MEGA LECTURE

www.megalecture.com · www.youtube.com/@megalecture

Online tutoring for Cambridge IGCSE, O Level & A Level Physics

IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Simple Magnetism & Magnetic Fields

Paper 2 — Theory / Structured Questions (topical compilation)

Fahad H. Ahmad

Contact: +92 323 509 4443

M.Eng NUS Singapore · B.Eng NUST · 15+ years of teaching experience in Singapore, UAE & Pakistan · 60,000+ subscribers and 20 million+ video lecture views.

5054/02 M/J/04/Q5

For Examiner's Use

1 Fig. 5.1 shows a piece of recording tape passing under the recording head of a tape recorder. An alternating current is passed through the coil. The tape is coated with a magnetic material that becomes magnetised.

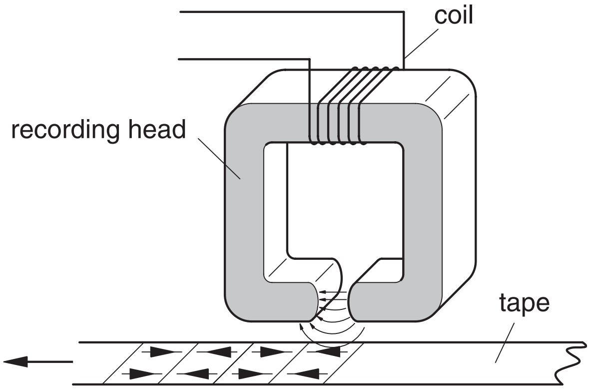

Fig. 5.1

(a) **(i)** Explain why the tape becomes magnetized.

....

....

....

(ii) Fig. 5.1 shows that sections of the tape are magnetised in opposite directions. Explain why they become magnetised in opposite directions.

....

....

(iii) The tape is moved faster past the recording head. State how this changes the pattern on the tape.

....

....
[3]

(b) **(i)** Explain why the coating on the tape must be of a permanent magnetic material.

....

....

(ii) State the name of a permanent magnetic material.

....
[2]

5054/02/M/J/05/Q5

For Examiner's Use

2 Fig. 5.1 shows a coil of wire wrapped around a plastic tube. Inside the tube are two pieces of soft iron. When the switch is closed, the compass needles point in the direction of the magnetic field produced at each position. You may ignore the magnetic field of the Earth in this question.

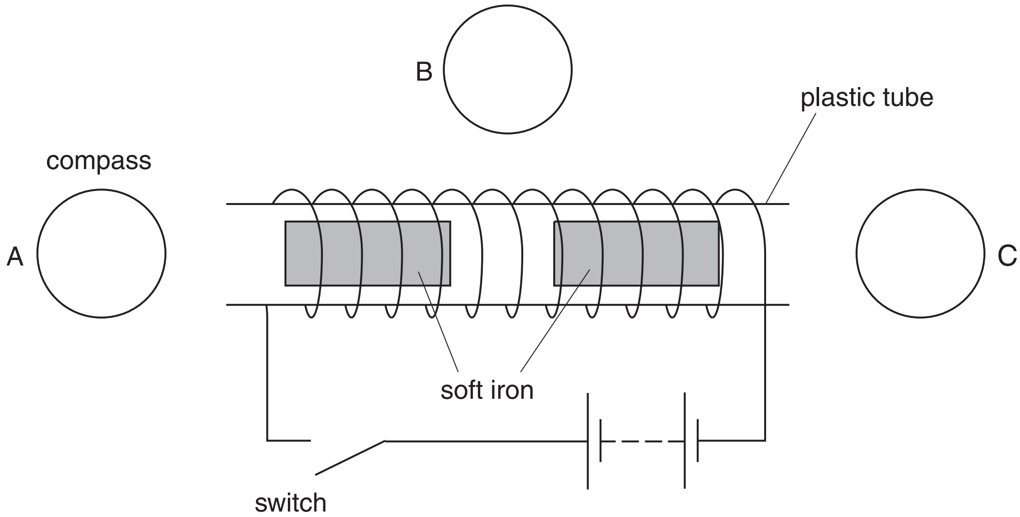

Fig. 5.1

(a) On Fig. 5.1 mark arrows, in compasses A, B and C, to show the direction of the magnetic field at each position after the switch has been closed. [2]

(b) When the switch is closed, the two pieces of soft iron in the tube become magnets and move.

(i) On Fig. 5.1, mark the poles formed on each piece of soft iron. [1]

(ii) State and explain how the pieces of iron move.

....

....

.... [2]

(c) State the effect on the magnetic field of

(i) reversing the direction of the current,

....

.... [1]

(ii) reducing the size of the current.

....

.... [1]

5054/02/M/J/07/Q6

For Examiner's Use

3 Fig. 6.1 shows a coil of wire wound on a cardboard tube.

There is a d.c. current in the coil. The direction of the current is shown in the key.

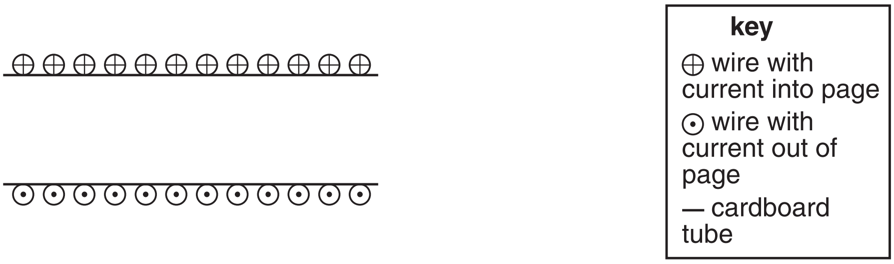

Fig. 6.1

(a) On Fig. 6.1, draw the magnetic field produced by the coil. [3]

(b) Fig. 6.2 shows a simple loudspeaker that uses the coil shown in Fig. 6.1 attached to a paper cone.

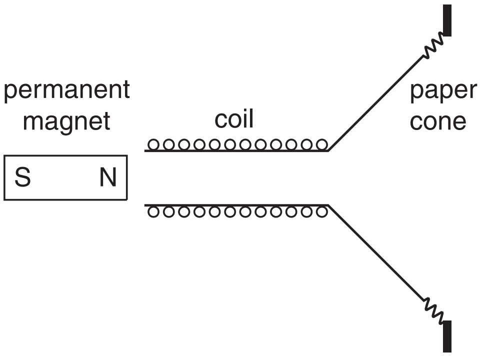

Fig. 6.2

The coil is connected to a signal generator.

There is an alternating current of frequency 100 Hz in the coil.

(i) State what is meant by a *frequency of 100 Hz*.

....

.... [1]

For Examiner's Use

(ii) Describe and explain the movement of the coil.

....

....

....

....

....

