NAME: ____________________________________

SCHOOL: ____________________________________

GRADE: ____________

PHYSICAL SCIENCES

GRADE 12 SBA TASK TERM 3

ELECTRIC CIRCUITS (Internal Resistance)

EXAMINER	**:**	**BLESSING CHIRISA**
MODERATOR	**:**	**ALBI PALMER**
TIME	**:**	**1 $\frac{1}{2}$ hours**
MARKS	**:**	**65**

PART A

Determine the internal resistance of a battery

AIM:
To determine the internal resistance of a battery

INVESTIGATIVE QUESTION:

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____ **(2)**

HYPOTHESIS:

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____ **(2)**

VARIABLES:

- **INDEPENDENT VARIABLE:** ____ **(2)**
- **DEPENDENT VARIABLE:** ____ **(2)**
- **CONTROL VARIABLE:** ____ **(2)**

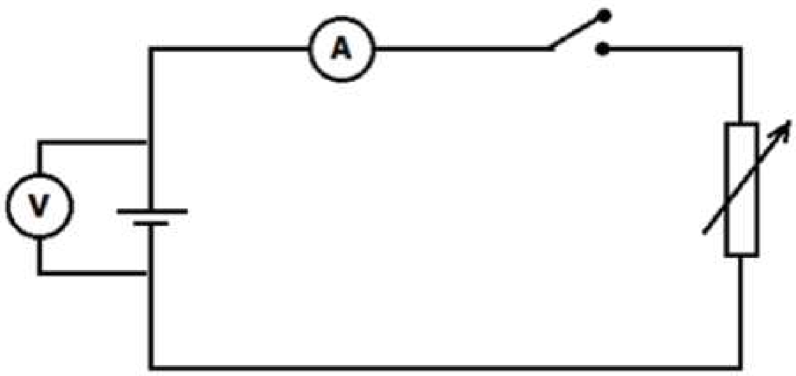
APPARATUS

Voltmeter (or multimeter)
Ammeter (or multimeter)
Any size carbon-zinc battery (Choose voltage in relation to the values of the resistors)
Battery holder
Rheostat
Connecting wires
Switch

METHOD

1. Set the rheostat to any resistance
2. Take the reading on the voltmeter and ammeter.
3. Repeat step two 5 times (or more) after changing the resistance provided by the rheostat each time.
4. Tabulate the terminal potential difference (volts)- and electric current (amperes) readings obtained.

EXPERIMENTAL SET-UP



NB. DO NOT KEEP THE SWITCH ON TOO LONG. IT WILL HEAT THE BATTERY AND CAUSE IT TO RUN DOWN.

TABLE OF RESULTS

	TERMINAL POTENTIAL DIFFERENCE (VOLTS)	ELECTRIC CURRENT (AMPERES)
1. (TRIAL RUN)		
2.		
3.		
4.		
5.		

(8)

INTERPRETATION OF RESULTS

1.1 Using the information in the table above, plot the points and draw the line of best fit on the attached GRAPH SHEET, Figure 1.1 (6)

1.2 Is the gradient of the graph a **positive** or a **negative**? Explain your answer (3)

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1.3 Use the graph to determine the **internal resistance** of the battery. (4)

