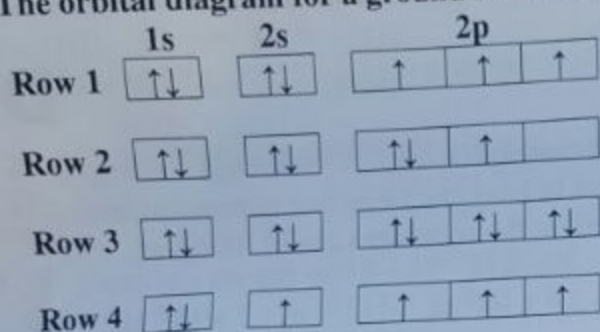


D-11 The orbital diagram for a ground state nitrogen (N) atom is



a) Row 1

b) Row 2

c) Row 3

d) Row 4

D-12 An element with the general electron configuration for its outermost electrons of ns^2np^2 would be in which element group?

a) 2A

b) 3A

c) 6A

d) 4A

D-13 A gas has a volume of 2 L at 25 °C and 3 atm. Calculate the volume of the gas if the temperature and pressure were 35 °C and 4 atm?

a) 1.55 L

b) 2.5 L

c) 0.45 L

d) 3.12 L

D-14 0.500 mole of ammonia (NH₃) occupies a 1.2 L flask at 150°C. Calculate the pressure of the ammonia inside the flask.

a) 10.56 atm

b) 1.4 atm

c) 12.34 atm

d) 14.47 atm

15 What is the total number of valence electrons in PCl₃ ?

a) 12

b) 26

c) 20

d) 18

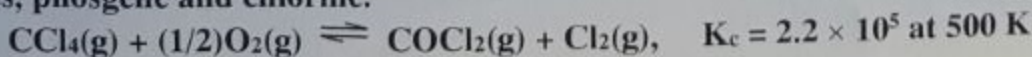
16 Which of these species make an *isoelectronic pair*: Br⁻¹, S⁻², Cl, K⁺, Ni⁺?

a) K⁺ and S⁻²b) S⁻² and Br⁻¹c) Cl and Ni⁺d) Br⁻¹ and K⁺

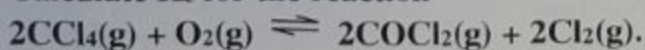
D-17 Which is the correct equilibrium constant expression for the following reaction?

a) $K_c = [\text{H}_2\text{O}] / [\text{H}_2] [\text{CO}]$ b) $K_c = [\text{H}_2] [\text{CO}] / [\text{H}_2\text{O}][\text{C}]$ c) $K_c = [\text{H}_2] [\text{CO}] / [\text{H}_2\text{O}]$ d) $K_c = [\text{H}_2\text{O}][\text{C}] / [\text{H}_2] [\text{CO}]$

D-18 Carbon tetrachloride reacts at high temperatures with oxygen to produce two toxic gases, phosgene and chlorine.



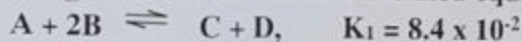
Calculate K_c for the reaction

a) 5.2×10^{13} b) 1.3×10^{12} c) 3.82×10^{11} d) 4.8×10^{10}

D-19 At 45°C, the equilibrium constant for the reaction $2\text{NOCl}(\text{g}) \rightleftharpoons 2\text{NO}(\text{g}) + \text{Cl}_2(\text{g})$ is $K_c = 5.2 \times 10^{-4}$. An equilibrium mixture was found to have the following concentrations $[\text{Cl}_2] = 5.5 \times 10^{-2} \text{ M}$; $[\text{NOCl}] = 3.2 \times 10^{-4} \text{ M}$. Calculate the concentration of $\text{NO}(\text{g})$ at equilibrium.

- a) $3.1 \times 10^{-5} \text{ M}$ b) $8.5 \times 10^{-4} \text{ M}$ c) $2.4 \times 10^{-2} \text{ M}$ d) $4.7 \times 10^{-3} \text{ M}$

D-20 Consider the following reactions and their associated equilibrium constants:



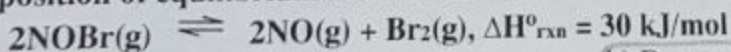
For the reaction $\text{A} + 2\text{B} \rightleftharpoons \text{D} + 2\text{E}$, having equilibrium constant K_c ?

- a) 1.9×10^{-8} b) 8.2×10^{-5} c) 3.3×10^{-7} d) 6.4×10^{-10}

D-21 At 700 K, the reaction $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$ has the equilibrium constant $K_c = 4.3 \times 10^6$, and the following concentrations are present: $[\text{SO}_2] = 8.5 \text{ M}$; $[\text{SO}_3] = 0.43 \text{ M}$; $[\text{O}_2] = 7.3 \text{ M}$. Is the mixture at equilibrium? If not at equilibrium, in which direction (as the equation is written), *left to right* or *right to left*, will the reaction proceed to reach equilibrium?

