U.S.C.G. Merchant Marine Exam

Third Assistant Engineer

Q538 Steam Plants II

(Sample Examination)
Choose the best answer to the following Multiple Choice Questions.

1. 8 ounces of oxygen, dissolved in 500,000 pounds of water, is a concentration of __________.
   - (A) 1.0 ppm
   - (B) 4.0 ppm
   - (C) 8.0 ppm
   - (D) 16.0 ppm

   *If choice A is selected set score to 1.

2. The most troublesome corrosive substances in boiler water are oxygen and __________.
   - (A) ammonia
   - (B) hydrogen sulfide
   - (C) sulfur dioxide
   - (D) carbon dioxide

   *If choice D is selected set score to 1.

3. The amount of sodium phosphate in treated boiler water can be measured by a/an __________.
   - (A) sodium phosphorous test
   - (B) chloride test
   - (C) alkalinity test
   - (D) phosphate test

   *If choice D is selected set score to 1.

4. When a boiler water test indicates a pH value of 6, you should __________.
   - (A) begin a continuous boiler blowdown
   - (B) chemically treat to lower the pH to normal level
   - (C) chemically treat to raise the pH to normal level
   - (D) check the DC heater for possible malfunction

   *If choice C is selected set score to 1.

5. Boiler water hardness is increased by __________.
   - (A) scale forming salts in the feedwater
   - (B) improper operation of the DC heater
   - (C) zero alkalinity in the water
   - (D) dissolved gases in the water

   *If choice A is selected set score to 1.
6. When the flame scanner senses flame failure during boiler operation, which of the listed events will occur FIRST?

- (A) The automatic purge cycle commences.
- (B) The "trial for ignition" period commences.
- (C) The fuel oil service pump is stopped.
- (D) The fuel oil solenoid valve is de-energized.

*If choice D is selected set score to 1.*

7. In an automatically fired boiler, the steam pressure regulator controls the supply of fuel oil to the burners by responding to variations in the __________.

- (A) steam header pressure
- (B) steam drum water level
- (C) burner flame intensity
- (D) master fuel oil solenoid valve position

*If choice A is selected set score to 1.*

8. Which of the following represents a significant system limitation to be aware of when a burner management system is operated in the "HAND" mode?

- (A) The burner sequence control is fully automatic even in the "HAND" mode.
- (B) The burner is not capable of maintaining a high firing rate when the boiler is in the "HAND" mode.
- (C) The flame failure alarm cannot function when the boiler is "HAND" fired.
- (D) Some boiler safety interlocks are bypassed when the boiler is "HAND" fired.

*If choice D is selected set score to 1.*

9. Modern day boiler automation allows bypassing the "flame safeguard" system to permit a burner to have a "trial for ignition" period during burner light off. This period may not exceed ______.

- (A) 5 seconds
- (B) 10 seconds
- (C) 15 seconds
- (D) 30 seconds

*If choice C is selected set score to 1.*

10. Tenon peening is a technique employed by turbine manufacturers to __________.

- (A) minimize turbine rotor axial thrust
- (B) balance the turbine rotor assembly
- (C) secure shroud bands to turbine blading
- (D) secure turbine blading to the rotor

*If choice C is selected set score to 1.*
11. Why do double flow reaction turbines produce very little axial thrust?
   - (A) Because partially expanded steam is exhausted to the low-pressure turbine where the expansion is completed.
   - (B) Because there is no pressure drop across the blades.
   - (C) Because the axial thrust is developed on the rotor in opposite directions providing counterbalance.
   - (D) Because equalizing holes are provided in the turbine wheels.

