PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

ENTRANCE EXAMINATIONS - 2017

CHEMISTRY – GRADE 12

TIME ALLOWED: 3 HOURS

NAME: _____

SIGNATURE: _____

VENUE: _____

DATE: _____

INFORMATION FOR CANDIDATES:

1. You have 10 minutes to read the paper. You must not begin writing during this time.
2. **ANSWER ALL QUESTIONS IN SECTIONS A AND B. Section A** consists of 20 multiple-choice questions worth 1 mark each.
3. All answers must be written only in this question/answer book.
4. **WRITE YOUR NAME CLEARLY ON THE FRONT PAGE. DO THIS NOW.**
5. Calculators are permitted in the examination room. Mobile phones ,notes and textbooks are not allowed.
6. Show all workings and calculations in the answer book.

MARKING SCHEME:

Section A: [20 marks]

Section B: [80 marks]

DO NOT TURN OVER THE PAGE AND DO NOT WRITE UNTIL YOU ARE TOLD TO START

Section A Multiple Choice

Choose the best answer to each question by circling the letter of your choice: A, B, C, or D beside the question number.

Question 1

When strong acid solutions dissociate, they;

A. Dissociate completely
B. Only dissolves partially
C. Do not dissociate.
D. Dissociates and there are more hydroxide ions in solution

Question 2

Which of the following substances is most basic?

A. Bleach
B. Lime water
C. Detergents
D. Soda water

Question 3

Which of the following solutions is acidic?

A. Coconut juice
B. Detergents
C. Soft drink
D. Sea water

Question 4

The colour of methyl orange indicator in basic solution is;

A. Yellow
B. Red
C. Pink
D. Colourless

Question 5

The formula mass for propane, $CH_3CH_2CH_3$:

A. 44.01
B. 55.70
C. 40.10
D. 39.30

Question 6

The percentage (%) sulfur in copper sulfate pentahydrate is

A. 13.10 B. 12.85
C. 12.99 D. 12.45

Question 7

Compound X contains by mass 48.64% carbon, 8.16% hydrogen and the rest oxygen. The EMPIRICAL formula of X is

A. $C_3H_5O_3$ B. $C_3H_6O_2$
C. $C_4H_8O_3$ D. $C_3H_3O_3$

Question 8

25 mL of $Ca(OH)_2$ solution was titrated with 29.1 mL of 0.1065 mol L^{-1} HCl. The molarity of the $Ca(OH)_2$ determined was:

A. 0.2479 mol L^{-1}
B. 0.233mol L^{-1}
C. 0.0233 mol L^{-1}
D. 0.1240 mol L^{-1}

Question 9

The number of valence electrons in Cl^- is;

A. Seven
B. Six
C. Eight
D. Eighteen

Question 10

Which of the following best represents the electron configuration of the calcium ion?

A. 2,8,6
B. 2,8,8,1
C. 2,8,8
D. 2,8,7

Question 11

Which of the following is False about non-metals?

A. They have low melting points.
B. They are poor conductors of electricity.
C. They are good conductors of heat
D. They cannot be hammered into shapes and drawn into wires.

Question 12

In an Al^{3+} ion there are:

A. Ten electrons and thirteen protons
B. The number of protons and electrons are the same
C. There are no protons
D. Six protons and seven electrons

Question 13

Which of these nonmetals is a liquid at room temperature?

A. Sulfur
B. Carbon
C. Bromine
D. Oxygen

Question 14

An example of a material that can be used as an inert electrode is;

A. Selenium
B. Copper
C. Iron
D. Platinum

Question 15

Which of the following occurs during electrolysis of copper sulphate solution?

A. The copper ions gain electrons
B. The hydroxide ions gain electrons
C. Hydroxide ions neither gain nor lose electrons.
D. Oxygen is produced at the negative electrode.

Question 16

The anode is the electrode where;

A. Reduction occurs and electrons are gained.
B. Reduction occurs and electrons are lost.
C. Oxidation occurs and electrons are gained.
D. Oxidation occurs and electrons are lost.

