

Higher

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Resistance

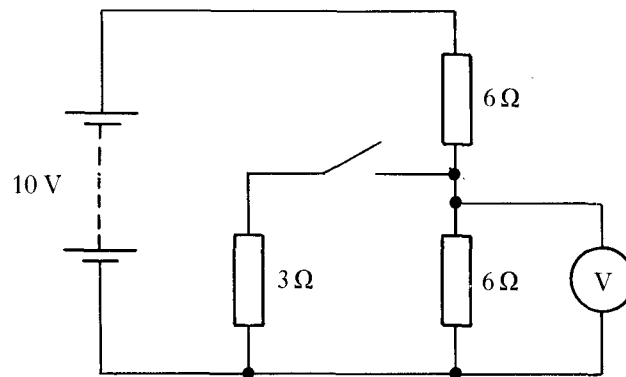
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Past Paper questions

1991 - 2003

1992 Q33.

The circuit below shows resistors connected as a potential divider.

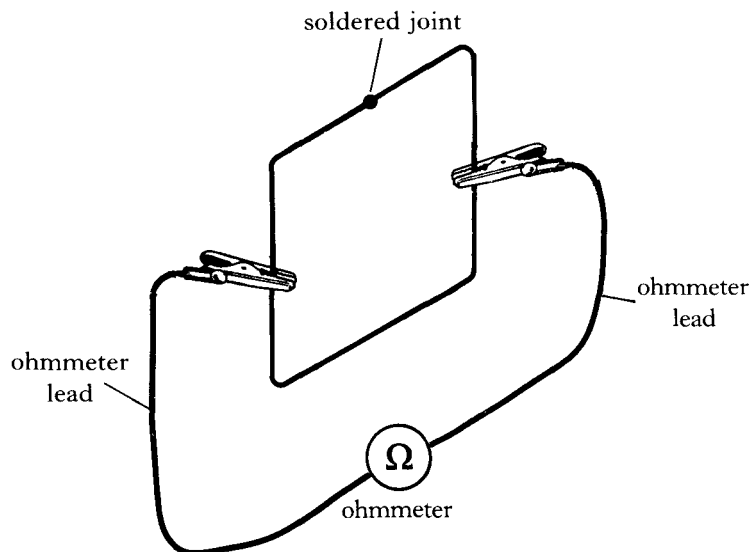


Calculate the reading on the voltmeter

- (a) when the switch is open;
- (b) when the switch is closed.

1992 Q43.

The resistance of a length of bare uniform resistance wire is $30\ \Omega$. The length of wire is folded into the shape of a square and the ends soldered together as shown below.



What value of resistance would the ohmmeter read if it is connected as shown at the mid-points of opposite sides of the square? (You may ignore the resistance of the ohmmeter leads.)

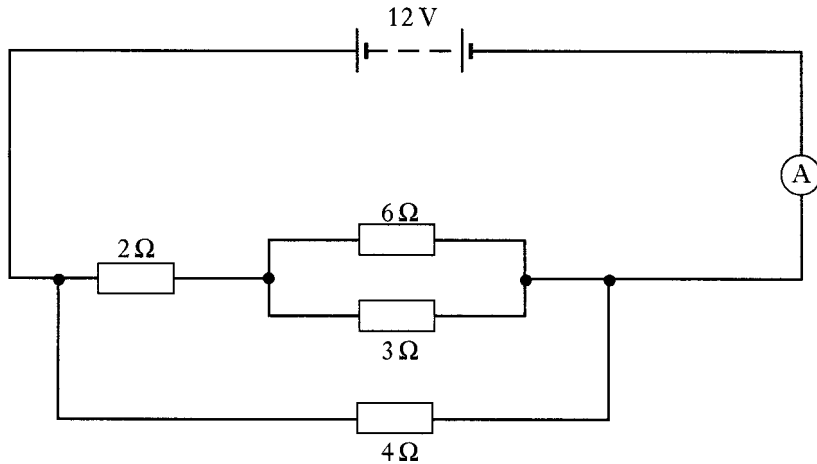
1995 Q34.

The potential difference across a lamp is $12\ \text{V}$.

