

## APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each part question are shown in brackets

1. With reference to austenitic stainless steels:
  - (a) list the THREE main constituents with approximate percentage composition; (3)
  - (b) state the main difference between grades 304 & 316 and how this is achieved; (3)
  - (c) list TWO typical applications for EACH grade stated in part (b) that would be found on a modern vessel. (4)
  
2. With reference to carbon fibre:
  - (a) describe how the base raw material is turned into a useable carbon fibre; (2)
  - (b) describe how the fibres produced in part (a) are turned into a usable product; (2)
  - (c) explain how its internal structure gives it its unique strength properties; (2)
  - (d) list FOUR properties of carbon fibre that make it desirable for marine fabrication. (4)
  
3.
  - (a) Describe how a Brinell hardness test is carried out. (3)
  - (b) With reference to a ball race bearing, explain EACH of the following terms:
    - (i) brinelling; (2)
    - (ii) false brinelling. (2)
  - (c) Explain how false brinelling can be reduced in practice. (3)
  
4. With reference to joining a steel hull to an aluminium superstructure:
  - (a) explain, with the aid of a sketch, the process of *explosion welding*; (6)
  - (b) explain why this joint is superior to an insulated bolt joint. (4)
  
5. With reference to marine corrosion:
  - (a) list EIGHT factors that influence the rate of corrosion for an unprotected metal surface; (4)
  - (b) explain the process of galvanic corrosion; (4)
  - (c) state TWO major factors influencing the severity of galvanic corrosion. (2)

6. With reference to glass reinforced plastic (GRP) hulls:
- (a) state THREE causes for EACH of the following defects to occur:
    - (i) de-lamination; (3)
    - (ii) osmotic blisters; (3)
    - (iii) stress cracking; (3)
  - (b) state the part of the underwater section of the hull on which osmotic blisters most commonly occur. (1)
7. (a) Describe, with the aid of a sketch, how a Bourdon Tube can be utilised to measure temperature. (8)
- (b) State a typical application and location for this type of device. (2)
8. (a) Describe with the aid of a sketch, how Bi-metallic strips are utilised to measure temperature. (8)
- (b) State a typical application for this type of device and its main shortcoming. (2)
9. With reference to engine governors, explain EACH of the following terms:
- (a) sensitivity; (2)
  - (b) hunting; (2)
  - (c) speed droop; (2)
  - (d) stability; (2)
  - (e) isochronous governing. (2)
10. (a) State the reasons for fitting a pneumatic process valve with EACH of the following:
- (i) a volume booster; (2)
  - (ii) a feedback positioner. (2)
- (b) State, with reasons, the type of actuator fitted to the process valves for EACH of the following systems:
- (i) a fuel supply system in which the valve must not move on loss of power to the control system; (3)
  - (ii) a lubrication oil cooling system in which the valve diverts the oil through a cooler. (3)