Keep 'em Safe, Keep 'em Sailing



U.S.C.G. Merchant Marine Exam First Assistant Engineer Q514 Motor Plants (Sample Examination)

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

- 1. As an engineer of a slow-speed diesel powered vessel, you note that the indicator card diagrams have a flat horizontal profile around TDC. To rectify this, what would be your best course of action?
 - A. Use a spring with a lower spring constant (k value) in the indicator.
 - B. Increase the RPM at which the readings are taken.
 - C. Use a spring with a higher spring constant (k value) in the indicator.
 - D. Reduce the RPM at which the readings are taken.

Correct answer: C

- 2. When analyzing indicator card diagrams you are calculating the work output from the cylinder by obtaining the area within the curve of what type of diagram?
 - A. pressure/temperature
 - B. temperature/entropy
 - C. pressure/volume
 - D. pressure/enthalpy

Correct answer: C

- 3. What will cause valve stem blow-by to the valve section shown in the O? Illustration MO-0030 Engine Illustration MO-0030
 - A. A cracked lower spring plate
 - B. Worn, broken or stuck compression rings
 - C. Damaged rubber rings on the valve seat insert
 - D. Defective rubber seal rings in the valve guides

Correct answer: D

- 4. If there is a 'clicking' sound in the valve compartment of a diesel engine, the cause may be
 - A. excessive valve lash
 - B. worn connecting rod bearings
 - C. a worn wrist pin
 - D. all of the above

Correct answer: A

- 5. Bouncing of the valve gear in a diesel engine can be caused by _____.
 - A. prolonged high-speed operation
 - B. spring surge
 - C. worn valve seats
 - D. excessively tightened spring retainers

- 6. Worn main bearings will cause the compression ratio of a diesel engine to ______.
 - A. increase
 - B. decrease
 - C. increase on compression; decrease on expansion
 - D. remain the same

Correct answer: B

- 7. The most practical way of detecting an overload in one cylinder of an operating large, low-speed, main propulsion diesel engine is to _____.
 - A. check the cylinder exhaust temperature frequently
 - B. check the cylinder exhausts for black smoke
 - C. isolate each cylinder and inspect the injector
 - D. listen for combustion knock in that cylinder

Correct answer: A

- 8. Which of the following procedures should be carried out to permit the continued operation of a crosshead engine with a leaky aftercooler?
 - A. Switch to diesel fuel and run at reduced speed.
 - B. Nothing needs to be done due to the low heating value of heavy fuel.
 - C. Blank off the cooling water lines and run at reduced speed.
 - D. Bypass the aftercooler to operate at sea speed.

Correct answer: C

- 9. A main propulsion diesel engine crankshaft bearing lacking sufficient 'crush', will ______.
 - A. tend to rotate with the journal
 - B. be lubricated more easily than with sufficient crush
 - C. pound under load
 - D. have a thicker layer of babbitt

Correct answer: A

- 10. In an auxiliary diesel engine, one reason for knurling the piston skirt is to ______.
 - A. allow for heat expansion
 - B. transmit forces evenly
 - C. improve the piston seal
 - D. improve skirt lubrication

- 11. One remedy for a high firing pressure, in addition to a high exhaust temperature in one cylinder of a diesel engine, is to _____.
 - A. adjust the fuel rack
 - B. increase scavenge air pressure
 - C. reduce fuel booster pump pressure
 - D. retard fuel injector timing

Correct answer: A

- 12. High exhaust temperature and black smoke exhausting from an auxiliary diesel engine can be caused by _____.
 - A. low combustion temperature
 - B. engine overload
 - C. plugged fuel nozzle holes
 - D. excessive compression pressure

Correct answer: B

- 13. The item labeled "T" as shown in figure 4 of the illustration is identified as the ______. Illustration MO-0025
 - A. Exhaust manifold
 - B. Aftercooler
 - C. Scavenge manifold
 - D. Exhaust gas turbine

Correct answer: A

- 14. Telescopic pipes which are attached to water cooled pistons of large, slow-speed, main propulsion diesel engines are designed to _____.
 - A. overcome excessive crankcase pressure
 - B. prevent excessive lube oil temperature
 - C. allow piston cooling water to efficiently enter the piston despite its reciprocating piston motion without contaminating the engine lube oil
 - D. prevent contamination of the cylinder cooling water with engine lube oil

Correct answer: C

- 15. In what figure of the illustration does the crosshead experience the greatest side thrust? Illustration MO-0025
 - A. Figure 1
 - B. Figure 2
 - C. Figure 5
 - D. Figure 6

- 16. The lower end of the piston rod, shown in the illustration, is fitted into the ______. Illustration MO-0003
 - A. crosshead
 - B. crank pin
 - C. piston pin
 - D. crosshead guide

Correct answer: A

- 17. According to the illustration, which of the following is true? Illustration MO-0067
 - A. The piston has a replaceable crown.
 - B. The piston has one oil scraper ring.
 - C. The piston has five compression rings.
 - D. All of the above.

