9 **(a)** By reference to heating effect, explain what is meant by the *root-mean-square* (r.m.s.) value of an alternating current.

.....

.....

..... [2]

(b) An electric heater has a resistance of 38 Ω at its working temperature. The variation with time t of the supply voltage V connected between the terminals of the heater is given by

$$V = 240 \sin 377t,$$

where V is measured in volts and t is in seconds.

Determine

(i) the frequency f of the supply voltage,

f = ... Hz [2]

(ii) the power dissipation of the heater.

power = ... W [3]

(c) The voltage of the supply in **(b)** is to be stepped down to 12 V r.m.s. using a transformer, as illustrated in Fig. 9.1.

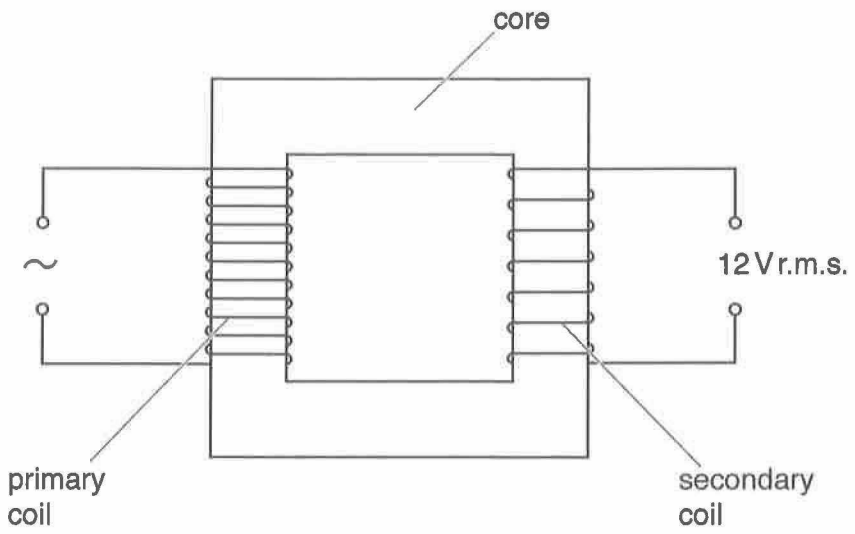

Fig. 9.1

(i) 1. State Faraday's law of electromagnetic induction.

.....

.....

..... [2]

2. Use Faraday's law to explain why an alternating current in the primary coil gives rise to an **alternating e.m.f.** in the secondary coil.

.....

.....

.....

.....

.....

..... [4]

(ii) The primary coil is wound with 5000 turns. The transformer is assumed to be ideal.

1. Explain what is meant by an *ideal* transformer.

.....

..... [1]

2. Calculate the number N of turns on the secondary coil.

N = ... [2]

(iii) In practice, the core of some transformers is made of laminated soft iron.

1. State **two** reasons why soft iron, which is easily magnetised and demagnetised, is used as the core.

.....

.....

..... [2]

2. Explain how the lamination of the core reduces energy losses.

.....

.....

..... [2]