

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
MSc DEGREE EXAMINATION MAY 2022
(Third Semester)

Branch – CHEMISTRY

INORGANIC CHEMISTRY-III

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions
ALL questions carry EQUAL marks (10 x 1 = 10)

- X-rays are generated by
a. Geiger tube
b. Goniometer
c. Coolidge tube
d. Rotameter
- X-ray diffractometers are not used to detect which of the following physical properties?
a. Metals
b. Liquids
c. Polymeric materials
d. Solids
- The electrical conductivity of crystalline solid increases with temperature. The solid is a
a. super semiconductor
b. metal
c. semi-conductor
d. semi metal
- Pick out the incorrect statement(s)
(i) Metal clusters have metal-metal bond
(ii) Metal clusters are only formed when carbonyl groups are attached with metal
(iii) Many metal clusters are known which contain double and triple metal-metal bonds
(iv) Re-Re distance in metal is larger than Re-Re distance in metal cluster
a. i and ii
b. ii and iii
c. ii only
d. iii and iv
- Nucleus of an atom whose atomic mass is 24 consists of
(a) 11 electrons, 11 protons and 13 neutrons
(b) 11 electrons, 13 protons and 11 neutrons
(c) 11 protons and 13 neutrons
(d) 11 protons and 13 electrons
- Among the following, the highest binding energy per nucleon is found for
a. ${}^1_1\text{H}^3$
b. ${}^8_8\text{O}^{16}$
c. ${}^{56}_{26}\text{Fe}^{56}$
d. ${}^{235}_{92}\text{U}^{235}$
- A cyclotron can accelerate
a. β particles
b. α particles
c. High-velocity gamma rays
d. High-velocity X-rays
- Which of the following instrument is used in the measurement of radioactivity?
a. Cyclotron
b. Spark chamber
c. Nuclear reactor
d. Bevatron
- The tremendous amount of energy released during explosion of a hydrogen bomb is due to
a. nuclear fission
b. nuclear fusion
c. chemical reaction
d. natural radioactivity
- In neutron activation analysis, the concentration of element is identified by
a. decay characteristics of the daughter element
b. the velocity of the neutron
c. nuclear recoil
d. threshold energy of the reaction

SECTION - B (25 Marks)

Answer ALL questions
ALL questions carry EQUAL Marks (5 x 5 = 25)

- a. Distinguish between X-ray and neutron diffraction study.
(OR)

- b. Define structure factor. Write the factors influencing the structure factor.
12. a. Write the electrical and mechanical properties of metal.
(OR)
b. Discuss the free electron theory of metallic bond.
13. a. Explain n/p ratio for stability of nucleus.
(OR)
b. i) Calculate the Q-value for the following reaction: (3)

$${}_{92}\text{U}^{235} + {}_0\text{n}^1 \rightarrow {}_{42}\text{Mo}^{98} + {}_{54}\text{Xe}^{136} + 2{}_0\text{n}^1$$
 The exact masses of reactants and products are

$${}_{92}\text{U}^{235} = 235.044 \text{ amu}; \quad {}_0\text{n}^1 = 1.009 \text{ amu}$$

$${}_{42}\text{Mo}^{98} = 97.905 \text{ amu}; \quad {}_{54}\text{Xe}^{136} = 135.917 \text{ amu}$$
- ii) Write a short note on Nuclear cross section. (2)
14. a. Enlist the characteristics of alpha, beta and gamma rays.
(OR)
b. Account on Scintillation counter and Cherenkov counter.
15. a. Illustrate nuclear fusion and nuclear fission reactions.
(OR)
b. What is meant by rate of radioactive disintegration? Derive an equation for the rate constant of radioactive disintegration.
- SECTION -C (40 Marks)**
Answer ALL questions
ALL questions carry EQUAL Marks (5 x 8 = 40)
16. a. i) Write the basic principle of electron diffraction study. Mention its applications.
ii) How do you elucidate the structure using neutron diffraction?
(OR)
b. Sketch and explain the following structures:
i) Zinc blende ii) Wurtzite
17. a. Account on the following:
i) Schottky defect ii) Frenkel defect
(OR)
b. What are metal clusters? Categorize it and explain with suitable examples.
18. a. i. Discuss liquid drop model of nucleus.
ii. Calculate the binding energy of an α -particle. Express the result in MeV.
 Mass of proton = 1.0078 amu
 Mass of neutron = 1.0089 amu
 Mass of α -particle = 4.0084 amu
 (OR)
 b. i. How is meson field theory applied in the stability of nucleus?
 ii. Write an explanatory note on packing fraction.
19. a. Describe the following methods for detection and determination of radioactivity:
i) Wilson Cloud Chamber ii) G.M. Counter
(OR)
b. With neat diagram, explain the following and compare:
i) Cyclotron ii) Synchrotron
20. a. What is nuclear reactor? Explain the design of nuclear reactor.
(OR)
b. Classify nuclear transmutations. Explain any two nuclear transmutation reactions with suitable examples.