

Name KEY M (Print last name in CAPS)

SECTION \_\_\_\_\_ (same as your lab section)

1.	Read each question carefully before answering.
2.	Mark the choice that best answers the question or completes the statement.
3.	Use the scantron provided. Use a no. 2 pencil and clearly mark your choice. If you change an answer, completely erase your previous mark.
4.	Answer each question. There is no penalty for guessing. However, multiple answers are graded as incorrect, and blank answers are graded as incorrect.
5.	On the scantron, fill in your last name, first name and initial. Blacken the corresponding letters.
6.	Fill in your ID, the department=CHEM, Course no. = 101, and Section= your lab section. Blacken the corresponding letters and numbers.
7.	If you want your score posted by a portion of your ID# mark A under the option column. They will be posted on the bulletin board where you got your seat assignment.
8.	Use the test for scratch paper.
9.	Mark your answers on the test so you can check them with the key when it is posted.
10.	<b>***Turning in a blank scantron results in a grade of zero.***</b>
11.	Turn in both the scantron and the exam, have your ID and your calculator ready to be checked.
12.	Work at a steady pace and you will have ample time to finish.
13.	The keys will be posted on my class web page as soon as possible. You may check your grade at the class web site. Your password is the middle 5 numbers of your student ID followed by the first letter of your last name in CAPS. Be patient and give the webmaster time to enter all of this information.

There are 35 questions for 125 points. Good Luck!

M

## Possibly Useful Information

$$1 \text{ cal} = 4.184 \text{ J}$$

$$M = \frac{\text{mol solute}}{\text{L soln}}$$

$$M_1V_1 = M_2V_2$$

$$q = \text{mass} \times \text{sp ht} \times \Delta T$$

$$\left(\frac{w}{w}\right) \% = \frac{\text{mass solute}}{\text{total mass}} \times 100$$

$$d = \text{mass/vol}$$

$$\text{Volume} = \ell \times h \times w$$

$$\lambda \nu = c$$

$$E = h\nu$$

$$\lambda = \frac{h}{mv}$$

TABLE 4-12

Element	Common Reduced Form	Common Oxidized Forms
Li	Li	Li <sup>+</sup>
K	K	K <sup>+</sup>
Ca	Ca	Ca <sup>2+</sup>
Na	Na	Na <sup>+</sup>
Mg	Mg	Mg <sup>2+</sup>
Al	Al	Al <sup>3+</sup>
Mn	Mn	Mn <sup>2+</sup>
Zn	Zn	Zn <sup>2+</sup>
Cr	Cr	Cr <sup>3+</sup> , Cr <sup>6+</sup>
Fe	Fe	Fe <sup>2+</sup> , Fe <sup>3+</sup>
Cd	Cd	Cd <sup>2+</sup>
Co	Co	Co <sup>2+</sup>
Ni	Ni	Ni <sup>2+</sup>
Sn	Sn	Sn <sup>2+</sup> , Sn <sup>4+</sup>
Pb	Pb	Pb <sup>2+</sup> , Pb <sup>4+</sup>
H (a nonmetal)	H <sub>2</sub>	H <sup>+</sup>
Sb (a metalloid)	Sb	Sb <sup>3+</sup>
Cu	Cu	Cu <sup>+</sup> , Cu <sup>2+</sup>
Hg	Hg	Hg <sub>2</sub> <sup>2+</sup> , Hg <sup>2+</sup>
Ag	Ag	Ag <sup>+</sup>
Pt	Pt	Pt <sup>2+</sup> , Pt <sup>4+</sup>
Au	Au	Au <sup>+</sup> , Au <sup>3+</sup>

