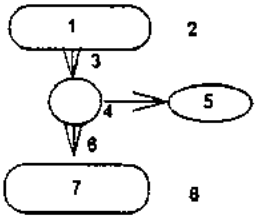
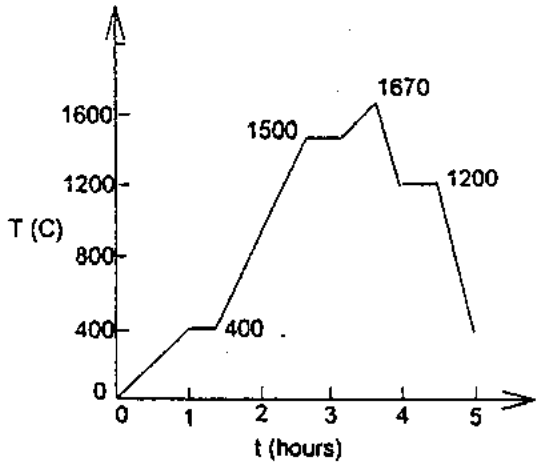
1. (10%)Please fill in the following sketch the affixed items. Describe your answer by appropriately identify the numbers with the items.

Heat Source, Cold Sink, Entropy Increases, Entropy Falls, Heat Withdrawn, Heat Dumped, Surrounding, Work



2.(15%) The superconducting material exhibits a Tc point at which the materia possesses the transition from normal conducting to superconducting. Will you expect the heat capacity of the superconducting material to change during such a transition? Why?

3.(15%) A piece of tool steel, of which the melting point is 1500°C, was heat treated according to the following heating profile. Please describe the enthalpy variation of this piece of tool steel with respect to the temperature change.



4.(15%) Please estimate the entropy and the enthalpy involved for the melting of the following metals.

Metals	Melting Point (°C)
Zn	419
Al	660
Cu	1083
Ni	1453
Ti	1668

5.(10%) Please describe an example of the irreversible process and provide the entropy variation of the universe of your example in terms of suitable equations.

6.(10%) The casting process involves heating, melting, and cooling of metals. Please describe the fittness of the First Law and the Second Law of the entire process according to the following steps. Please do provide explanations to your answer.

$$\text{Solid Metal} \xrightarrow{1} \text{Heating} \xrightarrow{2} \text{Melting} \xrightarrow{3} \text{Pouring} \xrightarrow{4} \text{Cooling}$$

7.(15%) Which of the following statements is (are) wrong?

1) the heat capacity of a solid is a constant value upon heating;
2) Metal (P_1, V_1, T_1) ---> Metal (P_2, V_2, T_2)
   $\triangle U = \triangle q - \triangle w$
   where $\triangle U = U_2 - U_1$, $\triangle q = q_2 - q_1$, $\triangle w = w_2 - w_1$
3) the Gibbs free energy of a material is minimum at its melting point;
4) the Carnot cycle related to the First Law of thermodynamics (the law of energy conservation);
5) it is possible to melt a piece of metal simply by applying a large pressure on it if the metal swell during melting;

8.(10%) Please estimate the entropy change of one mole of Mn when it is heated from 25°C to 1200°C.

	$\triangle H_{trans.}$ (joules)	$T_{trans.}$ (K)
$\alpha \rightarrow \beta$	2010	993
$\beta \rightarrow \gamma$	2300	1373
$\gamma \rightarrow \delta$	1800	1409
$\delta \rightarrow$ liquid	13400	1517

$Cp = a + bT + cT^{-2}$, jouls/deg.mole

	a	b x 10^3	c x 10^{-5}	Range (K)
Mn(α)	21.6	15.9		298-993
Mn(β)	34.9	2.8		993-1373
Mn(γ)	44.8			1373-1409
Mn(δ)	47.3			1409-1517
Mn(l)	46.0			1517-T_b