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KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF BSC (SCIENCE)

COURSE CODE: SCH 111

COURSE TITLE: INTRODUCTION TO INORGANIC CHEMISTRY

DURATION: 2 HOURS

DATE:

9/02/2021

TIME:

11:00 - 1:00 Pm

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 3 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

Answer Question ONE and ANY other TWO Questions. (70Marks)

Question 1(30MARKS)

- 1a). Differentiate between the following 4mks
- i. Electron Affinity and Ionization Energy
 - ii. Oxidation and Reduction
- b). Explain how the nuclear atom causes scattering of the alpha particles. 3mks
- c). 0.1978 g of copper is deposited by a current of 0.2 ampere in 50 minutes. What is the electrochemical equivalent of copper? 3mks
- d). Determine and arrange the following in order of increasing oxidation number of the Nitrogen atom. MnO_2 , MnO_4^{2-} , and MnCl_2 3 mks
- e). Chromium (24), Copper (29), Zinc (30), Mg (12) and Ca (20) are some of the elements of the d-block and p-block series respectively. Write the electronic configuration of each element 5 mks
- f) State **TWO** characteristics commonly exhibited by transition metals above. 2mks
- g). Draw the structures of the 2p-orbitals 3mks
- h). Differentiate between ionic bond and covalent bond 3mks
- i) i))Explain the trend of atomic radii across the period and down the group 3mks
- j). Give the correct number of each sub atomic particle in an ion $^{35}_{17}\text{Cl}^-$ 2mks

Question 2 (20 MARKS)

2. a). Define the following terms 3mks
- i. Mass number
 - ii. Isotope
 - iii. A chemical bond
- b) State four importance of electro negativities 4mks
- c). Explain why the ionic radii of anions are larger than their respective atoms 2mks
- d). Explain the electrical conductivity of ionic compounds 3mks

- e). Describe the electron affinity trend within a period of a periodic table 2mks
- h) i) What is VSEPR in full and explain it 2mks
- ii) Using the VSEPR model give the shapes of; 4mks
- i. BeCl_2
 - ii BCl_3
 - iii NH_3
 - iv CH_4

Question 3 (20marks)

- a). State and explain four types of quantum numbers 8mks
- b). Write Lewis structures of the following ionic compounds 3mks
- i. HCl
 - ii. NaCl
 - iii. MgCl
- c) Calculate the K_{sp} if the solubility of BaSO_4 is $1.05 \times 10^{-5}\text{M}$ at 298K 3mks
- d). Define a standard solution 2mks
- e). Hydrogen chloride is very soluble in water. This gas is bubbled through 500 cm^3 of water to form hydrochloric acid. The equation below represents the chemical reaction taking place.



- i. How would you classify water in terms of Bronsted-Lowry theory? Explain 2mks
- ii. Identify the acid and its conjugate base for the reverse reaction 2mks

Question 4 (20Marks)

- a). A stock solution of sulphuric acid contain a density of 1.836gcm^3 , percentage purity 98% and molar mass 98. Calculate
- i. The concentration of the acid. 3mks
 - ii. The volume of the acid that should be diluted to produce 2 litres of 2M sulphuric acid 3mks
- b). List the following atoms in order of increasing first ionization energy Li, Na, C, O, F 2mks

c). i). Explain what is a Bidentate ligand 2mks

ii). Write the formula of the following coordination compounds 5mks

- a) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
- b) $[\text{Fe}(\text{CN})_6]^{3-}$
- c) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
- d) $[\text{Zn}(\text{NH}_3)_4]^{2+}$
- e) $(\text{K}^+)_3[\text{Fe}^{3+}(\text{CN})_6]^-$

d). A compound known to phosphorus is an ingredient in signal fires, fireworks and rodents poison. A sample of phosphorus was found to contain 12.368g of calcium and 6.358 of phosphorus. Determine the empirical formula forming phosphorus. (Ca=40.0, P=31.0) 3mks

e). Determine the percentage composition by mass of each of the following elements in the Ammonium sulphate and copper (ii) nitrate 2mks

Question 5 (20Marks)

5.a) Define the following terms; 3mks

- i. Pauli's exclusive principle
- ii. Aufbau principle
- iii. Hund's rule

b). Give four postulates of Dalton atomic theory. 4mks

c). List the four spectral series in the atomic spectrum of hydrogen and the regions they occur 2 mks

d). Calculate the wavelength in Å of a line in the Balmer Series that is associated with a drop of the electron from $n=4$ ($R= 109,676 \text{ cm}^{-1}$) 4mks

f.i). Differentiate between wavelength and frequency 3mks

ii). What is the wavelength of a photon (in nanometers) emitted during a transition from the $n_i=5$ state to the $n_f=2$ state in the hydrogen atom? ($R = 2.18 \times 10^{-18} \text{ J}$, $h = 6.626 \times 10^{-34} \text{ Js}$, $c = 2.998 \times 10^8 \text{ m/s}$) 4mks

Elements of the Periodic Table

	1A (1)																	8A (18)
1	1	2A (2)											3A (13)	4A (14)	5A (15)	6A (16)	7A (17)	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	3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8) (9) (10)			1B (11)	2B (12)	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 47.88	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 65.39	31 Ga 69.72	32 Ge 72.61	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)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)	As of mid-1999, elements 110 through 112 have not yet been named.					

6	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
7	Actinides	90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (237)	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)