Chem 122 Rybolt Exam 3 Fall 2009 Name_____

Numerical constants may be listed below. Other needed information is given in the problem or written on the board or found in the periodic tables you will use during exam. For numerical problems, be sure to **show your work**, include units and circle your final answer. If several choices are given, **circle the one correct answer**. Your written answers should be brief and to the point. You can use only your own calculator on the exam, but no notes, books, external information, or other electronic devices are to be used. No cell phone is to be used in Exam room.

1 cal = 4.184 J c = 3.00 x 10^8 m/s 1 atm = 760 torr = 1.01x10^5 N/m^2 h = 6.63 x 10^{-34}Js

R = 0.08206 (L atm/ mol K) R = 8.31 J/mol K (K) = (^{o}C) + 273 (^{o}C) = (^{o}F - 32) / 1.8

1 g = 6.02x10^{23} amu 1 F =96485C/mol of e $\Delta G^o = -n F E^o$ $\Delta G^o = -R T \ln K$

$E = E^o - (0.0592/n) \log(Q)$ $\ln(N/N_o) = -kt$ or $\ln N = \ln N_o - k t$ $0.693 = k\, t_{1/2}$ J = C V A=C/s

1) Consider the following reaction Zn (s) + 2 HCl (aq) → $ZnCl_2$ (aq) + H_2(g)

The oxidation number of zinc in Zn is _____ and ox nu of H in H_2 is _____

2) The oxidation number of hydrogen in HCl is _____ and ox nu of Zn in $ZnCl_2$ is _____

3) In the combustion of methane for heating in a home we could write the following balanced equation and because of the changes in oxidation number we should say that C is

CH_4 + 2 O_2 → CO_2 + 2 H_2O

a) reduced b) oxidized c) not reduced or oxidized

4) Using the reaction MnO_4^- + H_2SO_3 ⇔ SO_4^{2-} + Mn^{2+} write two half reactions showing appropriate number of electrons for each half reaction as written

5) Now balance by first combining the two half reactions above appropriately and then adding H^+ and H_2O as needed assuming that this reaction takes place in a basic aqueous solution

6) You have an idea to make a gold and aluminum battery (galvanic cell) and you decide you need to do some preliminary calculations. First what is the overall balanced <u>spontaneous</u> chemical reaction obtained by combining these half reactions to obtain a correct redox reaction?

$Au^{3+} + 3e \Leftrightarrow Au$ 1.42V
$Al^{3+} + 3e \Leftrightarrow Al$ -1.66V

7) Second what is the standard state potential (volts) or electromotive force E^o obtained for this reaction?

8) Third complete the abbreviated cell representation below based on the reaction above

Al(s) | || |

9) And fourth at the Aluminum electrode which of the following is true

oxidation is occurring at the cathode reduction is occurring at the anode
oxidation is occurring at the anode reduction is occurring at the cathode

10) The standard state potential $E^o = 1.76$ V for the reaction
$Cl_2(g) + Cd(s) \Leftrightarrow Cd^{2+}(aq) + 2\,Cl^-(aq)$ is based on 2e on each side of half reaction or n=2
So therefore what is the voltage potential of E for the same reaction where conditions are not at standard but rather $[Cl^-]=0.55M$ and $[Cd^{2+}]=0.55M$ and $P_{Cl2}=2.55atm$

11) What is the value of ΔG^o (kJ) for a reaction if $E^o = +3.08V$ and the number of electrons is n=3mol

12) _____ is a halogen that exists as a red liquid.
bromine fluorine chlorine iodine

13) Balance the following fusion nuclear reaction which shows how a heavier element can be created from a lighter ones as it is in the interior of our sun and stars throughout the universe

$^{2}_{1}H + {}^{3}_{1}H \rightarrow \{ \quad \} + {}^{1}_{o}n$ + energy

14) Which of these noble gases has the highest boiling point
He Ne Ar Kr Xe

15) SiO_2 is made of:
small molecules of SiO_2 positive and negative ions
positive atoms and free electrons an extended 3–dimensional network of Si and O atoms

16) For a reaction with a potential of $E^0 = +3.08V$, you can expect that the equilibrium constant, K is

very small a little more than 1 a little less than 1 very large

17) A 15.5 ampere (A) current is passed for 888 seconds through a solution containing Al^{3+} ions. How many moles of Aluminum would plate out based on the half reaction $Al^{3+} + 3e \rightarrow Al$?

18) Complete the following equation associated with beta emission.

$^{27}_{12}Mg \rightarrow {}^{0}_{-1}e + \{ \quad \}$

19) NASA uses plutonium-238 isotope as a source of heat to generate electricity for all its deep space missions. In the past this isotope was made at the Savannah River National Laboratory in Aiken, SC. Neptunium-237 was placed in a reactor and allowed to absorb neutrons. Complete the missing parts below:

$^{237}_{93}Np + {}^{1}_{0}n \rightarrow \{ \quad \} \rightarrow {}^{238}_{94}Pu + \{ \quad \}$

20) Plutonium $^{238}_{94}Pu$ has how many neutrons and how many electrons

21) The size of atom is due to its
protons neutrons electrons photons

22) Protons and neutrons in close contact in the nucleus are attracted to each other by
gravity strong force electromagnetism vacuum pressure

23) Gold has a density of 19.3 g/mL and Aluminum is 2.70 g/mL. Although there are differences in the size and packing of the gold and aluminum atoms, another critical factor in this density difference is that relative to aluminum,
gold has more _____ and _____ in the _____ of each Au atom.

24) Which of these metals is very soft and can be cut with a steel knife
Na Ti Fe Cu Ni

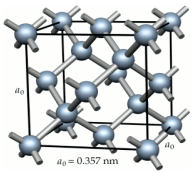
25) Metal that was used in a compound added to gasoline (banned about 2 decades ago in US) to make engine burn smoother (acted as antiknock agent)
Mg V Cr Cu Pb

26) Most abundant metal in the earth's crust but more expensive than gold in 1855.
Al Ag Na U

27) If 10.000 grams of ^{234}U are sealed in a container and then opened many years later —exactly how time has passed if the amount of uranium isotope left in the container is 1.8222g given that the half life of this isotope of uranium is $t_{1/2}$ = 200,000 year

28) Element found in the greatest number of compounds because of its unique ability to form long chains and rings.
Ar B C Si S

29) This diagram illustrates the connections found in



diamond graphite carbon nanotubes buckyballs

30) By mass your body is mostly
H C U O Cl

31) Is stronger than steel and a better conductor of electricity than copper.
sodium chloride carbon nanotube silicon dioxide sodium

32) This element has the lowest density as a gas: C H At Ta No O Ga