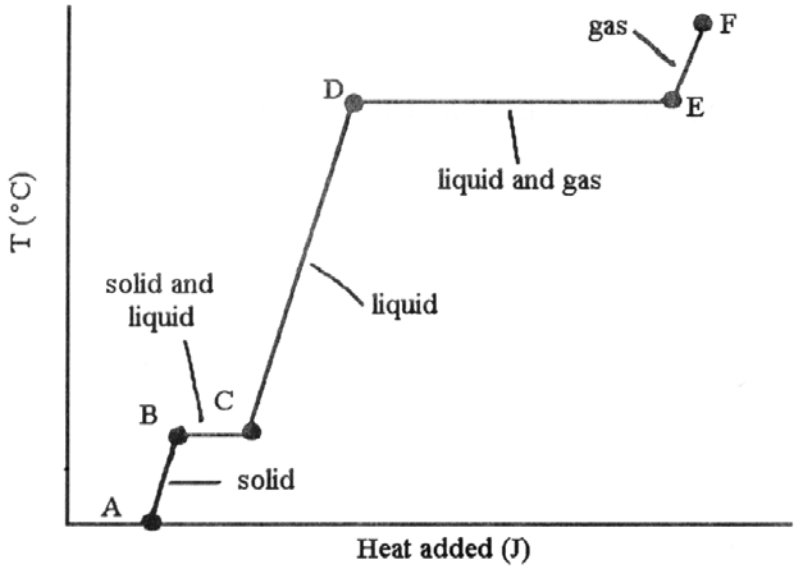
A.P. Chemistry Quiz: Phase Change Calculations

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.



1) The heating curve shown was generated by measuring the heat flow and temperature for a solid as it was heated. The slope of the _____ segment corresponds to the specific heat capacity of the liquid of the substance.

A) AB B) BC C) CD D) DE E) EF

2) The phase changes B → C and D → E are not associated with temperature increases because the heat energy is used up to _____.

A) increase the velocity of molecules
B) break bonds between molecules
C) rearrange atoms within molecules
D) increase the density of the sample
E) break intramolecular bonds

3) The enthalpy change when 1.00 mol of water at 25.0°C is converted to steam at 115.0°C is _____ kJ. The specific heats of ice, water, and steam are 2.09 J/g–K, 4.18 J/g–K, and 2.08 J/g–K, respectively. For H_2O, $\triangle H_{fus}$ = 6.01 kJ/mol, and $\triangle H_{vap}$ = 40.67 kJ/mol

A) 432.0 B) 7.08×10^3 C) 47.36 D) 46.9 E) 41.06

4) How much energy (kJ) is required to convert a 15.5 g ice cube at –5.0°C to water vapor at 180°C?

A) 56 B) 9.0×10^3 C) 11 D) 49 E) 27

5) If 10.0 kJ of heat are added to a 15.5 g ice cube at –5.00°C, what will be the resulting state and temperature of the water?

A) vapor, 134°C B) liquid, 13.9°C C) solid, –4.85°C D) liquid, 72.0°C E) vapor, 103°C

