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) carbon dioxide
   - (C) sulfur dioxide
   - (D) hydrogen sulfide

   If choice B is selected set score to 1.

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

   If choice D is selected set score to 1.

4. In the prevention of moisture carryover from a marine boiler, one important consideration is to __________.
   - (A) control the amount of boiler water solids
   - (B) maintain a high boiler water level
   - (C) properly treat the boiler water with hydrazine
   - (D) add foaming agents to the boiler water

   If choice A is selected set score to 1.

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

   If choice D 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 fuel oil solenoid valve is de-energized.
- (C) The fuel oil service pump is stopped.
- (D) The “trial for ignition” period commences.

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

*If choice D 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 is not capable of maintaining a high firing rate when the boiler is in the "HAND" mode.
- (B) The burner sequence control is fully automatic even 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) balance the turbine rotor assembly
- (B) secure turbine blading to the rotor
- (C) secure shroud bands to turbine blading
- (D) minimize turbine rotor axial thrust

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

   If choice B 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) a nozzle diaphragm in the low-pressure end of the turbine
   - (D) one or more velocity-compounded impulse stages at the high-pressure end of the turbine

   If choice D 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 unit and then flows through a crossover to the low-pressure unit
   - (C) high-pressure, intermediate and low-pressure units simultaneously
   - (D) high and low-pressure units simultaneously

   If choice B is selected set score to 1.

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

   If choice C is selected set score to 1.

15. The correct radial clearances between the rotor and the casing in a propulsion turbine are maintained by the turbine __________.
   - (A) journal bearings
   - (B) interstage packing
   - (C) thrust bearing
   - (D) diaphragms

   If choice A is selected set score to 1.
16. For a large main propulsion turbine, the most commonly used turbine thrust bearing is the _________.
   - (A) self-oiling sleeve
   - (B) pivoted segmental shoe
   - (C) overhung turbine wheel
   - (D) self-aligning shell

   If choice B is selected set score to 1.

17. Labyrinth packing rings are installed on turbine diaphragms to minimize _________.
   - (A) interstage steam leakage along the turbine rotor
   - (B) pressure buildup on both sides of the diaphragm
   - (C) air leakage from entering the turbine casing
   - (D) steam from escaping to the atmosphere

   If choice A is selected set score to 1.

18. The astern element of a main propulsion turbine is usually designed as a _________.
   - (A) single entry, double flow turbine
   - (B) Curtis stage, impulse turbine
   - (C) multiple entry, helical flow turbine
   - (D) Parsons stage, reaction turbine

   If choice B is selected set score to 1.

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

   If choice B is selected set score to 1.

20. The jacking gear on main propulsion turbines can be used to _________.
   - (A) provide propulsion in emergencies
   - (B) provide reduction gear tooth inspection
   - (C) reduce turbine speed during maneuvering
   - (D) lift the reduction gear casing

   If choice B 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) apply the Prony brake
  - (D) secure all steam to the turbine

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

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

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

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

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

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

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

*If choice B is selected set score to 1.*
25. Before placing the jacking gear in operation on a main turbine unit, you must always ensure that
   __________.
   o (A) the condensate system is operating
   o (B) the main salt water circulating pump is operating
   • (C) the main lube oil system is operating
   o (D) the gland seal steam system is operating

   If choice C 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 0.002 inch
   o (B) oil clearance has increased 0.010 inch
   o (C) oil clearance is 0.002 inch
   o (D) bearing wear is 0.010 inch

   If choice A 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.
   o (B) Excessive centrifugal force causes a spring loaded weight to trip a valve latch.
   o (C) Excessive speed causes an increase in lube oil control temperature which actuates a
     solenoid oil dump valve.
   o (D) Excessive centrifugal force causes spring loaded flyballs to actuate a control lever.

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

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

   If choice B is selected set score to 1.

30. An auxiliary turbine boiler feed pump should normally be stopped by __________.
   - (A) actuating the throttle hand tripping device
   - (B) rotating the hand lube oil pump backwards
   - (C) increasing the load on the driven unit
   - (D) closing the exhaust valve slightly

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

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

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

*If choice C 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) bull's-eye in the gravity tank overflow
- (B) lube oil strainer magnets
- (C) lube oil temperature at the cooler outlet
- (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) Pressure lubricated
- (B) Oil whip lubricated
- (C) Ring lubricated
- (D) Disk lubricated

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

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

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

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

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

   *If choice D 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 equal to main lube oil sump temperature
   - (B) be maintained in a temperature range of 160°F to a maximum of 180°F
   - (C) never exceed the highest main engine bearing temperature
   - (D) be equal to the normal lube oil cooler outlet temperature

   *If choice B 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 an equal amount of water from the bowl seal
   - (B) be retained in the bowl
   - (C) force the diameter of the oil column within the bowl to be narrowed
   - (D) displace water from the heavy phase discharge port, but of an amount less than that removed from the oil

   *If choice A 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 locating pin
   - (B) wire springs
   - (C) the use of an acme thread screw
   - (D) the drive pin

   *If choice A 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 drag bushing is used to permit the higher speed of rotation
   - (B) to produce a nearly equal magnitude of centrifugal force
   - (C) a narrow diameter bowl is not effected as much by windage losses as a larger diameter bowl
   - (D) the friction affecting rotation is not as significant with a narrow diameter bowl

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

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

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

   If choice B is selected set score to 1.

