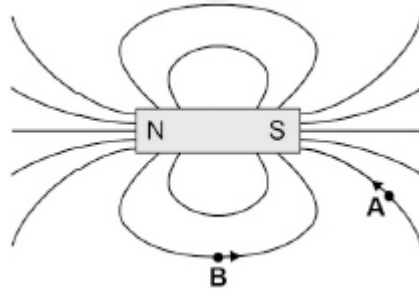


Mark schemes

1.

(a) both arrows correct

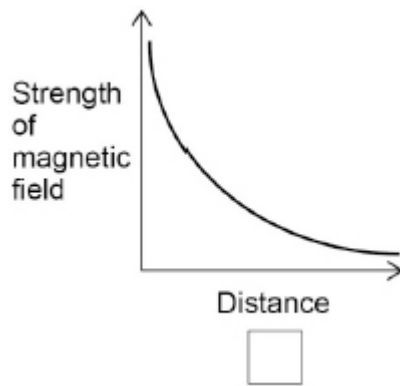


1

(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
- \times
- time

or

$$s = v t$$

1

- (g)
- $3.3 = 1.7 \times t$

1

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

1

$$t = 1.941 \text{ (s)}$$

1

$$t = 1.9 \text{ (s)}$$

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) $E_e = 0.5 \times 200 \times 0.040^2$ 1

$E_e = 0.16 \text{ (J)}$ 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

$$F = 0.18 \times 1.5$$

OR

$$F = 0.18 \times \text{their } 3.6$$

1

$$F = 0.27 \text{ (N)}$$

allow 0.18 x 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]