Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

STEM | Exam Builder

Magnetism

Time allowed: 1 hour 5 minutes

Subject code **0625**

Physics

Questions from Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 65

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 65 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 **(a)** Describe how the N pole of a bar magnet can be identified.

.....

.....

.....[2]

(b) Use words from the following list to answer the three questions below.

attractive force

repulsive force

no force

What force is there between

(i) two N poles, ...

(ii) two S poles, ...

(iii) a N pole and a S pole? .....

[3]

(c) Fig. 9.1 shows an iron bar placed close to the N pole of a bar magnet.

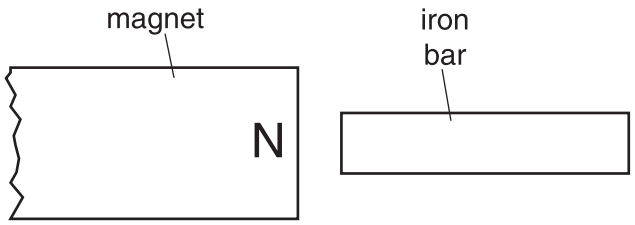


Fig. 9.1

(i) On Fig. 9.1, write N and S, to indicate the induced poles in the iron bar. [1]

(ii) Use a word from the list in **(b)** to describe the force between the magnet and the iron bar.

.....[1]

(iii) The iron bar is reversed end-to-end.

Describe the force that now exists between the magnet and the iron bar.

.....[1]

[Total: 8]

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1	**(a)**	idea of points to north (pole of Earth)	M1
		when freely suspended / floating on water	A1
		OR	
		repels	(M1)
		a (known) N pole	(A1)
	(b) **(i)**	repulsive / repel	B1
	(ii)	repulsive / repel	B1
	(iii)	attractive / attract	B1
	(c) **(i)**	S N	B1
	(ii)	attractive / attract	B1
	(iii)	attractive / attract	B1
			[Total: 8]

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2 A student has a permanent bar magnet and two metal bars, as shown in Fig. 9.1.

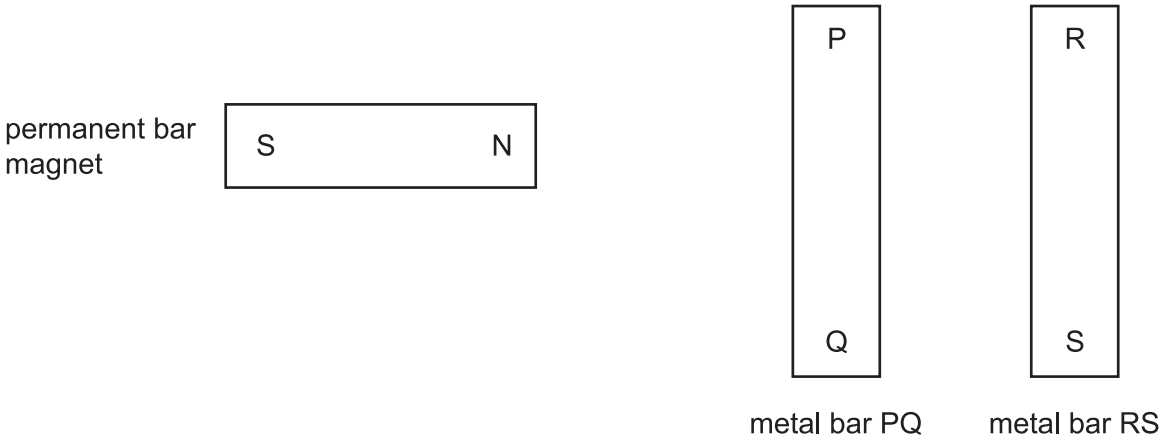


Fig. 9.1

The student tests bar PQ and bar RS separately. He holds the N pole of the permanent bar magnet close to each end of each metal bar. Table 9.1 shows the results of the tests.

Table 9.1

end of metal bar	result of test with N pole
P	attracted
Q	repelled
R	attracted
S	attracted

Deduce whether each metal bar is a magnet, an unmagnetised magnetic material or a non-magnetic material.

Give a reason for each of your answers.

1. metal bar PQ .....

.....

.....

2. metal bar RS .....

.....

.....