*If choice C is selected set score to 1.*

12. Large temperature and pressure drops which occur in the first stage of a combination impulse and reaction turbine are caused by steam passing through __________.
   - (A) a dummy piston and cylinder to offset axial thrust
   - (B) a single row of blades more than once
   - (C) one or more velocity-compounded impulse stages at the high-pressure end of the turbine
   - (D) a nozzle diaphragm in the low-pressure end of the turbine

*If choice C is selected set score to 1.*

13. In a cross-compounded turbine propulsion plant, steam enters the __________.
   - (A) high-pressure unit and then cross-flows to the condenser
   - (B) high-pressure, intermediate and low-pressure units simultaneously
   - (C) high and low-pressure units simultaneously
   - (D) high-pressure unit and then flows through a crossover to the low-pressure unit

*If choice D is selected set score to 1.*

14. As steam first enters the main propulsion turbine, which of the following energy conversions takes place?
   - (A) potential to kinetic
   - (B) mechanical to thermal
   - (C) chemical to thermal
   - (D) thermal to chemical

*If choice A is selected set score to 1.*

15. The purpose of the sentinel valve installed on a turbine casing is to __________.
   - (A) warn the engineer of backflow of steam from the exhaust trunk
   - (B) vent excess steam to the main condenser
   - (C) relieve excess pressure to the turbine extraction points
   - (D) warn the engineer of excessive pressure in the low-pressure turbine casing

*If choice D is selected set score to 1.*
16. When turbine rotor shafts extend through the casing, an external source of sealing steam is used in conjunction with labyrinth packing to __________.

   o (A) seal the casing during periods of high casing pressure
   • (B) seal the casing during periods of low casing pressure
   o (C) maintain the rotor journal temperature
   o (D) provide a constant flow to the gland leakoff condenser

   *If choice B is selected set score to 1.*

17. Which of the devices listed is found on an LP main propulsion steam turbine casing?

   o (A) HP turbine bypass valve
   o (B) Sliding beam
   • (C) Sentinel valve
   o (D) Duplex set of relief valves

   *If choice C is selected set score to 1.*

18. Journal bearings used with modern turbine rotors are manufactured in two halves in order to __________.

   o (A) facilitate interchanging with other bearing halves
   o (B) provide for positive oil flow at all loads
   • (C) permit removal of the bearing without removing the rotor from the turbine
   o (D) maintain axial alignment and reduce thrust

   *If choice C is selected set score to 1.*

19. Which of the following statements is true concerning the turbine shown in the illustration? Illustration SE-0016

   • (A) A steam deflector is provided between the astern element and the ahead stages of the LP turbine.
   o (B) The ahead rotor can be classified as a helical flow, Parsons type turbine.
   o (C) The astern element is of the Curtis type consisting of two three-row stages.
   o (D) The low-pressure turbine is designed with reaction type stages.

   *If choice A is selected set score to 1.*

20. The jacking gear on main propulsion turbines can be used to __________.

   o (A) reduce turbine speed during maneuvering
   o (B) provide propulsion in emergencies
   o (C) lift the reduction gear casing
   • (D) provide reduction gear tooth inspection

   *If choice D is selected set score to 1.*
21. To stop the rotor of a main turbine while underway at sea you should __________.
   - (A) admit astern steam to the turbine after securing the ahead steam
   - (B) tighten the stern tube packing gland
   - (C) secure all steam to the turbine
   - (D) apply the Prony brake

   *If choice A is selected set score to 1.*

22. Operating a steam turbine propulsion unit at medium-speed, in an area with extremely cold sea water and the main circulating pump providing full cooling water flow to the condenser will result in __________.