.... [3]

5054/02/M/J/09/Q7

4 Fig. 7.1 shows two pieces of soft iron in the magnetic field of a strong permanent magnet.

For Examiner's Use

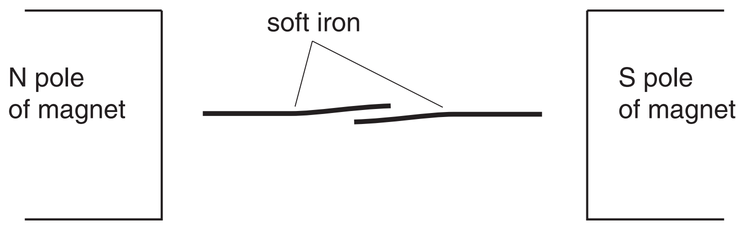

Fig. 7.1

The pieces of soft iron become magnetised.

(a) On Fig. 7.1, mark the magnetic poles produced at each end of both pieces of soft iron. [1]

(b) Fig. 7.2 shows a reed switch.

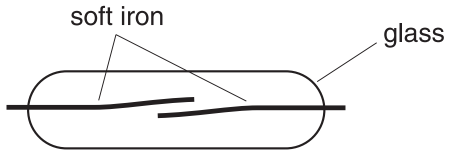

Fig. 7.2

The reed switch is placed between the poles of the strong permanent magnet.
State and explain what happens.

....

....

.... [2]

For Examiner's Use

(c) Fig. 7.3 shows two separate electrical circuits.

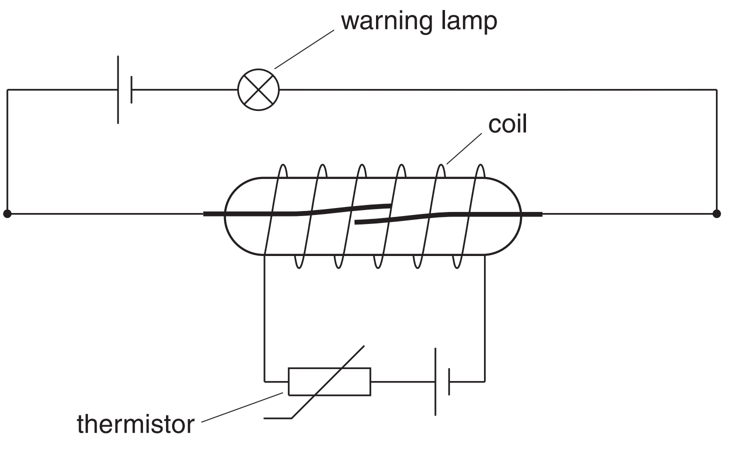

Fig. 7.3

One circuit consists of a reed switch, a cell and a warning lamp. The other circuit consists of a thermistor, another cell, and a coil wound round the reed switch. The thermistor is at the same temperature as the air around it.

(i) State what happens to the thermistor when the temperature of the air rises.

.... [1]

(ii) Explain why the warning lamp lights up when the air temperature rises.

....

....

....

.... [2]

5054/22/M/J/10/Q7

5 Fig. 7.1 shows a compass.

For Examiner's Use

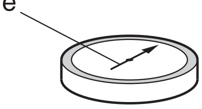

Fig. 7.1

The compass needle is a small magnet free to rotate. The head of the arrow on the compass needle is an N-pole.

(a) A bar magnet is placed between two compasses, as shown in Fig. 7.2.

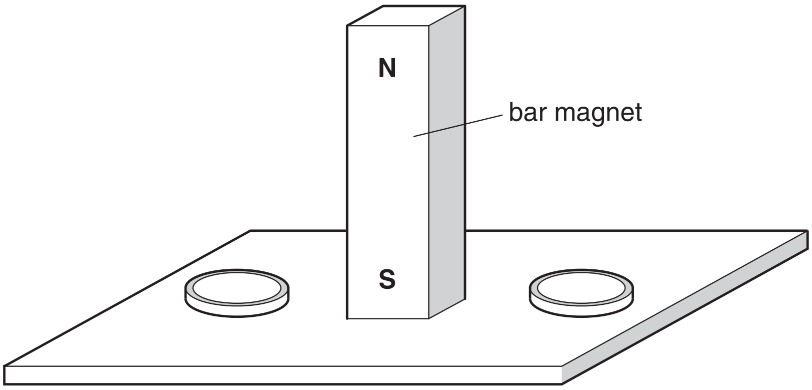

Fig. 7.2

On Fig. 7.2, draw the needles inside the two compasses and mark the N-pole of both compass needles. [2]

(b) Fig. 7.3 shows the structure of a relay.

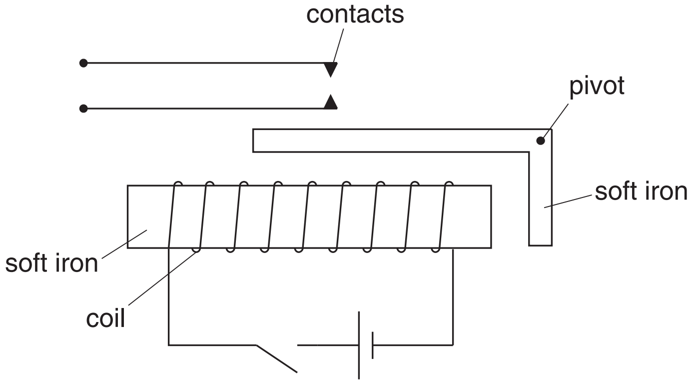

Fig. 7.3

Explain how closing the switch causes the contacts to close.

....

....

.... [2]

(c) Fig. 7.4 is a circuit that includes a relay.

For Examiner's Use

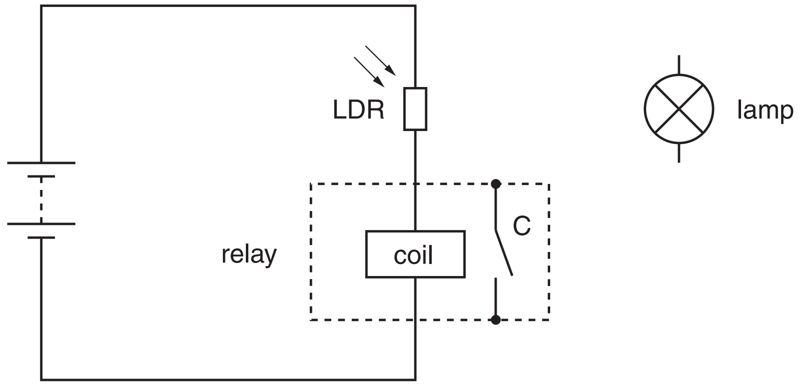

Fig. 7.4

When light shines on the light-dependent resistor (LDR), the relay contacts C close.

(i) State what happens to the resistance of the LDR when light falls on it.

.... [1]

(ii) The circuit for the lamp, as shown in Fig. 7.4, is not complete.

On Fig. 7.4, draw the connections to the lamp, the contacts C and the battery that cause the lamp to switch on when light shines on the LDR. [2]

5054/21/M/J/11/Q7

6 Fig. 7.1 shows the structure of a circuit-breaker that uses an electromagnet. The circuit-breaker operates when the current is 10 A.

