

**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**



**B.Sc. DEGREE EXAMINATION – CHEMISTRY**

**FIFTH SEMESTER – NOVEMBER 2022**

**UCH 5504 – TRANSITION ELEMENTS AND NUCLEAR CHEMISTRY**

Date: 02-12-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

**PART-A**

**Answer ALL questions.**

**(10 x 2 = 20 Marks)**

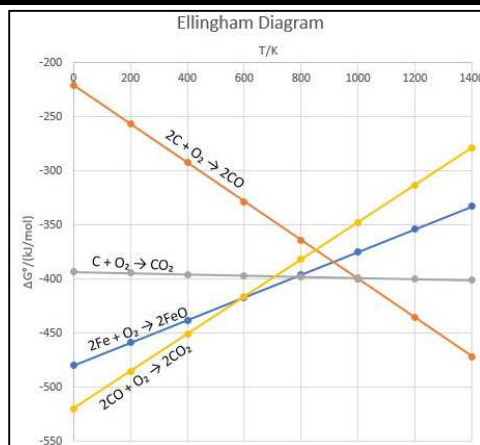
1. First row transition elements exhibit high tendency to form complexes. Why?
2. Give the chemical formula of sodium nitroprusside and the oxidation state of sulphur in it.
3. Name any two elements which predominantly form the following types of ores:  
(a) carbonate ores and (b) sulphide ores.
4. List any two differences between calcination and roasting.
5. The magnetic moment of f-block elements include contribution from orbital motion also. Justify.
6. How does  $\text{UO}_3$  react with (a)  $\text{HCl}$  and (b) excess  $\text{NaOH}$ ? Give appropriate chemical equations.
7. Define nuclear isobars with an example.
8. What is the relation between  $t$  and  $t_{1/2}$  of a nuclear reaction following first order kinetics. Specify the terms involved in it.
9. What is meant by fast breeder reactor?
10. Outline the principle of neutron activation analysis.

**PART-B**

**Answer any EIGHT questions.**

**(8 x 5 = 40 Marks)**

11. Compare the following properties of Fe, Co and Ni:  
(a) Stability of oxidation states (b) Stability and reactivity of their oxides
12. Give a detailed account on the role of silver in photography.
13. How is copper ore concentrated by froth floatation method? Explain.
14. The following is the Ellingham's diagram for formation of oxides of carbon and iron(II).
  - a. Among C and  $\text{CO}$ , which is/are can reduce  $\text{FeO}$  below 600 K? Substantiate your choice.
  - b. What happens to reaction between  $\text{FeO}$  and C at 800 K? Explain.



15. Comprehend the electrolytic reduction process in aqueous solution with appropriate principle and illustrations.
16. Discuss the effect of lanthanide contraction in affecting the properties of other group elements..
17. Compare the properties of lanthanides and actinides.
18. Explain the stability of the nucleus based on n/p ratio.
19. Give an account on (a) positron emission and (b) electron capture
20. State the principle of radio-carbon dating.

Calculate the binding energy per nucleon of oxygen atom (atomic number = 8; mass number = 16) which has a mass of 15.994910 amu. (Mass of neutron = 1.008665 amu, mass of proton = 1.007277 amu and mass of electron = 0.0005486 amu)

21. What is the overall reaction involved in stellar energy? How does Carbon-Nitrogen cycle contribute to this overall reaction? Explain with appropriate nuclear reactions.
22. Explain the principle of atom bomb and hydrogen bomb.

### PART-C

Answer any **FOUR** questions.

(4 x 10 = 40 Marks)

23. Highlight the difference in the physical and chemical properties among the 3d row and other rows of d block elements.
24.
  - a. Explain: Silvering of mirrors.
  - b. Discuss any three applications of nuclear isotopes in medicinal field.
  - c. Discuss the separation of lanthanides by solvent extraction method (2+3 + 5)
25. Describe the following metallurgical process with one example each:
  - (a) Zone refining method for purification of metal
  - (b) Self-reduction method of extraction of metals (5 + 5)
26. Schematically represent the extraction of uranium from pitchblende with appropriate chemical reactions involved. (5 + 5)
27. Explain the different components and the working principle of atomic nuclear reactor.
28.
  - a. Define the following terms with examples:
    - (i) Nuclear fission (ii) spallation reaction .
  - b. How is radioactivity measured by using Geiger-Muller counter. (4 + 6)

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