



## UNIVERSITY EXAMINATIONS

## RESIT/SPECIAL EXAMINATION

## EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE

## CHEM 419: CHEMISTRY OF TRANSITION METAL ELEMENTS

STREAMS: BSC

TIME: 2 HOURS

DAY/DATE: THURSDAY 04/11/2021

11.30 A.M. – 1.30 P.M.

## INSTRUCTIONS:

- Answer ANY TWO Questions.

## QUESTION ONE [35 marks]

(a) What are transition elements? Explain why transition elements show tendency to form large number of complexes [6marks]

(b). Give characteristics of transition elements. Which of the d block elements may not be regarded as transition elements. Give reasons for your answer. [5 marks]

(c). Comment on the following observations

(i). The expected electronic configuration of copper is  $[\text{Ar}]3d^94s^2$  but its observed electronic configuration is  $[\text{Ar}]3d^{10}4s^1$  [3 marks]

(ii). The expected electronic configuration of chromium is  $[\text{Ar}]3d^44s^2$  but its observed electronic configuration is  $[\text{Ar}]3d^54s^1$  [3marks]

(d) Account for the following observations:

i. Scandium  $[Z= 21]$  is a transition element but zinc  $[Z= 30]$  is not? [2 marks]

ii. Transition elements exhibit higher enthalpies of atomization [2 marks]

iii. Transition metals and many of their compounds show paramagnetic behavior. [2 marks]

iv. Of the  $d^4$  species, Cr(II) is strongly reducing while Mn(III) is strongly oxidizing [2 marks]

- v. Transition metals have high density and high melting points and boiling points. [6marks]
- vi. Transition metals and many of their compounds act as good catalysts [4marks]

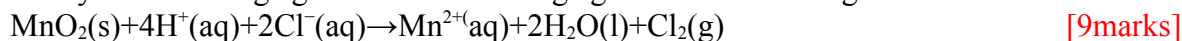
**QUESTION TWO****[35 marks]**

(a). (i) Explain the metallic character of the d-block elements. Why are Cr, Mo and W hard metals while Zn, Cd and Hg are soft? [10marks]

(ii) Giving sufficient reasons explain why most of the transition metal compounds are remarkably coloured [6 marks]

(b). Distinguish between the following terms with reference to, change in oxidation number, standard reduction potential and gain/loss of electrons

(i). Reduction process and Oxidation process (ii) Oxidizing agent and reducing agent. Hence identify the oxidizing agent and the reducing agent in the following redox reaction:

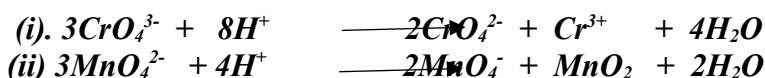


c). (i). Distinguish between standard reduction potential and standard oxidation potential. Explain how they are measured and comment on their relationship. [5marks]

(ii) Discuss briefly the reducing and oxidizing ability of chemical species in aqueous solution on the basis of reduction potential. [5marks]

**QUESTION THREE [35 marks]**

a). What is meant by the term disproportionation? [ Hint: Use the following two reactions as examples to illustrate your explanation]

**[4marks]**

(b). What are interstitial compounds? why are such compounds well known for transition elements. Give characteristics of interstitial compounds [9marks]

(c). Describe properties which demonstrate that f block elements are different from d-block elements. [5marks]

(d)(i). Distinguish between lanthanide contraction and actinide contraction. and explain why actinide contraction is more than lanthanide contraction. [4marks]

ii) What are the causes and consequences of lanthanide contraction?

[8marks]

(iii). Give brief explanation to the following: “Although the common oxidation state of lanthanide elements is + 3, the +2 oxidation state of Eu and Yb is significant”.

[5marks]

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