Combined Science - Physics - Key Stage 4 - Electricity

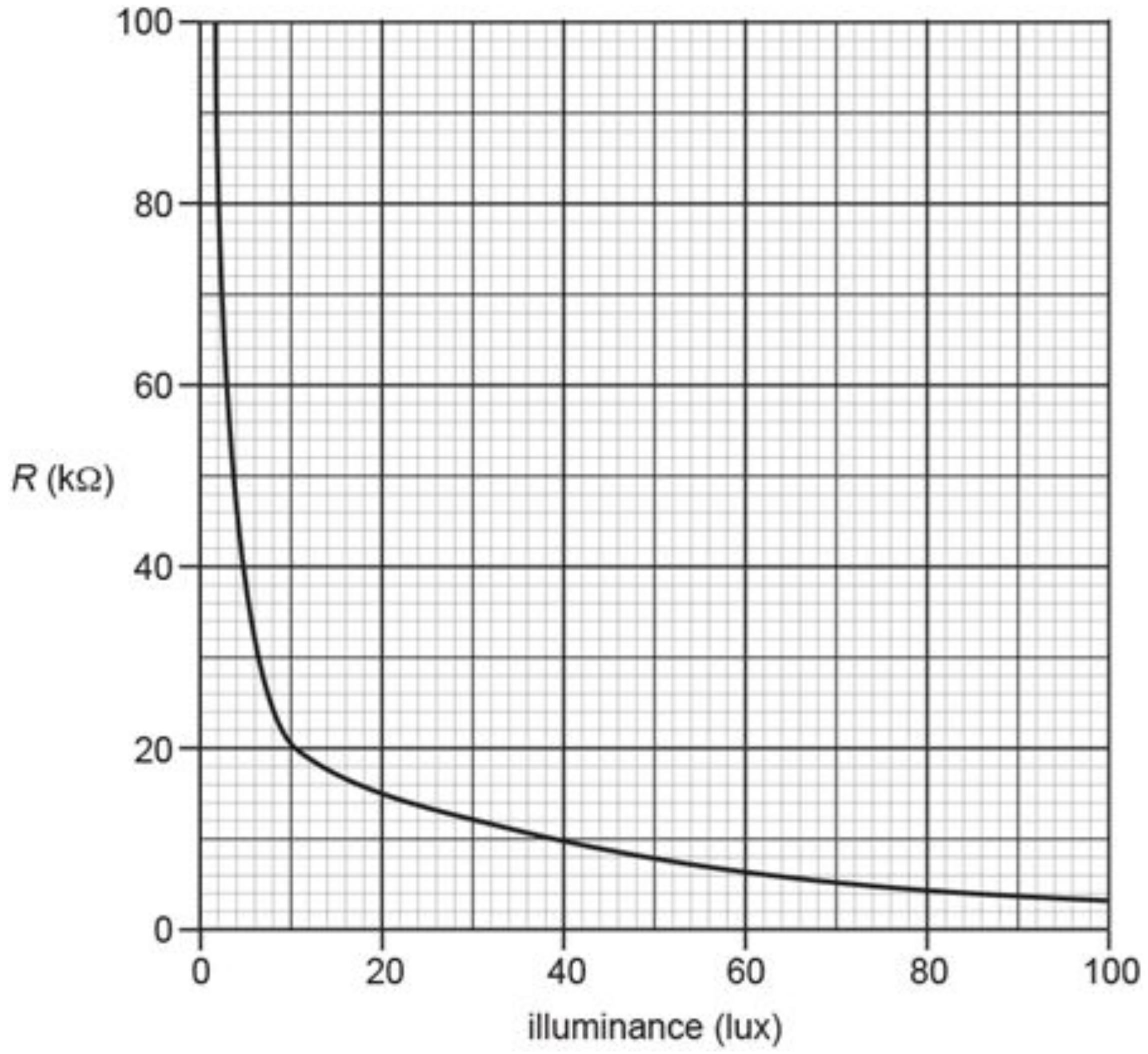
Light Dependent Resistors Worksheet

Miss Walrond

Q1.