Correct answer: A

- 18. The diesel engine shown in the illustration utilizes the type of cylinder construction identified as ______. Illustration MO-0007
 - A. a wet liner
 - B. a dry liner
 - C. integral with a removable sleeve
 - D. integral with a non-removable sleeve

Correct answer: A

- 19. Which construction detail is apparent in the connecting rod and piston assembly shown in the illustration? Illustration MO-0011
 - A. The piston is designed with a heat dam.
 - B. It is a fork assembly.
 - C. The piston is water cooled.
 - D. The wrist pin is free floating.

Correct answer: A

- 20. Piston cooling fins are located _____.
 - A. on top of the piston crown
 - B. underneath the piston crown
 - C. at the base of the piston skirt
 - D. inside the cylinder liner cooling water jacket

Correct answer: B

- 21. A 'Blotter test' is a test performed on the lube oil of a diesel engine which can determine _____.
 - A. the TBN number of the oil
 - B. a change in the oil's viscosity
 - C. the specific gravity of the oil
 - D. the flash point of the oil

- 22. While underway, a slow-speed diesel engine lube oil sump level slowly begins to decrease. Which of the following should be checked?
 - A. The tank heating coils to ensure they are secured.
 - B. The lubricating oil cooler for leakage into the cooling system.
 - C. The piston oil scraper rings for excessive wear.
 - D. The standby lube oil pump to ensure it is not operating.

Correct answer: B

- 23. Crankcase explosions in propulsion diesel engines result from ______.
 - A. the splashing of lubrication oil by the crankshaft
 - B. the dilution of crankcase oil with particles of combustion
 - C. broken fuel lines spraying oil on the crankcase
 - D. the ignition of unburned fuel and air in the crankcase

Correct answer: D

- 24. The pressure in an operating diesel engine cylinder continues to rise for a short period after the piston passes top dead center as a result of the ______.
 - A. exhaust and intake valves just closing
 - B. maximum compression pressure is just being attained
 - C. expansion during the combustion process
 - D. fuel injection occurring at that point and combustion begins

Correct answer: C

- 25. Which statement about diesel engine combustion is true?
 - A. Maximum combustion pressure is reached before TDC.
 - B. Maximum cylinder firing pressure is not developed until the piston passes TDC.
 - C. Combustion does not begin until the piston starts down on the power stroke.
 - D. Turbulence in the cylinder causes a delay in ignition.

Correct answer: B

- 26. Heavy fuel oils generally have an upper average ash content of 0.1% by weight. Which of the following conditions could be expected if the ash content increases above this amount?
 - A. Increased MEP
 - B. Excessive bearing wear
 - C. Increased exhaust valve wear
 - D. Glazing of the cylinder liners

- 27. How may water be removed from the bowl of the separator as shown in the illustration? Illustration MO-0127
 - A. The water may be removed through the water drain valve or through the sludge ports during the sludge discharge cycle.
 - B. Water may only be removed from the bowl when the unit is secured and the bowl hood is removed.
 - C. The separator is used to remove solids from the processed liquid; therefore, the accumulation of water does not present a problem.
 - D. When the unit is secured and the bowl stops rotating, the water is drained off the bottom of the bowl through orifice ports.

Correct answer: A

- 28. What is one of the most significant factors to consider when calculating the amount of time required to change over to low Sulphur fuel on a slow-speed diesel main engine?
 - A. The capacity of the fuel oil transfer pump.
 - B. The load on the engine.
 - C. The distance to the demarcation line.
 - D. The difference in density of the two fuels.

Correct answer: B

- 29. When changing over from residual to distillate fuel on a slow-speed diesel propelled vessel, you should limit the rate of temperature change of the fuel in order to prevent what operational difficulty?
 - A. Dezincification of the fuel in the mixing tank.
 - B. Surging/hunting of the governor due to rack sticking.
 - C. Seizing and scuffing of fuel pump plungers and injector needle valves due to thermal effects on close clearance components.
 - D. Carbonization in the fuel heater.

