



FINAL
Examination Paper

(COVER PAGE)

Session : **APRIL 2018**

Programme : **FOUNDATION IN SCIENCE (CFSI)**

Course : **CHM1203: CHEMISTRY 1**

Date of Examination : **30th July 2018 (Monday)**

Time : **02:00pm – 04:00pm**

Duration : **2 Hours** Reading Time : **Nil**

Special Instructions :

This paper consists of **FIVE (5)** questions. Answer **FOUR (4)** questions in the answer booklet provided.

All questions carry equal marks.

IMPORTANT NOTE : THIS PAPER SHOULD NOT BE TAKEN OUT OF THE EXAMINATION HALL

Materials Permitted : Non-programmable calculator

Materials Provided : Periodic Table

Examiner(s) : Ms. Lim Sze Theng

Moderator : Dr. Lim Gin Keat

This paper consists of 10 printed pages, including the cover page.

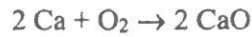
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FOUNDATION IN SCIENCE (CFSI)
CHM1203: CHEMISTRY 1
FINAL EXAMINATION: APR 2018 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

- (a) Classify each as (1) physical property, (2) a physical change, (3) chemical property or (4) a chemical change
- (i) the process of decomposing hydrogen peroxide (1 mark)
 - (ii) the fact that a block of ice can be chipped into smaller pieces (1 mark)
 - (iii) the process of evaporating a liquid (1 mark)
 - (iv) the fact that water freezes at 32°F. (1 mark)
- (b) Classify each of the following statements as true or false.
- (i) All homogeneous mixtures must contain at least two substances. (1 mark)
 - (ii) Heterogeneous mixtures, but not homogeneous mixture, can have a variable composition. (1 mark)
 - (iii) Pure substances cannot be separated into other kinds of matter by physical means. (1 mark)
- (c) Classify the element with each of the following electron configuration as a representative element, transition element, noble gas, or inner transition element.
- (i) $1s^2 2s^2 2p^6 3s^2 3p^5$ (1 mark)
 - (ii) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$ (1 mark)
 - (iii) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^2$ (1 mark)
 - (iv) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^5$ (1 mark)

- (d) In an experiment designed to produce calcium oxide by the chemical reaction



177.2 g of CaO was obtained out of a possible 203.9 g of CaO.

- (i) What is the theoretical yield of CaO? (2 marks)
- (ii) What is the actual yield of CaO? (2 marks)
- (iii) What is the percent yield of CaO? (2 marks)
- (e) Carbon monoxide is a chemical compound with the formula, CO.
- (i) Name the type of bonding in the CO (1 mark)
- (ii) Determine whether it is a polar or non-polar molecule. (1 mark)
- (iii) Draw the Lewis structure of the compound. (2 marks)
- (f) Find the $[\text{H}^+]$ and the pH for the following solutions:
- (i) 1.0 M of $\text{Ca}(\text{OH})_2$ (2 marks)
- (ii) 3.4×10^{-4} M H_2SO_4 (2 marks)

(TOTAL: 25 MARKS)

Question 2

- (a) Balance each of the following equations and identify the type of reaction from the choices combination, decomposition, displacement, exchange and combustion:
- (i) $\text{H}_2\text{SO}_4 \rightarrow \text{SO}_3 + \text{H}_2\text{O}$ (2 marks)
- (ii) $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ (2 marks)
- (iii) $\text{Ca} + \text{Cl}_2 \rightarrow \text{CaCl}_2$ (2 marks)
- (b) Indicate whether the elements for the following pairs of electron configurations have similar chemical properties. Explain.
- (i) $1s^22s^1$ and $1s^22s^22p^63s^23p^63d^{10}4s^1$ (2 marks)
- (ii) $1s^22s^22p^6$ and $1s^22s^22p^63s^23p^6$ (2 marks)
- (c)
- (i) Suppose copper (II) carbonate is heated. What mass of copper (II) oxide would be formed starting from 5.0 g of the carbonate? (3 marks)
- (ii) What mass of carbon dioxide is lost when 2.5 g of magnesium carbonate is decomposed by heating? (3 marks)
- (iii) What mass of potassium chloride is formed when 2.8 g of potassium hydroxide is completely neutralised by excess hydrochloric acid. (3 marks)
- (d) Determine the final concentration of the following solution after 30.0 mL water has been added.
- (i) 60.0 mL of 3.0 M NaCl solution (2 marks)
- (e) For each of the following solutions, how many milliliters of water should be added to yield a solution that has a concentration of 0.125 M.
- (i) 5.00 mL of 10.0 M AgNO_3 (2 marks)
- (ii) 75.0 mL of 0.130 M AgNO_3 (2 marks)
- (TOTAL: 25 MARKS)**