TABLE 4-8

Generally Soluble	Exceptions
Na <sup>+</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> compounds	No common exceptions
fluorides (F <sup>-</sup> )	Insoluble: MgF <sub>2</sub> , CaF <sub>2</sub> , SrF <sub>2</sub> , BaF <sub>2</sub> , PbF <sub>2</sub>
chlorides (Cl <sup>-</sup> )	Insoluble: AgCl, Hg <sub>2</sub> Cl <sub>2</sub> Soluble in hot water: PbCl <sub>2</sub>
bromides (Br <sup>-</sup> )	Insoluble: AgBr, Hg <sub>2</sub> Br <sub>2</sub> , PbBr <sub>2</sub> Moderately soluble: HgBr <sub>2</sub>
iodides (I <sup>-</sup> )	Insoluble: many heavy-metal iodides
sulfates (SO <sub>4</sub> <sup>2-</sup> )	Insoluble: BaSO <sub>4</sub> , PbSO <sub>4</sub> , HgSO <sub>4</sub> Moderately soluble: CaSO <sub>4</sub> , SrSO <sub>4</sub> , Ag <sub>2</sub> SO <sub>4</sub>
nitrates (NO <sub>3</sub> <sup>-</sup> ), nitrites (NO <sub>2</sub> <sup>-</sup> )	Moderately soluble: AgNO <sub>2</sub>
chlorates (ClO <sub>3</sub> <sup>-</sup> ), perchlorates (ClO <sub>4</sub> <sup>-</sup> )	Moderately soluble: KClO <sub>4</sub>
acetates (CH <sub>3</sub> COO <sup>-</sup> )	Moderately soluble: AgCH <sub>3</sub> COO
Generally Insoluble	Exceptions
sulfides (S <sup>2-</sup> )	Soluble: those of NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> , Ca <sup>2+</sup>
oxides (O <sup>2-</sup> ), hydroxides (OH <sup>-</sup> )	Soluble: Li <sub>2</sub> O*, LiOH, Na <sub>2</sub> O*, NaOH, K <sub>2</sub> O*, KOH, BaO*, Ba(OH) <sub>2</sub> Moderately soluble: CaO*, Ca(OH) <sub>2</sub> , SrO*, Sr(OH) <sub>2</sub>
carbonates (CO <sub>3</sub> <sup>2-</sup> ), phosphates (PO <sub>4</sub> <sup>3-</sup> ), arsenates (AsO <sub>4</sub> <sup>3-</sup> )	Soluble: those of NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , K <sup>+</sup>

\*Dissolves with evolution of heat and formation of hydroxides.

Q.1 What is an acceptable value for the missing quantum number?

$$n = ?, \quad \ell = 2 \quad m_\ell = 0 \quad m_s = +1/2$$

- a) 0      b) 1      c) 2      **(d) 3**      e) -1/2

Q.2 An atomic orbital represents ...

- a) the shape of an atom  
 b) the shape of the electron  
 c) A fixed path that the electron takes around the nucleus  
 d) the repulsion of electrons for each other.  
**(e) the region of high probability for an electron around an atom** ←

Q.3 How many unpaired electrons are there in the ground state electronic configuration of chlorine?

- a) 5      b) 2      c) 3      d) 0      **(e) 1**

3p<sup>5</sup>

Q.4 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>3s<sup>2</sup>3p<sup>6</sup>3d<sup>10</sup>4s<sup>2</sup>4p<sup>5</sup>

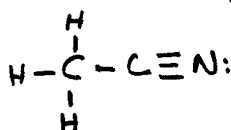
is the ground state electronic configuration of ...

35e<sup>-</sup>

- a) iodine      b) krypton      c) copper      d) ruthenium      **(e) bromine**

Q.5 How many covalent bonds are there in the molecule, acetonitrile, CH<sub>3</sub>CN?

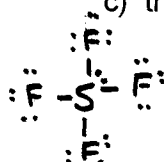
- a) 4      b) 5      c) 6      **(d) 7**      e) none of these



$$\begin{aligned} N &= 30 \\ A &= 16 \\ S &= 14 = 7 \text{ CB} \\ L &= 2 = 1 \text{ LP} \end{aligned}$$

Q.6 How many lone pairs are there on the central atom in the Lewis structure for SF<sub>4</sub>?

- a) none      b) two      c) three      d) four



**(e) one**

$$\begin{aligned} N &= 40 \\ A &= 34 \\ S &= \text{need } 8 = 4 \text{ CB} \\ L &= 26 = 13 \text{ LP} \end{aligned}$$

Q.7 How many electrons can be described by the quantum numbers  $n=3, \ell=2$ ?

- a) 0      b) 2      c) 6      **(d) 10**      e) 14

Q.8 An atom of silicon contains 14 electrons. How many of them are in p orbitals?

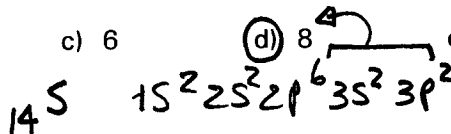
a) 2

b) 4

c) 6

(d) 8

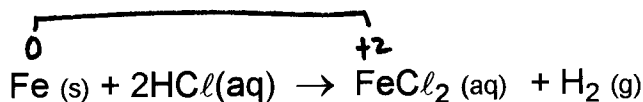
e) none



Q.9 The correct formula for the compound hypobromous acid is...

a)  $\text{HBrO}_4$ (b)  $\text{HBrO}$ c)  $\text{HBrO}_2$ d)  $\text{HBr}$ e)  $\text{HBrO}_3$ 

Q.10 In the reaction,



The substance oxidized is ...

