

B.A. / B.Com. / B.Sc. (Part-I) (NEP) Semester-II
SEC43 - Chemistry - Chemistry of Boiler Troubles-IV

P. Pages : 3

Time : Two Hours



GUG/S/25/16434S

Max. Marks : 40

Note : All questions are compulsory and carry marks as indicated.

1. a) Multiple Choice Questions (Each question carry two marks).
- i) What is priming in a boiler system? 2
 - a) The formation of scale deposits on boiler tubes
 - b) The carryover of water droplets with steam
 - c) The primary process of removing hardness
 - d) The buildup of sludge inside the boiler
 - ii) Which of the following is a primary cause of foaming in a boiler? 2
 - a) High levels of dissolved solids and oils in the feedwater
 - b) Low water temperature in the boiler
 - c) Proper blow down in water treatment
 - d) High steam pressure
 - iii) Which of the following can help to prevent priming in a boiler? 2
 - a) Increasing the steam pressure
 - b) Maintaining the correct water level in the boiler
 - c) Increasing the temperature of boiler feedwater
 - d) Reducing the amount of oxygen in the water
 - iv) Which of the following compounds is mainly responsible for the formation of scale in boilers? 2
 - a) Sodium chloride
 - b) Calcium sulphate
 - c) Sodium sulphate
 - d) Potassium nitrate
 - v) What is sludge in a boiler system? 2
 - a) Hard adherent deposits formed due to high pressure
 - b) Soft, loose, and generally amorphous deposits
 - c) A form of scale that improves boiler efficiency
 - d) Precipitates which can not remove by blow down operation
 - vi) Which of the following methods is used to prevent scale formation in boilers? 2
 - a) Increasing the boiler feedwater pH
 - b) Use of water softeners or demineralizers to remove hardness-causing salts
 - c) Use of corrosion inhibitors
 - d) Break point chlorination
 - vii) What is caustic embrittlement? 2
 - a) A form of corrosion caused by acidic conditions like dilute HCl
 - b) A type of corrosion caused by alkaline conditions, particularly sodium hydroxide
 - c) A mechanical failure due to high temperatures
 - d) A process of corrosion occurs due to chloride ions

- viii) Which of the following is a symptom of caustic embrittlement? 2
- Uniform thinning of the boiler metal
 - Making the metal brittle and formation of small cracks in stressed areas
 - Rust formation on the boiler surface
 - Scaling on the boiler tubes
- ix) What is the primary cause of corrosion in a boiler system? 2
- High temperature of the boiler water
 - Presence of dissolved oxygen and other corrosion gases
 - High alkalinity of the water
 - Low steam pressure
- x) Which of the following is not a type of boiler trouble occurs in boiler? 2
- Scale & Sludge
 - Calgon conditioning
 - Boiler corrosion
 - Carry over

OR

- b) What is carryover in a boiler system, and how does priming & foaming contribute to it? Explain the causes of priming and foaming. 5
- c) What is caustic embrittlement? How does it affect the mechanical properties of boiler materials, and what measures can be taken to prevent it? 5
- d) What are scale and sludge? Distinguish between scale and sludge. Give the disadvantages of formation of scale in the boiler. 5
- e) Explain the causes of boiler corrosion. How can corrosion be controlled and prevented. 5

2. a) Multiple Choice Questions (Each question carry two marks).

- i) What is the most significant effect of boiler corrosion on the boiler tubes? 2
- Increases water flow
 - Loss of material strength and tube failure
 - Decreases energy consumption
 - Enhance steam quality
- ii) What is the role of water treatment chemicals in boiler corrosion prevention? 2
- To increase water hardness
 - To neutralize dissolved oxygen and control pH levels
 - To increase boiler pressure
 - To decrease water temperature
- iii) Phosphate conditioning is commonly used in which of the following industries? 2
- Textile industry
 - Water treatment plants
 - Paper manufacturing
 - Food processing industry
- iv) Which of the following chemicals is typically used in phosphate conditioning? 2
- Sodium chloride
 - Sodium hexametaphosphate
 - Di and tri sodium phosphate
 - Both b and c

- v) What is the effect of phosphate conditioning on scale formation? 2
- Increases the scale formation
 - Prevents or reduces scale formation
 - Has no effect on scale formation
 - Causes the formation of hard scales
- vi) How does sodium carbonate (soda ash) function in carbonate conditioning? 2
- It lowers the pH of water
 - It increases the solubility of calcium and magnesium
 - It reacts with calcium and magnesium ions to form insoluble carbonates
 - It acts as a flocculant to remove suspended particles
- vii) Which of the following is a major advantage of carbonate conditioning? 2
- It increases acid content in boiler
 - It reduces the turbidity of water
 - It does not result in the formation of sludge
 - It reduces water hardness by precipitating calcium and magnesium
- viii) In Calgon conditioning, what is the main function of sodium hexametaphosphate? 2
- To act as a flocculant
 - To harden the water by precipitating salts
 - To sequester hardness-causing ions
 - To act as a coagulant
- ix) Calgon conditioning is most effective in which type of water? 2
- Soft water
 - Hard water
 - Acidic water
 - Alkaline water
- x) Which of the following is a disadvantage of Calgon conditioning? 2
- It increases the hardness of water
 - It can lead to the formation of phosphate-based sludge
 - It does not reduce water pH
 - It is only effective at high temperatures

OR

- b) What are the effects of boiler corrosion on the operation and performance of a boiler system? 5
- c) Describe the process of phosphate conditioning in water treatment. How does it help in preventing scale formation in boilers? 5
- d) Explain Calgon conditioning and its role in the prevention of scale formation in boilers. 5
- e) What is carbonate conditioning, and how does it function in softening hard water for boiler operations? Discuss the chemical reactions involved with its advantages and limitations. 5
