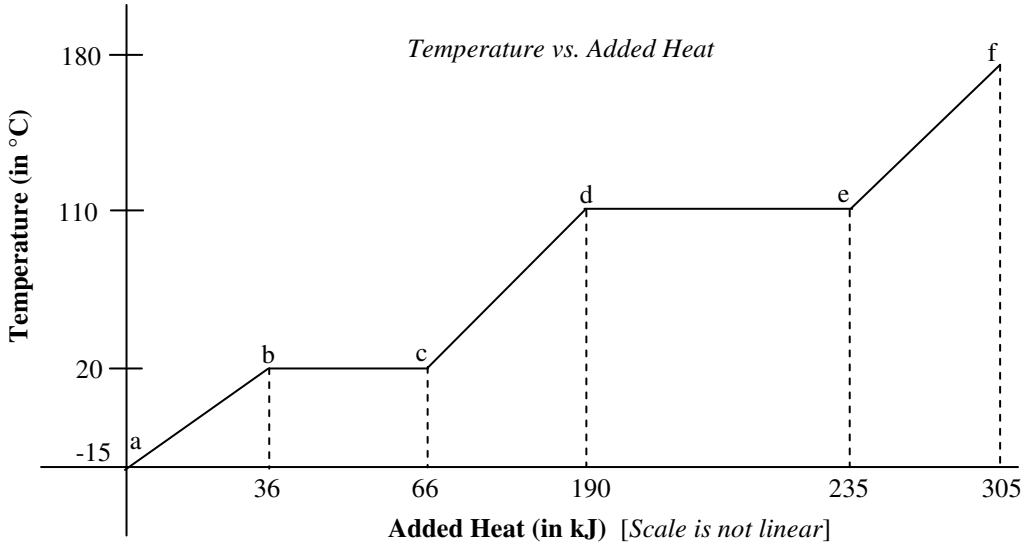
Name: _____

Period: _____

Temperature Graphs



The above graph shows the heat absorbed by 2 kg of an unknown substance. Notice that the heat is given in kilojoules, not joules.

1. Label the different regions of the graph as solid, liquid, gas, melting, and boiling.
2. What is the freezing point of the substance? (*At what temperature does it freeze*?)
3. What is the condensation point of the substance?
4. What is the melting point of the substance?
5. What is the boiling point for this substance?
6. Calculate the specific heat for the liquid phase of this substance.
   A. Is the temperature changing during the liquid phase or staying constant?
   B. So, are you going to have to use $Q = mL$ or $Q = mc_p\Delta T$ for this part of the graph?
   C. Q is the amount of heat added or removed. From the graph find the amount of heat added during the liquid phase. (*Not the total amount of heat from the start of the graph*.)
   D. What is the temperature change of the liquid phase?
   E. Now calculate the specific heat (c_p) of the substance as a liquid.

