# Quiz: Thermodynamics 1

---

**Q1: Thermodynamics is the branch of science that deals with:**

A) Rate of chemical reactions
B) Energy changes accompanying physical and chemical processes
C) Structure of atoms
D) Equilibrium constants only

**Q2: Which of the following is a state function?**

A) Heat
B) Work
C) Internal energy
D) Path length

**Q3: Which of the following is NOT a state function?**

A) Enthalpy
B) Entropy
C) Gibbs free energy
D) Work

**Q4: The first law of thermodynamics is a statement of conservation of:**

A) Mass
B) Energy
C) Entropy
D) Momentum

**Q5: The mathematical form of first law of thermodynamics is:**

A) DeltaU = q + w
B) DeltaU = q - w
C) DeltaU = w - q
D) DeltaU = q

**Q6: For an isothermal expansion of ideal gas, DeltaU is:**

A) Positive
B) Negative
C) Zero
D) Maximum

**Q7: Work done in a reversible isothermal expansion of ideal gas is given by:**

A) w = -PDeltaV
B) w = -nRT ln(V2/V1)
C) w = -nRT
D) w = -RT ln(P2/P1)

**Q8: Enthalpy (H) is defined as:**

A) U - PV
B) U + PV
C) U/T

D) PV/T

**Q9: At constant pressure, heat absorbed by the system is equal to:**

A) DeltaU
B) DeltaH
C) DeltaG
D) DeltaS

**Q10: For an exothermic reaction, the value of DeltaH is:**

A) Positive
B) Negative
C) Zero
D) Infinity

**Q11: Entropy is a measure of:**

A) Energy
B) Randomness
C) Heat
D) Temperature

**Q12: For a spontaneous process, DeltaS_universe is:**

A) Zero
B) Negative
C) Positive
D) Constant

**Q13: Which law introduces the concept of entropy?**

A) First law
B) Second law
C) Third law
D) Zeroth law

**Q14: For a reversible process, change in entropy is given by:**

A) DeltaS = q/T
B) DeltaS = q_rev/T
C) DeltaS = T/q
D) DeltaS = w/T

**Q15: Entropy change for an isolated system is:**

A) Always zero
B) Always positive
C) Zero or positive
D) Negative

**Q16: Gibbs free energy (G) is defined as:**

A) H - TS
B) U - TS
C) H + TS
D) U + TS

**Q17: For a spontaneous reaction at constant temperature and pressure, DeltaG is:**

A) Positive
B) Negative
C) Zero
D) Maximum

**Q18: At equilibrium, Gibbs free energy change is:**

A) Positive
B) Negative
C) Zero
D) Infinite

**Q19: Which of the following conditions makes a reaction spontaneous at all temperatures?**

A) DeltaH < 0 and DeltaS > 0
B) DeltaH > 0 and DeltaS > 0
C) DeltaH < 0 and DeltaS < 0
D) DeltaH > 0 and DeltaS < 0

**Q20: The unit of entropy is:**

A) J mol-1
B) J K-1
C) J mol-1 K-1
D) K mol-1

**Q21: The third law of thermodynamics states that entropy of a perfect crystal at 0 K is:**

A) Zero
B) Maximum
C) Infinity
D) Constant but not zero

**Q22: Which of the following is an intensive property?**

A) Volume
B) Internal energy
C) Entropy
D) Temperature

**Q23: Which quantity determines the direction of a chemical reaction?**

A) Enthalpy
B) Entropy
C) Gibbs free energy
D) Internal energy

**Q24: For an adiabatic process, heat exchanged (q) is:**

A) Positive
B) Negative
C) Zero
D) Maximum

**Q25: Which process is reversible?**

A) Free expansion of gas
B) Mixing of gases
C) Isothermal expansion at infinitesimal pressure difference
D) Chemical reaction in open vessel

**Q26: Which of the following reactions has DeltaS > 0?**

A) Freezing of water
B) Condensation of steam
C) Evaporation of water
D) Formation of solid from liquid