[4]

[Total: 4]

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2	1 (bar P–Q is a) (permanent) magnet	**M1**
	(because magnet) repels end Q	**A1**
	2 (bar R–S is an) unmagnetised magnetic material	**M1**
	(because magnet) attracts both ends (of R–S)	**A1**

3 The pivoted steel arrow from a small compass has become demagnetised.

The coil shown in Fig. 7.1 is to be used to magnetise it again.

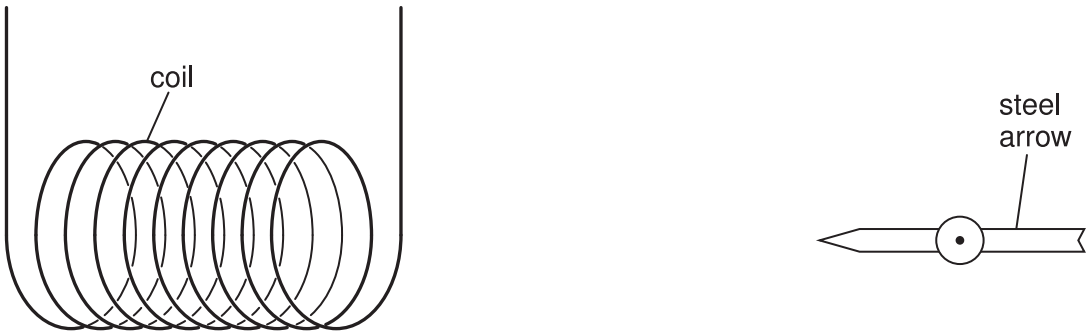


Fig. 7.1

(a) Describe carefully

(i) how the coil is used to magnetise the steel arrow,

.....

.....

.....

.....

.....[3]

(ii) how the polarity of the magnetised needle may be checked.

.....

.....

.....

.....[1]

(b) On Fig. 7.1, draw the magnetic field pattern of the magnetised needle. [2]

[Total: 6]

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3	**(a)**	**(i)**	needle inside coil	B1	
			current through coil OR connect battery/power supply direct current OR d.c.	M1	
			OR a.c. and switch off before removing needle/ magnet	A1	
		(ii)	freely suspend/pivot and see which end points N (or equivalent) OR see which end is <u>repelled</u> by N pole of a magnet	B1	
	(b)		4+ smooth curves leaving one end and going to the other (ignore any arrows)	B1	
			no lines crossing or meeting, even at ends	B1	[6]

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4 Fig. 6.1 shows a person using a magnetic window cleaner. The part on the outside of the window is attracted to the inside part through the glass window.

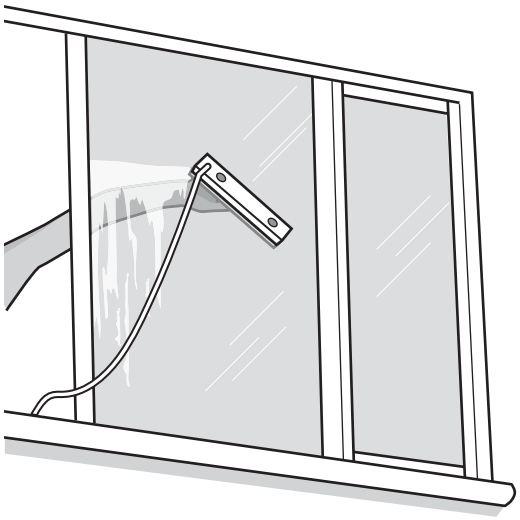


Fig. 6.1

Each part of the window cleaner contains two magnets. Fig. 6.2 shows the magnetic field between the parts of the window cleaner.

