

Name _____

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!!

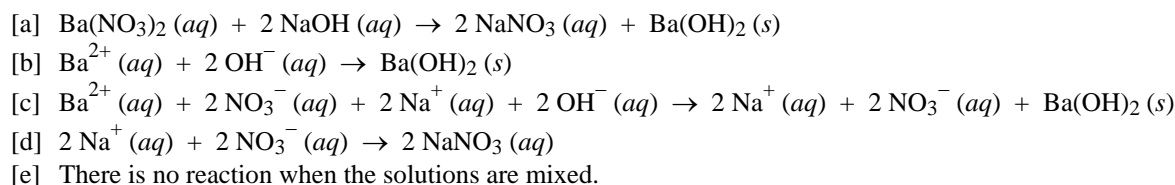
PART I: True-false statements (3 points each)

1. A weak acid or a weak base does not ionize in water.
2. There are **6** unpaired electrons in a Cr atom.
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.
4. When ice melts to form liquid water, the process is exothermic.

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] 1.72×10^{-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] 2.20×10^3 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?

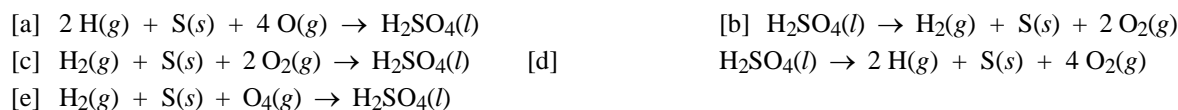


9. Given the three statements below, which answer is **correct**? [3 pts]

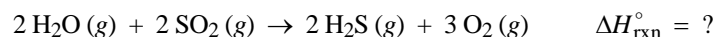
- (1) In an endothermic reaction, heat is transferred from the surroundings to the system.
 (2) The sign of ΔH for an endothermic reaction is positive.
 (3) An exothermic reaction releases heat.

- [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?

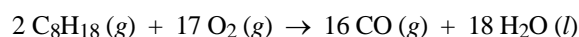


11. Given the following standard heats of formation, calculate the enthalpy change, ΔH , for the following reaction:

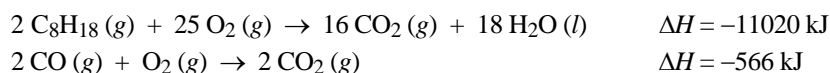


- [a] +1124 kJ/mol [b] +517.8 kJ/mol [c] +561.7 kJ/mol
 [d] -1036 kJ/mol [e] none of these

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

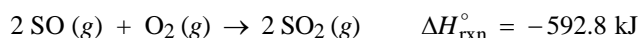


using the following information:



- [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?

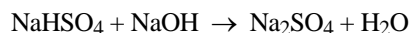


- [a] -18.5 kJ [b] -296.4 kJ [c] +296.4 kJ [d] -148.2 kJ [e] -384 kJ

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]

24. An acid-base titration was used to analyze an impure sample of sodium bisulfate (NaHSO₄) using NaOH as the standard solution.



A 0.3456 g impure sample of NaHSO₄ required 17.08 mL of 0.1376 M NaOH to reach the end point of the titration. What is the **percent purity** of the NaHSO₄ sample? [**Hint:** percent purity = $\frac{\text{mass of substance in the sample}}{\text{mass of sample}} \times 100\%$]

[6 pts]

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

[a] Se

[b] Nb

[c] Sr

Potentially Useful Information

$$q = ms\Delta t$$

$$c = \lambda\nu$$

$$c = 3.00 \times 10^8 \text{ m/s}$$

$$E = h\nu$$

$$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$E = \frac{hc}{\lambda}$$

$$\lambda = \frac{h}{mu}$$

$$E_n = -R_H \left(\frac{1}{n^2} \right)$$

$$\Delta E = E_f - E_i$$

$$1 \text{ Mm} = 1 \times 10^6 \text{ m}$$

$$\Delta t = t_f - t_i$$

$$\Delta H_{\text{rxn}}^\circ = \sum n\Delta H_f^\circ(\text{products}) - \sum n\Delta H_f^\circ(\text{reactants})$$

$$1 \text{ g} = 6.022 \times 10^{23} \text{ amu}$$

$$\text{Avogadro's number} = 6.022 \times 10^{23} \text{ particles/mole}$$

$$1 \text{ J} = \frac{1 \text{ kg} \cdot \text{m}^2}{\text{s}^2}$$

$$\Delta E = -R_H \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

$$R_H = 2.18 \times 10^{-18} \text{ J}$$

$$\text{Molarity} = \frac{\text{moles solute}}{\text{L of solution}}$$

$$M_1V_1 = M_2V_2$$

SOLUBLE COMPOUNDS	EXCEPTIONS
Compounds containing alkali metal ions (Li^+ , Na^+ , K^+ , Rb^+ , Cs^+) and the ammonium ion (NH_4^+)	
Nitrates (NO_3^-), bicarbonates (HCO_3^-), and chlorates (ClO_3^-)	
Halides (Cl^- , Br^- , I^-)	Halides of Ag^+ , Hg_2^{2+} , and Pb^{2+}
Sulfates (SO_4^{2-})	Sulfates of Ag^+ , Ca^{2+} , Sr^{2+} , Ba^{2+} , and Pb^{2+}
INSOLUBLE COMPOUNDS	EXCEPTIONS
Carbonates (CO_3^{2-}), phosphates (PO_4^{3-}), chromates (CrO_4^-), and sulfides (S^{2-})	Compounds containing alkali metal ions and the ammonium ion
Hydroxides (OH^-)	Compounds containing alkali metal ions and the Ba^{2+} ion