

## Physics Investigation 6 Teacher Manual

### Observation

When the escalator carries more passengers, the handrail of the escalator move faster than the escalator steps.

### Problem

What changes occur in the motor when a heavier load is to be moved?

### Hypothesis

The magnitude of the electric current flowing through a motor changes with the load.

### Aim

To investigate how the magnitude of current flowing through a motor varies with the load.

### Principle

If a motor is operated by a supply voltage  $V$  and the current flowing through the motor is  $I$ , then the electrical power supplied to the motor,  $P$ , is the product of voltage and current,  $VI$ . The motor converts the electrical energy into mechanical energies (kinetic energy and potential energy) for raising the load. Some energy might be dissipated over the resistance of the circuit.

When a current is flowing through the motor, the motor rotates. A turning torque is provided by the motor. This torque is responsible for raising the load.

In this investigation, the following variables are involved :

- independent variable - load
- dependent variable - current

### Equipment and materials

- data logging interface x 1
- current sensormeter x 1
- desktop computer x 1
- motor x 1
- scotch tape x 1
- scissors x 1
- 20g weights x 10
- inelastic string x 1
- battery pack (6V) x 2

## Set-up of experiment



## Procedure

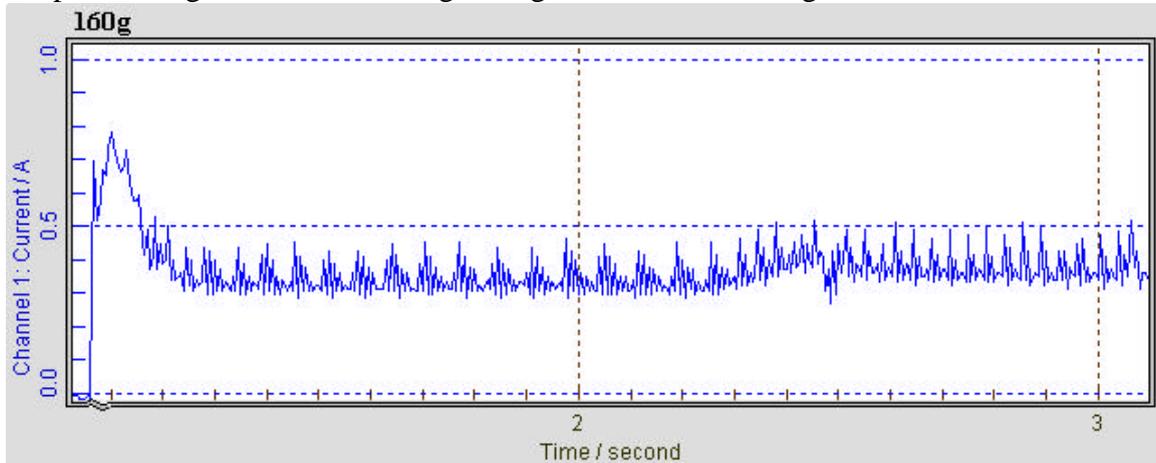
1. Connect a current sensor, a motor and a switch in series to a battery (6V);
2. Connect the current sensor to the computer via the datalogging interface. Open the Datadisc 32 software programme;
3. Tie a load of 240g to a string which rotates around the wheel of the motor. Put the load on the floor;
4. On the computer, press the button “**Measure**”, followed by “**Record**”. Set the time interval to 10s and start recording. At the same time, close the switch to switch on the motor;
5. When the load has reached the motor, stop the motor and the recording;
6. Plot a graph of current against time;
7. Transfer the data of the part of the graph where the current is steady to Microsoft Excel and find a mean value of the steady current;
8. Repeat steps (3) – (7) with different loads of 220g, 200g, 180g, 160g, 140g, 120g, 100g;
9. Plot a graph of the average current against load.

## Precautions

- 1) Add lubricant oil to the movable part of the motor to ensure that the rotating speed is more uniform;
- 2) Do not use a very heavy load, otherwise it will cause the motor to overheat ;
- 3) The motor should be switched off when not taking measurements.

## Results

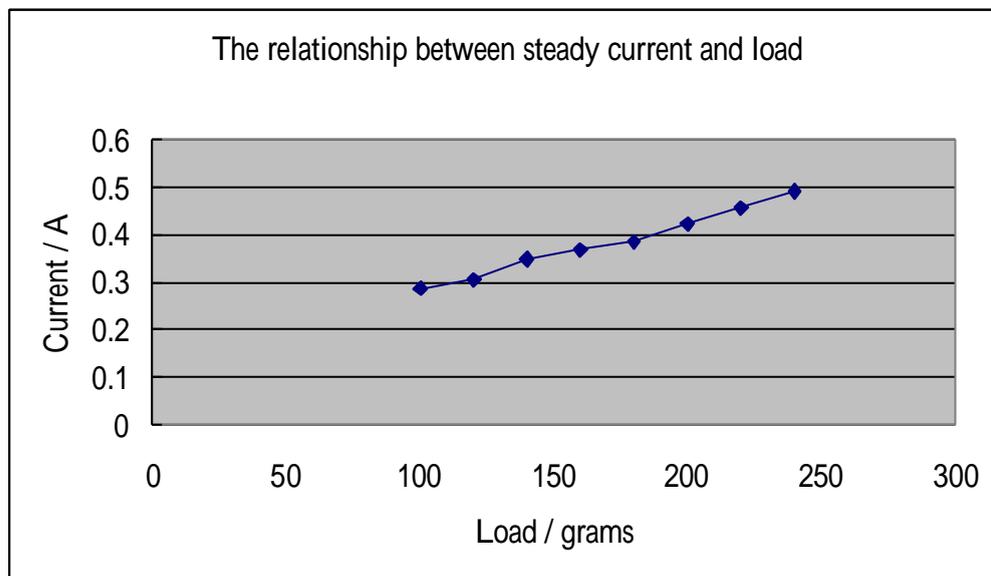
Graph showing the current flowing through the circuit for 160g load



The current first rose to a large value and then dropped to a steady value.

Table of steady current against load :

Load / g	140	160	180	200	220	240
Current / A	0.349	0.369	0.385	0.422	0.456	0.491



## Interpretation

1. By plotting steady current against load, a straight line was obtained. The current flowing through the motor was found to be directly proportional to the load.

**Possible errors**

1. The masses of the slotted weights might be slightly different from the marked values;
2. As the motor did not rotate steadily, the current fluctuated. The average current found might not be accurate;
3. There was friction between the string and the motor and within the motor, which increased the load to the motor.

**Improvements**

1. Check the masses of slotted weights using an electronic balance;
2. The relations between voltage supply and load, current and speed of load, voltage supply and speed of load are worth further investigation.

**Conclusion**

From the experiment, it was concluded that the electric current flowing through the motor was directly proportional to the load moved.