

Dec 1996

GENERAL ENGINEERING SCIENCE II

Attempt ALL questions

Marks for each part question are shown in brackets

1. (a) State the only condition necessary for the transfer of heat energy. (2)
- (b) Outline the mechanisms of heat transfer by:
- (i) conduction; (3)
- (ii) convection. (3)
2. A steel component having a specific heat capacity of 0.45kJ/kgK and a mass of 10 kg is cooled from a temperature of 430°C to 160°C by immersion in a tank of oil with an initial temperature of 20°C and of specific heat capacity 2.0kJ/kgK .
- Calculate the mass of oil in the tank. (8)
3. (a) State *Charles' Law* for a perfect gas. (3)
- (b) During a constant pressure process, gas at a pressure of 1.032 bar and temperature of -20°C has its temperature increased to 0°C . The initial volume of the gas is 0.03 m^3 . The characteristic gas constant for this gas is 255J/kgK .
- Calculate:
- (i) the mass of the gas; (3)
- (ii) the final volume of the gas. (3)
4. (a) State the meaning of the term *combustion*. (2)
- (b) A mass of 1.5 kg of Carbon is completely burnt to carbon dioxide with 30 percent air in excess of stoichiometric requirements.
- Calculate the mass of air supplied. (8)
- Note: Air contains 23% oxygen by mass.*
Atomic numbers: Carbon = 12; oxygen = 16.

5. The following test results were obtained from a single-acting, two-stroke single cylinder engine:

Indicator diagram:

mean height of the indicator card = 10.5 mm.

Spring scale = 50kN/m²/mm

Engine:

bore = 200 mm

stroke = 200 mm

speed = 200rev/min.

Calculate:

(a) the mean effective pressure; (4)

(b) the indicated power. (4)

6. (a) Sketch and label a simple refrigeration cycle diagram. (2)

(b) Explain the condition of the refrigerant as it passes through EACH stage of the cycle in Q.6(a). (8)

7. (a) Sketch and label the basic atomic structure of an atom. (4)

(b) With reference to the atomic structure of a conductor, explain electric current flow. (6)

8. (a) State THREE effects of an electric current. (3)

(b) List ONE practical application for each of the THREE effects stated in Q.8(a). (3)

9. An aluminium conductor 1000 m long is to carry a current of 300 A, the voltage drop between its ends being 30V.

Calculate the diameter of the conductor. (8)

Note: the resistivity of aluminium is 28.3 $\mu\Omega$ mm.

10. For the circuit in Fig. Q.10 calculate:

(a) the total supply current (I);

(4)

(b) the current through each resistor.

(4)

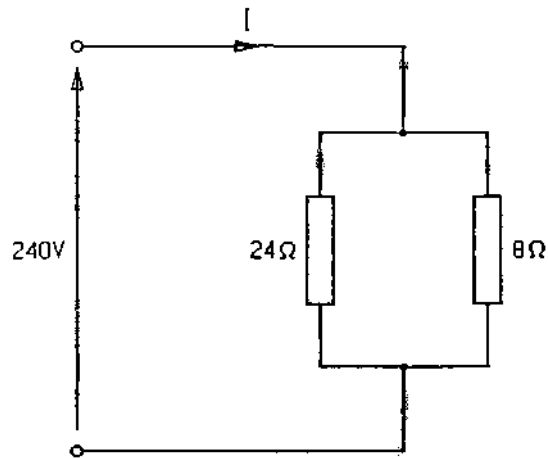


Fig. Q.10

11. (a) Sketch and label the component parts of a moving coil instrument.

(6)

(b) Describe the action of the instrument sketched in Q. 11(a).

(3)

12. Distinguish between the terms *electromotive force* and *potential difference*.

(6)