Grossmont College

Periodic Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IA |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | VIIA | NOBLE GASES |
| 1  **H**  1.008 | IIA |  |  |  |  |  |  |  |  |  | |  | IIIA | IVA | VA | VIA | 1  **H**  1.008 | 2  **He**  4.002 |
| 3  **Li**  6.941 | 4  **Be**  9.012 |  |  |  |  |  |  |  |  |  | |  | 5  **B**  10.81 | 6  **C**  12.01 | 7  **N**  14.01 | 8  **O**  16.00 | 9  **F**  19.00 | 10  **Ne**  20.18 |
| 11  **Na**  23.00 | 12  **Mg**  24.30 | IIIB | IVB | VB | VIB | VIIB | VIII VIII VIII | | | | IB | IIB | 13  **Al**  27.00 | 14  **Si**  28.09 | 15  **P**  30.97 | 16  **S**  32.06 | 17  **Cl**  35.45 | 18  **Ar**  39.95 |
| 19  **K**  39.10 | 20  **Ca**  40.08 | 21  **Sc**  44.96 | 22  **Ti**  47.90 | 23  **V**  50.94 | 24  **Cr**  52.00 | 25  **Mn**  54.94 | 26  **Fe**  55.85 | 27  **Co**  58.93 | 28  **Ni**  58.70 | | 29  **Cu**  63.55 | 30  **Zn**  65.38 | 31  **Ga**  69.72 | 32  **Ge**  72.59 | 33  **As**  74.92 | 34  **Se**  78.96 | 35  **Br**  79.90 | 36  **Kr**  83.80 |
| 37  **Rb**  85.47 | 38  **Sr**  87.62 | 39  **Y**  88.91 | 40  **Zr**  91.22 | 41  **Nb**  92.91 | 42  **Mo**  95.94 | 43  **Tc**  (99) | 44  **Ru**  101.1 | 45  **Rh**  102.9 | 46  **Pd**  106.4 | 47  **Ag**  107.9 | | 48  **Cd**  112.4 | 49  **In**  114.8 | 50  **Sn**  118.7 | 51  **Sb**  121.8 | 52  **Te**  127.6 | 53  **I**  126.9 | 54  **Xe**  131.3 |
| 55  **Cs**  132.9 | 56  **Ba**  137.3 | 57  **La**  138.9 | 72  **Hf**  178.5 | 73  **Ta**  180.9 | 74  **W**  183.9 | 75  **Re**  186.2 | 76  **Os**  190.2 | 77  **Ir**  192.2 | 78  **Pt**  195.1 | 79  **Au**  197.0 | | 80  **Hg**  200.6 | 81  **Tl**  204.4 | 82  **Pb**  207.2 | 83  **Bi**  209.0 | 84  **Po**  (209) | 85  **At**  (210) | 86  **Rn**  (222) |
| 87  **Fr**  (223) | 88  **Ra**  226.0 | 89  **Ac**  227.0 | 104  **Rf**  (261) | 105  **Db**  (262) | 106  **Sg**  (263) | 107  **Bh**  (262) | 108  **Hs**  (265) | 109  **Mt**  (266) | 110  **??**  (269) |  | |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 58  **Ce**  140.1 | 59  **Pr**  140.9 | 60  **Nd**  144.2 | 61  **Pm**  (147) | 62  **Sm**  150.4 | 63  **Eu**  152.0 | 64  **Gd**  157.3 | 65  **Tb**  158.9 | 66  **Dy**  162.5 | 67  **Ho**  164.9 | 68  **Er**  167.3 | 69  **Tm**  168.9 | 70  **Yb**  173.0 | 71  **Lu**  175.0 |
| 90  **Th**  232.0 | 91  **Pa**  231.0 | 92  **U**  238.0 | 93  **Np**  (237) | 94  **Pu**  (244) | 95  **Am**  (243) | 96  **Cm**  (247) | 97  **Bk**  (247) | 98  **Cf**  (251) | 99  **Es**  (252) | 100  **Fm**  (257) | 101  **Md**  (258) | 102  **No**  (259) | 103  **Lr**  (260) |

