

This Exam Includes Four Exercises. It Consists of two Pages Numbered from 1 to 2.  
The Use of Non-Programmable Calculator is allowed.

**Exercise 1:****MCQ**

The document to the right shows the indications found on the back of a PlayStation.

Choose the correct answer with justification.

- 1) The electric current that traverses the Play station is:
  - a. 600mA
  - b. 1666.6mA
  - c. 132mA
- 2) The electrical energy consumed by the PlayStation during two hours is:
  - a. 264 KWhr
  - b. 0.264KWhr
  - c. 264 J
- 3) A Grade 9 student plays with the PlayStation two hours daily for 8 days in a month. The electrical energy consumed during one month is:
  - a. 2112 KWhr
  - b. 2.112 KWhr
  - c. 2112J
- 4) knowing that the price of 1KWhr is 50000L.L, the monthly cost of normal functioning of the Play station during one month is:
  - a. 105000L.L.
  - b. 1000000L.L
  - c. 105600L.L

**Doc.1****Exercise 2:****Verifying Ohm's Law**

In a practical session, a group of students from Gr9 class have an adjustable DC voltage generator (G), a resistor (D) of resistance R, an ammeter (A), a voltmeter (V), a switch (K) and connecting wires.

In order to trace and study the current-voltage characteristic curve of the resistor (D), these students, after having made the appropriate electrical circuit, carried out measurements using the voltmeter (V) and the ammeter (A).

The following table shows some of the measurements obtained.

U(V)	0	2	3	
I(mA)			15	50

- 1) Draw the circuit that allows us to obtain the values in the table.
- 2) Show that  $R = 200\Omega$
- 3) Copy and complete the table above.
- 4) Plot the current-voltage characteristic of the ohmic conductor (D).

Scales: on the x-axis: 1cm  $\leftrightarrow$  10mA on the y-axis: 1cm  $\leftrightarrow$  1V

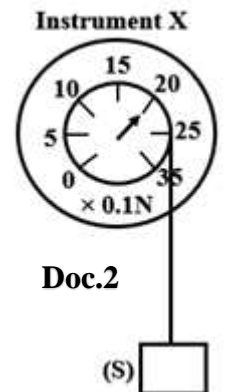
- 5) Complete the following sentence: The curve is an ..... Straight line and passing through the ....., thus it verifies ..... Law.

### Exercise 3: Identifying instrument X

The aim of this experiment is to determine the mass of solid (S). A student measures the weight of the solid (S) using instrument X as shown in document 2.

**Given:**  $g=10 \text{ N/Kg}$ .

- 1) What is the name of the instrument X?
- 2) What is the type of the weight force?
- 3)
  - 3.1) Using the document 2, find the magnitude of the weight force acting on (S).
  - 3.2) List the characteristics of the weight force.
  - 3.3) Redraw document 2, and represent the weight force acting on (S) using the scale:  $1\text{cm} \rightarrow 1\text{N}$ .
- 4) Show that the mass of solid (S) is  $m = 200\text{g}$ .
- 5) The same experiment is done now on the surface of the moon.
  - 5.1) What is the value of the mass of (S) on the surface of the moon? Justify.
  - 5.2) Does the gravity on the surface of moon change? Why?
  - 5.3) Knowing that the weight of (S) on the surface of the moon is  $w_{\text{moon}} = 0.333\text{N}$ . Calculate the gravity of the moon.
  - 5.4) Deduce that the relation between the gravity of earth and the gravity of the moon is  $g_{\text{moon}} = \frac{g_{\text{earth}}}{6}$



### Exercise 4: DC Circuit

An electric circuit consists of a dry cell that provides a DC voltage  $U_{PN}=12\text{V}$ , three lamps that are not identical, an oscilloscope that is connected across the terminals of  $L_3$ , an ammeter A, and a switch K, these elements are connected as shown in the given document 3

