Dr. Zellmer | Chemistry 1250 | T, R
Time: 7 PM Sun. | Spring Semester 2022 | February 20, 2022
40 min | Quiz V

Name _____ Rec. TA/time _____

Show **ALL** your work or **EXPLAIN** to receive full credit.

1. (5 pts) For the Hydrogen atom, calculate the **wavelength** (in nm) of a photon for a transition from the 7st shell to the 2nd shell? Is this photon being emitted **or** absorbed by the atom? Is this in the visible portion of the electromagnetic spectrum (and how do you know)? (**Show work and explain your answers.**)

2. (3 pts) Which of the following electron transitions requires the smallest energy to be absorbed by the hydrogen atom?

   a) from n = 1 to n = 2
   b) from n = 2 to n = 4
   c) from n = 2 to n = 6
   d) from n = 3 to n = 6
   e) from n = 4 1o n = 6

3. (5 pts) Calculate the de Broglie wavelength for a Ne molecule moving at 0.850 m/s? If this wavelength corresponded to a photon of light would we be able to see it in the visible portion of the electromagnetic spectrum (and how do you know)?

4. The uncertainty principle states that

a) matter and energy are really the same thing
b) it is impossible to know how many electrons there are in an atom
c) there can only be one unknown digit in a number
d) it is impossible to know what orbitals the electrons occupy.
e) it is impossible to know exactly both the position and momentum of an electron.

5. (2 pts) Which of the following sets of quantum numbers are **not** allowed for an electron in an atom?

1) $n = 2$ $\ell = 2$ $m_\ell = -1$ $m_s = +1/2$
2) $n = 3$ $\ell = 1$ $m_\ell = +2$ $m_s = +1$
3) $n = 4$ $\ell = 3$ $m_\ell = -2$ $m_s = -1/2$
4) $n = 8$ $\ell = 6$ $m_\ell = 0$ $m_s = +1/2$

6. Select an answer which includes all of the **CORRECT** statements given below.

1) There are **nine f** orbitals in an f subshell.

2) A **10p subshell** can have a maximum of **6 electrons**.

3) Each **p orbital** within a subshell consists of **four lobes** along the axes.

4) There are 11 **subshells** in the 11^{th} **shell**.

5) For the ground state of an atom, **within a shell**, all the **orbitals** of a **subshell** are filled **prior** to putting electrons in the **next subshell**.

7. The electron configuration for an excited state of Gd is $[Xe]6s^{1}4f^{7}5d^{2}$. How many **unpaired** electrons are in this excited atom? (Be careful!)

8. Which of the following electron configurations corresponds to an element in the same group as an element with a $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^2$ electron configuration?

a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$

b) $1s^2 2s^2 2p^6 3s^2 3p^4$

c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^2$

d) $1s^2 2s^2 2p^3$

e) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$

9. (4 pts) Fill in the blanks with the correct answer to each of the following.

(a) Which has the **smaller** ionization energy, $_{32}Ge$ or $_{15}P$? _____

(b) Which is **largest** (size): $_{35}Br^-$, $_{34}Se^{2-}$ or $_{33}As^{3-}$? _____

(c) Which reacts **more readily** with sulfur, $_{37}Rb$ or $_{55}Cs$? _____
(i.e. lose an e^- more easily)

(d) Which has the **more** negative electron affinity, $_{34}Se$ or $_{17}Cl$? _____

10. (3 pts) Explain how the effective nuclear charge, Z_{eff}, changes going across a row from left to right in the periodic table and why?

11. (3 pts) Explain why the electron affinity for Beryllium is positive while that for Boron is negative.

12. (2 pts) Write the equation corresponding to the first electron affinity of Oxygen.

13. (2 pts) Write the equation corresponding to the second ionization energy of Ca.