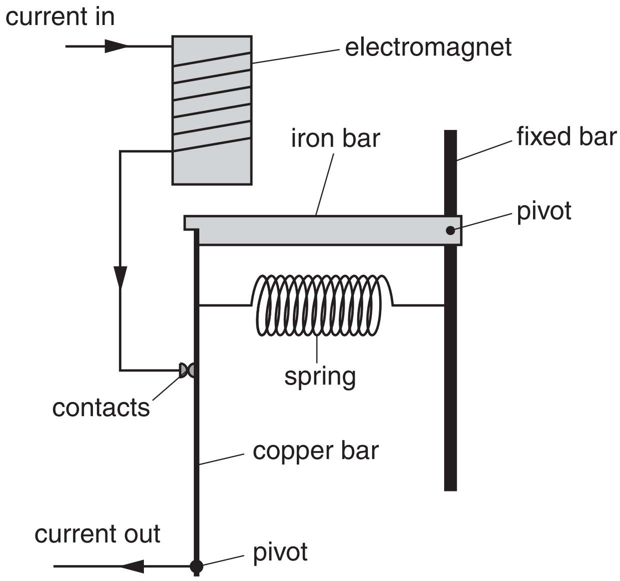

Fig. 7.1

(a) On Fig. 7.1, mark with an arrow the force on the iron bar caused by the electromagnet. [1]

(b) Suggest one reason why the iron bar does not move when the current is less than 10 A.

....

.... [1]

(c) When the current is greater than 10 A, the circuit-breaker stops the current. Explain what happens in the circuit-breaker when this occurs.

....

....

....

.... [3]

(d) State and explain how the electromagnet can be altered so that the circuit-breaker stops the current at less than 10 A.

....

....

.... [2]

5054/21/M/J/12/Q8

7 **(a)** A magnet is placed on a bench, as shown in Fig. 8.1a. End P of a rod is held above each end of the magnet in turn, as shown in Fig. 8.1b and in Fig. 8.1c. One end of the magnet is lifted off the bench in both cases.

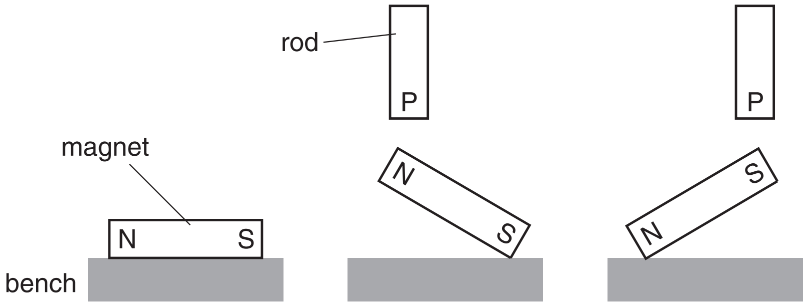

Fig. 8.1a **Fig. 8.1b** **Fig. 8.1c**

(i) Suggest what material the rod is made from.

....[1]

(ii) Explain how the rod lifts each end of the magnet off the bench.

....

....

....[2]

(b) Fig. 8.2 and Fig. 8.3 show views of a wire carrying a current downwards through a horizontal board.

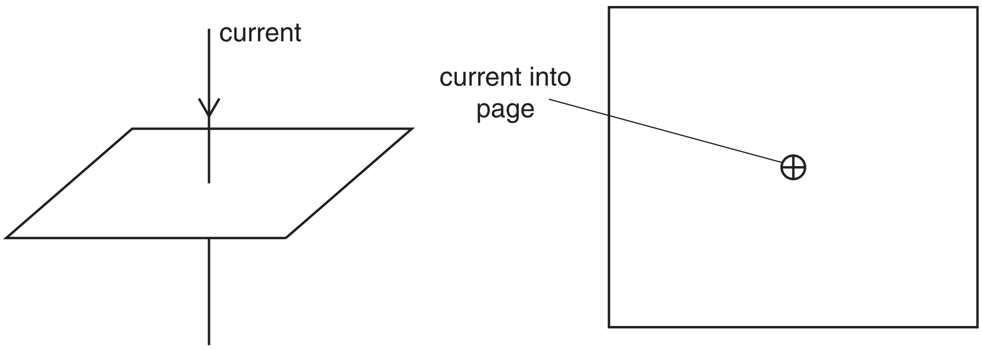

Fig. 8.2 **Fig. 8.3** (viewed from above)

(i) On Fig. 8.3, draw the magnetic field due to the current in the wire. [2]

(ii) The magnetic field is stronger closer to the wire. State how the magnetic field lines indicate that the field is stronger.

....

....[1]

5054/21/M/J/14/Q4

8 A teacher demonstrates magnetic screening. When a magnet is placed near a small cardboard box, paper clips on the other side of the box are picked up, as shown in Fig. 4.1.

When a small piece of soft iron is placed inside the box as shown in Fig. 4.2, the paper clips fall off.

Magnetic field lines in each diagram are shown as thin lines.

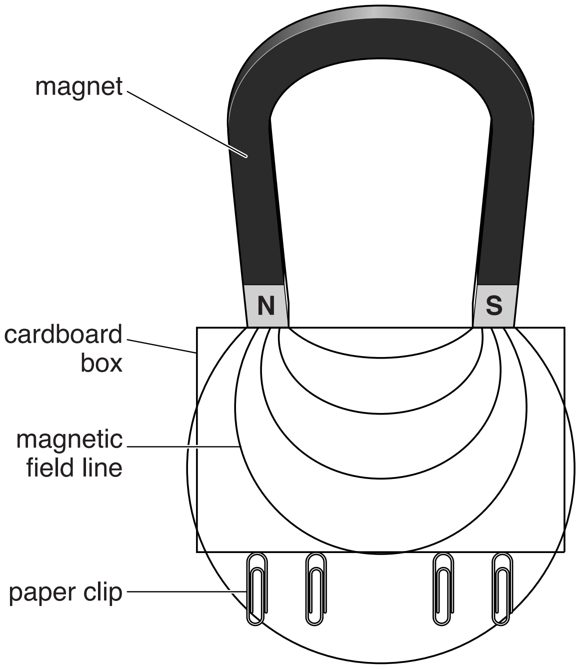

Fig. 4.1

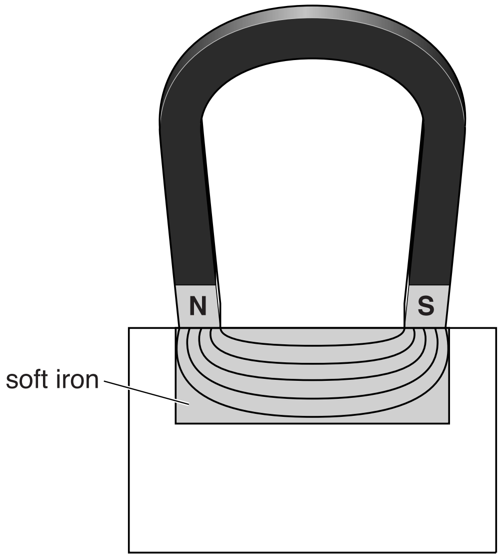

Fig. 4.2

(a) On Fig. 4.1, mark an arrow on each of the magnetic field lines to show its direction. [1]

(b) Explain why placing the soft iron inside the box causes the paper clips to fall off.

....

....

....

.... [2]

(c) Explain why it is sensible to have magnetic screening around the tube of a cathode-ray oscilloscope.

....