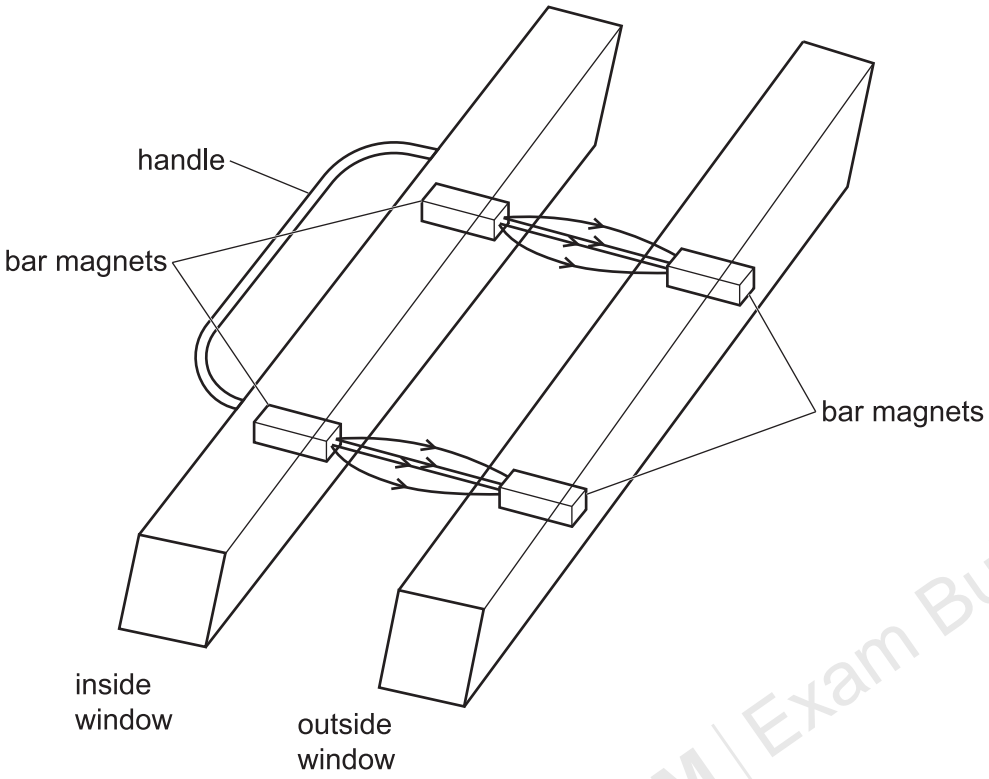


Fig. 6.2

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(a) Glass is **not** a magnetic material.

State the difference between magnetic and non-magnetic materials.

.....

..... [1]

(b) Suggest a suitable material for the magnets in the window cleaner. Explain your answer.

.....

..... [1]

(c) Label the poles of the magnets in Fig. 6.2. [1]

(d) State how the field lines in Fig. 6.2 show different strengths of the magnetic field between the magnets.

.....

..... [1]

[Total: 4]

Magnetism Click for more variations

Reduced to 77% to fit the page (wider than A4).

4(a)	any **one** from: • magnetic materials are attracted to magnets • non-magnetic materials are not attracted to magnets • magnetic materials experience a force in magnetic fields • non-magnetic materials don't experience a force in magnetic fields	**B1**
4(b)	any **one** from: • steel as it stays magnetised • steel makes a permanent magnet	**B1**
4(c)	N and S poles correctly labelled braille: north to south owtte	**B1**
4(d)	field lines close(r) indicates strong(er) (magnetic) field owtte ORA	**B1**

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5 **(a)** Fig. 8.1 shows a permanent bar magnet.

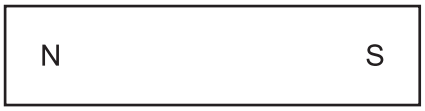


Fig. 8.1

Describe an experiment to identify the **pattern** and **directions** of the magnetic field lines around the bar magnet.
You may draw on Fig. 8.1 as part of your answer.

.....

.....

.....

.....

.....

..... [4]

(b) State the name of a material that is suitable for a permanent magnet.

..... [1]

(c) State **one** use of a permanent magnet.

..... [1]

[Total: 6]

Magnetism Click for more variations

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5(a)	use of compass to give direction of field lines first method (use of plotting) compass(es) idea of mark arrow position **OR** move compass in direction of arrow	**B1**
	start from different position(s) **OR** join up marks / draw lines (to show pattern) **OR** alternative method (use of plotting) compass(es) place number of compasses around magnet idea that arrows line up to show pattern	**B3**

5(b)	steel	**B1**
5(c)	electric motors **OR** loudspeakers **OR** burglar alarms	**B1**

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6 Fig. 8.1 shows a sheet of paper. A bar magnet is underneath the paper. A student sprinkles iron filings onto the paper.

