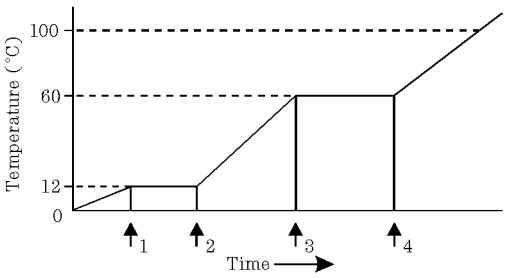
Thermochemistry (Regular) Spring 2018 STUDY GUIDE!!!

Name: _____ **Date:** _____

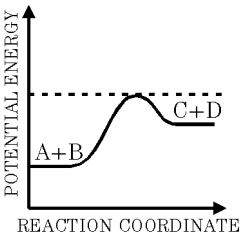
1. The diagram shown represents the uniform heating of a substance that is a solid at t_0. What is the freezing point of the substance?



A. $1^\circ C$ B. $12^\circ C$

C. $60^\circ C$ D. $100^\circ C$

2. According to the potential energy diagram shown for the reaction $A + B \rightarrow C + D$, the activation energy is highest for the



A. forward reaction, which is endothermic

B. forward reaction, which is exothermic

C. reverse reaction, which is endothermic

D. reverse reaction, which is exothermic

3. **In the Kitchen**

Common kitchen appliances include electric stoves, toasters and blenders. Each appliance uses an energy source and involves energy changes to prepare food.

An open pot of water is heated on the stove. As water boils, the molecules _____.

A. move slower and closer together

B. move faster and farther apart.

C. get larger

D. get smaller

4. Given the reaction: $A + B \leftrightharpoons C + D + \text{heat}$. Which statement best describes this reaction?

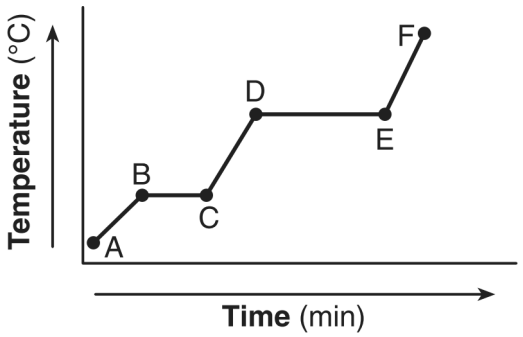
A. The forward reaction is exothermic, and the reverse reaction is always exothermic.

B. The forward reaction is exothermic, and the reverse reaction is always endothermic.

C. The forward reaction is exothermic, and the reverse reaction can be either exothermic or endothermic.

D. The forward reaction is endothermic, and the reverse reaction can be either endothermic or exothermic.

5. The graph below represents the uniform heating of a sample of a substance starting as a solid below its melting point.



Which statement describes what happens to the energy of the particles of the sample during time interval DE?

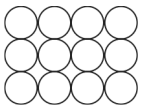
A. Average kinetic energy increases, and potential energy remains the same.

B. Average kinetic energy decreases, and potential energy remains the same.

C. Average kinetic energy remains the same, and potential energy increases.

D. Average kinetic energy remains the same, and potential energy decreases.

6. A scientist uses an instrument to observe the pattern of molecules in a substance. The picture below shows what the scientist sees.



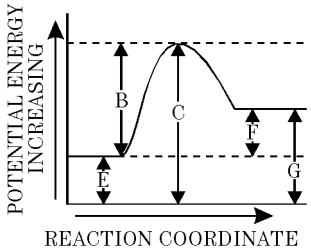
What state of matter is the scientist *most* likely observing?

A. gas B. liquid C. vapor D. solid

7. Which interval represents the heat of the reaction (ΔH)?

A. *E* B. *F*

C. *C* D. *G*



8. A solid is dissolved in a beaker of water. Which observation suggests that the process is endothermic?

A. The solution gives off a gas.

B. The solution changes color.

C. The temperature of the solution decreases.

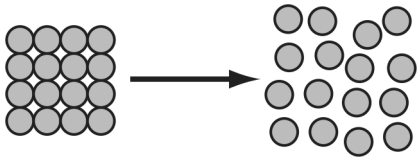
D. The temperature of the solution increases.

9. Which phase change is exothermic?

A. $H_2O(s) \rightarrow H_2O(\ell)$ B. $H_2O(\ell) \rightarrow H_2O(s)$

C. $H_2O(s) \rightarrow H_2O(g)$ D. $H_2O(\ell) \rightarrow H_2O(g)$

10. The diagram below represents a phase change for some copper atoms.



Which of the following phase changes are the copper atoms undergoing?

