

B.Sc. 3rd Semester (Honours) Examination, 2019 (CBCS)**Subject : Chemistry****Paper : CC-6****Time: 2 Hours****Full Marks: 40***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer *any five* questions from the following: 2×5=10
 - (a) Glycerol is more viscous liquid than ethanol. — Justify.
 - (b) Calculate the activity of 20.6g of ^{99m}Tc . ($t_{1/2} = 6.01\text{h}$)
 - (c) Which has the higher boiling point— CCl_4 or SiCl_4 ? Explain.
 - (d) What is Madelung constant? State its significance.
 - (e) 'Metals are good conductors of electricity'. — Comment.
 - (f) Though LiCl and MgS have similar structure and nearly the same internuclear distance yet MgS is harder than LiCl . — Explain.
 - (g) Explain why packing fraction may be positive or negative whereas mass defect is not.
 - (h) BeCl_2 has zero dipole moment while H_2S has some value of dipole moment. — Explain.

2. Answer *any two* questions from the following: 5×2=10
 - (a) (i) Why are Li_2CO_3 , MgCO_3 and CaCO_3 thermally unstable?
(ii) Explain the respective mode of decay of the radionuclide $^{14}_6\text{C}$ and $^{13}_7\text{N}$ with equations. 2+3=5
 - (b) (i) Discuss the kind of defect observed in the crystal structure of ZnO when heated. What is the consequence of heating?
(ii) Write the expression for Kapustinskii equation and state its merit. 2+3=5
 - (c) (i) Give the molecular orbital picture of CN^- ion and calculate its bond order.
(ii) Give any two differences between extrinsic and intrinsic semiconductor. 3+2=5
 - (d) (i) Write down two assumptions of liquid drop model.
(ii) 0.5gm ^{226}Ra is placed in a sealed tube. How much He (in ml) will be accumulated in 60 days ($t_{1/2} = 1580$ years) at NTP? 2+3=5

3. Answer any two questions from the following:

10×2=20

- (a) (i) Define Born-Haber Cycle. Give a schematic diagram of Born-Haber Cycle for the formation of ionic solid MX_2 . State its limitation.
- (ii) What shapes are associated with molecules involving sp^3d and sp^3d^2 hybridisation? Which d-orbitals are specifically required for each set of sp^3d and sp^3d^2 hybridisations?
- (iii) Write down the shapes of SOF_4 and SiF_6^{2-} using VSEPR theory. 4+3+3=10
- (b) (i) Use Fajan's rules to predict which is likely to be ionic or covalent: RbCl and AgCl .
- (ii) Write notes on delta bond.
- (iii) Predict the angle $\angle \text{X}-\text{C}-\text{X}$ trend in CH_2X_2 when $\text{X} = \text{H}, \text{F}$.
- (iv) Calculate the radius of an octahedral void created by the atoms of radius r in fcc lattice. 2+3+3+2=10
- (c) (i) A fusion reaction is called a thermonuclear reaction — Why? How does it work in a hydrogen bomb?
- (ii) Justify the statement — there is a basic difference between nuclear spallation and nuclear fission reactions.
- (iii) Meson exchange processes are limited within nuclear dimension. — Justify. 4+3+3=10
- (d) (i) Define nuclear isomerism and state its cause.
- (ii) Calculate the binding energy per nucleon in MeV of ${}^4_2\text{He}$ which has a mass of 4.00260 amu. Mass of neutron = 1.008665 amu and 1 hydrogen atom = 1.007825 amu.
- (iii) Explain the exceptional stability of ${}^4_2\text{He}$, ${}^{12}_6\text{C}$ and ${}^{16}_8\text{O}$ nuclides.
- (iv) The radius of ${}^{107}_{47}\text{Ag}$ is 6.7 fermi. Calculate the density of the nucleus in gm/cm^3 . 2+3+3+2=10