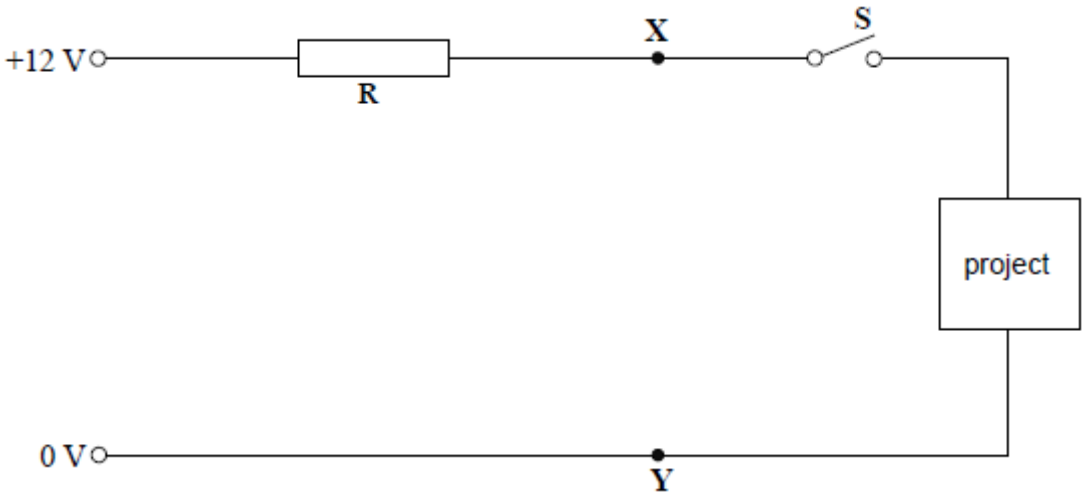
Practice Question Set For A-Level
Subject : Physics
Paper-3 Topic: Section B (Section 13_ Electronics)

Merit Minds
www.merit-minds.com
Exam Preparation and Free Resources

Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

A Zener diode is used to produce a stabilized 5.1 V from an unregulated 12 V supply to power a project that requires 80 mA.
Part of the circuit is shown in the diagram.



(a) Draw on the diagram the Zener diode connected correctly between points **X** and **Y**.

(2)

(b) The Zener diode requires at least 5 mA to maintain its Zener voltage of 5.1 V.

(i) Calculate the minimum current flowing through **R** when switch **S** is closed.

_____

(1)

(ii) Calculate the voltage across resistor **R** under these conditions.

_____

_____

(1)

(iii) Calculate the value of resistor **R**.

_____

_____

_____

(2)

(c) The circuit in the diagram above is now constructed using a value of 75 Ω for resistor **R**.

(i) Show that the power dissipated in the resistor is approximately 0.6 W.

_____

_____

_____

(2)

(ii) The project is disconnected by turning switch **S** off, but the 12 V supply remains connected.

Calculate the current that now flows through the Zener diode.

_____

_____

_____

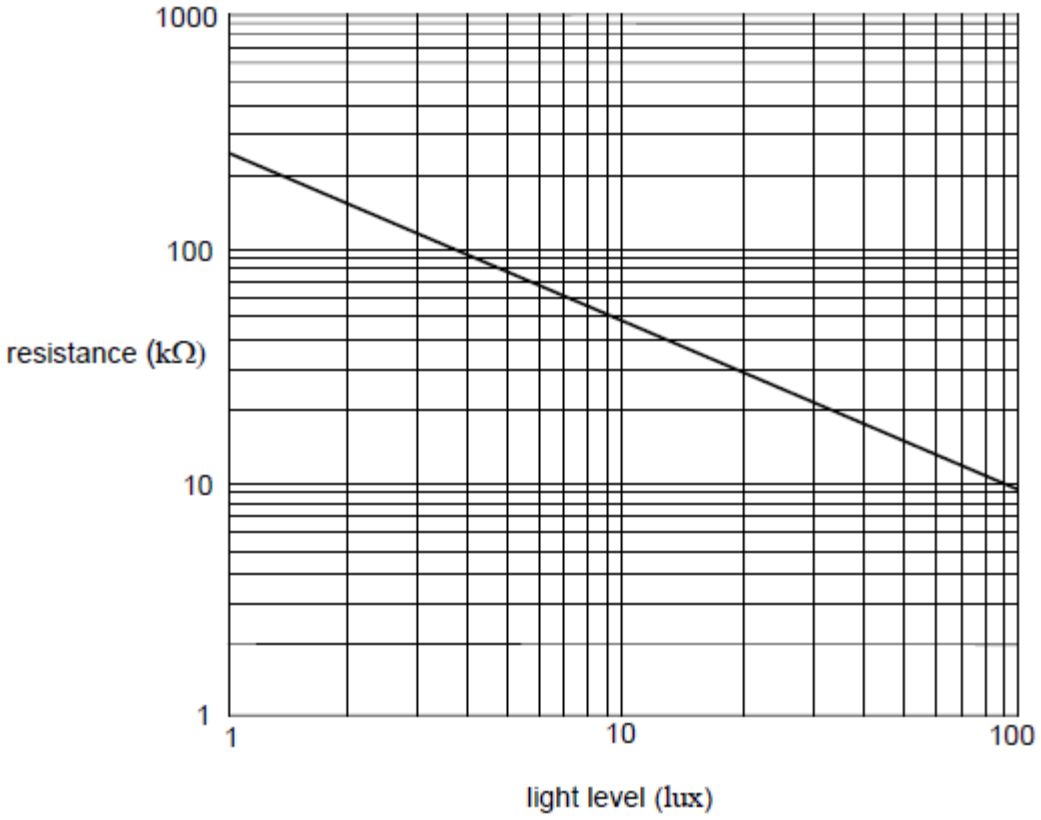
(2)

