A Level H2 Physics Tutorial 15: DC Circuits

Syllabus :
(a) recall and use appropriate circuit symbols as set out in the ASE publication Signs, symbols and systematics: the ASE companion to 16-19 science (2000)

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1. Draw circuit symbols for :

(i) wires crossed, but not joined

(ii) wires joined at junction

(iii) filament lamp

(iv) fuse

(v) resistors

(vi) variable resistors

(vii) potential divider

(viii) light sensitive resistors

(ix) thermistor

(x) light emitting diode

(xi) switch (open)

(xii) voltmeters

(xiii) ammeters

(xiv) galvanometer

(b) draw and interpret circuit diagrams containing sources, switches, resistors, ammeters, voltmeters, and/or any other type of component referred to in the syllabus

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2. Draw a circuit diagram containing :

- a cell of 1.5 V, with internal resistance 3 Ω
- a lamp with resistance 8 Ω
- a voltmeter across the lamp only
- an ammeter

(c) solve problems using the formula for the combined resistance of two or more resistors in series

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3.

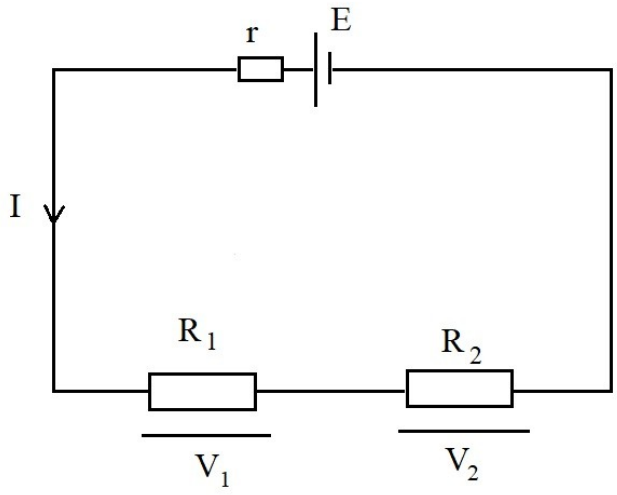

Figure 15-1

Using Ohm's law and the definition of voltage, show that the combined resistance of R_1 and R_2 is R_1+R_2.

(d) solve problems using the formula for the combined resistance of two or more resistors in parallel

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4.

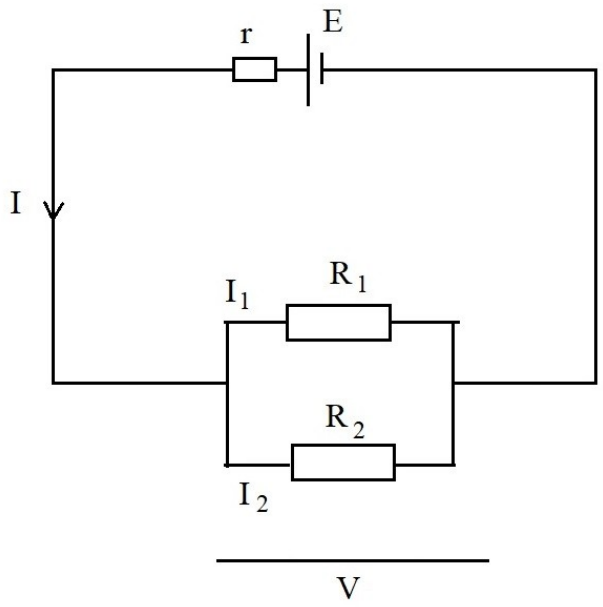

Figure 15-2

Using Ohm's law and the definition of current, show that the combined resistance of R_1 and R_2 is R, where

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

(e) solve problems involving series and parallel circuits for one source of e.m.f.

5.

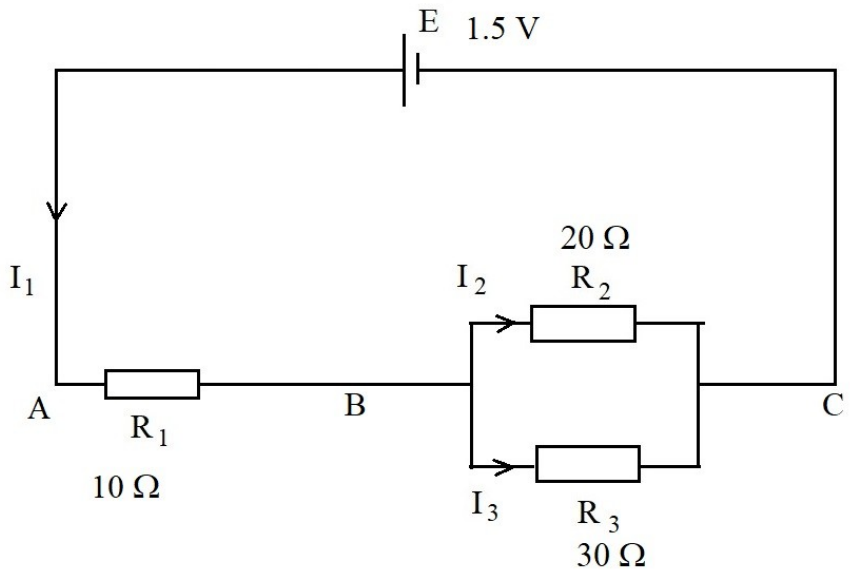

Figure 15-3

(i) Find the combined resistance between B and C.

