522.

Problem 38.25 (RHK)

In the circuit shown in the figure values of the circuit elements are E = 100 V, $R_1 = 10 \Omega$, $R_2 = 20 \Omega$, $R_3 = 30 \Omega$, and L = 2.0 H. We have to find the values of i_1 and i_2 (a) immediately after switch S is closed; (b) a long time later; (c) immediately after switch S is opened again; (d) a long time later.



Solution:

(a)

Immediately after the switch *S* is closed, there will be no flow of current in the inductor. At that instant current will flow through resistances R_1 and R_2 and its magnitude will be

$$i_1 = i_2 = \frac{100}{30}$$
 A = 3.33 A.
(b)

A long time after the switch S has been closed, the flow of current through the inductor L will stabilise and there will be no change in current flow. The values of currents i_1 and i_2 can be obtained by applying Kirchoff's laws to loops. We have two linear equations for determining i_1 and i_2 .

$$R_1 i_1 + R_2 i_2 = \mathcal{E},$$

and

$$(i_1-i_2)R_3=i_2R_2.$$



and E, and solving

the linear equations, we find

$$i_1 = 4.55$$
 A,
and
 $i_2 = 2.73$ A.

(c)

Immediately after the switch S is opened, the current i_1 will be zero and the current i_2 will be equal to the steady state current flowing through the inductor; and will be i = (4.55 - 2.73) A = 1.82 A.

(d)

A long time later both currents i_1 and i_2 will be zero.

