

ENGINEERING KNOWLEDGE - MOTOR

Attempt SIX questions only

Marks for each part question are shown in brackets

1. (a) Explain why an engine may fail to start on air when the start air receiver is fully charged and the air receiver outlet to the engine is open. (10)
- (b) Describe how problems with air starting systems may be avoided. (6)
2. (a) Describe, with the aid of a sketch, the lubrication systems of a crosshead type diesel engine. (8)
- (b) Explain the properties required by the lubricating oil in each of the systems described in part (a), stating how these properties compare with those of a lubricating oil used in the crankcase of a trunk piston type diesel engine. (8)
3. (a) Describe, with the aid of a sketch, the exhaust gas and charge air flow system through an engine cylinder and turbocharger of a two-stroke engine, indicating the cooling and water separation systems. (6)
- (b) Describe how a water separator removes water droplets from a charge air flow. (4)
- (c) Explain the possible consequences of not removing water droplets from engine charge air and draining the water separator unit. (6)
4. Write a report to the engineering superintendent regarding the failure of a main crosshead engine fuel pump cam and follower where the damage was so severe that the normal pump lifting equipment could not be immediately fitted. The report must explain how the defect was detected, the immediate action taken, the rectifying action taken to ensure that the engine could be operated and the checks made on the engine before restarting. (16)
5. With reference to diesel engine hybrid SO_x scrubber systems:
- (a) state the fluids used in the open and closed loops of the scrubber, explaining how these fluids are controlled to meet the scrubbing demand at different engine loads; (6)
- (b) state the circumstances under which *Open Loop scrubbing* would be used and *Closed Loop scrubbing* would be used; (2)
- (c) describe how the effective SO_x neutralising effect of the fluid used in the closed loop system is maintained during long operating periods and how pollution of the sea is avoided. (8)

6. (a) Explain, with the aid of a sketch, Thermal Stress, stating how thermal stress is induced in the cylinder liner when the engine is operating. (8)
- (b) Explain why thermal stress may be damaging to an engine cylinder. (4)
- (c) Explain how thermal stress may be avoided in an operating engine without reducing engine power output. (4)
7. (a) Explain how the build up of residue in the scavenge space of a large slow speed two stroke engine is minimised by design, operation and maintenance. (10)
- (b) Explain the possible damage which could be caused by a scavenge fire. (6)
8. (a) Explain why *Pilot Injection* is required for a dual fuel engine when burning natural gas. (2)
- (b) Describe, with the aid of a sketch, the arrangements for a dual fuel engine which is capable of burning natural gas on:
- (i) the Otto cycle; (7)
- (ii) the Diesel cycle. (7)
9. (a) Explain why highly efficient diesel engines tend to produce more NO_x than low performance diesel engines. (4)
- (b) Describe, with the aid of a sketch, a Selective Catalytic Reduction (SCR) unit for a marine propulsion diesel engine. (8)
- (c) Explain why accurate monitoring of the exhaust gas flows entering and leaving a Selective Catalytic Reduction unit are required and how these readings are used to control the reduction chemical supplied to the SCR unit. (4)