Name: _____ **Class:** _____ **Date:** _____ **ID: P**

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.*

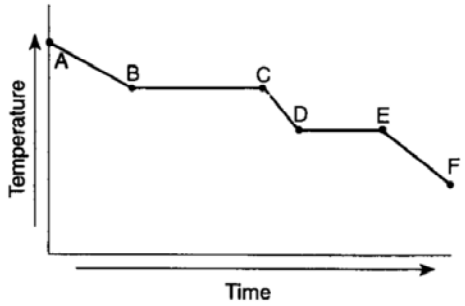
Important formulas and constants

$Q = m\Delta H_{vap}$ $m\text{-}\Delta H_{vap}$
$Q = m\Delta H_{fus}$ $m\text{-}\Delta H_{fus}$
$Q = mC\Delta T$

____ 1. The random molecular motion of a substance is greatest when the substance is
a. a gas.
b. condensed.
c. frozen.
d. 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?
a. $9.88 \frac{cal}{g°C}$
b. $1.77 \frac{cal}{g°C}$
c. $0.423 \frac{cal}{g°C}$
d. $48.8 \frac{cal}{g°C}$

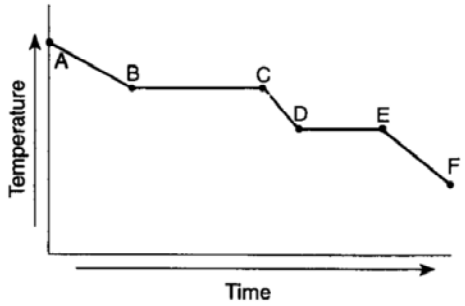
____ 3. The graph below represents the uniform cooling (freezing) of a substance, starting with the substance as a gas above its boiling point.



During which interval is the substance completely in the liquid phase?
a. AB
b. BC
c. CD
d. DE
e. EF

____ 4. During a phase change, the temperature of a substance ____.
a. may increase or decrease
b. remains constant
c. decreases
d. increases

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

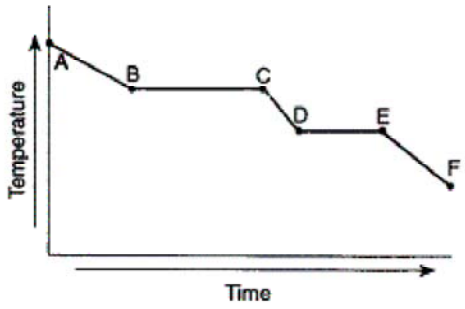


Choose the correct formula to find the amount of heat change from D to E.

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

____ 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
b. Ice is melting
c. A solid is getting warmer
d. A gas is condensing

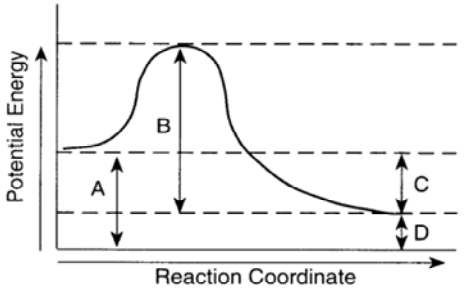
____ 8. How much heat needs to be absorbed by 100.0 g of water at $5.0^{o}C$ to raise its temperature to $75.0^{0}C$?

a. 2.93×10^4 J
b. 1.57×10^5 J
c. 175 J
d. 4.18 J

____ 9. What must happen for liquid water to freeze?

a. The water must absorb kinetic energy from the surroundings.
b. The water molecules must begin to move in random patterns.
c. The water molecules must begin to move faster
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

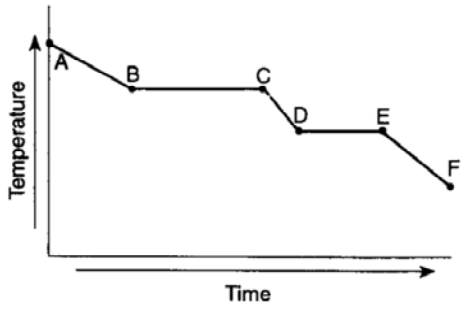
____ 14. The following equation shows the reaction that occurs when nitroglycerine explodes.

$4\ C_3H_5O_9N_3 \rightarrow 12CO_2 + 6N_2 + O_2 + 10H_2O + 1725\ kJ$

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. $Q = m\Delta H_{vap}$

____ 16. What mass of sucrose, $C_{12}H_{22}O_{11}$, is needed to make 500.0 mL of a 0.200*M* solution?

a. 34.2 g
b. 100 g
c. 17.1 g
d. 68.4 g

____ 17. How many mL of a 2.0*M* NaBr solution are needed to make 200.0 mL of 0.50*M* NaBr?

a. 25 mL
b. 50 mL
c. 100 mL
d. 150 mL

____ 18. The volume of 6.00*M* HCl needed to make 319 mL of 6.80*M* HCl is ____.

a. 0.128 mL
b. 7.8 mL
c. 281 mL
d. 362 mL

____ 19. Which of these is an example of an exothermic chemical process?

a. evaporation of water
b. melting ice
c. photosynthesis of glucose
d. combustion of gasoline

____ 20. A 25.0 g sample of water at 100°C has an energy change of -1670 J. What is the new temperature of the water?

a. 116°C
b. 84.0°C
c. 104.18°C
d. 58.5°C

____ 21. How many liters of NH_3, at STP, will react with 5.3 g O_2 to form NO_2 and water?

$4NH_3(g) + 7O_2(g) \rightarrow 4NO_2 + 6H_2O(g)$

a. 0.004 23 L
b. 2.12 L
c. 3.03 L
d. 6.49 L

____ 22. P_4O_{10} + H_2O --> H_3PO_4

How many molecules of water are needed to produce 66.8 g of phosphoric acid?

a. 2.74×10^{1}
b. 6.16×10^{1}
c. 6.16×10^{23}
d. 61.6×10^{-23}

____ 23. Select the set of coefficients that properly balance the equation below.

__ $Pb(NO_3)_2$ + __ NH_4Cl → __ $PbCl_2$ + __ NH_4NO_3

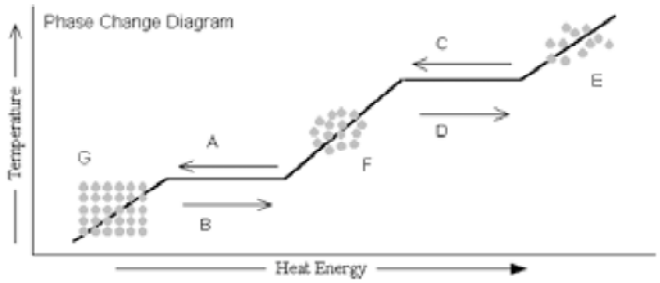
a. 1, 2, 1, 2
b. 1, 2, 2, 1
c. 2, 1, 2, 1
d. 1, 2, 2, 2

____ 24. Sketch a phase change diagram for water starting at 120 ^{0}C & increasing to -60 ^{0}C.

Consider the change in temerpature for your graph. Choose the best desription.

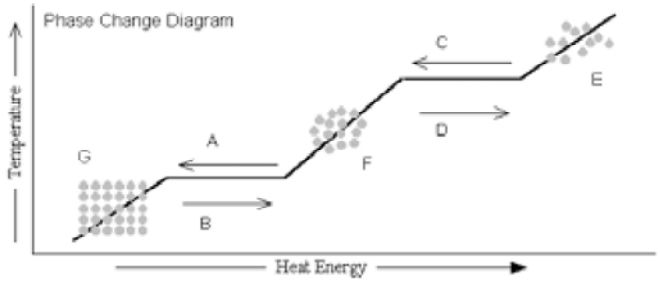
a. ΔT and Endothermic
b. ΔT and Exothermic
c. −ΔT and Endothermic
d. −ΔT and Exothermic
e. ΔT Niether Exothermic or Endothermic