Question 17

The products of the reaction between magnesium and water are

A. $Mg(OH)_2(aq) + H_2(g)$

B. $MgOH(aq) + H_2O(l)$

C. $MgOH(aq) + H_2(g)$

D. $H_2O(l) + H_2(g)$

Question 18

Which of the following is false about an endothermic reaction?

A. Heat is given off and the change in enthalpy is positive

B. Heat is absorbed and the change in enthalpy is negative

C. Heat is absorbed and the change in enthalpy is positive

D. Heat is given off and the change in enthalpy is negative

Question 19

Potassium chlorate. $KClO_3$, can be decomposed in the presence of a catalyst, MnO_2. KCl and O_2 gas are the products of the decomposition of potassium chlorate. Which of the following statements is NOT true about this reaction?

A. The catalyst is used up in the reaction.

B. The amount of O_2 produced is greater with a catalyst.

C. The amount of oxygen gas produced is dependent on the initial amount of potassium chlorate.

D. The catalyst is not used in the reaction

Question 20

Which of the following is false about Carbon?

A. Occurs in most naturally occurring compounds.

B. It has a special ability to bond to itself.

C. It causes air pollution.

D. It is a solid at room temperature

Section B **Short Answers**

Answer all questions in this section in the spaces provided on the paper. All equations must be correctly balanced, and must include the states of the reactants/products.

Question21

(a) Phenolphthalein was added to aqueous sodium hypochlorite.

(i) Is the solution acidic or alkaline? _____ [1 mark]

(i) What colour would phenolphthalein turn to? _____ [1 mark]

(b) Write down the formula of

Aluminum phosphate _____ [1 mark]

Zinc carbonate _____ [1 mark]

Acetic acid _____ [1 mark]

Iron (II) sulphide _____ [1 mark]

(c) Complete and balance the equation.

$NaHCO_3(aq)$ + HCl (aq) ----------> [2 marks]

(d) Write a balanced chemical equation for the reaction of zinc solid and concentrated nitric acid.

_____ [2 marks]

(e) Name the compounds represented by the following formulae

$CuSO_4.5H_2O$ _____ [1 mark]

$Ba(NO_3)_2$ _____ [1 mark]

$Pb(NO)_3$ _____ [1 mark]

Question 22

(a) Classify each of the following as a pure substance or as a mixture. Then further classify pure into "element" or "compound". And the mixtures into "homogenous" or "heterogeneous" mixture?

(i) Silver _____ [1 mark]

(ii) Cup of coffee _____ [1 mark]

(iii) Brass _____ [1 mark]

(b) Identify the following isotopes of neutral atoms with the appropriate elemental name and symbol:

(i) 19 electrons and 20 neutrons _____ [1 mark]

(ii) 13 protons and 14 neutrons _____ [1mark]

(c) List three (3) separation techniques most commonly used in separation of solids, liquids and gases? [3 marks]

(i) _____

(ii) _____

(iii) _____

(d) Calculate the formula mass of Tin (IV) sulphate. [2 marks]

(e) Calculate the number of moles in 30.0 g of $Mg(OH)_2$. [2 marks]

(f) Calculate the mass of 3.0 moles of Mercury metal. [2 marks]

(g) From the following information, identify the element and calculate its average atomic mass unit (a.m.u.).

Abundance (%)	Mass (atomic units)
004.351	49.94610
83.772	51.94050
09.521	52.94070
02.356	53.93890

The average atomic mass of _____ is _____. [4 marks]

(h) A saturated solution of calcium hydroxide contains 0.340g per 100 mL of solution. Calculate the molarity of the saturated calcium hydroxide solution.

[3 marks]

(i) 25.00 mL of 0.50 M NaOH required 24.90 mL of HCl for complete neutralization with phenolphthalein as indicator.

(i) Write the equation for the reaction. [2 marks]

(ii) Calculate the concentration of hydrochloric acid in terms of $molL^{-1}$.

[4 marks]

Question 23

(a) Write down the electronic configurations of the following elements and their ions.