   - (A) excellent plant efficiency due to higher attainable vacuum
   - (B) increased effectiveness of the air ejectors due to the increased main condenser vacuum
   - (C) increased condensate aeration due to the inability of the air ejectors to remove excessive air accumulation from the condenser
   - (D) increased plant efficiency due to increased condensate depression

   *If choice C is selected set score to 1.*

23. The FIRST step in breaking vacuum on a main turbine unit should be to __________.

   - (A) stop the main condensate pump
   - (B) secure the steam to the gland seal system
   - (C) secure the steam to the main air ejector
   - (D) stop the main circulating pump

   *If choice C is selected set score to 1.*

24. The main propulsion turbine should be operated with the __________.

   - (A) highest practical chest pressure and the minimum number of nozzles required to maintain the desired speed
   - (B) highest practical chest pressure and the maximum number of nozzles possible to maintain the desired speed
   - (C) lowest practical chest pressure and the maximum number of nozzles possible to maintain the desired speed
   - (D) lowest practical chest pressure and the minimum number of nozzles required to maintain the desired speed

   *If choice A is selected set score to 1.*
25. Before placing the jacking gear in operation on a main turbine unit, you must always ensure that
__________.

- (A) the main salt water circulating pump is operating
- (B) the main lube oil system is operating
- (C) the condensate system is operating
- (D) the gland seal steam system is operating

*If choice B is selected set score to 1.*

26. The original bridge gage reading for a reduction gear bearing was measured as 0.008 inches. A year
later, the bridge gage reading for the same bearing is 0.010 inches. This indicates __________.

- (A) bearing wear is 0.010 inch
- (B) oil clearance has increased 0.010 inch
- (C) bearing wear is 0.002 inch
- (D) oil clearance is 0.002 inch

*If choice C is selected set score to 1.*

27. Which of the following statements describes how the main propulsion turbine overspeed relay
initiates closing of the throttle valve?

- (A) Excessive speed causes an oil pump to develop sufficient pressure to open a spring-loaded
  relay valve which tends to close the steam control valve.
- (B) Excessive centrifugal force causes spring loaded flyballs to actuate a control lever.
- (C) Excessive centrifugal force causes a spring-loaded weight to trip a valve latch.
- (D) Excessive speed causes an increase in lube oil control temperature which actuates a
  solenoid oil dump valve.

*If choice A is selected set score to 1.*

28. An excess pressure governor is a special type of control device which would normally be found on a
__________.

- (A) forced draft fan
- (B) main circulator pump
- (C) low-pressure propulsion turbine
- (D) turbine-driven feed pump

*If choice D is selected set score to 1.*
29. Carbon ring packing segments are secured in a shaft gland assembly of a steam turbine by means of __________.

- (A) garter springs
- (B) steam pressure
- (C) labyrinth rings
- (D) centering rings

*If choice A is selected set score to 1.*

30. An auxiliary turbine boiler feed pump should normally be stopped by __________.

- (A) closing the exhaust valve slightly
- (B) increasing the load on the driven unit
- (C) actuating the throttle hand tripping device
- (D) rotating the hand lube oil pump backwards

*If choice C is selected set score to 1.*

31. Which of the following statements represents the significance of the differential pressure existing between the nozzle block and steam chest of a turbo-generator equipped with a lifting beam mechanism?

- (A) The pressure differential eliminates the possibility of valve binding in the lifting beam.
- (B) The pressure differential assists in seating the valves when the lifting beam is lowered.
- (C) The pressure differential requires the installation of a special biasing spring to open the valves.
- (D) The pressure differential necessitates the use of a special balance piston.

*If choice B is selected set score to 1.*

32. Which of the following is used to hold the poppet valves closed in a turbo-generators nozzle control speed regulator?

- (A) Steam pressure
- (B) Springs
- (C) Lifting beam
- (D) Oil pressure

*If choice A is selected set score to 1.*
33. If contaminated lube oil were allowed to settle undisturbed in a tank, into which layers would the contaminants separate?

- (A) Sediment on the bottom, water in the middle, and oil on top.
- (B) Sediment on the bottom, oil in the middle, and water on top.
- (C) Water on the bottom, sediment in the middle, and oil on top.
- (D) Water on the bottom, oil in the middle, and sediment on top.

If choice A is selected set score to 1.

34. To assure the main propulsion turbine bearings are receiving the proper lube oil supply, you should check the __________.

