

Chapter 12 Worksheet Enthalpy of Reaction

- $2 \text{NH}_3(\text{g}) + 3 \text{O}_2(\text{g}) + 2 \text{CH}_4(\text{g}) \rightarrow 2 \text{HCN}(\text{g}) + 6 \text{H}_2\text{O}(\text{g})$
- $\text{Ca}_3(\text{PO}_4)_2(\text{s}) + 3 \text{H}_2\text{SO}_4(\text{l}) \rightarrow 3 \text{CaSO}_4(\text{s}) + 2 \text{H}_3\text{PO}_4(\text{l})$
- $\text{NH}_3(\text{g}) + \text{HCl}(\text{g}) \rightarrow \text{NH}_4\text{Cl}(\text{s})$
- $\text{C}_2\text{H}_5\text{OH}(\text{l}) + 3 \text{O}_2(\text{g}) \rightarrow 2 \text{CO}_2(\text{g}) + 3 \text{H}_2\text{O}(\text{g})$
- $\text{SiCl}_4(\text{l}) + 2 \text{H}_2\text{O}(\text{l}) \rightarrow \text{SiO}_2(\text{s}) + 4 \text{HCl}(\text{aq})$
- $\text{MgO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Mg}(\text{OH})_2(\text{s})$
- $4 \text{NH}_3(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 4 \text{NO}(\text{g}) + 6 \text{H}_2\text{O}(\text{g})$
- $2 \text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{NO}_2(\text{g})$
- $3 \text{NO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow 2 \text{HNO}_3(\text{aq}) + \text{NO}(\text{g})$
- $3 \text{Al}(\text{s}) + 3 \text{NH}_4\text{ClO}_4(\text{s}) \rightarrow \text{Al}_2\text{O}_3(\text{s}) + \text{AlCl}_3(\text{s}) + 3 \text{NO}(\text{g}) + 6 \text{H}_2\text{O}(\text{g})$
- $4 \text{Na}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2 \text{Na}_2\text{O}(\text{s})$
- $2 \text{Na}(\text{s}) + 2 \text{H}_2\text{O}(\text{l}) \rightarrow 2 \text{NaOH}(\text{aq}) + \text{H}_2(\text{g})$
- $2 \text{Na}(\text{s}) + \text{CO}_2(\text{g}) \rightarrow \text{Na}_2\text{O}(\text{s}) + \text{CO}(\text{g})$
- $5 \text{N}_2\text{O}_4(\text{l}) + 4 \text{N}_2\text{H}_3\text{CH}_3(\text{l}) \rightarrow 12 \text{H}_2\text{O}(\text{g}) + 9 \text{N}_2(\text{g}) + 4 \text{CO}_2(\text{g})$

Compound	ΔH_f° (KJ/mol)
Al(s)	0
Al ₂ O ₃ (s)	-1676
AlCl ₃ (s)	-704
C ₂ H ₅ OH(l)	-278
Ca ₃ (PO ₄) ₂ (s)	-4126
CaSO ₄ (s)	-1433
CH ₄ (g)	-75
CO(g)	-110.5
CO ₂ (g)	-393.5
H ₂ (g)	0
H ₂ O(g)	-242
H ₂ O(l)	-286
H ₂ SO ₄ (l)	-814
H ₃ PO ₄ (l)	-1267
HCl(aq)	-92
HCl(g)	-92

HCN(g)	135.1
HNO ₃ (aq)	-207
Mg(OH) ₂ (s)	-925
MgO(s)	-602
N ₂ H ₃ CH ₃ (l)	54
N ₂ O ₄ (l)	10
Na(s)	0
Na ₂ O(s)	-416
NaOH(aq)	-470
NH ₃ (g)	-46
NH ₄ Cl(s)	-314
NH ₄ ClO ₄ (s)	-295
NO(g)	90
NO ₂ (g)	34
O ₂ (g)	0
SiCl ₄ (l)	-687
SiO ₂ (s)	-911

1	2NH3(g)	+	3O2(g)	+	2CH4(g)	-->	2HCN(g)	+	6H2O(g)
1			-46		0		-75		135.1
1			-92		0		-150		270.2
1			-242						-1181.8
1						$\Delta H =$	-939.8		
1							exothermic		
2	1Ca3(PO4)2(s)	+	3H2SO4(l)			-->	3CaSO4(s)		2H3PO4(l)
2			-4126		-814		-1433		-1267
2			-4126		-2442		-4299		-2534
2			-6568						-6833
2						$\Delta H =$	-265		
2							exothermic		
3	1NH3(g)	+	1HCl(g)			-->	1NH4Cl(s)		
3			-46		-92		-314		
3			-46		-92		-314		
3			-138						-314
3						$\Delta H =$	-176		
3							exothermic		
4	1C2H5OH(l)	+	3O2(g)			-->	2CO2(g)	+	3H2O(g)
4			-278		0		-393.5		-242
4			-278		0		-787		-726
4			-278						-1513
4						$\Delta H =$	-1235		
4							exothermic		
5	1SiCl4(l)	+	2H2O(l)			-->	1SiO2(s)	+	4HCl(aq)
5			-687		-286		-911		-92
5			-687		-572		-911		-368
5			-1259						-1279
5						$\Delta H =$	-20		
5							exothermic		
6	1MgO(s)	+	1H2O(l)			-->	1Mg(OH)2(s)		
6			-602		-286		-925		
6			-602		-286		-925		
6			-888						-925
6						$\Delta H =$	-37		
6							exothermic		
7	4NH3(g)	+	5O2(g)			-->	4NO(g)	+	6H2O(g)
7			-46		0		90		-242
7			-184		0		360		-1452
7			-184						-1092
7						$\Delta H =$	-908		
7							exothermic		
8	2NO(g)	+	1O2(g)			-->	2NO2(g)		
8			90		0		34		
8			180		0		68		
8			180						68
8						$\Delta H =$	-112		
8							exothermic		
9	3NO2(g)	+	1H2O(l)			-->	2HNO3(aq)	+	1NO(g)
9			34		-286		-207		90
9			102		-286		-414		90
9			-184						-324
9						$\Delta H =$	-140		

9					exothermic			
10	3Al(s)	+	3NH ₄ ClO ₄ (s)	-->	1Al ₂ O ₃ (s)	+	1AlCl ₃ (s)	+ 3H ₂ O(l)
10			0				-1676	-704
10			0				-1676	-704
10			-885					-3562
10					$\Delta H =$		-2677	
10					exothermic			
11	4Na(s)	+	1O ₂ (g)	-->	2Na ₂ O(s)			
11			0				0	-416
11			0				0	-832
11			0					-832
11					$\Delta H =$		-832	
11					exothermic			
12	2Na(s)	+	2H ₂ O(l)	-->	2NaOH(aq)	+	1H ₂ (g)	
12			0				-286	-470
12			0				-572	-940
12			-572					-940
12					$\Delta H =$		-368	
12					exothermic			
13	2Na(s)	+	1CO ₂ (g)	-->	1Na ₂ O(s)	+	1CO(g)	
13			0				-393.5	-416
13			0				-393.5	-416
13			-393.5					-526.5
13					$\Delta H =$		-133	
13					exothermic			
14	5N ₂ O ₄ (l)	+	4N ₂ H ₃ CH ₃ (l)	-->	12H ₂ O(g)	+	9N ₂ (g)	+ 4CO ₂ (g)
14			10				54	-242
14			50				216	-2904
14			266					-4478
14					$\Delta H =$		-4744	
14					exothermic			