**Q27: For an ideal gas, internal energy depends on:**

A) Volume only
B) Pressure only
C) Temperature only
D) Pressure and volume

**Q28: Which law of thermodynamics defines temperature?**

A) First law
B) Second law
C) Third law
D) Zeroth law

**Q29: For an isobaric process, heat exchanged is equal to:**

A) DeltaU
B) DeltaG
C) DeltaH
D) DeltaS

**Q30: If DeltaH = -20 kJ and DeltaS = -50 J K-1, reaction is spontaneous at:**

A) All temperatures
B) High temperature
C) Low temperature
D) Never spontaneous

**Q31: Which process increases entropy of universe?**

A) Reversible process
B) Irreversible process
C) Isothermal process
D) Adiabatic process

**Q32: Which condition gives maximum work?**

A) Irreversible process
B) Free expansion
C) Reversible process
D) Adiabatic process

**Q33: Which quantity is path dependent?**

A) Entropy
B) Enthalpy
C) Work
D) Internal energy

**Q34: The SI unit of work is:**

A) Calorie
B) Joule
C) Erg
D) Newton

**Q35: Which reaction is endothermic?**

A) Combustion of methane
B) Neutralisation reaction
C) Photosynthesis
D) Freezing of water

**Q36: Which process has DeltaH = 0 for ideal gas?**

A) Isothermal
B) Isochoric
C) Adiabatic
D) Isobaric

**Q37: If DeltaG is positive, the reaction is:**

A) Spontaneous
B) Non-spontaneous
C) At equilibrium
D) Fast

**Q38: Which term measures useful work obtainable from a system?**

A) Internal energy
B) Enthalpy
C) Entropy
D) Gibbs free energy

**Q39: For a cyclic process, change in internal energy is:**

A) Positive
B) Negative
C) Zero
D) Maximum

**Q40: Which thermodynamic quantity predicts feasibility of a reaction?**

A) DeltaH
B) DeltaS
C) DeltaG
D) DeltaU

**Q41: Calculate work done when 1 mol of an ideal gas expands reversibly and isothermally at 300 K from 10 L to 20 L. (R = 8.314 J mol-1 K-1)**

A) 1728 J
B) 2494 J
C) 3456 J
D) -1728 J

**Q42: For an isothermal expansion of an ideal gas, which quantity remains constant?**

A) Pressure
B) Volume
C) Temperature
D) Internal energy

**Q43: For an ideal gas undergoing isothermal expansion, DeltaU is:**

A) Positive
B) Negative
C) Zero
D) Maximum

**Q44: Calculate heat absorbed when 2 mol of an ideal gas expands isothermally from 5 L to 20 L at 300 K.**

A) 6912 J
B) -6912 J
C) 3456 J
D) 0

**Q45: For an adiabatic process, which of the following is true?**

A) DeltaT = 0
B) q = 0
C) w = 0
D) DeltaU = 0

**Q46: Which process gives maximum work?**

A) Free expansion
B) Irreversible process
C) Reversible process
D) Isochoric process

**Q47: For an isochoric process, work done is:**

A) Positive
B) Negative
C) Zero
D) Maximum

**Q48: If heat absorbed by a system is 500 J and work done by system is 200 J, calculate DeltaU.**

A) 300 J
B) 700 J
C) -300 J
D) -700 J

**Q49: For an exothermic reaction, which statement is correct?**

A) DeltaH > 0
B) DeltaH < 0
C) DeltaG > 0
D) DeltaS < 0 always

**Q50: If DeltaH = -100 kJ and DeltaS = +200 J K-1, reaction is spontaneous at:**

A) Low temperature
B) High temperature
C) All temperatures
D) No temperature

**Q51: Which condition makes a reaction non-spontaneous at all temperatures?**

A) DeltaH > 0 and DeltaS < 0
B) DeltaH < 0 and DeltaS > 0
C) DeltaH < 0 and DeltaS < 0
D) DeltaH > 0 and DeltaS > 0

**Q52: Calculate DeltaG at 298 K if DeltaH = -40 kJ and DeltaS = -100 J K-1.**

A) -10.2 kJ
B) -40 kJ
C) +10.2 kJ
D) +40 kJ

**Q53: Which quantity decides maximum non-PV work?**

A) DeltaU
B) DeltaH
C) DeltaS
D) DeltaG

**Q54: At equilibrium, which thermodynamic quantity is minimum?**

A) DeltaH
B) DeltaU
C) DeltaG
D) DeltaS

**Q55: Entropy change for melting of ice at 0 degC is:**

A) Positive
B) Negative
C) Zero
D) Infinite

**Q56: Calculate entropy change when 200 J of heat is absorbed reversibly at 400 K.**

A) 0.5 J K-1
B) 2 J K-1
C) 800 J K-1
D) 0.05 J K-1

**Q57: Which of the following increases entropy?**

A) Crystallisation
B) Condensation
C) Sublimation
D) Freezing

**Q58: Which process has DeltaS = 0?**

A) Isothermal reversible expansion
B) Cyclic process
C) Free expansion
D) Irreversible process