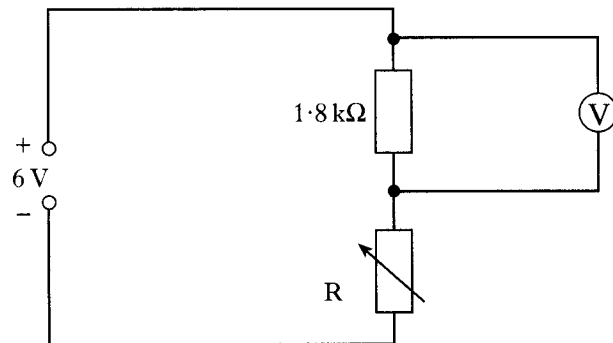
How much energy is dissipated in the lamp when a charge of $5\ \text{C}$ passes through it?

1998 Q33

Calculate the size of the current in the ammeter in the circuit below.
The battery has negligible internal resistance.

**1999 Q34**

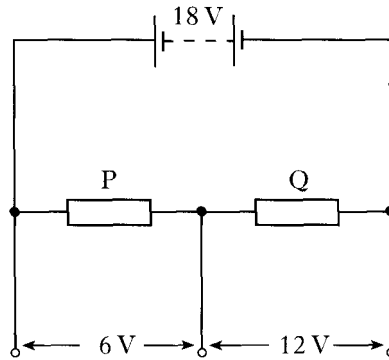
A $1.8\text{ k}\Omega$ resistor and a variable resistor, R , are connected to a 6 volt d.c. supply as shown.
The supply has negligible internal resistance.
A voltmeter is used to measure the potential difference across the $1.8\text{ k}\Omega$ resistor.



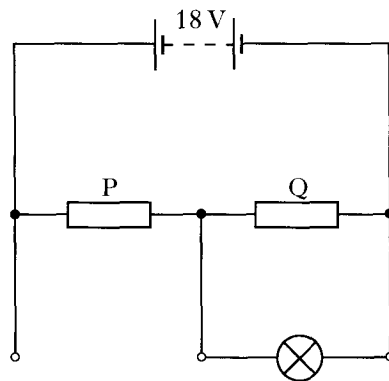
- Calculate the potential difference across the $1.8\text{ k}\Omega$ resistor when the variable resistor, R , has a value of $1.2\text{ k}\Omega$.
- The resistance of the variable resistor, R , is increased. Explain why the reading on the voltmeter decreases.

2000 Q33.

The following circuit has output voltages of 6 V and 12 V.
The 18 V battery has negligible internal resistance.



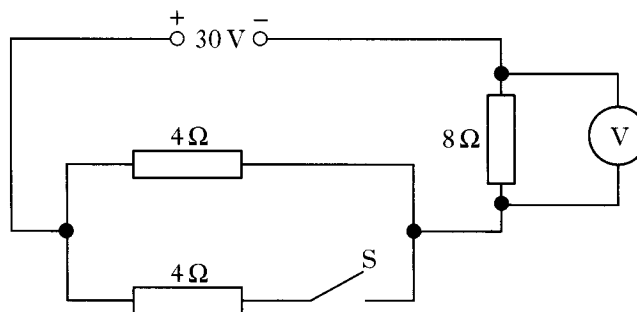
- (a) Resistor Q has a value of $200\ \Omega$. What is the resistance of resistor P?
- (b) A lamp operates at normal brightness when it has a voltage of 12 V across it. The lamp is connected in parallel with resistor Q as shown.



Does the lamp operate at normal brightness?
You must justify your answer.

2001 Q33.

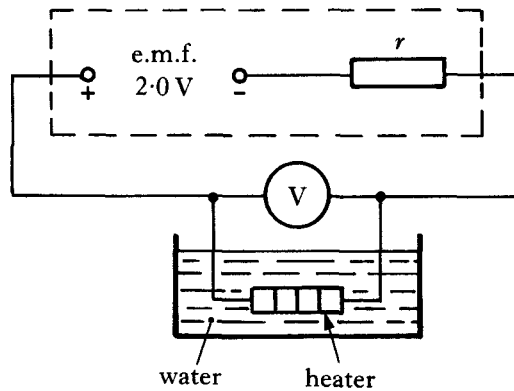
In the circuit shown below, the voltage supply has negligible internal resistance.



- (a) Calculate the reading on the voltmeter when switch S is open.
- (b) Switch S is now closed.
Explain why the reading on the voltmeter increases.