.... [1]

5054/22/M/J/14/Q7

9 Fig. 7.1 shows a compass needle near a bar magnet. Magnetic poles are shown on the compass needle and on the magnet.

A finger stops the compass needle from turning.

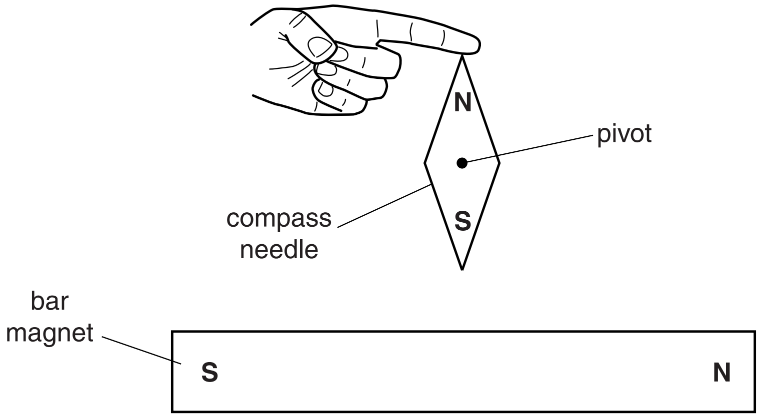

Fig. 7.1 (not to scale)

(a) **(i)** The magnet causes a force on the S-pole of the compass needle.

On Fig. 7.1, draw an arrow from the S-pole of the compass needle to show the direction of this force. [1]

(ii) Explain why the compass needle turns when the finger is removed.

....

.... [1]

(b) A small compass is used to plot the magnetic field lines of the magnet.

Describe how the compass is used to plot magnetic field lines on a piece of paper.

....

....

....

....

.... [3]

5054/22/M/J/15/Q10

10 Fig. 10.1 shows a relay connected to a cell and a switch.

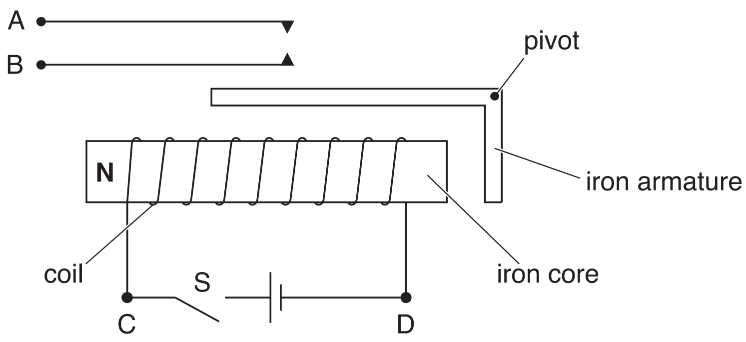

Fig. 10.1

(a) When switch S is closed, the iron core is magnetised. The left side of the core is an N-pole, as shown in Fig. 10.1. The iron armature is attracted to the core.

(i) On Fig. 10.1, mark

1. the S-pole of the iron core

2. the N-pole and the S-pole of the iron armature.

[2]

(ii) The cell is reversed.

State what happens to the poles and to the armature.

....

.... [2]

(iii) Explain why the core is made of iron and not steel.

....

....

.... [2]

(b) Fig. 10.2 shows the relay connected in a circuit to a 12 V battery. The bell is not ringing.

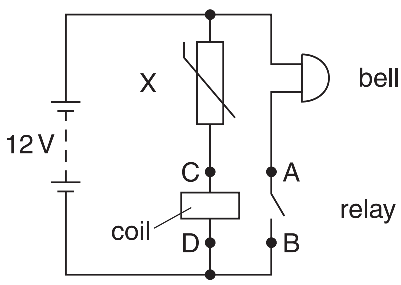

Fig. 10.2

(i) State the name of component X.

.... [1]

(ii) Explain why the bell rings when the temperature of X rises.

....

....

.... [2]

(iii) When the resistance of X is 2000 Ω, the current in the coil is 1.5 mA. This causes the contacts in the relay to close. The resistance of the bell is 200 Ω.

Calculate

1. the potential difference (p.d.) across X,

p.d. = ... [2]

2. the p.d. across the coil,

p.d. = ... [1]

3. the current in the battery.

current = ... [2]

(iv) Component X is removed from the circuit and replaced by a different component Y. The bell now rings when bright light shines on Y.

State the name of component Y.

.... [1]

5054/21/M/J/16/Q7

11 Fig. 7.1 shows part of a loudspeaker. A coil is attached to a paper cone and is suspended freely within a cylindrical magnet.

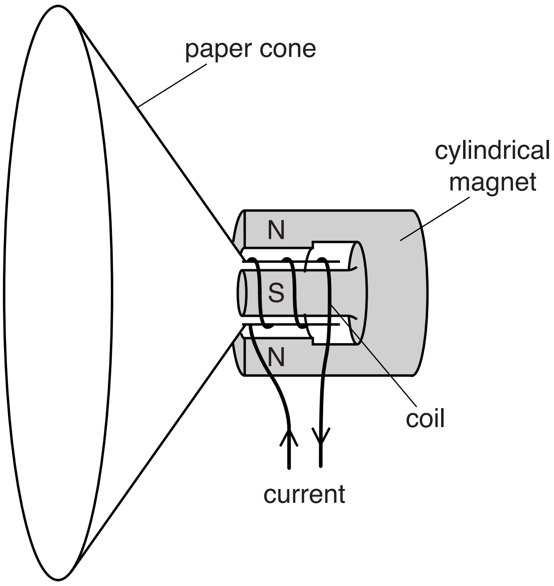

Fig. 7.1

(a) Explain why a current in the coil causes the paper cone to move.

....

....

....

....[2]

(b) Describe and explain the movement of the cone when there is an alternating current in the coil.

....

....

....[2]

(c) The loudspeaker produces sound of frequency 500 Hz. The speed of sound is 320 m/s. Calculate the wavelength of the sound produced.

wavelength = ...[2]

5054/21/M/J/18/Q6

12 A steel rod is magnetised using an electrical method.

(a) Describe how this is done.

You may draw a diagram if you wish.

....

....

....[2]

(b) Describe how you can check that the steel rod is magnetised.

....

....

....

....[2]

5054/22/M/J/18/Q7

13 A computer hard disk contains a layer of a magnetic material.

(a) Describe how a magnet is used to find out if a sample of material is magnetic or non-magnetic.

....

....

....[1]

(b) Data is stored on the disk as a series of N-poles and S-poles.

Fig. 7.1 shows part of the hard disk. The thin layer of magnetic material contains small regions. Each region has an N-pole and an S-pole. Some magnetic field lines are shown on Fig. 7.1.

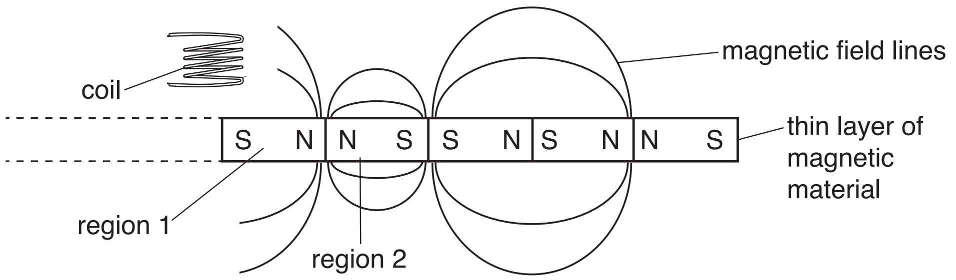

Fig. 7.1 (not to scale)

(i) Region 2 causes a magnetic force on region 1.

