The characteristic current-voltage curves of a transistor (Item No.: P1383300)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 16-19
Topic: Electricity
Subtopic: Electronics
Experiment: The characteristic current-voltage curves of a transistor

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	10 Minutes	2 Students

Additional Requirements:

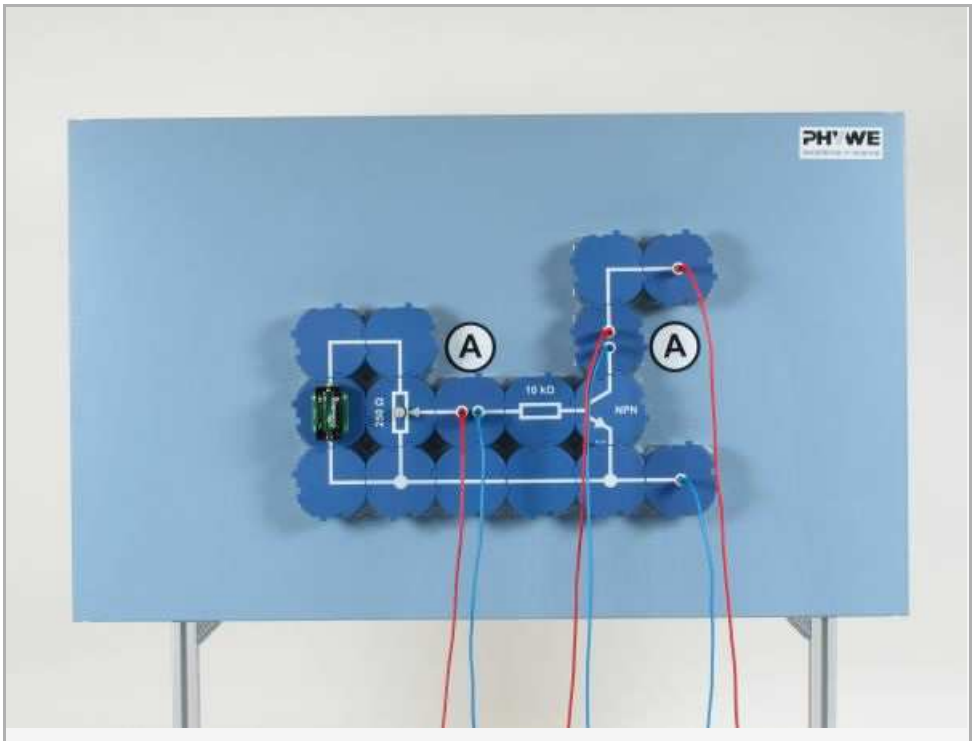
Experiment Variations:

Keywords:

Principle and equipment

Principle

The dependence of the strength of the collector current on the collector voltage is to be examined at various values of the base current.



Experimental set-up

Equipment

Position No.	Material	Order No.	Quantity
1	Multimeter ADM2, demo., analogue	13820-01	2
2	PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13500-93	1
3	Demo Physics board with stand	02150-00	1
4	Potentiometer 250 Ohm, module DB	09423-25	1
5	Transistor BC337,module DB	09456-00	1
6	Connector interrupted, module DB	09401-04	3
7	Junction, module DB	09401-10	2
8	Resistor 10 kOhm,module DB	09415-10	1
9	Electr.symbols f.demo-board,12pcs	02154-03	1
10	Connector, straight, module DB	09401-01	2
11	Connector, angled, module DB	09401-02	4
12	Connector, T-shaped, module DB	09401-03	2
13	Battery holder module (C type), SB	05605-00	1
14	Connecting cord, 32 A, 1000 mm, red	07363-01	3
15	Connecting cord, 32 A, 1000 mm, blue	07363-04	3
16	Battery cell, 1.5 V, baby size, type C	07922-01	1

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Set-up and procedure

- Connect up the circuit as shown in Fig. 1; select the 100 µA- measurement range for the base current measurement and the 30 mA- range for the collector current measurement; first set the potentiometer and the power supply regulator to zero.
- Switch on the power supply; set the voltage on the power supply to 1 V.
- Increase the base current I_B in steps of 10 µA, measure and note the collector current I_C at each step.
- Increase the power supply voltage stepwise to 10 V and, at each step, adjust I_B and read off and note the measured value after checking the base current and correcting it if necessary.

