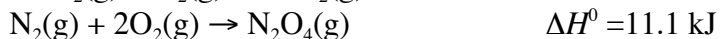
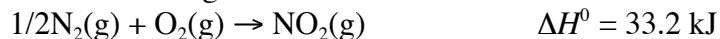


26. Given the following at 25°C and 1.00 atm:



Calculate the ΔH° for the following reaction at 25°C: $2\text{NO}_2(\text{g}) \rightarrow \text{N}_2\text{O}_4(\text{g})$

- a) -55.3 kJ b) -22.1 kJ c) +11.0 kJ d) +55.3 kJ e) +44.3 kJ

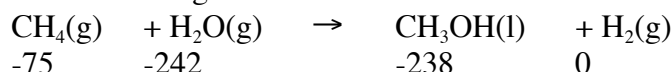
27. If 4.20 kJ of heat is added to a calorimeter containing 75.00 mL of water, the temperature of the water and the calorimeter increases from 24.6°C to 35.8°C. In the same calorimeter, a 50.0 mL solution of 1.2 M HCl at 24.1°C is mixed with 50.0 mL of 1.2 M NaOH, also at 24.1°C. After the reaction occurs, the temperature of the resulting mixture is 29.8°C. Calculate the molar heat of neutralization. Assume the specific heat of the solution is the same as pure water, 4.184 J/g•°C.

- a) -33.9 kJ/mol c) -41.7 kJ/mol e) -45.6 kJ/mol
b) -13.0 kJ/mol d) -58.5 kJ/mol

28. Which of the following is not a **formation** reaction?

- a) $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$ d) $4\text{Al}(\text{s}) + 3\text{O}_2(\text{g}) \rightarrow \text{Al}_2\text{O}_3(\text{s})$
b) $\frac{1}{2}\text{H}_2(\text{g}) + \frac{1}{2}\text{Br}_2(\text{l}) \rightarrow \text{HBr}(\text{g})$ e) $\text{Ca}(\text{s}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{CaO}(\text{s})$
c) $\text{H}_2\text{O}(\text{l}) + \text{SO}_3(\text{l}) \rightarrow \text{H}_2\text{SO}_4(\text{l})$

29. Given the standard heats of formation for the following compounds (listed below each compound in kJ/mol), calculate ΔH for the following reaction.



- a) +555 kJ/mol b) -79 kJ/mol c) +79 kJ/mol d) -555 kJ/mol e) -405 kJ/mol

30. For the following reaction at 25°C, $\Delta H^\circ = -26.88 \text{ kJ/mol}$ and $\Delta S^\circ = 11.2 \text{ J/mol-K}$. Calculate ΔG° for the reaction: $\text{I}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{ICl}(\text{g})$ at 25°C in kJ/mol.

- a) +77.0 kJ/mol b) -102 kJ/mol c) +50.6 kJ/mol d) -30.2 kJ/mol

31. For the reaction $\text{SiH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{SiO}_2(\text{s}) + 2\text{H}_2\text{O}(\text{l})$, $\Delta H^\circ = -1516 \text{ kJ/mol}$ at 25°C and $\Delta S^\circ = -432.8 \text{ J/mol-K}$ at 25°C. This reaction is spontaneous _____.

- a) only above a certain temperature d) cannot tell from the info available
b) at no temperatures e) at all temperatures
c) only below a certain temperature

32. **Estimate** the temperature at which $\Delta G = 0$ for the reaction $\text{NH}_3(\text{g}) + \text{HCl}(\text{g}) \rightarrow \text{NH}_4\text{Cl}(\text{s})$, having a $\Delta H = -176 \text{ kJ/mol}$ and a $\Delta S = -284.5 \text{ J/mol-K}$.

- a) 619 K b) 634 K c) 467 K d) 582 K e) 680 K

33. Which one of the following reactions has a **positive** entropy change?

- a) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ d) $\text{BF}_3(\text{g}) + \text{NH}_3(\text{g}) \rightarrow \text{F}_3\text{BNH}_3(\text{s})$
b) $\text{H}_2\text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$ e) $2\text{NH}_4\text{NO}_3(\text{s}) \rightarrow 2\text{N}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g}) + \text{O}_2(\text{g})$
c) $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$

34. The decomposition of dinitrogen pentoxide obeys the rate-law expression $\text{Rate} = k[\text{N}_2\text{O}_5]$ where $k = 0.080 \text{ min}^{-1}$. If the initial concentration of N_2O_5 is 0.30 M, what is the concentration after 2.6 minutes? $\text{N}_2\text{O}_5 \rightarrow \text{N}_2\text{O}_3 + \text{O}_2$

