College of Industrial Technology
King Mongkut's University of Technology North Bangkok

Seat No.

Final Examination of Semester 1 **Year:** 2019
Subject: 392151 Chemistry I **Section:** 15-18
Date: 10 October 2019 **Time:** 10.00-12.00

Name: _____ ID: _____ Class: _____

Directions: The test is designed to measure your comprehension. The test is divided into 2 parts. There will be 9 pages (including this page) and they are worth 70 points.

- Answer the questions on this test paper.
- Books, documents and lecture notes are not allowed.
- You must be in the room for one hour after the exam is started and, while taking the exam, you cannot go out except in an emergency case.
- Before leaving, make sure you do not bring this test outside.
- Do not use any electronic communication device.
- Calculators are **NOT** allowed in the examination.

Cheating in the exam is considered an extremely serious offence which will result in expulsion from the University.

Periodic Table of the Elements

1																	18
hydrogen 1 H 1.0079	2											13	14	15	16	17	helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078	3 scandium 21 Sc 44.955	4 titanium 22 Ti 47.867	5 vanadium 23 V 50.942	6 chromium 24 Cr 51.996	7 manganese 25 Mn 54.938	8 iron 26 Fe 55.845	9 cobalt 27 Co 58.933	10 nickel 28 Ni 58.693	11 copper 29 Cu 63.546	12 zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 ■ lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 ■ lawrencium 103 Lr [252]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs 269	meitnerium 109 Mt [268]	darmstadtium 110 Ds [271]	roentgenium 111 Rg [272]	ununbium 112 Uub [277]	ununtrium 113 Uut [284]	ununquadium 114 Uuq 289	ununpentium 115 Uup [288]	ununhexium 116 Uuh [293]	ununseptium 117 Uus [291]	ununoctium 118 Uuo [294]

■Lanthanide series	anthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
■Actinide series	actinium 89 Ac 227	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am 243	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md 258	nobelium 102 No [259]

	Multiple Choice	Part 2(1)	Part 2(2)	Total
score				

Part 1. Multiple Choice (10 points)

Choose the letter of the choice in the answer table that best completes the statement or answers the question.

Question no.	a.	b.	c.	d.
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10				

1. Which statement is a correct meaning of a closed system?
   a. It's a system where a quantity can leave the system
   b. It's a system where both quantity and energy can exchange with its environment
   c. It's a system where nothing can enter or leave the system
   d. It's a system where heat can exchange with its environment
2. Given that the percentage abundance of Cl-35 is 75% and that of Cl-37 is 25%, What is incorrect
   a. Chlorine has two isotopes
   b. Both have the same atomic number
   c. Their neutrons are equal
   d. Average mass of isotopes is 35.5
3. Molar mass of $CuSO_4.5H_2O$ is
   (Cu=63.5 , S=32 , O=16 , H=1)
   a. 159.5 g/mole
   b. 177.5 g/mole
   c. 185.5 g/mole
   d. 249.5 g/mole

4. Atomic weights of nitrogen (N), barium (Ba) and oxygen (O) are 14, 137, and 16 g/mole, respectively. The percent composition of oxygen in barium nitrate, $Ba(NO_3)_2$ is:
   a. 0.368%
   b. 6.13%
   c. 2.30%
   d. 36.8%
5. What is a correct answer if a container contains 12.04×10^{22} molecules of N_2?
   a. It's 2 moles of N_2
   b. N_2 contains 14 grams
   c. The number of N_2 atom is 24.08×10^{22} atoms
   d. The volume of this gas is 22.4 L at STP
6. Which of the following samples contains the largest number of atoms?
   a. 24.0 grams of carbon
   b. 6.02×10^{23} H_2 molecules
   c. 0.50 mol NH_3
   d. 28.0 grams of CO
7. How many moles of hydrogen gas would be produced if we put one mole of sodium with one mole of water?
   a. 0.5 mole b. 1 mole c. 1.5 moles d. 2 moles
8. Which compound has a highest molecular mass?
   a. $(NH_4)_3PO_4$
   b. Mg_3N_2
   c. KOH
   d. $KHSO_4$
9. Glucose ($C_6H_{12}O_6$) reacts with oxygen to produce carbon dioxide and water:

   $$C_6H_{12}O_6\,(s) + O_2\,(g) \longrightarrow CO_2\,(g) + H_2O\,(l)$$

   If student A does the reaction as expressed above and uses 180 g of glucose and reaction takes place completely, which choice is true?
   a. Number of moles of reactants and products are equal.
   b. Number of moles of products is greater than number of moles of reactants.
   c. Number of molecules of reactants and products are not significantly different.
   d. Oxygen gas might be found at the end of the reaction.
10. How many moles of Al_2O_3 can be prepared from the reaction of 0.90 mol of O_2 plus sufficient Al? $Al + O_2 \longrightarrow Al_2O_3$
    a. 0.3 mole b. 0.6 mole c. 1 mole d. 2 mole

Part 2 Write your answer in the space provided for each question.