(a)

 $\text{Fe}(\text{s})$  ←

b)

 $\text{HCl}(\text{aq})$ 

c)

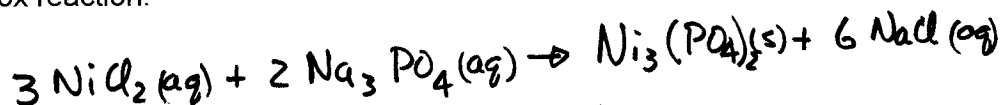
 $\text{FeCl}_2(\text{aq})$ 

d)

 $\text{H}_2(\text{g})$ 

e)

This is not a redox reaction.



Q.11 For the reaction between aqueous nickel(II) chloride and aqueous sodium phosphate, the "spectator ions" are,

a)

 $\text{Ni}^{2+}$  and  $\text{Na}^+$ 

b)

 $\text{Na}^+$  and  $\text{PO}_4^{3-}$ 

c)

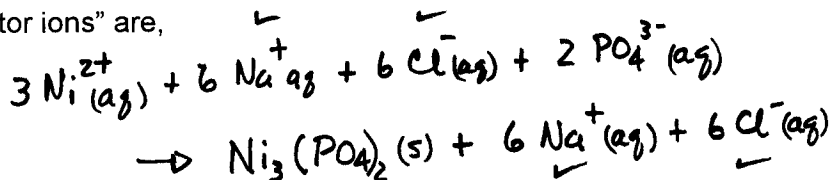
 $\text{H}^+$  and  $\text{Cl}^-$ 

(d)

 $\text{Na}^+$  and  $\text{Cl}^-$  ←

e)

All ions are spectator ions and no chemical reaction will occur.



Q.12 Which of the following combinations is correct?

a)

 $\text{CH}_3\text{OH}$  :strong base no

b)

 $\text{H}_2\text{SO}_3$  :strong acid no

(c)

 $\text{HNO}_2$  :weak acid yes ←

d)

 $\text{HF}$  :strong acid no

e)

None of the above no

Q.13 Which of the following substances will conduct a current?

- a) Benzene,  $C_6H_6$
- b)  $Cl_2$
- c)  $CH_3OH$
- d) Hexane,  $C_6H_{14}$
- ☒ e) None of these ←

Q.14 Addition of  $Na_2S(aq)$  and  $NaCl(aq)$  to a solution containing several different cations produces no precipitate. Which of the following conclusions is NOT valid?

- a)  $Na^+$  may be present
- b)  $Mg^{2+}$  may be present
- c)  $Ca^{2+}$  may be present
- ☒ d)  $Cu^{2+}$  may be present ←
- e)  $K^+$  may be present

Q.15 The neutralization of 50.0 mL of 0.24M  $HCl$  uses 5.0 mL of  $NaOH$ . What is the molarity of the  $NaOH$ ?

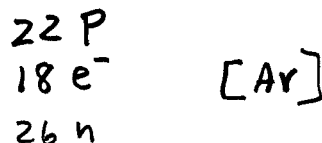
- a) 0.6M
  - b) 0.96M
  - c) 1.2M
  - ☒ d) 2.4M ←
  - e) 5.0M
- $0.0500L \times 0.24 \frac{mol}{L} = 0.0120 mol HCl$   
 $= mol NaOH$   
 $M_{NaOH} = \frac{0.0120 mol}{0.0050 L} = 2.4 M$

Q.16 Which statement best describes relationships in a modern periodic table?

- a) Each transition element is placed in a column of the main group elements which it most closely resembles. **no**
- b) Elements are always arranged in the order of increasing relative atomic mass. **no**
- c) The fourteen elements of the lanthanide series form a new period in the periodic table. **no**
- d) The fourteen elements of the actinide series form a new period in the main group elements. **no**
- ☒ e) Nonmetallic properties tend to predominate for elements in the far right portion of the periodic table. **yes**

Q.17 The ion represented by  ${}^{48}_{22}\text{Ti}^{4+}$  has...

- a) four, 3d electrons
- ☒ b) no, 4s electrons
- c) 48 neutrons
- d) 22 electrons
- e) 26 protons



Q.18 What is the frequency of radiation of wavelength 440 nm?

