PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

CH001 - ENTRANCE EXAMINATION – 2021

CHEMISTRY – GRADE 12

TIME ALLOWED: 3 HOURS

NAME: .....

SIGNATURE: .....

DATE: .....

VENUE: .....

COURSE APPLYING FOR: .....

INFORMATION FOR CANDIDATES:

1. You have 10 minutes to read the exam questions.**You must not answer any question during this time.**
2. ANSWER ALL QUESTIONS IN SECTION A & SECTION B. Section A consists of 20 multiple-choice questions worth 1 mark each. **Period table is attached.**
3. All answers must be written in the question paper on the space provided.
4. WRITE YOUR NAME CLEARLY ON THE FRONT PAGE. **DO IT 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 space provided.

MARKING SCHEME:

Section A: [20 Marks]

Section B: [80 Marks]

Section A: Multiple Choice

Choose by circling the correct answer either A, B, C or D for each question.

Question 1

If sugar is added to distilled water, what effect would this have on the melting point and billing point of the ice and solution.

(A) Lower melting point and higher boiling point.

(B) Higher melting and boiling point.

(C) Lower melting and boiling point.

(D) Higher melting point and Lower boiling point.

Question 2

Which of the statement below is false about separation of mixtures by re-crystallisation.

(A) The saturated solution is filtered to separate the pure crystals.

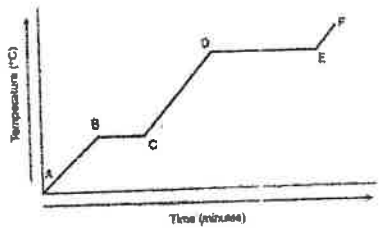
(B) More crystals are dissolved as the solution is heated.

(C) Technique is used to separate a solid that has been dissolved in a solvent.

(D) The crystals are dissolved in a solvent to create a solution.

Question 3

The graph below represents the heating curve of pure ice.



What does segment BC represent?

(A) No more hear is applied to ice.

(B) Pressure is constant.

(C) Same pressure and temperature.

(D) None of these.

Question 4

The correct electronic configuration for chloride ion (Cl^-) in terms of s and p orbitals is

(A) $1s^2\,2s^2\,2p^6\,3s^3\,3p^6$ (B) $1s^2\,2s^2\,2p^6\,3s^2\,3p^5$

(C) $1s^2\,2s^2\,2p^6\,3s^2 3p^6$ (D) $1s^2\,2s^2\,2p^6\,3s^1\,3p^6$

Question 5

Which statement below best describes a chemical bond?

A chemical bond

(A) is the result of protons attracting electrons of another atom.

(B) is formed when two electrons in close proximity attracts each other.

(C) is formed by atoms having the same number of outermost electrons.

(D) none of the above.

Question 6

The chemical reaction equation below between magnesium and oxygen is an example of

(A) oxidation/reduction reaction. (B) combustion reaction.

(C) precipitation reaction. (D) addition reaction.

Question 7

Three isotopes of silicon (Si) include Si-28, Si-29 and Si-30. How many electrons are there in Si-29?

(A) 14 (B) 15 (C) 29 (D) 43

Question 8

Chlorine, bromine and iodine are elements known as halogens. Which of the statement below is not true about these elements?

(A) They are colorless. (B) They are non-metals.

(C) They react similarly with metals. (D) They are poisonous.

Question 9

Which of the following is not true about metal solid?

(A) They are ductile and can conduct electricity.

(B) They are brittle and have a high melting point.

(C) They are malleable and have a high melting point.

(D) They have a high melting point and can conduct electricity.

Question 10

Consider the chemical equation below.

$HCl(aq) + NaOH(aq) \longrightarrow NaCl(aq) + H_2O(l)$ $\Delta = -176$ KJ ($\Delta H = -176$ KJ)

In the reaction above,

(A) energy is absorbed from the surroundings during the reaction.

(B) bond energy of the reactants is equal to those of the products.

(C) bonds in the products are stronger than those of the reactants.

(D) bonds in the products are weaker than those of the reactants.

Question 11

For a reaction which goes to completion, the equilibrium constant, Kc is:

(A) > 1 (B) ∞ (C) $= 1$ (D) $= 0$

Question12

For the equation below, which of the action will not increase the rate of the forward reaction?

$$N_{2(g)} + 3H_{2(g)} \longleftrightarrow 2NH_{3(g)}$$

(A) Increasing the temperature.

(B) Increasing the concentration of $N_{2(g)}$

(C) Increasing the concentration of $H_{2(g)}$

(D) Increasing the Pressure.

Question 13

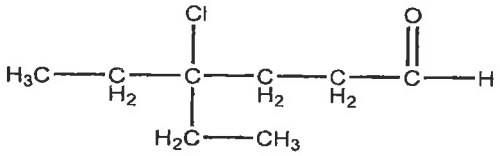
Which one of the compound below is named incorrectly?

(A) $HClO_2$ Chlorous acid. (B) HNO_2 Nitrous acid.

(C) $Sn(OH)_4$ Tin (IV) hydroxide. (D) PBr_5 Phosphorus (IV) bromide.

Question 14

What is the correct IUPAC name of the organic molecule given below?



(A) 4-chloro-4-propylhexanoic acid. (B) 4-chloro-4-ethylhexanoic acid.

(C) 4-chloro-4-ethylhexanal. (D) 4-ethyl-4-chlorohexanal.

Question 15

In a laboratory experiment, 58 g of potassium nitrate (KNO_3) were dissolved in 100 grams of hot distilled water. First crystals appeared at 60°C upon cooling. At this temperature, what is the solubility of KNO_3 in 25 grams of distilled water?

