

Marking of electronics prac booklet



Each section is marked out of 5. There are 25 marks in total (or 20 if your class didn't get to the extension questions.)

1. Page 4: All components are checked in & out every period. /2
2. Pages 10: Resistance colour code questions are completed & correct. /2
3. Pages 11 - 13: Series & parallel resistance questions are completed & correct. /2
4. Pages 14: Questions on LDR completed & correct. /2
5. Pages 15 – 17: Questions on capacitors completed & correct. /3
6. Pages 18: Questions on diodes completed & correct. /2
7. Pages 19 & 20: Measurements & questions on current / voltage completed & correct. /2
8. Pages 22 & 23: Correct graph & questions answered for Ohm's law. /3
9. Pages 25: Questions answered for transistors. /2
10. Pages 26 – 27: Extension activities completed, described & signed. /5

Page 10

1. What is the resistance indicated by the following colour bands?

a) red, red, brown	220Ω
b) yellow, purple, black	47Ω
c) white, black, green	9$\times 10^6\Omega$
d) brown, green, red	1500Ω

2. What colour bands would the following resistors have?

a) 470 Ω	yellow, purple, brown
b) 1000 Ω	brown, black, red
c) 1M Ω	brown, black, green
d) 2.5k Ω	red, green, red

3. State the minimum and maximum resistance that each of these resistors could have:

a) 870 Ω (gold band)	827Ω - 914Ω
b) 5000 Ω (gold band)	4750Ω - 5250Ω
c) 2M Ω (silver band)	1.8MΩ - 2.2MΩ
d) 2.2k Ω (silver band)	1.98kΩ - 2.42kΩ

Part 1: **R in series = 2000Ω**

Part 2 **R in parallel = 500Ω**

Part 3 **733Ω, 5500Ω, 2200Ω, 45Ω**

1. What is the combined resistance of a 100Ω resistor in parallel with a 200Ω resistor?

67Ω

2. What is the combined resistance of five 100Ω resistors in parallel?

20Ω

3. What is the combined resistance of one hundred 100Ω resistors in parallel?

1Ω

4. What is the combined *tolerance* of two gold band 1kΩ resistors in series?

100Ω

Part 1 – Measuring resistance

LDR resistance (bright light):

~5kΩ

LDR resistance (dim light):

~30kΩ

Part 2 – Using the LDR

LED brightness

Increases / Decreases

Current:

Increases / Decreases

LDR resistance:

Increases / Decreases

1. What happens to the resistance of the LDR as it is darkened?

The resistance of the LDR is increased when darkened.

2. Where might an LDR be used in a circuit?

An LDR could be used in a light sensing circuit such as a night light that comes on only when it is dark.

Part 1 - Charging a capacitor

Observe what happens to the LED over time. Explain why this occurs.

The LED starts of bright but dims and darkens over time. The capacitor's increasing voltage opposes the battery, meaning that there is less effective voltage across the whole circuit & less current flowing.

Part 2 - Discharging a capacitor

Close the switch and observe what happens to the LED over time. Explain why this occurs.

The LED starts of bright but dims and darkens over time. This is because the current flowing gets less & less as the capacitor loses its stored charge.

Part 3 - Changing capacitance

Build the following circuit and observe the time that it takes for the LED to darken once the switch is closed. **Before being used again, the capacitor must be discharged by removing it from the circuit and “shorting” it, by touching a wire or piece of metal across the connections.**

Time for LED to darken (capacitor is ~ fully charged):

~ 5 s

Replace the 100 μ F capacitor with a 10 μ F one. Observe the time taken for the light to darken.

Time for LED to darken (capacitor is ~ fully charged):

less than 1 s

Part 4 – Changing resistance

Time for LED to darken (capacitor is ~ fully charged):

~ 2 s



Questions

1. Explain why as a capacitor charges, an LED connected to it in series will dim over time, even though it is continually connected to the battery.

The capacitor's increasing voltage opposes the battery, meaning that there

is less effective voltage across the whole circuit & less current flowing.

Eventually, the fully charged capacitor means no current will flow.

2. Explain why increasing the capacitance increases the time for which the LED glows.

An increased capacitance means that more charge can be stored in the

capacitor. This means that more current will flow as the capacitor is charged

or discharged.

3. Explain why increasing the resistance increases the time for which the LED glows.

Increasing the resistance decreases the amount of charge moving over time.

This means that it will take longer for the same amount of charge to move.

Pages 18



Questions

1. How must a diode be connected to the battery so that a current can flow?

A diode must be connected in "forward bias", for current to flow. (The arrow on the symbol points in the direction of conventional current.)