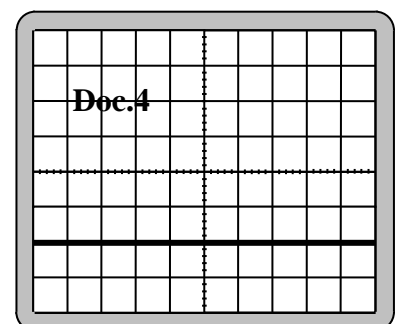
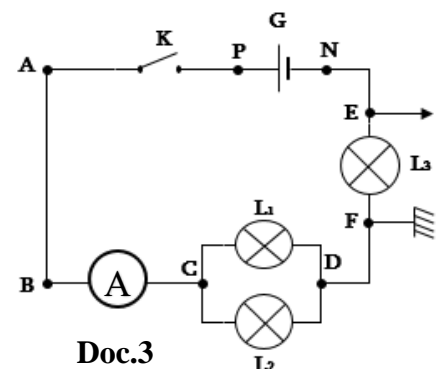
#### First case: Switch K is opened:

- 1) What is the voltage across the switch and each lamp.
- 2) What is the value of the current that traverses the circuit?

#### Second case: Switch K is closed:

When we close the switch K, the ammeter A indicated  $-500\text{mA}$ , document (4) shows the screen of the oscilloscope connected across  $L_3$  having a vertical sensitivity  $S_v = 2\text{v/div}$ . the lamp  $L_1$  carries the following indications  $L_1$  ( $8\text{v}$ ,  $200\text{mA}$ )

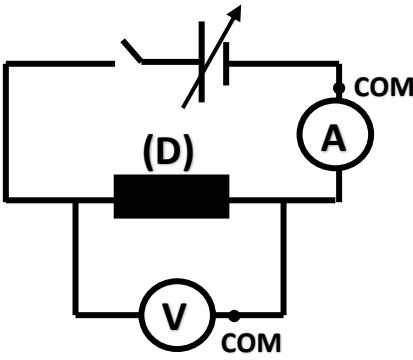
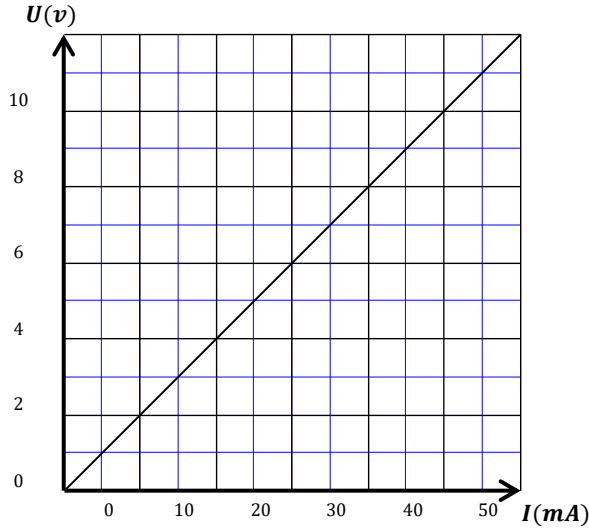
- 1) Redraw the figure again and show the COM terminal of the ammeter A.
- 2) The current traversing  $L_3$  is  $500\text{mA}$ . Why?
- 3) Specify whether the oscilloscope reads  $U_{EF}$  or  $U_{FE}$ ? Calculate the voltage across  $L_3$ .
- 4) Deduce that  $U_{CD} = 8\text{v}$ . Deduce the voltage across  $L_1$  and  $L_2$ .
- 5) The lamp  $L_1$  functions normally. Why?
- 6) Determine the current that flows across  $L_1$  and  $L_2$ .
- 7) A wire is connected between the terminals of  $L_3$ . Calculate the new voltage across  $L_1$ , then deduce what would happen to lamp  $L_1$ .



