Name_____Key K_____ (Print last name in CAPS)

SECTION 552-561____(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.	Use the test for scratch paper.
8.	Mark your answers on the test so you can check them with the key when it is posted.
9.	**✶✶✶Turning in a blank scantron results in a grade of zero. ✶✶✶**
10.	You may be asked to turn in <u>both</u> the scantron and the exam, have your PHOTO ID and your calculator ready to be checked when you do so.
11.	Work at a steady pace and you will have ample time to finish.
12.	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 30 questions for 150 points. Good Luck!

K

Possibly Useful Information

$$M = \frac{\text{mol solute}}{\text{L soln}} \qquad M_1 V_1 = M_2 V_2$$

$$\frac{w}{w}\% = \frac{\text{mass}}{\text{total mass}} \times 100 \qquad \text{density} = \frac{\text{mass}}{\text{volume}}$$

A periodic table is also provided on the last page of this exam.

Q.1   A breaking car converts kinetic energy into heat in the brake pads. This is an example of the ...

 (a)   Law of conservation of energy
 b)   Law of conservation of heat
 c)   Law of conservation of matter
 d)   Law of constant composition
 e)   Law of multiple proportions

Q.2   How many atoms are there in 15 formula units of copper(II) nitrate, $Cu(NO_3)_2$?

 a) 2.35×10^{25}
 b)   9
 c)   15
 d) 9.033×10^{24}
 (e)   135

$$\frac{9 \text{ atoms}}{\text{form. unit}} \times 15 \text{ form. units} = 135$$

Q.3   All of the following are properties of antimony. Which one is **not** a physical property?

 a)   It is a solid at room temperature. P
 b)   It has both yellow and gray forms (allotropes) in the solid state. P
 (c)   It burns in an atmosphere of chlorine. C
 d)   It is one of the few substances that expands upon freezing. P
 e)   The gray form melts at 631°C. P

2/9

Q.4 A sample of nitrogen gas has a mass of 28 grams. It contains 6.022×10^{23} ...

a) atoms
b) electrons
c) protons
d) neutrons
(e) molecules

$28g\ N_2 = 1\ mol\ N_2$

Q.5 Which response includes all of the following that are chemical properties of carbon and no physical properties?

I. It is a solid at room temperature. P
II. It undergoes combustion to produce carbon dioxide and water. C
III. It boils at 4200°C. P
IV. It is not attracted strongly by a magnet. P
V. Its density is 2.25 g/cm^3. P

a) I, III, IV
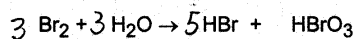b) II and IV
c) I and V
(d) II
e) III, IV,and V

Q.6 In the balanced reaction $2\ H_2$ (g) + 2 NO (g) → $2\ H_2O$ (g) + N_2 (g)

the mol ratio of nitric oxide gas to nitrogen gas is

a) 1:1
b) 1:2
(c) 2:1
d) ½:1
e) More than one of these is correct.

$2\ mol\ NO : 1\ mol\ N_2$

Q.7 What is the coefficient of HBr when the following equation is balanced with the smallest whole number coefficients?

$$3\ Br_2 + 3\ H_2O \rightarrow 5\ HBr + HBrO_3$$

(a) 5   b) 7   c) 8   d) 3   e) 6

Q.8   The elements of Group I are called

a)   Rare Earths
b)   Alkali metals
c)   Noble metals
d)   Rare metals
e)   Alkaline earth metals

Q.9   What is the molecular formula for ethanol?

a) CH_3COOH
b) CH_3COCH_3
c) $CH_3CH_2OCH_2CH_3$
d) $CH_3CH_2CO_2H$
e) CH_3CH_2OH

Q.10   How many grams of CH_4 contain the same number of molecules as 75.0 grams of H_2O?

$$\frac{75.0g\ H_2O}{18.02\ amu} \ast \frac{1\ mol\ CH_4}{1\ mol\ H_2O} \ast \frac{16.04g\ CH_4}{1\ mol\ CH_4} = 66.75\ g$$

a)   2170 g
b)   84.2 g
c)   3.85 g
d)   66.8 g
e)   217 g

Q.11   Express 18 nm in km.

a) 18×10^9 km
b) 18×10^{-9} km
c) 18×10^{12} km
d) 18×10^{-12} km
e) 1.8×10^{-10} km

$$18\ nm \ast \frac{10^{-9}\ m}{1\ nm} \ast \frac{1\ km}{10^3\ m} = 18 \times 10^{-12}\ km$$
$$or$$
$$1.8 \times 10^{-11}\ km$$

Q.12   When the following numbers are added, the answer to the correct number of significant figures is ...