(a) This question is about using an LDR (light-dependent resistor) to measure light intensity.

The resistance *R* of an LDR varies with illuminance (the amount of light energy per unit area hitting a surface) as shown in the graph.



i. Which of the following statements correctly describes this variation?

Tick **(✓) one** box.

The resistance is directly proportional to the illuminance.

The resistance and the illuminance have a positive correlation.

As the illuminance increases, the change in resistance becomes less and less.

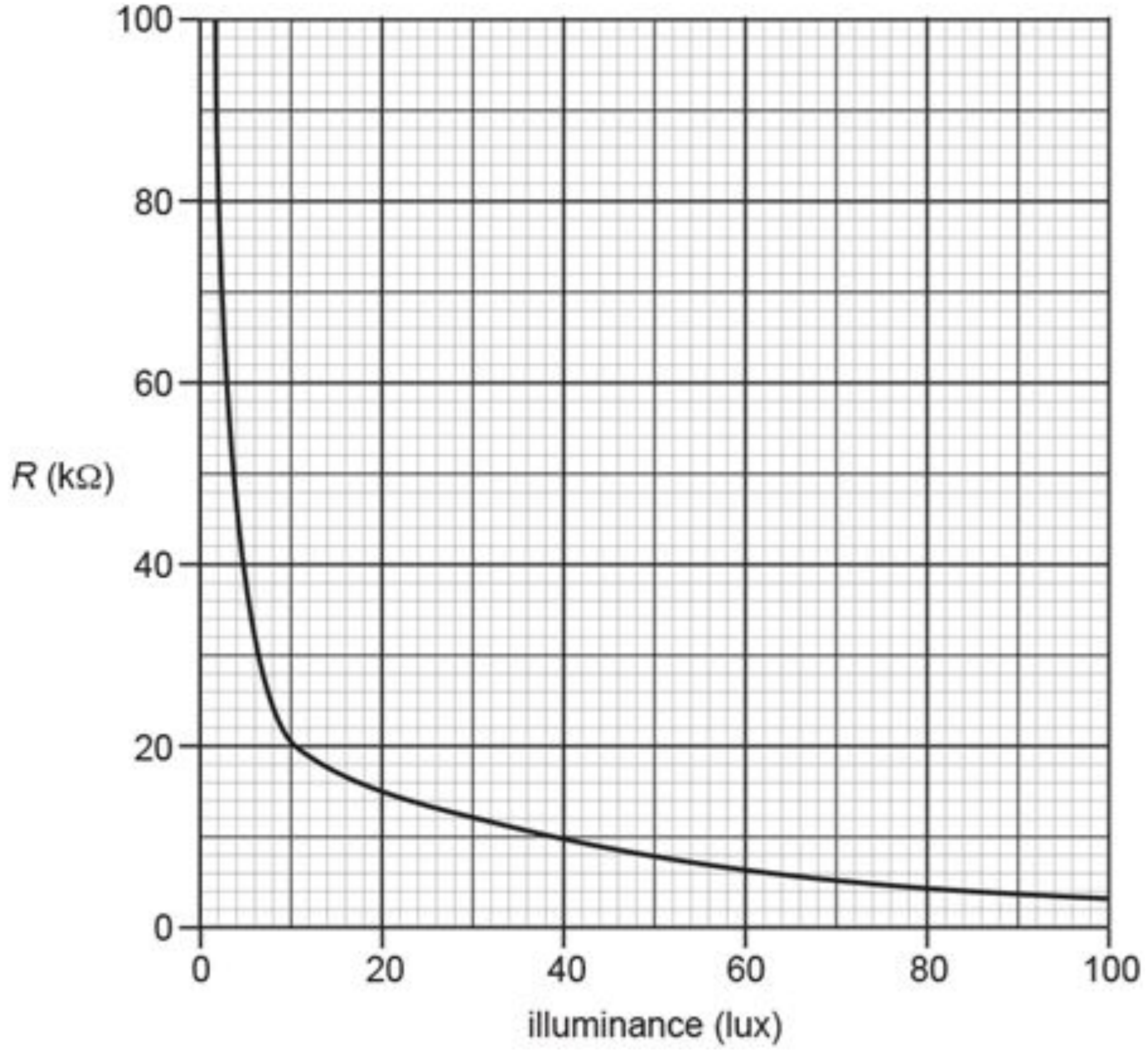
The resistance is greater at 80 lux than at 20 lux.

