5 The power supply in a circuit is made from several cells, each with the same electromotive force (e.m.f.). The cells are connected in parallel.

(a) Explain what is meant by 'electromotive force'.

.....

.....

..... [2]

(b) State **one** advantage of using several cells in parallel rather than a single cell as the power supply.

.....

..... [1]

(c) The power supply is connected in series to a resistor of resistance 4000 Ω and a thermistor. There is a voltmeter in parallel with the resistor.

Fig. 5.1 is the circuit diagram.

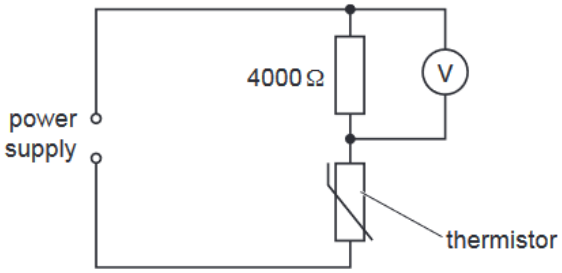

Fig. 5.1

(i) The temperature of the thermistor increases.

Explain what happens to the reading on the voltmeter.

.....

.....

.....

..... [3]

(ii) The e.m.f. of the power supply is 1.5 V.

Calculate the reading on the voltmeter when the resistance of the thermistor is 8000 Ω.

reading = ... [2]

[Total: 8]

6 The primary coil of a transformer is connected to the mains supply. The voltage of the a.c. mains supply is 240 V.

Fig. 6.1 is a diagram of the arrangement.

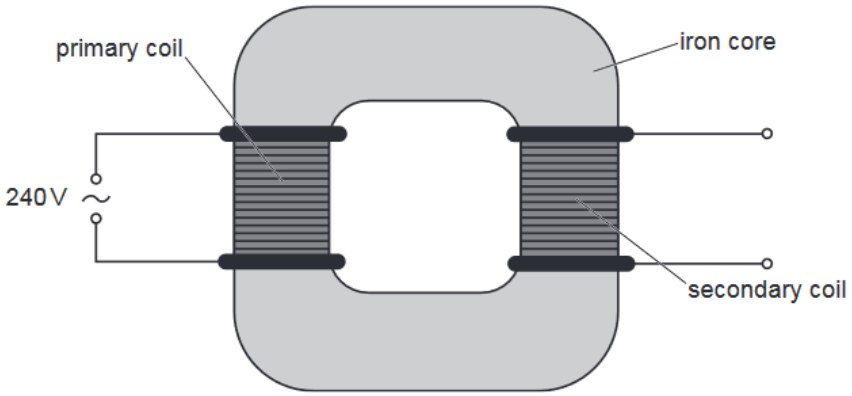

Fig. 6.1

(a) Explain why a voltage is produced in the secondary coil.

.....

.....

.....

..... [3]

(b) There are 5600 turns on the primary coil of the transformer and 350 turns on the secondary coil.

(i) Calculate the output voltage of the transformer.

output voltage = ... [2]

(ii) The output of the transformer is connected to a 90 W filament lamp which operates at normal brightness.

Calculate the current in the lamp.

current = ... [2]

[Total: 7]

9 The power supply in an electric circuit is a battery of electromotive force (e.m.f.) 12 V.

(a) State **two** ways in which the e.m.f. of a battery differs from that of an alternating current (a.c.) power supply.

1 .....

2 .....

[2]

(b) The circuit includes three resistors and two open switches, S_1 and S_2.

Fig. 9.1 shows the circuit.

