

## U.S.C.G. Merchant Marine Exam

DDE – 1000/4000 HP

Q631 Steam Plants

(Sample Examination)

**Choose the best answer to the following Multiple-Choice Questions:**

1. Which of the following statements is correct concerning heat transfer?
- A. Heat is given off from a high temperature region known as a heat sink.
  - B. Heat transfer rate is affected most by the size of the heat sink involved.
  - C. Heat transfer rate is affected most by the temperature difference between the heat source and the heat sink.
  - D. Heat transfer by radiation will occur only by mass motion of a fluid substance.

Correct answer: C

2. By which of the listed methods may heat be transferred from one body to another?
- A. Radiation
  - B. Convection
  - C. Conduction
  - D. All of the above

Correct answer: D

3. Steam tables can be used to obtain the \_\_\_\_\_.
- A. values for properties of water and steam vapor at various conditions
  - B. mechanical efficiency of the main unit
  - C. steam generating capacity of a vessel's boilers
  - D. specific fuel consumption under steady steaming conditions

Correct answer: A

4. The property of a fuel oil which is a measurement of its available energy, is known as its \_\_\_\_\_.
- A. cetane index
  - B. viscosity index
  - C. heating value
  - D. cetane number

Correct answer: C

5. The flash point of a residual fuel oil should be used to determine the highest temperature to which the oil may be heated \_\_\_\_\_.
- A. in a storage tank
  - B. for centrifuging
  - C. in the recirculating line
  - D. for atomizing

Correct answer: A

6. In terms of the completeness of combustion, in viewing the flame through the peephole, what would be the indication of the MOST complete combustion?
- A. Yellow flame
  - B. Golden yellow flame
  - C. Reddish flame
  - D. Orange flame

Correct answer: B

7. A variable capacity, pressure atomizing, fuel oil burner functions to \_\_\_\_\_.
- A. maintain a constant fuel temperature
  - B. provide a wide range of combustion
  - C. provide a constant fuel return pressure
  - D. maintain smokeless fuel oil atomization

Correct answer: B

8. Control of the fuel oil metering valve in an automatically fired boiler is accomplished by a \_\_\_\_\_.
- A. pressure magnifying device in the steam coil outlet
  - B. steam pressure sensing device with linkage to the damper air vanes
  - C. metering device in the air supply line
  - D. signal from the feedwater electrode

Correct answer: B

9. When operating with the auxiliary feed line, feed water flow is controlled \_\_\_\_\_.
- A. manually by throttling the auxiliary feed stop-check valve
  - B. automatically by the eco by-pass
  - C. automatically by the main feedwater regulator
  - D. manually by adjustment of the auxiliary feedwater regulator spring setting

Correct answer: A

10. Under normal conditions, the rate of heat transfer in a feed water heater is most greatly affected by the \_\_\_\_\_.
- A. temperature differential between the steam and feed water
  - B. speed of the feed pump
  - C. density of the feed water
  - D. pH of the feed water

Correct answer: A

11. Design characteristics of a velocity-compounded impulse turbine include the utilization of \_\_\_\_\_.
- A. one or more nozzles with one row of rotating blades
  - B. a single pressure stage with two or more velocity stages
  - C. two or more simple impulse stages
  - D. a low velocity steam jet from a nozzle

Correct answer: B

12. Nozzle diaphragms are installed in pressure-compounded impulse turbines to \_\_\_\_\_.
- A. hold the nozzles of the stage and admit steam to moving blades
  - B. support moving blades
  - C. support shrouding
  - D. eliminate blade and nozzle losses

Correct answer: A

13. As steam accomplishes work in an engine or turbine, the pressure of the steam is reduced because it \_\_\_\_\_.
- A. becomes saturated again
  - B. diminishes in volume
  - C. expands in volume
  - D. becomes superheated again

Correct answer: C

14. What statement concerning the operation of a propulsion steam turbine turning (jacking) gear is true?
- A. The turning gear is used to prevent turbine rotor distortion while warming-through or while cooling, since distortion is an issue when warming-through or cooling.
  - B. The turning gear is used to prevent turbine rotor distortion while warming-through only. The turning gear is never used while cooling since distortion is not an issue when cooling.
  - C. The turning gear is used to prevent turbine rotor distortion while cooling only. The turning gear is never used while warming-through since rotor distortion is not an issue when warming-through.
  - D. The turning gear is used to rotate the turbines, gearing, and shaft periodically when the main engines are secured only. The turning gear is never used to prevent turbine rotor distortion.

