Oct 2001

GENERAL ENGINEERING SCIENCE II

Attempt ALL questions

Marks for each part question are shown in brackets

1. *(a)* Define *specific heat capacity.* (3)

   (b) Calculate the heat energy required to raise the temperature of 275 kg of copper by 450°C. (5)

   Note: The specific heat capacity of copper is 0.385 kJ/kgK

2. During a constant temperature process, the pressure of a gas is reduced from 3 bar to 1.5 bar. The initial volume of the gas is 0.8 m^3 and its temperature is 27°C.

   Calculate EACH of the following:

   (a) the final volume of the gas; (4)

   (b) the mass of the gas. (4)

   Note: R for the gas is 4.16 kJ/kgK

3. *(a)* Explain the term *combustion.* (3)

   (b) From the combustion equation determine the mass of oxygen required to burn 1 kg of carbon to carbon dioxide. (5)

   Note: Relative molecular masses: C = 12, 0_2 = 32

4. An internal combustion engine develops 7.95 kW at the brake when consuming fuel of calorific value 42 x 10^6 kJ/kg at the rate of 3.42 kg/h. The indicated power is 9.47 kW.

   Calculate EACH of the following:

   (a) the mechanical efficiency; (3)

   (b) the brake thermal efficiency; (4)

   (c) the indicated thermal efficiency. (3)

5. *(a)* Sketch a simple vapour compression refrigeration circuit labelling the principal components. (4)

   (b) Indicate on the sketch in Q.5(a) the state of the refrigerant as it passes through the various stages. (4)

6. *(a)* Describe, with the aid of a labelled sketch, the principle of operation of a thermocouple. (6)

   (b) State TWO practical applications of a thermocouple. (2)

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7. Calculate the value of resistor R in the electrical circuit shown in Fig. Q.7. (8)

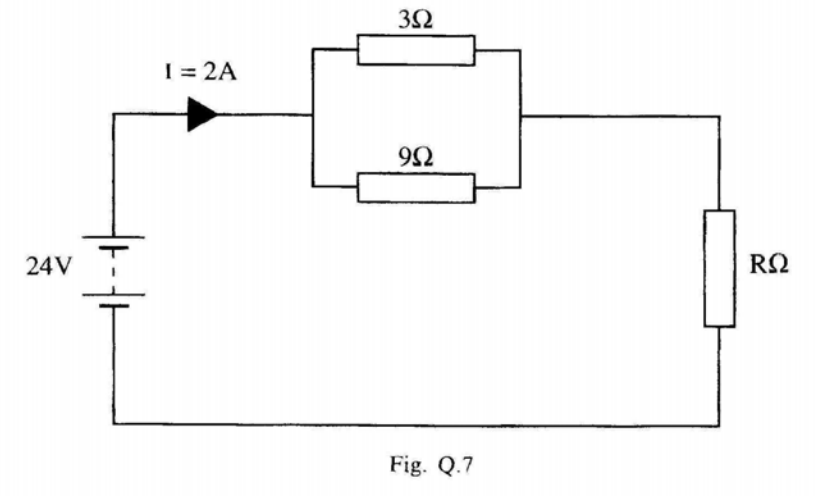

Fig. Q.7

8. Calculate the resistance of 2 m of wire of cross sectional area $0.0001m^2$ if the resistivity of the wire is 0.002 Ωm. (6)

9. *(a)* Explain the term *internal resistance of an electric cell*, stating the effect it has on the terminal voltage of the cell. (5)

(b) The e.m.f. of a cell is 1.5 V and its terminal voltage is 1.3 V when delivering a current of 0.7 A.

Calculate the internal resistance of the cell. (5)

10. *(a)* State the meaning of the term *magnetic flux.* (2)

(b) An electric conductor of length 45 metres is moved at a velocity of 9m/s at 90° to a uniform magnetic field. An e.m.f. of 0.12V is induced in the conductor.

Determine the density of the magnetic field. (6)

11. *(a)* With reference to the magnetic fields inside a d.c. motor, explain, with the aid of sketches, how shaft rotation is achieved. (6)

(b) Explain the function of the commutator in a d.c. generator. (3)

12. With reference to a moving coil ammeter:

(a) sketch the basic arrangement; (5)

(b) explain its principle of operation. (4)