[1]

OCR, Twenty First Century Physics B, Paper J259/04, June 2018

Q1.

ii. Use the graph to estimate the change in resistance of the LDR when the illuminance increases from 10 lux to 70 lux.



Change in resistance = kΩ **[2]**

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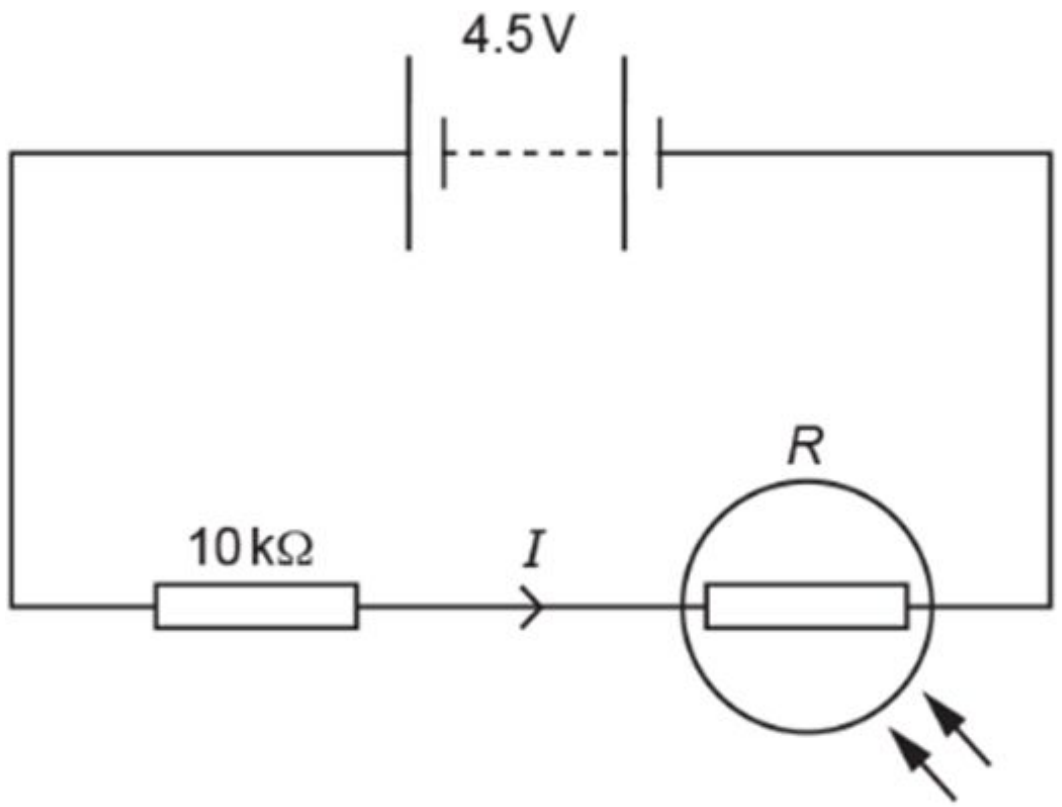
Q1.



(b) The LDR is connected in series with a fixed resistor of resistance 10 kΩ and a 4.5 V battery.

The **total** resistance at 30 lux is 22 000 Ω.

i. Calculate the current in the circuit.

