

## Chemistry 1210 Spring 2024 Test 2

Friday, March 1, 2024

Time: 1 hour 50 minutes

Name: \_\_\_\_\_

Student #: \_\_\_\_\_

*This test consists of **six** pages of questions, the formula sheet, and a periodic table. Please ensure that you have a complete test and, if you do not, obtain one from me **immediately**. There are **37.5** marks available. Good luck!*

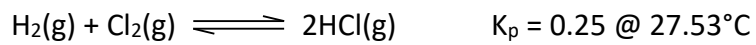
1) **[2 marks]** A certain reaction has  $\Delta H^\circ = 65.0$  kJ/mol and  $K = 50.0$  at  $25^\circ\text{C}$ . What will be its value of  $K$  at  $50^\circ\text{C}$ ?

- a) 50.1                      c)  $3.09 \times 10^8$                       e) None of these  
b) 380.1                      d)  $1.25 \times 10^{88}$

2) **[2 marks]** The normal boiling point of hexane is  $68.75^\circ\text{C}$ , and its enthalpy of vaporization is 31 kJ/mol. Its vapour pressure at  $22^\circ\text{C}$  will be:

- a)  $7.33 \times 10^{-73}$  torr                      c)  $7.51 \times 10^{-3}$  torr                      e) 758.7 torr  
b)  $6.78 \times 10^{-48}$  torr                      d) 135.1 torr

- 3) **[5 marks total]** A 10-litre flask was charged with 5 moles of H<sub>2</sub>, 5 moles of Cl<sub>2</sub>, and 10 moles of HCl, and the equilibrium

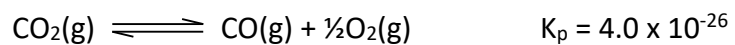


established.

- a) **[1 mark]** In which direction did the reaction shift to attain equilibrium? How do you know? (No marks for guessing. 😊)

- b) **[4 marks]** What were the equilibrium pressures of all species?

4) **[4 marks]** A flask was charged with  $4.0 \times 10^{-4}$  bar of  $\text{CO}_2$  and the equilibrium



established. Calculate the equilibrium pressures of all species.

5) **[6 marks]** The  $K_{sp}$  of  $Ag_2SO_4$  is  $1.2 \times 10^{-5}$ . How many grams of  $Ag_2SO_4$  (311.8 g/mol) will dissolve in **half a litre** of:

a) water

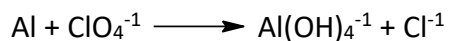
b) a solution with  $[AgNO_3] = 0.100$  M

6) **[3 marks]** You have a solution with  $[CO_3^{2-}] = 3.28 \times 10^{-3}$  M and  $[Cl^-] = 1.7 \times 10^{-5}$  M. You choose to separate these two anions by adding solid  $AgNO_3$ . The  $K_{sp}$  of  $Ag_2CO_3$  is  $8.2 \times 10^{-12}$ , and the  $K_{sp}$  of  $AgCl$  is  $1.7 \times 10^{-10}$ . At the point of maximum separation, what percent of the first of the two anions to precipitate will remain in solution?

7) **[4 marks]** Give the oxidation number of oxygen in the following molecules or ions:

- a)  $O_2$  \_\_\_\_\_      b)  $HOF$  \_\_\_\_\_      c)  $OF_2$  \_\_\_\_\_      d)  $H_2O_2$  \_\_\_\_\_

8) **[5.5 marks]** Given the following redox reaction, occurring in **basic** solution:



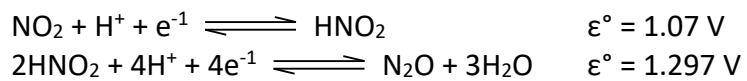
a) **[4 marks]** Balance the reaction.

b) **[0.5 marks]** Which species is oxidized?

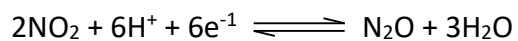
c) **[0.5 marks]** Which species is the reducing agent?

d) **[0.5 marks]** How many electrons are transferred in the overall reaction?

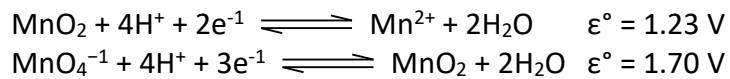
9) [3 marks] Given the half-reactions:



calculate  $\epsilon^\circ$  for:



10) [3 marks] Given the half-reactions:



Will  $\text{MnO}_2$  disproportionate? Calculate  $\epsilon^\circ$  for the disproportionation to prove your answer.