

Name: \_\_\_\_\_

Period: \_\_\_\_\_

Seat#: \_\_\_\_\_

**Directions:** Any worksheet that is labeled with an \* means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website...and the entire internet! See me if you need help finding practice on a topic you are struggling with.

- 1) Sketch and label a phase diagram for water. Be sure to include the following:
  - a. Label the areas with solid, liquid, gas
  - b. Label the triple point and critical point
  - c. Color code the three phase change boundaries to be different colors (make a key showing which color represents which phase change)
- 2) A metal with a C of  $0.780 \text{ J/g}^\circ\text{C}$  requires  $45.0 \text{ J}$  of heat to raise the temperature by  $2.00^\circ\text{C}$ . What is the mass of the metal?  $28.8 \text{ g}$
- 3) A metal with a specific heat of  $0.70 \text{ J/g}^\circ\text{C}$  and a mass of  $8.00 \text{ g}$  absorbs  $48.0 \text{ J}$  of heat. What will be the temp change?  $8.57^\circ\text{C}$
- 4) What would be the final temperature of a  $73.174 \text{ g}$  sample of cobalt with an initial temperature of  $102.0^\circ\text{C}$ , after it loses  $6800 \text{ J}$ ? (Note the specific heat of cobalt is  $0.4210 \text{ J/g}^\circ\text{C}$ )  $T_F = -120^\circ\text{C}$
- 5) How much heat is gained when a  $50.32 \text{ g}$  piece of aluminum is heated from  $9.0^\circ\text{C}$  to  $16^\circ\text{C}$ ?  $320 \text{ joules}$
- 6) A  $250 \text{ g}$  sample of water with an initial temp of  $98.8^\circ\text{C}$  loses  $7500 \text{ joules}$  of heat. What is the final temperature of the water?  $92^\circ\text{C}$
- 7) Copper has a specific heat of  $0.38452 \text{ J/g}^\circ\text{C}$ . How much change in temperature would the addition of  $35,000 \text{ Joules}$  of heat have on a  $538.0 \text{ gram}$  sample of copper?  $170^\circ\text{C}$
- 8) How many joules are required to melt  $100.0 \text{ grams}$  of ice?
- 9) How many joules are given off when  $120.0 \text{ grams}$  of water are cooled from  $25^\circ\text{C}$  to  $-250^\circ\text{C}$ ?  $-115332 \text{ J}$
- 10) How many joules are released when  $450.0 \text{ grams}$  of water are cooled from  $4 \times 10^7^\circ\text{C}$  (the hottest temperature ever achieved by man) to  $1 \times 10^{-9} \text{ K}$  (the coldest temp achieved by man) Note – our calculators struggle with how many decimals this goes out to. So use  $-273^\circ\text{C}$  as your coldest temp for the purposes of our calculator.  $3.4 \times 10^{10} \text{ J}$
- 11) How many joules are required to raise the temperature of  $100.0 \text{ grams}$  of water from  $-269^\circ\text{C}$  (the current temperature of space) to  $1.6 \times 10^{15}^\circ\text{C}$  (the estimated temperature of space immediately after the big bang)?  $2.94 \times 10^{17} \text{ J}$
- 12) How much energy must be absorbed by  $20.0 \text{ g}$  of steam to increase its temperature from  $283.0^\circ\text{C}$  to  $303.0^\circ\text{C}$ ?  $748 \text{ J}$
- 13) If  $720.0 \text{ g}$  of steam at  $400.0^\circ\text{C}$  absorbs  $800.0 \text{ kJ}$  of heat energy, what will be its increase in temperature?  $994.2^\circ\text{C}$
- 14) A certain mass of water was heated with  $41,840 \text{ Joules}$ , raising its temp from  $22.0^\circ\text{C}$  to  $28.5^\circ\text{C}$ . Find the mass of water.  $1.538 \text{ Kg}$
- 15) How many joules of heat are needed to change  $50.0 \text{ grams}$  of ice at  $-15.0^\circ\text{C}$  to steam at  $120.0^\circ\text{C}$ . Make a graph to indicate this change.
- 16) Calculate the joules given off when  $32.0 \text{ g}$  of steam cools from  $110.0^\circ\text{C}$  to ice at  $-40.0^\circ\text{C}$ . Make a graph to indicate this change.
- 17) If  $150.0 \text{ grams}$  of iron at  $95.0^\circ\text{C}$ , is placed in an insulated container containing  $500.0 \text{ grams}$  of water at  $25.0^\circ\text{C}$ , and both are allowed to come to the same temperature, what will that temperature be (Final Temp)? The specific heat of water is  $4.18 \text{ J/g}^\circ\text{C}$  and the specific heat of iron is  $0.444 \text{ J/g}^\circ\text{C}$
- 18) When  $80.0 \text{ grams}$  of a certain metal at  $90.0^\circ\text{C}$  was mixed with  $100.0 \text{ grams}$  of water at  $30.0^\circ\text{C}$ , the final equilibrium temperature of the mixture was  $36.0^\circ\text{C}$ . What is the specific heat ( $\text{Joules/gram}^\circ\text{C}$ ) of the metal?  $0.581 \text{ J/g}^\circ\text{C}$
- 19) Calculate the specific heat of a metal if a  $55.0 \text{ g}$  sample of an unknown metal at  $99.0^\circ\text{C}$  causes a  $1.7^\circ\text{C}$  temperature rise when added to  $225.0 \text{ g}$  of water at  $22.0^\circ\text{C}$ .  $0.386 \text{ J/g}^\circ\text{C}$
- 20) What amount of ice must be added to  $540.0 \text{ g}$  of water at  $25.0^\circ\text{C}$  to cool the water to  $0.0^\circ\text{C}$  and have no ice remaining?  $168.9 \text{ g}$