Current = A **[1]**

ii. Calculate the potential difference across the fixed 10 kΩ resistor when the illuminance is 30lux.

Potential difference = V **[3]**

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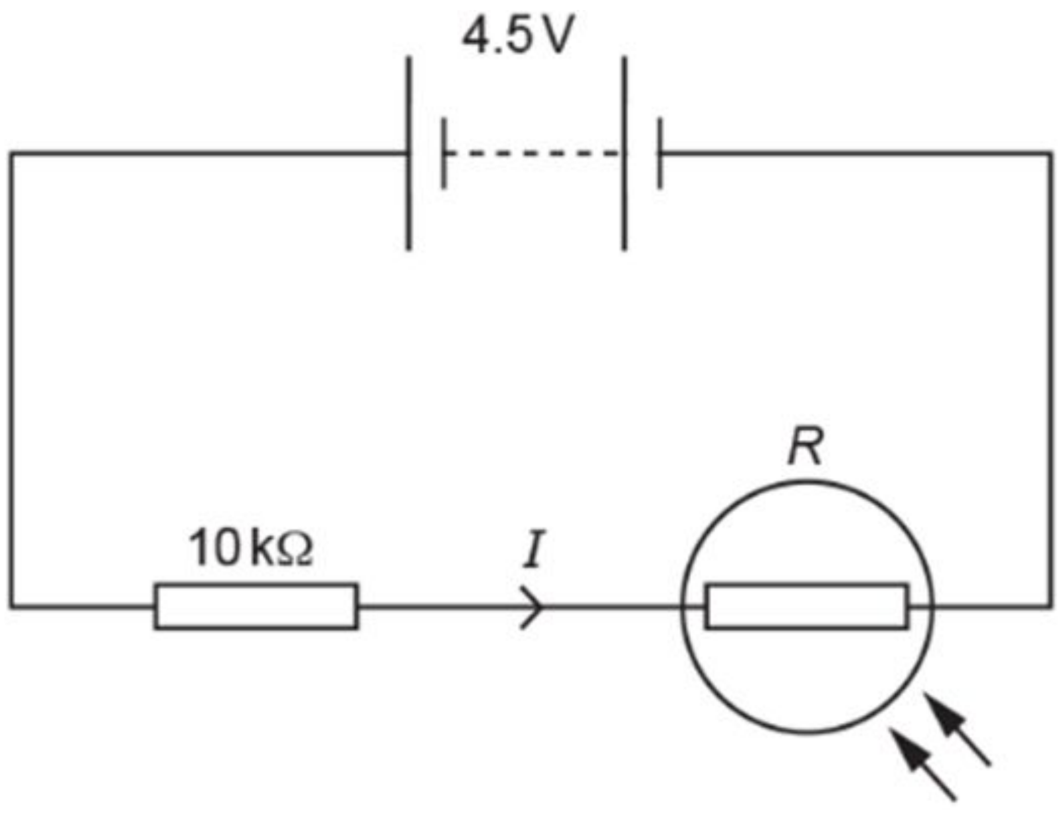
Q1.

iii. Describe, without any calculations, how the potential difference across the fixed resistor will change when the illuminance increases from 30 lux to 100 lux.



[3]

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Answers

Answers Q1

1 a i. As the illumination increases, the change in resistance becomes less and less. **1**

