and volume of an aluminum cylinder at STP?

- A) **It has a definite shape and a definite volume.**  
 B) It has a definite shape and no definite volume.  
 C) It has no definite shape and a definite volume.  
 D) It has no definite shape and no definite volume.

2. Given the particle diagram representing four molecules of a substance:



Which particle diagram best represents this same substance after a physical change has taken place?

- A) B)   
 C) D)

3. Which unit is used to express the energy absorbed or released during a chemical reaction?

- A) kelvin B) **joule** C) volt D) torr

4. At which temperature would atoms of a He(g) sample have the greatest average kinetic energy?

- A) 25°C B) **37°C** C) 273 K D) 298 K

5. An increase in the average kinetic energy of a sample of copper atoms occurs with an increase in

- A) concentration B) **temperature**  
 C) pressure D) volume

6. The temperature of a sample of a substance changes from 10.°C to 20.°C. How many Kelvin does the temperature change?

- A) **10.** B) 20. C) 283 D) 293

7. The temperature 30. K expressed in degrees Celsius is

- A) 243°C B) **-243°C**  
 C) 303°C D) -303°C

8. 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)  **$\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{s})$**

9. The boiling point of a liquid is the temperature at which the vapor pressure of the liquid is equal to the pressure on the surface of the liquid. What is the boiling point of propanone if the pressure on its surface is 48 kilopascals?

- A) 25°C B) 30.°C C) **35°C** D) 40.°C

10. Under which conditions of temperature and pressure would helium behave most like an ideal gas?

- A) 50 K and 20 kPa B) 50 K and 600 kPa  
 C) **750 K and 20 kPa** D) 750 K and 600 kPa

11. 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

12. The concept of an ideal gas is used to explain

- A) the mass of a gas sample  
 B) **the behavior of a gas sample**  
 C) why some gases are monatomic  
 D) why some gases are diatomic

13. When a sample of a gas is heated at constant pressure, the average kinetic energy of its molecules

- A) decreases, and the volume of the gas increases  
 B) decreases, and the volume of the gas decreases  
 C) **increases, and the volume of the gas increases**  
 D) increases, and the volume of the gas decreases

14. Under which conditions of temperature and pressure would a sample of  $\text{H}_2(\text{g})$  behave most like an ideal gas?

- A) 0°C and 100 kPa  
 B) 0°C and 300 kPa  
 C) **150°C and 100 kPa**  
 D) 150°C and 300 kPa

15. Which gas is *least* likely to obey the ideal gas laws at very high pressures and very low temperatures?

- A) He    B) Ne    C) Kr    **D) Xe**

16. Which is the first phase change that is most likely to occur as the pressure on nitrogen gas is increased and its temperature is decreased?

- A) evaporation                      **B) condensation**  
 C) crystallization                  D) solidification

17. One reason that a real gas deviates from an ideal gas is that the molecules of the real gas have

- A) a straight-line motion  
 B) no net loss of energy on collision  
 C) a negligible volume  
**D) forces of attraction for each other**

18. The table below shows mass and volume data for four samples of substances at 298 K and 1 atmosphere.

Masses and Volumes of Four Samples

Sample	Mass (g)	Volume (mL)
A	30.	60.
B	40.	50.
C	45	90.
D	90.	120.

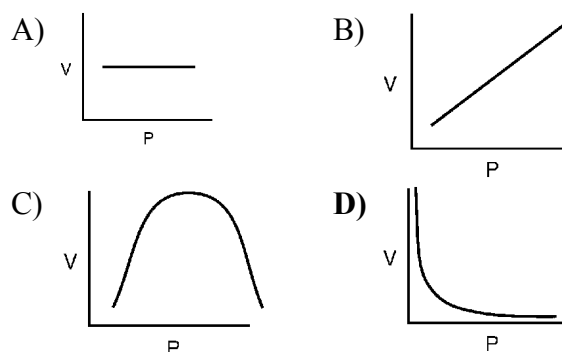
Which two samples could consist of the same substance?

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

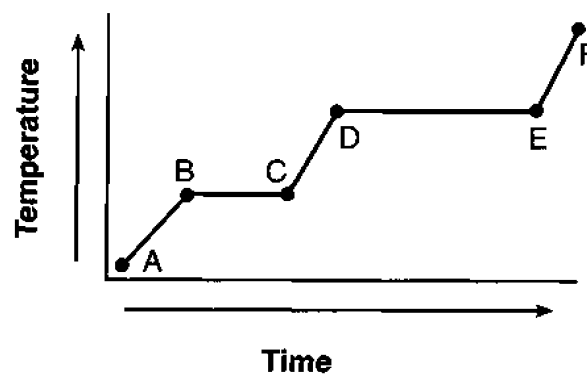
19. A sample of helium gas has a volume of 900. milliliters and a pressure of 2.50 atm at 298 K. What is the new pressure when the temperature is changed to 336 K and the volume is decreased to 450. milliliters?

- A) 0.177 atm                              B) 4.43 atm  
**C) 5.64 atm**                              D) 14.1 atm

20. Which graph best represents the pressure-volume relationship for an ideal gas at constant temperature?



21. The graph below represents the uniform heating of a substance, starting below its melting point, when the substance is solid.



Which line segments represent an increase in average kinetic energy?

