

Thermodynamics Practice Test

Multiple Choice

Identify the choice that best completes the statement or answers the question.

* You will also have questions from "Blast from the Past".

* You will not be given the formula's only the constants for water.

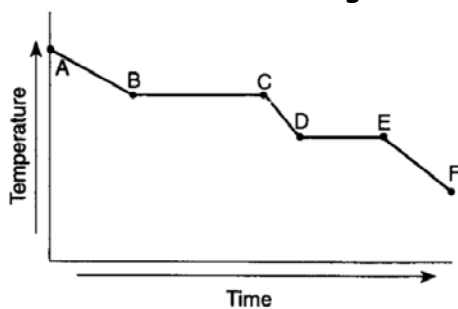
Important formulas and constants

$$Q = m\Delta H_{\text{vap}} \quad m - \Delta H_{\text{vap}}$$

$$Q = m\Delta H_{\text{fus}} \quad m - \Delta H_{\text{fus}}$$

$$Q = mC\Delta T$$

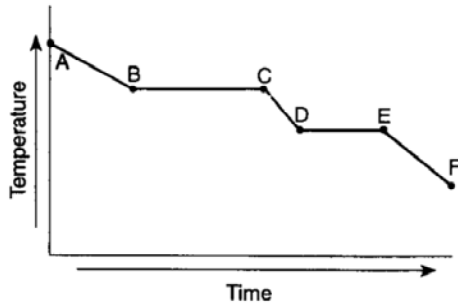
- _____ 1. The random molecular motion of a substance is greatest when the substance is
- a gas.
 - condensed.
 - frozen.
 - a liquid.
- _____ 2. When 45 g of an alloy, at 25°C, are dropped into 100.0 g of water, the alloy absorbs 956 J of heat. If the final temperature of the alloy is 37°C, what is its specific heat?
- $9.88 \frac{\text{cal}}{\text{g}^\circ\text{C}}$
 - $1.77 \frac{\text{cal}}{\text{g}^\circ\text{C}}$
 - $0.423 \frac{\text{cal}}{\text{g}^\circ\text{C}}$
 - $48.8 \frac{\text{cal}}{\text{g}^\circ\text{C}}$
- _____ 3. The graph below represents the uniform cooling (freezing) of a substance, starting with the substance as a gas above its boiling point.



During which interval is the substance completely in the liquid phase?

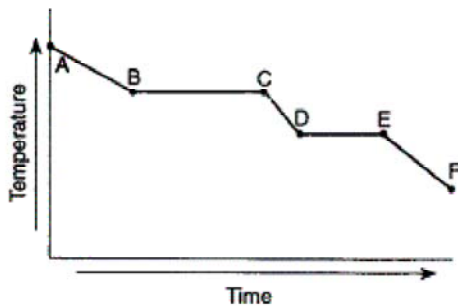
- AB
 - BC
 - CD
 - DE
 - EF
- _____ 4. During a phase change, the temperature of a substance _____.
- may increase or decrease
 - remains constant
 - decreases
 - increases

5. The graph below represents the uniform cooling (freezing) of a substance, starting with the substance as a gas above its boiling point.



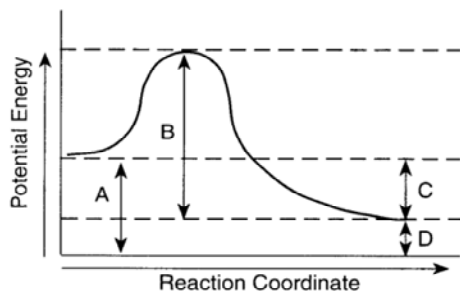
Choose the correct formula to find the amount of heat change from D to E.

- a. $Q = m(-\Delta H_{fus})$ d. $Q = m(-\Delta H_{vap})$
 b. $Q = m\Delta H_{vap}$ e. $Q = mC\Delta T$
 c. $Q = m\Delta H_{fus}$
6. A piece of metal is heated, then submerged in cool water. Which statement below describes what happens?
- a. The temperature of the water will increase.
 b. The temperature of the water will decrease.
 c. The temperature of the water will increase and the temperature of the metal will decrease.
 d. The temperature of the metal will increase.



