

Name KEY

ID # _____

INSTRUCTIONS:

- PRINT your name and ID# above.
- Code the answers to the True-False and Multiple-Choice questions on the scantron form. Mark **A** for true and **B** for false. There is only *one* correct answer for each multiple choice question. There is no partial credit given for this section.
- Show all work on the problems section because partial credit is awarded for this section.
- On the scantron form, write the color of your exam above your name.
- Below your ID# above, answer the following question. In one word, attempt to describe your feelings about chemistry. Try to keep it clean. You will receive 1 bonus pt.
- There are **86** points on this exam.

GOOD LUCK! ENJOY!!

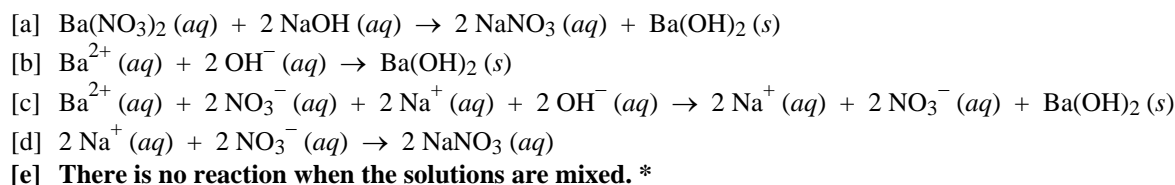
PART I: True-false statements (3 points each)

1. A weak acid or a weak base does not ionize in water. **F**
2. There are **6** unpaired electrons in a Cr atom. **T**
3. Consider the following reaction: $\text{Zn}(s) + \text{Cu}^{2+}(aq) \rightarrow \text{Zn}^{2+}(aq) + \text{Cu}(s)$. In this reaction, $\text{Cu}^{2+}(aq)$ is reduced. **T**
4. When ice melts to form liquid water, the process is exothermic. **F**

PART II: Multiple Choice (3 points each)

5. What is the **molarity** of a solution prepared by dissolving 3.65 grams of NaNO_3 in 250 mL of solution?
[a] 0.0932 M [b] 0.0429 M [c] **0.172 M *** [d] 14.6 M [e] $1.72 \times 10^{-4} M$
6. What **volume** of 1.10 M K_2CO_3 is needed to prepare 400 mL of a 0.200 M K_2CO_3 solution?
[a] 36 mL [b] **72.7 mL *** [c] 128 mL [d] 144 mL [e] $2.20 \times 10^3 \text{ mL}$
7. Consider the reaction of potassium hydroxide, KOH, with sulfuric acid, H_3PO_4 . Balance the equation with the smallest whole number coefficients. What is the **balancing coefficient** for water?
[a] 0 [b] 1 [c] 2 [d] **3 *** [e] 4

8. Which of the following is the correct **net ionic** equation for the reaction that occurs when solutions of $\text{Ba}(\text{NO}_3)_2$ and NaOH are mixed?



9. Given the three statements below, which answer is **correct**? [3 pts]

- (1) In an endothermic reaction, heat is transferred from the surroundings to the system.
(2) The sign of ΔH for an endothermic reaction is positive.
(3) An exothermic reaction releases heat.

- [a] 2 and 3 are true, 1 is false [b] 1 and 3 are true, 2 is false [c] 1 and 2 are false, 3 is true
[d] 1, 2, and 3 are false [e] **1, 2, and 3 are true ***

10. Which one of the following reactions occurring at 25°C does the symbol ΔH_f° for $\text{H}_2\text{SO}_4(l)$ refer to?

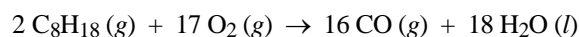


11. Given the following standard heats of formation, calculate the enthalpy change, ΔH , for the following reaction:

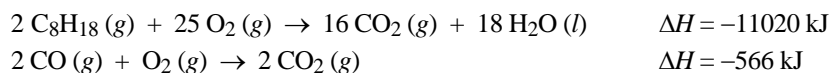


- [a] +1124 kJ/mol [b] +517.8 kJ/mol [c] +561.7 kJ/mol
[d] -1036 kJ/mol [e] **none of these ***

12. Calculate the enthalpy change, ΔH , for the reaction

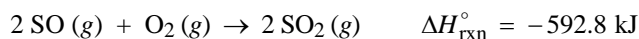


using the following information:



- [a] **-6492 kJ *** [b] -10454 kJ [c] 15548 kJ [d] +6492 kJ [e] -15548 kJ

13. Given the balanced equation below, what is the ΔH for the combustion of 24.04 grams of $\text{SO}(g)$ in an excess of oxygen?



- [a] -18.5 kJ [b] -296.4 kJ [c] +296.4 kJ [d] **-148.2 kJ *** [e] -384 kJ

PART III: Problems

23. A feverish student weighing 75 kilograms was immersed in 400 kg of water at 4.0°C to try to reduce the fever. The student's temperature dropped from 40°C to 37°C. Assuming the specific heat of the student to be 3.77 J/g·°C, what was the final temperature of the water? [$s_{\text{H}_2\text{O}} = 4.184 \text{ J/g}\cdot^\circ\text{C}$] [5 pts]

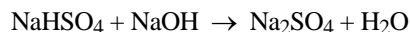
$$-q_{\text{student}} = +q_{\text{water}}$$

$$-m_s s_s \Delta T_s = +m_w s_w \Delta T_w$$

$$-(75 \text{ kg})(3.77 \text{ J/g}\cdot^\circ\text{C})(37 - 40)^\circ\text{C} = +(400 \text{ kg})(4.184 \text{ J/g}\cdot^\circ\text{C})(T_f - 4^\circ\text{C})$$

$$T_f = 4.5^\circ\text{C}$$

24. An acid-base titration was used to analyze an impure sample of sodium bisulfate (NaHSO_4) using NaOH as the standard solution.



A 0.3456 g impure sample of NaHSO_4 required 17.08 mL of 0.1376 M NaOH to reach the end point of the titration. What is the **percent purity** of the NaHSO_4 sample? [**Hint:** percent purity = $\frac{\text{mass of substance in the sample}}{\text{mass of sample}} \times 100\%$]

[6 pts]

$$\frac{0.1376 \text{ mol NaOH}}{1 \text{ L}} \times 0.01708 \text{ L} = 0.002350 \text{ mol NaOH}$$

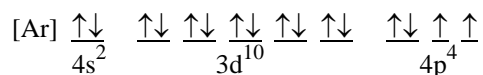
$$0.002350 \text{ mol NaOH} \times \frac{1 \text{ mol NaHSO}_4}{1 \text{ mol NaOH}} = 0.002350 \text{ mol NaHSO}_4$$

$$0.002350 \text{ mol NaHSO}_4 \times \frac{120.07 \text{ g NaHSO}_4}{1 \text{ mol NaHSO}_4} = 0.2822 \text{ g NaHSO}_4$$

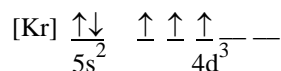
$$\% \text{ purity} = \frac{0.2822 \text{ g}}{0.3456 \text{ g}} \times 100 = \mathbf{81.66\%}$$

25. Write both an **electron configuration** and an **orbital diagram** for each of the following. You may use shorthand notation. [9 pts]

[a] Se $[\text{Ar}]4s^2 3d^{10} 4p^4$



[b] Nb $[\text{Kr}]5s^2 4d^3$



[c] Sr $[\text{Kr}]5s^2$