14. (3 pts) Write the electron configuration for the following ion by starting with the electron configuration for the neutral atom and then the ion given. **Show work.**

Fe^{2+}

15. (3 pts) The electrons that are removed from $_{48}Cd$ to form the Cd^{2+} ion are from the ___ subshell and the electrons that are removed from $_{83}Bi$ to form the Bi^{2+} ion are from the ____ subshell.

a) 5s; 6p b) 5s; 5s c) 4d; 4f d) 5d; 6p e) 4s; 5d

USEFUL INFORMATION

1 amu = 1.661×10^{-24} g

Avogadro's number, N_A, = 6.02×10^{23} particles/mole

1 A = 10^{-10} m

h = 6.626×10^{-34} J•s c = 3.00×10^{8} m/s $R_H = 1.097 \times 10^{7}$ m^{-1} 1 J = 1 kg•m^2/s^2

$E = h\nu$ $c = \lambda\nu$ $E_{Hydrogen} = (-hcR_H)(1/n^2)$ $\Delta E_{Hydrogen} = -(2.18 \times 10^{-18}\ J)(1/n_f^2 - 1/n_i^2)$

$1/\lambda = R_H\,(1/n_f^2 - 1/n_i^2)$ $\lambda = h/(mv)$ $p = mv$ $\Delta x \bullet \Delta p \geq h/4\pi$,

electron charge, *e* = 1.602×10^{-19} C 1D = 3.34×10^{-30} C•m $\mu = Q \bullet r$

	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1.008 **H** 1																	4.003 **He** 2
2	6.941 **Li** 3	9.012 **Be** 4											10.811 **B** 5	12.011 **C** 6	14.007 **N** 7	15.999 **O** 8	18.998 **F** 9	20.179 **Ne** 10
3	22.990 **Na** 11	24.305 **Mg** 12											26.98 **Al** 13	28.09 **Si** 14	30.974 **P** 15	32.06 **S** 16	35.453 **Cl** 17	39.948 **Ar** 18
4	39.098 **K** 19	40.08 **Ca** 20	44.96 **Sc** 21	47.88 **Ti** 22	50.94 **V** 23	52.00 **Cr** 24	54.94 **Mn** 25	55.85 **Fe** 26	58.93 **Co** 27	58.69 **Ni** 28	63.546 **Cu** 29	65.38 **Zn** 30	69.72 **Ga** 31	72.59 **Ge** 32	74.92 **As** 33	78.96 **Se** 34	79.904 **Br** 35	83.80 **Kr** 36
5	85.47 **Rb** 37	87.62 **Sr** 38	88.91 **Y** 39	91.22 **Zr** 40	92.91 **Nb** 41	95.94 **Mo** 42	98 **Tc** 43	101.07 **Ru** 44	102.91 **Rh** 45	106.42 **Pd** 46	107.87 **Ag** 47	112.41 **Cd** 48	114.82 **In** 49	118.69 **Sn** 50	121.75 **Sb** 51	127.60 **Te** 52	126.90 **I** 53	131.39 **Xe** 54
6	132.91 **Cs** 55	137.33 **Ba** 56	138.91 **La** 57	178.39 **Hf** 72	180.95 **Ta** 73	183.85 **W** 74	186.21 **Re** 75	190.23 **Os** 76	192.22 **Ir** 77	195.08 **Pt** 78	196.97 **Au** 79	200.59 **Hg** 80	204.38 **Tl** 81	207.2 **Pb** 82	208.98 **Bi** 83	209 **Po** 84	210 **At** 85	222 **Rn** 86
7	223 **Fr** 87	226.03 **Ra** 88	227.03 **Ac** 89	261 **Rf** 104	262 **Ha** 105	263 **Sg** 106	262 **Ns** 107	265 **Hs** 108	266 **Mt** 109	269 110	272 111	277 112						

Lanthanide Series	140.12 **Ce** 58	140.91 **Pr** 59	144.24 **Nd** 60	145 **Pm** 61	150.36 **Sm** 62	151.96 **Eu** 63	157.25 **Gd** 64	158.93 **Tb** 65	162.50 **Dy** 66	164.93 **Ho** 67	167.26 **Er** 68	168.93 **Tm** 69	173.04 **Yb** 70	173.04 **Lu** 71
Actinide Series	232.04 **Th** 90	231.04 **Pa** 91	238.03 **U** 92	237.05 **Np** 93	**Pu** 94	**Am** 95	**Cm** 96	**Bk** 97	**Cf** 98	**Es** 99	**Fm** 100	**Md** 101	**No** 102	**Lr** 103

A PERIODIC CHART OF THE ELEMENTS
(Based on ^{12}C)