Chemistry 102 Name KEY

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Exam 1a Spring 2017

 Multiple Choice (30 points)

 Page 5 (points)

 Page 6 (points)

 Page 7 (points)

 Total (100 points)

All work must be shown to receive credit. Give all answers to the correct number of significant figures. Percentage must be written at a conversion factor.

Bonus Question

Why is a radioactive nuclide which is an alpha emitter a bad choice in medical diagnostics or imaging? Give two reasons in a complete sentence or two.

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) |

Lanthanide series

Actinide series

Part 1 – Multiple Choice (30 points)

1. The elements below are used in fireworks. Which one is *not* classified correctly according to its position in the periodic table?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | Sodium is an alkali metal. | d. | Phosphorus is a nonmetal. |
| b. | Strontium is an alkaline earth metal. | e. | Sulfur is a metalloid. |
| c. | Iron is a transition metal. |

1. A chemist is given an unknown sample. Which of her observations is **not** a physical property?

|  |  |
| --- | --- |
| 1. The sample is a colorless liquid.
 | 1. The sample has an odor similar to gasoline.
 |
| 1. The sample is flammable.
 | 1. The sample size is 55 mL
 |
| 1. The density of the liquid is 0.789 g/mL.
 |  |

1. A pure substance is matter that consists of matter with a composition that \_\_\_\_\_\_\_\_.

|  |  |
| --- | --- |
| * 1. Is fixed in a definite proportion at all times
 | * 1. Varies according to the amount of water present
 |
| * 1. Depends on the temperature
 | * 1. Always contains oxygen
 |
| * 1. Always contains two or more substances
 |  |

1. The cubic centimeter (cm3 or cc) has the same volume as a \_\_\_\_\_\_\_\_.

|  |  |  |
| --- | --- | --- |
| 1. cubic inch
 | 1. milliliter
 | 1. cubic liter
 |
| 1. centimeter
 | 1. cubic decimeter
 |  |

1. Which of the following numbers contains the designated CORRECT number of significant figures?

|  |  |
| --- | --- |
| 1. 0.04300 5 sig figs
 | 1. 0.00302 2 sig figs
 |
| 1. 3.0650 4 sig figs
 | 1. 1.04 2 sig figs
 |
| 1. 156,000 3 sig figs
 |  |

1. The correct answer for the addition of 7.5g + 2.26g + 1.311g + 2g is

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 13.071g
 | 1. 13g
 | 1. 13.0g
 | 1. 10g
 | 1. 13.1g
 |

1. Technetium often is used to image areas of bone growth because it is a radioisotope with a half-life of 6 hours that emits gamma rays. A  ion has \_\_\_\_\_\_\_\_\_\_ protons, \_\_\_\_\_\_\_\_\_\_ neutrons, and \_\_\_\_\_\_\_\_\_\_electrons.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 99, 43, 98 | d. | 56, 43, 43 |
| b. | 43, 99, 42 | e. | 43, 99, 43 |
| c. | 43, 56, 42 |

1. Different isotopes of an element are atoms of that element which have
	1. The same atomic number and the same mass number
	2. The same atomic number and different mass number
	3. Different atomic number and the same mass number
	4. Different atomic number and different mass number
	5. None of the above
2. The half-life of a radioisotope is
3. One-half of the time it takes for the radioisotope to completely decay to a nonradioactive isotope.
4. The time it takes for the radioisotope to become an isotope with one-half of the atomic weight of the original radioisotope.
5. The time it takes for the radioisotope to become an isotope with one-half the atomic number of the original radioisotope.
6. The time it takes for the radioisotope to lose one-half of its neutrons.
7. The time it takes for one-half of the sample to decay
8. An anion always

|  |  |
| --- | --- |
| 1. Has a positive charge.
 | 1. Contains a group of two or more atoms with a positive charge.
 |
| 1. Forms covalent bonds
 | 1. Has a negative charge
 |
| 1. Contains a metal and a nonmetal.
 |  |

1. Avogadro's number is the number of

|  |  |
| --- | --- |
| 1. Particles in 1 mol of a substance.
 | 1. Amu in 1 mol of a substance.
 |
| 1. Grams in 1 mol of a substance.
 | 1. Moles in 6.022 × 1023 grams of an element
 |
| 1. Moles in 6.022 × 1023 amu of an element.
 |  |

1. Which of the following has the dipole arrow correctly oriented for the following bonds?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   |    |   |   |   |
| 1. C-C
 | 1. N-H
 | 1. Cl-O
 | 1. N-O
 | 1. C-H
 |

1. The balanced equation for the reaction between aqueous ammonium sulfate and aqueous barium acetate is
2. (NH4)2SO4 (aq) + Ba(C2H3O2)2 (aq) → BaSO4 (aq)+2NH4C2H3O2 (s).
3. (NH4)2SO4 (aq) + Ba(C2H3O2)2 (aq) → BaSO4 (s) + NH4C2H3O2 (aq).
4. (NH4)2SO4 (aq) + Ba(C2H3O2)2 (aq) → BaSO4 (s) +2NH4C2H3O2 (aq).
5. NH4SO4 (aq) + BaC2H3O2 (aq) → BaSO4 (s) + NH4C2H3O2 (aq).
6. (NH4)2SO3 (aq) + Ba(C2H3O2)2 (aq) → BaSO3 (aq) + NH4C2H3O2 (aq)
7. Which type of radiation has the greatest penetration ability?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. alpha
 | 1. beta
 | 1. gamma
 | 1. neutron
 | 1. positron
 |

