April 2004

GENERAL ENGINEERING SCIENCE II

Attempt ALL questions

Marks for each question are shown in brackets

1.   An iron casting has a volume of 0.42m^3 at 100°C. Its temperature falls to 12°C.

   Determine EACH of the following:

   (a)   the final volume;   (5)

   (b)   the percentage reduction in volume.   (3)

   Note: The coefficient of linear expansion of cast iron is 0.000011/ C.

2.   A 3kg mass of carbon is completely burnt with 25% excess air.   .

   (a)   State the fundamental combustion equation for this process.   (2)

   (b)   Calculate EACH of the following:

      (i)   the stoichiometric mass of air required;   (2)

      (ii)   the actual mass of air supplied;   (2)

      (iii) the mass of nitrogen in the flu gas produced by the process.   (2)

   Note: Air contains 23% Oxygen by mass.
   Relative atomic masses: C = 12; O =16.

3.   List the THREE major forms of fuel, stating ONE example of EACH.   (6)

4.   (a)   State the meaning of the term *ideal gas.*   (2)

   (b) One cubic metre of air at an absolute pressure of 1 x 10^5 N/m^2 and temperature of 15° C
      is compressed to 0. 1 m^3 and the pressure is then found to be 2.0 x 10^6 N/m^2.
      Determine the temperature of the air after compression.   (6)

5. An engine consumes 16kg of oil per hour when developing a brake power of 34kW. The mechanical efficiency of the engine is 84%.

   Calculate EACH of the following:

   (a) the indicated power of the engine; (4)

   (b) the indicated specific fuel consumption; (4)

   (c) the power losses due to friction. (2)

6. (a) Sketch a basic circuit for a vapour compression refrigeration plant, labelling the

       MAIN components. (4)

   (b) State the function of EACH of the MAIN components sketched in Q6(a). (4)

   (c) State the effect that higher ambient temperature would have on the plant operation. (2)

7. Sketch a *moving coil* electrical measurement instrument, labelling the component parts. (10)

8. (a) Explain the meaning of the term *magnetic flux*. (4)

   (b) Sketch the magnetic flux distribution in and around EACH of the following:

       (i) a bar magnet; (2)

       (ii) a U-shaped magnet. (2)

9.   In the circuit shown in Fig.Q9 the battery emf is 8V, terminal voltage is 4.8V and the current I is 4A.

Calculate EACH of the following:

(a)   the battery internal resistance Ri   (4)

(b)   the value of the external resistance R   (4)
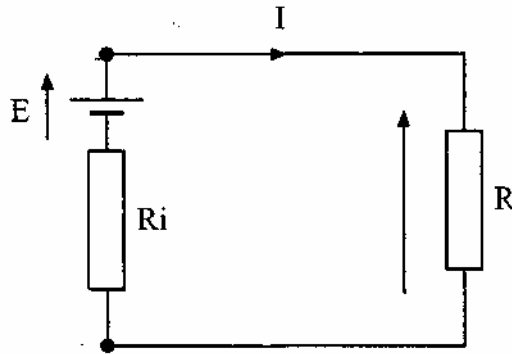

Fig. Q.9.

10.   Describe, with the aid of a sketch, the principle of operation of a dc electric motor.   (10)

11.   For the circuit shown in Fig.Q. 11, calculate EACH of the following:

(a)   the supply voltage V;   (4)

(b)   the potential difference across each resistance.   (4)
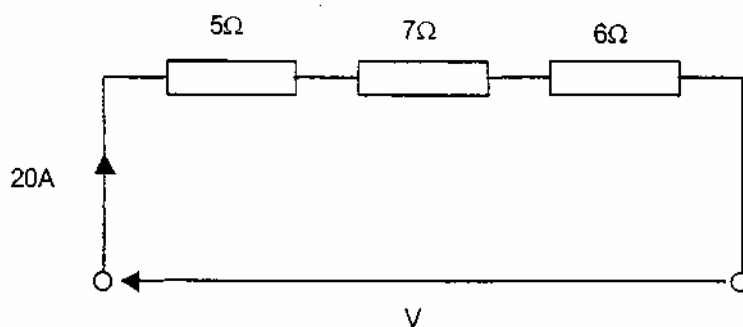

Fig. Q.11.

12.   A conductor 250mm long and carrying a current of 75A is placed at right angles to a magnetic field of flux density 0.8T.

Calculate the force on this conductor.   (6)