7 In a car, the power supply to two identical light bulbs R_1 and R_2 as shown in Fig. 7.1 consists of two power sources: a 12 V battery of internal resistance 0.20 Ω and a generator of 14 V connected in series with a variable resistor of resistance R. The resistance of each light bulb is 3.0 Ω.
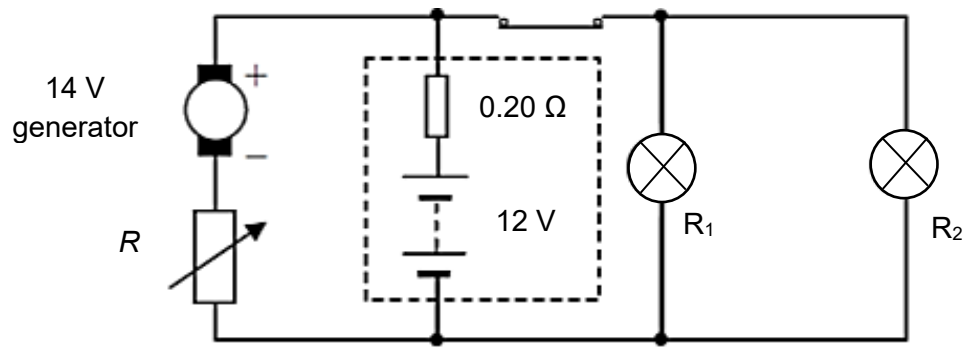

Fig. 7.1

(a) Resistance R is adjusted so that there is no current in the 12 V battery when the light bulbs are turned on.

Show that $R = 0.25$ Ω. Explain your working.

[2]

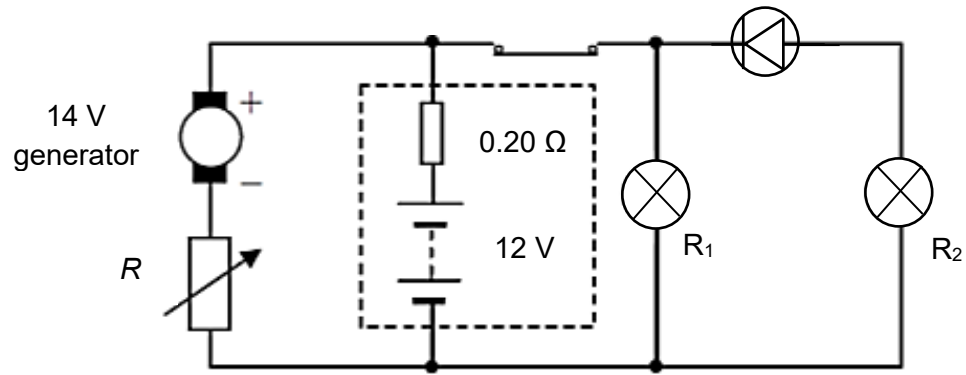**(b)**   A diode is connected to the circuit as shown in Fig. 7.2.

Fig. 7.2

Determine the value of R to maintain the current in the 12 V battery to be at zero ampere. Explain your working clearly.

R = ... Ω [3]

(c)   Suggest two advantages which the circuit, as shown in Fig. 7.1, has over a single power source.

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.... [2]

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