

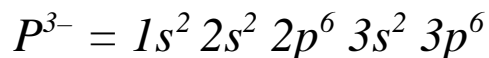
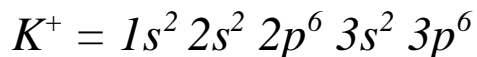
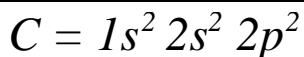
Name: Key-manius Rex
120 points
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Test 2
Chemistry 121A
November 8, 1999

SHOW ALL CALCULATIONS FOR FULL CREDIT

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

- Which of the following has the greatest number of significant figures? (4 points):
A) 1.02 B) 0.0034 C) 1.003 **D) 1.3001** E) 0.005001
- Which of the following has the greatest number of neutrons? (4 points)
A) ^{105}Rh B) ^{144}Nd C) ^{140}Ce D) ^{104}Rh **E) ^{145}Nd**
- How many grams of carbon are present in 44.0 g of CO_2 ? (4 points)
A) 12.0 g B) 24.0 g C) 44.0 g D) 16.0 g E) 56.0 g
- Which of the following is a strong base? (4 points)
A) RbOH B) $\text{HC}_2\text{H}_3\text{O}_2$ C) NH_3 D) HCl E) $\text{Fe}(\text{OH})_2$
- How much heat is required to heat a 10.0 g block of iron from 25.0°C to 500.0°C ? (4 points, the specific heat for iron is $C = 0.480 \text{ J / g }^\circ\text{C}$)
A) 120 J **B) 2280 J** C) 2400 J D) 2520 J E) 9900 J
- Which of the following orbitals is spherically symmetric? (4 points)
A) 2p B) 3d **C) 4s** D) 4f E) 6p
- Write the complete (no noble gas abbreviations) electron configurations for C, K^+ , and P^{3-} . (15 points)



Name: _____

Test 2

8. Name the following ionic compounds and indicate the solubility. (10 points)

BaCl ₂	<u>Barium Chloride</u>	<u>soluble/insoluble</u>
Pb ₃ (PO ₄) ₂	<u>Lead (II) Phosphate</u>	<u>soluble/insoluble</u>
Na ₂ SO ₃	<u>Sodium Sulfite</u>	<u>soluble/insoluble</u>

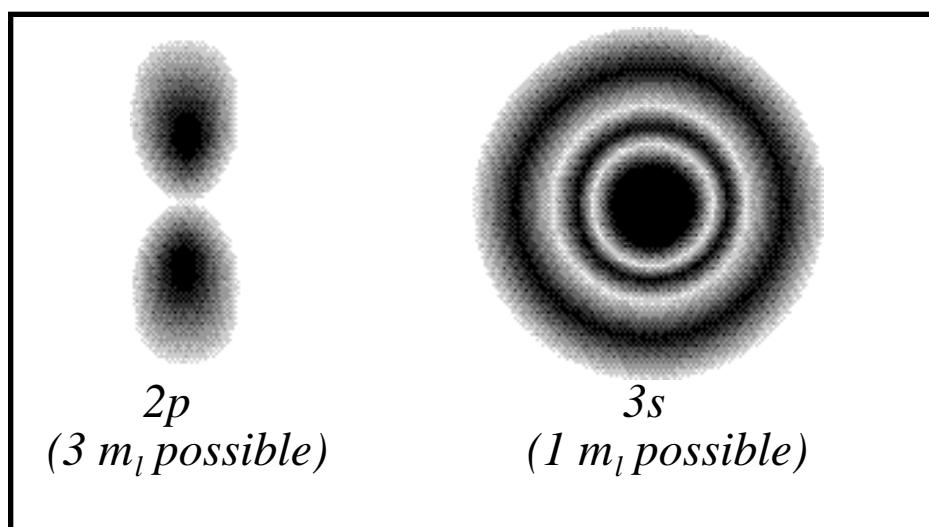
9. Write the empirical formula for the following compounds and indicate the solubility. (10 points)

aluminum nitrate	<u>Al(NO₃)₃</u>	<u>soluble/insoluble</u>
ammonium bromide	<u>NH₄Br</u>	<u>soluble/insoluble</u>
copper (II) hypochlorite	<u>Cu(ClO)₂</u>	<u>soluble/insoluble</u>

