

## U.G. 3rd Semester Examination - 2021

### CHEMISTRY

Course Code: BCEMCCHC302

Course Title: Inorganic Chemistry II

Full Marks : 30

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.*

1. Answer any **ten** questions: 1×10=10
- Which hydrogen bond would you expect to be stronger and why? S–H...O and S...H–O.
  - Which one of the two compounds CO<sub>2</sub> and NO<sub>2</sub> is paramagnetic?
  - What are the possible arrangement of atoms in hexagonal close packing in metals?
  - What are the decay modes of <sup>14</sup>C and <sup>14</sup>O?
  - Indicate the hybridisation of central atom and predict the shape of IO<sub>2</sub>F<sub>2</sub><sup>-</sup>.

- Under which condition insulator is converted to semiconductor?
- Determine nuclear spin of <sup>7</sup><sub>3</sub>Li.
- Calculate the formal charge of the N atoms in H–N=N=N.
- He<sub>2</sub> does not exist but He<sub>2</sub><sup>+</sup> exists. Explain.
- Arrange the following compounds according to their increasing order of boiling point:  
CH<sub>4</sub>, SiH<sub>4</sub>, GeH<sub>4</sub>, and SnH<sub>4</sub>.
- Indicate the types of semiconductor (*n* or *p*) expected from the following: (i) Ga doped Be (ii) KCl irradiated with X-rays.
- Compare the stabilities on N<sub>2</sub> and N<sub>2</sub><sup>+</sup> from bond order calculation.
- Given the Radii of Ag<sup>+</sup> and Cl<sup>-</sup> ions are 126 pm and 181pm respectively, what structure is expected for AgCl from radius ratio?
- Calculate % of ionic character in Li-F. Bond length of Li-F is 0.156×10<sup>-9</sup>m. Dipole moment of LiF is 6.32D.
- Which one of <sup>206</sup>Pb<sub>82</sub>, <sup>207</sup>Pb<sub>82</sub> and <sup>208</sup>Pb<sub>82</sub> is stablest nuclide and why?

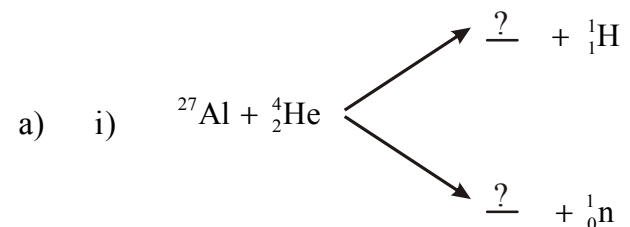
2. Answer any **five** questions from the following:

$$2 \times 5 = 10$$

- Why AgCl is colourless but AgI is yellow?
- Compare the bond angle of the following  $\text{OCl}_2$ ,  $\text{OF}_2$ ,  $\text{OH}_2$
- What do you mean by a average life of a radioactive element and how is it related to half-life of the element?
- A radioactive sample decays to 10% of its initial amount in 4600 minutes. Calculate the rate constant of this process in  $\text{hour}^{-1}$  unit.
- In ordinary condition  $\text{I}_2$  is solid;  $\text{Br}_2$  is liquid while  $\text{Cl}_2$  and  $\text{F}_2$  are gaseous—Justify.
- Which one is more soluble in water in between  $\text{NaHCO}_3$  and  $\text{Na}_2\text{CO}_3$ ? Justify your answer.
- $\text{BF}_3$ ,  $\text{PF}_3$ , and  $\text{ClF}_3$  are  $\text{AX}_3$  types of molecule but their structure and bond angles are different—Explain.
- Sodium metal crystallizes in bcc structure with  $a = 424$  pm. Calculate the radius of  $\text{Na}^+$ .

3. Answer any **two** questions from the following:

$$5 \times 2 = 10$$

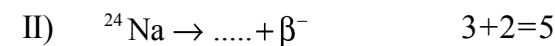
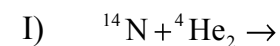


- The lattice energy of LiF calculated from Born-Landé equation is  $-1000 \text{ kJ mol}^{-1}$ . Assume that for both LiF and MgO the Madelung constants, interionic distance and Born Exponents have the same value. What is the lattice energy of MgO in  $\text{kJ mol}^{-1}$ ?  $2+3=5$

- i) An element of Mass no. 15 and isotopic mass 15.00486 a.m.u, has mass defect of 0.124043 amu. Find out the atomic number and mass no. of the element.

[Given: Mass of proton = 1.008145, mass of neutron = 1.008586]

- Complete the reactions:



- c) i) Calculate the lattice energy of MgO in KJ/mole using the following data:

Modelung const=1.7475

Inter nuclear distance = 2.05 Å

Born exponent = 7 and electronic charge  
=  $4.8 \times 10^{-10}$  e.s.u

- ii) Why  $\text{PCl}_5$  is tetragonal bipyramidal in shape whereas  $\text{IF}_5$  is square pyramidal?

$$3+2=5$$

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