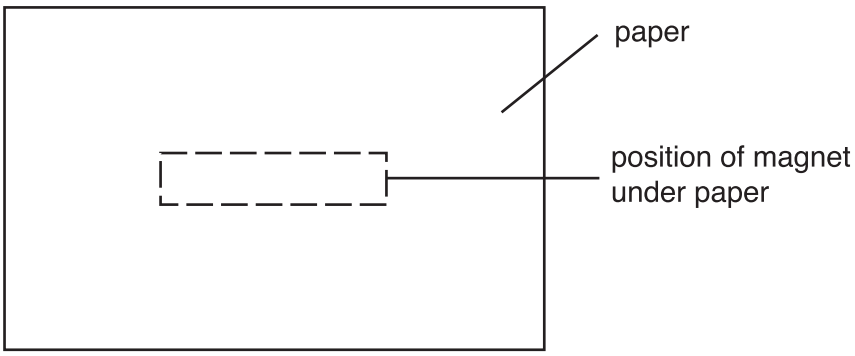


Fig. 8.1

(a) On Fig. 8.1

- Label the position of each pole of the magnet. Use the label N for the north pole and S for the south pole.
- Draw one magnetic field line above the magnet and draw one magnetic field line below the magnet.
- Add **one** arrow to show the direction of the magnetic field.

[4]

(b) A student places a soft iron rod inside a coil of insulated wire. The coil is connected to a battery, as shown in Fig. 8.2.

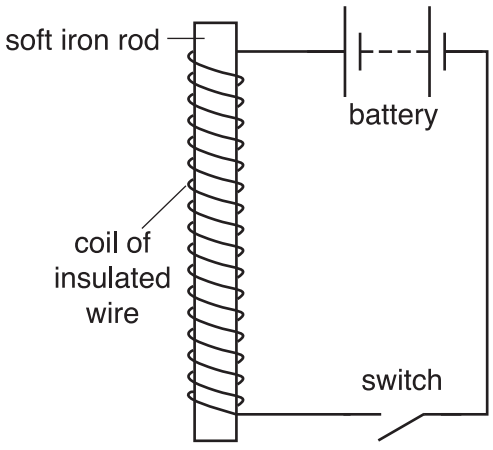


Fig. 8.2

(i) State the name given to the device shown in Fig. 8.2.

.....[1]

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(ii) The student puts one end of the device in Fig. 8.2 just above a pile of iron filings.

He closes the switch for a short time and then opens it again.

Describe the effect this has on the iron filings.

.....

.....[1]

(iii) The student removes the soft iron rod and replaces it with a steel rod.

He puts one end of the steel rod just above the pile of iron filings. He closes the switch for a short time and then opens it again.

Describe the effect this has on the iron fillings.

.....

.....

.....[1]

[Total: 7]

Magnetism Click for more variations

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6(a)	N and S labelled at either end of magnet correct field line shown above magnet correct field line shown below magnet field points in direction N to S	**B4**
6(b)(i)	electromagnet	**B1**
6(b)(ii)	(soft iron) filings attracted, but (most) fall off when switch opened	**B1**
6(b)(iii)	(steel) (most / more / they) remain attached when switch opened	**B1**

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7 A physics teacher suspends two pointers in a magnetic field. One pointer is made of brass and the other is a magnet.

She holds the pointers in the initial positions shown in the two upper circles of Fig. 7.1. She then releases the pointers.