(ii) Find the combined resistance between A and C.

(iii) Find the currents I_1, I_2, and I_3.

(f) show an understanding of the use of a potential divider circuit as a source of variable p.d.

6.

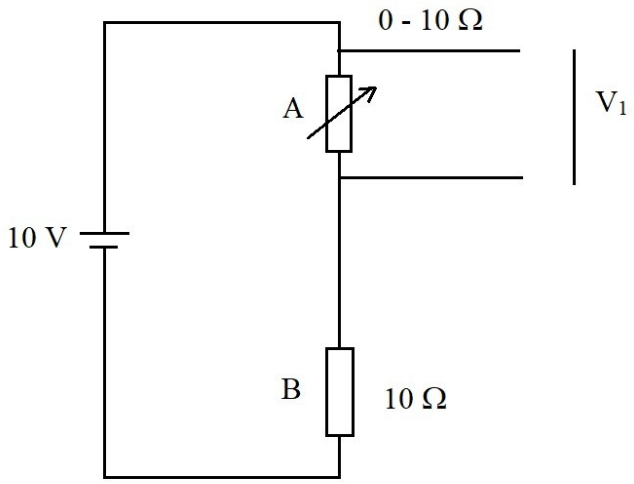

Figure 15-4

(a) What is the voltage V_1 when A is

(i) 0 Ω
(ii) 10 Ω

(b) If a light bulb is connected across A, what would be the effect as A is adjusted from 0 to 10 Ω.

(g) explain the use of thermistors and light-dependent resistors in potential divider circuits to provide a potential difference which is dependent on temperature and illumination respectively

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7. The resistance of a thermistor decreases when it gets hot, like if there is a fire.

Assume that the resistance-temperature R-θ graph is a straight line.

θ / deg C	R / kΩ
21	5.9
100	0.31

This figure shows a simple fire alarm circuit.

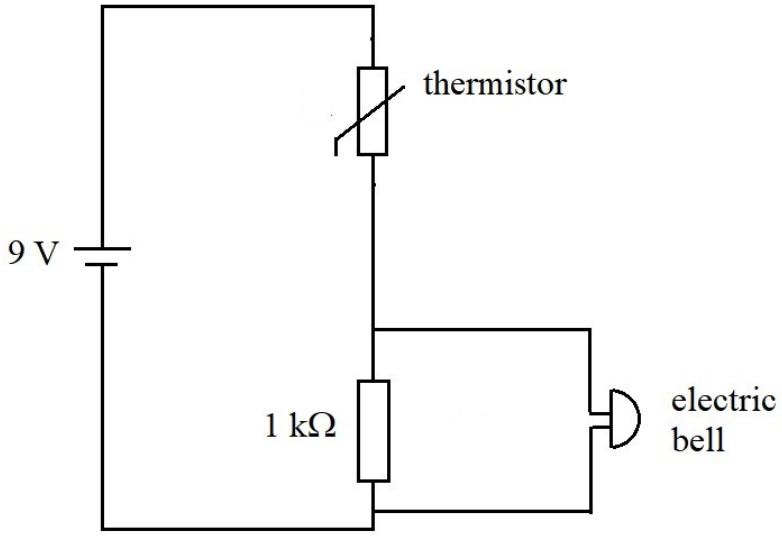

Figure 15-5

The electric bell rings when its voltage is over 5 V.

Estimate the temperature when it rings.

(h) recall and solve problems by using the principle of the potentiometer as a means of comparing potential differences.

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8 (a)

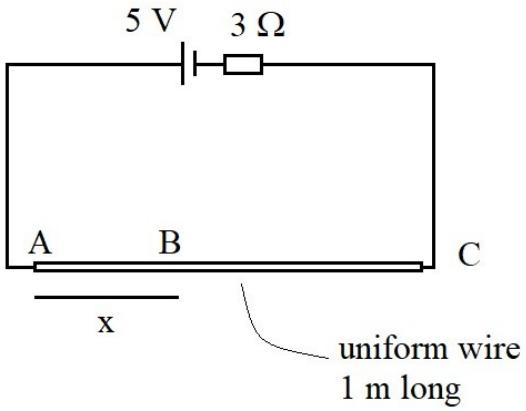

Figure 15-6

(i) What is the voltage across AC?

(ii) If x is 30 cm, what is the voltage across AB?

(b)

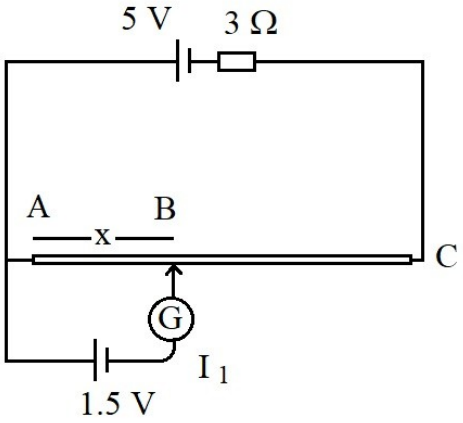

Figure 15-6

(i) A cell of emf 1.5 V is connected as shown. What is the current I_1?

(ii) Does I_1 increase or decrease if this cell has an internal resistance? Why?

(c) (i) Suggest how this setup (called a potentiometer) can be used to measure emf?

(ii) What advantage does it have over a voltmeter?

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