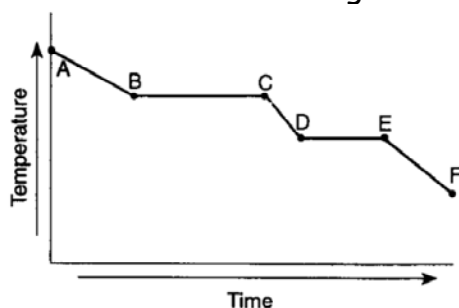
7. According to the above figure, what is happening as a substance goes from point A to point B?
- a. A gas is getting colder c. A solid is getting warmer
 b. Ice is melting d. A gas is condensing
8. How much heat needs to be absorbed by 100.0 g of water at 5.0°C to raise its temperature to 75.0°C?
- a. $2.93 \times 10^4 \text{ J}$ c. 175 J
 b. $1.57 \times 10^5 \text{ J}$ d. 4.18 J
9. What must happen for liquid water to freeze?
- a. The water must absorb kinetic energy from the surroundings. c. The water molecules must begin to move faster
 b. The water molecules must begin to move in random patterns. d. The water must release energy to the surroundings.

- ___ 10. The potential energy diagram of a chemical reaction is shown below.



Which letter represents the total amount of energy released in this exothermic reaction?

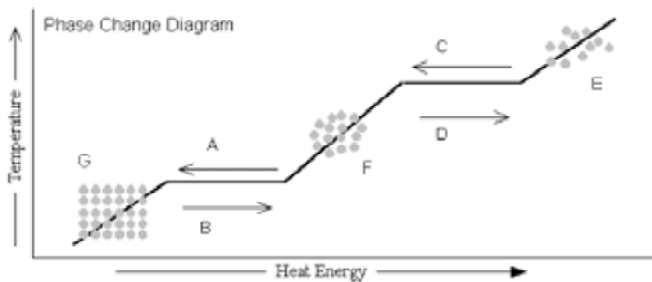
- a. A
b. B
c. C
d. D
- ___ 11. When a substance condenses or freezes energy is _____ and when a substance evaporates or melts energy is _____.
- a. absorbed, released
b. released, absorbed
- ___ 12. Freezing water is a(an) ____.
- a. endothermic process
b. polythermic process
c. ectothermic process
d. exothermic process
- ___ 13. Heat changes can occur when _____.
- a. a substance vaporizes
b. a substance melts
c. a substance dissolves
d. a substance solidifies
e. all of the above
- ___ 14. The following equation shows the reaction that occurs when nitroglycerine explodes.
- $$4 \text{C}_3\text{H}_5\text{O}_9\text{N}_3 \rightarrow 12\text{CO}_2 + 6\text{N}_2 + \text{O}_2 + 10\text{H}_2\text{O} + 1725 \text{ kJ}$$
- This reaction is _____.
- a. endothermic
b. a combination reaction
c. exothermic
d. a combustion reaction
- ___ 15. The graph below represents the uniform cooling (freezing) of a substance, starting with the substance as a gas above its boiling point.



Choose the correct formula to find the amount of heat change from E to F.

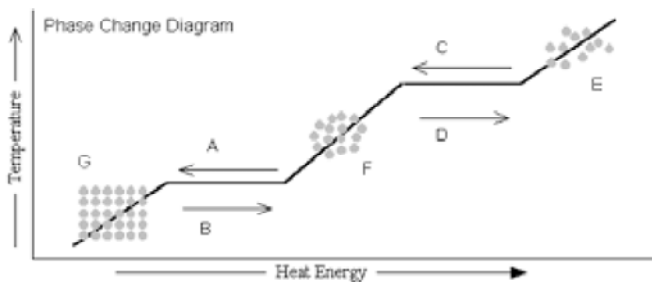
- a. $Q = m\Delta H_{fus}$
b. $Q = mC\Delta T$
c. $Q = m(-\Delta H_{vap})$
d. $Q = m(-\Delta H_{fus})$
e. $Q = m\Delta H_{vap}$

