First Name: ..... Given Name(s): ..... Faculty: ..... Group: .....

Lab Report: Measurement Techniques

Biophysics Lab – 2014/2015 first semester

Date of lab: .....

Measured together with: .....

Evaluation by lab teacher:
☐ ☐ ☐ ☐ to be corrected*

.....
☐ accepted signature

Aim of measurement:

Undestanding how analog and digital measuring instruments and oscilloscope works.

1. Basic electric measurements: measuring voltage, current, and resistance.
2. Measuring illuminance with a luxmeter.
3. Determining voltage, time, and resistance with digital oscilloscope.
4. Measuring the conductivity of solutions.

Measuring instrument and materials:

1st measurement: ..... (manufacturer) ..... (model) digital multimeter. Other objects included: a lantern battery, two resistors with known resistance (R_1 = ... Ω and R_2 = ... Ω), and another two with unknown resistance (R_{x1}, R_{x2}).

2nd measurement..... (manufacturer) ..... (model) luxmeter.

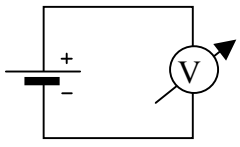
3rd measurement: ..... (manufacturer) ..... (model) digital oscilloscope.

4th measurement: ..... (manufacturer) ..... (model) conductometer with the matching measuring electrode. Other material included: deionized water, tapwater, and 500 mmol/L aqueous solution of NaCl.

Measurement results:

1. a. Determining the terminal voltage of the lantern battery

Measurement setup:



Measurement results:

measured or calculated quantity	*symbol*	*measured value with*		*unit*
		20 V	*200 V*	
		measuring range		
the measured voltage of the lantern battery	$U_{meas.}$	.....	.....	.....
least place-value	*, digit*	.....	.....	.....
uncertainty of measurement, H_{max}	H_{max}	.....	.....	.....
measured value with the uncertainty indicated	$U_{meas} \pm H_{max}$	.....±.....	.....±.....	.....

Measurement uncertainty: measured value · 0,5% + 1 digit.

* The parts to be corrected should be **repeated on a new sheet** that is attached to this one upon resubmission.

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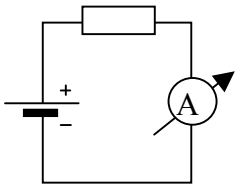
1.b. Measurement of electric current

Measurement setup: R = ... $k\Omega$



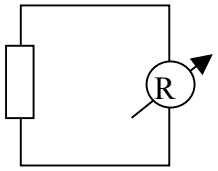
Results

The measured electric current $I_{meas.}$ = ... *mA*

The calculated resistance R = ... $k\Omega$

1. c. Measurement of resistance

Measurement setup:



Results

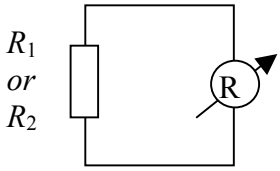
Resistance of the R_{x1} *resistor* R_{x1} = ... $k\Omega$

Resistance of the R_{x2} *resistor* R_{x2} = ... $k\Omega$

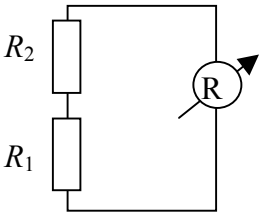
1. d. Series and parallel connection of resistors

Measurement setups:

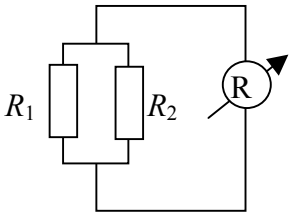
One by one



Connected in series



Connected in parallel



Measurement results:

measured or calculated quantity	*symbol*	*measured value*	*unit*	*calculated value*	*unit*
resistance of R_1	R_1	.....	.....		
resistance of R_2	R_2	.....	.....		
overall resistance of resistors in series	R_{series}	.....	.....	.....	.....
overall resistance of resistors in parallel	$R_{parallel}$	.....	.....	.....	.....

Calculations:

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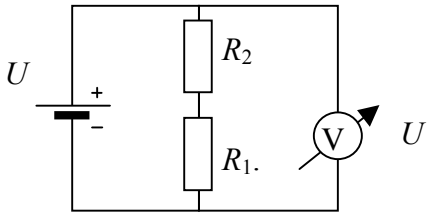
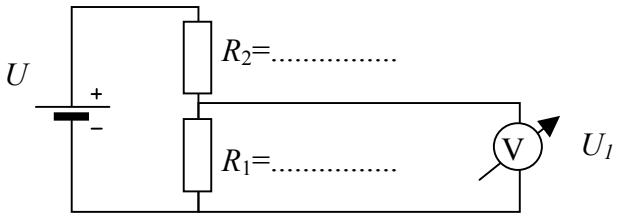
1. d. Measurement on a voltage divider

Measurement setup:





Measured voltage of lantern battery: U = ... *V*

Value of divided voltage: U_1 = ... *V*

Measured division ratio: U_1/U = ...

Calculated division ratio: $R_1/(R_1+R_2)$ = ...

Calculations:

2. Measurement of illuminance with luxmeter:

Illuminance without absorbent: $E_{v\ (w/o)}$ = ...

Illuminance with absorbent: $E_{v\ (w/)}$ = ...

Ratio of attenuation: $E_{v\ (w/)} / E_{v\ (w/o)}$ = ...

3. Measurement of conductance with analog conductometer

sample	*measured conductance*			
	symbol	*value*	*measurement uncertainty*	*unit*
deionized water	$G_{deion.}$	.....	±	.....
tapwater	$G_{tapw.}$	.....	±	.....
NaCl solution (500 mmol/L)	G_{NaCl}	.....	±	.....

(measurement uncertainty = measurement range · 2%)

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4. Measurement with oscilloscope

measured quantity	*symbol*	*method*	*sine wave signal*		..... *signal*	
			value	*unit*	*value*	*unit*
time period	*T*	*conventional*	.....	.....	.....	.....
		with markers	.....	.....	.....	.....
peak-to-peak voltage (double amplitude)	$U_{p\text{-}to\text{-}p}$	*conventional*	.....	.....	.....	.....
		with markers	.....	.....	.....	.....
effective voltage	U_{eff}	*calculation*	.....	.....		

Lab teacher's signature as proof of lab work: .....