97.625
3.45

$$101.075$$
$$\underbrace{}_{} $$
$$101.08$$

a)   101.075
b)   101.08
c)   101
d)   101.1
e)   100.07

Q.13 What is the percent by mass of nitrogen, N, in ammonium carbonate, $(NH_4)_2CO_3$? Molar mass of $(NH_4)_2CO_3$ = 96.09 amu

a) 14.5 %
b) 27.8%
c) 29.2%
d) 33.3%
e) 17.1%

$$\% N = \frac{2(14.01)}{96.09} \times 100 = 29.16\%$$

Q.14 A room is 12.5 ft wide by 13.4 ft long. The area of the room expressed in metric units is ...
[12 in. = 1 ft, 1 inch = 2.54 cm]

a) $1.56 \times 10^5 \, m^2$
b) $15.6 \, m^2$
c) $1.56 \times 10^5 \, m$
d) $42.1 \, m^2$
e) $42.1 \, m$

$$12.5 \, ft \times 13.4 \, ft \times \frac{(12)^2 \, in^2}{1 \, ft^2} \times \frac{(2.54)^2 \, cm^2}{1 \, in^2} \times \frac{(10^{-2})^2 \, m^2}{1 \, cm^2} =$$

$$= 15.56 \, m^2 \Rightarrow \boxed{15.6 \, m^2}$$

Q.15 The smallest particle of an element that retains the chemical properties of that element is ...

a) An atom
b) A molecule
c) An ion
d) A solid
e) A gas

Q.16 What volume of 5.56 M NaOH is needed to prepare 450 mL of a 1.45 M NaOH solution?

a) 85.2 mL
b) 180 mL
c) 260 mL
d) 117 mL
e) 15.9 mL

$$M_1 V_1 = M_2 V_2$$

$$V_1 = \frac{M_2 V_2}{M_1} = \frac{(1.45 \, M)(450 \, mL)}{5.56 \, M}$$

$$V_1 = 117.35 \Rightarrow \boxed{117 \, mL}$$

Q.17 Which of the following element/symbol pair is incorrect?

a) Fe/iron ✔
b) Ca/calcium ✔
c) Ag/gold ✗
d) Pb/lead ✔
e) O/oxygen ✔

Q.18   A compound is analyzed and found to contain 65.13% C, 7.57% H, 14.79% Cl,
5.84% N, and 6.67% O.   What is the simplest formula for this compound?

a) $C_5H_7ClN_2O$
b) $C_{10}H_7ClNO_2$
c) $C_5H_{14}Cl_2NO$
d) $C_{13}H_{18}ClNO$ ⟵ (circled)
e) $CHClNO$

C $\dfrac{65.13}{12.01} = 5.4229 / .417 = 13$

H $\dfrac{7.57}{1.008} = 7.5099 / .417 = 18$

Cl $\dfrac{14.79}{35.45} = 0.4172 / .417 = 1$

N $\dfrac{5.84}{14.01} = 0.4168 / .417 = 1$

O $\dfrac{6.67}{16.00} = 0.4168 / .417 = 1$

$C_{13}H_{18}ClNO$

Q.19   Calculate the number of moles of $KMnO_4$ in 25.5 g $KMnO_4$.
Molar mass $KMnO_4$ = 158.04 amu

a)   0.0161 mol
b)   0.879 mol
c)   0.161 mol ⟵ (circled)
d)   1.88 mol
e)   0.632 mol

