Sample Exam 2
CHEM 161

1. For the reaction below, how many grams of H₂ are produced by the complete reaction of 132 g of Al with 575 g of HCl? \( 2 \text{Al} + 6 \text{HCl} \rightarrow 2 \text{AlCl}_3 + 3 \text{H}_2 \)
   a. 7.88 g  
   b. 15.7 g  
   c. 4.89 g  
   d. 7.33 g  
   e. 14.7 g

2. Which of the following is a strong electrolyte?
   a. \( \text{CH}_3\text{OH} \)
   b. \( \text{KNO}_3 \)
   c. \( \text{HCHO}_2 \)
   d. both a and b
   e. all of these are strong electrolytes

3. Which of the following would be insoluble?
   a. \( \text{CaS} \)
   b. \( \text{KOH} \)
   c. \( \text{Pb(NO}_3)_2 \)
   d. \( \text{SrSO}_4 \)
   e. both a and d

4. Which of the following best represents what is present when sodium carbonate, \( \text{Na}_2\text{CO}_3 \), is dissolved in water?
   a. \( \text{Na}_2\text{CO}_3(s) \)
   b. \( 2 \text{Na}^{+}(aq) + \text{CO}_3^{2-}(aq) \)
   c. \( 2 \text{Na}^{+}(aq) + \text{CO}_3^{2-}(aq) \)
   d. \( 2 \text{Na}^{+}(aq) + \text{C}^{4+}(aq) + 3 \text{O}^{2-}(aq) \)
   e. none of the above

5. The balanced NET IONIC equation for the reaction between \( \text{Sn}(s) \) and \( \text{HBr}(aq) \) is:
   a. no reaction
   b. \( \text{Sn}(s) + 2 \text{H}^{+}(aq) \rightarrow \text{Sn}^{2+}(aq) + \text{H}_2(g) \)
   c. \( 2 \text{H}^{+}(aq) \rightarrow \text{H}_2(g) \)
   d. \( \text{Sn}(s) + 2 \text{Br}^{-}(aq) \rightarrow \text{SnBr}_2(s) \)
   e. \( \text{Sn}(s) + 2 \text{H}^{+}(aq) \rightarrow \text{SnH}_2(s) \)

6. The NET IONIC equation for the mixing of the solutions \( \text{Pb(NO}_3)_2 \) and \( \text{Na}_2\text{SO}_4 \) is:
   a. No Reaction - all species are soluble
   b. \( \text{Pb(NO}_3)_2(aq) + \text{Na}_2\text{SO}_4(aq) \rightarrow \text{PbSO}_4(s) + 2 \text{NaNO}_3(aq) \)
   c. \( \text{Pb(NO}_3)_2(aq) + \text{Na}_2\text{SO}_4(aq) \rightarrow \text{PbSO}_4(s) + \text{Na}_2(\text{NO}_3)_2(aq) \)
   d. \( \text{Pb}^{2+}(aq) + \text{SO}_4^{2-}(aq) \rightarrow \text{PbSO}_4(s) \)
   e. \( (\text{NO}_3)_2^{-1} + \text{Na}^{+} \rightarrow \text{Na}_2(\text{NO}_3)_2(s) \)
7. Which of the following reactions will produce a gas?
   a. $\text{K}_2\text{S(aq)} + \text{Ca(NO}_3\text{)_2(aq)} \rightarrow$
   b. $\text{FeS(s)} + \text{HCl(aq)} \rightarrow$
   c. $\text{KHCO}_3\text{(aq)} + \text{HCl(aq)} \rightarrow$
   d. both b and c
   e. none of the above will produce a gas

8. Calculate the molarity of a solution that contains 80.0 g of NaOH in 500. mL of water.
   a. 0.160 M  b. 160. M  c. 4.00 M  d. 40.0 M  e. 2.00 M

9. Hydrochloric acid (HCl) is sold as a 12M solution. What volume of this solution would be required to produce 600.mL of a concentration that is 0.50M?
   a. 10.mL  b. 25mL  c. 300mL  d. 6.0mL  e. 14,400mL

10. A 10.0 mL sample of oxalic acid, $\text{H}_2\text{C}_2\text{O}_4$, is titrated with a 0.105 M NaOH solution. If the sample required 24.7 mL to reach the endpoint, then how many grams of oxalic acid are dissolved in the 10.0 mL sample? The reaction is: $\text{H}_2\text{C}_2\text{O}_4 + 2\text{NaOH} \rightarrow 2\text{H}_2\text{O} + \text{Na}_2\text{C}_2\text{O}_4$
    a. 0.233 g  b. 0.259 g  c. 0.130 g  d. 0.117 g  e. 0.467 g

11. What is the oxidation number of Cr in $\text{K}_2\text{Cr}_2\text{O}_7$?
   a. +1  b. +3  c. +4  d. +6  e. +12

12. For the following two reactions, what statement is TRUE?
    $2\text{K(s)} + \text{F}_2\text{(g)} \rightarrow 2\text{KF(s)}$
    $\text{Cl}_2\text{(l)} + 2\text{NaI(s)} \rightarrow 2\text{NaCl(aq)} + \text{I}_2\text{(s)}$
    a. the K and the Cl$_2$ are reduced
    b. the K and the NaI are reduced
    c. the F$_2$ and the Cl$_2$ are reduced
    d. the F$_2$ and the NaI are reduced