**Exercise 1:**

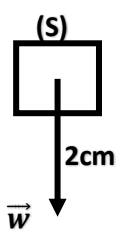
Part	Answer	Mark
1	$I = \frac{P}{U} = \frac{132}{220} = 0.6A = 600mA$	
2	$P = 132W = 0.132KW$ $E = P \times t = 0.132 \times 2 = 0.264KWhr$	
3	$E_{monthly} = 0.264 \times 8 = 2.112KWhr$	
4	$Cost = 2,112 \times 50000 = 105600L, L$	

**Exercise 2:**

Part	Answer	Mark										
1												
2	By ohm's law: $U = RI \Rightarrow R = \frac{U}{I} = \frac{3}{15 \times 10^{-3}} = 200\Omega$											
3	<table border="1" data-bbox="523 1276 1129 1406"> <tbody> <tr> <td>U(V)</td> <td>0</td> <td>2</td> <td>3</td> <td>10</td> </tr> <tr> <td>I(mA)</td> <td>0</td> <td>10</td> <td>15</td> <td>50</td> </tr> </tbody> </table>	U(V)	0	2	3	10	I(mA)	0	10	15	50	
U(V)	0	2	3	10								
I(mA)	0	10	15	50								
4												

5	The curve is an increasing Straight line and passing through the origin, thus it verifies ohm's Law.	
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**Exercise 3:**

Part	Answer	Mark
1	Spring balance	
2	Acting from a distance	
3	3.1 $w = \text{Reading} \times \text{Scale} = 20 \times 0.1 = 2N$	
	3.2 P.O.A: Center of gravity of the box L.O.A: Vertical straight line Direction: Vertically downwards	
	3.3 $1\text{cm} \rightarrow 1N$ $X\text{ cm} \rightarrow w = 2N$ $X = 2\text{cm}$ 	
4	$w = m \times g \Rightarrow m = \frac{w}{g} = \frac{2}{10} = 0,2Kg = 200g$	
5	5.1 $m = 200g$ , since mass is constant, it do not change	
	5.2 Yes, since the gravity differes from one planet to another	
	5.3 $w_{moon} = m \times g_{moon} = g_{moon} = \frac{w_{moon}}{m} = \frac{0,333}{0,2} = 1,665N/Kg$	
	5.4 $\frac{g_{earth}}{6} = \frac{10}{6} = 1,66 = g_{moon}$	

**Exercise 4:**

Part	Answer	Mark
<b>First Case</b>		
1	$U_K = U_{PN} = 12\text{v}$ The voltage across the lamps is zero	
2	$I = 0$	
<b>Second Case</b>		
1		
2	According to the law of uniqueness of current in series connection $I_{\text{main}} = I_{L3} = 500\text{mA}$	
3	The oscilloscope reads $U_{\text{Phase-Ground}}$ and the phase terminal is connected to E and the ground to F So it reads $U_{EF}$ $U_{EF} = S_V \times y = 2 \times -2 = -4\text{v}$ $U_{L3} = U_{FE} = -(-4) = +4\text{v}$	
4	According to law of addition of voltage in series connection $U_{PN} = U_{PA} + U_{AB} + U_{BC} + U_{CD} + U_{DF} + U_{FE} + U_{FN}$ $12 = 0 + 0 + 0 + U_{CD} + 0 + 4 + 0$ $U_{CD} = 12 - 4 = 8\text{v}$ According to the law of uniqueness of voltage in parallel connection: $U_{CD} = U_{L1} = U_{L2} = 8\text{v}$	
5	Since the voltage across ( $L_1$ ) is equal to the rated voltage so ( $L_1$ ) functions normally	
6	Since ( $L_1$ ) functions normally then the current traversing it is equal to the rated current, so $I_{L1} = 200\text{mA}$ According to the law of addition of current in parallel connection $I_{\text{main}} = I_{L1} + I_{L2}$ $500 = 200 + I_{L2}$ $I_{L2} = 300\text{mA}$	