$\dfrac{25.5 g}{158.04 amu} = 0.1613$ mol $KMnO_4$

Q.20   A sample of a PbS was chemically reacted in air to give sulfur dioxide and an
oxide of lead. The lead oxide formed is 92.83% lead. What is the simplest
formula for this lead oxide?

a)   PbO ⟵ (circled)
b) PbO_2
c) Pb_2O
d) Pb_2O_3
e) Pb_3O_4

$\dfrac{92.83 g}{207.2 amu} = 0.448$ (Pb)

$\dfrac{7.17 g}{16.00 amu} = 0.448$ (O)

∴ PbO

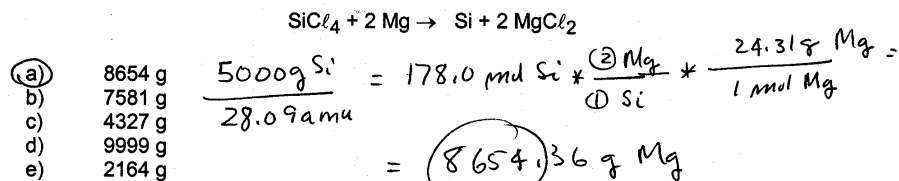Q.21   Which of the following statements is incorrect?

a)   A molecule is the smallest particle of a compound that can have a stable
      independent existence. ✓
b)   Molecules that consists of more than one type of atom are called polyatomic. ✓
ⓒ   The atomic number is defined as the number of neutrons in the nucleus. ✗
d)   The charge on the electron is negative, the charge on the proton is positive. ✓
e)   Molecules of a compound consist of more than one atom. ✓

Q.22   When the following chemical reaction is balanced with the smallest integer
   coefficients, the sum of the coefficients is ...

$$Fe_2O_3(s) + 3\,CO\,(g) \rightarrow 3\;CO_2(g) + 2\;Fe\,(s)$$

$$1 + 3 + 2 + 3 = 9$$
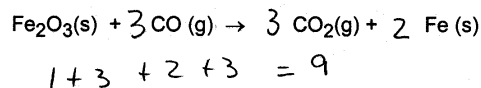
a) 4   b) 8   ⓒ 9   d) 10   e) 16

Q.23   How many grams of magnesium are required to produce 5.000 kg Si?

$$SiC\ell_4 + 2\,Mg \rightarrow Si + 2\,MgC\ell_2$$

ⓐ 8654 g
b) 7581 g
c) 4327 g
d) 9999 g
e) 2164 g

$$\frac{5000 g\,Si}{28.09\,amu} = 178.0\;mol\;Si * \frac{(2)\,Mg}{(1)\,Si} * \frac{24.31\,g\;Mg}{1\,mol\;Mg} =$$

$$= \boxed{8654.36}\;g\;Mg$$

$$\ulcorner 5.000\;kg = 5000\;g\;\{4\;sig.fig\}$$

Q.24   Consider the following reaction for the combustion of methane:
        $$CH_4\,(g) + 2O_2\,(g) \rightarrow CO_2\,(g) + 2\,H_2O\,(g)$$
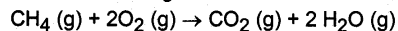
        If 10.0 g of methane is reacts with 39.9 g of oxygen, how much carbon dioxide
        is produced? [Assume 100% efficiency.]

        a) 10.0 g   b) 39.9g   c) 20.0 g   ⓓ 27.4 g   e) 5.00 g

$$\frac{10.0g}{16.04} = 0.6234\;mol\;CH_4 * \frac{(1)\,CO_2}{(1)\,CH_4} * \frac{44.01\,g\;CO_2}{1\,mol\;CO_2} = 27.4\,g\;CO_2$$

$$\frac{39.9}{32.00} = 1.2468\;mol\;O_2 * \frac{(1)\,CO_2}{(2)\,O_2} * \frac{44.01\,g\;CO_2}{1\,mol\;CO_2} = 27.4\;g\;CO_2$$

Stoichiometric units

Q.25   Express 1.5 micrometers in picometers.