Instruction

READ carefully

Students must provide calculation detail if CALCULATION is noted for any questions. Getting a full score cannot be provided if only answer without any detail is written.

1. Specify the following a phase or words whether they are open, closed or isolated systems. (3 points)

   1.1 A jar filled with water.....

   1.2 An egg.....

   1.3 A cooler.....

2. If the sample you have contains 60% carbon-12 and 40% carbon-14, calculate the relative atomic mass of an atom in that sample. (CALCULATION, 3 points)

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3. Relative atomic mass of nitrogen is 14.01 and atomic masses for ^{14}N and ^{15}N are 14 amu and 15 amu, respectively. Calculate % abundance of each nitrogen isotope. (CALCULATION, 5 points)

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4. Determine the molecular weight for the following molecules. (CALCULATION, 4 points)
(C=12, H=1, N=14, O=16, Co=59, Cl=35.5, Mg=24, and Si=28)

4.1 $C_8H_{10}N_4O_2$

4.2 $Co(NH_3)_6Cl_3$

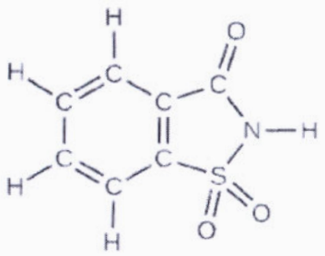
4.3 $Mg_6Si_4H_6O_{16}$

4.4 C_6H_6

5. A compound contains 52.2% carbon (C), 13.0% hydrogen (H) and 34.8% oxygen (O). Determine its empirical formula. (CALCULATION, 3 points)

6. Calculate the percentage composition by mass of each element in $C_6H_5NH_2$
(CALCULATION, 3 points)

10. A packet of an artificial sweetener contains 40.0 mg of saccharin ($C_7H_5NO_3S$), whose chemical structure is displayed below. How many saccharin molecules are in a 40.0 mg of saccharin? How many carbon atoms are in the same sample? (CALCULATION, 5 points) (C=12, H=1, O=16, N=14 and S=32)



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11. Calculate the number of moles of each compounds. (CALCULATION, 6 points)

11.1. 2.24 L of O_2 at STP

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11.2 3.01×10^{25} CO_2 molecules

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11.3 N_2O 132 g

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12. Balance all the following equations (5 points)

1. ____MgI_2 (aq) + ____$AgNO_3$ (aq) ⟶ ____$Mg(NO_3)_2$ (aq) + ____AgI(aq)
2. ____PCl_5 (aq) + ____H_2O (l) ⟶ ____H_3PO_4 (aq) +____ HCl (aq)
3. ____C_3H_8(g) + ____O_2(g) ⟶ ____CO_2(g) + ____H_2O(g)
4. ____P_4O_{10} (s) + ____ H_2O (l) ⟶ ____ H_3PO_4 (aq)
5. ____$Al(OH)_3$ + ____H_2SO_4 ⟶ ____$Al_2(SO_4)_3$+____ H_2O

13. From the reaction: $B_2H_6 + O_2 \longrightarrow HBO_2 + H_2O$

(CALCULATION, 5 points) (B=11, H=1 and O=16)

13.1 What mass of O_2 will be needed to burn 36.1 g of B_2H_6?

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13.2 How many moles of water are produced from 19.2 g of B_2H_6?

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14. KO_2 is used in a closed-system breathing apparatus. It removes water and carbon dioxide from exhaled air. The reaction for the removal of water is:

$$KO_2 + H_2O \longrightarrow O_2 + KOH.$$

The KOH produced is used to remove carbon dioxide by the following reaction:

$$KOH + CO_2 \longrightarrow KHCO_3.$$

(CALCULATION, 6 points) (K=39, H=1, O=16 and C=12)

14.1 What mass of KO_2 produces 235 g of O_2?

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14.2 What mass of CO_2 can be removed by 123 g of KO_2?

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7. Vinegar is a dilute solution form of acetic acid. A sample of acetic acid has the following percentage composition: 39.9% carbon, 6.7% hyrogen and 53.4% oxygen. (CALCULATION, 6 points)

   7.1. Determine the empirical formula of acetic acid.

   7.2. Determine the molecular formula of acetic acid if the molar mass of acetic acid is 60 g/mol.

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8. Compute and compare the number of carbon atoms in 2 mole of ethanol (C_2H_5OH) and 3 mole of carbon dioxide (CO_2). (CALCULATION, 3 points) (C=12, H=1 and O=16)

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9. Vitamin C is a covalent compound with the molecular formula $C_6H_8O_6$. The recommended daily dietary allowance of vitamin C for children aged 4–8 years is 1.42×10^{-4} mol. What is the mass of this allowance in grams? (CALCULATION, 3 points) (C=12, H=1 and O=16)

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