



GCSE Physics

Permanent and Induced Magnetism

Mark Scheme

Time available: 55 minutes

Marks available: 52 marks

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Mark schemes

- 1.** (a) the magnets are not touching
but (each) experiences a force
allow but there is a force of attraction between them 1
- (b) place a (plotting) compass near the (north / south) pole of the magnet and mark the direction that the compass points 1
- move the (plotting) compass around the bar magnet (to the other pole) marking at (regular) intervals the direction the compass points 1
- join the points up and add an arrow pointing from the north pole to the south pole 1
- (c) (closing switch S) causes a current in the coil
allow switches on the electromagnet 1
- a magnetic field is created 1
- a force of attraction acts on the ball bearing 1
- so the ball bearing accelerates (towards the iron rod) 1
- [9]
- 2.** (a) top of each paper clip labelled N / north
both parts required
- and**
bottom of each paper clip labelled S / south 1
- (b) so the paper clips have the same weight / mass 1
- which allows the results for different numbers of turns to be compared (fairly)
allow fair test
allow the control variable (is the weight / mass of a paper clip)
allow to obtain valid results
ignore accurate results 1

- (c) as the number of turns increases so does the number of paper clips (held)
allow positive correlation 1

in a linear pattern

directly proportional scores 2 marks

allow a correct description of directly proportional for 2 marks

1

- (d) some of the paper clips were already magnetised

1

- (e) discount the result of 18

ignore repeat experiment / measurements

1

as the three new results are similar (and not close to 18)

1

and use 15 (the mean of the new results)

allow find the mean of the remaining results (16, 14 and 15)

if no other marks have been awarded: calculate the mean (of all four results) (1)

round down to 15 (1) – this mark only scores if the mean of 15.75 has been calculated

1

- (f) keep number of turns constant

allow a specific number of turns

1

(use the variable resistor to) change the current (several times)

change the p.d. is insufficient

1

(for each current value) count how many paper clips the electromagnet will hold

1

[12]

3.

- (a) induced

1

- (b) bar 2

1

(the same end) of bar 1 attracts both ends of bar 2

or

only two magnets can repel so cannot be bar 1 or bar 3

1

(c) so the results for each magnet can be compared

or

so there is only one independent variable

fair test is insufficient

allow different thickness of paper would affect number of sheets each magnet could hold

accept it is a control variable

1

(d) because the magnet with the biggest area was not the strongest

accept any correct reason that confirms the hypothesis is wrong eg smallest magnet holds more sheets than the largest

1

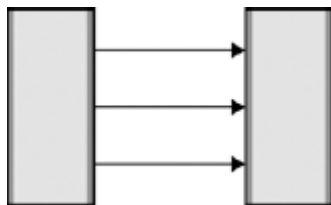
[5]

5.

(a) (i) field pattern shows:
some straight lines in the gap

1

direction N to S



1

(ii) north poles repel

1

(so) box will not close

1

(b) (i) as paper increases (rapid) decrease in force needed

1

force levels off (after 50 sheets)

1

(ii) the newtonmeter will show the weight of the top magnet

1

(iii) (top) magnet and newtonmeter separate before magnets separate

accept reverse argument

1

(because) force between magnets is greater than force between magnet and hook of newtonmeter

1

(iv) any **three** from:

- means of reading value of force at instant the magnets are pulled apart
- increase the pulling force gently
- **or**
use a mechanical device to apply the pulling force
- clamp the bottom magnet
- use smaller sheets of paper
- fewer sheets of papers between readings (smaller intervals)
- ensure magnets remain vertical
- ensure ends of magnet completely overlap
- repeat the procedure several times for each number of sheets and take a mean
- make sure all sheets of paper are the same thickness

3

(v) 3 (mm)

30 × 0.1 ecf gains 2 marks

2.1 N corresponds to 30 sheets gains 1 mark

3

[15]

6. (a) (i) increase 1
- (ii) A and B
and
B and C
*both required for the mark
either order* 1
- (iii) any **two** from:
- size of nail
or
nail material
allow (same) nail
 - current
*allow (same) cell
allow p.d.
same amount of electricity is insufficient*
 - (size of) paper clip
 - length of wire
accept type / thickness of wire 2
- (b) 4 1
- B picks up the same number as C, so this electromagnet would pick up the same number as A
or
direction of current does not affect the strength of the electromagnet
allow it has got the same number of turns as A 1
- (c) 2 1
- allow 1 or 3* [7]
7. (i) relay
*accept solenoid
do **not** accept magnetic switch* 1

- (ii) a current flows through the coil (of the electromagnet)
or a current flows through the electromagnet
or a (magnetic) field is produced
accept 'electricity' for 'current'
*accept the electromagnet is activated **or** magnetised **or** turned on*
*do **not** accept answer in terms of magnetic charge*

1

the (iron) arm is attracted to the electromagnet
*accept the arm pivots **or** moves towards the electromagnet*

1

the contacts are pushed together
*do **not** accept contacts attract*

1

[4]