1. Which of the following formulas contains the **most oxygen** atoms?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * 1. Na2CO3
 | * 1. K2Cr2O7
 | * 1. Ba(ClO3)2
 | * 1. Ca(MnO4)2
 | * 1. Fe(NO2)2
 |

Part 2: Short answers

1. (4 points) The doctor ordered Nafcillin 640 mg by IV. The bottle comes labeled Nafcillin 1.0 g/4.0 mls. How many ml would you give? \_\_\_\_

$$640 mg Nafcillin × \frac{1 g}{1000 mg } ×\frac{4.0 mL}{1 g}=2.6 mL$$

1. (4 points) The recommended adult dose of ElixophyllinTM, a drug used to treat asthma, is 6.00 mg/kg of body mass. Calculate the dose in milligrams for a 115-lb person.

$$115 lb ×\frac{454 g}{1 lb} ×\frac{1 kg}{1000 g} × \frac{6.00 mg}{1 kg}=313 mg$$

1. (6 points) The anesthetic procaine hydrochloride is often used to deaden pain during dental surgery. The compound is packaged as a 15.% solution (by mass). If your dentist injects 0.50 g of the solution, what mass of procaine hydrochloride (in micrograms) is injected (put answer in scientific notation)?

$$0.50 g soln×\frac{15. g PHCl}{100 g soln}×\frac{1×10^{6} μg}{1 g}=7.5×10^{4} μg procaine hydrochloride$$

1. When the human body is exposed to extreme cold, hypothermia can result and the body’s temperature can drop to 28.5˚C. Convert this temperature to K and ˚F.

$$℉=\frac{9}{5}℃+32=\frac{9}{5}\left(28.5℃\right)+32=51.3℉+32℉=83.3 ℉$$

$$K=℃+273.15=\left(28.5℃\right)+273.15=301.7 K$$

1. Pseudoephedrine hydrochloride C10H16ClNO is a nasal decongestant commonly found in cold medication.
2. (3 points) What is the molar mass of pseudoephedrine hydrochloride?

C: (12.01 g/mol)10 = 120.1 g/mol

H: (1.008 g/mol)16 =16.128 g/mol

O: (15.99 g/mol)1 = 15.99 g/mol

N: (14.01 g/mol)1 = 14.01 g/mol

Cl: (35.45 g/mol) 1 = 35.45 g/mol

 = 201.7 g/mol

1. (4 points) How many molecules of pseudoephedrine hydrochloride are in a tablet that contains 0.0350 g of this decongestant?

$0.0350 g C\_{10}H\_{16}ClNO×\frac{1 mol C\_{10}H\_{16}ClNO}{201.7 g C\_{10}H\_{16}ClNO}× \frac{6.022 ×10^{23} C\_{10}H\_{16}ClNO}{1 mol C\_{10}H\_{16}ClNO}=1.04 ×10^{20}C\_{10}H\_{16}ClNO$

1. The isotope gallium-68 has a half-life of 68 minutes. If a diagnostic test is begun with 15 mCi of this isotope,
	1. (4 points) How much is left after a test that runs approximately 2 hours and 15 minutes?

$$2hr×\frac{60 min}{1 hr}+15 min=135 min×\frac{1 half-life}{68 min}=1.98 half-lives≈2 half-lives$$

$$mCi→7.5 mCi→3.75 mCi$$

* 1. (4 points) Gallium-68 decays by positron emission. Write the nuclear equation.

$$\rightarrow +$$

1. (9 points) Write the complete and shorthand electron configuration for an atom of cobalt.
2. Complete configuration 1s2 2s2 2p6 3s2 3p6 4s2 3d7
3. Shorthand configuration [Ar] 4s2 3d7
4. Using boxes to represent orbitals and arrows to represent electrons, draw a picture to show the electrons in the highest occupied **d sublevel**.

$$ $$

1. (10 points) Draw Lewis electron dot structures for the following molecules/ ions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Molecular formula | Valence Electrons | Lewis structure | Molecular geometry  | Bond angle | Polar or nonpolar |
| SiF2O | 24 e- |  | Si atomTrigonal planar | 120 | polar |
| N2F4 | 38 e- |  | N atomTrigonal pyramidal | <109 | Polar |

1. (8 points) Name or write the formula for the following:

|  |  |
| --- | --- |
| **Name**  | **Formula** |
| Magnesium nitride | Mg3N2 |
| Iron (III) chloride  | FeCl3 |
| Dinitrogen oxide or (monoxide) | N2O |
| ammonium phoshite | (NH4)3PO3 |

1. (6 points) Given the balanced equation between aqueous HBr and aqueous Ca(OH)2. What is the total and net ionic equation?

2 HBr (aq) + Ca(OH)2 (aq) 🡪 2 H2O (l) + CaBr2 (aq)

Total ionic Equation: 2H+ (aq) + 2 Br- (aq) + Ca2+ (aq) + 2 OH- (aq) 🡪 2 H2O (l) + Ca2+ (aq) + 2 Br- (aq)

Total Net ionic equation: H+ (aq) + OH- (aq) 🡪 H2O (l)