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 the department=CHEM, Course no. = 101, and Section= your lab section.
7.	If you want your score posted by a portion of your ID# mark A under the option column.
8.	Use the test for scratch paper.
9.	Mark your answers in the test as well as on the answer sheet so you can check your score with the key after the test.
10.	Turn in both the scantron and the exam, have your ID and your calculator ready to be checked.
11.	The key will be posted on my class web page sometime tomorrow.
12.	You may pick up your exams outside of room 410 HELD Friday AM, 27th Sep.'02

There are 30 questions for 125 points.
Good Luck!

Possibly Useful Information

1 cal = 4.184 J

$q = mass \times sp\ ht \times \Delta T$

$d = mass/vol$

$Volume = \ell \times h \times w$

Q.1   The correct chemical name for the compound $Sr(OH)_2$ is ...
a)   Strontium oxyhydride
b)   Strontium dioxyhydride
c)   Strontium(II) oxyhydride
d)   Strontium(II)dihydroxide
(e)   Strontium hydroxide ◀———

Q.2   The correct formula for the ammonium ion is...

a) NH_2^- b) NH_2^+ c) NH_3^- d) NH_3^+ (e) NH_4^+

Q.3   When the following chemical equation is balanced with the smallest integer
       coefficients, the sum of the coefficients in the balanced equation is,

$$4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$$
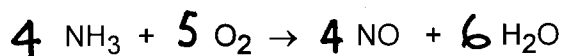
a) 6   b) 10   (c) 19   d) 9   e) 7

Q.4   When sodium reacts with water, hydrogen gas and aqueous sodium hydroxide
       are produced. This is an example of ...
a)   an inert element
b)   a physical property
(c)   a chemical property ◀———
d)   all of these
e)   none of these

Q.5   The basic SI unit of time is ...
a)   hours
b)   minutes
c)   years
(d)   seconds ◀——
e)   1/seconds

Q.6 $^{23}_{11}$ Na and $^{24}_{11}$ Na are examples of

a)   split atoms
b)   isotopes ←————————
c)   molecular formulas
d)   more than one of these
e)   none of these

Q.7   Xe -133 is a beta-emitter and has a half-life of 5.25 days. How many neutrons
      are there in Xe-133?

a) 133   b) 187   c) 25   d) 79   e) 50

$133 - 54 = 79$

$^{133}_{54}Xe$

Q.8   The proton to neutron ratio, p/n, in the element rubidium-87 is

a) 1   b) 0.74   c) 0.425   d) 50   e) 2.35

$^{87}_{37}Rb$ $\frac{37}{50} = 0.74$

Q.9   Fluorosulfuric acid, HSO_3F, is a fuming liquid with a density of 1.745 g/mL at
      15°C.   What is the mass of 2.50 liters of this acid at 15°C?

a)   4.36 kg ←—
b)   4.36 g
c)   1.43 g
d)   1.43 kg
e)   0.0698 kg

$1.745 \frac{g}{mL} \times 2.50 L \times \frac{1 mL}{10^{-3} L} = 4.36 \times 10^3 g$

$4.36 \ kg$

Q.10   If it were possible to measure samples of cadmium and cesium weighing
       exactly 1124 g of cadmium and 1329 g of cesium, each sample would contain,

a)   10 atoms
b)   100 atoms
c)   1 mole
d)   10 moles ←—
e)   100 moles

$1124 g\ Cd \times \frac{mol\ Cd}{112.4 g\ Cd} = 10\ mol\ Cd$

$1329 g\ Cs \times \frac{mol\ Cs}{132.9 g\ Cs} = 10\ mol\ Cs$

Q.11   Acute lymphatic leukemia is sometimes treated with the drug Purinethiol. The
        initial dose for adults is 2.5 mg/kg of body weight per day. The drug is supplied
        in scored tablets containing 50 mg of Purinethol, An adult patient weighing
        154.33 lbs will use how many tablets of this drug in a 25-day period?
        [1 lb = 454 g]

a)   between 85 and 95 tablets ◄—
b)   105 tablets
c)   25.5 tablets
d)   between 60 and 65 tablets
e)   50 tablets

$$154.33 \text{ lbs} * \frac{454 g}{lb} * \frac{1 kg}{1000 g} * \frac{2.5 mg}{kg \cdot day} * \frac{1 \text{ tablet}}{50 mg} * 25 \text{ days} =$$

$$= 87.58 \text{ tablets}$$

Q.12   A 100-g sample of a compound was analyzed and found to contain:
        14.29 g C, 1.20 g H, 27.37 g Na, and 57.14 g O.   What is the empirical
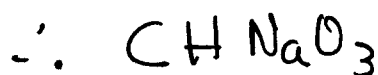   formula of this compound?