- (A) lube oil temperature at the cooler outlet
- (B) bull's-eye in the gravity tank overflow
- (C) lube oil strainer magnets
- (D) flow through the sight glass at the bearing

If choice D is selected set score to 1.

35. Which of the following types of bearing lubrication schemes can carry the highest unit loading?

- (A) Disk lubricated
- (B) Pressure lubricated
- (C) Ring lubricated
- (D) Oil whip lubricated

If choice B is selected set score to 1.

36. Which of the following conditions is indicated by oil flowing through a lube oil gravity tank overflow sight glass?

- (A) Turbine bearing failure has occurred.
- (B) Sufficient oil flow is being supplied to the gravity tank.
- (C) Excessive oil is stored in the gravity tank.
- (D) Insufficient oil is being pumped to the gravity tank.

If choice B is selected set score to 1.

37. Which of the following statements is true concerning lube oil coolers?

- (A) Magnets are installed in the tube sheets to remove metal particles.
- (B) The temperature of the oil is less than that of the cooling water.
- (C) The pressure of the oil is greater than that of the cooling water.
- (D) The pressure of the oil is less than that of the cooling water.

If choice C is selected set score to 1.
38. Turbine lube oil suction strainer baskets have __________.
   - (A) frame lined with wire cloth
   - (B) coarse perforations
   - (C) fine perforations
   - (D) self-cleaning design

   If choice B is selected set score to 1.

39. In order to obtain the best performance with a lube oil purifier, the lube oil inlet temperature should __________.
   - (A) be maintained in a temperature range of 160°F to a maximum of 180°F
   - (B) be equal to the normal lube oil cooler outlet temperature
   - (C) be equal to main lube oil sump temperature
   - (D) never exceed the highest main engine bearing temperature

   If choice A is selected set score to 1.

40. When water is removed from lube oil passing through a centrifugal purifier, the water removed will __________.
   - (A) displace water from the heavy phase discharge port, but of an amount less than that removed from the oil
   - (B) be retained in the bowl
   - (C) displace an equal amount of water from the bowl seal
   - (D) force the diameter of the oil column within the bowl to be narrowed

   If choice C is selected set score to 1.

41. The disk stack and tubular shaft used in a lube oil centrifugal purifier, is forced to rotate at bowl speed by __________.
   - (A) the drive pin
   - (B) the locating pin
   - (C) the use of an acme thread screw
   - (D) wire springs

   If choice B is selected set score to 1.

42. The rotating speed of the tubular bowl centrifuge is more than twice that of the disk-type. The reason for this is __________.
   - (A) the friction affecting rotation is not as significant with a narrow diameter bowl
   - (B) a narrow diameter bowl is not affected as much by windage losses as a larger diameter bowl
   - (C) the drag bushing is used to permit the higher speed of rotation
   - (D) to produce a nearly equal magnitude of centrifugal force

   If choice D is selected set score to 1.
43. In a gravity lube oil system, a sight glass is installed in a line near the operating platform. This line connects the __________.

- (A) bottom of the gravity tank and the sump
- (B) bottom of the gravity tank and the lube oil headers
- (C) gravity tank overflow and the sump
- (D) gravity tank overflow and the lube oil headers

*If choice C is selected set score to 1.*

44. In a steam turbine and reduction gear main propulsion plant, the alarm sensor for low turbine oil pressure is usually installed __________.

- (A) at a point on the inlet side of the main bearings as close to the bearings as possible
- (B) at the end of the supply line header to the bearings
- (C) at a point on the outlet side of the main bearings as close to the bearings as possible
- (D) at the outlet of the main thrust bearing

*If choice B is selected set score to 1.*

45. While a vessel is underway, which of the conditions listed would indicate a tube leak associated with the sea water-cooled lube oil cooler on service?

- (A) Excessive lube oil consumption.
- (B) Excessive water discharge rate from the lube oil purifier.
- (C) Corrosion of the journals and bearings.
- (D) Contamination of the lube oil.

