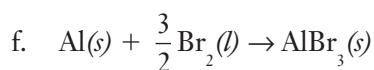
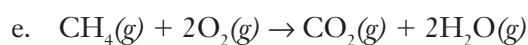
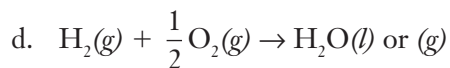
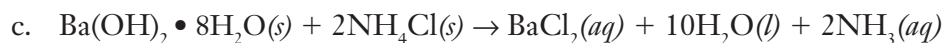
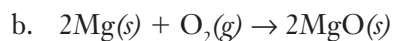
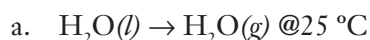


ENTHALPY AND THE FIRST LAW

NAME _____

SECTION _____

1. Energy in the form of heat can be either released (exothermic) or absorbed (endothermic) in a chemical reaction. This heat, called the enthalpy, is a driving force for chemical reactions. Predict which of the following spontaneous reactions are exothermic and which are endothermic.



2. A formation reaction is a chemical reaction depicting the formation of one mole of a substance from its naturally occurring elemental sources. Which of the reactions in question 1 are formation reactions?

Thermodynamic Values (25 °C)

Substance and State	ΔH_f^0 ($\frac{\text{kJ}}{\text{mol}}$)	ΔG_f^0 ($\frac{\text{kJ}}{\text{mol}}$)	S^0 ($\frac{\text{J}}{\text{K}\cdot\text{mol}}$)	Substance and State	ΔH_f^0 ($\frac{\text{kJ}}{\text{mol}}$)	ΔG_f^0 ($\frac{\text{kJ}}{\text{mol}}$)	S^0 ($\frac{\text{J}}{\text{K}\cdot\text{mol}}$)
Aluminum				Iodine			
AlBr ₃ (g)	-526.3	-505	184	I ₂ (s)	0	0	116.7
Al(s)	0	0	28.32	I ₂ (g)	62.25	19.37	260.57
				HI(g)	25.94	1.30	206.3
Barium				Magnesium			
BaCl ₂ (aq)	-872	-823	123	Mg(s)	0	0	33
Ba(OH) ₂ ·8H ₂ O(s)	-3342	-2793	427	Mg ²⁺ (aq)	-492	-456	-118
				MgO(s)	-601	-569	26.9
Bromine				Oxygen			
Br ₂ (l)	0	0	152.231	O ₂ (g)	0	0	205
BrCl(g)	14.64	-0.96	239.99	O(g)	249	232	161
				O ₃ (g)	143	163	239
Carbon				Nitrogen			
C(s) (graphite)	0	0	6	N ₂ (g)	0	0	192
C(s) (diamond)	2	3	2	NCl ₃ (g)	230	271	-137
CO(g)	-110.5	-137	198	NF ₃ (g)	-125	-83.6	-139
CO ₂ (g)	-393.5	-394	214	NH ₃ (g)	-46	-17	193
CH ₄ (g)	-75	-51	186	NH ₃ (aq)	-80	-27	111
CH ₃ OH(g)	-201	-163	240	NH ₂ CONH ₂ (aq)	?	?	174
CH ₃ OH(l)	-239	-166	127	NO(g)	90	87	211
H ₂ CO(g)	-116	-110	219	NO ₂ (g)	34	52	240
HCOOH(g)	-363	-351	249	N ₂ O(g)	82	104	220
HCN(g)	135.1	125	202	N ₂ O ₄ (g)	10	98	304
C ₂ H ₂ (g)	227	209	201	N ₂ O ₅ (g)	-42	134	178
C ₂ H ₄ (g)	52	68	219	N ₂ H ₃ CH ₃ (l)	54	180	166
CH ₃ CHO(g)	-166	-129	250	HNO ₃ (aq)	-207	-111	146
C ₂ H ₅ OH(l)	-278	-175	161	HNO ₃ (l)	-174	-81	156
C ₂ H ₆ (g)	-84.7	-32.9	229.5	NH ₄ Cl(s)	-314	-201	95
C ₃ H ₆ (g)	20.9	62.7	266.9	NH ₄ ClO ₄ (s)	-295	-89	186
C ₃ H ₈ (g)	-104	-24	270				
Chlorine				Silver			
Cl ₂ (g)	0	0	222.957	Ag(s)	0	0	42.6
Cl ₂ (aq)	-23	7	121	Ag ⁺ (aq)	105.6	77.1	72.7
Cl ⁻ (aq)	-167	-131	57	AgBr(s)	-100.4	-96.9	107.1
HCl(g)	-92	-95	187	AgCl ₃ (s)	-127.1	-109.8	96.2
Fluorine				Sulfur			
F ₂ (g)	0	0	203	S(rhombic)	0	0	31.8
F ⁻ (aq)	-333	-279	-14	S(monocl)	0.3	0.1	32.6
HF(g)	-271	-273	174	SO ₂ (g)	-296.8	-300.2	248.8
				SO ₃ (g)	-395.7	-371.1	256.3
Hydrogen				Titanium			
H ₂ (g)	0	0	131	H ₂ S(g)	-20.17	-33.0	205.6
H(g)	217	203	115				
H ⁺ (aq)	0	0	0				
OH ⁻ (aq)	-230	-157	-11	TiCl ₄ (g)	-763	-727	355
H ₂ O(l)	-286	-237	70	TiO ₂ (s)	-945	-890	50
H ₂ O(g)	-242	-229	189				