Correct answer: C

- 30. When tightening the lock ring "G" of the device shown in the illustration, two events are simultaneously accomplished. Which of the following statements represents these events? Illustration MO-0112
 - A. The lock ring ensures proper positioning of the disc stack and maintains a positive contact of the bowl top and bowl bottom.
 - B. The lock ring forces the disc stack onto the spindle, providing a positive means of rotation and locating the bowl top to seal the separation chamber.
 - C. The lock ring ensures proper contact between the bowl top and the sliding bowl bottom, in addition to compressing the disc stack.
 - D. When tightened, the lock ring allows for movement of the sliding piston and positions the sliding piston within the bowl bottom.

- 31. From the graph shown in the illustration, determine the size of the regulating ring required for the proper operation of the fuel oil centrifuge if the fuel oil specific gravity is 0.9 kg/dm3 at 68°F, and the separating temperature is 158°F. Illustration MO-0113
 - A. 86 mm
 - B. 104 mm
 - C. 110 mm
 - D. 117 mm

Correct answer: C

- 32. As Chief Engineer of a slow-speed diesel engine vessel equipped with an ALCAP fuel oil purification system. You note a definite increase in the rate at which the purifier sludge tank is rising. One of the first items to check on your system would be which of the following?
 - A. The water transducer located in the dirty oil supply line.
 - B. The RPM of the bowl.
 - C. The voltage to the EPC control cabinet.
 - D. The opening water solenoid for leak through.

Correct answer: D

- 33. Which of the following statements describes what will occur if the annular spaces, indicated by the letter "K" of the device shown in the illustration, became restricted? Illustration MO-0112
 - A. The bowl will fail to close when starting and the unit will not shoot when operating.
 - B. Operating water will be supplied through port "S".
 - C. The bowl will fail to close, but the unit will be capable of shooting while in operation.
 - D. The unit will not start due to pressure/time delay relays.

Correct answer: A

- 34. While operating the fuel oil centrifuge shown in the illustration, the fuel oil is being continuously ejected with the sludge and the seal water. The probable cause is the ______. Illustration MO-0012
 - A. gravity disk inside diameter is too small
 - B. back pressure is too low
 - C. gravity disk inside diameter is too large
 - D. incorrect number of disks have been placed in the disk stack

Correct answer: C

- 35. While operating the fuel oil centrifuge shown in the illustration, the bowl fails to open for sludge ejection. The probable cause is that ______. Illustration MO-0012
 - A. the bowl disk set is clogged
 - B. one or more of the sludge ports is partially clogged
 - C. the seal ring on the operating slide is defective
 - D. the operating water pressure is too high

- 36. The item labeled #16 in the illustration is a stack of spring washers. Their function is to ______. Illustration MO-0062
 - A. absorb the high-pressure pulses developed during the fuel injection process
 - B. prevent bolt failure by allowing limited movement of the injector when excessively high cylinder pressures are developed
 - C. maintain the same hold-down force on the injector regardless of varying engine operating temperatures
 - D. permit accurate stretch gauge measurement of bolt elongation during installation

Correct answer: C

- 37. Regarding the fuel injector shown in the illustration, the purpose of piece #38 is to ______. Illustration MO-0059
 - A. adjust the fuel rack spring tension
 - B. maintain fuel pressure at a preset level
 - C. filter the fuel
 - D. relieve excess fuel pressure to the suction side of the pump

Correct answer: C

- 38. In the large slow-speed main propulsion diesel engine shown in the illustration, the part labeled "G" is the ______. Illustration MO-0003
 - A. crankcase exhaust fan
 - B. fuel oil pump
 - C. jacket water pump
 - D. lube oil pump

Correct answer: B

- 39. Which of the fuel nozzles listed requires the LEAST maintenance?
 - A. Pintle
 - B. Single hole
 - C. Open
 - D. Multi-hole

Correct answer: A

- 40. You are testing a closed fuel injection nozzle using a nozzle tester. A pressure slightly less than design valve opening pressure is applied. If no fuel appears at the spray tip, the
 - A. nozzle orifices are too small
 - B. needle valve spring is defective
 - C. nozzle orifices are eroded
 - D. needle valve is operating properly

Correct answer: D

- 41. Injection lag in a diesel engine may be caused by _____.
 - A. a decrease in compression pressure
 - B. a decrease in the air temperature
 - C. the flexibility of high-pressure fuel lines
 - D. a change in the cetane number of the fuel

- 42. While examining a used fuel injection nozzle(s), one finds worn and enlarged orifices. What does this indicate about that cylinder's performance prior to nozzle replacement(s)?
 - A. Volume of fuel injected is increased, reduced injection pressure, decreased ignition delay.
 - B. Volume of atomization is increased, penetration is reduced, vaporization is increased, and efficiency is not affected.
 - C. Penetration is increased, air/fuel mixture is increased, and cylinder efficiency is not substantially affected.
 - D. Reduced combustion efficiency, increased ignition delay, reduced atomization, and prolonged penetration.