Chemistry 142 Name \_Key\_\_\_\_\_

Martin Larter

Exam 4 May 2009

Page 1 (12 points)

Page 2 (24 points)

Page 3 (20 points)

Page 4 (17 points)

Page 5 (17 points)

Total (90 points)

Percent (100 %)

**All work must be shown to receive credit. Give all answers to the correct number of significant figures**

**Constants**

|  |  |  |
| --- | --- | --- |
| NA = 6.022 x 1023 mol-1 | h=6.626x10-34 J sec | c=3.00x108 m sec-1 |
| R = 8.3145 J/(mol K) = 0.08206 L atm/(mol K) | Kw = 1x 10-14 M2 | F = 96,485 C/mol |
| h= 6.626 x 10-34 J\*s | 1 amu =1.6605 x 10-27 kg |  |

**Equations**

|  |  |  |
| --- | --- | --- |
| ΔG = ΔH – TΔS | Δ=hc/λ | ΔGo = = – RT Ln Keq |
| ΔG = –nFE |  | *G* = *G*o + RT ln *Q* |
| pH= -Log[H+] | Ln [A] = Ln [A]o – kt | [A] = [A]o e- kt |
| t1/2 = Ln2/ k | 1 = 1 + 2kt  [A]2 [A]o2 | Kw=Ka\*Kb |
| PT = P1 + P2 + P3 + .............. | ∆E=∆mc2 | x=-b ± (b2 – 4ac)½  2a |
| t½ = 3  2k[A]o2 | t1/2 = [A]o  2k | 1 = 1 + kt  [A] [A]o |

1. Multiple Choice: (8 pts)
2. Which of the following may contain a double bond?
3. **C4H8**  B) C4H10 C) C4H6 D) C5H12
4. Which of the following statements is true: (mistake)
5. Fission reactions involve the combination of two smaller nuclides to make a larger nuclide
6. Fusion involves the splitting of larger nuclides into smaller nuclides
7. In both fission and fusion reactions, energy is released because the mass of the product nuclides is greater than the mass of the reactant nuclides
8. The mass of a nuclide is greater then the sum of the masses of its constituent protons and neutrons
9. Protons attract each other, and this explains why a nucleus holds together
10. When a beta particle is emitted,
11. An electron is converted to a helium nucleus.
12. A gamma ray is released.
13. Two gamma rays are released.
14. Proton is converted to a neutron.
15. **Neutron is converted to a proton**
16. The structure of amphetamine is shown to the below. What is the molecular formula of amphetamine?



**(a) C9H13N** (b) C8H2N (c) C8H7NO (d) C9H10N (e) C7H14N

1. Short Answer
2. Explain how nuclear reactions differ from ordinary chemical reactions. (4 pts)

Nuclear reactions involve protons and neutrons….the nucleus. Chemical reactions involve valence electrons. Nuclear reactions release much more energy than do chemical reactions.

1. Write a balanced nuclear equation for each of the following reactions: (12 pts)
   1. 212Po decays by emission:\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_
   2. 137Cs decays by emission:\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. 55Fe undergoes electron capture:\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_
   4. 84Zr decays by positron emission:\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   5. 232Th undergoes an , , and another  emission:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. :\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Nuclear disarmament could be accomplished if weapons were not "replenished." The tritium in nuclear warhead decays with a half-life of 12.26 yr to helium, and must be periodically replaced or the weapon is useless. What fraction of the tritium is lost in 5 years? (8 pts)

t1/2 = Ln2/ k k= 0.693/12.26 yr = 5.65 x10-2 yr-1

Ln( [A]/[A]o) = – kt Ln( [A]/[A]o) = – 5.65 x10-2 yr-1(5 yrs)