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



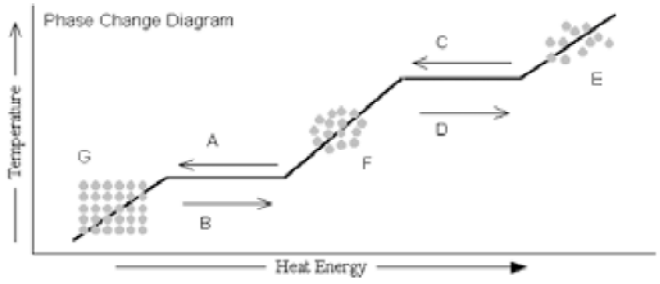
a. Q = mΔHvap
b. Q = mCΔT
c. Q = m-ΔHvap
d. Q = mΔHfus
e. Q = m-ΔHfus

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



a. Q = mΔHvap
b. Q = mCΔT
c. Q = m-ΔHvap
d. Q = mΔHfus
e. Q = m-ΔHfus

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



a. Exothermic
b. Endothermic

Name: _____ **ID: P**

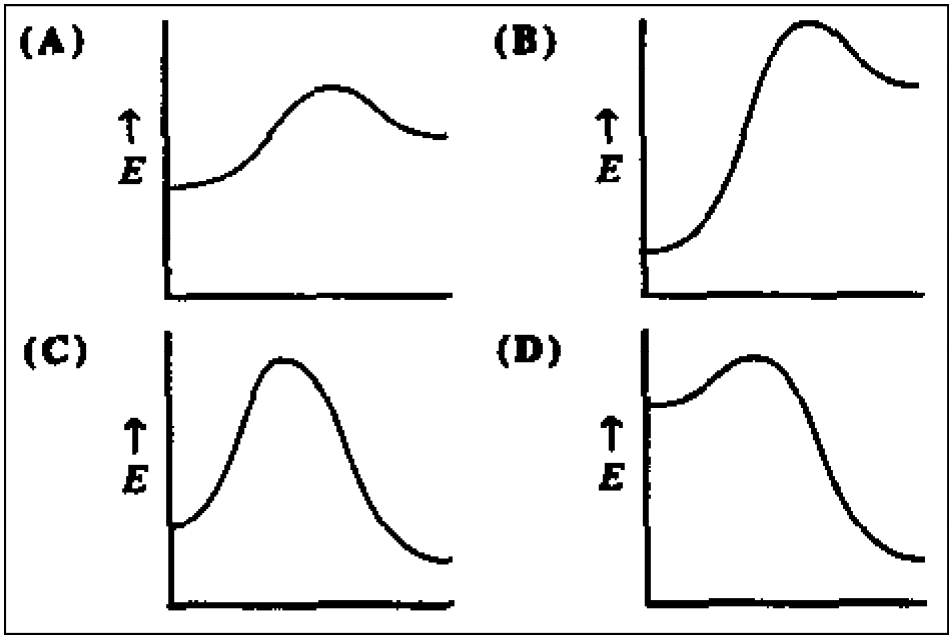
Multiple Response
Identify one or more choices that best complete the statement or answer the question.

____ 28. Choose which example/s below are exothermic. Choose all the 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 mcΔT
b. It has units of J
c. It is enthalpy
d. The units are in J/g x ^{0}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. Δ H is negative
c. The energy of the products is lower than the energy of the reactants
d. Heat is found on the products
e. Δ H 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 °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°C? (specific heat of aluminum = 0.21 $\frac{\text{cal}}{\text{g°C}}$)