A. gas to liquid B. liquid to gas

C. solid to liquid D. liquid to solid

11. Which change of phase is exothermic?

A. gas to liquid B. solid to liquid

C. solid to gas D. liquid to gas

12. Which statement is true concerning the reaction $N(g) + N(g) \rightarrow N_2(g) + \text{energy}$?

A. A bond is broken and energy is absorbed.

B. A bond is broken and energy is released.

C. A bond is formed and energy is absorbed.

D. A bond is formed and energy is released.

13. Solids have a definite shape and volume. This is because

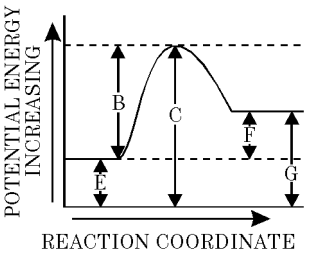
A. the molecules in solids move past each other easily.

B. the molecules in solids stay in a definite location and vibrate.

C. the molecules in solids move freely in all directions.

D. the molecules in solids do not move at all.

14. Interval *B* represents the



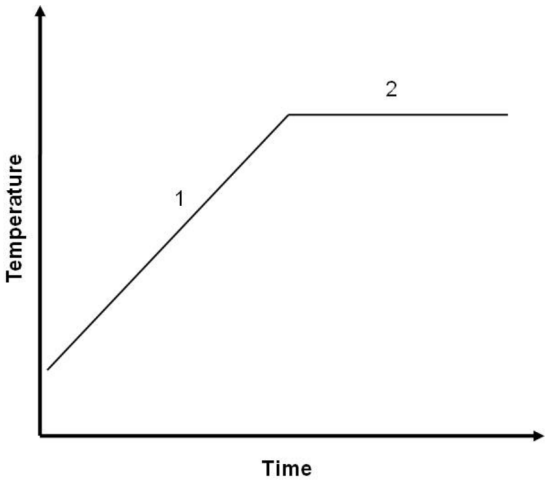
A. potential energy of the products

B. potential energy of the reactants

C. activation energy

D. activated complex

15. Alex placed a small beaker of cold water on a hot plate and heated it for 10 minutes. He took the temperature of the water several times during those 10 minutes and recorded his data. Alex claims that the graph below shows the relationship between temperature and time when water is heated.



Which statement *best* explains why the temperature leveled off in section 2 of the graph?

A. Alex turned off the hot plate so the water did not get any warmer.

B. The water reached the boiling point, so the temperature no longer increased.

C. An experimental error caused the graph to level off, because the water temperature should keep increasing over time.

D. Cold water heats faster than warm water, so once the cold water was room temperature, it took more than 10 minutes to make it hot.

16. When a substance was dissolved in water, the temperature of the water increased. This process is described as

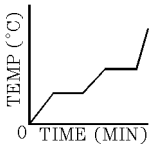
A. endothermic, with the release of energy

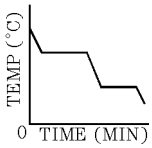
B. endothermic, with the absorption of energy

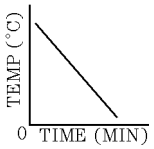
C. exothermic, with the release of energy

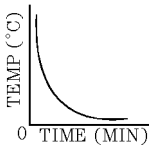
D. exothermic, with the absorption of energy

17. Which graph shown could represent the uniform cooling of a substance, starting with the gaseous phase and ending with the solid phase?

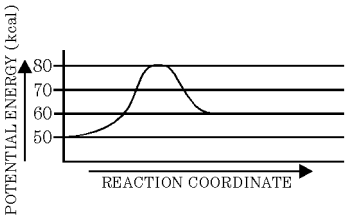
A. 

B. 

C. 

D. 

18. The potential energy diagram of a chemical reaction is shown. What is the minimum amount of energy required to initiate the forward reaction?



A. 30 kcal B. 50 kcal

C. 60 kcal D. 80 kcal

19. As ice cools from 273 K to 263 K, the average kinetic energy of its molecules will

A. decrease B. increase

C. remain the same

20. Which phase change is endothermic?

A. gas → solid B. gas → liquid

C. liquid → solid D. liquid → gas

21. In a chemical reaction, the difference in potential energy between the products and the reactants is equal to

A. ΔS B. ΔG C. ΔH D. ΔT

22. Given the balanced equation representing a reaction:

$$Br_2 + \text{energy} \rightarrow Br + Br$$

Which statement describes the energy change and bonds in this reaction?