13. You are given 0.255g of an unknown acid and are told that it has three acidic hydrogen's per mole of acid. If this acid required 15.1mL of a 0.265M NaOH solution to reach the endpoint then what is the molecular weight of the unknown acid? The generic balanced reaction is: $\text{H}_3\text{A} + 3\text{NaOH} \rightarrow 3\text{H}_2\text{O} + \text{Na}_3\text{A}$
    a. 21.2g  b. 2.89g  c. 63.7g  d. 191g  e. none of the above

14. How much heat is required to raise the temperature of 30.0 g of silver from 18.2°C to 35.6°C? The specific heat of silver is 0.226 J/g°C.
    a. 123 J  b. 118 J  c. 241 J  d. 2.31 kJ  e. 1.08 kJ
15. What is the change in enthalpy for the production of 1.00 mol of SnO?

\[ \text{Sn} + \text{SnO}_2 \rightarrow 2 \text{SnO} \quad \Delta H = +92 \text{ kJ} \]

a. –184 kJ  

b. –92 kJ  
c. –46 kJ  
d. 46 kJ  
e. 92 kJ

16. Find the heat required for the conversion of graphite into diamond, \( C_{(gr)} \rightarrow C_{(dia)} \), given

\[ C_{(gr)} + O_2(g) \rightarrow CO_2(g) \quad \Delta H = -393 \text{ kJ} \]
\[ C_{(dia)} + O_2(g) \rightarrow CO_2(g) \quad \Delta H = -395 \text{ kJ} \]

a. –788 kJ  

b. –395 kJ  
c. –393 kJ  
d. –2 kJ  
e. +2 kJ

17. When 6.35g of NH\(_4\)Cl are added to 50.0g of water at 22.5°C, the temperature of solution decreases to 15.0°C. What is the value of \( \Delta H \) in kJ per mole of NH\(_4\)Cl for the solution formation process? Assume that the specific heat of the solution is 4.18 J/g°C.

\[ \text{NH}_4\text{Cl}_{(s)} \rightarrow \text{NH}_4^{+}_{(aq)} + \text{Cl}^{-}_{(aq)} \]

a. +278 kJ/mol  

b. +14.9 kJ/mol  
c. +1.77 kJ/mol  
d. –1.77 kJ/mol  
e. none of the above

18. When 1.35g of thymol, C\(_{10}\)H\(_{14}\)O, is combusted in a bomb calorimeter, the temperature of the calorimeter increases from 21.57°C to 28.31°C. If the heat capacity of the calorimeter is 7.35kJ/°C, then what is the \( \Delta H \) for the combustion of one mole of thymol?

\[ C_{10}H_{14}O_{(s)} + 13 O_2(g) \rightarrow 10 CO_2(g) + 7 H_2O_{(l)} \]

a. –49.5 kJ/mol  

b. –36.7 kJ/mol  
c. –5,500 kJ/mol  
d. –66.9 kJ/mol  
e. none of the above

19. The space shuttle’s reusable booster rockets use a solid propellant as a fuel source. Using the \( \Delta H_f^0 \) provided and the following equation, calculate the reaction’s change in enthalpy.

\[ 3 \text{ Al}_{(s)} + 3 \text{NH}_4\text{ClO}_4_{(s)} \rightarrow \text{Al}_2\text{O}_3_{(s)} + \text{AlCl}_3_{(s)} + 3 \text{ NO}_{(g)} + 6 \text{H}_2\text{O}_{(g)} \]

\[ \Delta H_f^0 = 0 -295 \text{ kJ} \quad -1676 \text{ kJ} \quad -704 \text{ kJ} \quad +90 \text{ kJ} \quad -242 \text{ kJ} \]

(a) all values are per mole)

a. –2237 kJ  

b. +4447 kJ  
c. +2677 kJ  
d. –4447 kJ  
e. –2677 kJ

20. What is the energy of a photon of ultraviolet radiation with a wavelength of 5.00 x 10\(^{-8}\) m?

a. 1.11 x 10\(^{-49}\) J  

b. 1.67 x 10\(^{-16}\) J  
c. 9.95 x 10\(^{-33}\) J  
d. 3.98 x 10\(^{-18}\) J  
e. 7.24 x 10\(^{-12}\) J
21. How many photons are produced by a laser that operates at 80 Watts (1 Watt = 1 J/s) of power for 25 minutes and a wavelength of 525nm?
   a. $3.2 \times 10^{32}$ photons
   b. $2.1 \times 10^{20}$ photons
   c. $5.3 \times 10^{21}$ photons
   d. $3.2 \times 10^{23}$ photons
   e. none of the above

22. The chief component of “smog” is nitrogen dioxide, which dissociates into NO and O by the reaction below. Given the $\Delta H$ below, determine the minimum wavelength that an NO$_2$ molecule needs to absorb to dissociate. NO$_2$(g) $\rightarrow$ NO(g) + O(g); $\Delta H^0 = 304.1$ kJ
   a. $6.54 \times 10^{-31}$ m
   b. 745 nm
   c. 354 nm
   d. 394 nm
   e. none of the above

23. What is the wavelength of light produced when the Hydrogen atom undergoes a transition from n = 6 to n = 1?
   a. 93.8 nm   b. 91.2 nm   c. 109 nm   d. 0.0107 nm   e. 3280 nm

24. The maximum number of electrons which could have the principle quantum number of n = 2 in an atom is
   a. 2   b. 6   c. 8   d. 18   e. infinity

25. Which of the following quantum numbers is often designated by the letters s, p, d, or f?
   a. n   b. $\ell$   c. $m_l$   d. $m_s$   e. none of the above


Note: I have not double-checked all of these, so if you think there is any mistakes please let me know!