- a) Yes, the mixture is at equilibrium b) No, *left to right*
c) No, *right to left* d) There is not enough information to be able to predict the direction.

D-22 For the following reaction at equilibrium, which choice gives a change that will shift the position of equilibrium to favor formation of more reactant (right to left)?

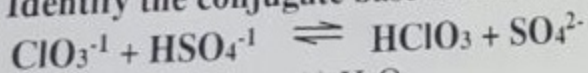


- a) Remove NO .
b) Decrease the temperature
c) Remove Br_2 .
d) Add NOBr

D-23 In which of these gas-phase equilibria is the yield of products increase by decreasing the total pressure on the reaction mixture?

- a) $\text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + \text{H}_2(\text{g})$
b) $2\text{NO}(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2\text{NOCl}(\text{g})$
c) $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$
d) $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$

D-24 Identify the conjugate base of HClO_3 in the reaction

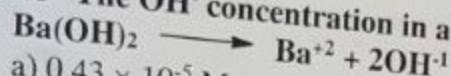


- a) HSO_4^{-1} b) H_2O c) SO_4^{2-} d) ClO_3^{-1}

D-25 One liter of an aqueous solution contains $6.022 \times 10^{24} \text{ H}_3\text{O}^+$ ions. Therefore, its H_3O^+ ion concentration is

- a) 0.1 mole/L b) 0.001 mole/L c) 6.02 mole/L d) 10 mol/L

D-26 The OH^- concentration in a $2.1 \times 10^{-2} \text{ M}$ $\text{Ba}(\text{OH})_2$ solution is



- a) $0.43 \times 10^{-5} \text{ M}$ b) $0.06 \times 10^{-2} \text{ M}$ c) $4.2 \times 10^{-2} \text{ M}$ d) $2.1 \times 10^{-2} \text{ M}$

D-27 A 0.30 M HF solution is 1% ionized. Calculate the H^+ ion concentration.

- a) 5.2 M b) $3 \times 10^{-3} \text{ M}$ c) 0.3 M d) $4.1 \times 10^{-3} \text{ M}$

D-28 Calculate the pH of $9.3 \times 10^{-2} \text{ M}$ KOH .

- a) 5.6 b) 11.7 c) 13.2 d) 12.97



D-29 Calculate the hydrogen ion concentration in a solution of fruit juice having a pH of 1.3?

- a) 0.05 M b) 0.51 M c) 0.01 M d) 0.09 M

D-30 What is the pH of a 4 M HF solution (at 25°C) if $K_a = 7.1 \times 10^{-4}$?

- a) 13.4 b) 2.5 c) 1.27 d) 3.72

D-31 Which one of the following combinations can function as a buffer solution?

- a) HBr (weak acid)/ CH_3COONa b) HCl (strong acid)/ KBr
 c) HClO_4 (strong acid)/ NaNO_3 d) HNO_2 (weak acid)/ NaNO_2

D-32 Calculate the pH of a buffer solution that contains 0.63 M benzoic acid ($\text{C}_6\text{H}_5\text{CO}_2\text{H}$) and 0.25 M sodium benzoate ($\text{C}_6\text{H}_5\text{COONa}$). [$K_a = 6.5 \times 10^{-5}$ for benzoic acid]

- a) 6.92 b) 3.79 c) 1.7 d) 12.3

D-33 The molar solubility of magnesium carbonate (MgCO_3) is $3.2 \times 10^{-3} \text{ mol/L}$. What is K_{sp} for this compound? $\text{MgCO}_3(\text{s}) \rightleftharpoons \text{Mg}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq})$

- a) 1.02×10^{-5} b) 2.8×10^{-2} c) 7.2×10^{-5} d) 6.3×10^{-4}

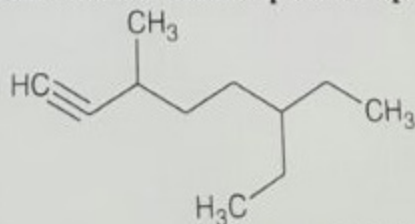
D-34 Which of these molecules is saturated?

- a) C_3H_8 b) C_4H_8 c) C_6H_{12} d) C_2H_4

D-35 The alkane with five carbon atoms is called

- a) butane b) hexane c) heptane d) pentane

D-36 Which of these is the systematic name for the compound represented below?



- a) 3-ethyl-6-methyl-8-octene b) 6-ethyl-3-methyl-1-octene
 c) 6-ethyl-3-methyl-1-octyne d) 3-ethyl-6-methyl-8-octyne