INTI
International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2018**
Programme	:	Foundation in Science (CFSI)
Course	:	**CHM1203 : CHEMISTRY 1**
Date of Examination	:	10 December 2018 (Monday)
Time	:	11:00AM – 1:00PM Reading Time : Nil
Duration	:	2 hours
Special Instructions	:	

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

Materials permitted :

Non-Programmable Calculator

Materials provided :

Periodic Table

Examiner(s)	:	**Ms. Lim Sze Theng**
Moderator	:	**Dr. Lim Gin Keat**

*This paper consists of **11** printed pages, including the cover page.*

INTI INTERNATIONAL COLLEGE PENANG
FOUNDATION IN SCIENCE (CFSI)
CHM1203: CHEMISTRY 1
FINAL EXAMINATION: AUG 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 of the following changes as physical or chemical.

(i) A newspaper page turns yellow over time. (1 mark)

(ii) A rubber band breaks. (1 mark)

(iii) A firecracker explodes. (1 mark)

(iv) Dry ice "disappears" over time. (1 mark)

(b) Characterize each of the following pairs of atoms as containing (1) the same number of neutrons, (2) the same number of protons, (3) the same number of nucleons, or (4) the same total number of subatomic particles.

(i) $^{13}_{6}C$ and $^{13}_{7}N$ (1 mark)

(ii) $^{37}_{17}Cl$ and $^{36}_{18}Ar$ (1 mark)

(iii) $^{35}_{17}Cl$ and $^{37}_{17}Cl$ (1 mark)

(iv) $^{18}_{8}O$ and $^{19}_{9}F$ (1 mark)

(c) Select the quantity that contains the greater number of atoms in each of the following pairs of substance amounts. Make your selection using the periodic table, but without performing an actual calculation.

(i) 1.00 mole of S or 1.00 mole of S_8 (1 mark)

(ii) 28.00 g of Al or 1.00 mole of Al (1 mark)

(iii) 28.09 g of Si or 30.09 g of Mg (1 mark)

(iv) 2.00 g of Na or 6.02×10^{23} atoms of He (1 mark)

(d) If 125.5 g of Ca_3N_2 were produced from 29.0 g of N_2 and an excess of Ca according to the reaction

$3\ Ca + N_2 \rightarrow Ca_3N_2$

What was the percent yield of Ca_3N_2?

(3 marks)

(e) What is the molarity of the solution prepared by diluting 25.0 mL of 0.220 M NaCl to each of the following final volumes?

(i) 457 mL

(2 marks)

(ii) 2.00 L

(2 marks)

(f) Identify the two "active species" in each of the following buffering systems.

(i) Na_2HPO_4 and KH_2PO_4

(2 marks)

(ii) K_2CO_3 and $KHCO_3$

(2 marks)

(g) Write an equation for the following buffering actions.

(i) the response of a $H_3PO_4/H_2PO_4^-$ buffer to the addition of OH^- ions.

(2 marks)

(TOTAL: 25 MARKS)

Question 2

(a) On the basis of the total number of electrons present, identify the elements whose electron configurations are

(i) $1s^2 2s^2 2p^4$

(1 mark)

(ii) $1s^2 2s^2 2p^6$

(1 mark)

(iii) $1s^2 2s^2 2p^6 3s^2 3p^1$

(1 mark)

(iv) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

(1 mark)

(b) Using Lewis structures, show how ionic compounds are formed by atoms of

(i) Na and F

(2 marks)

(ii) Li and S

(2 marks)

(iii) Be and S

(2 marks)

(iv) P and K

(2 marks)

(c) The concentration of cholesterol in a blood sample is found to be 203 mg/dL. Express this concentration in the following units:

(i) mg/100 mL

(2 marks)

(ii) g/100 mL

(2 marks)

(iii) g/L

(2 marks)

(d) Indicate whether or not product formation increases with increasing temperature in each of the following equilibrium systems.