ii. R (al 10 lux) = 20k□ **or** R (at 70 lux) = 5 (+/- 1) k□ **1**

Second R and change in R = 20 - 5 (+/- 1) k□

Change in R = 15 k□ *accept answers in the range 14 - 16 k□* **1**

1 b i. Current = V / R **1**

Current = 4.5 / 22 000 **1**

Current = 0.00020(5) or 2.0(5) × 10^{-4} A

ii. Unit conversion 10 k□ = 10,000 □ **1**

Potential difference = 0.00020(5) × 10 000 **1**

Potential difference = 2.0(5) V **1**

Answers Q1

1 b iii. As illuminance increases the resistance decreases. **1**

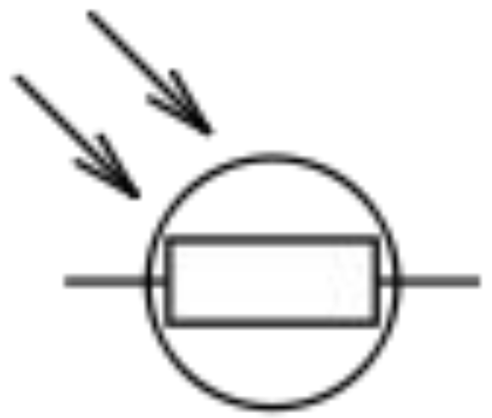
Potential difference across the resistor increases. **1**

Resistance changes get smaller, so the change in potential difference becomes smaller **1**

In lesson questions

Independent Task: LDR

1) **Copy the circuit symbol for an LDR**



2) **Complete the sentences below:**
LDR stands for ____________ ______________ ______________. When the light intensity increases the resistance ______________. When the light intensity decreases the resistance ______________.

Independent Task: Investigating LDRs part 1

1) Name the independent variable in this investigation.
2) Name the dependent variable in this investigation.
3) Write down a control variable.

Independent Task: Writing a method

Write a method that could be used to investigate how the light intensity affects the resistance of the LDR. Use the checklist to help you.

In this experiment I will change the .....

I will use intervals of ....

I will measure the ..... by measuring the ....

I will keep ..... the same.

I will plot ....

Checklist:
IV
Intervals
DV
How to measure R
Control
Graph

Independent Task: Investigating LDRs part 3

1) **Describe your observations.**
   As the light intensity decreases the current _______________ this is because the resistance ____________.

Independent Task - complete the table.

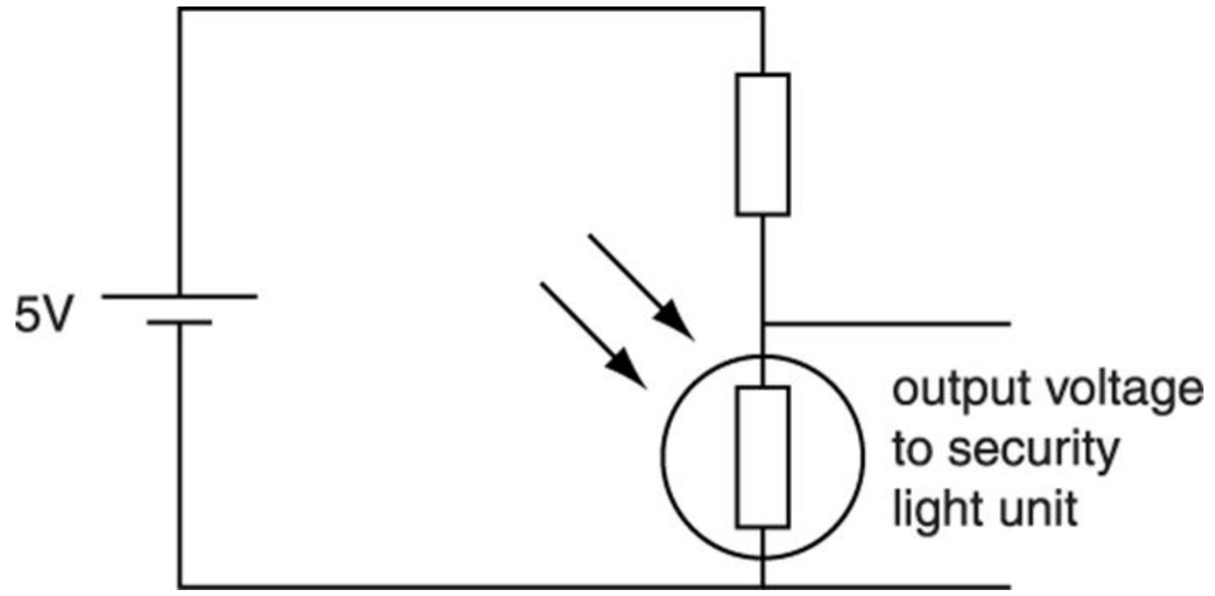
Light Intensity (Lux)	Potential Difference (V)	Current (A)	Current (A)	Current (A)	Mean Current (A)	Resistance (Ω)
0	4.5	1.1	1.0	1.2	1.1	4.1
1	4.5	2.3	1.2	1.3		
2	4.5	1.8	1.6	1.7		
3	4.5	2.2	2.1	2.1		
4	4.5	2.5	2.7	2.8		