46. The maximum lube oil temperature leaving a large, main propulsion steam turbine bearing should __________.
   - (A) never exceed 170°F
   - (B) be always maintained at 130°F
   - (C) not exceed the normal lube oil outlet temperature from the centrifugal purifier
   - (D) never exceed the inlet temperature by more than 70°F

   If choice A 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. Most main propulsion reduction gear bearings are __________.

- (A) rigidly mounted, Babbitt lined, split type
- (B) self-lubricating, sealed, roller ball type
- (C) self-aligning, solid bushings
- (D) spherical-seated, tapered roller type

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

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

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

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

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

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

*If choice C 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) alignment gauges
- (B) bluing the teeth
- (C) bridge gauges
- (D) dial indicators

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

52. 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) F and H
- (B) G and J
- (C) F and J
- (D) G and H

*If choice C 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) 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.
- (B) Avoid applying gland sealing steam to the low-pressure turbine until you are ready to start up the first-stage air ejector.
- (C) Always ensure that the lubricating oil pressure is 14-17 psi when operating in unusually cold waters.
- (D) The temperature of the lubricating oil should not exceed the gear manufacturer’s recommendation when the unit is operating at full load.

*If choice A 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) Insufficient bearing crush
- (D) Short periods of above normal operating speeds

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

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

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

*If choice D 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. Which statement is true concerning drain inspection tanks?

- (A) They collect condensate from the cargo tank heating coils only.
- (B) Inspection tanks provide for a visual examination of condensate which could be oil contaminated.
- (C) Inspection tanks collect all HP drains.
- (D) They are discharged to the condensate system just forward of the feed pump.

*If choice B 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. When a boiler flareback occurs, you should __________.

- (A) reduce the forced draft blower speed
- (B) close the master fuel oil valve
- (C) take the boiler off the line
- (D) increase the fuel oil supply pressure

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

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

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

61. 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 with the special wrench supplied with the gag.
- (C) Do not allow the gag to contact the safety valve stem.
- (D) Tighten the gag only finger tight to prevent damage to the valve stem, disc or seat.

*If choice D is selected set score to 1.*
62. Which of the listed operating practices is considered as safe, and should be followed when opening and inspecting the waterside of a boiler?

- (A) Remove handhole plate dogs with a slugging wrench.
- (B) Wire all valves closed that connect to other boilers.
- (C) Ventilate the waterside until completely dry.
- (D) Open the water drum manhole before opening the steam drum manhole.

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

63. In the auxiliary diesel engine, shown in the illustration, the __________. Illustration MO-0006

- (A) explosion relief doors are clearly visible on both sides of the crankcase
- (B) governor is linked to the fuel injection pump by vertical linkage
- (C) engine oil filter is outboard of the electric starter
- (D) camshaft rotates at the same speed as the crankshaft

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

64. The intake and exhaust valves used in a diesel engine are returned to their seats by __________.

- (A) push rod pressure
- (B) exhaust pressure
- (C) spring force
- (D) combustion pressure

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

65. Before any auxiliary diesel engine hydraulic starting system is opened for servicing or repair, you must __________.

- (A) place all control levers in the 'HOLD' position
- (B) ensure that the hydraulic fluid reservoir is full
- (C) block all hydraulic hoses using high-pressure covers
- (D) bleed off all hydraulic pressure from the system

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

66. The service life of a worn aluminum piston for an auxiliary diesel, for which no spares are readily available, can be extended by __________.

- (A) knurling the piston skirt surface
- (B) turning down the piston skirt to concentric values
- (C) increasing the dimensions of the ring land grooves
- (D) building up the piston skirt with a liquid epoxy material and then remachining

*If choice A is selected set score to 1.*
67. Before any auxiliary diesel engine hydraulic starting system is opened for servicing or repair, you must __________.

- (A) ensure that the hydraulic fluid reservoir is full
- (B) place all control levers in the ‘HOLD’ position
- (C) block all hydraulic hoses using high-pressure covers
- (D) bleed off all hydraulic pressure from the system

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

68. A diesel engine could fail to start because of __________.

- (A) floating exhaust valves
- (B) excessive cranking speed
- (C) low exhaust back pressure
- (D) incorrect injection timing

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

69. Excessive vibration in an operating diesel generator may be caused by __________.

- (A) surging at governed RPM
- (B) electrical overload
- (C) coolant leaking into the cylinder
- (D) loose engine mounting bolts

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

70. Worn diesel engine intake valve guides can result in __________.

- (A) excessive lube oil consumption
- (B) increased engine breathing efficiency
- (C) excessive valve lash
- (D) lower than normal fuel consumption

*If choice A is selected set score to 1.*
SE-0012

Stationary View

Rotating View

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Nominal System Pressures

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Device Settings

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