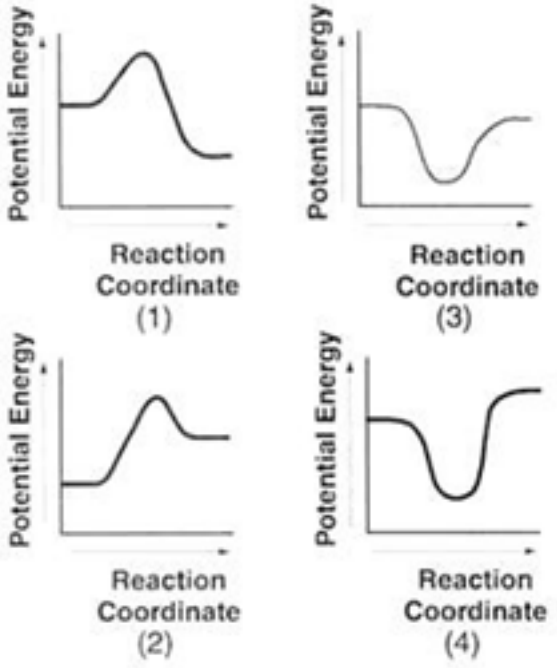
34. A 55.0-g piece of copper wire is heated, and the temperature of the wire changes from 19.0°C to 86.0°C. The amount of heat absorbed is 343 cal. What is the specific heat of copper?

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.

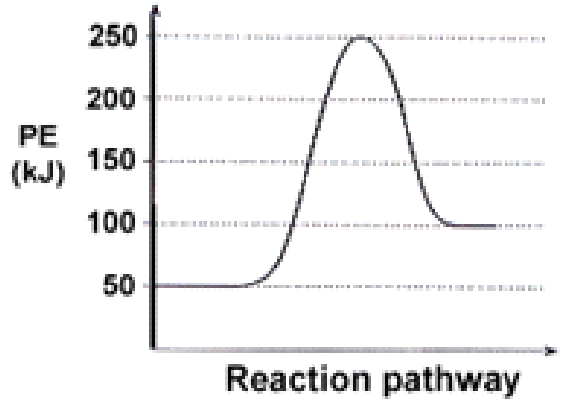
Problem

36. Choose the correct graph for an endothermic reaction.
    1:A
    2: B
    3: C
    4: E

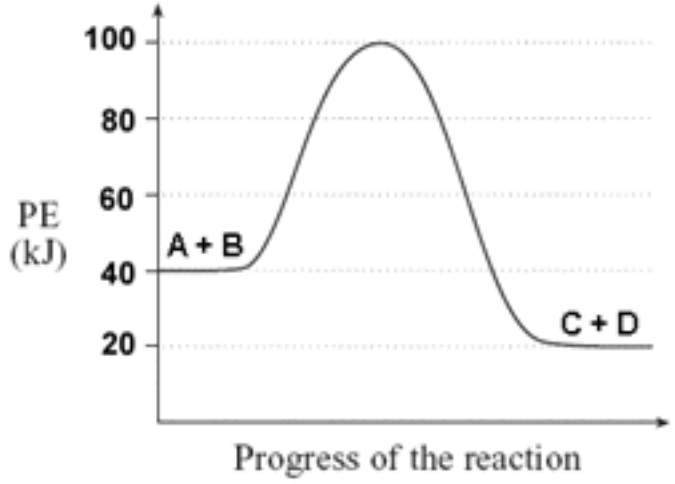


37. Which of the following pictures best represents an endothermic reaction?

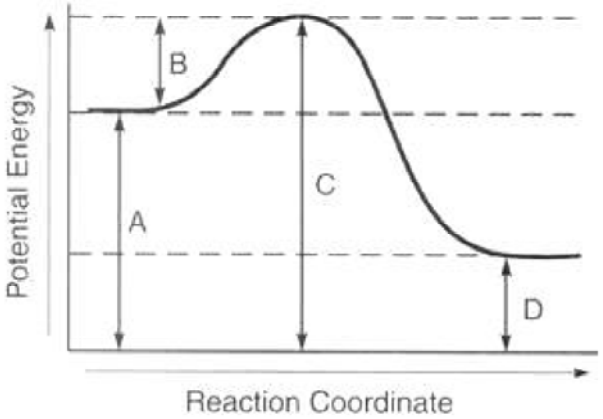
A.



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:

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

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

33. ANS:

Heat energy = mass × specific heat × temperature change

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

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

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

34. ANS:

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

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

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

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

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