1994 Q6.

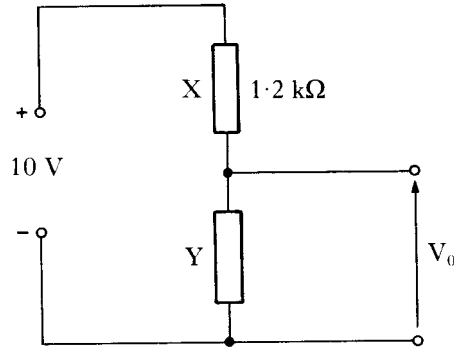
A heater of resistance $0.32\ \Omega$ is connected to a power supply of e.m.f. $2.0\ \text{V}$ and internal resistance r as shown below.



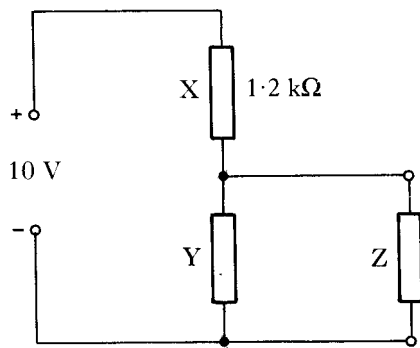
- (a) State what is meant by the term electromotive force (e.m.f.).
- (b) The power output of the **heater** is $8.0\ \text{watts}$.
Calculate:
(i) the current in the heater;
(ii) the reading on the voltmeter;
(iii) the internal resistance of the power supply.
- (c) Another identical heater is now placed in the water and connected in parallel with the original heater. The rest of the circuit is unaltered.
How does this affect the rate at which heat is supplied to the water?
Justify your answer by calculation.

1994 Q5. (part)

- (a) A potential divider is used to provide an output voltage V_0 from a 10 V supply as shown below. The supply has negligible internal resistance.



- (i) The resistance of resistor X is $1.2 \text{ k}\Omega$ and the output voltage required is 6.0 V. Calculate the resistance of resistor Y.
- (ii) A load resistor Z is now connected across the output as shown below.

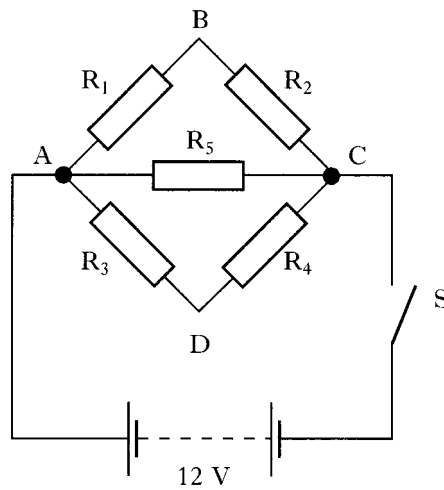


Explain why the voltage across Z is less than 6.0 V.

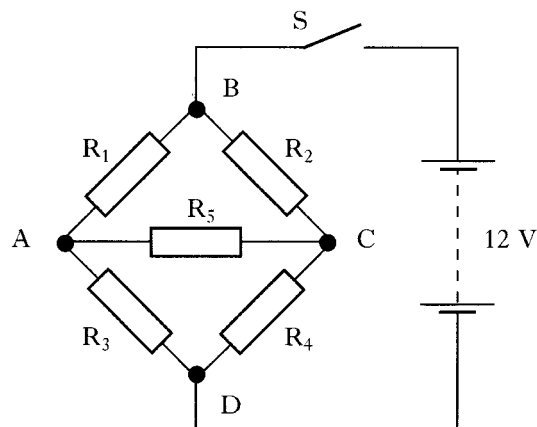
- (iii) Calculate the voltage across resistor Z when its resistance is $4.7 \text{ k}\Omega$.

1995 Q5.

Four $10\ \Omega$ resistors R_1 , R_2 , R_3 and R_4 are connected in the form of a square ABCD. A fifth resistor R_5 of the same value is connected between A and C. This arrangement of resistors is connected in a circuit as shown below. The battery in the circuit has negligible internal resistance.



- Determine the total resistance between A and C.
- The switch S is now closed.
 - In which of the resistors is the greatest power developed?
 - Calculate the value of **this** power.
- In a second experiment with the same resistors, the battery is connected across BD.

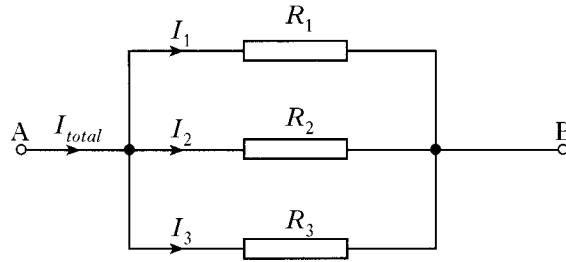


The switch S is now closed.