Correct answer: A

15. A turbine assembly in which steam flows in series through a high-pressure turbine and then on to a low-pressure turbine, with both turbines driving a common reduction gear through separate shafts, is classified as \_\_\_\_\_.
- A. dual series
  - B. tandem compound
  - C. cross compound
  - D. tandem, double flow

Correct answer: C

16. Journal bearings used with turbine rotors are manufactured in two halves in order to \_\_\_\_\_.
- A. facilitate interchanging with other bearing halves
  - B. permit removal of the bearing without removing the rotor from the turbine
  - C. maintain axial alignment and reduce thrust
  - D. provide for positive oil flow at all loads

Correct answer: B

17. Allowance for axial expansion of a steam turbine due to temperature changes is provided for by the use of \_\_\_\_\_.
- A. casing flexible joints
  - B. a deep flexible I beam support
  - C. rotor position indicators
  - D. pivoted-shoe type thrust bearings

Correct answer: B

18. When the temperature of the main turbine lubricating oil is lowered, an increase will occur in the \_\_\_\_\_.
- A. viscosity
  - B. flash point
  - C. pour point
  - D. concentration of contaminants

Correct answer: A

19. Which of the filters listed will deplete the additives in lubricating oil?
- A. Extended area membrane filter
  - B. Cloth bag extractor
  - C. Absorbent filter
  - D. Adsorbent filter

Correct answer: D

20. Of the many impurities commonly found in marine lubricating oil, which of the following CANNOT be removed by a centrifugal purifier at normal operating speeds and temperatures?
- A. Metal particles
  - B. Carbon particles
  - C. Diesel fuel oil
  - D. Water

Correct answer: C

21. When monitoring steam propulsion plant lubricating oil pressures, what pressure is the most critical to check regularly while underway?
- A. Lube oil service pump discharge pressure
  - B. The pressure immediately downstream of the variable orifice
  - C. The pressure at the most remote bearing
  - D. The pressure immediately upstream of the variable orifice

Correct answer: C

22. The splits located in the halves of main reduction gear bearings are aligned at an angle to the horizontal in order to resist \_\_\_\_\_.
- A. wiping
  - B. steam loss
  - C. oil loss
  - D. axial stress

Correct answer: A

23. On main turbine propulsion units, gear-type flexible couplings are generally used between the \_\_\_\_\_.

- A. rotor shaft and pinion shaft
- B. second reduction and the shaft thrust bearing
- C. quill shaft and high-speed pinion
- D. rotor shaft and quill shaft

Correct answer: A

24. In the diagrammatic arrangement of the thrust bearing, shown in the illustration, the direction of shaft rotation and the direction of thrust are indicated respectively by arrows \_\_\_\_\_. Illustration SE-0012

- A. G and J
- B. F and H
- C. G and H
- D. F and J

Correct answer: D

25. While your vessel is underway at normal speed, a steam drum safety valve develops a significant leak. Your first corrective action should be to \_\_\_\_\_.

- A. secure the boiler and check the valve spring compression
- B. attempt to reseat the valve using the hand releasing gear
- C. secure the boiler and blank off the valve flange
- D. inspect the escape piping for binding on the valve body

Correct answer: B

26. Where do fuel oil vapors tend to accumulate in an engine room?

- A. At the point in the engine room where the vapors were initially formed
- B. In the upper engine room spaces, especially in the fidley
- C. Oil vapors tend to distribute throughout the engine room evenly
- D. In the lower engine room spaces, especially in the bilges

Correct answer: D

27. With reference to the chart, if a boiler generates saturated steam at 385.3 psig, how much heat per pound was required to change the water into steam if the feed water temperature was initially 220°F? Illustration SG-0004

