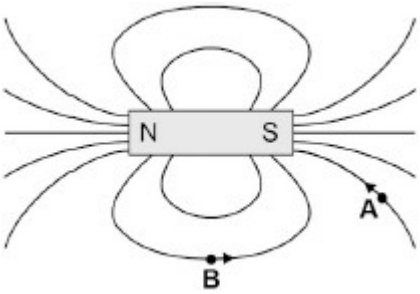
Mark schemes

1.

(a) both arrows correct

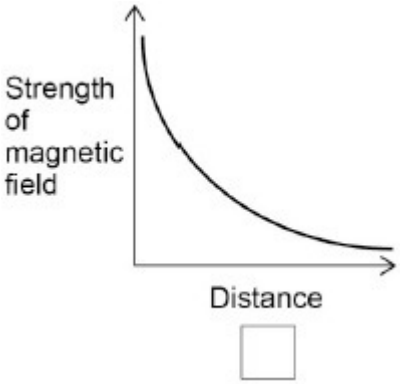


1

(b) a permanent magnet

1

(c) third box ticked



1

any **one** from

- (the only graph) that shows the magnetic field getting weaker (as distance increases)
- both other graphs show the magnetic field getting stronger (as the distance increases)

only scores if correct box is chosen

1

(d) steel cans are attracted to the electromagnet and are transferred to the container (by the conveyor belt)

1

aluminium cans are not attracted to the electromagnet and are left behind on the table

If no other mark scored: Steel cans are attracted (to the electromagnet) but aluminium cans are not – scores one mark

1

(e) raise the height of the table

allow longer legs on the table

allow put a (non-magnetic) box on top of the table

allow lower the electromagnet

1

use a larger potential difference / current

or

use a stronger electromagnet

allow more turns on the coil (of the electromagnet)

*do **not** accept insert a (soft) iron core*

1

(f) distance travelled = speed × time

or

$s = v\,t$

1

(g) $3.3 = 1.7 \times t$

1

$t = \frac{3.3}{1.7}$

1

$t = 1.941$ (s)

1

$t = 1.9$ (s)

allow a calculation using the given data incorrectly but correctly rounded to 2 sig figs

1

[13]

2. (a) (the north pole of the floating magnet is) repelled from the north pole (of the fixed magnet)

1

and attracted to the south pole (of the fixed magnet)

*allow following a magnetic field line for **1 mark** if no other marks scored*

1

(b) it was attracted (to the fixed magnet)

allow it sticks / joins to the (fixed) magnet

allow it becomes an induced magnet

allow it becomes magnetised

1

(c) **Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

3–4

Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content:

- mark where the compass points on the paper
- move the compass to the marked point
- repeat until you go back to the magnet
  join up the points
- add an arrow pointing from the north pole to the south pole
- repeat for positions (above and below the bar magnet)

(d) C B A

*allow **1** mark for one letter in the correct box*

2

(e) Ee = 0.5 × 200 × 0.0402

1

Ee = 0.16 (J)

1

[11]

3. (a) both arrows pointing horizontally and to the right

judged by eye

1

(b) (two south) poles would repel

allow magnets would repel

1

so the coat would not be held together

allow so the coat would not fasten

1

(c) C

1

(d) steel rod

1

(e) electromagnet exerts a downwards force on the iron bar

allow electromagnet pulls the iron (bar) down(wards)

allow electromagnet attracts the iron (bar)

1

(f) 1.5 (cm)

1

(g)

*an answer 0.27 (N) scores **2** marks*

F = 0.18 × 1.5
OR
F = 0.18 × their 3.6

1

F = 0.27 (N)

allow 0.18 × their 3.6 correctly calculated

1

(h) it increases

1

and reaches a maximum

allow and then does not change
*any change other than current causing strength to increase scores **0***

1

[11]

4. (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]

5. (a) the magnets are not touching

1

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]

6. (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]

7. (a) move a (magnetic / plotting) compass around the wire

1

the changing direction of the compass needle shows a magnetic field has been produced

OR

sprinkle iron filings onto the card (1)

tapping the card will move the filings to show the magnetic field (pattern) (1)

1

(b) **Level 2 (3–4 marks):**

A detailed and coherent explanation is provided. The response makes logical links between clearly identified, relevant points that explain how the ignition circuit works.

Level 1 (1–2 marks):

Simple statements are made. The response may fail to make logical links between the points raised.

0 marks:

No relevant content.

Indicative content

- closing the (ignition) switch causes a current to pass through the electromagnet
- the iron core (of the electromagnet) becomes magnetised
- the electromagnet / iron core attracts the (short side of the) iron arm
- the iron arm pushes the (starter motor) contacts (inside the electromagnetic switch) together
- the starter motor circuit is complete
- a current flows through the starter motor (which then turns)

4

[6]