

Baptist Lui Ming Choi Secondary School
E. 5 Physics
Circuit Worksheet 1

Finish the following tasks with the aid of **Electronics Workbench Demo**.
 Consult the handout **Electronics Workbench Demo reference** when required.

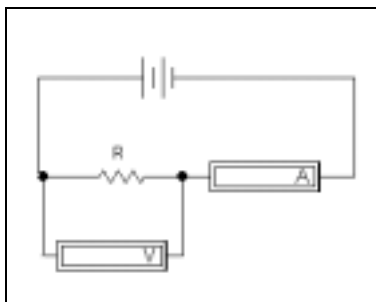
Task 1 Resistance of a resistor

Change the **internal resistance** of the ammeter and voltmeter to be **1 Ω** and **1 k Ω** respectively.

Change the resistance of the resistor R to be 500 Ω .

The battery is of **12 V**. With the aid of **Electronics Workbench Demo** connect up the following circuits and

calculate the resistance of the resistor R (= 500 Ω) using the readings measured by the meters..

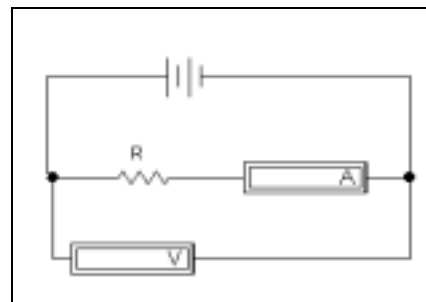


Circuit A

V = _____ V

I = _____ mA

$R = \frac{V}{I} =$ _____ Ω



Circuit B

V = _____ V

I = _____ mA

$R = \frac{V}{I} =$ _____ Ω

Which circuit give a **better value** of R (**closer to the real value of R**) ? Circuit _____

Reasoning

R_v – internal resistance of the voltmeter

I_r – current passing through the resistor

I_v – current passing through the voltmeter

R_a – internal resistance of the ammeter

V_r – voltage across the resistor

V_a – voltage across the ammeter

For circuit A :

(1) Ammeter measures the current through **R and voltmeter**

(2) Voltmeter measures the voltage across **R**

(3) When $R \cong R_v$ (in order), $I_r \cong I_v$ (same V),
 so the measured I ($=I_r + I_v$) $> I_r$, and
 calculated R ($= V / I$) is **smaller** than the real R.

For circuit B :

(1) Voltmeter measures the voltage across **R and ammeter**

(2) Ammeter measures the current through **R**

(3) When $R \gg R_a$, $V_r \gg V_a$ (same I),
 so measured V ($=V_r + V_a$) $\cong V_r$, and
 calculated R ($= V / I$) is **close to** real R

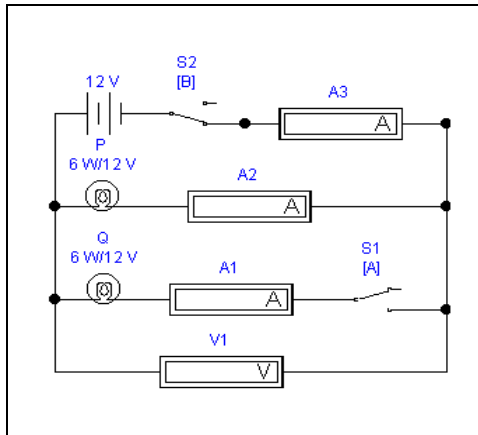
Now the calculated R is of the order of hundred Ohm, **close to the internal resistance of the voltmeter** and **much greater than the internal resistance of the ammeter**, so circuit _____ should be used.

When **R is close to the internal resistance of ammeter** and **much smaller than internal resistance of voltmeter**, circuit _____ should be used. (Why?)

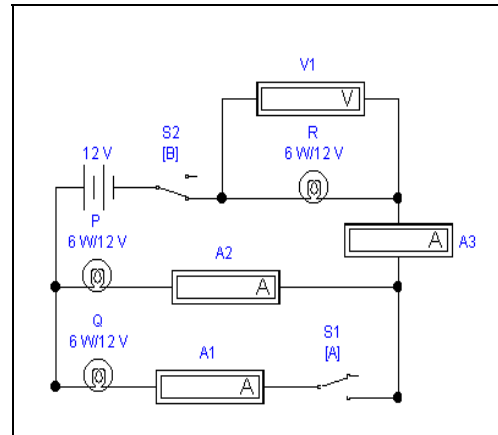
Task 2 Change in ammeter and voltmeter reading in different circuits

Change the internal resistance of ammeter and voltmeter to be $1\text{ M}\Omega$.

Put down increases, decreases or unchanged for statements 1 – 8 when the switch S1 in circuit A and B are opened.



Circuit A



Circuit B

	Circuit A	Circuit B
1. The reading of ammeter A1.	_____	_____
2. The reading of ammeter A2.	_____	_____
3. The reading of ammeter A3.	_____	_____
4. The reading of the voltmeter V1.	_____	_____
5. The brightness of bulb P.	_____	_____
6. The brightness of bulb Q.	_____	_____
7. The brightness of bulb R.	-----	_____
8. The power output from the battery.	_____	_____
9. When switch S2 in circuit A and B are opened, what should be the readings in all the meters?	_____	_____

Explain the above in terms of the connection of the circuits (simple parallel, a mix of series and parallel).