Feb 2004

GENERAL ENGINEERING SCIENCE II

Attempt ALL questions

Marks for each question are shown in brackets.

1. (a) Explain the purposes of thermal insulation used on propulsion machinery. (4)

(b) State ONE example of material used for thermal insulation. (1)

(c) State ONE engineering area where thermal insulation would normally be used. (1)

2. A copper vessel of mass 2kg contains 6kg of water. The initial temperature of the vessel and water is 20°C and the final temperature is 80°C.

Calculate the amount of heat energy added in kJ, assuming that heat losses are negligible. (6)

Note: The specific heat capacity of copper is 394 J/kg K.

The specific heat capacity of water is 4193.2 J/kgK.

3. (a) State Charles'Law for a perfect gas. (4)

(b) (i) During a constant pressure process the specific volume of a certain gas is $0.625 m^3/kg$ at 20°C. Calculate the specific volume at 150°C. (3)

(ii) Calculate the work done by 1kg of the gas, if this constant pressure process was carried out at 12 bar. (3)

4. (a) Explain the meaning of the term *stoichiometric air requirement.* (2)

(b) With reference to an internal combustion engine, describe the effect of supplying EACH of the following:

(i) the stoichiometric air; (3)

(ii) excess air. (3)

5. An internal combustion engine has a thermal efficiency of 30%. It is supplied with fuel of calorific value 38,000kJ/kg at a rate of 20kg/min.

Calculate the power developed by the engine in kW. (8)

6. (a) List the FOUR main mechanical components of a vapour compression refrigeration plant. (4)

(b) List FOUR properties of a good refrigerant fluid. (4)

7. (a) Explain, with the aid of a diagram, the principle of operation of a thermocouple. (8)

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

8. For the circuit shown in Fig.Q8, calculate EACH of the following:

(a) the total circuit resistance; (3)

(b) the circuit current; (3)

(c) the current through EACH resistance. (4)

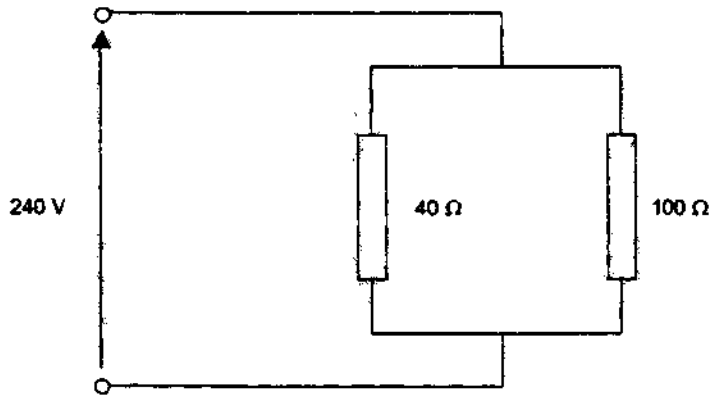

Fig. Q.8.

9. (a) Sketch the basic structure of an atom, naming the particles. (4)

(b) Explain, with the aid of a sketch, how an electric current flows through a metallic conductor. (6)

10. (a) Sketch a circuit diagram showing how a moving coil instrument can be used to measure different current scales. (3)

(b) A moving coil has a resistance of 30 and requires 25mA to produce full scale deflection. Calculate the shunt resistance required to measure a current of 4A. (4)

11. (a) Sketch the basic construction of EACH of the following:

(i) a primary cell; (3)

(ii) a secondary cell. (3)

(b) Explain the difference in operation between the two cell types sketched in Q11 (a). (4)

12.. A coil of 200 turns with a coil side of active length 300mm rotates in a uniform magnetic field between the poles of an electromagnet with a field of flux density 0.02T. The conductor speed is 12.6m/s.

Calculate the maximum e.m.f. generated in the coil. (7)