

Energy Additional Practice

1. Which form of energy is associated with the random motion of the particles in a sample of water?
A) chemical energy B) electrical energy
C) nuclear energy D) thermal energy
2. Object *A* at 40°C and object *B* at 80°C are placed in contact with each other. Which statement describes the heat flow between the objects?
A) Heat flows from object *A* to object *B*.
B) Heat flows from object *B* to object *A*.
C) Heat flows in both directions between the objects.
D) No heat flow occurs between the objects.
3. Which property is a measure of the average kinetic energy of the particles in a sample of matter?
A) mass B) density
C) pressure D) temperature
4. In which sample is the average kinetic energy of the particles greatest?
A) 10. mL of HCl(aq) at 25°C
B) 15 mL of HCl(aq) at 20.°C
C) 10. mL of H₂O(l) at 35°C
D) 15 mL of H₂O(l) at 30.°C
5. A 100.-gram sample of H₂O(l) at 22.0°C absorbs 8360 joules of heat. What will be the final temperature of the water?
A) 18.3°C B) 20.0°C
C) 25.7°C D) 42.0°C
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. What is the total amount of heat required to vaporize 2.00 gram of H₂O(l) at 100.°C and 1 atmosphere?
A) 8.36 J B) 334 J
C) 668 J D) 4520 J
8. Which phase change is accompanied by the release of heat?
A) H₂O(s) → H₂O(g)
B) H₂O(s) → H₂O(l)
C) H₂O(l) → H₂O(g)
D) H₂O(l) → H₂O(s)
9. Which phase change is exothermic?
A) solid to liquid B) solid to gas
C) liquid to solid D) liquid to gas
10. A 30-gram sample of water has an initial temperature of 20°C. After the sample absorbs 1400 joules of heat energy, the final temperature of the sample is
A) 31°C B) 11°C
C) 9.0°C D) 55°C
11. What is the minimum amount of heat required to completely melt 50.0 grams of ice at its melting point?
A) 20.0 J B) 16,700 J
C) 6,680 J D) 113,000 J
12. What is the minimum number of kiloJoules needed to change 40.0 grams of water at 100°C to steam at the same temperature and pressure?
A) 1,810 kJ B) 90.4 kJ
C) 2.26 kJ D) 13.4 kJ
13. 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
14. 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
15. When 200 grams of water cools from 50.°C to 25°C, the total amount of heat energy released by the water is
A) 42 kJ B) 21 kJ
C) 34 J D) 17 J

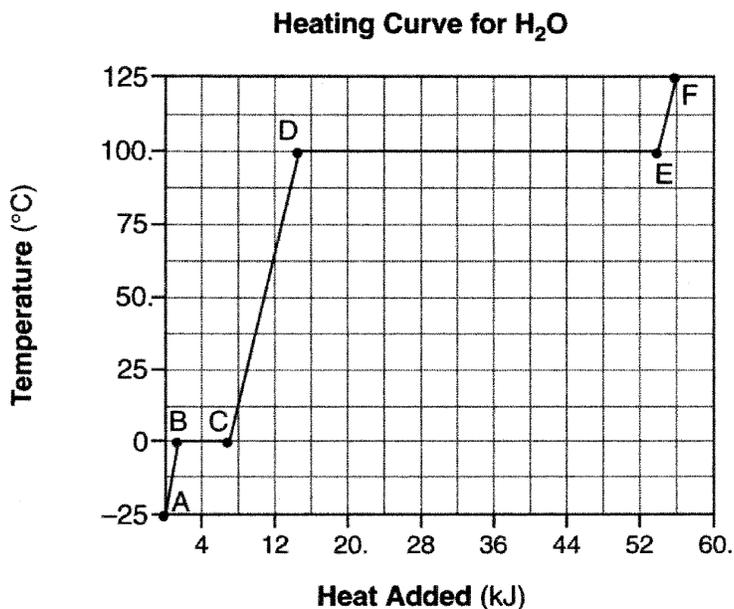
16. Base your answer to the following question on the information below and on your knowledge of chemistry.

At standard pressure, water has unusual properties that are due to both its molecular structure and intermolecular forces. For example, although most liquids contract when they freeze, water expands, making ice less dense than liquid water. Water has a much higher boiling point than most other molecular compounds having a similar gram-formula mass.

Determine the total amount of heat, in joules, required to completely vaporize a 50.0-gram sample of $\text{H}_2\text{O}(\ell)$ at its boiling point at standard pressure.

Base your answers to questions 17 and 18 on the information below and on your knowledge of chemistry.

Starting as a solid at -25°C , a sample of H_2O is heated at a constant rate until the sample is at 125°C . This heating occurs at standard pressure. The graph below represents the relationship between temperature and heat added to the sample.



17. 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.

18. Using the graph, determine the total amount of heat added to the sample during interval CD .

Base your answers to questions **19** and **20** on the information below.

At a pressure of 101.3 kilopascals and a temperature of 373 K, heat is removed from a sample of water vapor, causing the sample to change from the gaseous phase to the liquid phase. This phase change is represented by the equation below.



- _____ 19. Determine the total amount of heat released by 5.00 grams of water vapor during this phase change.
- _____ 20. Explain, in terms of particle arrangement, why entropy *decreases* during this phase change.

Answer Key Energy Practice

1. **D**
 2. **B**
 3. **D**
 4. **C**
 5. **D**
 6. **A**
 7. **D**
 8. **D**
 9. **C**
 10. **A**
 11. **B**
 12. **B**
 13. **D**
 14. **C**
 15. **B**
 16. — 1.13×10^5 J
— 113 000 J
— 113,000 J
 17. –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.
 18. 8 kJ \pm 1 kJ
 19. 11 300 J
 20. The arrangement of the H₂O molecules becomes more ordered as liquid water forms; As a liquid, the movement of the particles is less random.
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