*If choice A is selected set score to 1.*

46. The maximum lube oil temperature leaving a large, main propulsion steam turbine bearing should __________.

- (A) never exceed the inlet temperature by more than 70°F
- (B) never exceed 170°F
- (C) not exceed the normal lube oil outlet temperature from the centrifugal purifier
- (D) be always maintained at 130°F

*If choice B is selected set score to 1.*

47. Which of the following methods is used to securely fasten the Babbitt lining of a reduction gear bearing to its shell?

- (A) The Babbitt is securely bonded to the shell by the pressure of the hydrodynamic oil wedge.
- (B) The Babbitt has a crescent shaped pocket cast symmetrically about the bearing split.
- (C) The Babbitt is relieved in way of the split and held in place by locking pins.
- (D) The Babbitt is centrifugally spun into the bearings or cast under a pressure head.

*If choice D is selected set score to 1.*
48. What type of bearing is shown in the illustration? Illustration SE-0017

- (A) Tilting pad journal bearing
- (B) Single piece bushing
- (C) Precision insert, split-half thrust bearing
- (D) Precision insert, split-half journal bearing

*If choice D is selected set score to 1.*

49. Axial movement in a gear-type flexible coupling is provided for by __________.

- (A) adjusting the pitch of the teeth on the pinion and high-speed gears
- (B) gear teeth on the floating member sliding between internal teeth on the shaft ring
- (C) the variable oil clearance in the quill shaft
- (D) each gear sliding on its shaft between retaining collars

*If choice B is selected set score to 1.*

50. The component shown in the illustration, labeled "I", is the __________. Illustration SE-0013

- (A) second reduction gear
- (B) first reduction pinion
- (C) second reduction pinion
- (D) first reduction gear

*If choice D is selected set score to 1.*

51. After the housing has been bolted down, the final check of reduction gear tooth contact is usually made by __________.

- (A) bridge gauges
- (B) dial indicators
- (C) alignment gauges
- (D) bluing the teeth

*If choice D is selected set score to 1.*

52. In the thrust bearing assembly illustrated the total oil clearance can be correctly decreased by __________. Illustration SE-0007

- (A) decreasing the thickness of the adjusting ring
- (B) increasing the thickness of the adjusting ring
- (C) increasing the thickness of the filler piece
- (D) decreasing the thickness of the filler piece

*If choice A is selected set score to 1.*
53. Which of the following operational practices is helpful in avoiding the accumulation of condensate in the main reduction gear casing?

- (A) Avoid applying gland sealing steam to the low-pressure turbine until you are ready to start up the first-stage air ejector.
- (B) Always ensure that the lubricating oil pressure is 14-17 psi when operating in unusually cold waters.
- (C) The temperature of the lubricating oil should not exceed the gear manufacturer’s recommendation when the unit is operating at full load.
- (D) After the main unit is secured, lubricating oil should be circulated until the temperature of the oil and reduction gear casing approximates the engine room temperature.

*If choice D is selected set score to 1.*

54. Which of the following would cause the dowel or locking lip of a split-type, precision insert, main bearing to shear and allow the bearing to rotate with the journal?

- (A) Excessive bearing bolt torque
- (B) Unequal torque to any two adjacent bearing bolts
- (C) Short periods of above normal operating speeds
- (D) Insufficient bearing crush

*If choice D is selected set score to 1.*

55. Auxiliary steam at full operating pressure is supplied from the boiler directly to the __________.

- (A) sootblowers
- (B) turbo-generators
- (C) distilling plants
- (D) main air ejectors

*If choice A is selected set score to 1.*

56. As shown in the illustration, live steam is supplied to the gland seal regulator via ________.

Illustration SE-0019

- (A) line "A"
- (B) line "G"
- (C) line "C"
- (D) line "D"

*If choice C is selected set score to 1.*
57. A contaminated steam generator is used to produce saturated vapor from collected __________.