State the direction of the magnetic force on region 1 and explain why it acts.

....

....

....[2]

(ii) On Fig. 7.1, draw arrows on the field lines to show the direction of the magnetic field near the boundary between region 1 and region 2. [1]

(iii) The coil shown in Fig. 7.1 is fixed in position. The layer of magnetic material passes quickly under the coil.

A voltage is induced in the coil as some of the boundaries between the regions pass under the coil.

1. Explain why a voltage is induced in the coil.

....

....

....[1]

2. Suggest why the coil must be close to the layer.

....

....

....[1]

5054/02/O/N/03/Q6

For Examiner's Use

14 Fig. 6.1 shows a small plotting compass placed above a copper wire. When there is no current in the wire, the plotting compass points towards the North.

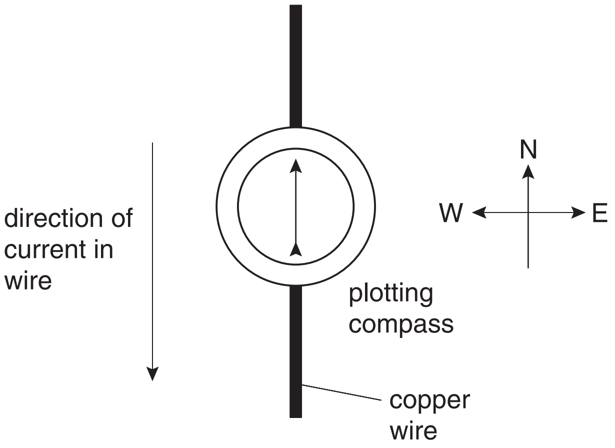

Fig. 6.1

(a) A large current is switched on in the wire. The direction of the current is shown in Fig. 6.1.

(i) State what happens to the compass needle.

....

....

(ii) State what happens if the compass is placed under the wire.

....

.... [3]

(b) State and explain what is observed if there is a 50 Hz alternating current in the wire.

....

....

....

.... [2]

5054/02/O/N/05/Q7

For Examiner's Use

15 Fig. 7.1 shows a coil of wire wound around a rectangular tube.

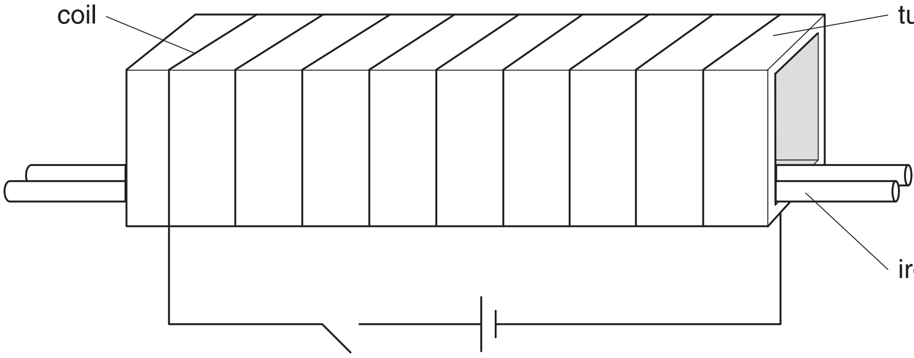

Fig. 7.1

(a) Two iron rods are placed next to each other at the bottom of the tube. When the current is switched on, the two rods repel each other. They move to the sides of the tube.

Explain why the two iron rods repel.

....

....

....

.... [2]

(b) An iron rod and a similar copper rod are placed next to each other at the bottom of the tube. State and explain what, if anything, happens to the rods when the current is switched on.

....

....

....

.... [2]

For Examiner's Use

5054/02/O/N/06/Q5

16 Fig. 5.1 shows a magnet, two compasses and two nails.

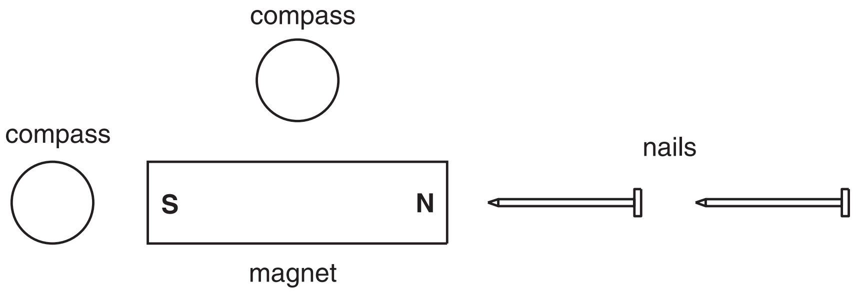

Fig. 5.1

(a) On Fig. 5.1, draw an arrow in each compass to show the direction of the magnetic field at the two positions. [2]

(b) The magnet causes the nails to become magnetised by induction. Both ends of each nail become magnetic poles.

On Fig. 5.1, mark an N or an S at each end of the two nails to show the magnetic poles. [2]

(c) When the magnet is removed, the nails are still magnetised.

Describe with the aid of a diagram how the nails can be demagnetised.

....

....

....

....

.... [2]

5054/02/O/N/07/Q7

For Examiner's Use

17 Fig. 7.1 shows apparatus that can be used to make an electromagnet or a permanent magnet.

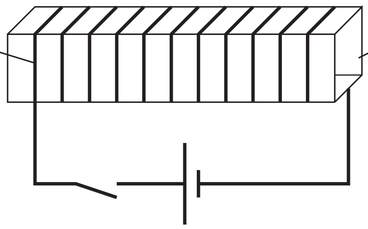

Fig. 7.1

Four rods are available. They are made of aluminium, soft iron, steel and wood.

(a) **(i)** State which rod is used to make a permanent magnet.

.... [1]

(ii) Describe how the apparatus is used to make a permanent magnet.

....

.... [1]

(b) A computer component is screened from external magnetic fields by placing it in a box, as shown in Fig. 7.2.

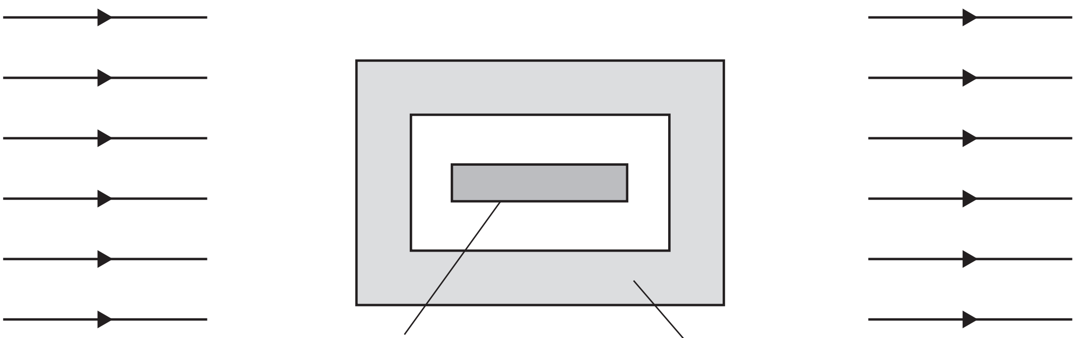

Fig. 7.2

There is a strong magnetic field outside the box. The magnetic field lines have not been drawn near the box.

