

Chemistry 1220

Practice Problems for Final - Ch 20, 21, 23 Material Only

This practice exam covers only the new material from chapters 20 (20.6-20.9), 21 (21.1-21.4) and 23 (23.1-23.4, only isomerism from 23.4). The actual final is cumulative and covers material from the entire semester.

USEFUL INFORMATION

$$R = 0.08206 \text{ L-atm/mol-K} = 8.3145 \text{ J/mol-K}$$

$$k = 1.38 \times 10^{-23} \text{ J/K}$$

$$1 \text{ J} = 1 \text{ C}\cdot\text{V}, 1 \text{ C} = 1 \text{ A}\cdot\text{s}, F = 96,485 \text{ C/mol e}^-$$

$$\Delta G = -nFE \quad \Delta G^\circ = -nFE^\circ$$

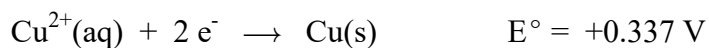
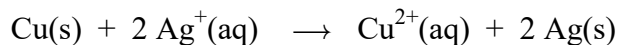
$$E^\circ = \frac{RT}{nF} \ln Q \quad E^\circ = \frac{0.0592 \text{ V}}{n} \log K \quad (\text{at } 25^\circ \text{C})$$

1. A concentration cell is made from two Cr electrodes, one with 0.040 M Cr^{3+} and one with 1.0 M Cr^{3+} . Calculate the voltage (in volts) generated by this concentration cell at 25°C.



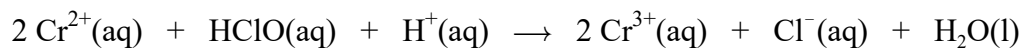
- A. 0.083 V
- B. 0.028 V
- C. 0.055 V
- D. 0.125 V
- E. 0.24 V

2. Given the following balanced reaction equation and standard electrode potentials, what is the concentration (M) of Ag^{+} if the emf of the cell is 0.350 V when the concentration of Cu^{2+} is 3.50 M?



- A. 0.012 M
- B. 0.0045 M
- C. 0.20 M
- D. 0.00058
- E. 0.024 M

3. Consider an electrochemical cell in which the following reaction occurs and predict which changes will increase the cell voltage.



- I increase in $[\text{HClO}]$
- II increase in size of inert electrodes
- III decrease in pH of cell solution

- A. I
- B. II
- C. III
- D. I & II
- E. I & III
- F. II & III

4. Calculate the standard voltage that can be obtained from an ethane-oxygen ($\text{C}_2\text{H}_6(\text{g})$ - $\text{O}_2(\text{g})$) fuel cell at 25°C .

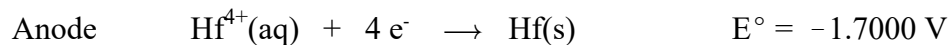


- A. +1.09 V
- B. +0.91 V
- C. +0.72 V
- D. +0.54 V
- E. +0.35 V

5. Which of the following is characteristic of the **anode** in an **electrolysis** cell?

- A. It is where reduction occurs.
- B. It may attract positive ions.
- C. It receives electrons from the wire.
- D. It may lose weight during electrolysis.
- E. It has a negative sign.

6. Using standard electrode potentials, calculate the ΔG° (kJ) for the following electrochemical cell.



- A. +37.8 kJ
- B. +113 kJ
- C. -9.46 kJ
- D. +9.46 kJ
- E. -113 kJ

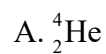
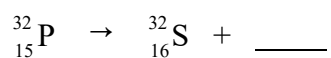
7. Calculate the mass (**kg**) of Li formed by electrolysis of molten LiCl by a current of $6.60 \times 10^4 \text{ A}$ flowing for a period of 12.0 h. Assume the cell is 85.0 percent efficient. (atomic weight: Li = 6.941)

- A. 126
- B. 155
- C. 174
- D. 205
- E. 242

8. By what process does thorium-230 decay to radium-226?

- A. gamma emission
- B. alpha emission
- C. beta emission
- D. electron capture
- E. positron emission

9. What is the missing product from the following reaction?



10. Radium undergoes alpha decay. The product of this reaction also undergoes alpha decay. What is the product of this second decay reaction?

- A. Po
- B. Rn
- C. U
- D. Th
- E. Hg

11. In the nuclear transmutation represented by, ${}_{13}^{27}\text{Al} (n, ?) {}_{11}^{24}\text{Na}$, what is the emitted particle?
- A. an alpha particle
 - B. a beta particle
 - C. a gamma photon
 - D. a proton
 - E. a neutron
12. Bombardment of ${}^{238}\text{U}$ with a deuteron (${}^2_1\text{H}$) generates ${}^{237}\text{Np}$ and _____ neutrons.
- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5
13. A freshly prepared sample of curium-243 undergoes 3312 disintegrations per second. After 6.00 yr, the activity of the sample declines to 2755 disintegrations per second. What is the half-life (in yr) of curium-243?
- A. 4.99 yr
 - B. 32.6 yr
 - C. 7.2 yr
 - D. 0.765 yr
 - E. 22.6 yr

