Clicker/Poll Question

For a particular function X (where X is either U, H, F, or G), the following relationship holds:

$$\left(\frac{\partial X}{\partial V}\right)_{T,N} = -P$$

What is the thermodynamic potential, X?

A. Internal Energy, U
B. Enthalpy, H
C. Helmholtz Free Energy, F
D. Gibbs Free Energy, G

Your Turn

Derive the Maxwell relation corresponding to the 2nd mixed partials of G with respect to T and P. Make sure you include which variables are held constant.

Clicker/Poll Question

By looking at the appropriate Maxwell relation, which of the following is equal to $\left(\frac{\partial S}{\partial P}\right)_{T,N}$?

A) $+\left(\frac{\partial T}{\partial P}\right)_{V,S}$

B) $-\left(\frac{\partial T}{\partial P}\right)_{V,S}$

C) $+\left(\frac{\partial V}{\partial T}\right)_{P,N}$

D) $-\left(\frac{\partial V}{\partial T}\right)_{P,N}$

Clicker/Poll Question

Suppose you are interested in the heat transfer at constant pressure of a particular chemical reaction. Which thermodynamic potential is most relevant for this question?

A. Internal Energy, U
B. Enthalpy, H
C. Helmholtz Free Energy, F
D. Gibbs Free Energy, G

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$dA = dF$ (where A is the availability and F is the Helmholtz free energy) in the case of constant volume and temperature. Does this require that the constant temperature of the system T be equal to the constant temperature of the reservoir, T_0?

A. Yes
B. No
C. ???

Clicker/Poll Question

Is carbonic acid a strong acid? That is, does H_2CO_3 spontaneously disassociate into HCO_3^- and H^+?

Substance (form)	$\Delta_f H$ (kJ)	$\Delta_f G$ (kJ)	S (J/K)	C_P (J/K)	V (cm^3)
H_2CO_3 (aq)	−699.65	−623.08	187.4		
HCO_3^- (aq)	−691.99	−586.77	91.2		
H^+ (aq)	0	0	0	0	

A. Yes

B. No

C. ???

Clicker/Poll Question

To induce more disassociation from H_2CO_3 into HCO_3^- and H^+, should we increase temperature or decrease temperature?

Substance (form)	$\Delta_f H$ (kJ)	$\Delta_f G$ (kJ)	S (J/K)	C_P (J/K)	V (cm^3)
H_2CO_3 (aq)	−699.65	−623.08	187.4		
HCO_3^- (aq)	−691.99	−586.77	91.2		
H^+ (aq)	0	0	0	0	

A. Increase temperature

B. Decrease temperature

C. ???

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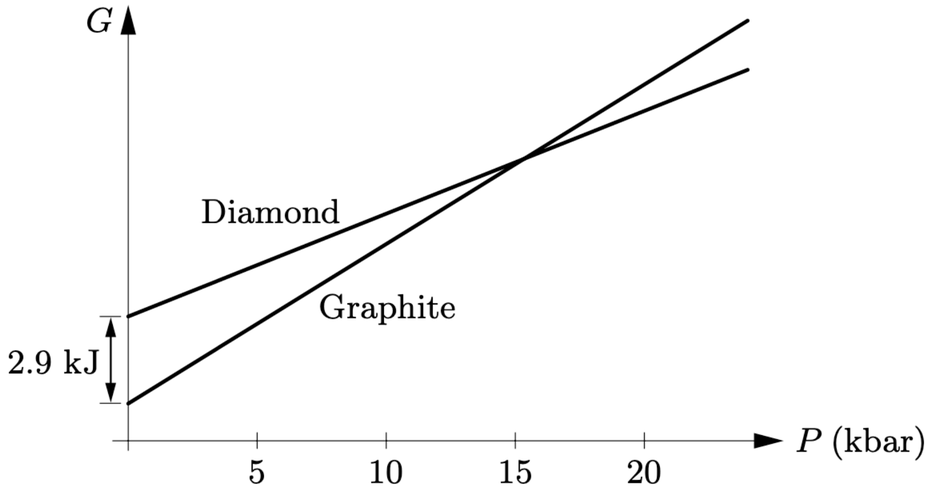
Clicker/Poll Question

What does the slope represent in this graph?

A. Volume
B. Pressure
C. Entropy
D. None of the above



Clicker/Poll Question

Suppose you are looking at a phase diagram (P vs. T). At the boundary between two phases,

A. The entropy of the two phases is the same
B. The Gibbs energy of the two phases is the same
C. The Helmholtz energy of the two phases is the same
D. The volume of the two phases is the same

Clicker/Poll Question

Substance	ΔH_f° (25°C) kJ mol^{-1}	S° (25°C) J K^{-1} mol^{-1}	ΔG_f° (25°C) kJ mol^{-1}
$H_2O(\ell)$	−285.83	69.91	−237.18
$H_2O(g)$	−241.82	188.72	−228.59

Water boils at 100.0 degrees C at atmospheric pressure. What absolute pressure is required for it to boil at 101.0 degrees C?

A. A pressure slightly higher than 1.0atm.
B. A few atm (say, between 2.0atm and 9.0atm).
C. Between 10-100 atm.
D. Well over 100 atm.
E. None of the above —it actually requires a lower pressure.

Clicker/Poll Question

In the Maxwell construction, which of the following best explains why the critical pressure line is drawn so that the “areas are equal”?

A. The 2nd Law of Thermodynamics
B. The Clausius-Clapeyron relation
C. The fact that the Gibbs Free Energy is a state function
D. None of the above — the choice is pretty arbitrary