- a)  $6.81 \times 10^5 \text{ s}^{-1}$
- ☒ b)  $6.81 \times 10^{14} \text{ s}^{-1}$
- c)  $1.51 \times 10^{-27} \text{ s}^{-1}$
- d)  $4.95 \times 10^{-12} \text{ s}^{-1}$
- e)  $2.02 \times 10^{-11} \text{ s}^{-1}$

$$\gamma = \frac{3.00 \times 10^8 \text{ m} \cdot \text{s}^{-1}}{440 \times 10^{-9} \text{ m}} = 6.818 \times 10^{14} \text{ s}^{-1}$$

Q.19 The following reaction is classified as ...



- ☒ a) Decomposition ←
- b) Redox
- c) Combination
- d) Displacement
- e) More than one of these

Q.20 How many photons of light of  $\nu = 5.50 \times 10^{15} \text{ Hz}$  are needed to provide 4.00 kJ of energy?

- a)  $7.28 \times 10^{-18}$  photons
- b)  $5.48 \times 10^{20}$  photons
- c)  $9.12 \times 10^{-4}$  photons
- ☒ d)  $1.10 \times 10^{21}$  photons
- e)  $7.28 \times 10^{-16}$  photons

$$E = 6.626 \times 10^{-34} \text{ J} \cdot \text{s} \times 5.50 \times 10^{15} \text{ s}^{-1}$$

$$E = 3.64 \times 10^{-18} \frac{\text{J}}{\text{photon}}$$

$$\frac{4000 \text{ J}}{3.64 \times 10^{-18} \text{ J/photon}} = \frac{1.097 \times 10^{21} \text{ photons}}{1.0}$$

Q.21 A 8.50 gram sample of an acid HX, requires 237.5 mL of a 0.650 M NaOH solution for complete reaction. What is the molar mass of the acid?

- a) 36.5 g/mol  
 b) 23.3 g/mol  
 c) 55.1 g/mol  
 d) 18.1 g/mol  
 e) 3.11 g/mol

$$0.2375 \text{ L} \times \frac{0.650 \text{ mol}}{\text{L}} = 0.154 \text{ mol NaOH} \\
= \text{mol HX} \\
\text{molar mass HX} = \frac{8.50 \text{ g}}{0.154 \text{ mol}} = 55.19 \text{ g/mol}$$

Q.22 Which of the following reactions will proceed as written?

- a)  $\text{Ca (s)} + 2\text{H}_2\text{O (l)} \rightarrow \text{Ca}^{2+} \text{ (aq)} + 2\text{OH}^- \text{ (aq)} + \text{H}_2 \text{ (g)}$  ←  
 b)  $\text{Ca (s)} + 2\text{H}_2\text{O (l)} \rightarrow \text{CaH}_2 \text{ (s)} + \text{O}_2 \text{ (g)} + \text{H}_2 \text{ (g)}$   
 c)  $\text{Ca (s)} + 2\text{H}_2\text{O (l)} \rightarrow \text{Ca}^{2+} \text{ (aq)} + \text{O}_2 \text{ (g)} + 2\text{H}_2 \text{ (g)}$   
 d)  $\text{Ca (s)} + 2\text{H}_2\text{O (l)} \rightarrow \text{CaH}_2 \text{ (s)} + 2\text{OH}^- \text{ (aq)}$   
 e) None of these will proceed as written.

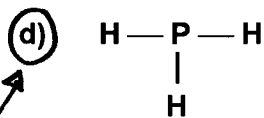
Q.23 How many valence electrons are there in the nitrite ion,  $\text{NO}_2^-$ ?

- a) 22      b) 24      c) 18      d) 23      e) 16

$$A = 5 + 12 + 1 = 18 e^-$$

Q.24 Which of the following is not a correct Lewis structure?

- a)  $[: \text{N} \equiv \text{O} :]^+$       b)  $\text{H} - \text{C} \equiv \text{N}:$       c)  $:\text{N} \equiv \text{N}:$



e) all are correct



Q.25 Which of the following is the ground state electron configuration for Ni?

a) [Ar]  $\uparrow\downarrow$   $\uparrow\downarrow$   $\uparrow$   $\uparrow$   $\uparrow$   $\uparrow$

☒ b) [Ar]  $\uparrow\downarrow$   $\uparrow\downarrow$   $\uparrow\downarrow$   $\uparrow\downarrow$   $\uparrow$   $\uparrow$   $\leftarrow$

Ni  $28e^-$

c)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$

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

e) More than one of these is correct.