- A. 96.85 BTU
- B. 97.15 BTU
- C. 1016.40 BTU
- D. 1196.45 BTU

Correct answer: C

28. The purpose of the boiler drum air cock is to \_\_\_\_\_.
- A. permit escape of air when steam is forming in the drum after lighting off
  - B. permit escape of air when the boiler is being filled
  - C. admit air when the boiler is being emptied
  - D. all of the above

Correct answer: D

29. The best conductor of heat in a marine boiler is \_\_\_\_\_.
- A. water
  - B. steam
  - C. steel
  - D. brick

Correct answer: C

30. The bottom blow valve on a water-tube boiler is usually attached to the \_\_\_\_\_.
- A. floor tubes
  - B. boiler mud drum
  - C. external downcomers
  - D. steam and water drum

Correct answer: B

31. Bottom blow valves are installed on water-tube boilers to \_\_\_\_\_.
- A. completely drain the boiler in an emergency
  - B. prevent sludge from forming in the steam drum
  - C. remove floating impurities from the boiler water surface
  - D. remove settled solids from the water drum

Correct answer: D

32. The purpose of the separating nozzle in the accumulator of a water-tube, coil-type, steam generator is to separate \_\_\_\_\_.
- A. dry steam from the steam and water mixture
  - B. condensate from feedwater
  - C. superheated steam from saturated steam
  - D. sludge accumulations from feedwater

Correct answer: A

33. Which of the following statements concerning fire-tube boilers is correct?
- A. Combustion gases flow through the tubes
  - B. Flames impinge on the tubes
  - C. Combustion occurs in the tubes
  - D. Water flows through the tubes

Correct answer: A

34. During unsafe firing conditions in a boiler, various control actuators are interlocked with the burner circuit to prevent start-up, in addition to safety shutdown. These controls are referred to as \_\_\_\_\_.

- A. limit controls
- B. flame safeguard controls
- C. combustion controls
- D. programming controls

Correct answer: A

35. A photoelectric cell installed in a boiler burner management system \_\_\_\_\_.

- A. opens the burner circuit upon sensing a flame failure
- B. detects a flame failure by monitoring radiant heat from glowing refractory
- C. requires mechanical linkage to secure the burner fuel supply
- D. must be bypassed at low firing rates

Correct answer: A

36. The purpose of the mica used in a boiler water gauge glass assembly is to prevent \_\_\_\_\_.

- A. light refraction in the glass
- B. overheating of the glass
- C. leakage from the glass
- D. etching of the glass

Correct answer: D

37. A boiler safety valve must be capable of \_\_\_\_\_.

- A. remaining open until all pressure in the steam drum is relieved
- B. closing with a chattering motion to free scale deposits from the seats
- C. remaining open until a preset pressure drop occurs
- D. opening gradually above a designated pressure

Correct answer: C

38. The useful life of furnace refractory is affected most by \_\_\_\_\_.

- A. the quality of the fuel being burned
- B. large and rapid changes in furnace temperature
- C. improper treatment of boiler water
- D. high steady steaming boiler loads

Correct answer: B

39. As the percentage of CO<sub>2</sub> in the stack gas decreases, you can assume that \_\_\_\_\_.

- A. you are approaching secondary combustion
- B. fuel is being burned with increasing economy
- C. excess air is increasing
- D. the fuel to air ratio is increasing

Correct answer: C



40. Which of the following is the best reason for opening the air cock when draining a water-tube boiler?

- A. Air mixed with the water will create a cleansing effect in the tubes.
- B. Air coming into the boiler will help dry out the boiler's surface.
- C. Water flows out of the boiler too rapidly with the air cock closed.
- D. With the air cock open, the boiler drains without producing a vacuum.

Correct answer: D

41. When cleaning the inside surfaces of the boiler tubes of a water-tube boiler with a powered rotary brush, the brush should be kept in motion to \_\_\_\_\_.

- A. reduce wear to brush bristles
- B. avoid internal tube damage
- C. prevent it from seizing
- D. reduce tube pitting

Correct answer: B

42. To make temporary emergency repairs to brickwork in a boiler furnace, which of the materials listed should be used?

- A. Insulating block
- B. Plastic refractory
- C. Air setting mortar
- D. Calcined diatomaceous earth

Correct answer: B

43. When a boiler is removed from service for an extended period, why should the firesides be thoroughly dried after water washing?

