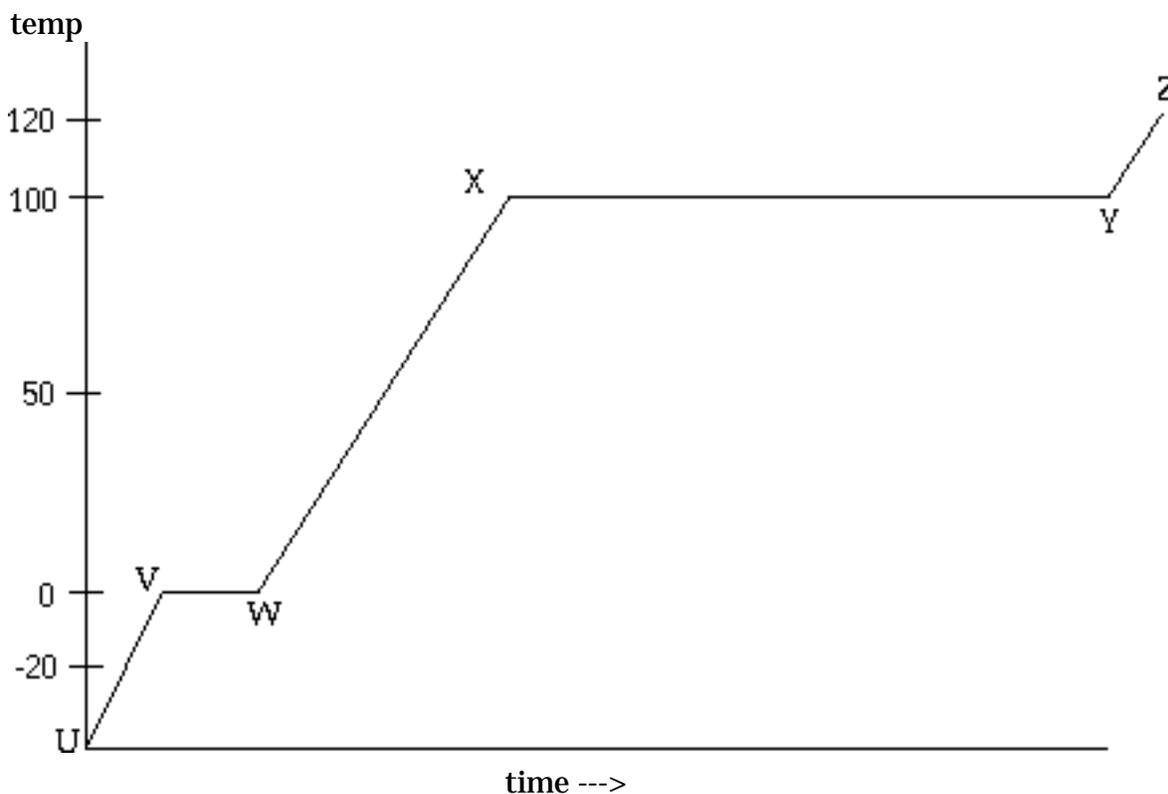


Thermochemistry Problems - Worksheet Number One (answers available on web site)

