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(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

SUPPLEMENTARY/SPECIAL EXAMINATION

2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE (CHEMISTRY), BACHELOR OF SCIENCE (INDUSTRIAL CHEMISTRY) AND BACHELOR OF EDUCATION (SCIENCE)

COURSE CODE: SCH 211

COURSE TITLE: COMPARATIVE CHEMISTRY OF D-BLOCK ELEMENTS

DATE: MONDAY AUGUST 1ST 2022 **TIME:** 8.00 AM-10.00 AM

INSTRUCTIONS TO CANDIDATES

Total Marks: 70

Answer all the Questions

TIME: 2 Hours

Question One **(18 marks)**

a. Briefly explain the FOUR series that make up the d-block elements (8 Marks).

b. Explain why Copper shows abnormal electronic configuration (3 Marks)

c. State any FOUR characteristics of transition elements (4 Marks)

d. Why do think Cr, Mo and W are hard metals while Zn, Cd and Hg are not very hard metals (3 Marks)

Question Two **(17 marks)**

a. Zn does not exist in variable oxidation states. Explain (3 Marks)

b. Predict which of the following ions will be coloured or colourless in aqueous solution. Ti^{3+}, V^{3+}, Cu^{+}, Sc^{3+}, Mn^{2+}, Fe^{3+} and Co^{2+}. Give reasons for each (4 Marks).

c. Briefly explain the THREE geometries that can be adopted by complexes with coordination number of 5 (6 Marks)

d. Give the molecular formula of the following coordination compounds (4 Marks)

i. Hexaammineiron(III) nitrate

ii. Ammonium tetrachlorocuprate(II)

iii. PentacarbonylIron*(0)*

iv. Triamminedichloronitritocobalt(II) ion

Question Three **(18 marks)**

a. State and explain any TWO magnetic behaviour exhibited by metal ions when placed in a magnetic field (6 Marks)

b. Calculate the spin-only magnetic moments of the Ni^{2+} ion in $[Ni(H_20)_6]^{2+}$(Ni =28, Lande splitting parameter, for a free electron, is 2.00023) (3 Marks)

c. Briefly explain how pure copper can be obtained from its chief ore chalcopyrite. Use of chemical equation for illustrations is encouraged (6 Marks)

d. State any THREE applications of group 12 elements (3 Marks)

Question Four **(17 Marks)**

a. D-block elements and their compounds are used as catalysts in various reactions. Using chemical equation where possible, give five reactions where these elements/their compounds are used as catalysts (5 Marks)

b. State FOUR ores from which pure iron metal can be obtained from (4 Marks)

c. Reducing metal compound to metal is an important stage in extraction of metal from its ores. Give THREE factors that determine the method used (3 Marks)

d. Explain the splitting of d-orbitals in transition elements (3 marks).

e. State any TWO properties of alloys (2 Marks)

Periodic Table of the Elements

Metals (main-group)
Metals (transition)
Metals (inner transition)
Metalloids
Nonmetals

Period	MAIN-GROUP ELEMENTS 1A (1)	2A (2)	TRANSITION ELEMENTS 3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8)	8B (9)	8B (10)	1B (11)	2B (12)	MAIN-GROUP ELEMENTS 3A (13)	4A (14)	5A (15)	6A (16)	7A (17)	8A (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 32.07	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.

INNER TRANSITION ELEMENTS

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)