6 A light dependent resistor (LDR) is a resistor whose resistance decreases with increasing incident light intensity. An image of a typical LDR and its circuit symbol is shown in Fig. 6.1.

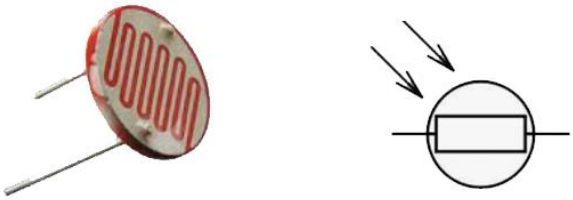

Fig. 6.1

An LDR is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

Fig. 6.2 shows a plot of the resistance of the LDR against the intensity of incident light on a logarithmic scale.

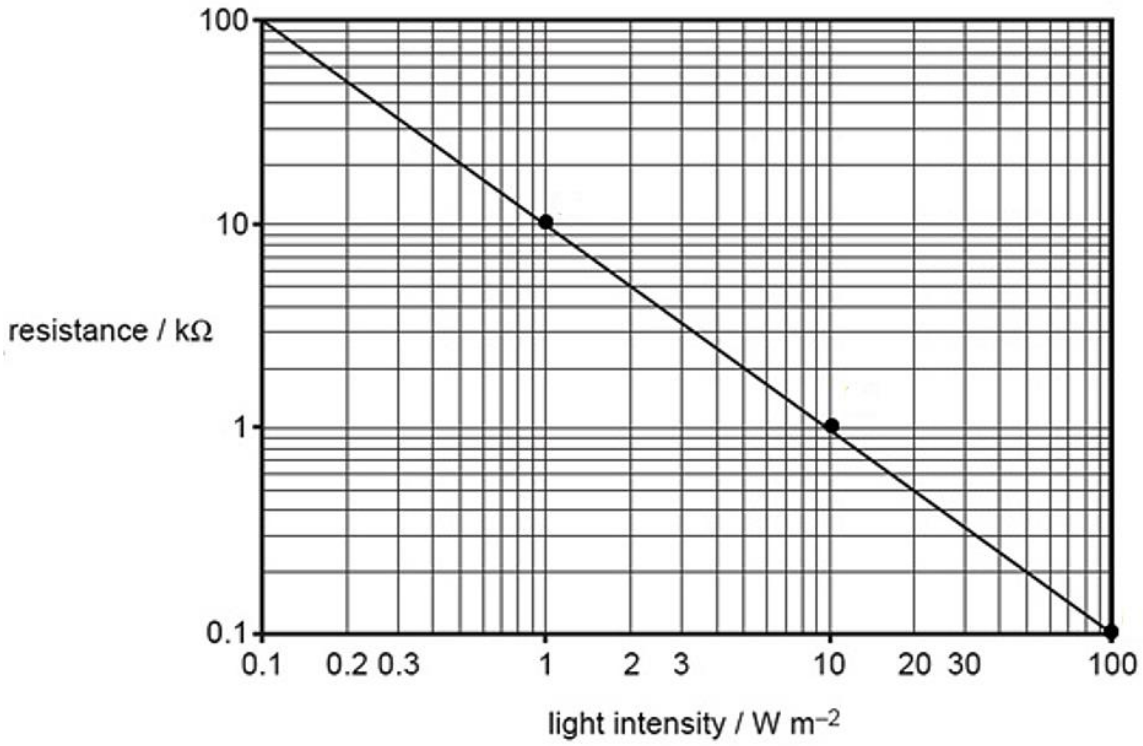

Fig. 6.2

(a) State what is meant by *resistance* of a material.

.....

..... [1]

(b) **(i)** Use Fig. 6.2 to find the resistance of the LDR at a light intensity of 50.0 W m^{-2}.

resistance of LDR = ... Ω [1]

(ii) Explain the advantage of plotting the resistance-intensity graph on the logarithmic scale.

.....

.....

..... [1]

(iii) It is proposed that the resistance R of the LDR is related to the intensity I of incident light by a relation of the form

$$R = \frac{k}{I}$$

where k is a constant.

Using the data in Fig. 6.2, deduce whether this relation is supported.

Hence determine the value of k.

k = ... Ω W m^{-2} [3]

(c) The LDR is connected in series with a variable resistor X and a 12.0 V d.c. supply. The buzzer is connected across the variable resistor X as shown in Fig. 6.3.

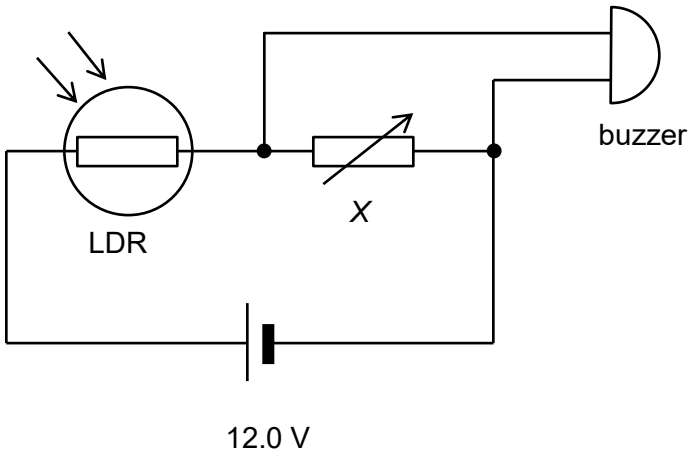

Fig. 6.3

The buzzer is set to sound if the potential difference across it is equal to or greater than 9.0 V.

(i) Calculate the value of the resistance of X if the buzzer were to sound when the light intensity exceeds 50.0 W m^{-2}.

resistance of X = ... Ω [3]

(ii) Suggest an application for the circuit in Fig. 6.3 and explain how it works.

.....

.....

.....

..... [2]

(iii) Explain why it is impractical to use this LDR as a trigger for light intensity below 1.0 W m^{-2}.

.....

.....

.....

..... [2]

(iv) Suggest how you would modify the circuit if you want the buzzer to sound for falling light intensity.

.....

.....

..... [1]

[Total: 14]

Section B

Answer **one** question from this Section in the spaces provided.