1. How much energy must be absorbed by 20.0 g of water to increase its temperature from 283.0 °C to 303.0 °C?
2. When 15.0 g of steam drops in temperature from 275.0 °C to 250.0 °C, how much heat energy is released?
3. How much energy is required to heat 120.0 g of water from 2.0 °C to 24.0 °C?
4. If 720.0 g of steam at 400.0 °C absorbs 800.0 kJ of heat energy, what will be its increase in temperature?
5. How much heat (in kJ) is given out when 85.0 g of lead cools from 200.0 °C to 10.0 °C? ( $C_p$  of lead = 0.129 J/g °C)
6. If it takes 41.72 joules to heat a piece of gold weighing 18.69 g from 10.0 °C to 27.0 °C, what is the specific heat of the gold?
7. It takes 333.51 joules to melt exactly 1 gram of H<sub>2</sub>O. What is the molar heat of fusion for water, from this data?
8. A certain mass of water was heated with 41,840 Joules, raising its temperature from 22.0 °C to 28.5 °C. Find the mass of water.
9. How many joules of heat are needed to change 50.0 grams of ice at -15.0 °C to steam at 120.0 °C. Make a graph to indicate this change.
10. Calculate the number of joules given off when 32.0 grams of steam cools from 110.0 °C to ice at -40.0 °C. Make a graph to indicate this change.
11. You have a sample of H<sub>2</sub>O with a mass 23.0 grams at a temperature of -46.0 °C. How many kilojoules of heat energy are necessary to carry out each step? Also, please calculate the total amount of energy needed and make a time-temperature graph.
  - a) heat the ice to 0.0 °C?
  - b) melt the ice?
  - c) heat the water from 0.0 °C to 100.0 °C?
  - d) boil the water?
  - e) heat the steam from 100.0 °C to 109.0 °C?
12. Calculate the energy released when 10.0 g of steam at 120.0 °C are converted into ice at minus 20.0 °C.
13. How much energy is required to convert 100.0 g of water at 20.0 °C completely to steam at 100.0 °C?
14. What amount of ice must be added to 540.0 g of water at 25.0 °C to cool the water to 0.0 °C and have no ice remaining?
15. How many grams of ice could be melted by the energy obtained as 18.0 g of steam is condensed at 100.0 °C and cooled to 0.0 °C?
16. If 150.0 grams of iron at 95.0 °C, is placed in an insulated container containing 500.0 grams of water at 25.0 °C, and both are allowed to come to the same temperature, what will that temperature be? The specific heat of water is 4.18 J/g °C and the specific heat of iron is 0.444 J/g °C)
17. When 80.0 grams of a certain metal at 90.0 °C was mixed with 100.0 grams of water at 30.0 °C, the final equilibrium temperature of the mixture was 36.0 °C. What is the specific heat (Joules gram<sup>-1</sup> °C<sup>-1</sup>) of the metal?
18. Calculate the specific heat of a metal if a 55.0 g sample of an unknown metal at 99.0 °C causes a 1.7 °C temperature rise when added to 225.0 g of water at 22.0 °C.
19. If 10.0 g water at 0.0 °C is mixed with 20.0 g of water at 30.0 °C, what is the final temperature of a mixture?
20. 15.0 g of water at 0.0 °C are added to 40.0 g of water at 40.0 °C. What is the final temperature of the mixture?

21. The graph below shows a pure substance which is heated by a constant source of heat supplying 2000.0 joules per minute. Identify the area described in the questions below and complete the necessary calculations.

UV = 0.36 min, VW = 3.6 min, WX = 3.6 min, XY = 19.4 min, YZ = 0.6 min



- being warmed as a solid \_\_\_\_\_
- being warmed as a liquid \_\_\_\_\_
- being warmed as a gas \_\_\_\_\_
- changing from a solid to a liquid \_\_\_\_\_
- changing from a liquid to a gas \_\_\_\_\_
- What is its boiling temperature? \_\_\_\_\_
- What is its melting temperature? \_\_\_\_\_
- How many joules were needed to change the liquid to a gas? \_\_\_\_\_
- Where on the curve do the molecules have the highest kinetic energy? \_\_\_\_\_
- If the sample weighs 10.0 g, what is its heat of vaporization in J/g? \_\_\_\_\_

22. The number of Joules needed to raise the temperature of 100 grams of water 10 °C. is the same as the number of Joules needed to raise the temperature of 1000 grams of water

a. 1 °C b. 0.1 °C c. 10 °C d. 100 °C

23. 10.0 g of a fuel are burned under a calorimeter containing 200.0 g of H<sub>2</sub>O. The temperature of the water increases from 15.0 °C to 55.0 °C. Calculate the total heat produced (in joules) and the heat of combustion per gram of fuel.

24. Why does moisture condense on the outside of a glass of cold water?

25. Is it possible for a cup of water to completely evaporate in a room with a constant temperature?

26. Why does alcohol at room temperature feel cooler to the touch than does water at the same temperature?

27. If you put a very shallow dish of water in a pan of alcohol and blow air over it by means of a electric fan, the water will freeze...why?