**Q59: Entropy change of universe for spontaneous process is:**

A) Zero
B) Negative
C) Positive
D) Constant

**Q60: Which law states entropy of universe always increases?**

A) Zeroth law
B) First law
C) Second law
D) Third law

**Q61: For an ideal gas, DeltaH depends on:**

A) Pressure
B) Volume
C) Temperature
D) Path

**Q62: Which of the following is an extensive property?**

A) Temperature
B) Pressure
C) Entropy
D) Density

**Q63: Which quantity remains unchanged in an isolated system?**

A) Entropy
B) Energy
C) Volume
D) Pressure

**Q64: Which thermodynamic function predicts equilibrium?**

A) DeltaH
B) DeltaU
C) DeltaG
D) DeltaS

**Q65: Which process is irreversible?**

A) Isothermal reversible expansion
B) Free expansion of gas
C) Slow compression
D) Phase equilibrium

**Q66: Which quantity is always positive for spontaneous process?**

A) DeltaS_system
B) DeltaS_surroundings
C) DeltaS_universe
D) DeltaH

**Q67: At absolute zero, entropy of a perfect crystal is:**

A) Zero
B) Maximum
C) Infinite
D) Negative

**Q68: Which reaction is endothermic?**

A) Combustion
B) Neutralisation
C) Photosynthesis
D) Freezing

**Q69: For a spontaneous reaction at equilibrium, DeltaG is:**

A) Negative
B) Positive
C) Zero
D) Maximum

**Q70: Which quantity determines feasibility of reaction?**

A) DeltaH
B) DeltaU
C) DeltaG
D) DeltaS

**Q71: Which process has DeltaU = 0?**

A) Isothermal ideal gas process
B) Adiabatic expansion
C) Isochoric heating
D) Isobaric cooling

**Q72: Which law is the basis of temperature measurement?**

A) First law
B) Second law
C) Third law
D) Zeroth law

**Q73: Which function is minimum at equilibrium under constant T and P?**

A) U
B) H
C) G
D) S

**Q74: Which change increases entropy most?**

A) Solid -> Liquid
B) Liquid -> Gas
C) Gas -> Liquid
D) Liquid -> Solid

**Q75: Which quantity has unit J K-1?**

A) Enthalpy
B) Entropy
C) Gibbs energy
D) Work

**Q76: For an irreversible process, work done is:**

A) Maximum
B) Minimum
C) Zero
D) Independent of path

**Q77: Which quantity is path independent?**

A) Heat
B) Work
C) Entropy
D) All of these

**Q78: Which reaction has DeltaS < 0?**

A) Evaporation
B) Fusion
C) Condensation
D) Sublimation

**Q79: For a reversible process, entropy change of universe is:**

A) Positive
B) Negative
C) Zero
D) Maximum

**Q80: Which thermodynamic quantity is conserved in isolated system?**

A) Entropy
B) Energy
C) Volume
D) Temperature

**Q81: Calculate work done when 2 mol of an ideal gas expands reversibly and isothermally at 300 K from 2 L to 8 L. (R = 8.314 J mol-1 K-1)**

A) 3456 J
B) 6912 J
C) 13824 J
D) -6912 J

**Q82: For an ideal gas, calculate DeltaU when temperature rises from 300 K to 400 K for 1 mol. (Cv = 12.5 J mol-1 K-1)**