Independent Task: Investigating LDRs part 4

1) Sketch the graph on the right.
2) Describe the relationship shown on the graph.

Worked Example:

1. Felippe has a security light which turns on when it becomes dark.
   An LDR can be used as part of a potential divider circuit to turn on the security light.
   Look at the diagram.



Explain how the potential divider circuit and the LDR can be used to turn on the security light when it becomes dark.

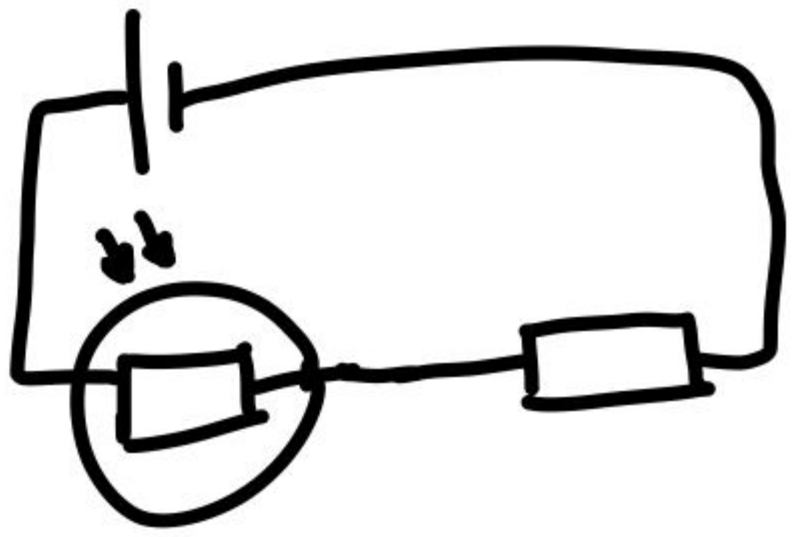
The quality of written communication will be assessed in your answer to this question.

OCR, Gateway Physics B, Paper B752/02, June 2016

[6]

Independent Task - LDR

Explain why the potential difference across the LDR decreases, as the light intensity increase.



Worked Example: Calculations

a) Calculate the resistance of the LDR.

b) The light intensity increases, and the LDR now has a resistance of 2000 □
Calculate the new potential difference across the LDR and the fixed resistor.

Independent Task - Calculations

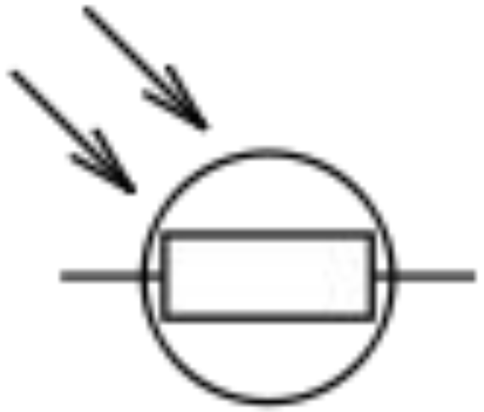
a) Calculate the resistance of the LDR.

b) The light intensity increases, and the LDR now has a resistance of 6 □
Calculate the new potential difference across the LDR and the fixed resistor.