Question 3

- (a) Write complete electron configurations for atoms whose electron configurations end as follows.
- (i) $5s^1$ (2 marks)
 - (ii) $4p^2$ (2 marks)
- (b) Predict whether each of the following pairs of substances could function as a buffer system in aqueous solution. Explain.
- (i) HNO_3 and NaNO_3 (2 marks)
 - (ii) HF and NaF (2 marks)
 - (iii) KCl and KCN (2 marks)
 - (iv) H_2CO_3 and NaHCO_3 (2 marks)
- (c) Determine the molarity of a KOH solution when each of the following amounts of acid neutralizes 25.0 mL of the KOH solution.
- (i) 5.00 mL of 0.500 M H_2SO_4 (3 marks)
 - (ii) 20.00 mL of 0.250 M HNO_3 (3 marks)
 - (iii) 13.07 mL of 0.100 M H_3PO_4 (3 marks)
- (d) Indicate the major types of intermolecular forces (dipole-dipole forces, hydrogen bonds or van der Waals forces) that occurs between the particles :
- (i) BrCl (1 mark)
 - (ii) HCl (1 mark)
- (e) Predict which compound in each of the following pairs that has higher melting and boiling points.
- (i) H_2 and HCl (1 mark)
 - (ii) ClF and HF (1 mark)

(TOTAL: 25 MARKS)

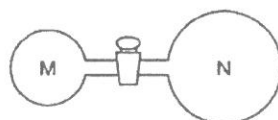
Question 4

- (a) Consider the following chemical system at equilibrium.



For each of the following adjustments of conditions, indicate the effect (shifts left, shifts right, or no effect) on the position of equilibrium.

- (i) Heating the equilibrium mixture (1 mark)
- (ii) Increasing the pressure on the equilibrium mixture by adding nonreactive gas (1 mark)
- (iii) Adding H_2 to the equilibrium mixture (1 mark)
- (iv) Decreasing the size of the reaction container (1 mark)
- (b) What does the term reversible reaction mean? (2 marks)
- (c) Using Lewis structures, show how ionic compounds are formed by atoms of
- (i) Be and O (2 marks)
- (ii) Mg and S (2 marks)
- (iii) N and K (2 marks)
- (iv) F and Ca (2 marks)
- (d) Two glass vessels M and N are connected by a closed valve.



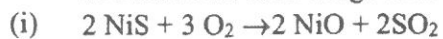
M contains helium at $20\text{ }^\circ\text{C}$ at a pressure of $1 \times 10^5\text{ Pa}$. N has been evacuated, and has three times the volume of M. In an experiment, the valve is opened and the temperature of the whole apparatus is raised to $100\text{ }^\circ\text{C}$.

What is the final pressure in the system?

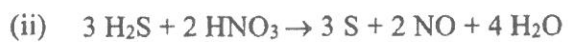
(4 marks)

- (e) A reaction between 7.0 g of copper(II) oxide and 50 mL of 0.20 M nitric acid produces copper(II) nitrate and water.
- (i) Write a balanced equation for the reaction above. (1 mark)
- (ii) Determine the limiting reactant. (2 marks)

(f) Identify which substance has been oxidized and which substance has been reduced in each of the following redox reactions.



