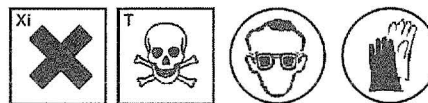


It is to be demonstrated that an electric potential is created between two electrodes of different metals when they are dipped in an aqueous solution of an electrolyte

Equipment

Physics demonstration board, with frame	02150.00	1
Connector, straight, DB	09401.01	1
Connector, angled, DB	09401.02	4
Connector, T-shaped, DB	09401.03	2
Connector, interrupted, DB	09401.04	2
Switch on/off, DB	09402.01	1
Clamp on fixing magnet	02151.01	1
Motor, 2 V	11031.00	1
Disc for motor, 2 V	11031.01	1
Support plate with holder, DB	09471.00	1
Pneumatic trough, 100 x 50 x 120 mm	06620.00	1
Plate electrode holder	06618.00	2
Copper electrode 76 mm x 40 mm	45212.00	1
Zinc electrode 76 mm x 40 mm	45214.00	1
Lead electrode 76 mm x 40 mm	45215.00	1
Iron electrode, 76 x 40 mm	45216.00	1
Connecting cable, 25 cm, red	07360.01	2
Connecting cable, 25 cm, blue	07360.04	2
Connecting cable, 100 cm, red	07363.01	1
Connecting cable, 100 cm, blue	07363.04	1
Analog demonstration multimeter ADM 2	13820.00	1
Electr. symbols f. demo-board	02154.03	1
Sulphuric acid, 10%, tech. gr., 1000 ml	31828.70	1
Spoon with spatula end, 18 cm, plastic	38833.00	1
Sandpaper, medium, 1 from	01605.02	(1)
Water		
Absorbent cloth or paper		

Safety Precautions



R: 36/38/61-62-E20/22-33

S: 7-26/53-37-45

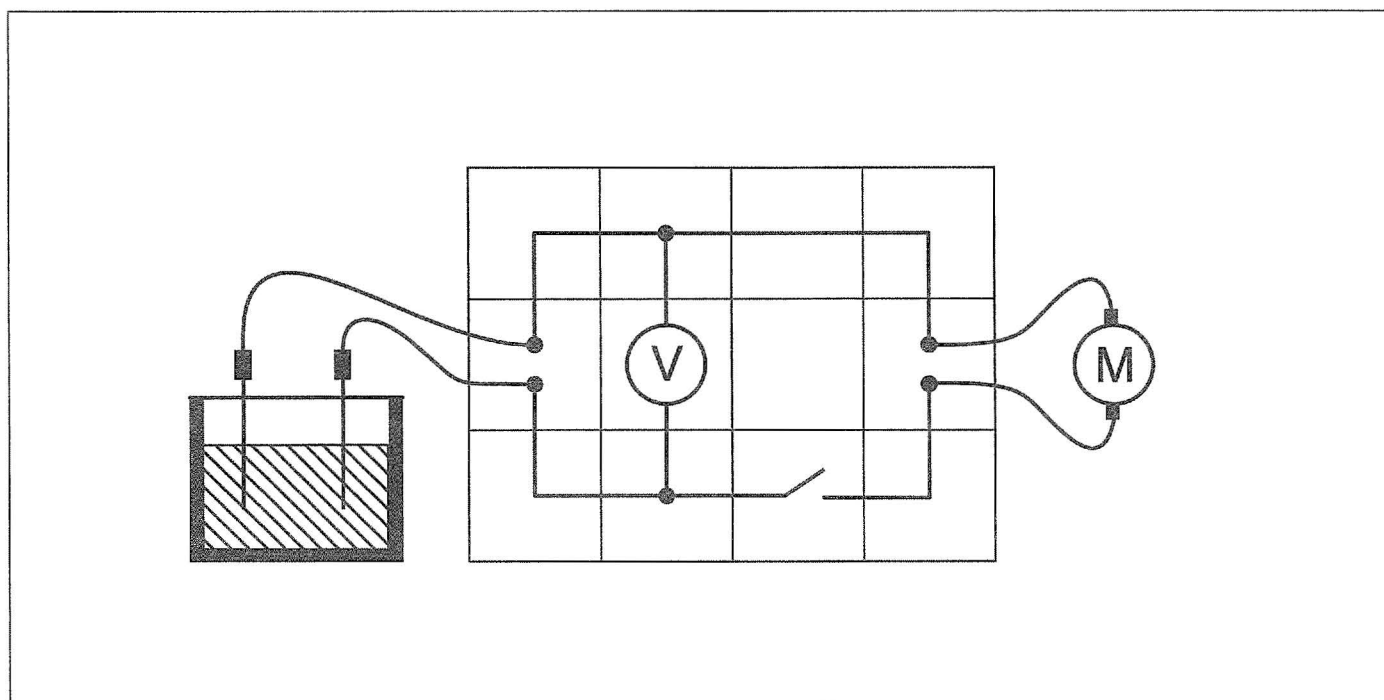
Dilute sulphuric acid is highly corrosive to skin, eyes and mucous membranes. Aerosols irritate the respiratory organs. Lead is a hazard to health. Carry out cleaning of the lead electrodes in a fume cupboard if possible! Wear protective gloves! Wash hands at the end of the experiment.