- A)  $\overline{AB}$  and  $\overline{BC}$                       **B)  $\overline{AB}$  and  $\overline{CD}$**   
 C)  $\overline{BC}$  and  $\overline{DE}$                       D)  $\overline{DE}$  and  $\overline{EF}$

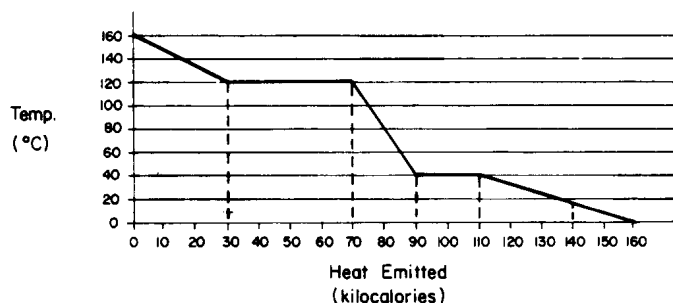
22. A student obtained the following data while cooling a substance. The substance was originally in the liquid phase at a temperature below its boiling point.

Time (minutes)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Temperature (°C)	70.	63	57	54	53	53	53	53	53	52	51	48

What is the freezing point of the substance?

- A) 70.°C      B) 59°C      C) **53°C**      D) 48°C

23. The graph below represents the uniform cooling of a substance, starting as a gas at 160°C. At which temperature does a phase change occur for this substance?



- A) 0°C      B) **40°C**  
C) 80°C      D) 140°C

24. What amount of heat is required to completely melt a 29.95-gram sample of H<sub>2</sub>O(s) at 0°C?

- A) 334 J      B) 2260 J  
C) 1.00 × 10<sup>3</sup> J      D) **1.00 × 10<sup>4</sup> J**

25. Approximately how many Joules of heat are needed to completely change 10.0 grams of ice to water at the melting point temperature?

- A) 1.00 J      B) 33.4 J  
C) 334 J      D) **3,340 J**

26. 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**

27. What is the total number of kiloJoules required to boil 100. grams of water at 100°C and 1 atmosphere?

- A) 22.6 kJ      B) 33.4 kJ  
C) **226 kJ**      D) 334 kJ

28. 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)

29. Which substance has the *lowest* vapor pressure at 75°C?

- A) water      B) **ethanoic acid**  
C) propanone      D) ethanol

30. Based on intermolecular forces, which of these substances would have the highest boiling point?

- A) He    B) O<sub>2</sub>    C) CH<sub>4</sub>    D) **NH<sub>3</sub>**

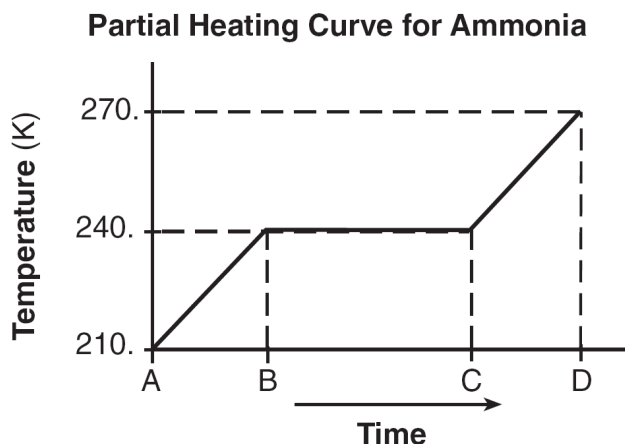
31. Which statement explains why H<sub>2</sub>O has a higher boiling point than N<sub>2</sub>?

- A) H<sub>2</sub>O has greater molar mass than N<sub>2</sub>.  
B) H<sub>2</sub>O has less molar mass than N<sub>2</sub>.  
C) **H<sub>2</sub>O has stronger intermolecular forces than N<sub>2</sub>**  
D) H<sub>2</sub>O has weaker intermolecular forces than N<sub>2</sub>.

## Do Now Unit 7

Base your answers to questions 32 through 34 on the information below

A 5.00-gram sample of liquid ammonia is originally at 210. K. The diagram of the partial heating curve below represents the vaporization of the sample of ammonia at standard pressure due to the addition of heat. The heat is *not* added at a constant rate.



Some physical constants for ammonia are shown in the data table below.

**Some Physical Constants for Ammonia**

specific heat capacity of $\text{NH}_3(\ell)$	4.71 J/g•K
heat of fusion	332 J/g
heat of vaporization	1370 J/g

32. Determine the total amount of heat required to vaporize this 5.00-gram sample of ammonia at its boiling point.
33. Calculate the total heat absorbed by the 5.00-gram sample of ammonia during time interval AB. Your response must include *both* a correct numerical setup and the calculated result.
34. Describe what is happening to *both* the potential energy and the average kinetic energy of the molecules in the ammonia sample during time interval BC. Your response must include both potential energy and average kinetic energy.

## Do Now Unit 7

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35. Base your answer to the following question on the information below.

A weather balloon has a volume of 52.5 liters at a temperature of 295 K. The balloon is released and rises to an altitude where the temperature is 252 K.

The original pressure at 295 K was 100.8 kPa and the pressure at the higher altitude at 252 K is 45.6 kPa. Assume the balloon does not burst. Show a correct numerical setup for calculating the volume of the balloon at the higher altitude.

# Answer Key

## Do Now Unit 7 Physical Behavior of Matter

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

32. 6850 J

33.  $q = mC\Delta T = (5.00$   
 $g)(4.71 J/g \cdot K)(30.$   
 $K)$   
 $(5)(4.71)(30)$   
710 J

34. The potential energy of the ammonia molecules increases and the average kinetic energy of the ammonia molecules remains the same.

35.  $\frac{(100.8 \text{ kPa})(52.5 \text{ L})}{295 \text{ K}} = \frac{(45.6 \text{ kPa})(X)}{(252 \text{ K})}$

$$52.5 \times \frac{252}{295} \times \frac{100.8}{45.6}$$