Physical Experiments I

Pre-lab Assignment

The Potentiometer

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Score

Answers to Questions (20 points)

(1) **Can we use a voltmeter to measure the EMF of a cell? Why?**

We can't use the voltmeter to measure it.

Because the terminal voltage of a cell is the potential difference between its terminals. The EMF of a cell may be defined as the terminal voltage of the cell when not under load, that is delivering no current fig 3.15-2 shows a circuit to measure the terminal voltage of a cell by a voltmeter. since a voltmeter is always connected in parallel with the component or components under test, it draws some current in the tested circuit. the measured terminal voltage is always lower than the EMF due to the current I through the circuit and intimal resistance of the battery. So we can't use the voltmeter to measure it.

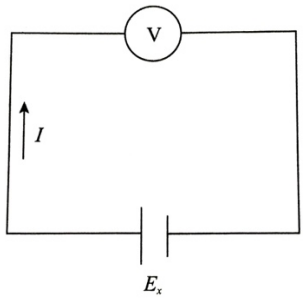

Fig. 3.15-2 Measurement of the terminal voltage of a cell by a voltmeter

(2) **What is the null balance measuring method in electricity?**

Figure 3.15-3 shows the schematic circuit diagram of the null

balance measuring method. The galvanometer G is a sensitive device capable of indicating the presence of very small current. Its purpose is to accurately indicate a condition of zero current, rather than to indicate any specific (nonzero) quantity as a normal ammeter would e is a standard cell, whose EMF is adjustable. when the deflection of the galvanometer is observed, adjust the EMF of the standard cell until the galvanometer no longer deflects from zero It means the galvanometer draws no current from the unknown source, and the magnitude of the unknown EMF is equal to that of the standard cell. The key point of null balance measuring method is to measure electrical potentials without any current draw.

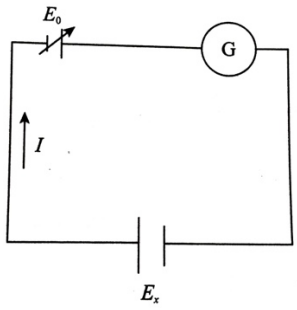

Fig. 3.15-3 Schematic circuit diagram of the null balance measuring method

(3) **In Fig 3.15-4, consider $E_s = 2.00V$. What is the resistant value of R in order to obtain a working current of 5.00mA in the source circuit? In the measuring circuit. R_x is 201.5Ω when the galvanometer read zero. What's the measured EMF.**

When the galvanometer reads zero, the current in the source circuit is equal to the current in the calibration circuit, so we can obtain the R by applying the Ohm's law:

$$R = \frac{E_s}{I} = \frac{2}{0.005} = 400\Omega$$

So $R = 400\Omega$.

Since the resistant R_x doesn't draw any current in the measurement circuit. We have:

$$E_x = R_x I = 201.5\Omega \times 0.005A = 1.0075V$$

So the EMF is $E_x = 1.0075V$.