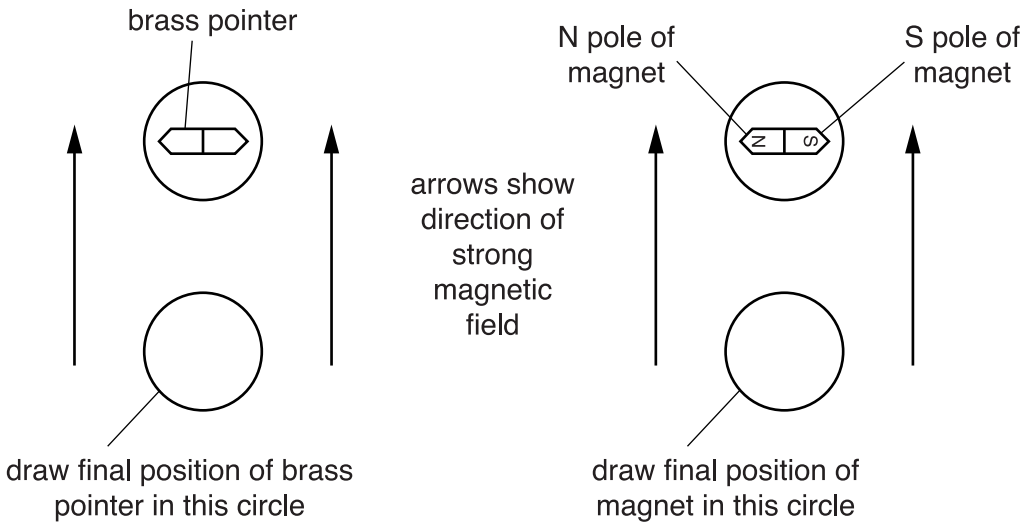


Fig. 7.1

(a) In the lower circles of Fig. 7.1, draw the settled final positions of the two pointers. [2]

(b) **(i)** Explain the final position of the brass pointer.

.....

.....

.....

(ii) Explain the final position of the magnet.

.....

.....

.....

[2]

(c) Suggest a material from which the magnet is made.

.....[1]

[Total: 5]

Magnetism Click for more variations

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7 **(a)** brass: needle horizontal B1

magnet: needle vertical, N pole up B1

(b) **(i)** no forces/effect on needle B1

(ii) needle aligns with field OR N or S pole attracted along field line or to (magnetic) S or N
NOT points to N of Earth B1

(c) steel, accept cobalt, nickel, ferrite, Magnadur, Alnico
NOT iron B1

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8 **(a)** Different materials have differing magnetic properties.

(i) State the name of a material that is suitable for a **temporary** magnet.

..... [1]

(ii) State the name of a material that is suitable for a **permanent** magnet.

..... [1]

(iii) State how a magnet can show that a material is non-magnetic.

..... [1]

(b) A teacher uses the arrangement in Fig. 10.1 to demonstrate an electric bell. When the switch is closed, the hammer repeatedly hits the metal gong.

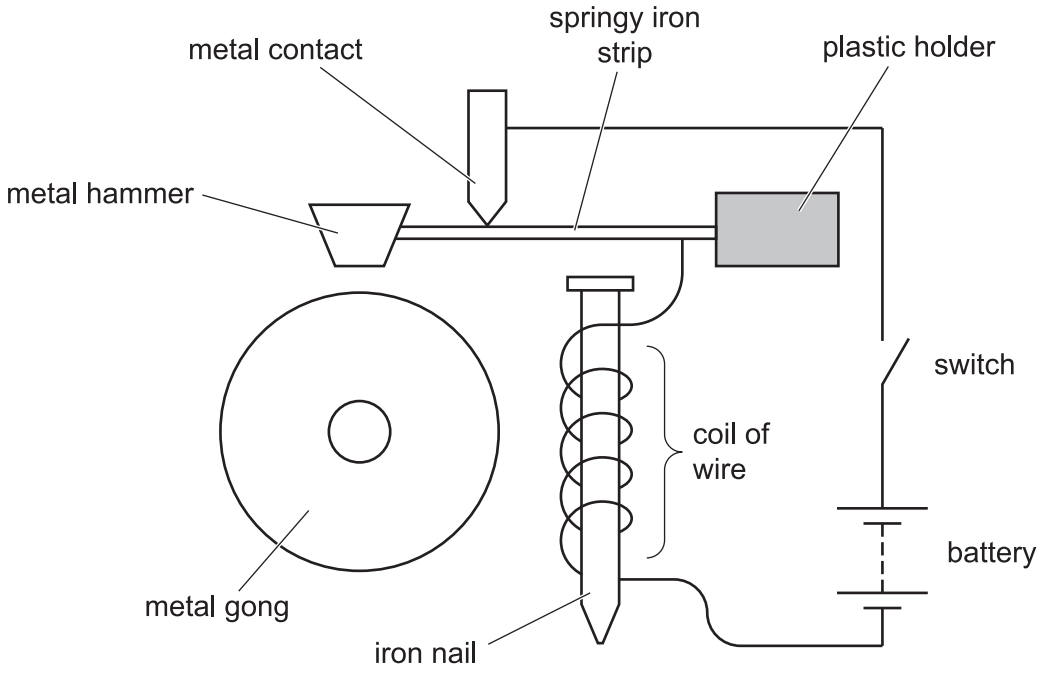


Fig. 10.1

Using the information in Fig. 10.1, explain why the hammer repeatedly hits the metal gong when the switch is closed.

