CP Chemistry Mr. Thaler

Thermochemistry II

Use the data table below, heating curves, dimensional analysis, and $q = m$ x *specific heat* x ΔT to solve the following problems.

Substance	**Specific Heat ($J/g \cdot K$)**	**MP (^oC)**	**ΔH_{fus} (kJ/mol)**	**BP (^oC)**	**ΔH_{vap} (kJ/mol)**
$Al_{(s)}$	0.902	660	10.7	***	***
$Al_{(l)}$	***	***	***	2467	294
$Ca_{(s)}$	0.653	839	9.3	***	***
$Ca_{(l)}$	***	***	***	1493	151
$Cu_{(s)}$	0.385	1083	13.0	***	***
$Cu_{(l)}$	***	***	***	2567	305
$Fe_{(s)}$	0.451	1535	14.9	***	***
$Fe_{(l)}$	***	***	***	2750	351
$Hg_{(s)}$	***	$^-38.8$	2.33	***	***
$Hg_{(l)}$	0.138	***	***	357	59.4
$C_2H_5OH_{(s)}$, ethanol	***	$^-117$	5.02	***	***
$C_2H_5OH_{(l)}$, ethanol	2.46	***	***	78.0	39.3
$C_2H_5OH_{(g)}$, ethanol	0.954	***	***	***	***
$H_2O_{(s)}$, ice	2.09	0.00	6.02	***	***
$H_2O_{(l)}$, water	4.18	***	***	100.00	40.7
$H_2O_{(g)}$, steam	1.84	***	***	***	***

*** *indicates data not available or not applicable*

<u>SHOW YOUR WORK FOR EACH OF THE FOLLOWING.</u>
<u>WRITE YOUR ANSWERS IN JOULES.</u>
<u>All processes occur at a constant pressure of 1 atm.</u>

1. Calculate the amount of heat required to change 80.0 g of ice at $^-12.0\ ^oC$ to steam at 114 ^oC.

2. How much heat is required to completely melt a 7.8-g piece of copper metal from a 25.0 ^oC solid to a liquid with a temperature of 1083 ^oC?

3. How much heat is released when a 75-kg sample of entirely molten iron, at 1535 ^oC, is cooled to room temperature (22 ^oC)?

4. Calculate the amount of heat required to fully vaporize a 30.00-mL sample of mercury (density = 13.55 g/ mL) starting from 22.0 ^oC. Is this process endothermic or exothermic?

5. How much heat is needed to change 57.1 mL of liquid ethanol at 20.0 ^oC to a gas at 110 ^oC? (Assume density of ethanol = 0.789 g/ cm^3.)

6. Calculate the amount of heat transferred when 2.0 L of water at 25.0 ^oC (density = 0.997 g/cm^3) is frozen to $^-10.0\ ^oC$. Is this process exothermic or endothermic?