- (A) fuel oil heating return drains
- (B) bilge water
- (C) sanitary water
- (D) condenser cooling water

*If choice A is selected set score to 1.*

58. The intermediate pressure bleed steam system, shown in the illustration, is used to supply steam at approximately __________. Illustration SG-0024

- (A) 13.6 psia
- (B) 13.6 psig
- (C) 35.0 psig
- (D) 67.0 psig

*If choice D is selected set score to 1.*

59. If the water level in one boiler of a two-boiler plant rapidly falls out of sight, which of the following actions should be carried out FIRST?

- (A) Blowdown the gage glass.
- (B) Secure the steam stop to that boiler.
- (C) Raise the feed pump pressure.
- (D) Secure the fuel oil to that boiler.

*If choice D is selected set score to 1.*

60. Which boiler casualty is considered to be the most serious?

- (A) High water level
- (B) Low feed pressure
- (C) Loss of feed suction
- (D) Low water level

*If choice D is selected set score to 1.*

61. Who must supervise the setting of a boiler safety valve?

- (A) Any licensed engineer
- (B) Inspector of the US Coast Guard
- (C) Master
- (D) Chief Engineer

*If choice B is selected set score to 1.*
62. Which of the precautions listed should be taken when gagging a boiler safety valve?

- (A) Ensure that all moving parts of the safety valve are free to move before installing the gag.
- (B) Tighten the gag only finger tight to prevent damage to the valve stem, disc or seat.
- (C) Tighten the gag only with the special wrench supplied with the gag.
- (D) Do not allow the gag to contact the safety valve stem.

If choice B is selected set score to 1.

63. What is the purpose of a rotocap on an auxiliary diesel engine exhaust valve spindle?

- (A) to close the valve
- (B) to increase lube oil penetration to the guide
- (C) to increase valve life
- (D) to keep the valve cool

If choice C is selected set score to 1.

64. When the plunger of an injection pump of an auxiliary diesel engine is stuck, it may cause which of the following conditions?

- (A) injector failure
- (B) excessive fuel consumption
- (C) failure of the cylinder to fire
- (D) engine shutdown

If choice C is selected set score to 1.

65. What may be an indication of white smoke coming from the exhaust of an auxiliary diesel engine?

- (A) worn piston rings
- (B) cracked cylinder liner or head
- (C) not enough air
- (D) late injection timing

If choice B is selected set score to 1.

66. When removing a piston, what is a good indication that your lube oil is good and supplied in the proper amount?

- (A) liners and piston rings have a bright surface and rings are free
- (B) liners and piston rings have a dull grayish appearance and rings are free
- (C) liners and piston rings have a dull grayish appearance and rings are tight
- (D) liners and piston rings show an accumulation of lube oil deposits and rings are tight

If choice A is selected set score to 1.
67. In which four stroke diesel engine system are sacrificial zinc anodes most commonly found?

- (A) fuel system
- (B) exhaust system
- (C) cooling system
- (D) lube oil system

If choice C is selected set score to 1.

68. What may be an indication that you have a leaking injection nozzle?

- (A) low exhaust temperature and high firing pressure
- (B) high exhaust temperature and low firing pressure
- (C) high exhaust temperature and low compression pressure
- (D) low exhaust temperature and high compression pressure

If choice B is selected set score to 1.

69. If an auxiliary diesel engine starts firing but does not come up to normal speed, without load or under a small load, one cause may be __________.

- (A) a clogged fuel filter
- (B) late fuel injection
- (C) incorrect fuel oil
- (D) excessive compression pressure

If choice A is selected set score to 1.

70. When you hear an exhaust gas turbine of an auxiliary diesel engine surge it sounds like it is "barking." What is the likely cause of a turbine "barking?"

- (A) worn bearings
- (B) damaged blades
- (C) insufficient lube oil supply
- (D) a dirty intake air filter

If choice D is selected set score to 1.
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### Nominal System Pressures

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### Device Settings

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