A) 1250 J
B) 1000 J
C) 2500 J
D) 500 J

**Q83: Calculate DeltaH for 2 mol of an ideal gas when temperature increases by 50 K. (Cp = 20.8 J mol-1 K-1)**

A) 1040 J
B) 2080 J
C) 4160 J
D) 520 J

**Q84: For a process, q = +500 J and DeltaU = +200 J. Calculate work done by the system.**

A) +300 J
B) -300 J
C) +700 J
D) -700 J

**Q85: Calculate entropy change when 1000 J of heat is absorbed reversibly at 500 K.**

A) 0.5 J K-1
B) 2 J K-1
C) 5 J K-1
D) 10 J K-1

**Q86: For an isothermal reversible expansion of 1 mol ideal gas at 300 K, calculate work when volume doubles.**

A) 1728 J
B) 2494 J
C) 3456 J
D) -1728 J

**Q87: If DeltaH = -60 kJ and DeltaS = -150 J K-1, calculate DeltaG at 300 K.**

A) -15 kJ
B) +15 kJ
C) -105 kJ
D) +105 kJ

**Q88: At what temperature will a reaction become spontaneous if DeltaH = +40 kJ and DeltaS = +100 J K-1?**

A) 200 K
B) 300 K
C) 400 K
D) 500 K

**Q89: Calculate DeltaS for melting of ice at 273 K if DeltaH_fus = 6.0 kJ mol-1.**

A) 22 J K-1 mol-1
B) 44 J K-1 mol-1
C) 11 J K-1 mol-1
D) 6 J K-1 mol-1

**Q90: For an adiabatic expansion of an ideal gas, which statement is correct?**

A) DeltaT = 0
B) q = 0
C) DeltaU = 0
D) w = 0

**Q91: Calculate work done in an irreversible expansion against constant external pressure of 1 atm when volume increases by 10 L.**

A) 1013 J
B) 2026 J
C) -1013 J
D) -2026 J

**Q92: For a cyclic process, which thermodynamic quantity is zero?**

A) DeltaH
B) DeltaS
C) DeltaU
D) q

**Q93: Calculate DeltaG if DeltaH = -120 kJ and DeltaS = +200 J K-1 at 400 K.**

A) -200 kJ
B) -40 kJ
C) +40 kJ
D) +200 kJ

**Q94: Which condition gives maximum PV work from a gas?**

A) Adiabatic irreversible
B) Isothermal irreversible
C) Isothermal reversible
D) Isochoric

**Q95: For an ideal gas, relation between Cp and Cv is:**

A) Cp = Cv
B) Cp > Cv
C) Cp < Cv
D) Cp = 2Cv

**Q96: Calculate DeltaU for isothermal expansion of ideal gas.**

A) Positive
B) Negative
C) Zero
D) Depends on path

**Q97: Entropy change of universe for a reversible process is:**

A) Positive
B) Negative
C) Zero
D) Maximum

**Q98: Calculate entropy change when 500 J of heat is rejected reversibly at 250 K.**

A) -2 J K-1
B) -1 J K-1
C) +2 J K-1
D) +1 J K-1

**Q99: Which thermodynamic function is minimum at equilibrium (constant T, P)?**

A) U
B) H
C) G
D) S

**Q100: For a reaction, DeltaG = -RT ln K. If K = 1, DeltaG is:**

A) Negative
B) Positive
C) Zero
D) Maximum

**Q101: Calculate DeltaG at 298 K if K = 10. (R = 8.314 J mol-1 K-1)**

A) -5.7 kJ
B) +5.7 kJ
C) -57 kJ
D) +57 kJ

**Q102: Which process increases entropy the most?**

A) Solid -> liquid
B) Liquid -> gas
C) Gas -> liquid
D) Liquid -> solid

**Q103: For an isolated system, which quantity remains constant?**

A) Entropy
B) Energy
C) Temperature
D) Pressure

**Q104: Which reaction is spontaneous at low temperature only?**

A) DeltaH < 0, DeltaS > 0
B) DeltaH < 0, DeltaS < 0
C) DeltaH > 0, DeltaS > 0
D) DeltaH > 0, DeltaS < 0

**Q105: Which thermodynamic quantity predicts feasibility of reaction?**

A) DeltaH
B) DeltaS
C) DeltaG
D) DeltaU

**Q106: Calculate work done in free expansion of an ideal gas.**

A) Positive
B) Negative
C) Zero
D) Maximum

**Q107: Which quantity is path dependent?**

A) DeltaU
B) DeltaH
C) DeltaG
D) Work

**Q108: Which thermodynamic law gives absolute entropy?**

A) Zeroth law
B) First law
C) Second law
D) Third law

**Q109: For a reversible isothermal expansion, heat absorbed is equal to:**

A) DeltaU
B) DeltaH
C) Work done
D) Zero

**Q110: Which condition makes DeltaG most negative?**

A) Low T, high DeltaS
B) High T, high DeltaS
C) Low T, low DeltaS
D) High T, low DeltaS