(i) $\text{heat} + H_2\,(g) + I_2\,(g) \rightleftharpoons 2\,HI\,(g)$

(1 mark)

(ii) $CO\,(g) + 2\,H_2\,(g) \rightleftharpoons CH_4O\,(g) + \text{heat}$

(1 mark)

(iii) $4\,NH_3\,(g) + 5\,O_2\,(g) \rightleftharpoons \text{heat} + 4\,NO\,(g) + 6\,H_2O\,(g)$

(1 mark)

(iv) $\text{heat} + 2\,NaHCO_3\,(s) \rightleftharpoons Na_2CO_3\,(s) + CO_2\,(g) + H_2O\,(g)$

(1 mark)

(e) Indicate whether the reactants in the following Bronsted-Lowry acid-base reactions is functioning as an acid or a base.

$F^- + H_2O \rightarrow HF + OH^-$

(2 marks)

(f) Write the formula of conjugate base of H_2SO_3.

(1 mark)

(TOTAL: 25 MARKS)

Question 3

(a) Indicate whether each of the following quantities would involve an exact number or an inexact number.

(i) The length of a swimming pool

(1 mark)

(ii) The number of gummi bears in a bag

(1 mark)

(iii) The number of quarts in a gallon

(1 mark)

(iv) The surface area of a living room rug

(1 mark)

(b) Potassium thiosulfate ($K_2S_2O_3$) is used to remove any excess chlorine from fibers and fabrics that have been bleached with that gas. The reaction is

$$K_2S_2O_3 + 4\ Cl_2 + 5\ H_2O \rightarrow 2\ KHSO_4 + 8\ HCl$$

How many grams of HCl will be produced at the same time that 25.0 g of $KHSO_4$ is produced?

(3 marks)

(c) Classify each of the following reactions as a redox reaction or a nonredox reaction.

(i) $2\ Cu + O_2 \rightarrow 2\ CuO$

(1 mark)

(ii) $K_2O + H_2O \rightarrow 2\ KOH$

(1 mark)

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

(1 mark)

(iv) $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$

(1 mark)

(d) Determine the molarity of a NaOH solution when each of the following amounts of acid neutralizes 25.0 mL of the NaOH solution.

(i) 5.00 mL of 0.250 M HNO_3

(3 marks)

(ii) 20.00 mL of 0.500 M H_2SO_4

(3 marks)

(iii) 23.76 mL of 1.00 M HCl

(3 marks)

(e) Using VSEPR theory, predict the molecular geometry of the following molecules

(i) NCl_3

(1 mark)

(ii) $SiCl_4$

(1 mark)

(iii) H_2Se

(1 mark)

(iv) SBr_2

(1 mark)

(v) HOCl

(1 mark)

(TOTAL: 25 MARKS)

Question 4

(a) Draw Lewis structure to illustrate the bonding in the following molecules. In each case, there will be at least one multiple bond present in a molecule.

(i) $COCl_2$: Both chlorine atoms and oxygen atom are bonded to the carbon atom.

(2 marks)

(ii) $C_2H_2Br_2$: The two carbon atoms are bonded to one another. Each carbon atom also has a bromine atom and a hydrogen atom bonded to it.

(2 marks)

(iii) C_2N_2: The two carbon atoms are bonded to one another, and each carbon atom also has a nitrogen bonded to it.

(2 marks)

(iv) CH_2N_2: A central carbon atom has both nitrogen atoms bonded to it. Both hydrogen atoms are bonded to one of the two nitrogen atoms.

(2 marks)

(b) Determine the following for a 0.250 mole sample of CO_2 gas.

(i) Volume, in liters, at 27°C and 1.50 atm

(2 marks)

(ii) Pressure, in atmospheres, at 35°C in a 2.00 L container.

(2 marks)

(iii) Temperature, in degree Celsius, at 1.20 atm pressure in a 3.00 L container.

(2 marks)

(iv) Volume, in milliliters, at 125°C and 0.500 atm pressure.