Answers

Review: Independent Task: LDR

1) **Copy the circuit symbol for an LDR**



2) **Complete the sentences below:**
LDR stands for ***light dependent resistor.*** *When the light intensity increases the resistance* ***decreases****. When the light intensity decreases the resistance* ***increases****.*

Review - Investigating LDRs part 1.

Independent variable: Light intensity or distance of a lamp from the LDR

Dependent variable: Resistance of the LDR.

Control variable: Background lighting levels.

Review - Independent Task: Writing a method

Write a method that could be used to investigate how the light intensity affects the resistance of the LDR.

In this experiment I will change the ***light intensity by moving a lamp relative to the LDR.***

I will use intervals of ***10 cm, starting at 20 cm and increasing to 1 m.***

I will measure the ***resistance*** *by measuring the* ***current using an ammeter (in series) and the potential difference using a voltmeter (in parallel).***

I will keep ***the background light*** *the same.*

I will plot ***a graph of distance from the LDR and resistance on a graph.***

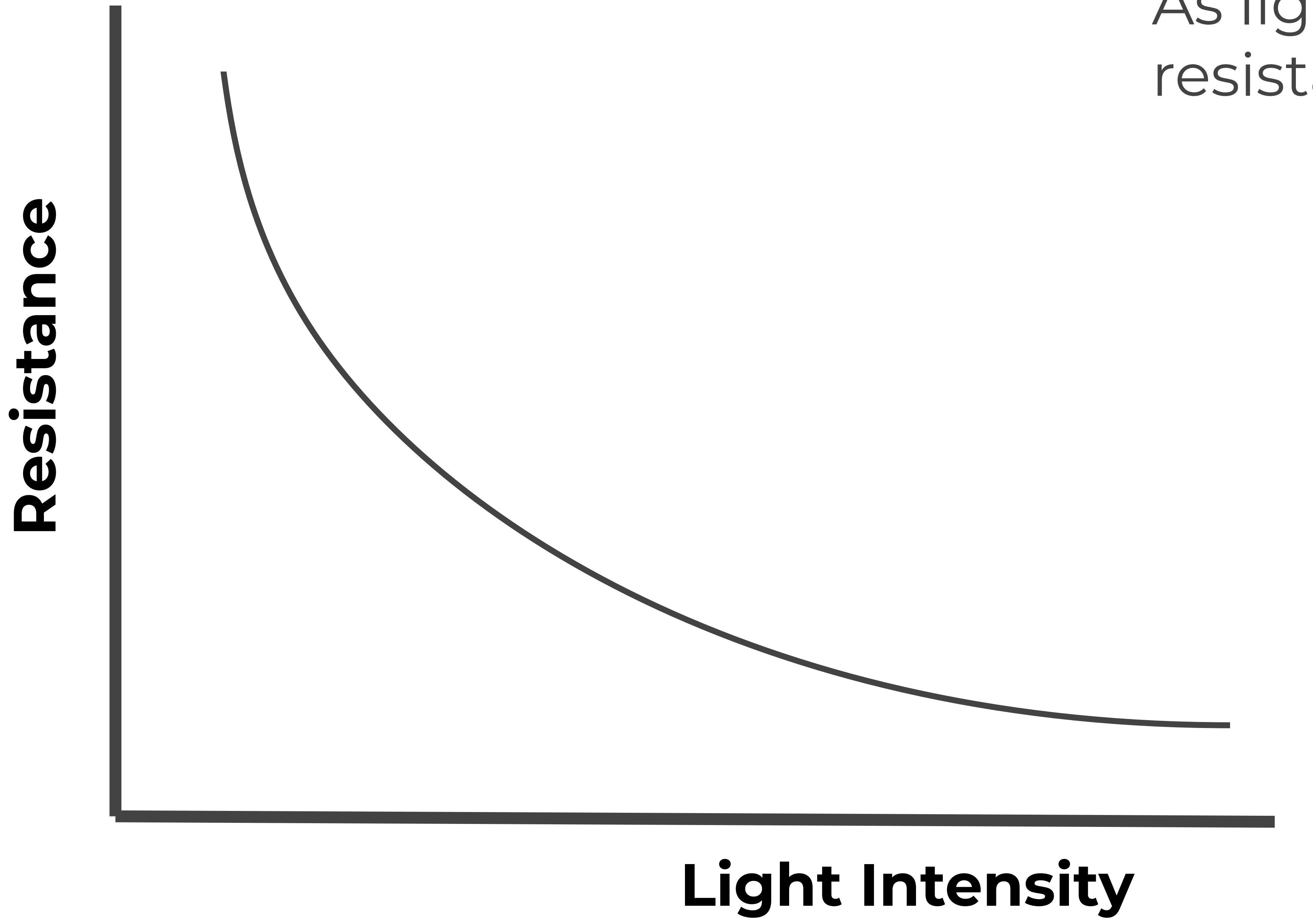
Review - Investigating LDRs part 3.