- a) 0.38 M b) 0.028 M c) 0.32 M d) 0.13 M e) 0.24 M

35. Calculate the activation energy of a reaction if the rate constant is 0.75 s^{-1} at 25°C and 11.5 s^{-1} at 75°C .
 a) 681 J/mol b) 47.1 kJ/mol c) 15.8 kJ/mol d) 20.4 kJ/mol e) 31.4 kJ/mol
36. The gas phase reaction $\text{SO}_2\text{Cl}_2 \rightarrow \text{SO}_2 + \text{Cl}_2$ obeys the rate-law expression $\text{rate} = k[\text{SO}_2\text{Cl}_2]$. At 593 K the rate constant is $2.2 \times 10^{-5} \text{ s}^{-1}$. A 2.0-g sample of SO_2Cl_2 is introduced into a closed 4.0-L container. How much time must pass in order to reduce the amount of SO_2Cl_2 present to 1.8 grams?
 a) $3.5 \times 10^2 \text{ s}$ b) $2.1 \times 10^2 \text{ s}$ c) $7.4 \times 10^3 \text{ s}$ d) $4.8 \times 10^3 \text{ s}$ e) $5.8 \times 10^4 \text{ s}$
37. The gas-phase reaction $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$ has the following rate law expression, $\text{rate} = k[\text{NO}]^2[\text{H}_2]$. If the $[\text{NO}]$ is halved and the $[\text{H}_2]$ is tripled, what change in rate is expected?
 a) Change by factor 9/4 b) Change by factor 4/3 c) Change by factor 3/4 d) Change by factor 3/2
38. In the reaction $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ the rate of formation of NH_3 is $0.15 \text{ M}^{-1}\cdot\text{min}$. What is the rate of loss of H_2 ?
 a) $0.20 \text{ M}^{-1}\cdot\text{min}$ b) $0.15 \text{ M}^{-1}\cdot\text{min}$ c) $0.075 \text{ M}^{-1}\cdot\text{min}$ d) $0.225 \text{ M}^{-1}\cdot\text{min}$
39. Given the following data for the $\text{NH}_4^+ + \text{NO}_2^- \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$ reaction
- | Trial | $[\text{NH}_4^+]$ | $[\text{NO}_2^-]$ | Rate |
|-------|-------------------|-------------------|-----------|
| 1 | 0.010 M | 0.020 M | 0.020 M/s |
| 2 | 0.015 | 0.020 | 0.030 |
| 3 | 0.010 | 0.010 | 0.005 |
- The rate law for the reaction is:
 a) $\text{rate} = k[\text{NH}_4^+][\text{NO}_2^-]^2$ c) $\text{rate} = k[\text{NH}_4^+]^2[\text{NO}_2^-]$ e) None of the above
 b) $\text{rate} = k[\text{NH}_4^+]^2[\text{NO}_2^-]^2$ d) $\text{rate} = k[\text{NH}_4^+][\text{NO}_2^-]$
40. At 300 K the reaction $2\text{NOCl} \rightarrow 2\text{NO} + \text{Cl}_2$ obeys the rate law $\text{rate} = k[\text{NOCl}]^2$ where $k = 2.8 \times 10^{-5} \text{ M}^{-1}\cdot\text{s}^{-1}$. Suppose 1.0 mole of NOCl is introduced into a 2.0-liter container at 300 K. How much NOCl will remain after 1,800 seconds?
 a) 0.87 mol b) 0.97 mol c) 0.84 mol d) 0.77 mol e) 0.63 mol
41. Consider the hypothetical reaction $\text{A} + 2\text{B} \rightarrow \text{AB}_2$. Assume that the following proposed mechanism is consistent with the rate data.
- | | |
|--|------|
| $\text{B} + \text{B} \rightarrow \text{B}_2$ | slow |
| $\text{B}_2 + \text{A} \rightarrow \text{AB} + \text{B}$ | fast |
| $\text{B} + \text{AB} \rightarrow \text{AB}_2$ | fast |
-
- Which one of the following statements must be true? The reaction is _____.
- a) second order in A and second order overall
 b) first order in A, second order in B, and third order overall
 c) second order in B, zero order in A, and third order overall
 d) second order in B and second order overall
 e) first order in A and first order overall
42. In the hypothetical reaction of question #41,
 a) B_2 and AB are intermediates and A is a catalyst.
 b) B_2 is the only intermediate and A is a catalyst.
 c) B_2 and AB are intermediates and there is no catalyst.
 d) B_2 is the only intermediate and both A and AB are catalysts.
 e) B_2 is the only intermediate and there is no catalyst.
43. Which version of the quiz do you have?
 a) **Version A** b) Version B

KEY:

26)a 27)e 28)c 29)c 30)d 31)c 32)a 33)e 34)e 35)b 36)d 37)c 38)d 39)a 40)b 41)d 42)c 43)a