

Name: _____
105 points
Dr. Jay H. Baltsberger

Test 2
Chemistry 121A
October 31, 1994

SHOW ALL CALCULATIONS & USE PROPER SIGNIFICANT FIGURES AND UNITS

Multiple Choice Questions: Circle the single best answer. No penalty for guessing.

- What is the total volume of a 83.31 g block of iron with density 8.11 g/cm³? (2 points)
A) 676 cm³ B) 10.3 cm³ C) 0.0973 cm³ D) 91.4 cm³ E) 1.48x10⁻³cm³
- What is the complete atomic symbol for the element with 48 protons, 65 neutrons and 46 electrons? (2 points)
A) ${}_{46}^{113}\text{Cd}^{2-}$ B) ${}_{46}^{113}\text{Pd}$ C) ${}_{65}^{113}\text{Tb}^{2-}$ D) ${}_{48}^{65}\text{Cd}^{2+}$ E) ${}_{48}^{113}\text{Cd}^{2+}$
- Calculate the number of moles of NaNO₃ (MW 85.054) in 51.3 g of the material. (2 points)
A) 51.3 moles B) 1.00 mole C) 0.603 moles D) 1.66 moles E) 4360 moles
- Calculate the hydrogen ion concentration in a solution made from 21.0 g of HCl (MW 36.46) and 100.0 ml of H₂O? (2 points)
A) 2.10 M B) 1.74 M C) 17.4 M D) 5.76 M E) 0.0576 M
- What is the change in temperature of a 5.00 g block of iron if 761.0 J of heat are added and the specific heat of iron is 0.550 J/g°C? (2 points)
A) 277 °C B) 0.00 °C C) -277 °C D) 83.7 °C E) 2093 °C
- Use Hess' Law to calculate the H_{rxn} for the following reaction:
$$2 \text{C}_2\text{H}_6 (g) + \text{O}_2 (g) \longrightarrow \text{CO}_2 (g) + \text{H}_2\text{O} (l)$$

Given the following heats of formation: CO₂ (g) = -394 kJ/mol, H₂O (l) = -286 kJ/mol, C₂H₆ (g) = -85 kJ/mol. (10 points)

H_{rxn} = _____

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7. Name the following ionic compounds and indicate the solubility. (6 points each)

$\text{Pb}_3(\text{PO}_4)_2$ _____

CrSO_4 _____

$\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ _____

8. Write the empirical formula for the following compounds and indicate the solubility. (6 points each)

sodium sulfide _____

iron (II) chloride _____

silver (I) carbonate _____

9. Calculate the frequency and energy of a single photon of red (750 nm) light. (Useful Equations: $E = n h \nu$, $c = \lambda \nu$, $c = 3.0 \times 10^8$ m/s, $h = 6.626 \times 10^{-34}$ J s) (6 points)

10. Sketch a rough picture showing the shape of an s , p_x and $a_{x^2-y^2}$ orbitals. Be sure to indicate the x , y and z axes in these pictures as well as any nodal planes. (9 points)

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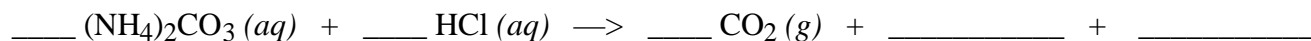
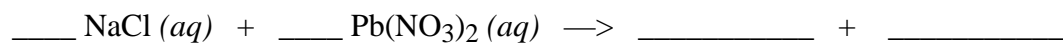
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11. Given that the heat of combustion (formation of $\text{CO}_2 (g)$ and $\text{H}_2\text{O} (l)$ when reacted with $\text{O}_2 (g)$) of C_6H_6 is $-3268 \text{ kJ/mol C}_6\text{H}_6$, calculate the maximum heat which may be released when 7.5 g of C_6H_6 is burned in 45.0 g of $\text{O}_2 (g)$. (Note: this is a limiting reagent problem and you should write the balanced chemical equation first) (15 points)

Maximum heat released = _____

12. Write the electron configurations (show all electrons) for a Na atom. (5 points)

13. Balance the following two equations and write out the final net ionic equations for each. (Note: CO_2 is produced in the second equation) (10 points)



14. BONUS QUESTION: Describe the photoelectric effect and give at least one reason why quantization of light energy is important in its physical description. (Note: use no more than 6 sentences) (5 bonus points)