

**APPLIED MARINE ENGINEERING**

Attempt ALL questions

Marks for each part question are shown in brackets

1. Detail the changes in the properties of steel by the addition of EACH of the following elements:
  - (a) nickel; (2)
  - (b) chromium; (2)
  - (c) molybdenum; (2)
  - (d) silicon; (2)
  - (e) manganese. (2)
  
2. (a) List FIVE different desirable properties of aluminium. (5)  
(b) In modern vessels identify parts that utilises EACH of the properties listed in part (a). (5)
  
3. With reference to the heat treatment of steel:
  - (a) explain which steels this process is best suited to; (2)
  - (b) explain EACH of the following processes, making reference to mechanical properties and internal structure:
    - (i) hardening; (4)
    - (ii) tempering. (4)
  
4. Describe, with the aid of load extension graphs, EACH of the following engineering terms:
  - (a) limit of proportionality; (2)
  - (b) yield point; (2)
  - (c) Ultimate Tensile Strength; (2)
  - (d) 0.1% Proof Stress. (4)
  
5. (a) Explain the process of *brazing* for the joining of metals and alloys. (4)  
(b) State TWO methods by which a cracked aluminium alloy pump casting might be repaired. (2)  
(c) List the FOUR functions that the flux performs in the brazing process. (4)

6. With reference to the protection of aluminium from corrosion: (4)
- explain the naturally occurring process and its limitations; (6)
  - explain the process of anodising, stating its advantages. (6)
7. With reference to glass reinforced plastic (GRP) hulls:
- state THREE causes for EACH of the following defects to occur:
    - de-lamination; (3)
    - osmotic blisters; (3)
    - stress cracking; (3)
  - state the part of the underwater section of the hull on which osmotic blisters most commonly occur. (1)
8. With reference to the flowrate measuring device shown in the figure, describe the principle of operation, explaining how an analogue remote reading may be obtained. (10)

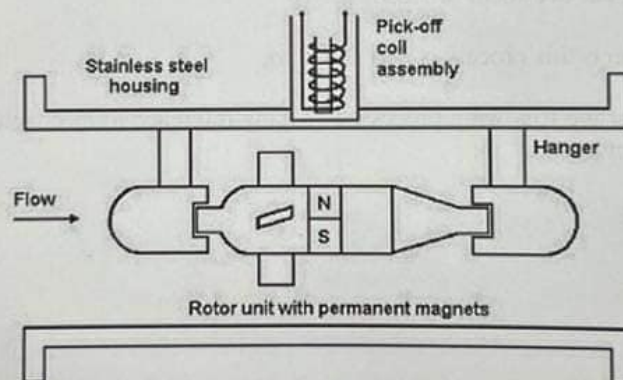


Fig Q8

9. With reference to *Discontinuous* or *On Off* control systems:
- sketch the response of a basic heater control, showing temperature against time and labelling the key points; (4)
  - state THREE methods of improving the accuracy/speed of response. (6)
10. With reference to a main engine lubricating oil system, explain, with the aid of a sketch, the principle of a *closed loop* temperature control system. (10)