14. ^{210}Pb has a half-life of 22.3 years and decays to produce ^{206}Hg . If you start with a 7.50 g of ^{210}Pb , how many grams of ^{206}Hg will you have after 17.5 years?
- A. 4.35 g
 - B. 3.15 g
 - C. 3.09 g
 - D. 0.0600 g
 - E. 1.71 g
15. In which of the following complexes does the transition metal have a d^5 configuration?
- A. PtCl_4^{2-}
 - B. $\text{Cu}(\text{H}_2\text{O})_6^{2+}$
 - C. $\text{Ni}(\text{CO})_4$
 - D. $\text{Zn}(\text{NH}_3)_4^{2+}$
 - E. $\text{Fe}(\text{CN})_6^{3-}$
16. Which of the following coordination compounds will form a precipitate when treated with an aqueous solution of AgNO_3 ?
- A. $[\text{Cr}(\text{NH}_3)_3\text{Cl}_3]$
 - B. $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$
 - C. $[\text{Cr}(\text{NH}_3)\text{Cl}](\text{NO}_3)_2$
 - D. $\text{Na}_3[\text{Cr}(\text{CN})_6]$
 - E. $\text{Na}_3[\text{CrCl}_6]$

17. From the following pairs of coordination compounds which pair are linkage isomers?
- A. $\text{K}_2[\text{NiBr}_2\text{Cl}_2]$ and $\text{Na}_2[\text{NiBr}_2\text{Cl}_2]$
 - B. $\text{K}_4[\text{Pt}(\text{Cl})_2(\text{NCS})_4]$ and $\text{Na}_4[\text{Pt}(\text{Cl})_4(\text{NCS})_2]$
 - C. $[\text{Ni}(\text{NH}_3)_3(\text{H}_2\text{O})]\text{Br}_2$ and $[\text{Ni}(\text{NH}_3)_2(\text{H}_2\text{O})_2]\text{Cl}_2$
 - D. $\text{K}_4[\text{Pt}(\text{Cl})_2(\text{SCN})_4]$ and $\text{K}_4[\text{Pt}(\text{Cl})_2(\text{NCS})_4]$
 - E. $[\text{Ni}(\text{NH}_3)_3\text{Br}]\text{Cl}$ and $[\text{Ni}(\text{NH}_3)_3\text{Cl}]\text{Br}$
18. From the following pairs of coordination compounds which pair are coordination-sphere isomers?
- A. $\text{K}_2[\text{NiBr}_2\text{Cl}_2]$ and $\text{Na}_2[\text{NiBr}_2\text{Cl}_2]$
 - B. $\text{K}_4[\text{Pt}(\text{Cl})_2(\text{NCS})_4]$ and $\text{Na}_4[\text{Pt}(\text{Cl})_4(\text{NCS})_2]$
 - C. $[\text{Ni}(\text{NH}_3)_3(\text{H}_2\text{O})]\text{Br}_2$ and $[\text{Ni}(\text{NH}_3)_2(\text{H}_2\text{O})_2]\text{Cl}_2$
 - D. $\text{K}_4[\text{Pt}(\text{Cl})_2(\text{SCN})_4]$ and $\text{K}_4[\text{Pt}(\text{Cl})_2(\text{NCS})_4]$
 - E. $[\text{Ni}(\text{NH}_3)_3\text{Br}]\text{Cl}$ and $[\text{Ni}(\text{NH}_3)_3\text{Cl}]\text{Br}$
19. How many geometric isomers are possible for the complex ion $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_3]^{3+}$?
- A. 4
 - B. 1
 - C. 0
 - D. 2
 - E. 3

20. Which of the following transition metal complexes can exhibit the phenomenon of optical isomerism?

- A. $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$
- B. $[\text{CoCl}_6]^{4-}$
- C. $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
- D. $[\text{Ni}(\text{SCN})_3\text{Br}_3]^{4-}$
- E. $[\text{Mn}(\text{C}_2\text{O}_4)_2\text{Br}_2]^{4-}$

21. Which of the following complexes are chiral?

- 1) $[\text{Cr}(\text{en})_2\text{Cl}_2]^+$ 2) $[\text{Cr}(\text{en})_2(\text{NH}_3)_2]^{3+}$ 3) $[\text{Cr}(\text{en})_3]^{3+}$ 4) $[\text{Cr}(\text{en})\text{Cl}_2(\text{NH}_3)_2]^+$
 cis Cl trans-NH₃ cis Cl cis NH₃

- A. 1, 2, 3
- B. 1, 3, 4
- C. 2, 3, 4
- D. 1, 3
- E. 2, 4

Chemistry 1220**Answers to Practice Problems for New Material**
Ch 20, 21, 23

1) B

9) B

17) D

2) E

10) A

18) E

3) E

11) A

19) D

4) A

12) C

20) E

5) D

13) E

21) B

6) B

14) C

7) C

15) E

8) B

16) B