UNIVERSITY OF SWAZILAND

RE-SIT EXAMINATION – 2019, JULY

TITLE OF PAPER   :   Chemistry

COURSE NUMBER   :   CPR 103

TIME   :   Three Hours

INSTRUCTIONS   : Answer any **FOUR** questions (each question is 25 marks)

        NB: Non-programmable electronic calculators may be used

                  A periodic table is attached

This Examination Paper Contains **FIVE** Printed Pages Including This Page

You are not supposed to open the paper until permission to do so has been granted by the Chief Invigilator.

Question 1

a) The average speed of a nitrogen molecule in air at 250 °C is 515 m.s⁻¹. Convert this to km per hour.

[5]

b) Using the Periodic Table, predict the chemical formulas of the compounds formed by the following elements:

[10]

    i.   Ga and F

    ii.   Ca and H.

    iii. Mg and N

    iv. Al and P

    v.   Na and Br

c) How many of the indicated atoms are contained in one mole of each chemical formula: [10]

    i.   Carbon atoms in $C_2H_5COOCH_3$

    ii.   Oxygen atoms in $Ca(ClO_4)_2$

    iii. Hydrogen atoms in $(NH_4)_2HPO_4$

Question 2

a) Consider the compound $NiSO_4$

    a. Name the compound

[2]

    b. Calculate the molar mass of the compound

[2]

    c. How many moles are there in 5.00 g of the compound?

[4]

    d. How many oxygen atoms are present in one molecule of the compound? [4]

    e. How many moles of hydrogen atoms are present in 4.2×10^{-3} mol of the compound

[6]

b) Determine the volume, in milliliters, of 3.0 M H_2SO_4 that is needed to make 450 mL of 0.10 M H_2SO_4.

[5]

c) The formula of a salt is XCl_2. The X-ion in this salt has 27 electrons. What is metal X? [2]

Question 3

a)   Lead nitrate, $Pb(NO_3)_2$, and sodium sulfide, Na_2S, solutions react to form lead sulfide and sodium nitrate. Write

    i) the molecular equation,

    ii) the ionic equation and

    iii) the net ionic equation

[10]

b)   Write the electron configuration for phosphorus, element 15. How many unpaired electrons does a phosphorus atom possess?

[5]

2

c)   Use the Periodic Table to write the condensed electron configuration for   [10]

     i)   Co

     ii)   Te

     iii) Ca^{2+},

     iv) Co^{3+},

     v) S^{2-}

Question 4

a) What mass (g) of AgBr is formed when 35.5 mL of 0.184 M $AgNO_3$ is treated with an excess of aqueous hydrobromic acid?

     [10]

b) What is the empirical formula of a compound that contains 29% Na, 41 % S, and 30% 0 by mass?

     [10]

c) How many moles of carbon dioxide are there in 42.06 g of carbon dioxide?   [5]

Question 5

a) Name the following compounds   [25]

     i. $HClO_3$

     ii. $HClO_4$

     iii. $HClO$

     iv. HCl

     v. $HClO_2$

     vi. MgF_2

     vii. $Al_3(PO_4)_3$

     viii. $AlPO_4$

     ix. $Al(PO_4)_3$

     x. $Al_2(PO_4)_3$

     xi. AlP

     xii. H_2O_2

     xiii. $Pb(NO_3)_2$

Question 6

a) Draw al the isomers of C_4H_{10}.

     [9]

b) Draw the structures of the following compounds:

     [10]

     i)   Cis-2-butene

     ii)   Octa-2,5-diene

     iii)   4,6-Dimethyl-hept-l-yne

     iv)   1-methylcyclohexene

     v)   2-Bromo-4-hydroxy-pentanoic acid

c) Give the name and structure of the product of the reaction of 2-methyl-2-butene with HBr.

[6]

UNIVERSITY OF SWAZILAND
Department of Chemistry

Atomic Number

2	
He	
4.0026	Atomic Weight

1 **H** 1.0079																	2 **He** 4.0026
3 **Li** 6.941	4 **Be** 9.0122											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.179
11 **Na** 22.990	12 **Mg** 24.305											13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.064	17 **Cl** 35.453	18 **Ar** 39.948
19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.88	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.847	27 **Co** 58.933	28 **Ni** 58.69	29 **Cu** 63.546	30 **Zn** 65.39	31 **Ga** 69.723	32 **Ge** 72.61	33 **As** 74.922	34 **Se** 78.96	35 **Br** 79.904	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.94	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** 121.75	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57 **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.2	76 **Os** 190.2	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)
87 **Fr** (223)	88 **Ra** 226.03	89 **Ac** 227.03															

58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** 146.92	62 **Sm** 150.36	63 **Eu** 151.97	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** 173.04	71 **Lu** 174.97
90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** 237.05	94 **Pu** (244)	95 **Am** (234)	96 **Cm** (247)	97 **Bk** 247	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)