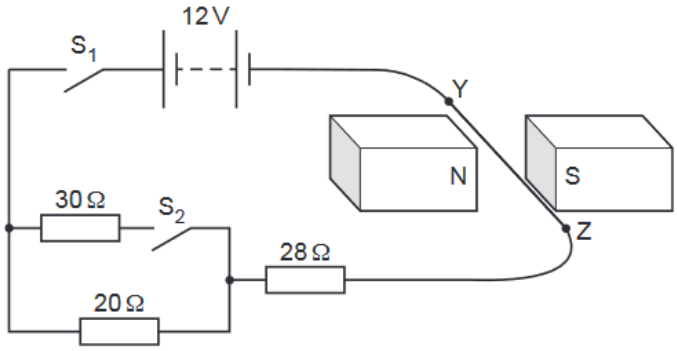

Fig. 9.1

YZ is a straight, horizontal section of connecting wire that lies between two magnets.

S_1 is now closed.

(i) Calculate the current in YZ.

current = ... [2]

(ii) Explain why YZ experiences a force.

.....

.....

..... [2]

(iii) Tick the box which describes the direction of the force on YZ.

towards N	☐	towards Z	☐
towards S	☐	downwards	☐
towards Y	☐	upwards	☐

[1]

(iv) Explain how the direction of the force on YZ is determined.

.....

.....

..... [2]

(c) Switch S_2 in the circuit in Fig. 9.1 is now also closed.

(i) Calculate the total resistance of the circuit.

resistance = ... [3]

(ii) Explain what happens to the force on YZ as switch S_2 is closed.

.....

.....

..... [2]

(iii) The current in the 20 Ω resistor is I_{20}. The current in the 30 Ω resistor is I_{30}.

State a value for the ratio I_{20}/I_{30}.

ratio I_{20}/I_{30} = ... [1]

9 A vertical solenoid (long coil) with an iron core is held in a wooden clamp above a laboratory bench.

The solenoid is connected in series with a battery, a switch S, an ammeter and a variable resistor. There is a voltmeter in parallel with the solenoid.

Fig. 9.1 represents this apparatus.

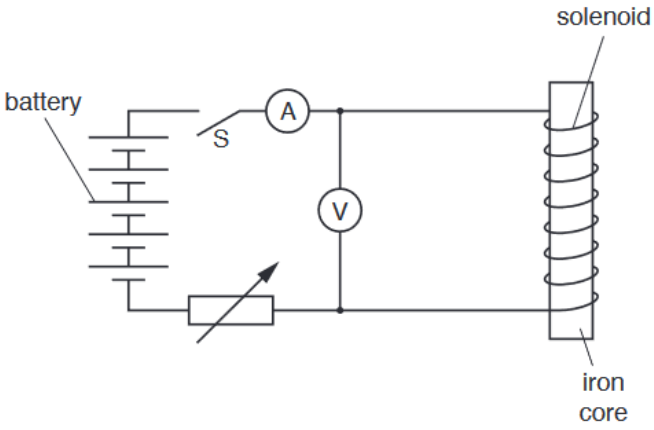

Fig. 9.1

A student closes switch S and a current in the circuit produces a reading on the ammeter.

(a) State what is meant by *current*.

.....

.....[1]

(b) The battery consists of five 1.5 V cells in series. The reading on the ammeter is 4.0 A.

(i) State the size of the electromotive force (e.m.f.) of the battery.

.....[1]

(ii) Calculate the total resistance of the series circuit.

resistance = ...[2]

(iii) The reading on the voltmeter is 6.5 V.

Calculate the power dissipated in the solenoid.

power = ...[2]

(iv) The solenoid is made of copper and the student notices that, as time passes, the solenoid becomes extremely warm.

State and explain the effect of this temperature increase on the ammeter reading.

.....

.....

.....[2]

(c) (i) The current in the solenoid magnetises the iron core so that the lower end of the core is an N-pole.

On Fig. 9.1, draw the pattern and indicate the direction of the magnetic field in the region surrounding the iron core. [3]

(ii) The student holds an iron cylinder against the bottom surface of the iron core in the solenoid. When he releases the iron cylinder, it stays in contact with the iron core.

1. Explain why the iron cylinder does not fall.

.....

.....

.....

.....

.....[3]

2. The switch S is opened.

State and explain whether the iron cylinder remains in contact with the iron core.

.....

.....

.....[1]