Q.26 In which of the following are the elements arranged in order of increasing first ionization energy?

a) Sc < Mn < Cs

b) Sc < Cs < Mn

c) Cs < Mn < Sc

☒ d) Cs < Sc < Mn  $\leftarrow$

e) Mn < Cs < Sc

Q.27 Which of the following has the smallest atomic radius?

☒ a) Br  $\leftarrow$

b) K

c) Ga

d) Rb

e) Bi

Q.28 When  $\ell = 2$ , the possible values for  $m_\ell$  are ...

a) 0    b) 0,1,2    c) -1,0,+1    ☒ d) -2,-1,0,+1,+2    e) -3,-2,-1,0,+1,+2,+3

Q.29 What is the value of quantum number  $\ell$  for a 4f orbital?

☒ a) +3    b) -3    c) +2    d) -2    e) all of these

Q.30 The quantum number  $m_s$  represents the

a) The number of electrons in an orbital

b) The magnetic field of the electron

c) The shape of the orbital

d) The orientation of the orbital

☒ e) The electron spin  $\leftarrow$

Q.31 Which of the following has the least metallic character?

- a) calcium    b) lithium    c) gallium    d) aluminum    ☒ (e) helium

Q.32 Which of the following (if any) are spectator ions in the reaction of Zn metal with an aqueous solution of lead(II)nitrate,  $\text{Pb}(\text{NO}_3)_2$  (aq)?

- a)  $\text{Pb}^{2+}(\text{aq}) + \text{NO}_3^{2-}(\text{aq})$   
 b)  $\text{H}^+(\text{aq}) + \text{N}_2^-(\text{aq})$   
☒ (c)  $\text{NO}_3^-(\text{aq})$  ←  
 d)  $\text{Zn}^{2+}(\text{aq}) + \text{Pb}^{2+}(\text{aq})$   
 e) All chemical species are spectator ions, there is no reaction.
- $$\text{Zn}(\text{s}) + \text{Pb}^{+2}(\text{aq}) + 2\text{NO}_3^-(\text{aq}) \rightarrow \text{Zn}^{+2}(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + \text{Pb}(\text{s})$$

Q.33 Which of the following contains all ionic compounds?

- a)  $\text{H}_2\text{O}$ ,  $\text{MgO}$ ,  $\text{NO}_2$   
 b)  $\text{CO}_2$ ,  $\text{SO}_2$ ,  $\text{H}_2\text{S}$   
 c)  $\text{CCl}_4$ ,  $\text{CaCl}_2$ ,  $\text{Na}_2\text{S}$   
☒ (d)  $\text{NaCl}$ ,  $\text{KOH}$ ,  $(\text{NH}_4)_2\text{S}$  ←  
 e)  $\text{MgO}$ ,  $\text{NCl}_3$ ,  $\text{HOCl}$

Q.34 What is the oxidation number of S in  $\text{SF}_6$ ?

- a) +1    b) +12    c) -6    d) -1    ☒ (e) +6

Q.35 Assigning the oxidation number of -1 to chlorine and -2 to oxygen, the oxidation number of Xenon in the compound,  $\text{XeOCl}_2$ , is...

- a) +2    ☒ (b) +4    c) -2    d) +6    e) +8

End of Test

KEY Ex2 FORM **M** Magnuson 101 24 Oct 2002

Total points = 125

Each question = 3.572 points

	1	<b>D</b>
	2	<b>E</b>
	3	<b>E</b>
	4	<b>E</b>
	5	<b>D</b>
	6	<b>E</b>
	7	<b>D</b>
	8	<b>D</b>
	9	<b>B</b>
	10	<b>A</b>
	11	<b>D</b>
	12	<b>C</b>
	13	<b>E</b>
	14	<b>D</b>
	15	<b>D</b>
	16	<b>E</b>
	17	<b>B</b>
	18	<b>B</b>
	19	<b>A</b>
	20	<b>D</b>
	21	<b>C</b>
	22	<b>A</b>
	23	<b>C</b>
	24	<b>D</b>
	25	<b>B</b>
	26	<b>D</b>
	27	<b>A</b>
	28	<b>D</b>
	29	<b>A</b>
	30	<b>E</b>
	31	<b>E</b>
	32	<b>C</b>
	33	<b>D</b>
	34	<b>E</b>
	35	<b>B</b>