

CHM 152 Competencies

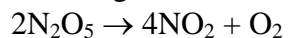
1. For a reaction in which A and B form C, $2A + B \rightarrow C$, the following data were obtained from three experiments.

<u>Experiment</u>	<u>Initial [A]</u>	<u>Initial [B]</u>	<u>Initial Rate</u>
1	.30 M	.20 M	1.5×10^{-3} M/s
2	.60 M	.20 M	3.0×10^{-3} M/s
3	.30 M	.40 M	3.0×10^{-3} M/s

a. Write the expression for the rate law for this reaction.

2. The reaction $A + 2B \rightarrow C$ has a rate law expression of $\text{Rate} = k[A]$. Determine the value of the rate constant, k , for this reaction if an initial $[A] = .25$ M and initial $[B] = .25$ M produces an initial rate of 2.5×10^{-3} M/s.

3. The following first-order reaction has a half-life of 8.95 sec at 30°C .

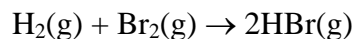


a. Determine the value for the rate constant, K .

b. Determine the time required for the concentration of N_2O_5 to decrease from 3.00 M to 1.56M.

4. For the reaction $2\text{N}_2\text{O}(\text{g}) \rightleftharpoons 2\text{N}_2(\text{g}) + \text{O}_2(\text{g})$, an equilibrium mixture at 450°C was found to contain .250 M O_2 , .333 M N_2 , and .684 M N_2O . Calculate the value for the equilibrium constant K_c for this reaction at 450°C .

5. The following equilibrium constant K_c for the reaction

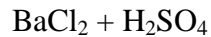
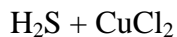


is 2.18×10^6 at 730°C . Starting with 3.20 moles of HBr in a 12.0 L reaction vessel, calculate the concentration of H_2 , Br_2 , and HBr at equilibrium.

6. Determine the pH of a solution having $[\text{H}^+] = 4.8 \times 10^{-3} \text{ M}$.

7. Determine the $[\text{H}^+]$ of a solution whose pH is 7.52.

8. Write a balanced net ionic equation for the reaction expected when aqueous solutions of each of the following are mixed. Indicate the form of the equilibrium constant in terms of other constants K_a , K_b , K_{sp} .

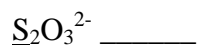


9. For the reaction $\text{C}_2\text{H}_4(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$

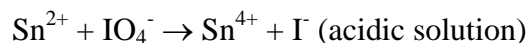
a. Calculate $\Delta G^\circ_{\text{rxn}}$ from the free energies of formation given in the table and indicate whether the reaction is spontaneous or nonspontaneous.

10. For a certain reaction at 400K, $\Delta H = -1059 \text{ kJ}$ and $\Delta G = -1195 \text{ kJ}$. Determine ΔS for the reaction using the Gibbs-Helmholtz equation. Is the reaction spontaneous or nonspontaneous?

11. Give the oxidation number for the underlined atom in:



12. Balance the reaction using the ion-electron method and identify the oxidizing and reducing agent.



Oxidizing Agent _____ Reducing Agent _____

13. A voltaic cell is constructed in the usual manner having Cu metal in contact with a 1.0 M $\text{Cu}(\text{NO}_3)_2$ solution and Ni metal in contact with a 1.0 M $\text{Ni}(\text{NO}_3)_2$ solution at 25°C.



Write the equation for the spontaneous cell reaction and determine the voltage associated with this cell.

14. Write the half-reaction for Co^{3+} and determine the mass of cobalt metal deposited by the following reaction if 6.75 amperes of current is passed through the electrolytic cell for 40.0 min. (At. Wt.: Co = 58.9 amu)?

15. Consider the electrolysis of molten barium chloride BaCl_2 . (a) write the half-reactions, and (b) how many grams of barium metal can be produced by supplying .50 A for 30 min.

16. Indicate the products expected at each electrode for the following electrolysis reactions involving inert electrodes.

ANODE CATHODE

$\text{RhCl}_2(\text{aq})$
(Rh lies **below** Zn)

17. Fill in the blanks for each of the following coordination compounds:

Formula: $[\text{Co}(\text{OH}_2)_6]\text{Cl}_3$

Name: _____

Coordination Sphere: _____

Center of coordination: _____

Ligands: (underline the donor atom of ligand where applicable)

Coordination number: _____

Formula: _____

Name: Diaminetetrachlorobisethyldiamineosmium(V) bromide

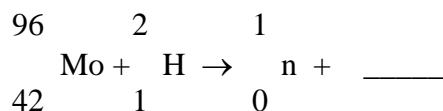
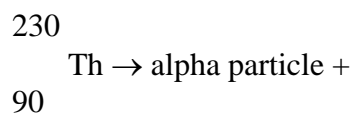
Coordination Sphere: _____

Center of coordination: _____

Ligands: (underline the donor atom of ligand where applicable)

Coordination number: _____

18. Fill in the blanks in the following nuclear equation:



19. A certain radioisotope has half-life of 47.6 days. Determine the mass of an 80.0 g sample remaining after 92.0 days.

20. The radioactive decay of Ti-206 to Pb-206 has a half-life of 4.2 min. Starting with 5.00×10^{22} atoms of Ti-206, calculate the number of such atoms left after 42.0 mins.

21. Give the condensed structural formula and IUPAC name for three (3) of the possible isomers of C_6H_{14} .

22. Give the condensed structural formula and IUPAC name for the major organic product(s) expected for each of the following reactions:



23. Give the condensed formula and classification for the organic product(s) expected for of the following reactions.



24. Outline a synthesis for the following compounds:

3-pentanone