(i) State the best choice for the material of the box.

.... [1]

(ii) On Fig. 7.2, join the magnetic field lines on the left of the box to those on the right, showing the pattern of the magnetic field. [2]

5054/02/O/N/08/Q10

18 Fig. 10.1 shows a wire passing through a hole in a horizontal, plastic board.

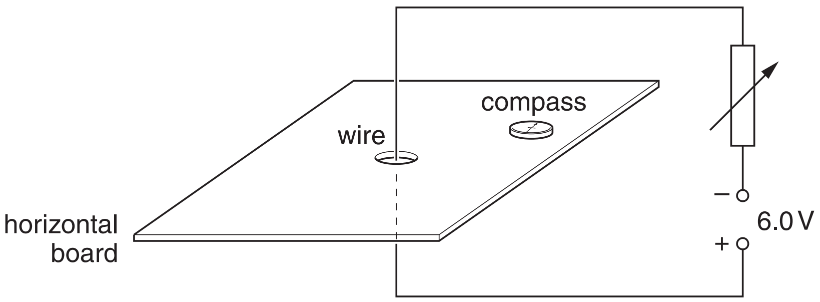

Fig. 10.1

The wire carries a current vertically upwards. A student moves a small compass around the board and plots the magnetic field lines due to the current.

(a) **(i)** Draw a diagram of the board as seen from above and mark on it the magnetic field lines due to the current. [3]

(ii) The current is increased. Describe how the magnetic field changes. [1]

(b) A 6.0 V power supply produces a current of 8.0 A in the wire. Calculate

(i) the total resistance of the circuit, [2]

(ii) the charge that flows through the wire in 2.0 minutes. [2]

(c) The north pole of a bar magnet is held on the left of the wire and the south pole of another bar magnet is held on the right, as shown in Fig. 10.2.

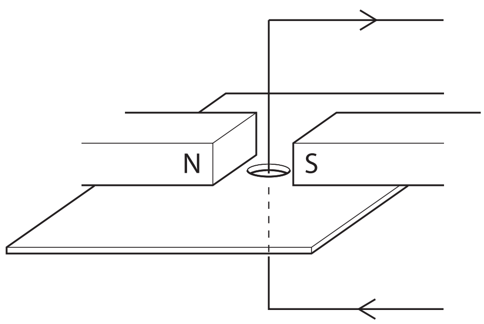

Fig. 10.2

(i) State the direction of the magnetic field at the wire due to these two poles. [1]

(ii) The wire is flexible. Describe the effect of this magnetic field on the current-carrying wire. [2]

(iii) The current in the wire is now reversed. State the effect of this on the wire. [1]

(iv) Describe how this effect is put to use in a d.c. motor. [3]

5054/21/O/N/10/Q6

19 Fig. 6.1 shows the coil of a loudspeaker attached to a cardboard cone. One pole of a stationary cylindrical magnet lies near to the coil.

For Examiner's Use

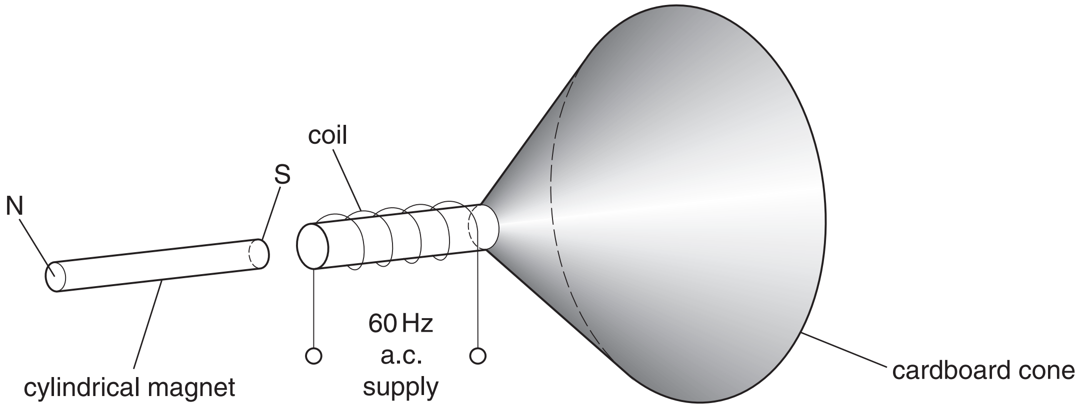

Fig. 6.1

There is an alternating current in the coil of the loudspeaker. A student hears the note produced.

(a) **(i)** Explain why the cone of the loudspeaker vibrates.

....

....

....

.... [3]

(ii) Explain how the vibrating cone produces sound waves in the air.

....

....

.... [2]

(b) A stronger cylindrical magnet is now used. State the difference in the note heard.

....

.... [1]

5054/22/O/N/10/Q6

20 Fig. 6.1 shows a metal bar placed inside a vertical solenoid.

For Examiner's Use

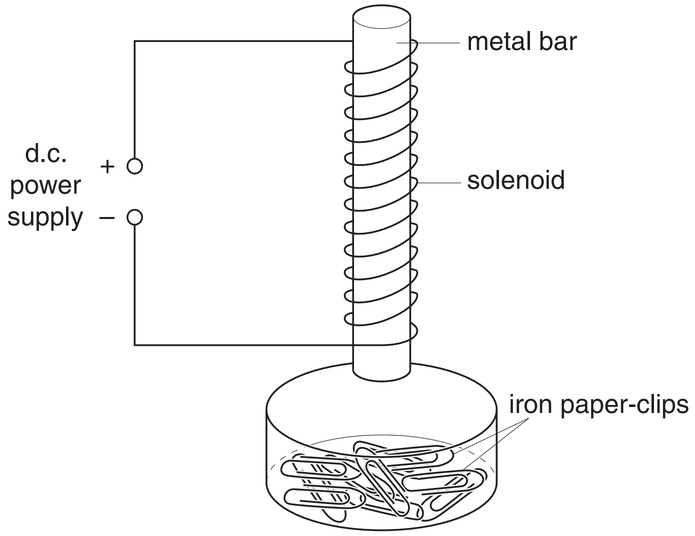

Fig. 6.1

The solenoid is a coil of several turns of insulated wire. A d.c. power supply is connected to the solenoid so that there is a current in it when the supply is switched on. The metal bar is a short distance above a small pile of iron paper-clips in a glass dish.

The power supply is

- switched on,
- left on for several seconds,
- then switched off.

Describe the behaviour of the paper-clips when this procedure is carried out using a metal bar of

(a) aluminium,

....

.... [1]

(b) iron,

....

.... [2]

(c) steel.

....