(a) 1.5×10^{6} pm
b) 1.5×10^{-6} pm
c) 1.5×10^{9} pm
d) 1.5×10^{12} pm
e) 1.5×10^{-18} pm

$$pico = 1 \times 10^{-12} \quad micro = 1 \times 10^{-6}$$

$$1.5 \, \mu m \ast \frac{10^{-6} \, m}{1 \, \mu m} \ast \frac{1 \, pm}{10^{-12} \, m} =$$

$$= 1.5 \times 10^{6} \, pm$$

Q.26   Which of the following is a nonmetal?

a) Ca   b) Cr   c) Co   (d) Cℓ   e) Cs

Q.27   What mass of SrF_2 can be prepared from the reaction of 8.05 g of $Sr(OH)_2$ with 3.88 g HF?

molar mass $Sr(OH)_2$ = 121.64 amu
molar mass SrF_2 = 125.62
molar mass HF = 20.008 amu

$$Sr(OH)_2 + 2\,HF \rightarrow 2\,H_2O + SrF_2$$

smallest
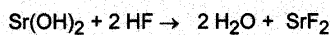
a)   11.7 g
b)   12.2 g
c)   10.5 g
(d)   8.31 g
e)   8.62 g

$$\frac{8.05g \; Sr(OH)_2}{121.64 \, amu} \ast \frac{(1) \, SrF_2}{(1) \, Sr(OH)_2} \ast \frac{125.62 \, g}{1 \, mol \; SrF_2} = \boxed{8.31 \, g \quad SrF_2}$$

$$\frac{3.88 g \; HF}{20.008 \, amu} \ast \frac{(1) \, SrF_2}{(2) \, HF} \ast \frac{125.62 \, g}{1 \, mol \; SrF_2} = 12.18 = 12.2 g \; SrF_2$$

Q.28   The balanced chemical equation for the reaction of lithium with molecular
       oxygen is ...

   a) $4\ Li\ (s) + 2\ O_2\ (g) \rightarrow 2\ Li_2O\ (s)$
   b) $2\ Li\ (s) + 2\ O_2\ (g) \rightarrow 2\ LiO\ (s)$
   c) $4\ Li\ (s) + O_2\ (g) \rightarrow 2\ Li_2O\ (s)$
   d) $Li\ (s) + 2\ O_2\ (g) \rightarrow 2\ LiO\ (s)$
   e) $2\ Li\ (s) + O\ (g) \rightarrow Li_2O\ (s)$

$4 Li + O_2 \rightarrow 2 Li_2O$

Q.29   What mass of iron is contained in 86.6 g of pyrite, FeS_2?

   a)   40.3 g
   b)   29.2 g
   c)   47.3 g
   d)   80.6 g
   e)   64.1 g

$\% Fe = \dfrac{55.85}{55.85 + 2(32.07)} \times 100 = 46.54\%$

$86.6 \times 0.4654 = 40.3\ g\ Fe$

Q.30   A stock solution of hydrofluoric acid, HF, is 15.0% HF, and has a density of
       1.20 g/cc. What is the molarity of this solution?

   a) 2.50 M
   b) 9.00 M
   c) 10.6 M
   d) 12.0 M
   e) 15.9 M

$1000\ mL \times \dfrac{1.20g}{mL} = 1200\ g\ soln$

$(0.150)(1200) = 180.0\ g\ HF$

$\dfrac{180.0\ g\ HF}{(19.00 + 1.008)amu} = \dfrac{180.0}{20.008} = 8.996\ mols$

$\dfrac{9.00\ mol}{L}$

$9.00\ M$

End of Test

Magnuson KEY EX1 Form K   26 Sep 2003

Q1	A
Q2	E
Q3	C
Q4	E
Q5	D
Q6	C
Q7	A
Q8	B
Q9	E
Q10	D
Q11	D
Q12	B
Q13	C
Q14	B
Q15	A
Q16	D
Q17	C
Q18	D
Q19	C
Q20	A
Q21	C
Q22	C
Q23	A
Q24	D
Q25	A
Q26	D
Q27	D
Q28	C
Q29	A
Q30	B