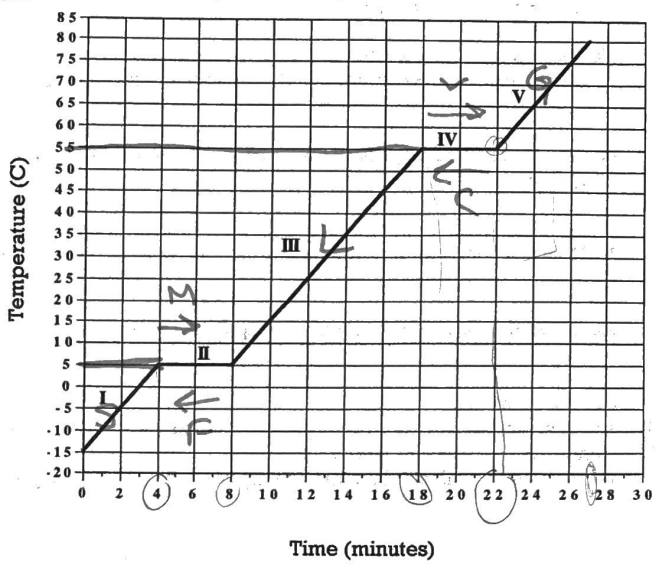
Name: KEY Official Class: _____ Date: _____

Teacher: _____ Period: _____ Class: _____

# Ultimate Thermochemistry Review

**Part 1: Analyze It!**

**Directions:** Students in a chemistry lab conducted the following experiment. They started with a mysterious compound in the solid phase. They placed the solid substance in a beaker and placed it on a hot plate. They measured the temperature of the contents every 2 minutes. Below is a graph of their data. Answer the following questions based on their data and graph.




1. What is the melting point of the substance?
   5°C
2. At what time does the substance begin to melt?
   4 min
3. How long does it take for the substance to completely melt?
   8-4 = 4 mins
4. How many phases are present between 0 min and 4 min? What phase(s) is/are present?
   1 phase - solid
5. What happens to the potential and kinetic energy between 0 min and 4 min?
   KE ↑ & PE constant
6. How many phases are present between 4 min and 8 min? What phase(s) is/are present?
   2 phases liquid & solid
7. What happens to the potential and kinetic energy between 4 min and 8 min?
   KE constant & PE ↑
8. What is the total amount of time a liquid is present according to the graph?
   4 min → 22 min 22 - 4 = 18 mins total
9. How many phases are present between 8 min and 18 min? What phase(s) is/are present?
   one phase - liquid
10. What happens to the potential and kinetic energy between 8 min and 18 min?
    KE ↑ & PE constant
11. At what time does the gas phase first appear?
    @ min 18
12. How many phases are present between 18 min and 22 min? What phase(s) is/are present?
    2 phases liquid & gas
13. What happens to the potential and kinetic energy between 18 min and 22 min?
    KE constant & PE ↑
14. How long is this substance only a gas?
    22 min → 27 min 27 - 22 = 5 min
15. What is the boiling point of the substance?
    55°C
16. How many phases are present between 22 min and 27 min? What phase(s) is/are present?
    1 phase - gas
17. What happens to the potential and kinetic energy between 22 min and 27 min?
    KE ↑ & PE constant

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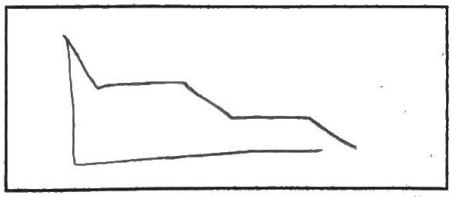
18. What happens to heat as time progresses on the graph? Is it added or removed?

heat is added

19. If this was a cooling curve, sketch what it would look like in the box to the right.



20. On a cooling curve, what happens to the potential and kinetic energy on the flat plateaus on the graph?

PE ↓ & KE constant

21. On a cooling curve, what happens to the potential and kinetic energy on the declining slants on the graph?

PE constant KE ↓

22. How is a cooling curve different from a heating curve *in terms of* heat?

heat is removed

23. Could this substance be water? Explain

no - Boiling point & melting point don't match water's

**Part 2: Calculate It!**

**Directions:** Answer the following questions using your knowledge of chemistry as well as your Chemistry Reference Table. Show all your work.

1. How many joules of heat energy are absorbed when 13 grams water are heated from 15 °C to 95°C?

$q = mc\Delta T$

$q = (13g)(4.18 J/g\cdot°C)(80°C) = 4,347.2 J$

95 − 15 = 80

2. How many joules of heat energy are released when 52 grams water are cooled from 85 °C to 25°C?

$q = mc\Delta T$

$q = (52g)(4.18 J/g°C)(-60°C) = -13,041.6 J$

$\Delta T = 25 - 85 = -60$

3. What is the mass of a sample of ice if 1821 joules of heat was needed to completely melt it?

$q = mH_f$

$\frac{1821 J}{334} = m \frac{(334 J/g)}{334}$

$m = 5.45 g$

4. How much energy is needed to vaporize 10 grams of water at its boiling point?

$q = mH_v$ $q = (10g)(2260 J/g) = 22600 J$

5. Based the following questions on the information provided. A student has a 5 gram sample of water and a 10 gram sample of water. Both samples are heated from 10°C to 50°C.
   a. Predict: Do you think one sample will require more energy to heat than the other? Which sample do you think will require more energy?

   (ANSWERS MAY VARY)

   b. Support your prediction with evidence. Show your work below.

$q = mc\Delta T$ $\Delta T = 40°C$

$q = (5g)(4.18 J/g°C)(40°C) = 836 J$

$q = (10g)(4.18 J/g°C)(40°C) = 1672 J$

   c. Was your prediction supported by your calculation?

(ANSWERS MAY VARY) 10g sample takes twice as much energy than 5 gram sample

6. Based the following questions on the information provided. A student has multiple 5 gram samples of pure water.
   a. Predict: Which phase change will require more energy, melting or vaporization?

   (ANSWERS MAY VARY)

   b. Support your prediction with evidence. Show your work below.

$q = mH_f$ melt

$q = (5g)(334 J/g) = 1670 J$

$q = mH_v$ vaporize

$q = (5g)(2260 J/g) = 11300 J$

   c. Was your prediction supported by your calculation?

(ANSWERS MAY VARY)

Takes more energy to vaporize than melt