(2 marks)



(2 marks)

(TOTAL: 25 MARKS)

Question 5

- (a) By using the solubility rules, predict whether each of the following ionic compounds is soluble (S) or insoluble (I) in water:
- (i) FeSO_4 (1 mark)
 - (ii) FeCO_3 (1 mark)
 - (iii) $\text{Fe}(\text{NO}_3)_2$ (1 mark)
 - (iv) FeCl_2 (1 mark)
- (b) For the reaction
- $$\text{C}_6\text{H}_6(\text{g}) + 3 \text{H}_2(\text{g}) \rightleftharpoons \text{C}_6\text{H}_{12}(\text{g}) \quad \Delta H = \text{exo}$$
- determine in what direction the equilibrium will be shifted by each of the following changes.
- (i) Decreasing the concentration of H_2 (1 mark)
 - (ii) Increasing the concentration of C_6H_6 (1 mark)
 - (iii) Decreasing the temperature (1 mark)
 - (iv) Increasing the pressure by decreasing the volume of the container (1 mark)
- (c) A gas mixture contains He, Ne and H_2S at partial pressure of 125, 175 and 225 mm Hg, respectively. If all of the H_2S is removed from the mixture, what will be the partial pressure, in millimeters of mercury, of Ne? (2 marks)
- (d) Determine the following for a 0.500 mole sample of CO gas
- (i) Pressure, in atmospheres, at 35°C in a 1.00 L container (2 marks)
 - (ii) Temperature, in degrees Celsius, at 5.00 atm pressure in a 5.00 L container (2 marks)
 - (iii) Volume, in liters, at 127°C and 3.00 atm (2 marks)
 - (iv) Pressure, in millimeters of mercury, at 25°C in a 2.00 L container (2 marks)

- (e) Indicate whether the reactants in each of the following Bronsted-Lowry acid-base reactions is functioning as an acid or a base.
- (i) $\text{HClO} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{ClO}^-$ (2 marks)
- (ii) $\text{H}_3\text{PO}_4 + \text{NH}_3 \rightarrow \text{NH}_4^+ + \text{H}_2\text{PO}_4^-$ (2 marks)
- (iii) $\text{HNO}_2 + \text{HS}^- \rightarrow \text{H}_2\text{S} + \text{NO}_2^-$ (2 marks)
- (f) Write the formula of conjugate base of HC_2O_4^- (1 mark)
- (TOTAL: 25 MARKS)**

--THE END--

CHM1203(F)/APR2018/S.T.LIM

18
Group
VIII
VIIIA

1
Group
IA

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	Group IA	Group IIA	Group IIIB	Group IVB	Group VB	Group VIB	Group VIIB	Group VIII	Group VIII	Group VIII	Group IIB	Group IIIA	Group IVA	Group VA	Group VIA	Group VIIA	Group VIIIA	Group VIIIA	
1	1 H 1.01	2 He 4.00																	
2	3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18	
3	11 Na 22.99	12 Mg 24.31										13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95		
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.63	33 As 74.92	34 Se 78.97	35 Br 79.90	36 Kr 83.80	
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.95	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29	
6	55 Cs 132.91	56 Ba 137.33	57 La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)	
7	87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (263)	105 Db (262)	106 Sg (266)	107 Bh (267)	108 Hs (277)	109 Mt (276)	110 Ds (281)	111 Rg (280)	112 Cn (285)	113 Nh (284)	114 Fl (289)	115 Lv (288)	116 Lv (293)	117 Ts (293)	118 Og (294)	
			58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.05	71 Lu 174.97			
			90 Th (232)	91 Pa (231)	92 U (238)	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)			

Atomic number
Symbol
Atomic mass

24
Cr
52.00

Nonmetals
Metals

2
He
4.00

4
Be
9.01

12
Mg
24.31

20
Ca
40.08

38
Sr
87.62

56
Ba
137.33

88
Ra
(226)

5
B
10.81

6
C
12.01

7
N
14.01

8
O
16.00

13
Al
26.98

14
Si
28.09

15
P
30.97

16
S
32.07

17
Cl
35.45

31
Ga
69.72

32
Ge
72.63

33
As
74.92

49
In
114.82

50
Sn
118.71

81
Tl
204.38

82
Pb
207.2

83
Bi
208.98

113
Nh
(284)

114
Fl
(289)

115
Lv
(288)

116
Lv
(293)

117
Ts
(293)

118
Og
(294)