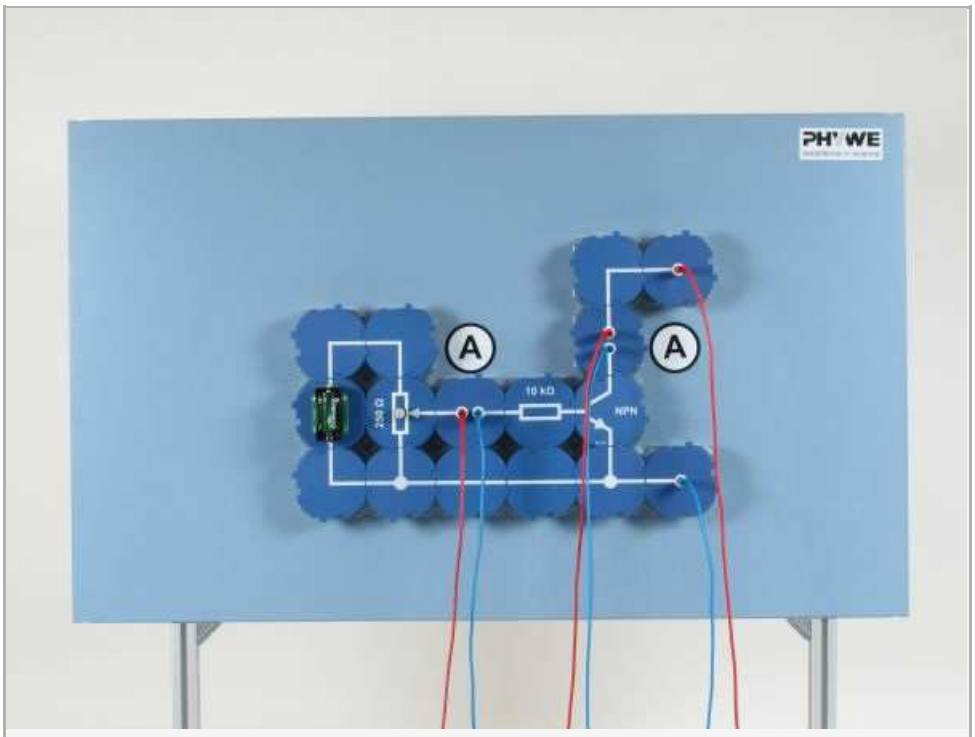

Fig. 1

Observation and evaluation

Observation

Table 1: The collector current I_C (in mA) in dependence on the collector voltage at various values of the base current.

$\frac{U_{CE}}{V}$ / $\frac{I_B}{\mu A}$	1	2	4	6	8	10
10	3.2	3.3	3.6	3.7	3.8	4.0
20	6.6	6.7	6.8	7.0	7.5	8.1
30	10.5	11.0	11.3	11.5	11.8	12.5
40	15.0	15.2	15.7	15.9	16.2	17.0
50	18.0	19.0	19.5	19.8	20.0	22.0

Evaluation

The dependencies of the collector current on the collector voltage at various values of the base current that are graphically shown in Fig. 2 are the characteristic output curves for the transistor.

In all characteristic curves, the collector current increases sharply at low values of the collector voltage, but then hardly changes on further increasing the voltage. The strength of the collector current so depends predominately on the base current, and small changes in this cause great changes in the collector current.

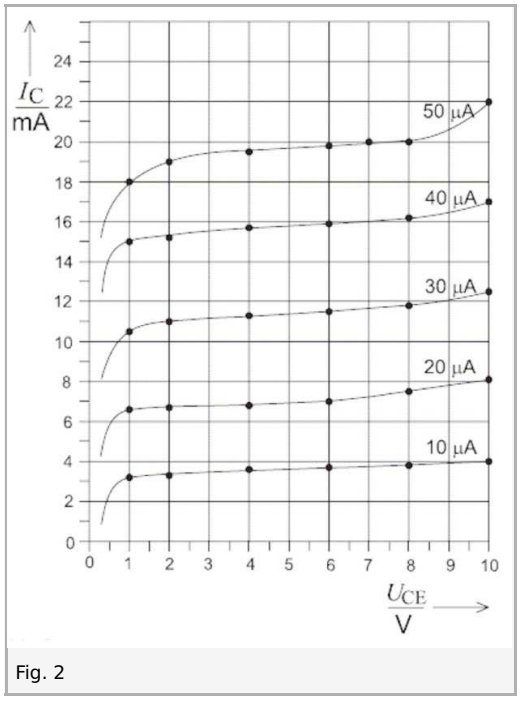

Fig. 2

Remarks

It can be observed that the collector current continually increases at higher collector voltages and collector currents, as the power dissipation $P_D = U_{CE} \cdot I_C$ leads to heating of the barrier layer and so to an increase in the number of charge carriers. The transistor should therefore only be used for a short time under these conditions.

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