Correct answer: D

- 43. Poor combustion in a diesel engine can be caused by _____.
 - A. low compression temperature
 - B. high scavenge air pressure
 - C. low exhaust pressure
 - D. high compression pressure

Correct answer: A

- 44. Which of the following statements describes the function of the device labeled "C" shown in the illustration? Illustration MO-0115
 - A. Constant pressure is maintained at device "B" while device "C" is used only to modify the output signal.
 - B. The regulator, or pressure reducer, drops the supply pressure to the desired operating level.
 - C. The regulator reduces the pressure of the supply air to provide ancillary main engine services.
 - D. The device is a relief valve with feedback to prevent excessive pressure from damaging system components.

Correct answer: B

- 45. The pneumatic circuit shown in the illustration is part of a complex large low-speed engine control system. Which of the following statements describes the function of this circuit? Illustration MO-0117
 - A. Valve D, when depressed, allows the retained pneumatic pressure within the shutdown servomotor to be relieved.
 - B. The circuit shown is used to shift the camshaft position when reversing the engine.
 - C. The piston labeled A provides a low-pressure signal to the other components illustrated.
 - D. When oil pressure to valve C is diminished, a pressure decrease is developed at valve D, causing it to shift, and nullifying the actuating signal to device A.

Correct answer: A

- 46. Which of the following statements describes the primary reason for the device shown in the illustration to be incorporated into the air start system? Illustration MO-0116
 - A. The shuttle valve compensates for any decrease in the operator's physical abilities.
 - B. The three-position valve prevents the fuel flow from reaching the fuel injection pumps.
 - C. The unit shown is used to prevent starting of the main engine when the turning gear is engaged.
 - D. This unit controls the air operated turning motor exhaust when the unit is in operation.

- 47. Clearance volume scavenging in a turbocharged, four-stroke cycle diesel engine is accomplished
 - A. without cooling the cylinders or pistons
 - B. with only the exhaust valve open
 - C. at a pressure below atmospheric
 - D. during the valve overlap period

Correct answer: D

48. Air scavenging of the cylinder shown in the illustration begins between figures ______. Illustration MO-0025

- A. 2 and 3
- B. 3 and 4
- C. 4 and 5
- D. 5 and 6

Correct answer: B

- 49. Which condition indicates the air side fouling of an aftercooler on a turbocharged diesel engine?
 - A. Excessive condensate forming in the air box.
 - B. A decrease in the air pressure differential across the cooler.
 - C. A decrease in the air temperature differential between the cooler inlet and outlet.
 - D. An increased air temperature differential between the cooler inlet and outlet.

Correct answer: C

- 50. The overspeed trip installed on most diesel engines will stop the engine by shutting off the
 - A. lube oil supply
 - B. fuel and/or air supply
 - C. exhaust damper
 - D. water supply

Correct answer: B

- 51. A propulsion engine, using the speed control circuit shown in the illustration, fails to function at speeds lower than the low end of the critical speed range. Which of the following statements describes what should be done to correct this malfunction? Illustration MO-0114
 - A. To increase the critical speed range of the engine, reduce the setpoint of 17A and 17B respectively, to 0.80 bar and 1.0 bar.
 - B. Device 17A needs to be replaced, repaired, or reset to the setpoint coinciding with the RPM value for the low end of the critical speed range.
 - C. The critical speed range will be varied as the setpoints of 17A or 17B are reset, therefore, another segment of the speed control circuit must be repaired.
 - D. Both 17A and 17B need to be reset to decrease the critical speed range, although this procedure will increase the operating range of the engine.

- 52. The purpose of the compensating adjustment used in a diesel engine hydraulic governor is to
 - A. increase governor promptness
 - B. compensate for low oil level
 - C. prevent governor hunting
 - D. limit engine load

Correct answer: C

- 53. The direct acting mechanical governor used with some small diesel engines, controls fuel flow to the engine by _____.
 - A. positioning a butterfly valve in the fuel delivery system
 - B. governor flyweight action on a pilot valve which controls fuel injection
 - C. governor flyweight motion acting on fuel controls through suitable linkage
 - D. positioning a servomotor piston attached to the fuel controls

Correct answer: C

- 54. Increasing the oil pressure acting on the power piston of the hydraulic governor shown in the illustration will . Illustration MO-0092
 - A. decrease the speed droop
 - B. require the overspeed trip setting to be adjusted
 - C. increase the governor output power
 - D. increase the speed droop