___ 25. Choose the correct formula to find the amount of heat change at D.



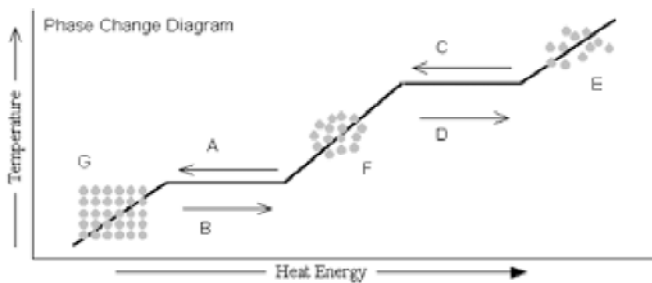
- a. $Q = m\Delta H_{vap}$
- b. $Q = mC\Delta T$
- c. $Q = m-\Delta H_{vap}$
- d. $Q = m\Delta H_{fus}$
- e. $Q = m-\Delta H_{fus}$

___ 26. Choose the correct formula to find the amount of heat change at A.



- a. $Q = m\Delta H_{vap}$
- b. $Q = mC\Delta T$
- c. $Q = m-\Delta H_{vap}$
- d. $Q = m\Delta H_{fus}$
- e. $Q = m-\Delta H_{fus}$

___ 27. The graph below represents what type of reaction?

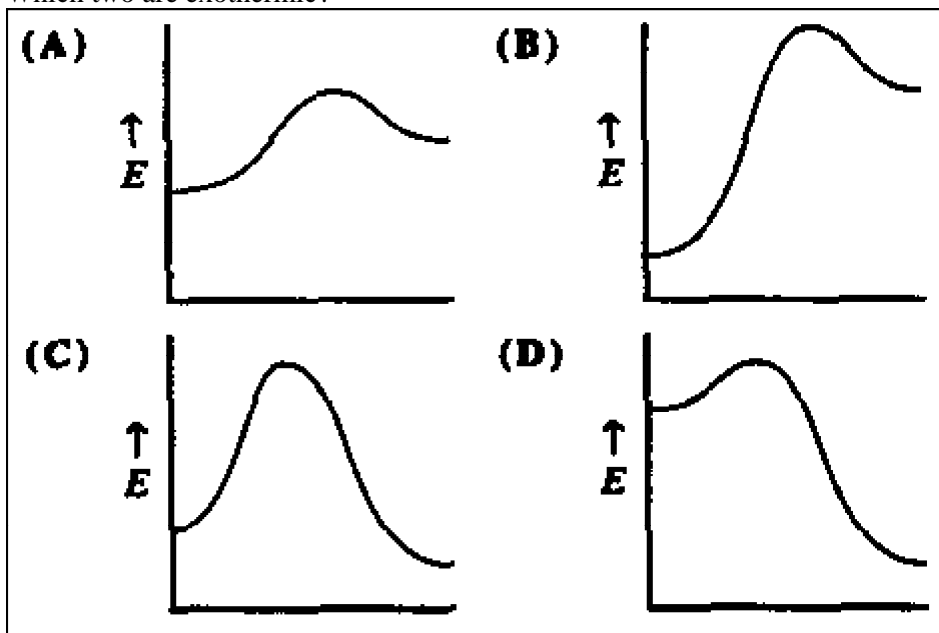


- a. Exothermic
- b. Endothermic

Multiple Response

Identify one or more choices that best complete the statement or answer the question.

- ___ 28. Choose which example/s below are exothermic. Choose all that apply.
- a. burning hydrogen gas
 - b. condensing steam
 - c. melting ice
 - d. burning wood
 - e. boiling water
- ___ 29. Which of the following are true about Q?
- a. It is equal to $mc\Delta T$
 - b. It has units of J
 - c. It is enthalpy
 - d. The units are in $J/g \times ^\circ C$
- ___ 30. Which of the following are true for endothermic reactions?
- a. The energy of the products is higher than the energy of the reactants
 - b. ΔH is negative
 - c. The energy of the products is lower than the energy of the reactants
 - d. Heat is found on the products
 - e. ΔH is positive
- ___ 31. Which two are exothermic?