.... [2]

5054/22/O/N/11/Q5

21 Fig. 5.1 shows part of an electric bell.

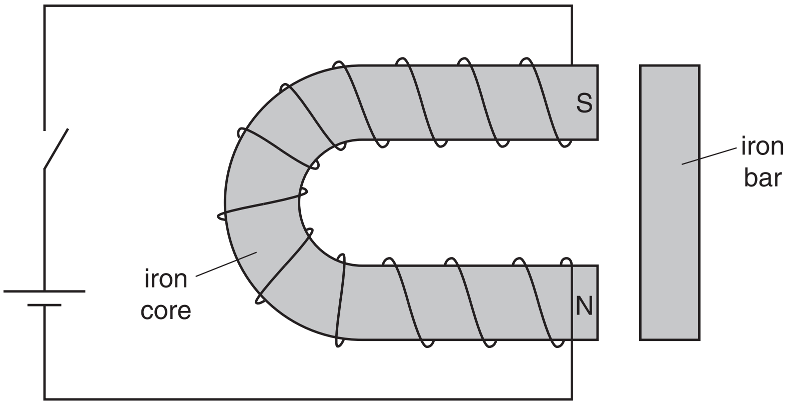

Fig. 5.1

A switch and a cell are in series with a length of wire coiled around an iron core.

The switch is closed and the current in the wire produces a south pole S and a north pole N at the ends of the core, as shown in Fig. 5.1. Magnetic poles are also produced in a small iron bar, placed near to the ends of the core.

(a) **(i)** On Fig. 5.1, mark with an N the position of the north pole produced in the iron bar and mark with an S the position of the south pole produced in the iron bar. [1]

(ii) State and explain what happens to the iron bar once it is magnetised.

....

....[2]

(b) The switch is opened and there is no current in the wire. State what happens to the magnetic poles in the iron bar.

....

....[1]

5054/21/O/N/13/Q6

For Examiner's Use

22 **(a)** Suggest a material that is used to make a permanent magnet.

.... [1]

(b) When there are no other magnetic fields present, the needle of a plotting compass points due north in the Earth's magnetic field. This is shown in Fig. 6.1.

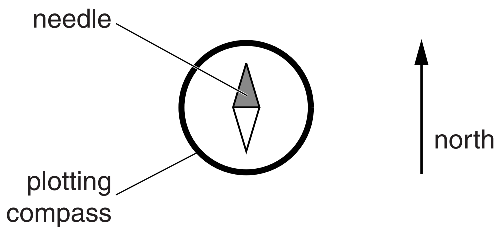

Fig. 6.1

The plotting compass is placed close to a permanent magnet, first at position A and then at position B, as shown in Fig. 6.2.

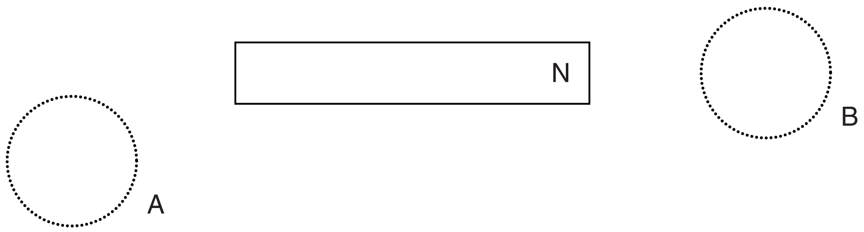

Fig. 6.2

The magnetic field close to the permanent magnet is very much larger than the magnetic field of the Earth.

On Fig. 6.2, draw needles in the two circles to show the direction in which the compass needle points when the compass is at A and at B. [2]

(c) Describe an electrical method that is used to demagnetise a permanent magnet. You may include a diagram in your answer.

....

....

....

.... [3]

5054/22/O/N/15/Q10

23 Thin wire, covered in plastic insulation, is used to make a solenoid (long coil). The solenoid is connected to a sensitive ammeter. Fig. 10.1 shows the N-pole of a steel magnet placed next to the solenoid.

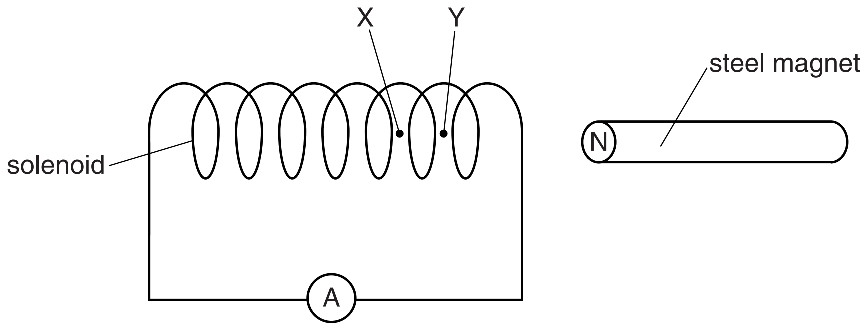

Fig. 10.1

Point X and point Y are on the axis of the solenoid.

(a) **(i)** Explain why plastic is an electrical insulator.

....

....

.... [1]

(ii) Explain why the magnet is **not** made from

1. aluminium,

.... [1]

2. iron.

.... [1]

(b) In one experiment, the magnet in Fig. 10.1 is moved to the left and passes into the solenoid. The N-pole of the magnet travels from Y to X at a constant speed. As it moves, the ammeter shows a small current.

(i) Explain why there is a current in the solenoid when the magnet is moving.

....

....

....

....

....

.... [3]

(ii) The N-pole travels from Y to X in 0.14 s. As it moves, the current shown on the ammeter is 0.045 mA. The resistance of the solenoid is 1.2 Ω.

Calculate

1. the potential difference (p.d.) across the solenoid,

potential difference = ... [2]

2. the charge that passes through the solenoid as the N-pole moves from Y to X.

charge = ... [2]

(c) In a second experiment, the speed of the N-pole is greater than its speed in the first experiment. It now takes only 0.070 s to travel from Y to X.

A current in the same direction is shown on the ammeter.

(i) State and explain how the size of this current compares with the size of the current in the first experiment.

....

....

.... [2]

(ii) The same quantity of charge passes through the coil in both the first and second experiments.

Explain why this is the case.

....

....

.... [1]

(d) State two ways in which the equipment shown in Fig. 10.1 can be used to produce a current in the solenoid that is in the opposite direction.

1. ....

2. ....

[2]

5054/22/O/N/16/Q9

24 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.