1.1 Graph

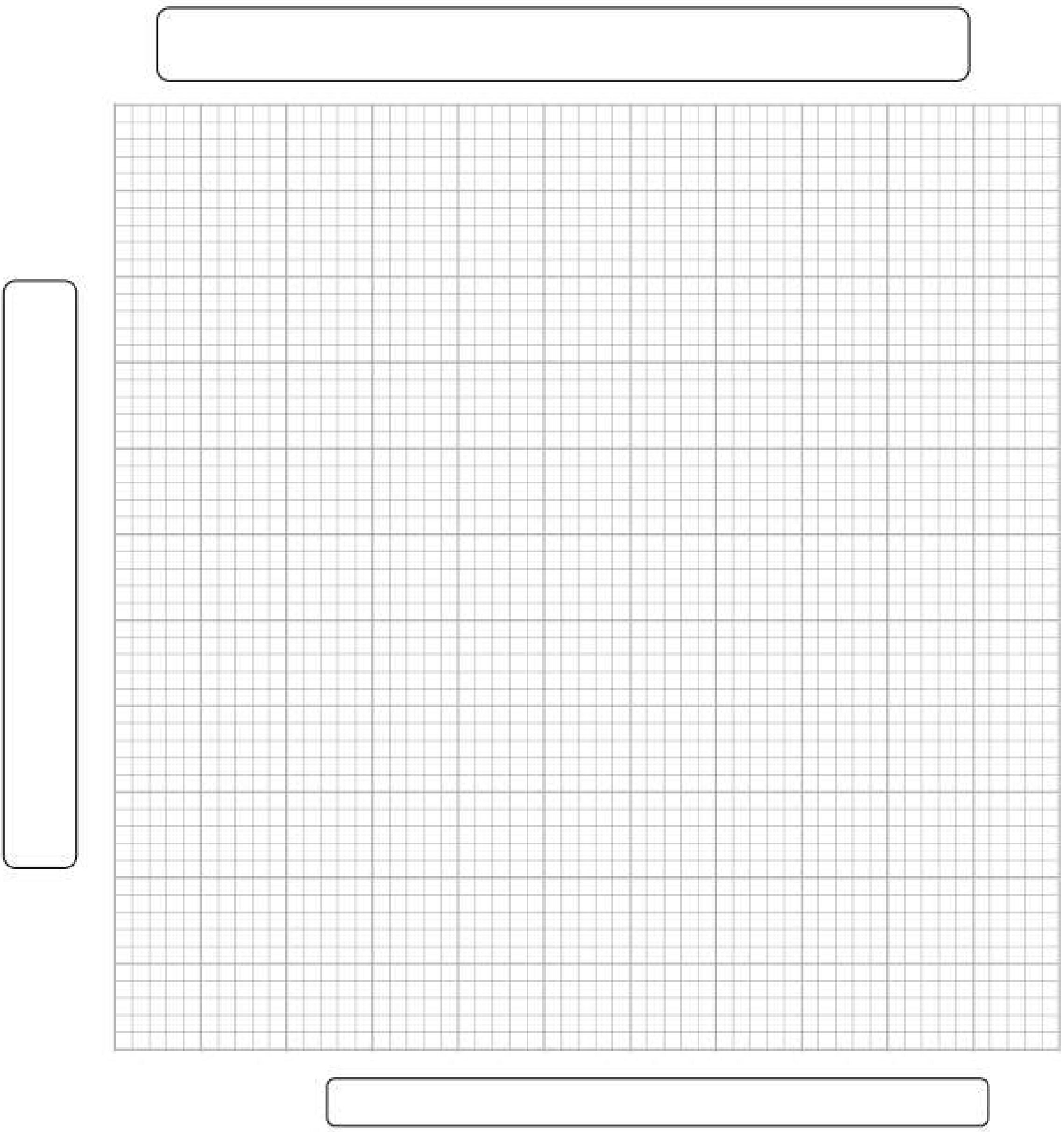


Figure 1.1

1.4 Which point on your graph represents the **emf** of the battery? Explain. (4)

1.5 Draw a **conclusion** from the results obtained. (2)

CONTROLLED QUESTIONS

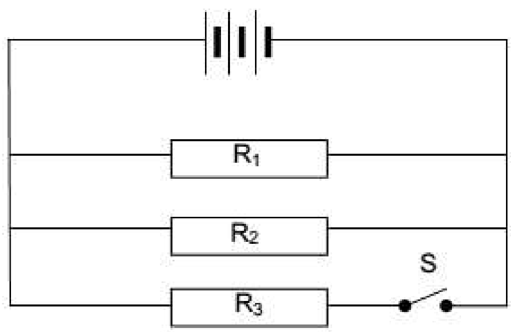
(These questions must be written under controlled circumstances)

QUESTION 1

1.1 Two resistors of equal resistance are connected in SERIES to a battery with negligible internal resistance. The current through the battery is I.
When the two resistors are connected in PARALLEL to the same battery, the current through the battery will be …

A ½I.
B I.
C 2I.
D 4I. (2)

1.2 Consider the circuit diagram below.

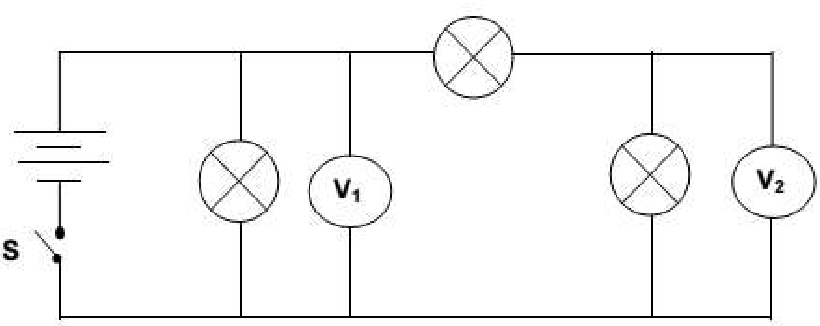


Which ONE of the following correctly describes the change in total resistance and total current when switch S is closed?