- a. A
- b. B
- c. C
- d. D

Short Answer

32. It takes 770 joules of energy to raise the temperature of 50.0 g of mercury by $110^\circ C$. What is the specific heat of mercury?
33. How much heat is required to raise the temperature of 5.5×10^2 g of aluminum by $10^\circ C$? (specific heat of aluminum = $0.21 \frac{\text{cal}}{\text{g}^\circ C}$)

34. A 55.0-g piece of copper wire is heated, and the temperature of the wire changes from 19.0°C to 86.0°C. The amount of heat absorbed is 343 cal. What is the specific heat of copper?

True/False

Indicate whether the statement is true or false.

- ___ 35. The melting point and the freezing point of a water do not occur at the same temperature.

Problem

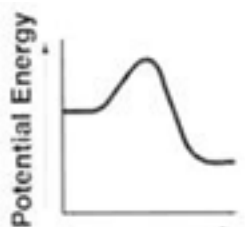
36. Choose the correct graph for an endothermic reaction.

1: A

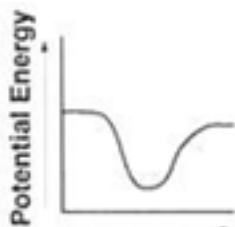
2: B

3: C

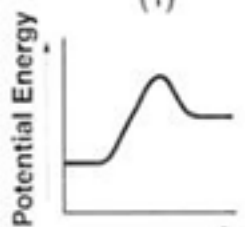
4: E



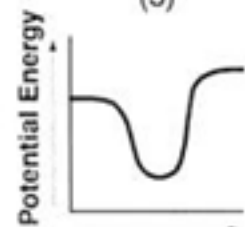
Reaction
Coordinate
(1)



Reaction
Coordinate
(3)



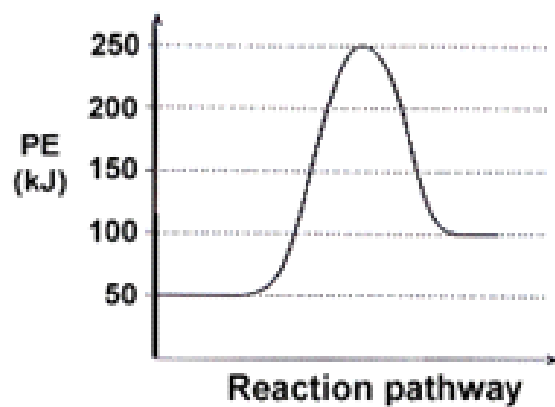
Reaction
Coordinate
(2)



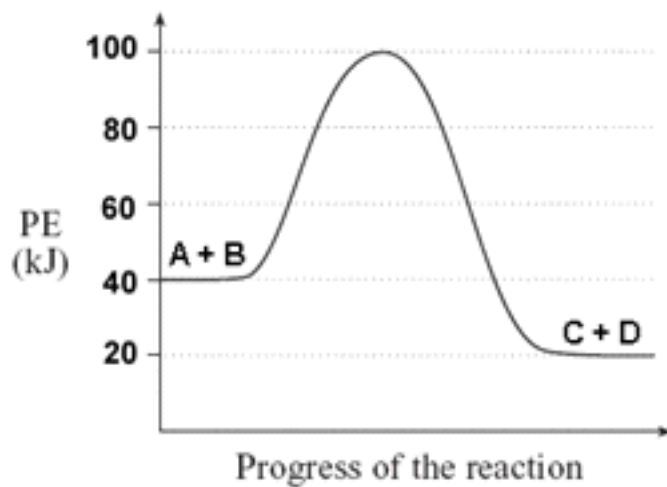
Reaction
Coordinate
(4)

37. Which of the following pictures best represents an endothermic reaction?

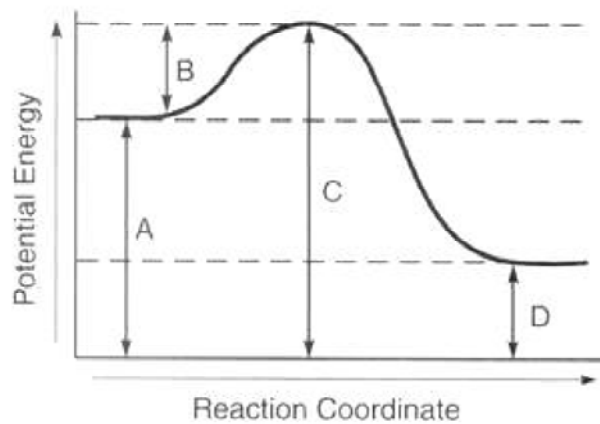
A.