Wear eye protection!

Set-up and Procedure

- After thorough cleaning of the glass trough and all electrodes, half-fill the trough with water, add a few ml of sulphuric acid and stir
- Set up the experiment as in Fig. 1, set to the 1 V measurement range and first dip the copper and zinc electrodes in the aqueous solution, taking care that the (+) connection of the voltmeter is connected to the copper electrode
- Read the voltage and enter it in the Table
- Close the switch and observe the motor (1); open the switch
- Successively replace one electrode with another and – if necessary – reverse the polarity of the voltmeter; measure each voltage and enter it in the Table together with the corresponding polarity of the electrodes

Fig. 1



- Finally, measure the copper and zinc electrode combination once again
- Lift one or both the electrodes out of the solution a little, so that the effective electrode surface area is reduced, while watching the voltmeter (2)
- Reduce or increase the distance apart of the electrodes while watching the voltmeter (3)

Waste Disposal

Dilute remainders of acids with water, neutralize them (pH 6-8) and flush then to drain.

Pour solutions containing heavy metal ions or salts into an appropriately labelled container and subject them to proper disposal.

Observations and Measurement Results

See the Table 1

- (1) The motor runs
- (2) The voltage remains unchanged
- (3) The voltage again remains unchanged

Evaluation

When two electrodes of different metals are dipped in an aqueous solution of an electrolyte, then an electric potential is created between them. Such a set-up is named a galvanic cell.

The value of the potential is dependent on the materials of the electrodes, but not on their surface area or distance apart.

The creation of a potential in a galvanic cell can be explained by the passage of positive metal electrons from the electrode surface into the solution, which leaves free mobile electrons behind. As this occurs to different extents with different metals, they are negatively charged to different extents. The difference in the charges on the electrodes gives a potential that can be measured with a voltmeter, and be utilized to drive electrical equipment.

Remarks

The measured values in the Table are only to be taken as approximate values, because the potential that can be attained is highly dependent on the chemical nature of the surface of the electrode. It is therefore important, particularly for lead electrodes, that they the surfaces are previously thoroughly cleaned.

When the electrodes in each combination measured are ordered so that the metal that was electrically positive it is to the left of the other metal, then the succession found is: Cu-Pb-Fe-Zn.

Table 1

Left electrode		Right electrode		Potential U/V
Material	Polarity	Material	Polarity	
Cu	+	Zn	-	0.95
Cu	+	Pb	-	0.43
Cu	+	Fe	-	0.49
Cu	0	Cu	0	0.00
Fe	-	Pb	+	0.18
Fe	+	Zn	-	0.50
Zn	-	Pb	+	0.59