A. Energy is released as bonds are broken.

B. Energy is released as bonds are formed.

C. Energy is absorbed as bonds are broken.

D. Energy is absorbed as bonds are formed.

23. Which of the following best describes exothermic chemical reactions?

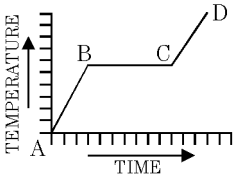
A. They never release heat.

B. They always release heat.

C. They never occur spontaneously.

D. They always occur spontaneously.

24. The graph shown represents the relationship between temperature and time as heat was added uniformly to a substance, starting as a solid below its melting point. During the *BC* portion of the curve, the average kinetic energy of the molecules of the substance



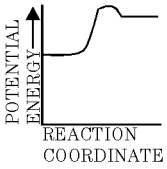
A. increases and the potential energy increases

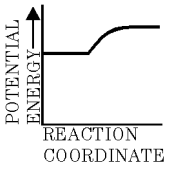
B. decreases and the potential energy increases

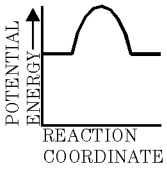
C. remains the same and the potential energy increases

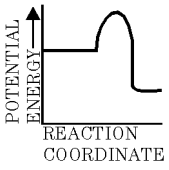
D. remains the same and the potential energy decreases

25. Which diagram represents the potential energy of an exothermic reaction?

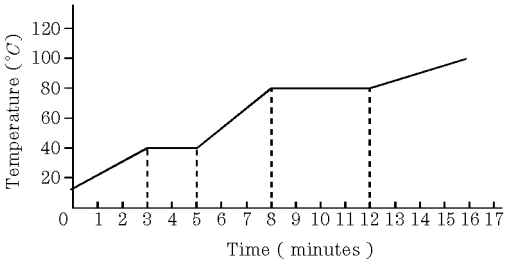
A. 

B. 

C. 

D. 

26. The graph shows the relationship between temperature and time as heat is added to one mole of a substance at a rate of 100 calories per minute. The substance is in the solid phase at Time = 0 minutes.



The temperature at which the substance begins to boil is

A. 10° C B. 40° C

C. 80° C D. 110° C

27. The specific heat of copper is about 0.4 joules/gram° C. How much heat is needed to change the temperature of a 30-gram sample of copper from 20.0° C to 60.0° C?

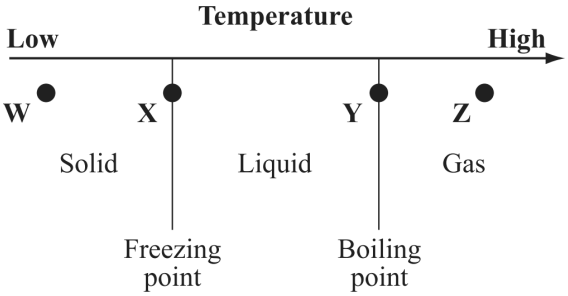
A. 1000 J B. 720 J C. 480 J D. 240 J

28. As the average kinetic energy of a substance increases, the temperature of the sample

A. decreases B. increases

C. remains the same

29. The diagram below shows how a change in temperature affects the physical state of a substance. Each of the labeled points represents the same substance at a different temperature.



Which point represents the substance in the physical state with the particles moving the least?

A. point W B. point X

C. point Y D. point Z

30. A student observed that when sodium hydroxide was dissolved in water, the temperature of the water increased. The student should conclude that the dissolving of sodium hydroxide

A. is endothermic

B. is exothermic

C. produces an acid solution

D. produces a salt solution

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1.
Answer: B

2.
Answer: A

3.
Answer: B

4.
Answer: B

5.
Answer: C

6.
Answer: D

7.
Answer: B

8.
Answer: C

9.
Answer: B

10.
Answer: C

11.
Answer: A

12.
Answer: D

13.
Answer: B

14.
Answer: C

15.
Answer: B

16.
Answer: C

17.
Answer: B

18.
Answer: A

19.
Answer: A

20.
Answer: D

21.
Answer: C

22.
Answer: C

23.
Answer: B

24.
Answer: C

25.
Answer: D

26.
Answer: C

27.
Answer: C

28.
Answer: B

29.
Answer: A

30.
Answer: B