1) *As the light intensity decreases the current **decreases** this is because the resistance **increases**.*

Review: Independent Task

Light Intensity (Lux)	Potential Difference (V)	Current (A)	Current (A)	Current (A)	Mean Current (A)	Resistance (Ω)
0	4.5	1.1	1.0	1.2	1.1	4.1
1	4.5	2.3	1.2	1.3	**1.25**	**3.6**
2	4.5	1.8	1.6	1.7	**1.7**	**2.6**
3	4.5	2.2	2.1	2.1	**2.13**	**2.1**
4	4.5	2.5	2.7	2.8	**2.67**	**1.7**

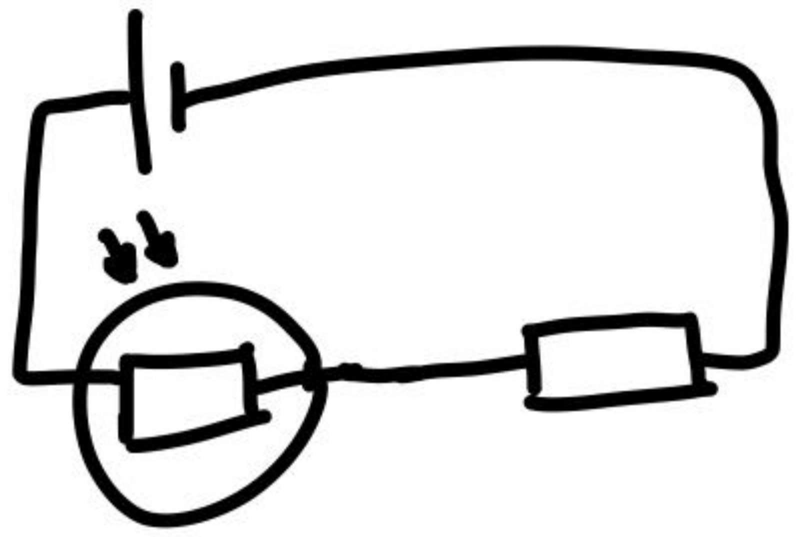
Review - Investigating LDRs part 4



As light intensity increases, resistance decreases.

Review: Independent Task - LDR

Explain why the potential difference across the LDR decreases, as the light intensity increase.



As the light intensity increases, the LDR resistance decreases. This reduces the total resistance in the circuit, and increases the current. The potential difference across the fixed resistor increases, so the potential difference across the LDR must decrease.

or

As the light intensity increases, the LDR resistance decreases. This means its resistance is less than the fixed resistor, so it received a smaller share of the potential difference.

Independent Task - Calculations

a) Calculate the resistance of the LDR. **10□**

b) The light intensity increases, and the LDR now has a resistance of 6 □

Calculate the new potential difference across the LDR and the fixed resistor. **2 V**