10. Calculate the frequency of light emitted from a hydrogen atom when its electron falls from the $n = 5$ to the $n = 2$ state. (Potentially Useful Equations: $E_n = -R_H / n^2$, $E = h \nu$, $h = 6.626 \times 10^{-34}$ J s, $R_H = 2.18 \times 10^{-18}$ J) (10 points)

$$E = E_5 - E_2 = 2.18 \times 10^{-18} \text{ J} (1/2^2 - 1/5^2) = 4.58 \times 10^{-19} \text{ J}$$
$$\nu = E / h = 4.58 \times 10^{-19} \text{ J} / 6.626 \times 10^{-34} \text{ J s} = 6.91 \times 10^{14} \text{ Hz}$$

11. Draw pictorial representations of both an $n = 2, l = 1$ and an $n = 3, l = 0$ orbital. Indicate normal notation used to describe each orbital (i.e. 4f, 6s, ...) and the number of distinct m_l possible for each case. (15 points)



Name: _____

Test 2

12. How many mL of a 0.251 M HCl solution are required to titrate a 1.251 g sample of Ba(OH)₂ dissolved in 100.0 mL to a phenolphthalein endpoint? (10 points)

$$1.251 \text{ g Ba(OH)}_2 \times (1 \text{ mol} / 171.34168 \text{ g}) \times (1 \text{ mol H}^+ / 2 \text{ mol OH}^-) \times \\ (1000 \text{ ml HCl} / 0.251 \text{ mol H}^+) = 14.5 \text{ ml HCl}$$

13. Calculate the H_{rxn} for combustion of octane and then determine the amount of energy released if 500.0 g of octane (C₈H₁₈, $H_f = -251 \text{ kJ/mol}$) is burned completely in air to produce water (H₂O, $H_f = -285 \text{ kJ/mol}$) and carbon dioxide (CO₂, $H_f = -393 \text{ kJ/mol}$). (20 points)



$$\Delta H_{\text{rxn}} = 16 \times (-393 \text{ kJ/mol}) + 18 \times (-285 \text{ kJ/mol}) - 2 \times (-251 \text{ kJ/mol}) \\ = -10,900 \text{ kJ/mol reaction}$$

$$500.0 \text{ g C}_8\text{H}_{18} \times (1 \text{ mol} / 114.23092 \text{ g}) \times (1 \text{ mol reaction} / 2 \text{ mol C}_8\text{H}_{18}) \times \\ (10900 \text{ kJ released} / \text{mol reaction}) = 23,900 \text{ kJ released} = 23.9 \text{ MJ released}$$

note that the negative ΔH indicates an exothermic reaction which releases heat.

14. What is the concentration of a solution of 5.21 g of CuSO₄ diluted to 500.0 mL with distilled water? What is the concentration of a second solution prepared by dilution of 25.0 mL of the original solution to 250.0 mL with distilled water? (6 points)

$$[\text{Cu}^{2+}]_{\text{initial}} = 5.21 \text{ g CuSO}_4 \times (1 \text{ mol} / 159.6096 \text{ g}) / 0.5000 \text{ L} \\ = 0.0163 \text{ mol} / \text{L} = 0.0163 \text{ M}$$

$$[\text{Cu}^{2+}]_{\text{final}} V_{\text{final}} = [\text{Cu}^{2+}]_{\text{initial}} V_{\text{initial}} \\ [\text{Cu}^{2+}]_{\text{final}} = [\text{Cu}^{2+}]_{\text{initial}} V_{\text{initial}} / V_{\text{final}} = 0.0163 \text{ M} \times (25.0 \text{ mL}) / \\ (250.0 \text{ mL}) \\ = 0.00163 \text{ M}$$