**Q111: Calculate DeltaS when 1 mol of ideal gas expands isothermally from V to 2V at 300 K.**

A) 5.76 J K-1
B) 2.88 J K-1
C) 8.31 J K-1
D) 0

**Q112: Which thermodynamic function is always positive for spontaneous process?**

A) DeltaS_system
B) DeltaS_surroundings
C) DeltaS_universe
D) DeltaG

**Q113: Which process has maximum entropy?**

A) Solid
B) Liquid
C) Gas
D) Plasma

**Q114: At equilibrium under constant T and P, which quantity is zero?**

A) DeltaH
B) DeltaS
C) DeltaG
D) DeltaU

**Q115: Which thermodynamic quantity measures disorder?**

A) Enthalpy
B) Entropy
C) Internal energy
D) Work

**Q116: Which process gives zero work?**

A) Isothermal expansion
B) Adiabatic expansion
C) Isochoric process
D) Reversible expansion

**Q117: Which quantity is conserved in cyclic process?**

A) Entropy
B) Energy
C) Work
D) Heat

**Q118: Which reaction is spontaneous at all temperatures?**

A) DeltaH < 0, DeltaS > 0
B) DeltaH > 0, DeltaS > 0
C) DeltaH < 0, DeltaS < 0
D) DeltaH > 0, DeltaS < 0

**Q119: Which thermodynamic quantity depends only on temperature for ideal gas?**

A) Work
B) Internal energy
C) Entropy
D) Volume

**Q120: Which condition gives maximum efficiency of heat engine?**

A) Irreversible cycle
B) Reversible cycle
C) Adiabatic cycle
D) Isochoric cycle

**Q121: Calculate DeltaU for 2 mol of an ideal gas when temperature decreases from 400 K to 300 K. (Cv = 12.5 J mol-1 K-1)**

A) -2500 J
B) -1250 J
C) +1250 J
D) +2500 J

**Q122: For an ideal gas undergoing cyclic process, which quantity is non-zero?**

A) DeltaU
B) DeltaH
C) Net work
D) DeltaS

**Q123: Calculate entropy change when 1 mol of ideal gas expands reversibly and isothermally from 10 L to 40 L.**

A) 11.53 J K-1
B) 5.76 J K-1
C) 2.88 J K-1
D) 8.31 J K-1

**Q124: Which process gives maximum entropy production?**

A) Reversible
B) Isothermal
C) Irreversible
D) Adiabatic reversible

**Q125: If DeltaG is negative and DeltaS is negative, reaction is spontaneous at:**

A) All temperatures
B) High temperature
C) Low temperature
D) No temperature

**Q126: Calculate work done when gas expands irreversibly against constant pressure of 2 atm with DeltaV = 5 L.**

A) -1013 J
B) -2026 J
C) -5065 J
D) -10130 J

**Q127: Which thermodynamic quantity decides spontaneity under constant T and V?**

A) DeltaH
B) DeltaU
C) DeltaG

D) DeltaS

**Q128: For a reaction, DeltaH = +30 kJ and DeltaS = -100 J K-1. Reaction is:**

A) Spontaneous always
B) Spontaneous at high T
C) Spontaneous at low T
D) Never spontaneous

**Q129: Calculate DeltaG at 300 K if DeltaH = -90 kJ and DeltaS = -200 J K-1.**

A) -30 kJ
B) +30 kJ
C) -150 kJ
D) +150 kJ

**Q130: Which thermodynamic quantity is minimized in isolated system?**

A) U
B) H
C) G
D) S

**Q131: Calculate entropy change of surroundings if system absorbs 1000 J heat at 250 K.**

A) -4 J K-1
B) +4 J K-1
C) -250 J K-1
D) +250 J K-1

**Q132: Which statement is correct for Gibbs free energy?**

A) Depends on path
B) State function
C) Always positive
D) Always zero

**Q133: Which process has DeltaS_system = 0 but DeltaS_universe > 0?**

A) Reversible isothermal
B) Irreversible adiabatic
C) Reversible adiabatic
D) Cyclic reversible