a)   CHNaO
b) C_3H_3NaO
c) CH_3NaO_3
d) $CHNaO_3$ ◄—
e)   none of the above

$$\frac{14.29}{12.11} = 1.1897 \text{ mol, C} / 1.1897 = 1, C$$

$$\frac{1.20}{1.008} = 1.190 \text{ mol, H} / 1.1897 = 1, H$$

$$\frac{27.37}{22.99} = 1.1905 \text{ mol, Na} / 1.1897 = 1, Na$$

$$\frac{57.14}{16.00} = 3.571 \text{ mol, O} / 1.1897 = 3, O$$

$$\therefore CH Na O_3$$

Q.13   When the following chemical equation is balanced with the smallest integer

coefficients, the sum of the coefficients in the balanced equation is,

$$1 \quad + \quad 1 \quad + 2 \quad + 1$$
$$Cu_2S + \quad O_2 \rightarrow 2\,Cu \quad + \quad SO_2$$
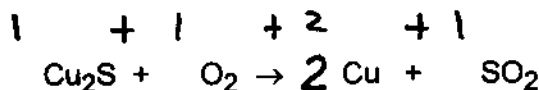
a) 2   (b) 5   c) 3   d) 4   e) 6

Q.14   How many grams of Li_2O are needed to produce 25.0 g of LiOH in the following

reaction. [Water is in excess.]
$$Li_2O + H_2O \rightarrow 2\,LiOH$$

(a) 15.6 g
b) 7.8 g
c) 31.2 g
d) 6.2 g
e) 14.0 g

Molar mass Li_2O = 29.88 g/mol

molar mass LiOH = 23.948 g/mol

$25.0g\ LiOH * \dfrac{mol\ LiOH}{23.948g} * \dfrac{(1)\ mol\ Li_2O}{(2)\ mol\ LiOH} * \dfrac{29.88\ g\ Li_2O}{1\ mol\ Li_2O} =$

$= 15.596\ g \Rightarrow 15.6\ g\ Li_2O$

Q.15   In the compound $BaCrO_4$, the mol ratio of barium to oxygen, O, is,

a)   1 to 1 $1 : 4$
b)   4 to 1
(c) 1 to 4 ◄——
d)   2 to 1
e)   1 to 2

Q.16   A 364.4 g - sample of an element , is found to contain 4.615 moles of the

element. What is the element?

a)   Erbium, Er
b)   Gallium, Ga
(c) Selenium, Se ◄——
d)   sulfur, S
e)   Germanium, Ge

$\dfrac{364.4\ g}{4.615\ mols} = \underbrace{78.959\ g/mol}$

Se

Q.17   What is the percent by mass of phosphorus in $Mg_3(PO_4)_2$.

a)   11.78 %
b)   76.42 %
c)   88.22 %
d)   26.00 %
(e) 23.56 % ◄——

molar mass $Mg_3(PO_4)_2$ = 262.86 g/mol

$\%\,P = \dfrac{2(30.97)}{262.86} * 100 = 23.56\%$

Q.18 Which of the following is a physical change?
a)   dissolving sugar in water ✔
b)   melting ice ✔
c)   burning gasoline
d)   all of these
(e)   more than one of these ←

Q.19 Solid sodium chloride is a(n) ...

a)   element
b)   heterogeneous mixture
c)   homogeneous mixture
(d)   compound ←
e)   polymer

Q.20 How many significant figures are there in the number 0.006502840?

a) 10   (b) 7   c) 6   d) 8   e) 5

Q.21 Consider the reaction: CH_4 (g) + 4S (g) → CS_2 (g) + 2 H_2S (g)

If the % yield of this reaction is 78.0%, how many grams of sulfur are needed to make 125 grams of carbon disulfide?

a)   8.41 g
b)   160 g
c)   78.0 g
(d)   270 g ←
e)   97.5 g

$$0.78 = \frac{125}{X} \Rightarrow X = 160.25 \text{ g } CS_2 \text{ theoretical}$$

$$160.25 \text{ g } CS_2 \times \frac{mol\ CS_2}{76.14\ g} \times \frac{④\ mol\ S}{①\ mol\ CS_2} \times \frac{32.07\ g\ S}{1\ mol\ S} =$$

$$= 269.98\ g \Rightarrow \boxed{270\ g\ S}$$

Q.22 Consider the reaction of sodium metal with chlorine gas to form sodium chloride solid. If you start out with 8.40 g Na and 3.70 g Cl_2 , what is the mass of product formed? [Hint: Write the balanced equation.]

a)   3.65 g
(b)   6.10 g ←
c)   0.762 g
d)   7.30 g
e)   5.22 g

$$2 Na + Cl_2 \longrightarrow 2 NaCl$$
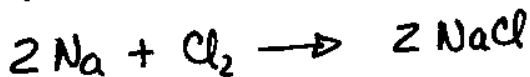
$$8.40g\ Na \times \frac{mol\ Na}{22.99\ g} \times \frac{②\ mol\ NaCl}{②\ mol\ Na} = 0.36537\ mol\ NaCl$$

$$3.70g\ Cl_2 \times \frac{mol\ Cl_2}{70.90\ g} \times \frac{②\ mol\ NaCl}{①\ mol\ Cl_2} = 0.10437\ mol\ NaCl$$

smallest

$$\therefore\ 0.1044\ mol\ NaCl \times \frac{58.44\ g\ NaCl}{1\ mol\ NaCl} = \boxed{6.10g\ NaCl}$$