Answer Key
Testname: QUIZ_PHASE_CHANGE_CH_10.TST

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) C
ID: chem9b 2.1–52

2) B
ID: chem9b 2.1–55

3) D
ID: chem9b 2.2–1

4) D
ID: chem9b 2.1–59

5) D
ID: chem9b 2.1–61

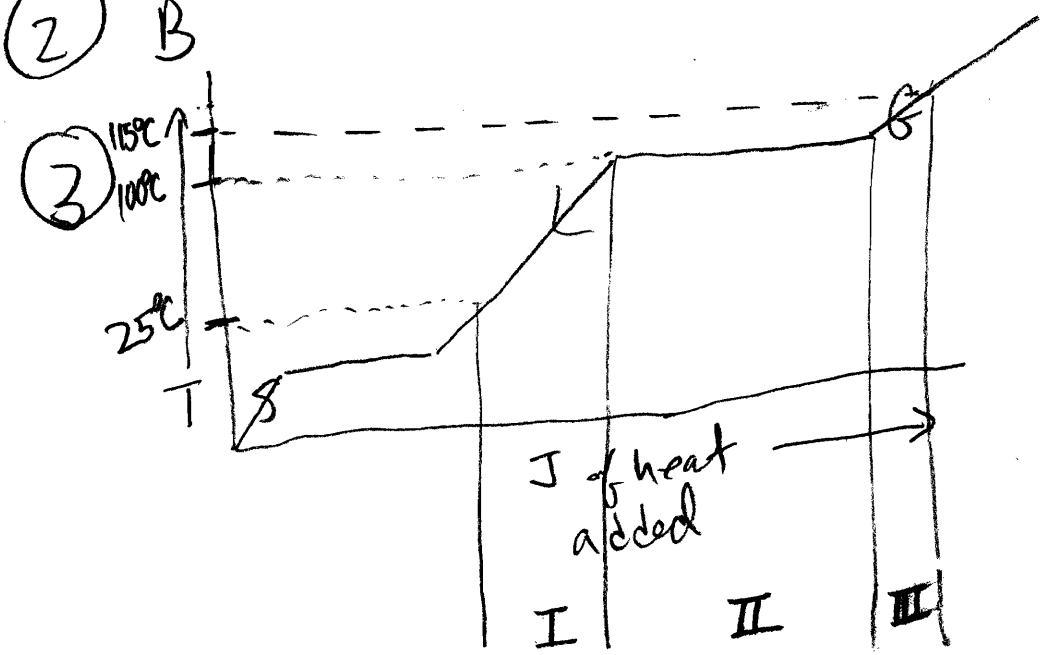
AP Chemistry
Quiz - Phase Change
Calcs
version A

PAGE ONE

(1) CD - specific heat is the amount of heat needed to raise the temp of 1g of a substance by 1°C. The steeper this line, the greater the # of °C (temperature change) per J of added heat; bigger slope = lower specific heat capacity.

(2) B

(3)



(I) 25°C $H_2O_{(l)} \rightarrow$ 100°C $H_2O_{(l)}$

$q = mC\Delta T$

$= (18.02g)\left(\frac{4.18 J}{g°C}\right)(75.0°C)$

$= 5649.27 J$

(II) 100°C $H_2O_{(l)} \rightarrow$ 100°C $H_2O_{(g)}$

$1.00 mol \times \frac{40.67 kJ}{mol} = 40670 J$

(III) 100°C $H_2O_{(g)} \rightarrow$ 115°C $H_2O_{(g)}$

$q = mC\Delta T$

$q = (18.02g)(2.08 \frac{J}{g°C})(15.0°C)$

$= 562.224 J$

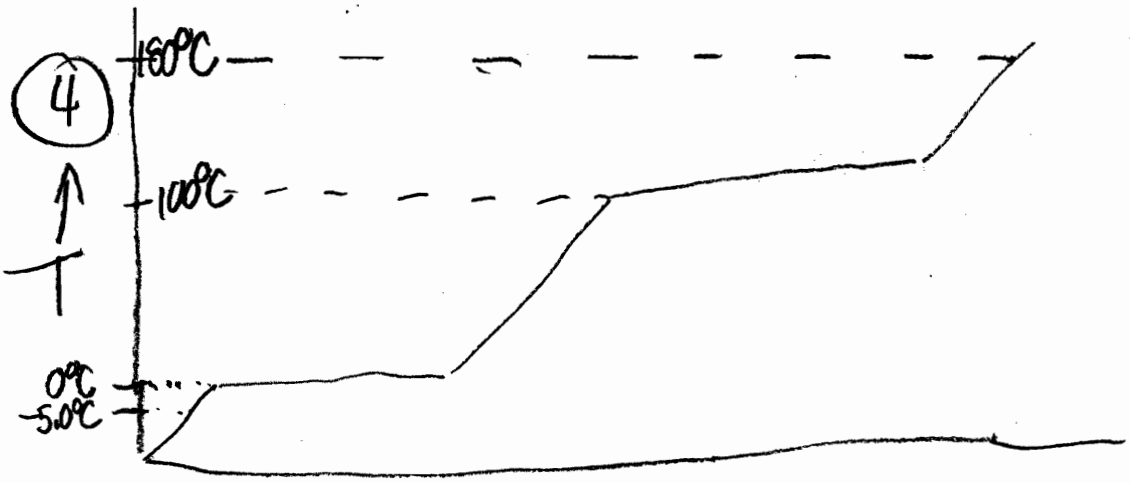
A+B+C = 46880 J

$= 46.9 kJ$

(D)

