Name_____**KEY P**_____ (Print last name in CAPS)

SECTION _____(same as your lab section)

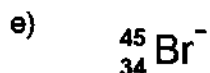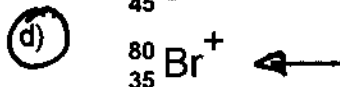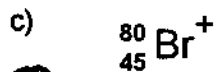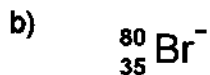|	
1.	Read each question carefully before answering.
2.	Mark the choice that best answers the question or completes the statement.
3.	Use the scantron provided. Use a no. 2 pencil and clearly mark your choice. If you change an answer, completely erase your previous mark.
4.	Answer each question. There 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 × sp ht × ΔT   d = mass/vol   Volume = l × h × w

P

Q.1   What is the correct $_Z^A X$ notation for an ion having 35 protons, 34 electrons,

and 45 neutrons?

a) $_{35}^{45}\text{Br}^+$

b) $_{35}^{80}\text{Br}^-$

c) $_{45}^{80}\text{Br}^+$

d) $_{35}^{80}\text{Br}^+$ ⬅—
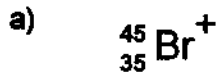
e) $_{34}^{45}\text{Br}^-$

$$\nearrow Z$$
$$35\, p \Rightarrow Br$$
$$-\ 34\, e^-$$
$$\overline{}$$
$$+1\ charge$$

$$35 + 45 = 80 = mass\ \# = A$$

$$\therefore\ _{35}^{80}Br^+$$
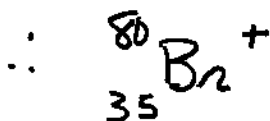
Q.2   One millimeter is equal to... $1\, mm = 10^{-3}\, m = 0.001\, m$

a) 1000 m   b) 0.001 m   c) 100 m   d) 0.10 m   e) 0.01 m

Q.3   The volume of a rectangular solid is given by Vol = length × width × height.

What is the volume of a solid of h = 2500 μm

ℓ = 85 cm

w = 150 m

a) 0.32 m³
b) 0.0032 m³
c) 3.2 m³
d) 32 m³
e) 320 m³

$$Vol = 2500\, \mu m * \frac{10^{-6}\, m}{1\, \mu m} * 85\, cm * \frac{10^{-2}\, m}{1\, cm} * 150\, m =$$

$$0.3187\, m^3 \Rightarrow 0.32\, m^3$$

Q.4   The molarity of a solution that contains 24.7 grams of H_2SO_4 in exactly 400 mL

of solution is ...

Molar mass H_2SO_4 : 98.09 g/mol

a)   0.251 M
b)   0.00630 M
c)   0.502 M
d)   3.20 M
e)   0.630 M ⬅—

$$M = \frac{mol}{L} = \frac{24.7\, g / 98.09}{0.400\, L}$$

$$M = 0.6295 \Rightarrow 0.630\, M$$

Q.5 How many kJ of heat are needed to raise the temperature of 225 g of water 50.0 °C?

(a) 47.1 kJ ←
b) 4.71 kJ
c) 471 kJ
d) 11.3 kJ
e) 113 kJ

$$q = 225\ g * \frac{4.184\ J}{g \cdot °C} * 50\ °C$$

$$= 47070\ J * \frac{kJ}{10^3\ J} = 47.1\ kJ$$

Q.6 The prefix giga means

(a) 10^9 ←
b) 10^{-9}
c) 10^6
d) 10^{-6}
e) None of these

Q.7 Calculate the volume of 4.00 M NaOH solution required to prepare exactly 200 mL of a 0.800 M solution of NaOH.

a) 2.00 mL
b) 4.00 mL
c) 20.0 mL
(d) 40.0 mL ←
e) 8.00 mL

$$(4.00\ M)\ X = (200\ mL)(0.800\ M)$$

$$X = \frac{(200\ mL)(0.800\ M)}{4.00\ M} = 40.0\ mL$$

Q.8 How many atoms are there in exactly 280.9 g of silicon?

(a) 10 × Avogadro's number ←
b) 100 × Avogadro's number
c) Avogadro's number
d) 1000 × Avogadro's number
e) 0.01 × Avogadro's number

$$\frac{280.9\ g\ Si}{28.09\ g/mol} = 10\ mols\ Si$$

$$\therefore \#\ atoms = 10 * N_A$$

Q.9 How many grams of the element copper, Cu, would contain as many copper atoms as there are sulfur atoms, S, in 5.00 moles of carbon disulfide, CS_2?
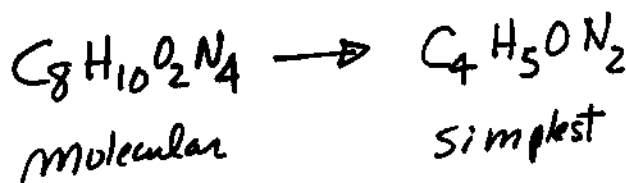
a) 762 g
b) 381 g
c) 318 g
(d) 636 g ←
e) 699 g