[A]/[A]o = e– 5.65 x10-2 yr-1(5 yrs) = 0.753

75.3% tritium remains after 5 years and **24.6% is lost in 5 years**

1. Give an example of a stable isotope of oxygen (using the concept of the stability belt) and a radioactive isotope of oxygen and explain why the one is stable and the other one is instable (determine the mode of decay). (4 pts)

16-O is stable, having 8 protons and 8 neutrons, it has a n/p ratio = 1 (since the strong force and the repulsion force cancel each other). 17-O is not stable, having more neutrons than protons (n/p > 1) (repulsion greater than strong force in the nucleus) and would undergo beta decay.

1. The most abundant natural isotope of copper is 63Cu. It has an atomic mass of 62.93433 amu. Given the mass of a proton of 1.00728 amu and the mass of a neutron of 1.00866 amu, calculate the binding energy of 63Cu (in units of J) and the binding energy per nucleon (in units of J/nucleon). (8 pts)

63Cu *has 29 protons and 34 neutrons. Add up the masses of 29 protons and 34 neutrons and subtract the atomic mass of 63Cu to determine the mass defect:*



*In order to calculate the mass defect, convert this mass into energy by using E = mc2. First, convert the mass defect to kilograms:*



*The binding energy, in units of J, is equal to:*



*Divide the binding energy by the mass number of 63Cu (63) to obtain the binding energy per nucleon:*



1. For each pair of isotopes listed, **circle** the nuclide that is radioactive and explain why: (6 pts)
2. 42 95*Mo or* **4392*Tc***

4392Tc contains odd number of protons and neutrons which is very unstable where 42 95Mo contains even number of protons and a odd number of neutrons. The even number of protons in 42 95Mo gives the compound more stability

1. 2040*Ca or***2045*Ca***

2045*Ca is more unstable than* 2040*Ca* since calcium-40 contains a magic number of protons and neutrons giving it increased stability. The calcium 45 on the other hand contains a odd number of neutrons (which undermines its stability) and has only a magic number of protons.

1. Draw isomeric structures (showing all atoms) of C3H7NO with the following characteristic functional groups: (6 pts)
2. A cyclic ether with an amine group b) An amide

 

1. Warfarin is used to prevent blood clots from forming or growing larger in your blood and blood vessels. Circle and label 4 functional groups in Warfarin? (5 pts)



A.\_\_\_\_Ketone \_\_\_\_\_\_\_ B.\_\_\_\_\_aromatic\_\_\_\_\_\_\_\_ C.\_\_\_\_ester\_\_\_\_\_\_\_\_\_\_

D\_\_\_\_alkene\_\_\_\_\_\_\_\_\_ E.\_\_\_\_alcohol \_\_\_\_\_\_\_\_\_\_

1. Name the following compounds using IUPAC rules (6 pts)





Name\_\_\_\_trans-3,4-dimethyl-2-octene\_\_\_\_\_\_ Name\_\_3,7-dichloro-3,6,6-trimethyldecane\_

1. Draw the structure for each of the following names: (6 pts)

a) 3-isopropylcyclopentene b) 8-bromo-5-*tert*-butyl-2-octyne

 

1. Describe the relationship between each of the following pairs of structures as one of the following: identical, cis-trans isomers, constitutional isomers, or different compounds.(4 pts)



\_\_\_\_ identical\_\_\_\_\_ \_\_\_\_ constitutional isomers \_\_\_\_\_

1. Draw the structures of the major organic products of the following reactions. (9 pts)





1. 235U is fissionable; 238U is not. Explain what “fissionable” means and give a reaction that illustrates this point. (The equation doesn’t have to be correct, but should illustrate the point you are trying to make.) (4 pts)

A fissionable isotope means that bombarding the nucleus with a neutron produces more neutrons, so that the reaction is self sustaining. 235-U is fissionable, because bombarding the nucleus with one neutron produces three neutrons.



On the other hand, 238-U is not fissionable:

