
Q631 - Steam Plants

1. Under normal conditions, the rate of heat transfer in a feedwater heater is most greatly affected by the _____.

- pH of the feedwater
- **temperature differential between the steam and feedwater**
- density of the feedwater
- speed of the main feed pump

Note:
Heat transfer rate in a feedwater heater is primarily determined by the temperature differential between the steam and feedwater, as this difference directly drives the heat transfer process according to the fundamental equation $Q = U \cdot A \cdot \Delta T$, where U and A are relatively constant under normal operating conditions.

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2. The main feed check valve functions to _____.

- reduce feed pump discharge pressure loading
- **prevent backflow of water from the boiler in the event of a feed pump failure**
- check pressure pulsations in the feed line
- provide feed pump positive discharge head

Note:
The main feed check valve prevents backflow of water from the boiler into the feed line during feed pump failure.

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3. Which of the following is the advantage of operating a typical closed feedwater system for a marine boiler when compared to an open feedwater system?

- Reduced steam requirement for feedwater heating.
- Reduced requirement for condensate purity.
- Allows for lower feed pump operating pressures.
- **Increased capability of removing and controlling dissolved oxygen.**

Note:
A closed feedwater system minimizes air contact and facilitates efficient deaeration, primarily improving dissolved oxygen removal and control, which is its key advantage over an open system.

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4. By which of the listed methods may heat be transferred from one body to another?

- Conduction
- Radiation
- Convection
- **All of the above**

Note:
Heat transfer occurs through conduction, convection, and radiation. Therefore, 'All of the above' is the correct answer.

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5. Which of the following statements is correct concerning heat transfer?

- Heat is given off from a high temperature region known as a heat sink.
- Heat transfer rate is affected most by the size of the heat sink involved.
- **Heat transfer rate is affected most by the temperature difference between the heat source and the heat sink.**
- Heat transfer by radiation will occur only by mass motion of a fluid substance.

Note:
Heat transfer rate is primarily determined by the temperature difference between the heat source and the heat sink; the size of the sink or fluid motion are secondary factors. A heat sink receives heat, while a heat source provides it. Radiation heat transfer occurs via electromagnetic waves, not fluid motion.

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6. As steam accomplishes work in an engine or turbine, the pressure of the steam is reduced because it _____.

- **expands in volume**
- becomes saturated again
- becomes superheated again
- diminishes in volume

Note:
Steam pressure decreases as it performs work due to expansion in volume, which requires an increase in volume to move a piston or turbine blades.

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7. Why is superheated steam used in the main propulsion turbines instead of saturated steam?

- Less specific energy available per pound of steam.
- **Greater heat energy available per pound of steam.**
- Lower required specific volume than saturated steam.
- Higher pressure available than saturated steam.

Note:
Superheated steam is used instead of saturated steam because it possesses greater heat energy per pound, allowing for more work to be extracted in the turbine before condensation.

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8. Which type of energy conversion is associated with an operating steam boiler?

- Specific
- **Thermal**
- Mechanical
- Kinetic

Note:
A steam boiler converts the chemical energy of fuel into heat energy; therefore, the energy conversion is thermal.

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9. Steam tables can be used to obtain the _____.

- specific fuel consumption under steady steaming conditions
- steam generating capacity of a vessel's boilers
- mechanical efficiency of the main unit
- **values for properties of water and steam vapor at various conditions**

Note:
Steam tables provide values for properties of water and steam vapor at various conditions; they do not directly provide data for fuel consumption, boiler capacity, or mechanical efficiency, which require separate calculations.

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10. The best conductor of heat in a marine boiler is _____.

- water
- brick
- steam
- **steel**

Note:
Steel is the best heat conductor of the options and is used in marine boiler heating surfaces to efficiently transfer heat.