$$5.00\ mol\ CS_2 * \frac{2\ mol\ S}{1\ mol\ CS_2} = 10\ mol\ S$$

$$\therefore 10\ mol\ Cu * \frac{63.55\ g\ Cu}{1\ mol\ Cu} = 635.5\ g\ Cu$$

Q.10   The molecular formula for caffeine is $C_8H_{10}O_2N_4$. What is its simplest

formula?
a) C_4HO_2N
b)   CHON
c) $C_4H_5ON_4$
ⓓ $C_4H_5ON_2$ ◀—
e) C_2HON_2

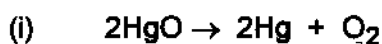$C_8H_{10}O_2N_4 \longrightarrow C_4H_5ON_2$

molecular   simplest

Q.11   The formula mass of phenol, C_6H_5OH, is ...
ⓐ   94.11 amu ◀—
b)   93.11 amu
c)   22.03 amu
d)   50.00 amu
e)   92.11 amu

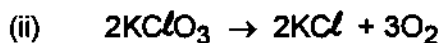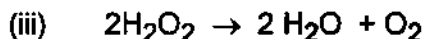$6(12.01) + 6(1.008) + 16.00 = 94.108 \text{ g/mol}$

$\underline{94.11 \text{ amu}}$

Q.12   How many mol oxygen, O_2, can be produced by the decomposition of 16.0 mol

of reactant in each of the following reactions:

(i) $2HgO \rightarrow 2Hg + O_2$

(ii) $2KClO_3 \rightarrow 2KCl + 3O_2$

(iii) $2H_2O_2 \rightarrow 2H_2O + O_2$

$16 \times \frac{1}{2} = 8$

$16 \times \frac{3}{2} = 24$

$16 \times \frac{1}{2} = 8$

a)   8, 8, 8, respectively
b)   8, 16, 16, respectively
c)   16, 16, 8, respectively
ⓓ   8, 24, 8, respectively ◀—
e)   16, 8, 32, respectively

Q.13   When the following numbers are added, the answer contains ____ significant

figures.   822.68

+ 205.986

1028.66̸

1028.67

‿‿‿‿‿‿ = 6 sig. fig.

a) 4   ⓑ 6   c) 3   d) 5   e) 7

Q.14   Matter may be classified as a(n) ...

a)   Solid, liquid or gas
b)   heterogeneous or homogeneous mixture
c)   Element
d)   Compound
e)   All the above are ways of classifying matter ⬅—

Q.15   Fumaric acid, $C_4H_4O_4$, is sometimes used as a substitute for citrus acid in fruit

drinks. What is the % O in fumaric acid?

a)   0.50 %
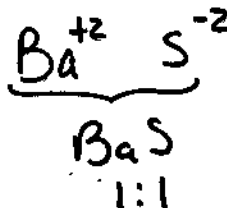b)   55.14 % ⬅—
c)   53.33 %
d)   53.52%
e)   33.33 %

Molar mass = 116.072 g/mol

$$\% O = \frac{4(16.00)}{116.072} \times 100 = 55.138 \%$$

$$55.14 \%$$

Q.16   In the correct formula for the ionic compound formed between the barium ion

and the sulfide ion, the mol ratio of barium to sulfur, S, is,

a)   1 to 1 ⬅—
b)   2 to 1
c)   1 to 2
d)   1 to 4
e)   3 to 2

$$Ba^{+2} \ S^{-2}$$

$$Ba S$$

$$1 : 1$$

Q.17   How many mols of lead are present in a piece of lead with a volume of 0.800

mL? The density of Pb is 11.34 g/mL.

a)   0.438
b)   43.8
c)   0.0438 ⬅—
d)   438
e)   2.94

$$11.34 \frac{g}{mL} \times 0.800 \, mL \times \frac{1 \, mol \, Pb}{207.2 \, g} = 0.04378 \ mol \, Pb$$

Q.18   How many neutrons are there in a O-15 isotope?

a) 15   b) 8   c) 7   d) -7   e) 22

$$15 - 8 = 7$$

Q.19 How many electrons are there in the ion, O^{-2} ? $8+2 = 10$

a) 1   b) 3   c) 7   d) 4   (e) 10

Q.20 Carbon tetrachloride has a density of 1.59 g/mL at 20°C. What volume is occupied by 318 grams of CCl_4?

