**2022**

**CHEMISTRY**

**[Honours]**

**B.Sc. Second Semester End Examination - 2022**

**PAPER - C3T**

***Full Marks : 40*** ***Time : 2 hours***

*The figures in the right-hand margin indicate marks.*
*Candidates are required to give their answers in their own words as far as practicable.*
*Illustrate the answers wherever necessary.*

## Group - A

**Answer any five questions : -** **5×2=10**

1. (a) Between $MgSO_4$ and $BaSO_4$ which one is soluble in water and why?

   (b) Write down two fundamental differences between nuclear reaction and chemical reaction.

   (c) What is meant by Mirror nuclei? Give example.

*(Turn Over)*

(d) The half life of a radio element is 231 mins. How long will it take for 9/10th fraction of the radio element to deeay?

(e) BaO is 2000 times more soluble in water than MgO. Explain.

(f) Draw the structure of $ICl_2^{(+)}$ using VBT.

(g) Compare the stability of $H_2$ molecule relative to $H_2^+$ and $H_2^-$ species.

(h) Neculear fission products of $^{235}U$ are always $\beta^{(-)}$active. Explain.

## Group - B

**Answer any four questions** **4×5=20**

2. (a) Which of the following nucliedes are electron emitter and which are positron emitters? Give reasons for your choice. 5

$C^{14}$, $P^{30}$, $He^6$, $Na^{22}$, $F^{19}$

3 (a) Draw the M.O. diagram of HCl indicating bonding, non-bonding and antibonding electron present. 3





(b) MgO is harder and has higher melting point than NaF, although $Mg^{2+}$, $O^{2-}$, $Na^+$ $F^-$ ions are isoelectronic. 2

4. (a) What do you understand by magic numbers? Can you cite evidence in its favour from the binding energy curve? 1+2

(b) ZnO is white when cold but yellow when hot. 2

5. (a) Write the relation between half-life and average life of a radio element.

(b) Unlike CO, isoelectronic $N_2$ molecule is unreactive at normal condition. Explain. 2

6. (a) What is meant by "ion deformation". Applying Fajan's rule, how will you determine whether a compound is covalent or not? 5

7. (a) Bond angles in $F_2O$ and $Cl_2O$ are 105° and 111° respectively. Explain. 2

(b) How can you account for the forces binding the nucleus on the basis of meson particles? 3

## Group - C

**Answer any one question.** **1×10=10**

8. (a) What is spallation and how does it differ from fission? 3

   (b) A sample of $^{90}Sr_{38}$ ($t_{1/2}$=19.9 yrs) originally had an activity of 0.5 millicurie. Calculate– 2+2

   (i) specific activity of the sample.

   (ii) activity of the sample after 30 years.

   (c) Discuss the bonding in $B_2$ molecule in the light of M.O. theory and hence explain its magnetic behaviour. 3

9. (a) Draw the Born-Haber cycle for the formation for Pottassium hydride. Hence find the electron affinity of hydrogen atom using the following data given kj/mole. 2+4

   Heat of submilation of Potassium metal= 83 kj $mol^{-1}$
   First ionisation energy of Potassium = 417 kj $mol^{-1}$
   Bond dissociation energy of hydrogen molecule
   =436 kj $mol^{-1}$





   Lattice energy of Potassium hydride = –742 kj/$mol^{-1}$
   Heat of formation of Potassium hydride=–59 kj/$mol^{-1}$

   (b) Explain why the conductivity of Ge is enhanced many folds when trace amount of As is added to it. 2

   (c) The $^{14}C$ to $^{12}C$ ratio in a piece of wood is 19% of that of the atmosphere. Calculate the age of the piece of wood. ($t_{1/2}$ of $^{14}C$ =5679 years) 2