.....

.....

.....

.....

..... [4]

[Total: 7]

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Reduced to 78% to fit the page (wider than A4).

8(a)(i)	(soft) iron	**B1**
8(a)(ii)	steel	**B1**
8(a)(iii)	magnet does not attract a non-magnetic material	**B1**
8(b)	any **four** from: (when switch closed) there is a complete circuit current in the circuit magnetic effect (of current / in coil) owtte (coil and nail become) electromagnet (springy) iron (strip) attracted to (nail / electromagnet) circuit broken owtte springy iron strip springs back / makes contact (again) owtte	**B4**

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9 **(a)** Fig. 7.1 shows two magnets and the gap between the N pole of one magnet and the S pole of the other magnet.

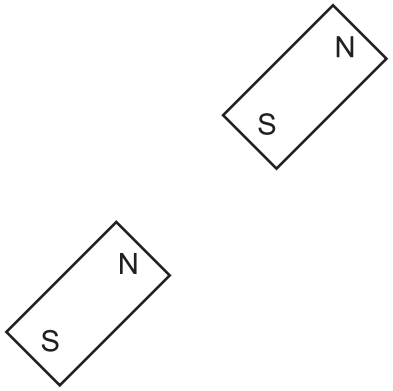


Fig. 7.1

On Fig. 7.1, draw **three** lines to show the pattern and direction of the magnetic field in the gap. [2]

(b) **(i)** Fig. 7.2 is a repeat of Fig. 7.1 showing the two magnets.

On Fig. 7.2, draw the position of a plotting compass needle when it comes to rest in the gap between the N pole and the S pole.

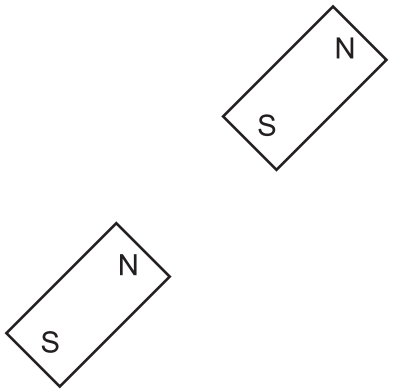


Fig. 7.2 [1]

(ii) Explain why the needle comes to rest in this position.

.....

.....

..... [2]

(c) Describe a method of demagnetising a bar magnet.

.....

.....

..... [2]

[Total: 7]

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9(a)	3 lines from N face to S face middle line must be straight AND perpendicular to end faces	**B1**
	at least 1 arrow from N to S AND NO arrows from S to N	**B1**
9(b)(i)	needle perpendicular to end faces AND {arrow pointing to S OR correctly labelled N OR S}	**B1**
9(b)(ii)	compass / needle / it aligns with field OR compass / needle / it points in direction of magnetic field OR compass / needle / it points to S(outh)	**B1**
	N pole of needle attracted to S of magnet(s) OR N pole repelled by N of magnets OR unlike poles attract / like poles repel	**B1**
9(c)	heat OR hammer	**B1**
	with magnet lying (magnetically) E – W	**B1**
	OR place in coil / solenoid with a.c.	**(M1)**
	withdraw OR reduce current to 0	**(A1)**

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10 Fig. 7.1 shows a barrier at the entrance to a car park. The wooden barrier arm has a weight of 60 N which acts through the centre of gravity at the position shown on Fig. 7.1.