Version A, PAGE TWO

4



heat added ⟶

(I) $q = mC\Delta T$ $\quad -5.0°C\ H_2O_{(s)} \rightarrow 0°C\ H_2O_{(s)}$

$$q = (15.5g)\left(\frac{2.09\ J}{g°C}\right)(5.0°C) = 161.975\ J$$

(II) $0°C\ H_2O_{(s)} \longrightarrow H_2O_{(l)}\ 0°C$

$$q = 15.5g \times \frac{1\ mol}{18.02g} \times \frac{6.01\ kJ}{1\ mol} = 5169.5\ J$$

(III) $H_2O_{(l)}\ 0°C \rightarrow H_2O_{(l)}\ 100°C$

$$q = (15.5g)\left(\frac{4.18\ J}{g°C}\right)(100°C) = 6479\ J$$

(IV) $H_2O_{(l)}\ 100°C \longrightarrow H_2O_{(g)}\ 100°C$

$$q = 15.5g \times \frac{1\ mol}{18.02g} \times \frac{40.67\ kJ}{1\ mol} = \underline{34983}\ J$$

(V) $H_2O_{(g)}\ 100°C \longrightarrow H_2O_{(g)}\ 180°C$

$$q = mC\Delta T = (15.5g)\left(\frac{2.08\ J}{g°C}\right)(80°C) = 2579.2\ J$$

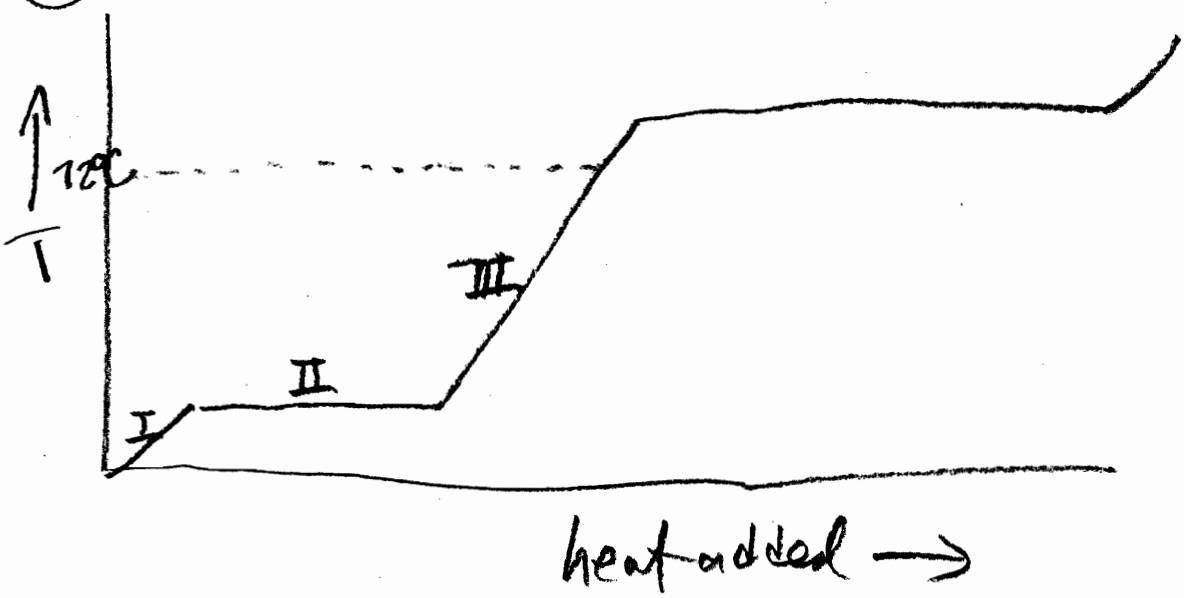
$$= 49372.675\ J$$

$= 49\ kJ$

5

Version A

PAGE THREE



10000 J

I heat needed to warm ice = 162 J

II heat needed to melt ice = 5169.5 J

$10{,}000\,J - (162 + 5169.5) = 4668.5\,J$

III $q = mc\Delta T$

$4668.5\,J = (15.5\,g)(4.18\,J/g\,°C)(\Delta T)$

$\Delta T = 72.0\,°C$

$0\,°C + 72.0\,°C = 72.0\,°C$

F.P. of H_2O — ΔT — Final temp