B.



38. Which part of the diagram is the activation energy?



Thermodynamics Practice Test Answer Section

MULTIPLE CHOICE

1. ANS: A
St. 4b, 7a

PTS: 1 STA: 4b, 7a
2. ANS: B PTS: 1 DIF: L2 REF: p. 509
OBJ: 17.1.3 STA: Ch.7.d
3. ANS: C PTS: 1
4. ANS: B PTS: 1 DIF: L1 REF: p. 520
OBJ: 17.3.1 STA: Ch.7.d
5. ANS: A PTS: 1
6. ANS: C PTS: 1 DIF: L1 REF: p. 506
OBJ: 17.1.1 STA: Ch.7.a
7. ANS: A PTS: 1
8. ANS: A PTS: 1
9. ANS: D
St. 7c

PTS: 1
10. ANS: C PTS: 1
11. ANS: B PTS: 1
12. ANS: D PTS: 1 DIF: L1 REF: p. 506
OBJ: 17.1.2 STA: Ch.7.b
13. ANS: E PTS: 1
14. ANS: C PTS: 1
15. ANS: B PTS: 1
16. ANS: A PTS: 1 DIF: L3 REF: p. 481 | p. 482
OBJ: 16.2.1 STA: Ch.6.d
17. ANS: B PTS: 1 DIF: L2 REF: p. 483 | p. 484
OBJ: 16.2.2 STA: Ch.6.d
18. ANS: D PTS: 1 DIF: L2 REF: p. 483 | p. 484
OBJ: 16.2.2 STA: Ch.6.d
19. ANS: D
St. 7b

PTS: 1
20. ANS: B PTS: 1
21. ANS: B PTS: 1 DIF: L2 REF: p. 371
OBJ: 12.3.1 STA: Ch.3.d
22. ANS: C PTS: 1
23. ANS: A PTS: 1 STA: 3a KEY: Balancing Equations
24. ANS: D PTS: 1
25. ANS: A PTS: 1

26. ANS: E PTS: 1
 27. ANS: B PTS: 1

MULTIPLE RESPONSE

28. ANS: A, B, D PTS: 1
 29. ANS: A, B, C PTS: 1
 30. ANS: A, E PTS: 1
 31. ANS: C, D PTS: 1

SHORT ANSWER

32. ANS:

$$\text{Specific heat} = \frac{770 \text{ J}}{50 \text{ g} \cdot 110^\circ\text{C}} = 0.14 \frac{\text{J}}{\text{g}^\circ\text{C}}$$

PTS: 1 DIF: L2 REF: p. 512 OBJ: 17.2.1
 STA: Ch.7.d

33. ANS:

Heat energy = mass \times specific heat \times temperature change

$$= 550 \text{ g} \times 0.21 \frac{\text{cal}}{\text{g}^\circ\text{C}} \times 10^\circ\text{C}$$

$$= 1.2 \times 10^3 \text{ cal}$$

PTS: 1 DIF: L2 REF: p. 508 OBJ: 17.1.3
 STA: Ch.7.d

34. ANS:

$$\Delta T = 86.0^\circ\text{C} - 19.0^\circ\text{C} = 67.0^\circ\text{C}$$

$$\text{specific heat} = \frac{\text{heat absorbed}}{\text{mass temperature change}}$$

$$= \frac{343 \text{ cal}}{55.0 \text{ g} \cdot 67.0^\circ\text{C}}$$

$$= 9.31 \times 10^{-2} \frac{\text{cal}}{\text{g}^\circ\text{C}}$$

PTS: 1 DIF: L2 REF: p. 509 | p. 510
 OBJ: 17.1.3 STA: Ch.7.d

TRUE/FALSE

35. ANS: F PTS: 1

PROBLEM

36. ANS:
A

PTS: 1

37. ANS:
A

PTS: 1

38. ANS:
B

PTS: 1