O _____ O^{2-} _____ Sr _____ Sr^{2+} _____

[2 marks]

(b) Which of the following pairs of elements is the more electronegative?

(i) Chlorine and fluorine _____ [1 mark]

(i) Magnesium and calcium _____ [1 mark]

(c) What type of bond is formed between the following elements?

(i) Tin and chlorine _____ [1 mark]

(ii) Hydrogen and oxygen _____ [1 mark]

(d) Show the ionic/covalent bonding in for the following molecules using lines to represent bonds. You must also show the unpaired electron pairs.

(i) $AlCl_3$ [2 marks]

(iii) CH_4 [2 marks]

(iv) Phosphorus trichloride [2 marks]

Question 24

(a) For the electrolysis of *aqueous sodium sulphide*:

(i) Write the equation for the reaction at the cathode.

_____ [2 marks]

(ii) Write the equation for the reaction at the anode.

_____ [2 marks]

(iii) Write the equation for the overall reaction.

_____ [2 marks]

(b) What are the two types of energy to initiate this reaction?

(i)_____ ii)_____ [2 marks]

Question25

The passage below contains 8 numbered brackets, each containing two or more alternative descriptions. For each bracket chose the correct alternative and write your choice in the spaces provided below the passage.
The bracket given in the first line is used as an example to assist you.

The dilution of concentrated sulphuric acid is an (*exothermic/endothermic*) process because the process (*releases/absorbs/transduces*) heat energy. Therefore, when diluting **(i)** concentrated sulphuric acid, you must never add (*water to the acid /the acid to water/water or acid*) **(ii)** in order to reduce the risk of an accident. When an acid spill occurs it is best to (*dilute/neutralise/titrate*) it with sodium carbonate. Sodium carbonate reacts with the acid to **(iii)** produce ($Na_2O_{(s)}/SO_{2(g)}/CO_{2(g)}$). It is safer to use sodium bicarbonate rather than sodium **(iv)** hydroxidefor cleaning up acid spills because sodium bicarbonate is a(*weaker/stronger/more* **(v)** *soluble*) base than sodium hydroxide. Sodium bicarbonate is also known as (*caustic soda/limestone/baking soda*).

(vi)

When lime water is added to an aqueous solution of sodium bicarbonate, ($Na_2CO_3/CaO/CaCO_3$) is precipitated as white solid. Limewater turns litmus (*red/blue/milky*). **(vii)** **(viii)**

e.g: *exothermic*

(i) _____ (ii) _____

(iii) _____ (iv) _____

(v) _____ (vi) _____

(vii) _____ (viii) _____

[8 marks]

Question 26

Diamond and graphite are allotropes of carbon.

(a) Explain what the term 'allotropes' mean. [2 marks]

(b) Carbon can be released back into the atmosphere in many different ways. Describe two ways in detail. [4 marks]

Question 27

Draw the structures of Butane, Pentene and Hexyne. [6 marks]

END OF EXAMINATION

Periodic Table of Elements

1 ← Atomic Number
H
1.008 ← Atomic Mass

Period	Group I/1	II/2	Transition Elements 3	4	5	6	7	8	9	10	11	12	III/13	IV/14	V/15	VI/16	VII/17	VIII/18
1	1 H 1.008																	2 He 4.003
2	3 Li 6.941	4 Be 9.012											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 32.06	17 Cl 35.45	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	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 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
6	55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
7	87 Fr (223)	88 Ra (226.0)	89 Ac+ (227)	104 Unq	105 Unp	106 Unh	107 Uns	108 Uno	109 Une									

metals ← → nonmetals

*Lanthanides	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm (150.4)	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
+Actinides	90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (244)	94 Pu (242)	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 (260)

Avagadro's number = 6.022×10^{23} **GAS CONSTANT, R = 0.0821 L.atm/K.mol or 8.31 kPa dm^3 K^{-1}** **STP at 0^0 C (273 K) and 1 atm (760 mm Hg)**

$c = 2.9979 \times 10^8$ m/s **Planck's constant = 6.626×10^{-34} J.s**