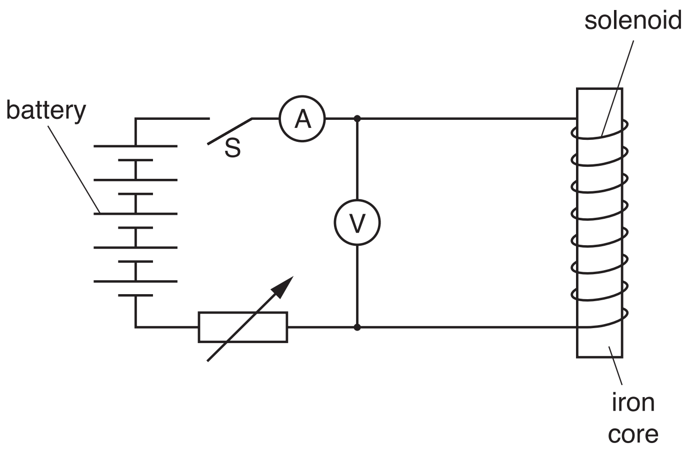

Fig. 9.1

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]

5054/21/O/N/18/Q6

25 Fig. 6.1 is the view from above of a stationary magnet and a small compass on a laboratory bench.

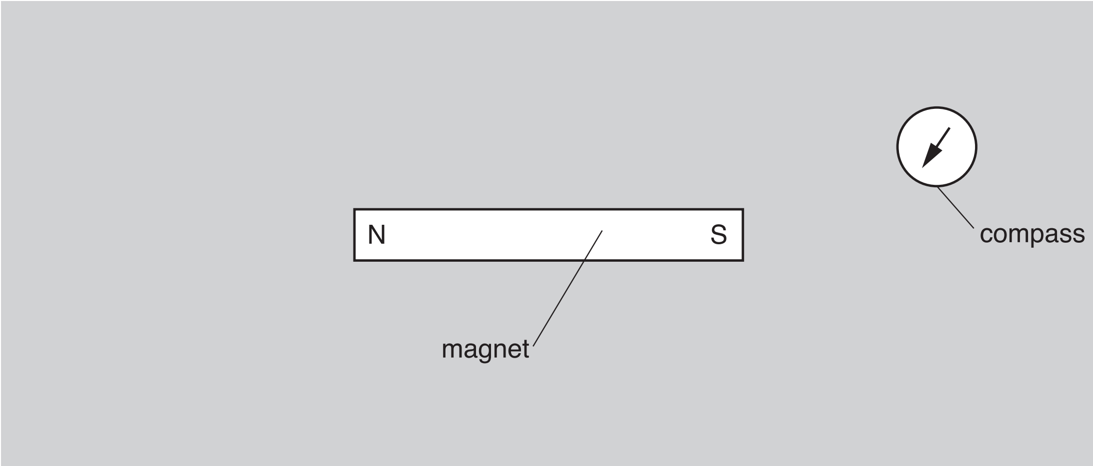

Fig. 6.1

(a) State the material from which the compass needle is made.

.... [1]

(b) Describe how the small compass is used to plot magnetic field lines in the region surrounding the magnet.

....

....

....

....

.... [3]

(c) An unmagnetised iron bar PQ is placed near to the magnet on the laboratory bench.

Fig. 6.2 shows the two poles of the magnet and PQ.

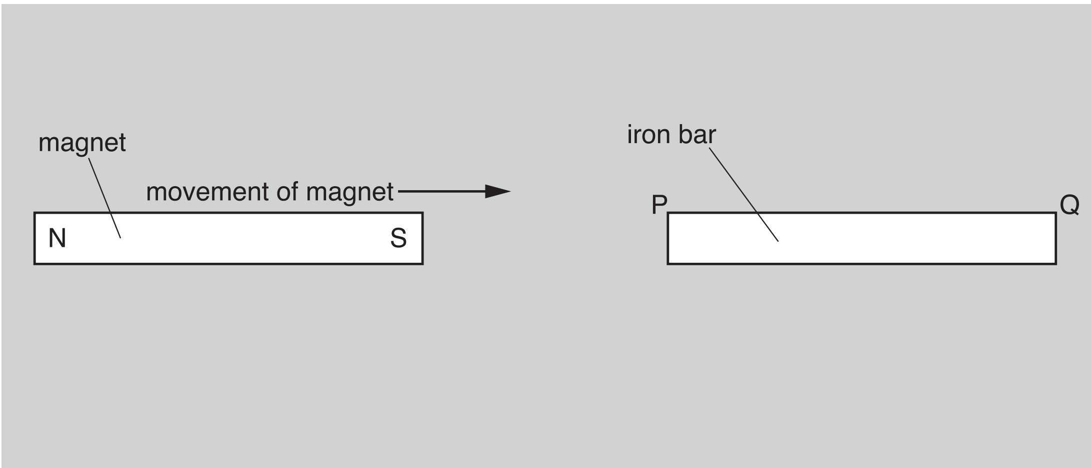

Fig. 6.2

The iron bar is initially at rest and the magnet is moved to the right very slowly.

When the magnet is a short distance from the iron bar, the iron bar moves very quickly to the left towards it.

Explain why the iron bar is attracted to the magnet.

....

....

....

.... [3]

5054/21/O/N/19/Q8

8 **(a)** A small electric component in a circuit needs to be protected from a strong, external magnetic field.

Describe how this is done and state any material used.

....

....

.... [2]

(b) Electromagnets have many domestic and industrial applications.

(i) In the space, draw a diagram of a simple electromagnet.

[3]

(ii) State and describe in detail one use of an electromagnet.

....

....

....

....

.... [3]

5054/22/O/N/20/Q9

9 Fig. 9.1 shows a permanent magnet lying on a piece of paper.

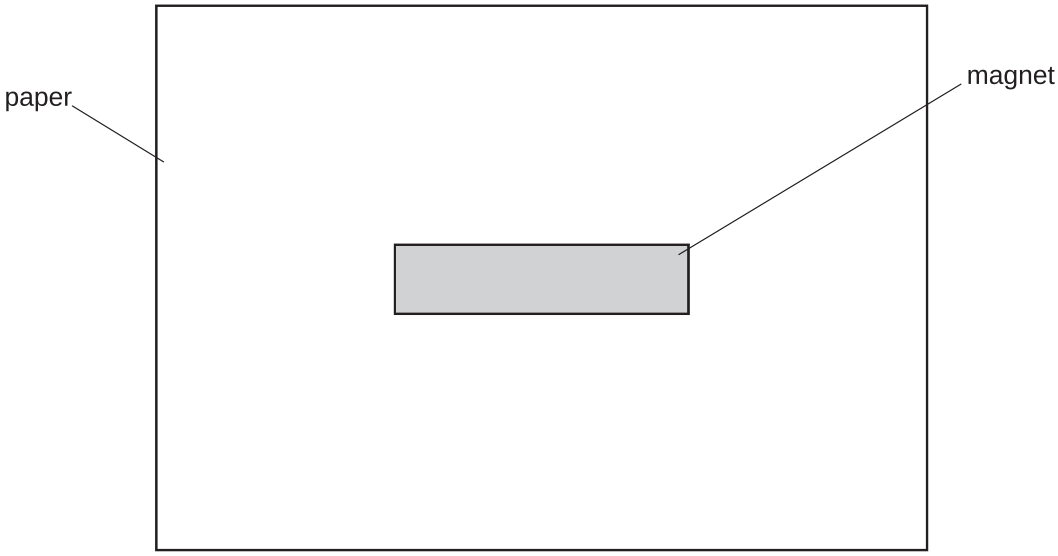

Fig. 9.1

(a) Underline the material in the list from which it is possible to make a strong, permanent magnet.

aluminium **copper** **glass** **iron** **mercury** **plastic** **steel**

[1]

(b) Describe an experiment to plot the pattern and the direction of the magnetic field surrounding the magnet. You may draw on Fig. 9.1, if you wish.

....

....

....

....

....

....

....

.... [4]