- A. Reduce the possibility of thermal spalling
- B. Prevent flarebacks on lighting off
- C. Prevent cracking of the brickwork
- D. Reduce the probability of corrosion

Correct answer: D

44. You are standing watch in the engine room of a steam vessel. You should blow down a gauge glass periodically to \_\_\_\_\_.

- A. provide water samples for the second assistant
- B. test the feedwater stop-check valve
- C. remove any sediment that has accumulated
- D. maintain the proper water level in the steam drum

Correct answer: C

45. Water in the fuel supply to a steaming boiler can be detected by \_\_\_\_\_.

- A. dense white smoke being observed in the periscope
- B. sputtering of the fires
- C. observation of the fuel oil heater drains
- D. panting of the casing

Correct answer: B

46. Which color burner flame would indicate too much excess air?

- A. Yellowish orange
- B. Orange red
- C. Incandescent white
- D. Bright red

Correct answer: C

47. Oil accumulation in boiler water would \_\_\_\_\_.

- A. practically eliminate boiler sludge formation
- B. increase the heat transfer rate
- C. prevent acid attack on the boiler tubes
- D. cause foaming and carryover from the boiler

Correct answer: D

48. The MOST common cause of heat blisters developing on boiler generating tubes is due to \_\_\_\_\_.

- A. gas laning
- B. insufficient water circulation
- C. flame impingement
- D. waterside deposits

Correct answer: D

49. The most troublesome corrosive substances in boiler water are oxygen and \_\_\_\_\_.

- A. sulfur dioxide
- B. ammonia
- C. carbon dioxide
- D. hydrogen sulfide

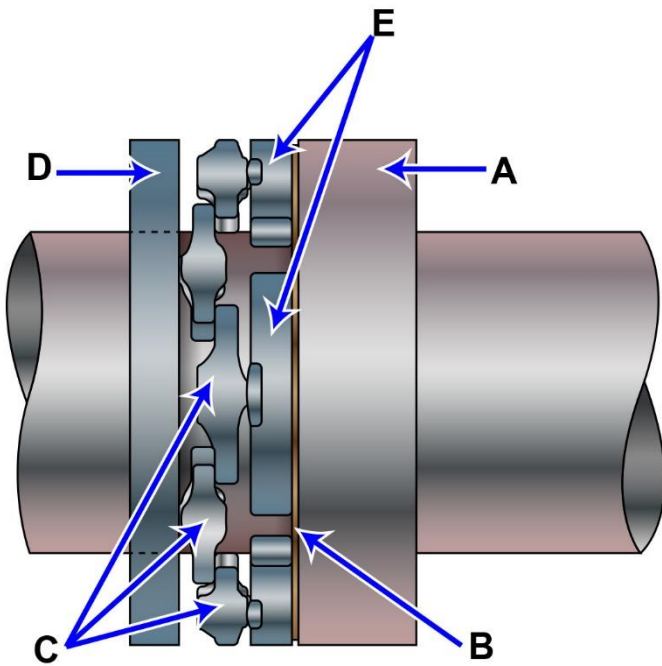
Correct answer: C

50. Testing boiler water for chloride content will indicate the amount of \_\_\_\_\_.

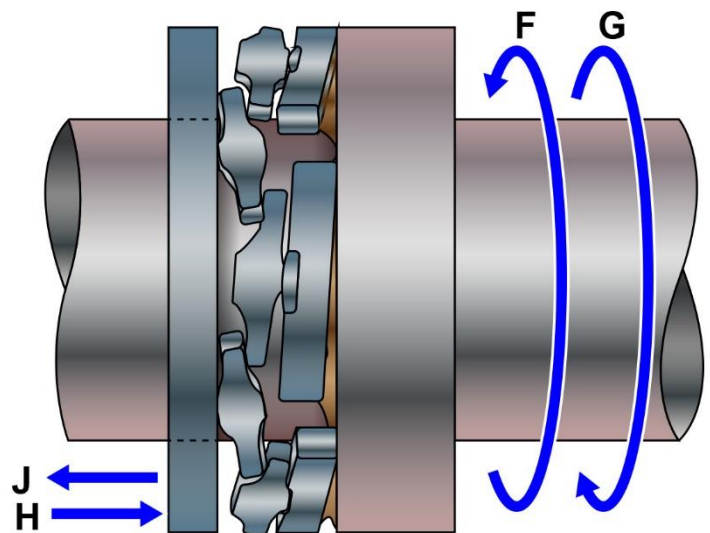
- A. total alkalinity in the water
- B. dissolved salts from sea contamination
- C. phosphates present in the water
- D. methyl orange that should be added