	TOTAL RESISTANCE	TOTAL CURRENT
A	Decreases	Decreases
B	Increases	Increases
C	Decreases	Increases
D	Increases	Decreases

(2)

1.3 Three identical light bulbs are connected in a circuit as shown below. The resistances of the battery and connecting wires can be ignored.



Which ONE of the following statements is CORRECT when switch S is closed?

The reading on V1 is …

A half that on V_2.

B equal to that on V_2.

C twice that on V_2.

D three times that on V_2. (2)

1.4 The minimum value of the resistance that can be obtained by connecting two 4 Ω resistors is ...

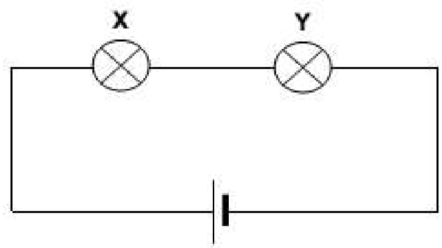
A 1 Ω

B 2 Ω.

C 3 Ω.

D 8 Ω (2)

1.5 The diagram below shows two light bulbs, X and Y, connected in series to a battery with internal resistance.



If bulb X glows brighter than bulb Y, then the …

A current through bulb X is smaller than that through bulb Y.

B resistance of bulb X is smaller than that of bulb Y.

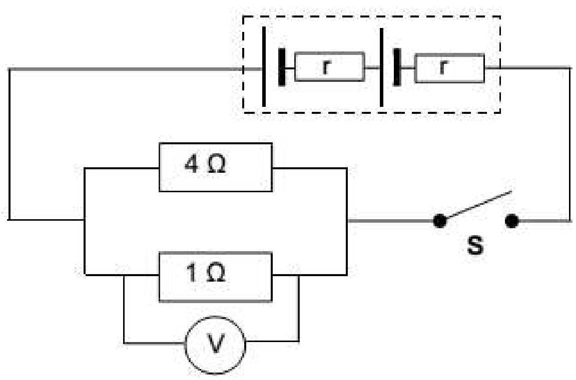
C resistance of bulb X is greater than that of bulb Y.

D current through bulb X is greater than that through bulb Y. (2)

[10]

QUESTION 2

Two identical cells, EACH with an emf of 1,5 V and an internal resistance r, are connected in series with each other and to the resistors as shown below.



2.1 Define, in words, the term *electromotive force (emf)* (2)

2.2 Write down the total emf of the circuit. (1)

When switch S is closed, the potential difference across the 4 Ω resistor is 2,8 V.

2.3 Calculate the total current in the circuit. (5)

2.4 Calculate the internal resistance r of EACH cell. (5)

2.5 An unknown resistor is now connected in parallel with the 4 Ω and 1 Ω resistors. How will this change affect the magnitude of:

2.5.1 The internal resistance of the battery
Write down only INCREASES, DECREASES or REMAINS THE SAME. (1)

2.5.2 The reading on the voltmeter
Write down INCREASES, DECREASES or REMAINS THE SAME.
Explain the answer by referring to resistance, current and 'lost volts'. (4)

[18]

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

ELECTROSTATICS/*ELEKTROSTATIKA*

$F=\frac{kQ_1Q_2}{r^2}$	$E=\frac{kQ}{r^2}$
$V=\frac{W}{q}$	$E=\frac{F}{q}$
$n=\frac{Q}{e}$ or/*of* $n=\frac{Q}{q_e}$	

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$R=\frac{V}{I}$	emf (ε)= $I(R + r)$ emk (ε)= $I(R + r)$
$R_s = R_1 + R_2 + ...$ $\frac{1}{R_p}=\frac{1}{R_1}+\frac{1}{R_2}+ ...$	$q = I\,\Delta t$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P=\frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P=\frac{V^2}{R}$

ALTERNATING CURRENT/*WISSELSTROOM*

$I_{rms}=\frac{I_{max}}{\sqrt{2}}$ / $I_{wgk}=\frac{I_{maks}}{\sqrt{2}}$ $V_{rms}=\frac{V_{max}}{\sqrt{2}}$ / $V_{wgk}=\frac{V_{maks}}{\sqrt{2}}$	$P_{ave}=V_{rms}I_{rms}$ / $P_{gemiddeld}=V_{wgk}I_{wgk}$ $P_{ave}=I_{rms}^2R$ / $P_{gemiddeld}=I_{wgk}^2R$ $P_{ave}=\frac{V_{rms}^2}{R}$ / $P_{gemiddeld}=\frac{V_{wgk}^2}{R}$