(Total 10 marks)

Q2.

An LDR is being used as a light sensor in a system that will switch on a porch light when it gets dark. The characteristic for the LDR is shown in **Figure 1**.

Figure 1



(a) (i) Explain how the use of the logarithmic scale in **Figure 1** is helpful when displaying this characteristic.

_____

_____

(1)

(ii) The LDR has a resistance of 60 kΩ when the light level causes the system to switch on the porch light.

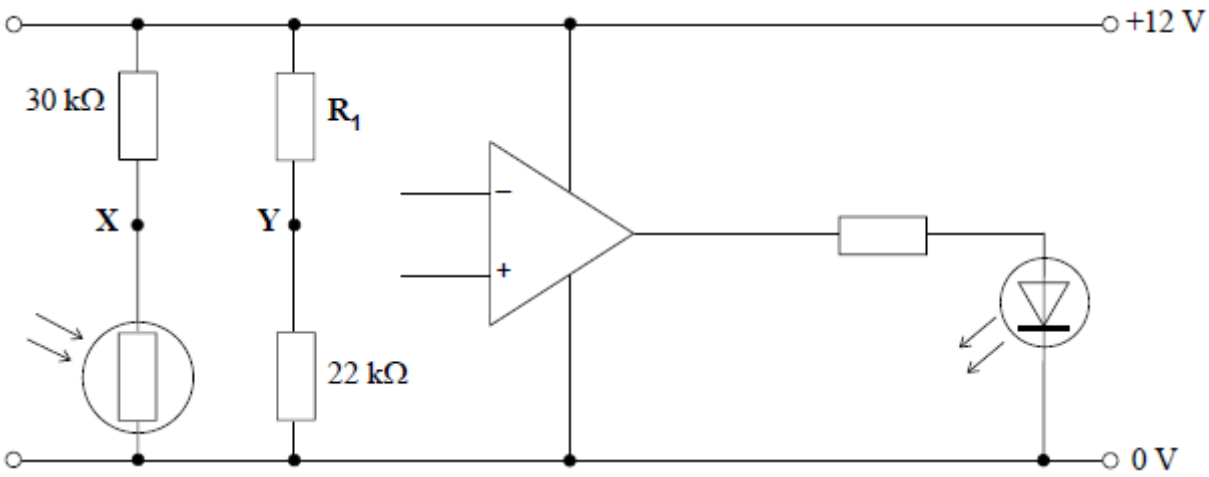
State the value of this light level by reading from the graph in **Figure 1**.

light level _____ lux

(1)

(b) **Figure 2** shows the circuit for detecting the light level.
The design makes use of an op-amp acting as a comparator.
A red LED acts as an output indicator to aid testing of the detector circuit.

Figure 2



Draw on **Figure 2** the connections from points **X** and **Y** to the op-amp inputs so that the red LED switches on when the light level falls below the required value.

(1)

(c) (i) Calculate the voltage at point **X** when the red LED switches on.

_____

_____

_____

(2)

(ii) The reference voltage at **Y** is produced by two fixed-value resistors.

Calculate the value for resistor $\mathbf{R_1}$ in order to achieve the required circuit operation.

_____

_____

(2)

(d) The red LED was found to stay on dimly even when the light level was well above the value expected to switch it off.

Explain why this might happen and how the problem could be solved.

(3)

(Total 10 marks)