(A) 14.5 g (B) 1.45 g

(C) 29 g (C) 0.145 g

Question 16

Which group of four elements below correctly predicts an increase of atomic radius from left to right?

(A) O < P < K < Mg (B) K < Mg < O < P

(C) Mg < K < P < O (D) O < P < Mg < K

Question 17

Which of the following is an acid?

(A) $NaHSO_4$ (B) Na_2CO_3

(C) Aqueous NH_3 (D) CH_3NH_2

Question 18

Which is not a true statement?

(A) One mole of methane contains four moles of hydrogen atoms.

(B) One mole of ^{12}C has a mass of 12.00 g.

(C) One mole of hydrogen gas contains 6.02×10^{23} atoms of hydrogen.

(D) One mole of methane contains 75.875% of carbon by mass.

Question 19

The number of valence electrons in P^{2+} is

(A) Five (B) Three

(C) Seven (C) Ten

Question 20

A hydrocarbon has a molar mass of 58 g mol^{-} and contains 82.7% carbon and 17.3% hydrogen by weight. What is its molecular formula?

(A) C_4H_{10} (B) C_5H_{12}

(C) C_2H_5 (D) C_3H_8

Section B **Short Answers**

Answer all questions in the space provided on the question paper. All equations must be correctly balanced.

Question 21

(a) Give the formula of the ionic compounds listed below. [4 marks]

(i) Magnesium bromide. .....

(ii) Calcium oxide. .....

(iii) Magnesium nitrate. .....

(iv) Ammoniumsulphate. .....

(b) Name the following ionic compounds. [4 marks]

(i) CuBr .....

(ii) FeS .....

(iii) PbO_2 .....

(iv) $K_2Cr_2O_7$ .....

Question 22

(a) Complete and balance the chemical equations given below by including the appropriate products.

(i) $NaOH_{(aq)} + FeSO_{4(s)} \longrightarrow$ [2 marks]

(ii) $CuO_{(s)} + H_2SO_{4(aq)} \longrightarrow$ [2 marks]

(iii) $Zn_{(s)} + HCl_{(aq)} \longrightarrow$ [2 marks]

(b) For the following chemical statements write the corresponding balance chemical equations including their appropriate states.

(i) When water is electrolysed it decomposes into its constituent elements. [3 marks]

(ii) Heating potassium chlorate, $KClO_3(s)$, releases oxygen, leaving solid potassium chloride. [3 marks]

Question 23

(a) What is the gram formula weight of aluminum nitrate? [2 marks]

(b) Calculate the weight in grams of 1.09×10^{24} atoms of vanadium (V). [2 marks]

(c) Write the correct name and element symbol from the data provided below.

(i) 78 protons and 79 neutrons..... [2 marks]

(ii) 26 neutrons and 50 electrons..... [2 marks]

(d) How many grams are there in 0.14 moles of barium chloride? [2 marks]

(e) How many moles are there in 1.8 grams of Cu (II) nitrate? [2 marks]

Question 24

(a) What is the molarity (M) of 2.50 grams of silver nitrate dissolved in 200 mL of distilled water? [4 marks]

(b) An element consists of 93.1% of an isotope with mass 38.963 amu and 0.001% of an isotope with mass 39.974 amu and 6.88% of an isotope with mass 40.961 amu. Calculate the average atomic mass and identify the element. [4 marks]

(c) (i) State Dalton's Law of Partial Pressure. [2 marks]

(ii) 1.44 liters of gas at 0.935 atmosphere are compressed to a volume of 0.275 liter. Find the new pressure in atm. [2 marks]

Question 25

(a) In a volumetric analysis, 46.8 mL of 0.659 NaOH were required to titrate 25 mL of H_2SO_4.

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

(ii) Calculate the molarity (M) of H_2SO_4. [4 marks]

(b) How many moles of carbon dioxide are produced when 2.4 moles of ethane reacts with oxygen (burns). [4 marks]

Question 26

(a) (c) Write the correct electron configuration of the ions below in terms of s and p orbitals. [2 marks]

(i) Mg^{2+}

(ii) F^-

(b) Find the oxidation state of P in each of the formula below.

(i) Na_3PO_3. [2 marks]

(ii) $H_2PO_4^-$ [2 marks]

(c) (i) The energy change (ΔH) required for the formation of NH_3 Is -46.5 KJ. When 1.0 mole of ammonia is decomposed, how much energy is involved, and explain if energy is given out or taken in. [2 marks]

(ii) What is ΔH when 34 g of ammonia is formed from its constituent elements? [2 marks]

(d) Electrolysis of copper sulphate solution is performed with platinum electrodes:

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

(ii) Write the equation for the reaction at the cathode. [2 marks]

(iii) What would be the observation at the electrodes? [2 marks]

Question 27

(a) Draw the structures of the organic molecules listed below.

(i) 4-Bromo-2-butanal [2 marks]

(ii) 1-Methylcyclopentanol. [2 marks]

(iii) 3-Chloro-3-methylbutanoic acid. [2 mark]

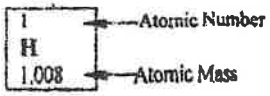
(c) Complete the equations below. [6 marks]

(i) $H_3C-CH_3 \xrightarrow[500\ ^oC]{Cr_2O_7^{2-}}$

(ii) $H_3C-\underset{H}{C}=CH_2 + Br_2 \longrightarrow$

(iii)  $+ Cl_2 \xrightarrow{FeCl_3}$

Periodic Table of Elements



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

Chemistry Entrance Examination

EE 2017