1. Hydrazine, H2NNH2, is used as a rocket fuel. For liquid hydrazine at 25°C, ΔH°f = 50.63 kJ.mol and S° is 121.2 J/K.mol. Can hydrazine be prepared from the reaction?

N2(g) + 2H2(g) ----> H2NNH2(l)

At 25°C, S° for N2(g) = 0.192 J/K.mol and S° for H2(g) = 130.68 J/K.mol.

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2. Use the data that is provided below to calculate the standard free-energy change for the thermal decomposition of calcium carbonate at 25°C. Is the reaction spontaneous under these conditions? Explain your answer.

CaCo3(s) ----> CaO(s) + CO2(g)

ΔH°f(kJ/mol)	-1206.9	-635.1	-393.5
S°(J/K.mol)	92.9	39.7	213.6

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3. Calculate the free energy change, ΔG, for the formation of ethylene (C2H4) from carbon and hydrogen at 25°C when the partial pressures are 10 atm H2 and 2.0 atm C2H4, then tell whether the reaction is spontaneous in the forward direction or not.

2C(s) + 2H2(g) ----> C2H4(g), ΔG° = 68.1 kJ

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4. Consider the following anaerobic fermentation reaction of glucose:

C6H12O6(aq) ----> 3CH4(g) + 3CO2(g), ΔG° = -418 kJ.

If ΔG° for CH4 is -50.8 kJ/mol and -394.2 kJ/mol for CO2, what is ΔG° for C6H12O6?

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5. Calculate ΔG°f and Kp for NH3 at 25°C given that for ΔG° for the reaction is -31.0 kJ:

N2(g) + 3H2(g) <----> 2NH3(g)