(a)   200 mL ◄─
b) 5.00×10^{-3} mL
c)   5000 mL
d)   506 mL
e)   50.0 L

$$\frac{318 g}{1.59 \text{ g/mol}} = 200 \text{ mL}$$

Q.21 Naepaine hydrochloride, $C_{14}H_{23}ClN_2O_2$, molar mass = 286.7906 g/mol, is a compound used as a local anesthetic. How many millimoles of naepaine hydrochloride are there in 100.0 mg of this drug?

a)   3.49 mmol
(b)   0.349 mmol ◄─
c)   0.287 mmol
d)   0.0349 mmol
e)   349 mmol

$$100.0 \text{ mg} \times \frac{10^{-3} g}{1 mg} \times \frac{1 mol}{286.7906 g} \times \frac{1 mmol}{10^{-3} mol} =$$

$$= 0.3486 \text{ mmol} \Rightarrow 0.349 \text{ mmol}$$

Q.22 A compound is found to have the following % composition: 38.7% K, 13.8% N, 47.5% O. What is its simplest formula?

a) KNO_2
b) $K_2N_2O_3$
c) K_2NO_3
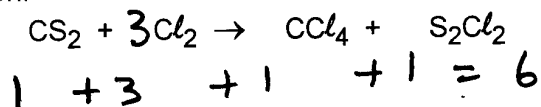(d) KNO_3 ◄─
e) K_2NO_2

$$\frac{38.7 g K}{39.10} = 0.989 \text{ mol } K / .985 = 1, K$$

$$\frac{13.8 g N}{14.01} = 0.985 \text{ mol } N / .985 = 1, N$$

$$\frac{47.5 g O}{16.00} = 2.960 \text{ mol } O / .985 = 3, O$$

$$\therefore \quad KNO_3$$

Q.23   When the equation:

$$CS_2 + 3Cl_2 \rightarrow CCl_4 + S_2Cl_2$$

$$1 + 3 + 1 + 1 = 6$$

is balanced with the smallest integer coefficients, the sum of the coefficients is:
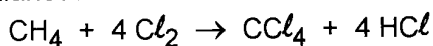
a) 7   b) 4   ⓒ 6   d) 5   e) 3

Q.24   How much chlorine, Cl_2, in grams is required to produce 22.0 g CCl_4

according to the following balanced reaction:

$$CH_4 + 4Cl_2 \rightarrow CCl_4 + 4HCl$$

ⓐ   40.6 g ◄— $22.0 g * \dfrac{mol\ CCl_4}{153.81\ g} * \dfrac{④\ Cl_2}{①\ CCl_4} * \dfrac{70.90\ g\ Cl_2}{1\ mol\ Cl_2} =$
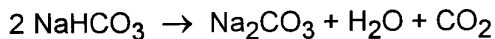
b)   0.574 g
c)   5.74 g
d)   10.2 g $= 40.564\ g\ Cl_2 \Rightarrow \underline{40.6\ g\ Cl_2}$
e)   1.02 g

Q.25   Calculate the % yield if 76.5 grams sodium carbonate is obtained from the
        thermal decomposition of 175.0 g of sodium hydrogen carbonate according to
        the reaction:

$$2\ NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$$

molar masses:
$NaHCO_3$ = 84.00 g/mol
Na_2CO_3 = 105.99 g/mol
H_2O = 18.01 g/mol
CO_2 = 44.01 g/mol

a) 6.93 %   ⓑ 69.3 %   c) 0.693 %   d) 30.7 %   e) 3.07 %

$175.0\ g\ NaHCO_3 * \dfrac{mol\ NaHCO_3}{84.00g\ NaHCO_3} * \dfrac{①mol\ Na_2CO_3}{②mol\ NaHCO_3} * \dfrac{105.99\ g\ Na_2CO_3}{1\ mol\ Na_2CO_3} =$

$= 110.4\ g\ Na_2CO_3\ theoretical$

$\%\ yield = \dfrac{76.5}{110.4} * 100 = 69.29\% \Rightarrow \underline{69.3\ \%}$
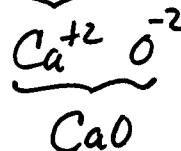
Q.26   The correct chemical name for the compound $(NH_4)_2S$ is ...
a)   diammine sulfide
b)   sulfur ammonia(II)
c)   diammonia sulfide
d)   diammonium sulfide
(e)   ammonium sulfide ◁——

Q.27   How many mols of calcium are needed to form 0.875 mol of calcium oxide?

a) 0.438   b) 0.1.09   (c) 0.875   d) 1.75   e) 0.219 $Ca^{+2} O^{-2}$

$0.875 mol\ CaO \times \dfrac{1\ mol\ Ca}{1\ mol\ CaO} = .875\ mol\ Ca$ CaO

Q.28   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 ◁—— $2 Mg + O_2 \longrightarrow 2 MgO$ smallest ∴ Mg limiting
b) O_2
c)   Both $\dfrac{46.5 g\ Mg}{24.3} = 1.91\ mol\ Mg \longrightarrow 1.91\ mol\ MgO$
d)   None

$\dfrac{37.2 g\ O_2}{32.00} = 1.16\ mol\ O_2 \times \dfrac{2\ mol\ MgO}{1\ mol\ O_2} = 2.325\ mol\ MgO$

Q.29   Which of the following is an intensive property of matter?

a)   Volume
b)   Mass
(c)   Density ◁——
d)   Length
e)   More than one of these

Q.30   When the following chemical equation is balanced with the smallest integer

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

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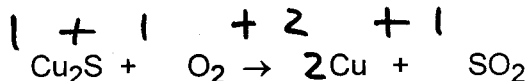
(a) 5   b) 4   c) 2   d) 6   e) 3

End of Test

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

TOTAL PTS = 125

each question = 4.167