2023

CHEMISTRY — HONOURS

Paper : DSE-B-1 and DSE-B-2

(Inorganic Materials of Industrial Importance)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Paper : DSE-B-1

(Inorganic Materials of Industrial Importance)

Full Marks : 50

Answer ***question no.*** **1** (compulsory) and ***any eight*** questions from the rest (***question nos.*** **2** to **13**).

1. Answer the following questions (***any ten***) : 1×10

(a) What is the role of linseed oil in varnish?

(b) What makes steel stainless?

(c) Mention one role of plasticizer added to a paint.

(d) State any one application of Monel metal.

(e) Give an example of a super+*+*+*/conducting oxide.

(f) What is muriate of potash?

(g) Which type of cement is used in underwater constructions?

(h) Name the principal constituent of white paint.

(i) Cite one example each of a primary and a secondary explosive.

(j) Which common element is present in brass and bronze?

(k) What is the composition of clay?

(l) Mention any one industrial application of heterogeneous catalysis.

2. (a) Which compound(s) is (are) used to give—

(i) amber colour, (ii) blue colour, (iii) purple colour to glass?

(b) Compare the properties of solid and liquid propellants. 3+2

3. (a) What are carbon nanotubes? State any one application of carbon nanotubes.
   (b) What is vehicle? 3+2

4. (a) State the composition and properties of borosilicate glass.
   (b) Explain the process— 'Carburizing'. 3+2

5. (a) The following equation shows reaction products of the molecular explosive PETN ($C_5H_8N_4O_{12}$).

$$C_5H_8N_4O_{12} \rightarrow 4CO_2 + 4H_2O + 2N_2 + C$$

   Calculate the oxygen balance for PETN.
   (b) What is meant by 'Acid pickling'? State its use. 3+2

6. (a) Write down with equations the working principle of Pb–acid battery.
   (b) What are the differences between glass and ceramics? 3+2

7. (a) How is calcium ammonium nitrate manufactured? Construct the flow chart diagram for the above manufacturing process.
   (b) Discuss the chemical changes that occur during the setting of cement. 3+2

8. (a) What is the basic difference between an emulsion paint and an ordinary paint? Give the approximate formulation of an ordinary paint.
   (b) What are the active materials used in the fabrication of solar cells? 3+2

9. (a) What are fillers? Cite an example. Write down the functions of fillers in a paint.
   (b) Distinguish between drying oils and semi-drying oils. 3+2

10. (a) Explain the two commonly used techniques for metal spraying. Why is sand blasting done on the metal surface prior to spraying?
   (b) What is the function of gypsum in cement? 3+2

11. (a) Differentiate between ferrous and non-ferrous alloys with examples.
   (b) Explain the role of a phase transfer catalyst with the help of a suitable example. 3+2

12. (a) What is glazing? State two advantages of glazed ceramics.
   (b) Write down one advantage and one disadvantage of Ni-Cd batteries. 3+2

13. (a) What are the objectives of electroplating? Mention the difference between electroplating and electroless plating.
   (b) What is an eco-friendly paint? 3+2

Paper : DSE-B-2
(Novel Inorganic Solids)
Full Marks : 50

Answer ***question no.*** **1** and ***any eight*** questions from the rest.

1. Answer ***any ten*** questions : 1×10
   (a) Give one application of sol-gel method.
   (b) Cite an example of black inorganic pigment.
   (c) Mention two uses of one-dimensional metals.
   (d) Give an example of molecular magnets.
   (e) Mention one use of Gold nanoparticles.
   (f) Give one example of bionanocomposites.
   (g) What is meant by plain carbon steel?
   (h) Give two uses of thermoplastics.
   (i) Mention two uses of fibre-reinforced composites.
   (j) Mention two applications of conducting polymers.
   (k) What are refractory materials?
   (l) Mention any one medicinal use of ceramic.

2. (a) Distinguish between sol-gel and co-precipitation method of synthesis of inorganic solid.
   (b) Give two advantages of hydrothermal method. 3+2

3. (a) What is 'heat and beat' method of synthesis of inorganic solid?
   (b) Give two examples of mixed inorganic pigments and mention their uses. 3+2

4. (a) What are fullerides? Mention one method of preparing fullerides and one important property of fullerides.
   (b) What is one-dimensional metal? 3+2

5. (a) Differentiate between Single wall carbon nanotubes (SWCNT) and Multiwall carbon nanotubes (MWCNT).
   (b) Mention two uses inorganic liquid crystals. 3+2

6. (a) How can silver nanoparticles be prepared? Mention two biological activities of silver nanoparticles.
   (b) What is the role of plasticizer in thermoplastics? 3+2

7. (a) Differentiate between Matrix and reinforcement in composite materials.
   (b) Mention two applications of nanowires. 3+2

8. (a) How conducting polypyrrole polymer is synthesized chemically? Mention one application of such polymer.
   (b) How does moisture affect composite materials? 3+2

9. (a) How does ion-exchange resins work? How can such resin be regenerated after being exhausted?
   (b) What are superalloys? Mention one of its important property. 3+2

10. (a) Describe a method for fabrication of cast iron.
    (b) Write two significant properties of Duralumin. 3+2

11. (a) Differentiate between top-down and bottom-up synthesis of nanomaterials.
    (b) What are the drawbacks of polyacetylene as conducting polymer? 3+2

12. (a) What are conventional engineering materials? Write two limitations of such materials.
    (b) Write two properties of bionanocomposites. 3+2

13. (a) What are natural and antisical nanomaterials?
    (b) Mention two applications of superconducting ceramics. 3+2
