CHEMISTRY 101   SPRING 2005
EXAM 2   FORM A   SECTIONS 501-511   DR. KEENEY-KENNICUTT

Directions: (1) Put your name and signature on PART 2 of the exam where indicated.
(2) Sign the Aggie Code on PART 2 of this exam.
(3) Each multiple choice question is actually 2 questions on your scanning sheet. If you are sure of an answer, **put the same answer down for both questions** for 5 pts. If you cannot decide between two answers, put one answer down for one question and the other answer down for the other question. If you get one correct you'll get half credit for 2.5 pts. If there is an ambiguous multiple choice question, use the last page to explain your answer.
(4) Do NOT write on the envelope.
(5) When finished, put everything in the envelope and wait to be excused. At the table, take everything out of the envelope. You can pick up the multiple choice part with the answers outside my office after the exam.
(6) There are a total of 30 questions (18 actual questions).

PART 1

1&2. What is the oxidation number of chromium in the ion, $Cr_2O_7^{2-}$?

(a) +6   (b) +5   (c) +4   (d) +3   (e) +2

3&4. Which of the following is classified as a strong soluble base?

(a) $Cu(OH)_2$ (b) $Ca(OH)_2$ (c) $Fe(OH)_3$ (d) $Al(OH)_3$ (e) $Ni(OH)_2$

5&6. Which of the following elements is diamagnetic in its ground state?

(a) F   (b) S   (c) B   (d) Be   (e) Si

A1

7&8. How many neutrons are in an atom of the isotope ^{90}Sr?

    (a) 90   (b) 63   (c) 1   (d) 52   (e) 0

9&10. You are given the data for all the isotopes of the newly discovered element, Aggiemomium:

Abundance (%)	Isotopic Mass (amu)
30.00	143.00
60.00	145.00
10.00	149.00

What is the atomic weight of Aggiemomium (in amu)?

    (a) 145.5   (b) 146.0   (c) 145.2   (d) 145.0   (e) 144.8

11&12. The maximum number of electrons that may be assigned to the orbitals in the 4th principal energy level ($n = 4$) is:

    (a) 16   (b) 32   (c) 8   (d) 20   (e) 30

13&14. Which of the following statements is FALSE?

(a) If an electron has the quantum number $n = 2$, the electron could be in p energy sublevel.
(b) If an electron has the quantum number $\ell = 1$, the only possible values of m_ℓ are -1, 0 and +1.
(c) An electron that has $n = 3$ might be in an f energy sublevel..
(d) If an electron has $m_\ell = -1$, it might be in a p, d, or f energy sublevel, but not in an s energy sublevel. .
(e) An electron that has $n = 4$ could be in an s, p, d, or f energy sublevel.

15&16. Which is the appropriate name for SF_4?

(a) sulfur(IV) fluoride

(b) sulfur fluoride

(c) sulfur quatrafluorine

(d) monosulfur quatrafluoride

(e) sulfur tetrafluoride

17&18. After the 4p subshell of an atom is filled, the next electron is located in the _____ subshell:
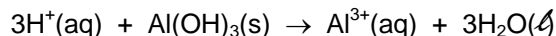
(a) 3d   (b) 4d   (c) 5s   (d) 4f   (e) 5p

19&20. An appropriate set of 4 quantum numbers for the "last" electron to go into an atom of platinum (Pt, atomic number 78) could be:

	n	ℓ	m_ℓ	m_s
(a)	5	3	-3	+1/2
(b)	4	3	0	-1/2
(c)	5	2	2	+1/2
(d)	4	2	-2	-1/2
(e)	5	1	0	-1/2

OVER $\Rightarrow$

A3

21&22. Which of the following statements is TRUE given the following net ionic equation?

$$3H^+(aq) + Al(OH)_3(s) \rightarrow Al^{3+}(aq) + 3H_2O(l)$$

(1) The base in this reaction is a strong electrolyte.

(2) The acid could be HNO_3.

(3) This could be the net ionic equation for H_3PO_4 reacting with $Al(OH)_3$.

(4) The salt produced could be $Al(CH_3COO)_3$.

(5) This reaction is classified as a precipitation reaction.

(6) The spectator ion could be ClO_4^-.

