



Notes : 1. All questions are compulsory.

2. All questions carry equal marks.

1. A) Solve the following multiple-choice questions (Each carry 2 marks). 2x10
=20

i) Which of the following is a key cause of boiler carryover?

a) Deaeration

b) Priming

c) Blowing down

d) Mechanical cleaning

ii) What is foaming in steam boilers?

a) Excessive steam generation in the boiler

b) Continuous formation of bubbles or foam in the boiler water

c) Overheating of boiler water

d) Corrosion of boiler components

iii) What are the common components of boiler sludge?

a) Sodium chloride and sodium phosphate

b) Magnesium carbonate, magnesium chloride, calcium chloride, and magnesium sulphate.

c) Silica and iron oxide

d) Potassium nitrate and sodium bicarbonate

iv) Which of the following is NOT a cause of scale formation in boilers?

a) Decomposition of calcium bicarbonate

b) Deposition of calcium sulphate

c) Presence of silica

d) Regular water treatment

v) What is the effect of caustic embrittlement on the boiler material?

a) It increases the strength of the metal

b) It causes the metal to become brittle and weak

c) It leads to excessive scale formation

d) It reduces the corrosion resistance of the boiler

vi) Which of the following is not a result of the excess impurity in boiler food?

a) Scale and sludge formation

b) Decomposition

c) Corrosion, priming, and foaming

d) Caustic embrittlement

vii) Foaming is caused by the formation of -----

a) Acids

b) Alcohols

c) Oils and alkalis

d) Ketones

viii) What is the purpose of regular blowdown in boiler operations?

a) To increase steam generation

b) To remove concentrated solids from the boiler

c) To improve water temperature

d) To reduce boiler corrosion

- ix) Which boiler component is most at risk of failure due to priming?
 - a) Boiler drum
 - b) Superheater
 - c) Feedwater pump
 - d) Furnace
- x) What is the recommended pH range for boiler water to prevent corrosion?
 - a) 6.5 to 7.5
 - b) 7.0 to 8.0
 - c) 8.5 to 9.5
 - d) 10.0 to 11.0

OR

B) Solve the following questions (Each carry 5 marks).

**5x4
=20**

- A) Explain the main causes and consequences of carryover in boilers.
- B) What is Calgon? Give its molecular formula. Differentiate between Scale and Sludge.
- C) Discuss the electrochemical process involved in caustic embrittlement and its prevention methods.
- D) Explain the causes and effects of priming in detail

2. A) Solve the following multiple-choice questions (Each carry 2 marks).

**2x10
=20**

- i) Oxygen corrosion in a boiler system can be identified by:
 - a) Black magnetite deposits
 - b) Reddish-brown rust
 - c) White calcium deposits
 - d) Green copper corrosion
- ii) Which type of phosphate is commonly used in phosphate conditioning?
 - a) Sodium phosphate
 - b) Calcium phosphate
 - c) Ammonium phosphate
 - d) Potassium phosphate
- iii) Phosphate conditioning is a type of:
 - a) Internal treatment
 - b) External treatment
 - c) Mechanical treatment
 - d) Physical treatment
- iv) Which compound is commonly added in carbonate conditioning to treat hard water?
 - a) Sodium bicarbonate
 - b) Sodium carbonate
 - c) Calcium carbonate
 - d) Magnesium carbonate
- v) What is the primary purpose of Calgon in water treatment?
 - a) To increase water hardness
 - b) To reduce dissolved gases
 - c) To prevent scale formation
 - d) To kill microorganisms
- vi) Carbonate conditioning is most effective in which type of boilers?
 - a) Low-pressure boilers
 - b) High-pressure boilers
 - c) Open-loop cooling systems
 - d) Boilers with oxygen scavengers
- vii) What kind of substance is Calgon?
 - a) Acid
 - b) Base
 - c) Salt
 - d) Polyphosphate
- viii) Which of the following ions are primarily seized by Calgon?
 - a) Sodium and potassium ions
 - b) Magnesium and calcium ions
 - c) Chloride and Sulphate ions
 - d) Iron and aluminum ions

- ix) What type of reaction occurs during phosphate treatment?
- | | |
|--------------|-------------------|
| a) Oxidation | b) Precipitation |
| c) Reduction | d) Neutralization |
- x) Carbon dioxide in boiler water reacts with water to form:
- | | |
|------------------|----------------------|
| a) Sulfuric acid | b) Hydrochloric acid |
| c) Carbonic acid | d) Nitric acid |

OR

B) Solve the following questions (Each carry 5 marks).

**5x4
=20**

- A) Discuss the effects of boiler corrosion on boiler operation.
- B) Discuss various methods for removal dissolved oxygen to prevent boiler corrosion.
- C) Give any two causes of boiler corrosion and any two types of external treatment of feed water.
- D) What is boiler corrosion? Discuss the principles involved in carbonate and phosphate conditioning
