**HPS Specific Heat & Latent Heat Calcs 2021** Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Per \_\_\_\_\_

Objective 3: Describe the relationship between temperature and state of matter using a heating curve.

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| Substance | Specific Heat | Substance | Specific Heat |
| H2O (s) | 2.06 J/g °C | Aluminum (s) | 0.900 J/g °C |
| H2O (g) | 2.02 J/g °C | Benzene (l) | 1.74 J/g °C |
| H2O (l) | 4.18 J/g °C | Ethanol (l) | 2.42 J/g °C |

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| Substance | Latent Heat of Fusion | Latent Heat of Vaporization | Boiling Point (K) | Melting Point (K) |
| H2O | 334 J/g | 2260 J/g | 373.2 | 273.2 |
| Benzene | 136 J/g | 394 J/g | 353.2 | 278.6 |
| Ethanol | 99.8 J/g | 944 J/g | 351.5 | 158.7 |
| Acetone | 98.5 J/g | 501 J/g | 329.4 | 179.0 |

**SPECIFIC HEAT**

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| Specific heat is defined as the amount of heat energy needed to raise 1 gram of a substance by 1\*C. *Be sure your units for specific heat match the units in the problem.*  The equation is **Q = mC(Tf - Ti)** where  *Q* is the heat energy (joules), *m* is the mass of the sample (grams or kilograms\*), *C* is the specific heat of the substance (J/g\*C), and *Tf - Ti* is the change in temperature (\*C)  The higher the specific heat, the more energy is required to cause a change in temperature.  *\*This equation is used when the state of matter does not change.* |

1. How much heat energy is required to raise the temperature of 1.0 kilogram of steel by 10.0\*C? (Specific Heat of steel = 470 J/kg\*C)

2. What is the mass of a concrete block of concrete that gains 52,800 joules of energy when its temperature is increased by 5.0 \*C? (Specific Heat of concrete = 880 J/kg\*C)

3. What is the change in temperature for a 2.0x103 gram mass of water that loses 8,500 joules of energy? (Specific Heat of water = 4.18 J/g\*C)

**LATENT HEAT**

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| Latent heat is defined as the “hidden” heat when a substance absorbs or releases heat without producing a change in the temperature of the substance (ex: during a phase change). *Be sure your units for specific heat match the units in the problem.*  The equation for Latent Heat of Fusion is **Q = mLf** where  *Q* is the heat energy (joules), *m* is the mass of the sample (grams or kilograms\*), *Lf* is the latent heat of fusion for the substance (J/g)  *\*This equation is used when the sample is changing from a solid to a liquid.*  The equation for Latent Heat of Vaporization is **Q = mLv** where  *Q* is the heat energy (joules), *m* is the mass of the sample (grams or kilograms\*), *Lv* is the latent heat of vaporization for the substance (J/g)  *\*This equation is used when the sample is changing from a liquid to a gas.* |

1. How much heat is required to melt 25.0 g of ice at 0°C?

2. How much heat is required to boil away 25.0 g of Ethanol at 351.5 K?

**SPECIFIC HEAT AND LATENT HEAT COMBINED**

3. You have a sample of H2O with a mass of 23.0 g at a temperature of –46.0 °C. How many kilojoules (kJ) of heat energy are necessary to:

A) heat the ice to 0°C?

B) melt the ice?

C) heat the water from 0°C to 100°C?

D) boil the water?

E) heat the steam from 100°C to 109°C?

4. How much heat is required to change 25.0 g of liquid Ethanol that is at a temperature of 158.7 K to a gas at 351.5 K?