Physics
Leaving Certificate
Higher Level

Past Exam Questions on
Electric Circuits

Q4 Section A 2013

4. A student was asked to investigate the variation of current with potential difference for a thin metallic conductor. The student set up a circuit using appropriate equipment. The student recorded the values of the current I passing through the conductor for the corresponding values of potential difference V. The recorded data are shown in the table.

V/V	1.0	2.0	3.0	4.0	5.0	6.0
I/A	0.17	0.34	0.50	0.64	0.77	0.88

Draw and label the circuit diagram used by the student.

Name the device in the circuit that is used to vary the potential difference across the conductor.

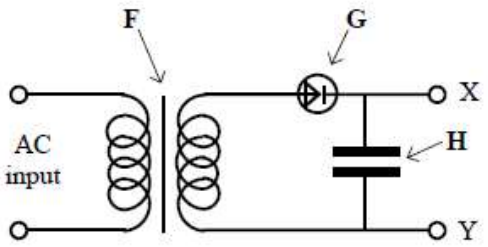
Explain how the student used this device to vary the potential difference. (18)

Use the data in the table to draw a graph on graph paper to show the variation of current with potential difference. Use your graph to find the value of the resistance of the conductor when the current is 0.7 A. (15)

Explain the shape of your graph. (7)

Q8 Section B 2013

8. (*a*) The diagram shows a circuit used in a charger for a mobile phone.



Name the parts labelled **F**, **G** and **H**. (9)

Describe the function of **G** in this circuit. (6)

Sketch graphs to show how voltage varies with time for

(i) the input voltage

(ii) the output voltage, V_{XY}. (12)

The photograph shows the device **H** used in the circuit. Use the data printed on the device to calculate the maximum energy that it can store. (9)

(*b*) Electricity generating companies transmit electricity over large distances at high voltage. Explain why high voltage is used. (6)

A 3 km length of aluminium wire is used to carry a current of 250 A. The wire has a circular cross-section of diameter 18 mm.

(i) Calculate the resistance of the aluminium wire.

(ii) Calculate how much electrical energy is converted to heat energy in the wire in ten minutes. (14)

(resistivity of aluminium = $2.8 \times 10^{-8}\ \Omega$ m)

Q10 Part (a) & (b) Section B 2012

10. Answer **either** part (*a*) **or** part (*b*).

(*a*) (i) What is a positron? (6)

(ii) When a positron and an electron meet two photons are produced.
Write an equation to represent this interaction. (6)

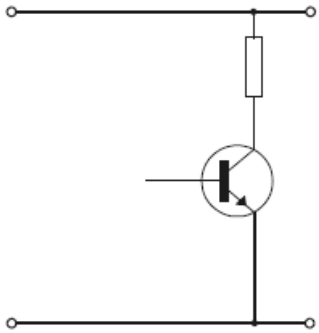
(iii) Why are photons produced in this interaction?
Explain why two photons are produced.
Calculate the minimum frequency of the photons produced.
Explain why the photons produced usually have a greater frequency than your calculated minimum frequency value. (24)

(iv) Why must two positrons travel at high speeds so as to collide with each other?
How are charged particles given high speeds? (12)

(v) Explain why two positrons cannot annihilate each other in a collision. (8)

(*b*) Draw a labelled diagram to show the basic structure of a bipolar transistor. Indicate the difference in the composition of the parts of the transistor that you have drawn. (18)

The diagram shows part of a circuit in which a transistor is to be used as a voltage inverter.



(i) Copy the diagram into your answerbook and complete the circuit diagram.
Label each part of the circuit.
Indicate on your diagram the terminals used for the input and output voltages. (15)

(ii) Draw a sketch of an input voltage and its corresponding output voltage, using the same axes and scale. (9)

(iii) A voltage inverter can be used as a NOT gate.
Draw the symbol of a NOT gate.
Draw the truth table for a NOT gate. (9)

(iv) Give another application of a transistor. (5)

Q8 Section B 2010

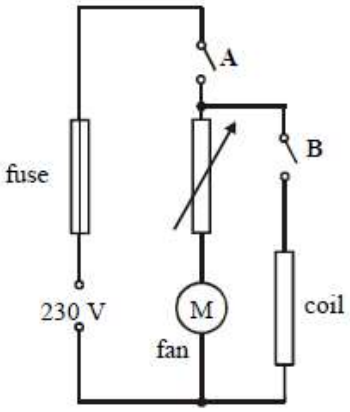
8. A hair dryer with a plastic casing uses a coiled wire as a heat source. When an electric current flows through the coiled wire, the air around it heats up and a motorised fan blows the hot air out.

What is an electric current?

Heating is one effect of an electric current.

Give two other effects of an electric current. (12)

The diagram shows a basic electrical circuit for a hair dryer.



(i) Describe what happens:
   (*a*) when switch **A** is closed and the rheostat is adjusted
   (*b*) when switch **A** and switch **B** are closed. (9)

(ii) The maximum power generated in the heating coil is 2 kW.
   (*a*) What is the initial resistance of the coil?
   (*b*) Calculate the current that flows through the coil when the dryer is turned on. (9)

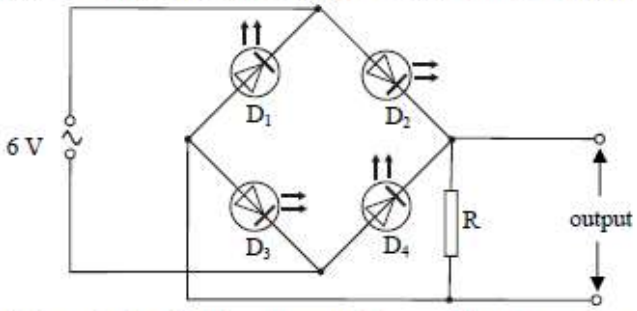
(iii) A length of nichrome wire of diameter 0.17 mm is used for the coil. Calculate the length of the coil of wire. (18)

(iv) Explain why the current through the coil would decrease if the fan developed a fault and stopped working. (8)

(resistivity of nichrome = $1.1 \times 10^{-6}\ \Omega$ m)

Q10 Part (b) Section B 2010

(*b*) Distinguish between intrinsic conduction and extrinsic conduction in a semiconductor. (9)



The circuit shows four light-emitting diodes connected to a resistor R and a 6 V a.c. supply of frequency 1 Hz.

(i) What is observed when the circuit is operating?

Explain what is observed by referring to the circuit.

What is observed when the frequency of the a.c. supply is increased to 50 Hz? (18)

(ii) Give two functions of the resistor R?

How was the output voltage displayed?

Draw graphs to show the differences between the input voltage and the output voltage. (24)

(iii) It is noticed that the output voltage is lower than the input voltage. Explain why. (5)

Q5 Part (g) Section B 2009

(g) When will an RCD (residual current device) disconnect a circuit? (7)

Q5 Part (h) 2005

(h) Explain why high voltages are used in the transmission of electrical energy. (7)