Correct answer: C

- 55. A diesel-generator governor is hunting. After changing the oil, the governor is flushed and the compensation needle valve is adjusted, but the hunting persists. You should NOW ______.
 - A. check air intake manifold pressure
 - B. carefully check for binding in the governor linkage
 - C. set the speed droop adjustment to zero
 - D. calibrate the fuel pump rack settings

Correct answer: B

- 56. Adjustments to the compensating needle valve in a hydraulic governor should be made with the engine at ______.
 - A. half-speed and normal temperature
 - B. maximum power at a normal load
 - C. normal operating temperature without a load
 - D. maximum power and load under normal conditions

Correct answer: C

- 57. If the speeder spring of a main propulsion diesel engine governor breaks while operating at full load, the engine RPM will _____.
 - A. decrease to a slightly lower value
 - B. increase until the overspeed trip is actuated
 - C. remain the same until manually changed
 - D. hunt until stabilized by the droop rod

58. The boiler shown in the illustration would be classed as ______. Illustration MO-0064

- A. two-pass, scotch marine
- B. two-pass, water-tube
- C. single-pass, fire-tube, scotch marine
- D. forced circulation, coil-type

Correct answer: C

- 59. When preparing to light off a cold boiler equipped with a return flow fuel oil system, the recirculating valve directs the flow of oil ______.
 - A. directly to the fuel oil heater inlet for further warm-up
 - B. directly to the deep tanks
 - C. back to the suction side of the service pump
 - D. back to the fuel oil settler for further filtration

Correct answer: C

- 60. In the water level electrode assembly, shown in the illustration, the feed pump should restart when the level of the water reaches the position indicated by arrow '____'. Illustration MO-0047
 - A. E
 - В. В
 - C. C
 - D. D

Correct answer: C

61. In general, diesel engine waste heat boiler construction is usually of the _____.

- A. water-tube type
- B. critical circulation boiler type
- C. dry back boiler type
- D. cyclone furnace boiler type

Correct answer: A

- 62. With which of the following types of diesel engine arrangements is a waste heat boiler most likely to produce the maximum steam pressure, temperature, and flow conditions?
 - A. Supercharged, four-stroke cycle diesel engine
 - B. Supercharged, loop scavenged diesel engine
 - C. Turbocharged, cross flow scavenged diesel engine
 - D. Turbocharged, return flow diesel engine

Correct answer: A

- 63. The primary function of a flame safeguard system, as used on an automatically fired auxiliary boiler, is to prevent ______.
 - A. accidental dry firing and overpressure
 - B. uncontrolled fires in the furnace
 - C. explosions in the boiler furnace
 - D. overheating of the pressure parts

64. The pressuretrol which is installed on an auxiliary boiler senses steam pressure changes and

- A. controls the flow of feedwater to the boiler
- B. monitors the boiler high water level
- C. secures the fires when a fusible plug burns out
- D. automatically regulates the quantity of oil and air flow to the burner

Correct answer: D

65. 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

- 66. A burner producing black smoke in an automatic auxiliary boiler, would be caused by a/an
 - A. incorrect electrode setting
 - B. defective solenoid valve
 - C. grounded high tension lead
 - D. incorrect primary air setting

Correct answer: D

67. Burner ignition failure in an automatically fired auxiliary boiler would be caused by ______.

- A. a burned-out solenoid in the oil supply valve
- B. high temperature excess air
- C. incorrectly setting the hotwell dump valve
- D. an incorrectly positioned burner snubber relay

Correct answer: A

- 68. Which of the following oil mist to air ratios would most likely lead to the most severe crankcase explosion?
 - A. 2-3% by volume
 - B. 5-7% by volume
 - C. 9-10% by volume
 - D. 12-15% by volume

Correct answer: B

- 69. Oil in a scavenging air space on a slow-speed diesel engine can be ignited by which of the following?
 - A. Hot main bearing
 - B. Burned exhaust valve seat
 - C. Early fuel injection
 - D. Excessive piston ring blow-by

- 70. In accordance with 46 CFR Subchapter J, which of the listed starting aids is acceptable for use with the emergency diesel-generator?
 - A. Injection of ether into the air intake
 - B. Thermostatically controlled electric water jacket heater
 - C. Thermostatically controlled electric oil sump heater
 - D. Heating the starting battery

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MO-0003



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MO-0007



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MO-0011



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MO-0025



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MO-0030



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MO-0047



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MO-0059



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MO-0062



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MO-0064



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MO-0067



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MO-0092



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MO-0112



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MO-0115



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MO-0116



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MO-0117



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MO-0127



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