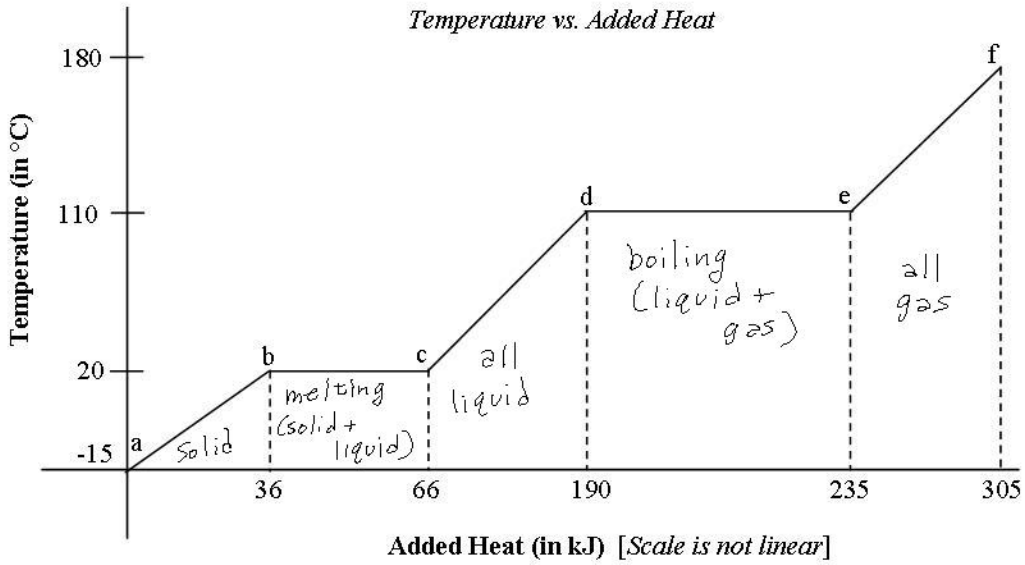
7. Calculate the latent heat of fusion for the substance.
   A. Which line relates to fusion?
   B. What equation will you use: $Q = mL$ or $Q = mc_p\Delta T$?
   C. Calculate the latent heat of fusion.

8. Calculate the specific heat for the solid phase of the substance.

9. Calculate the latent heat of vaporization for this substance.

10. Calculate the specific heat for the gaseous phase.

11. During which parts of the graph is the kinetic energy of the molecules constant?



The above graph shows the heat absorbed by 2 kg of an unknown substance. (The answers are on the back page. I suggest you cover up the answers with a piece of paper and look at each one as you finish it.)

1. Label the different regions of the graph as solid, liquid, gas, melting, and boiling.
2. What is the freezing point of the substance? (*At what temperature does it freeze?*) 20°C (lower flat line)
3. What is the condensation point of the substance? 110°C (top flat line)
4. What is the melting point of the substance? 20°C
5. What is the boiling point for this substance? 110°C

freezing point = melting point
boiling point = condensation point

Notice that the heat is in kilojoules, not joules. So you will have to convert, first.

6. Calculate the specific heat for the liquid phase of this substance.
   A. Is the temperature changing during the liquid phase or staying constant? changing
   B. So, are you going to have to use Q = mL or (Q = $mc_p\Delta T$) for this part of the graph?
   C. Q is the amount of heat added or removed. From the graph find the amount of heat added during the liquid phase. (*Not the total amount of heat from the start of the graph.*) 190 − 66 = 124 kJ
   D. What is the temperature change of the liquid phase? 110 − 20 = 90°C
   E. Now calculate the specific heat (c_p) of the substance as a liquid.

$Q = mc_p\Delta T$
$124{,}000 = 2(c_p)(90)$
$c_p = 689\ J/kg\cdot°C$

7. Calculate the latent heat of fusion for the substance.
   A. Which line relates to fusion? bc
   B. What equation will you use: (Q = mL) or Q = $mc_p\Delta T$?
   C. Calculate the latent heat of fusion.

$Q = 66 - 36 = 30\ kJ$
$30{,}000 = 2(L_f)$
$L_f = 1.5 \times 10^4\ J/kg\cdot°C$

8. Calculate the specific heat for the solid phase of the substance.

$Q = mc_p\Delta T$
$36{,}000 = 2(c_p)(20 - (-15))$
$36{,}000 = 2(c_p)(35)$
$c_p = 514\ J/kg°C$

9. Calculate the latent heat of vaporization for this substance.

$Q = mL$
$235\ kJ - 190\ kJ = 2(L)$
$22{,}500 = L = 2.25 \times 10^4\ J/kg°C$

10. Calculate the specific heat for the gaseous phase.

$Q = mc_p\Delta T$
$(305 - 235)\ kJ = 2(c_p)(180 - 110)$
$70{,}000 = 2c_p(70)$ div. by 70
$1{,}000 = 2c_p$
$c_p = 500\ J/kg\cdot°C$