Q.23   One mol of solid $(NH_4)_2SO_4$ contains,
a)   one mole of N
b) 6.022×10^{23} atoms of O
(c)   two moles of N ◄───────────
d)   eight moles of N
e)   two mole of sulfate

Q.24   A 648.3-mg sample of KIO_3 is dissolved in enough water to make 50.0 mL of
        solution. What is the molarity of this solution? Molar mass KIO_3 = 214 g/mol

$$M = \frac{mol}{L}$$

a) $3.03 \times 10^{-3}M$
b)   6.06 M
(c)   0.0606 M ◄───
d) $6.06 \times 10^{-5}M$
e)   3.03 M

$$\frac{648.3 \, mg \times \frac{10^{-3} \, g \, KIO_3}{1 \, mg} \times \frac{mol \, KIO_3}{214 \, g \, KIO_3}}{0.050 \, L} = 6.058 \times 10^{-2} \underbrace{M}_{0.0606 \, M}$$

Q.25   150.0 mL of a 5.0 M NaOH stock solution is diluted in a volumetric flask with
        enough distilled water to make a final volume of exactly 500 mL, What is the
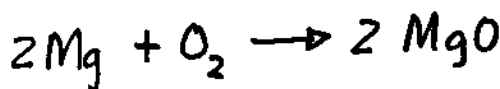   molarity of the diluted solution?
a)   17 M
(b)   1.5 M ◄───
c)   2.5 M
d)   1.0 M
e)   0.50 M

$$(150.0 \, mL)(5.0 \, M) = 500 \, mL \times X$$

$$\frac{(150.0)(5.0)}{500} = X = \boxed{1.5 \, M}$$

Q.26   Magnesium metal and molecular oxygen react to form magnesium oxide.
        If 46.5 g of magnesium and 37.2 g of molecular oxygen are caused to react,
        which reactant is limiting? [Hint: Write the balanced equation.]

(a)   Mg ◄───
b) O_2
c)   both
d)   none

$$2 Mg + O_2 \longrightarrow 2 MgO$$

smallest ∴ Mg limiting

For Mg $\{$ $46.5 \, g \, Mg \times \frac{mol \, Mg}{24.305 \, g \, Mg} \times \frac{(2) \, mol \, MgO}{(2) \, mol \, Mg} = 1.91 \, mol \, MgO$

for O_2 $\{$ $37.2 \, g \, O_2 \times \frac{mol \, O_2}{32.00 \, g \, O_2} \times \frac{(2) \, mol \, MgO}{(1) \, mol \, O_2} = 2.33 \, mol \, MgO$

Q.27   The formula mass of sulfanilamide, $C_6H_4SO_2(NH_2)_2$, is ...
a)   172.3 amu
b)   156.2 amu
c)   48.00 amu
d)   58.00 amu

$6(12.011) + 4(1.008) + 32.07 + 2(16.00)$

$+ 2(14.07) + 4(1.008) = 172.34\ amu$

Q.28   When the following quantities are added the answer has _____
       significant figures.

       47.6 + 66.85

47.6
66.85
114.45 → 114.4

a) 1   b) 2   c) 3   d) 4   e) 5

Q.29   Do the following calculation and report your answer to the proper number of
       significant figures.

       $2.0\ cm^3 \times 5.0\ mm^3$

a) $1.0 \times 10^{-2}\ cm^6$
b) $1.0\ cm^6$
c) $1.0\ cm^3$
d) $1.0\ mm^6$
e) $1.0 \times 10^6\ cm^3$

$2.0\ cm^3 \times 5.0\ mm^3 \times \frac{(10^{-3})^3 m^3}{1^3 mm^3} \times \frac{1\ cm^3}{(10^{-2})^3 m^3}$

$= 0.010\ cm^6$

$5.0\ mm^3 \times 2.0\ cm^3 \times \frac{(10^{-2})^3 m^3}{1 cm^3} \times \frac{1^3\ mm^3}{(10^{-3})^3 m^3} =$

$= 1.0 \times 10^4\ mm^6$

Q.30   The chemical formula for the ionic compound formed between the magnesium
       ion and the nitrate ion is ...

a) MgN   b) MgNO   c) Mg_2NO_3 d) $Mg(NO_3)_2$ e) $MgNO_3$

$Mg^{+2} + NO_3^-$
need
2
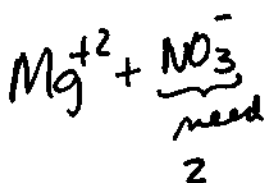
End of Test

1	E
2	E
3	C
4	C
5	D
6	B
7	D
8	B
9	A
10	D
11	A
12	D
13	B
14	A
15	C
16	C
17	E
18	E
19	D
20	B
21	D
22	B
23	C
24	C
25	B
26	A
27	A
28	D
29	A
30	D

TOTAL = 125 pt.

Each Question = 4.167 pts.