(2 marks)

(c) For each of the following solutions, how many milliliters of water should be added to yield a solution that has a concentration of 0.100 M.

(i) 50.0 mL of 3.00 M KCl

(2 marks)

(ii) 75.0 mL of 0.110 M KCl

(2 marks)

(d) After the following chemical equation was balanced, the name of one of the reactants was substituted for its formula.

$$2 \text{ butyne} + 11\ O_2 \rightarrow 8\ CO_2 + 6\ H_2O$$

Using only the information found within the chemical equation, determine the molecular formula of butyne.

(2 marks)

(e) In an experiment designed to produce sulfur dioxide by the chemical reaction

$$2\ S + O_2 \rightarrow 2\ SO_2$$

9.75 g of SO_2 was obtained out of a possible 11.2 g of SO_2 .

(i) What is the theoretical yield of SO_2?

(1 mark)

(ii) What is the actual yield of SO_2?

(1 mark)

(iii) What is the percent yield of SO_2?

(1 mark)

(TOTAL: 25 MARKS)

Question 5

(a) Classify each of the following as a heterogeneous mixture, homogeneous mixture, or a pure substance.

(i) Mouthwash

(1 mark)

(ii) Perfume

(1 mark)

(iii) A bowl of Fruit Loops cereal

(1 mark)

(b) A gaseous mixture containing He, Ne, and Ar exerts a pressure of 3.00 atm. What is the partial pressure of each gas present in the mixture under the following conditions?

(i) There is an equal number of moles of each gas present.

(1 mark)

(ii) There is an equal number of atoms of each gas present.

(1 mark)

(iii) The partial pressures of He, Ne, and Ar are in a 3:2:1 ratio.

(1 mark)

(iv) The partial pressure of He is one-half that of Ne and one-third that of Ar.

(1 mark)

(c) Classify each of the following reactions as a combination, decomposition, displacement, exchange, or combustion reaction.

(i) $2\ NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

(1 mark)

(ii) $2\ Ag_2CO_3 \rightarrow 4\ Ag + 2\ CO_2 + O_2$

(1 mark)

(iii) $2\ C_2H_6 + 7\ O_2 \rightarrow 4\ CO_2 + 6\ H_2O$

(1 mark)

(iv) $Mg + 2\ HCl \rightarrow MgCl_2 + H_2$

(1 mark)

(d) Indicate which molecule in each of the following pairs of molecules has the greatest molecular polarity.

(i) BrCl and BrI

(1 mark)

(ii) CO_2 and SO_2

(1 mark)

(iii) SO_3 and NH_3

(1 mark)

(iv) CH_4 and CH_3Cl (C is the central atom)

(1 mark)

(e) In which of the following pairs of diatomic species do both members of the pair have bonds of the same multiplicity (single, double, triple)?

(i) HCl and HI

(1 mark)

(ii) S_2 and Cl_2

(1 mark)

(iii) CO and NO^+

(1 mark)

(iv) OH^- and HS^-

(1 mark)

(f) Indicate whether or not each of the following pairs of atoms/ions are isoelectronic.

(i) K^+ and Ar

(1 mark)

(ii) Al^{3+} and Cl^-

(1 mark)

(iii) Ar and Kr

(1 mark)

(iv) O^{2-} and N^{3-}

(1 mark)

(g) Write the chemical formulas for the following binary ionic compounds.

(i) Cobalt (II) sulfide

(1 mark)

(ii) Lead (II) nitride

(1 mark)

(TOTAL: 25 MARKS)