**Q134: Which quantity is always conserved according to first law?**

A) Heat
B) Work
C) Energy
D) Entropy

**Q135: For an ideal gas, which quantity depends only on temperature?**

A) Pressure
B) Volume
C) Internal energy
D) Entropy

**Q136: Calculate DeltaS for vaporisation of water at 373 K if DeltaH_vap = 40.7 kJ mol-1.**

A) 109 J K-1 mol-1
B) 218 J K-1 mol-1
C) 54.5 J K-1 mol-1
D) 40.7 J K-1 mol-1

**Q137: Which condition gives minimum work output?**

A) Reversible expansion
B) Irreversible expansion
C) Isothermal reversible
D) Adiabatic reversible

**Q138: For a reaction, DeltaG = +5 kJ. Reaction can be made spontaneous by:**

A) Lowering temperature
B) Increasing temperature
C) Adding catalyst
D) Changing pressure

**Q139: Which thermodynamic quantity is zero for reversible cyclic process?**

A) DeltaS_system
B) DeltaS_universe
C) DeltaU
D) All of these

**Q140: Which process is impossible according to second law?**

A) Heat flowing hot to cold
B) 100% conversion of heat to work
C) Reversible cycle
D) Entropy increase

**Q141: Which thermodynamic function is used to predict chemical equilibrium?**

A) DeltaH
B) DeltaU
C) DeltaG
D) DeltaS

**Q142: Which reaction has DeltaS = 0 approximately?**

A) 2H2 + O2 -> 2H2O(l)
B) N2(g) -> N2(g)
C) Ice -> Water
D) Gas expansion

**Q143: Which quantity is intensive?**

A) Entropy
B) Enthalpy
C) Gibbs energy
D) Temperature

**Q144: For a spontaneous process, which inequality holds?**

A) DeltaG > 0
B) DeltaS_universe < 0
C) DeltaS_universe > 0
D) DeltaH > 0

**Q145: Which law introduces absolute entropy scale?**

A) Zeroth
B) First
C) Second
D) Third

**Q146: Calculate DeltaG at 298 K if K = 0.01.**

A) +11.4 kJ
B) -11.4 kJ
C) +5.7 kJ
D) -5.7 kJ

**Q147: Which process results in decrease of entropy of system?**

A) Evaporation
B) Melting
C) Condensation
D) Sublimation

**Q148: Which quantity decides maximum electrical work?**

A) DeltaU
B) DeltaH
C) DeltaS
D) DeltaG

**Q149: Which statement is correct for an isolated system?**

A) DeltaU != 0 always
B) DeltaS decreases
C) Energy remains constant
D) Entropy always zero

**Q150: Which thermodynamic quantity cannot be measured absolutely?**

A) Entropy
B) Enthalpy
C) Internal energy
D) Gibbs energy

**Q151: For a reaction, DeltaH = -50 kJ and DeltaS = +100 J K-1. Calculate DeltaG at 500 K.**

A) -100 kJ
B) 0 kJ
C) +100 kJ
D) -50 kJ

**Q152: Which quantity determines spontaneity under constant T and P?**

A) DeltaU
B) DeltaH
C) DeltaS
D) DeltaG

**Q153: Which thermodynamic quantity is path independent?**

A) Work
B) Heat
C) Entropy
D) Both B and C

**Q154: Which reaction is spontaneous at all temperatures?**

A) DeltaH < 0, DeltaS > 0
B) DeltaH > 0, DeltaS > 0
C) DeltaH < 0, DeltaS < 0
D) DeltaH > 0, DeltaS < 0

**Q155: Which thermodynamic law forbids perpetual motion machine of first kind?**

A) Zeroth law
B) First law
C) Second law
D) Third law

**Q156: Which thermodynamic law forbids perpetual motion machine of second kind?**

A) Zeroth law
B) First law
C) Second law
D) Third law

**Q157: Which quantity measures energy available to do useful work?**

A) Internal energy
B) Enthalpy
C) Entropy
D) Gibbs free energy

**Q158: Which process has maximum efficiency?**

A) Irreversible cycle
B) Reversible cycle
C) Adiabatic cycle
D) Isochoric cycle

**Q159: Which quantity is zero at equilibrium?**

A) DeltaH
B) DeltaS
C) DeltaU
D) DeltaG

**Q160: Which thermodynamic quantity predicts direction of reaction?**

A) DeltaH
B) DeltaU
C) DeltaS
D) DeltaG