**CH 117 Mock Exam V**

Name:

Please keep your answers covered as you proceed through the exam. Each question is worth 6 points.

1. Americium-241 is the isotope used in US smoke detectors. Plutonium-241decays by emitting a beta particle with a fairly short half-life of 14 years to generate americium-

241. How many J/mol of energy are released for the decay? Masses in amu are: Pu-241 241.0568453;

Am-241 241.0568229 (the electron is part of the Am-241 atom)

a) +7.21 x 103 b) +3.43 X 1010 c) +2.33 x 10-13 d) +9.57 X *10ZZ* e) +2.02 x 109

2. Technicium-98 decays to ruthenium-98. What type of decay is this?

a) alpha b) beta

c) gamma d) delta

e) moral

3. The half-life ofamericium-241 is 470 years. A 1.0

gram sample in a lab survives the end of civilization which is

prophesied by the Mayan calendar to occur next year. The

next era is scheduled to end 5127 years from now. How many gram of Am-241 will there be after 5127 years?

6. When nitric acid (an oxidizing acid) reacts with a metal, nitrogen monoxide gas is generated. What is the standard reduction potential of the appropriate half-reaction in Appendix I?

a) 0.15 V

b) 0.01 v

c) 1.7 V

d) 0.96 v

e) 0.682 V

7. Which metal will react spontaneously with nitrate in acidic solution to form NO, but not with an acidic solution containing H+ only to form H2 ? Hint: see answer to prob. 6. a) Na

b) Zn c) Cu d) *F2* e) Al

8. In an electrolytic cell that manufactures Clz and NaOH,

the overall reaction is 2 Cl- + 2 H2O Cl2 + H2 + 2 OH-

a) Cl is oxidized from-2 to 0, 0 is oxidized 0 to +2 b) Cl is oxidized from -1 to 0, H is reduced+1 to 0 c) Cl is reduced from 0 to +2, 0 is reduced 0 to -2 d) Cl is reduced from +2 to 0, His oxidized 0 to +2 e) H is reduced

a) 1.00 b) 0.50 c) 0.25 d) 0.125

e) 0.00052

4. For the electrochemical cell where the balanced reaction is 2 Fe3+ (aq) + Cu (s) *Cu2+* (aq) + 2 *Fe2+* (aq), n

lS:

a)l b) 2 c) 3 d) 4 e) 12

5. What is the potential of the cell (in V) in problem 4 if

[Fe3+] = 1.0 x 10-4M, [FeZ+]= 0.20 M,, *[Cuz+]* = 0.20 M?

a) 1.62

b) -0.127 c) 0.25

d) 2.91

e) 0.77

9. In the electrolytic cell above, n=2. How many grams

of NaOH are produced if the cell is run at 30 amps for one hour?

a) 44.8 b) 5880 c) 28.7

d) 147,000

e) 3.66

10. What is the volume of Cl2 gas (in L) at STP from the experiment above? One mol of gas at STP is 22.4 L.

a) 186 b)O.l92 c) 12.5 d) 8.01 e) 20.4

11. The strongest oxidizing agent below is:

a) Au3+

b)Au c) Ca

d) Ca2+

e) *Br2*

Short answer: Answer in the space provided. Put labels on the diagram.

11. Nestle wants to get you wired with more than their instant coffee branded Nescafe , so they invent a battery called Nes-CaFe. (40 points) The standard reduction potential for iron that you need is Fe3 *+* (aq) + 3e- 🡪 *Fe(s)* -0.036V.)

a) Write the balanced chemical reaction (look at each half-cell in th diagram to get the correct half-reaction).

b) Label the cathode and anode

c) Label the poles + and -

d) What is the oxidizing agent?

e) What is the reducing agent?

f) What is oxidized?

g) What is reduced?

h) Label the direction of electron flow.

------



i) Calculate the standard voltage

j) Label the direction that the ions in the salt bridge move

k) Calculate :lG0

Ca

1.0 Mea 2 +

Fe.

1.0 *M* Fe3+ aq)

1) Calculate K0

Formulas:

llG0 = -nFE0

llG0 = -RT ln(K) ; llG0 = llH- T llS ; llG = /:lG0 + RT ln(Q) ; E = E0

;

- { 0.0592 V log (Q) }/n

I coulomb (C) = 1 ampere x 1 second ; R = 0.0821 L atrn *I* (mol K) ; R = 8.314 J /(mol K) ; F = 96,500 C/mol