- Explain why there is no current in resistor R_5 .
- Calculate the current drawn from the battery.

2000 Q6.

- (a) Three resistors are connected in parallel as shown in the diagram below.



The potential difference between points A and B is V .

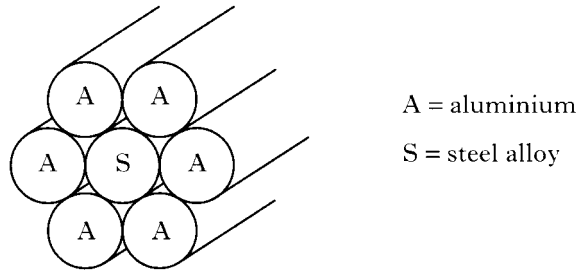
The diagram shows the total current and the current in each resistor.

Starting with the statement

$$I_{total} = I_1 + I_2 + I_3$$

derive the expression for the resistance between A and B.

- (b) A length of electrical cable for use at high voltages consists of a steel alloy conductor surrounded by six aluminium conductors as shown in the diagram.



The resistance of one kilometre of each type of conductor is shown below.

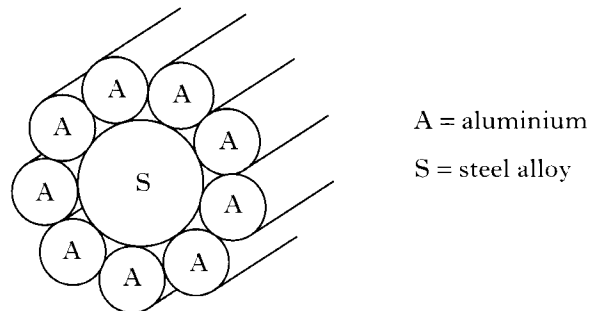
Resistance of 1 km of aluminium conductor = 0.60Ω

Resistance of 1 km of steel alloy conductor = 4.0Ω .

Calculate the resistance of one kilometre of this cable.

Give your answer to **three** decimal places.

- (c) Another type of electrical cable has a much thicker conductor, of the same steel alloy surrounded by nine aluminium conductors as shown.



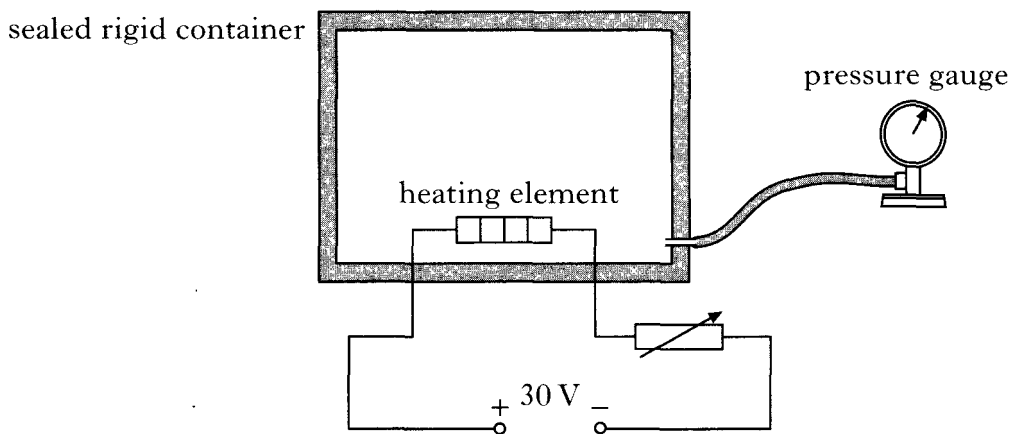
The aluminium conductors have the same cross section area as those in part (b).

In what way does the resistance of 1 km of this cable differ from the resistance of 1 km of the cable in part (b)?

You must Justify your answer.

2003 Q24. (part)

A technician designs the following apparatus to investigate the pressure of a gas at different temperatures.



The heating element is used to raise the temperature of the gas.

- (b) The power supply shown above has an e.m.f. of 30V and negligible internal resistance. The resistance of the heating element is 0.50Ω and the resistance of the variable resistor is set to 1.50Ω .
- (i) Calculate the power output from the heating element.
- (ii) How would your answer to part (b) (i) be affected if the internal resistance of the power supply was not negligible?
You must justify your answer.