

POSTGRADUATE FOURTH SEMESTER EXAMINATION, 2022

CHEMISTRY

Course Code: CHEM 402E

Course ID: 41452

Inorganic Chemistry Special

Time: 2 Hours

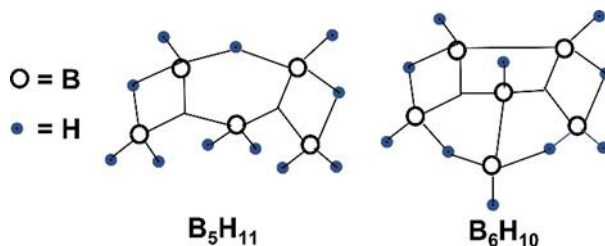
Full Marks: 40

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

1. Attempt *any five* of the followings: 2×5 = 10
- (a) Mention three main characteristics of metallic conductivity
 - (b) Draw the unit cell structure of perovskite (XYO_3) and determine the chemical formula from its unit cell arrangement.
 - (c) Write down two main applications of superconductor.
 - (d) What are pyroelectricity and piezoelectricity?
 - (e) What is Curie and Neel temperature?
 - (f) What is biosensor? Give one example of it.
 - (g) Which compound is known as "inorganic benzene" and why it is called so?
2. Attempt *any four* of the followings. 5 × 4 = 20
- (a) Draw the diagram of Ruby Laser and explain its working principle. 2+3 = 5
 - (b) How can you determine the oxygen content of $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$? Explain the superconducting mechanism of cuprates. 2+3 = 5
 - (c) Mention the differences between fluorescence and phosphorescence. Draw the Jablonski Diagram. 2+3 = 5
 - (d) (i) Why intercalation and deintercalation techniques are called topochemical reactions?
(ii) Explain how graphite can act as an excellent intercalating agent for different types of ions, atoms, and molecules.
(iii) Write down the characteristics of superconductive materials. 1+2+2 = 5
 - (e) (i) What is Stokes shift and how it is generated?

(ii) When YF_3 doubly doped with Yb^{3+} and Er^{3+} , it converts infrared radiation into green luminescence – explain the phenomenon. 5

(f) (i) Calculate the ‘*styx*’ number of the following boranes



(ii) Why does NiO behave as an antiferromagnet? 2+3 = 5

3. Attempt *any one* of the followings. 10×1 = 10

(a) (i) Briefly describe how haemoglobin transports oxygen through the blood?

(ii) Lanthanides show large spin-orbit coupling and small crystal field splitting whereas for transition metals it is the reverse – explain why?

(iii) Draw the change of magnetisation (M) or induction (B) against the applied magnetic field (H) and indicate the coercivity, H_c , and remanence, B_r/M_r in it. Explain the terms H_c and B_r/M_r . 4+2+4 = 10

(b) Describe briefly the formulae and structure of the high- T_c cuprate superconductors. Indicate their relation to the perovskite structure and show how the coordination environment of Cu may be taken as an indicator of its oxidation state. 5 +5 = 10