Correct answer: B

## SE-0012



**Stationary View**



**Rotating View**

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## SG-0004

**Table 1**  
**Thermodynamic Properties of Saturated Steam (Temperature)**

Temp, °F	Absolute Pressure, psi	Enthalpy (BTU/lb) of Liquid	Enthalpy (BTU/lb) of Evaporation	Enthalpy (BTU/lb) of vapor
32	0.08859	0.01	1075.5	1075.5
40	0.12170	8.05	1071.3	1079.3
50	0.17811	18.07	1065.6	1083.7
60	0.25630	28.06	1059.9	1088.0
70	0.36310	38.04	1054.3	1092.3
80	0.50690	43.02	1048.6	1096.6
90	0.69820	57.99	1042.9	1100.9
100	0.94920	67.97	1037.2	1105.2
110	1.27480	77.94	1031.6	1109.5
120	1.69240	87.92	1025.8	1113.7
130	2.22250	97.90	1020.0	1117.9
140	2.88860	107.90	1014.1	1122.0
150	3.71800	117.90	1008.2	1126.1
160	4.74100	127.90	1002.3	1130.2
170	5.99200	137.90	996.3	1134.2
180	7.51000	147.90	990.2	1138.1
190	9.33900	157.90	984.1	1142.0
200	11.52600	168.00	977.9	1145.9
212	14.69600	180.00	970.4	1150.4
220	17.18600	188.10	965.2	1153.4
240	24.96900	208.30	952.2	1160.5
280	49.20300	249.10	924.7	1173.8
300	67.01300	269.60	910.1	1179.7
340	118.01000	311.10	879.0	1190.1
380	195.77000	353.50	844.6	1198.1
400	247.31000	375.00	826.0	1201.0

**Table 2**  
**Thermodynamic Properties of Saturated Steam (Pressure)**

Absolute Pressure, psi	Temp, °F	Enthalpy (BTU/lb) of Liquid	Enthalpy (BTU/lb) of Evaporation	Enthalpy (BTU/lb) of vapor
0.5	79.58	47.6	1048.8	1096.4
1.0	101.74	69.7	1036.3	1106.0
5.0	162.24	130.1	1001.0	1131.1
10.0	193.21	161.2	982.1	1143.3
14.7	212.00	180.0	970.4	1150.4
15.0	213.03	181.1	969.7	1150.8
20.0	227.96	196.2	960.1	1156.3
25.0	240.07	208.5	952.1	1160.6
30.0	250.33	218.8	945.3	1164.1
40.0	267.25	236.0	933.7	1169.7
50.0	281.01	250.1	924.0	1174.1
60.0	292.71	262.1	915.5	1177.6
70.0	302.92	272.6	907.9	1180.6
80.0	312.03	282.0	901.1	1183.1
90.0	320.27	290.6	894.7	1185.3
100.0	327.81	298.4	888.8	1187.2
110.0	334.77	305.7	883.2	1188.9
120.0	341.25	312.4	877.9	1190.4
130.0	347.32	318.8	872.9	1191.7
140.0	353.02	324.8	868.2	1193.0
150.0	358.42	330.5	863.6	1194.1
200.0	381.79	355.4	843.0	1198.4
250.0	400.95	376.0	825.1	1201.1
300.0	417.33	393.8	809.0	1202.8
350.0	431.72	409.7	794.2	1203.9
400.0	444.59	424.0	780.5	1204.5

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