--THE END--

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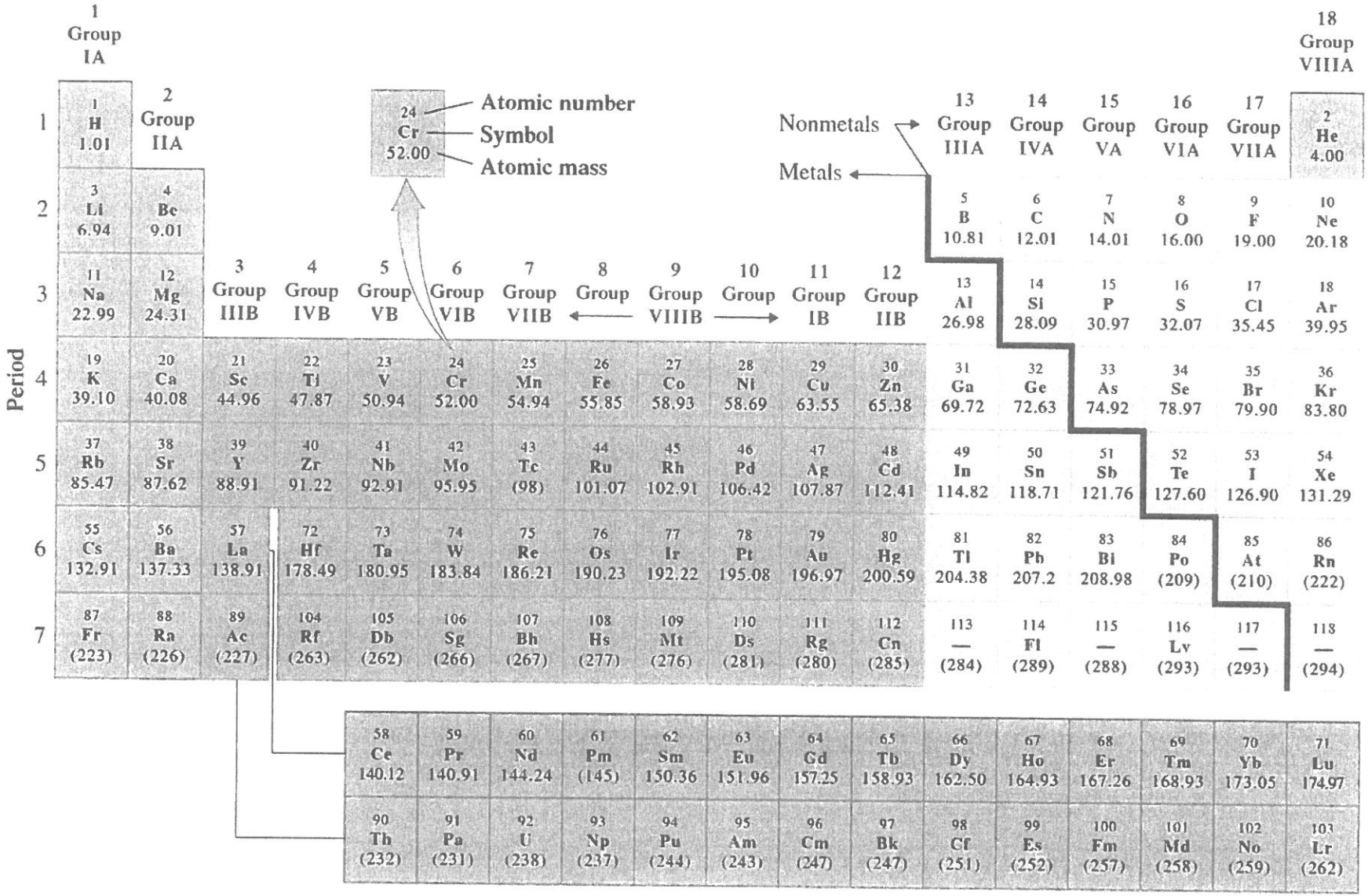
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Symbol
Atomic mass
Nonmetals
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3 Li 6.94
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5 B 10.81
6 C 12.01
7 N 14.01
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9 F 19.00
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12 Mg 24.31
13 Al 26.98
14 Si 28.09
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18 Ar 39.95
19 K 39.10
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22 Ti 47.87
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26 Fe 55.85
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28 Ni 58.69
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30 Zn 65.38
31 Ga 69.72
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56 Ba 137.33
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74 W 183.84
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