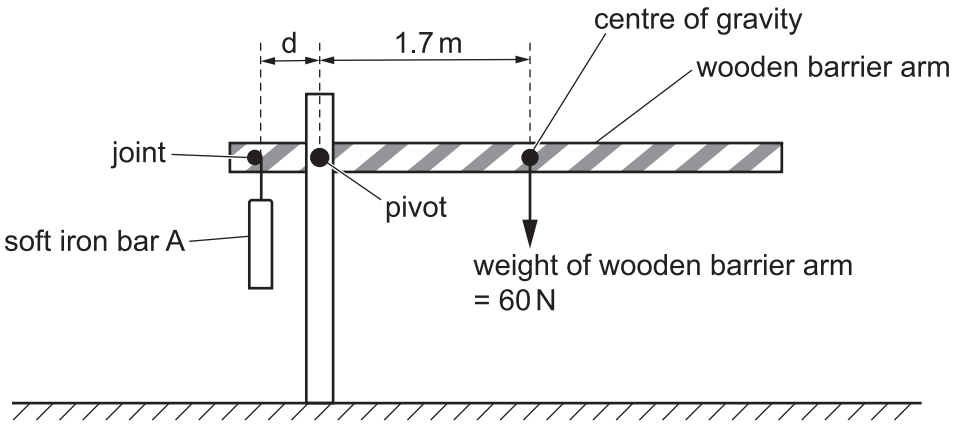


Fig. 7.1

(a) Initially the wooden barrier arm is horizontal.

(i) Using Fig. 7.1, calculate the clockwise moment of the weight of the wooden arm about the pivot.

clockwise moment = ... Nm [1]

(ii) The wooden barrier arm is in equilibrium. The mass of the soft iron bar A is 23 kg.

Calculate the distance d between the pivot and the joint holding the soft iron bar A.

distance d = ... [3]

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(b) Fig. 7.2 shows a coil attached to a power supply placed below the soft iron bar A.

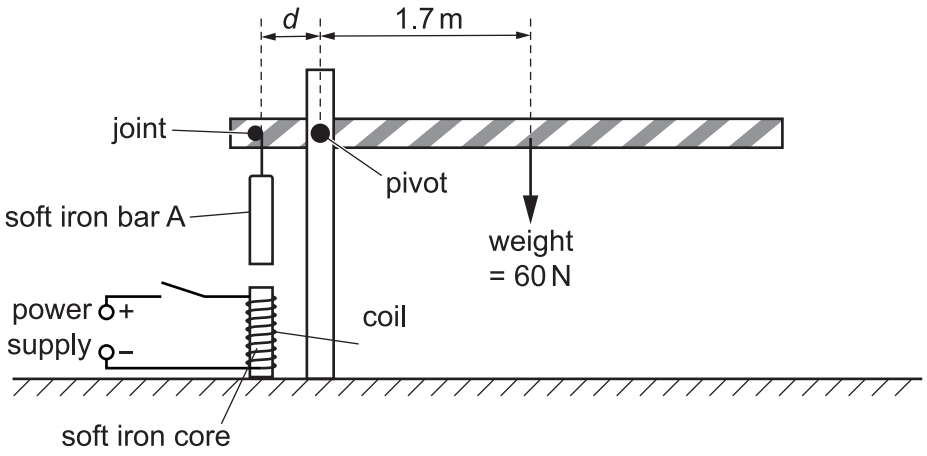


Fig. 7.2

(i) State and explain what happens to the wooden barrier arm when the switch in the coil circuit is closed.

statement .....

explanation .....

.....

.....

.....

[3]

(ii) The switch is opened. An operator decreases the potential difference across the coil and the switch is closed.

State and explain how the effect on the wooden barrier arm compares with the effect in **(b)(i)**.

statement .....

explanation .....

.....

[2]

(iii) A student suggests that the soft iron bar A is replaced by a steel bar. Explain why a steel bar is less effective than a soft iron bar in the barrier.

.....

.....

..... [2]

[Total: 11]

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10(a)(i)	100 (Nm)	**B1**
10(a)(ii)	0.44 m ***OR*** 0.45 m	**A3**
	total clockwise moment = total anticlockwise moment	C1
	(d =) 100 / 225 ***OR*** (d =) 100 / (23 × 9.8) ***OR*** 100 / (23 × g × d)	C1
10(b)(i)	(barrier arm) rotates anticlockwise ***OR*** (RHS of barrier arm) moves upwards	**B1**
	(when the switch is closed) coil produces a magnetic field ***OR*** coil / core becomes an (electro)magnet	**B1**
	(coil/core/electromagnet) attracts (iron) bar (downwards)	**B1**
10(b)(ii)	statement: (barrier arm) moves slower / goes up (more) slowly	**B1**
	explanation: decreases strength of (magnetic) field / smaller force / smaller moment	**B1**
10(b)(iii)	steel would become permanently magnetised	**B1**
	(so when switch is opened) barrier would stay up ***or*** bar A will stay attracted (to soft iron core)	**B1**

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