(a) all are correct   (b) none are correct   (c) 2, 3, 5, 6 only

(d) 2, 6 only   (e) 3, 5, 6 only

23&24. The odor of skunks is caused by chemical compounds called thiols. These compounds, of which butanethiol ($C_4H_{10}S$) is a representative example, can be deodorized by reaction with household bleach (NaOCl) according to the following equation. How many grams of butanethiol can be deodorized by reaction with 10.0 mL of 0.200 M NaOCl?

$$2C_4H_{10}S + NaOCl \rightarrow C_8H_{18}S_2 + NaCl + H_2O.$$

(a) 0.361 g   (b) 0.175 g   (c) 352 g   (d) 183 g   (e) 1.04 g

A4

PART 2

Please read and sign: "On my honor, as an Aggie, I have neither given nor received unauthorized aid on this exam." _____

25. Consider the reaction: $As_2O_3 + 5H_2O + 2I_2 \rightarrow 2H_3AsO_4 + 4HI$.

(2 pts) Which is the element being oxidized? _____

(2 pts) The element changes in oxidation number from ____ to ____.

(2 pts) The oxidizing agent is _____.

(6 pts) **26.** Write the formula unit, total ionic and net ionic equations for the neutralization reaction that would yield the salt, $Fe(ClO_4)_3$. (Note: there will be deductions if you forget to put the correct phase and charges for all species **for all equations**.)
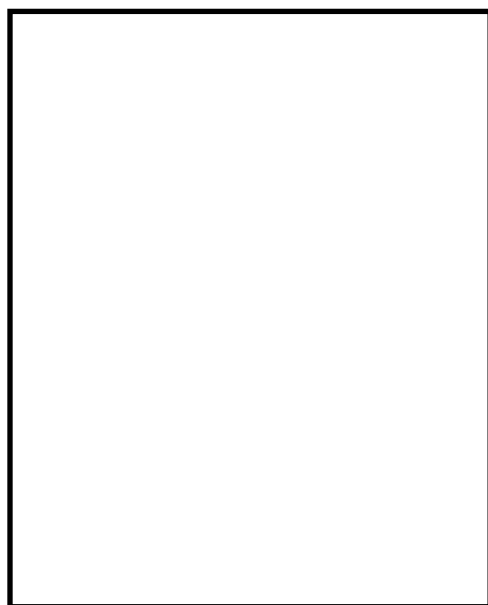
OVER $\Rightarrow$

(7 pts) **27.** In class we had a demonstration of the emission lines of hydrogen. In this experiment, 4.09×10^{-19} J of energy is released as blue-green light when one electrons falls from the n=4 to the n=2 principle energy level.

Calculate the wavelength of light emitted (in Å) when one excited electron went from the n=4 energy level to the n=2 energy level. (1 Å = 1×10^{-10} m)
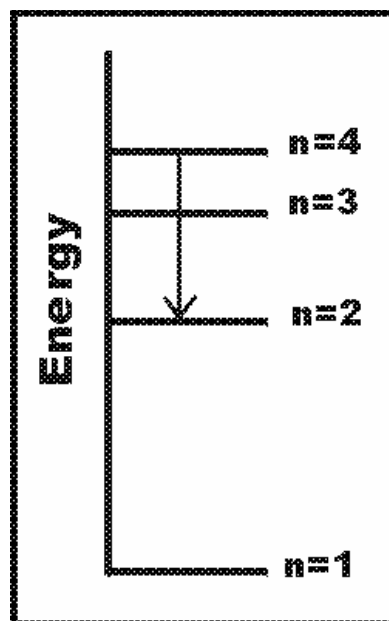
(6 pts) **28.** (a) Write the formula unit, total ionic and net ionic equations for the precipitation reaction between sodium carbonate and copper(II) nitrate. (Note: there will be deductions if you forget to put the correct phase and charges for all species **for all equations**.)

(4 pts) (b) Show all the major species present in the beaker before the reaction occurs and after the reaction is finished. You don't need to include water.

BEFORE

AFTER

OVER $\Rightarrow$

(6 pts) **29.** Sketch the following orbitals. Label the relevant axes.

        (a) p_y orbital   (b) $d_{x^2-y^2}$ orbital

(5 pts) **30.** Write out an acceptable ground state electronic configuration for the unknown element with atomic number 115. Use the correct noble gas to abbreviate the configuration.

SCRAP PAPER OR COMMENTS ON EXAM