2. List at least two reasons why a diode might be placed in a circuit.

Diodes can be used as protection from connecting batteries the wrong way.

Diodes can be used to rectify AC in DC by preventing any reverse current flow.

3. Why should a diode never be connected directly to the battery (forward biased) without a resistor in the circuit?

The diode has a very low resistance when conducting, so high current would flow

if there was no protective resistor in series.

	Measured current
I_1	5.8 mA
I_2	3.9 mA
I_3	9.7 mA

1. How does the sum of the two currents in the parallel paths (I_1 and I_2) compare with I_3 (allowing for some variation in the ammeter readings)?

The current splits between the two resistors, but the sum of the two ($I_1 + I_2$) is equal to the total (I_3).

2. Which of the two readings I_1 or I_2 is larger? Explain why this is so.

I_1 has the larger current because it is the lower of the two parallel resistors.

	Measured voltage
V_1	5.8 V
V_2	5.8 V
V_3	3.2 V
V_4	9.0 V

1. What is the relationship between the voltages across two resistors **in parallel**?

The voltage across two or parallel components is the same.

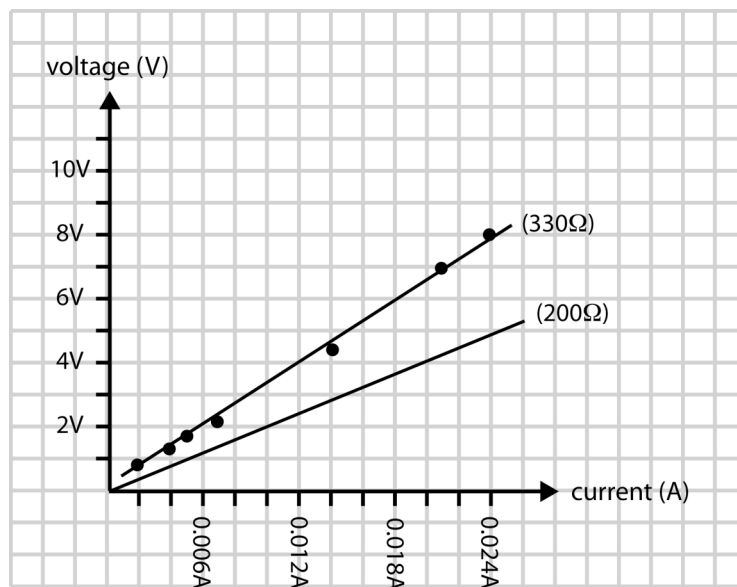
2. What is the relationship between the voltages across resistors **in series around a circuit** (V_1 or V_2 plus $V_3 = ?$)

The voltages around the circuit add to make the total battery voltage.

$$V_1 \text{ (or } V_2) + V_3 = V_4$$

Part 1

Voltage	7.9V	6.9V	4.5V	2.2V	1.6V	1.2V	0.8V
Current (mA)	24mA	21mA	14mA	7mA	5mA	4mA	2mA
Current (A)	0.024A	0.021A	0.014A	0.007A	0.005A	0.004A	0.002A
Resistance (Ω)	330 Ω	330 Ω	330 Ω	330 Ω	330 Ω	330 Ω	330 Ω



1. Draw a line of best fit on the graph and use the gradient to estimate the resistance of the measured resistor.

From the graph: gradient $\approx 8V \div 0.024A = 333$

The gradient of the line of fit is approximately 330 Ω .

2. How close to 330 Ω were you? Does the value of your gradient fit within the tolerance of the resistor?

The gradient of the graph should be within the 5% tolerance of the resistance.

Part 2

Voltage	7.54V	8.89V	8.94V	9.11V	9.18V	9.22V
Current (mA)	74	8.81	5.82	0.91	0.13	0.09
Current (A)	0.074	0.00881	0.00582	0.00091	0.00013	0.00009
Resistance (Ω)	100 Ω	1,000 Ω	1,500 Ω	10,000 Ω	68,000 Ω	100,000 Ω

From the data that you recorded above, describe what happens to the current through the circuit as the resistance is increased, with a constant voltage applied.

As the resistance is increased, the current decreases.

Page 25

Part 1

1. Which of the two LEDs in the circuit has a greater current flowing through it? How do you know this?

LED B has the greater current - this can be seen by the higher brightness.

2. List at least two reasons why a transistor might be placed in a circuit.

Transistors can be used as electronic switches, where a small base current switches on the main collector / emitter current.

Transistors can also be used as an amplifier - a small current signal to the base causes a higher collector / emitter current signal.