## Dougherty Valley HS Chemistry

### Thermochemistry – Extra Practice

21) What mass of ice could be melted by the energy obtained as 18.0g of steam is condensed at 100.0°C and cooled to 0.0°C? 144.8 g

22) 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?

23) Determine the energy required to:

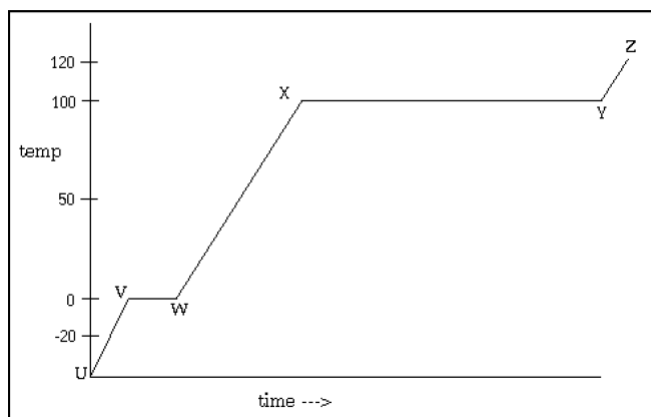
- melt 5.62 moles of ice at 0 °C.
- boil 0.345 moles of water at 100.0 °C.

24) ~~Determine the final temp when 14.2 g of ice at -16.2 °C is placed in 250.0 grams of water at 70.0 °C.~~

25) ~~A student places 42.3 grams of ice at 0.0 °C in an insulated bottle. The student adds 255.8 grams of water at 90.0 °C. Determine the final temperature of the mixture. 65.9 °C~~

26) 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? \_\_\_\_\_

27) Equal amounts of heat are used to heat a 25.0 g sample of water and a 25.0 g sample of alcohol. The temperature of the water rises from 23.1°C to 27.9°C, while the temperature of the alcohol rises from 21.6°C to 29.9°C. Calculate the specific heat of alcohol. 2.42 J/g°C

28) 31.5 g of water at 22.3°C is placed into a beaker. Some hot water is then poured into the beaker. The total mass of the water in the beaker is found to be 48.9 g, and the final temperature (after mixing) is 29.1°C. What was the temperature of the hot water? 41.4°C

29) ~~What is the smallest number of ice cubes at 0.00°C, each containing one mole of water, necessary to cool 500.0 g of liquid water initially at 20.0°C to 0.00°C? 7 cubes~~

30) ~~At a bar, there is a bucket containing ice, some of which has melted. A bartender gets an ice cube weighing 20.0 grams from the ice bucket and puts it into an insulated cup containing 100 grams of water at 20.0°C. Will the ice cube melt completely? What will be the final temperature of the water in the cup? Yes, 3.38°C~~

31) Consider a rigid insulated box containing 20.0 g of He(g) at 44.6°C and 1.00 atm in one compartment and 20.0 g of N<sub>2</sub>(g) at 115.0°C and 2.00 atm in the other compartment. These compartments are connected by a partition which transmits heat. What will be the final temperature in the box at thermal equilibrium?  $C_{\text{He}} = 12.5 \text{ J/K}\cdot\text{mol}$ ,  $C_{\text{N}_2} = 20.7 \text{ J/K}\cdot\text{mol}$  58°C

32) Here is a link to an extra Hess Law worksheet and heat of formation worksheet that I have for AP Chem. Some of these may be much harder than what we would see, but I don't have any other easy level practice right now. Hopefully I will be able to find some soon! <https://tinyurl.com/y5x7xfs7>

33) Here is a link to a Bond Energy worksheet I have from AP Chem. I don't have any other practice right now. Hopefully I will be able to find some soon! 😊  
<https://tinyurl.com/mw36djjwv>