

Mark schemes

Q1.

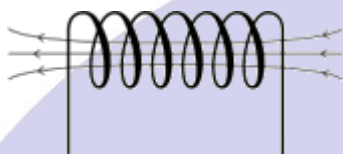
- (a) direction (of the magnetic field)

1

- (b) increase the current in the wire

1

- (c)



1

- (d) **D A B C**

allow 1 mark for D B A C

2

- (e) decrease the distance between the electromagnet and the iron arm

1

[6]

Q2.

- (a) iron

1

- (b) coil

1

- (c) the magnetic field would be stronger

1

- (d) the magnetic field would be weaker

1

[8]

Q3.

- (a) at least three circles drawn

1

clockwise arrows on circles

allow 1 mark for one or two circles with clockwise arrows

1

[2]

Q4.

- (a) C 1
- (b) steel rod 1
- (c) electromagnet exerts a downwards force on the iron bar
allow electromagnet pulls the iron (bar)
down(wards)
allow electromagnet attracts the iron (bar) 1
- (d) it increases 1

and reaches a maximum

allow and then does not change

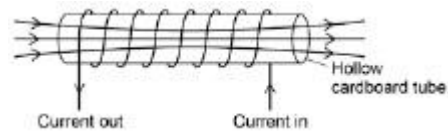
any change other than current causing strength
to increase scores 0

1

[11]

Q5.

- (a) field lines going in, (through) and out of the solenoid



allow field lines only visible outside the cardboard tube

allow a bar magnet shaped field with lines above and below the solenoid

1

arrow(s) in correct direction

1

- (b) the rods become (induced) magnets

allow the rods are (temporarily) magnetised

ignore rods repel

*do **not** accept rods become charged*

1

with the same polarity (at each end)

1

- (c) changed two (independent) variables (at the same time)

allow need to keep current or number of turns constant

allow should only change one variable (at a time)

allow current and number of turns both changed

ignore fair test

1

so it is not possible to know the effect of one (independent) variable or the other

1

- (d) (increasing the current) increases the strength until the strength reaches a maximum value

allow weight (held) for strength of electromagnet

ignore a given current value for when maximum strength happens

1

- (e) increasing the number of turns from 10 to 20 increases the strength more than increasing from 20 to 30

a general trend is required

1

[8]

Q6.

- (a) 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
- (b) 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
- (c) some of the paper clips were already magnetised 1
- (d) 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
- (e) 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]

Q7.

- (a) Iron 1
- (b) there is a current in the solenoid / circuit 1
allow a charge flows through the solenoid / circuit
- creating a magnetic field 1
allow the solenoid / coil is magnetised
- attracting the bolt 1

- (c) Any **two** from: 2 [14]
- increase the current (in the solenoid / circuit)
*allow any sensible suggestion for increasing the current such as increasing the p.d. / power of the battery **OR** using lower resistance wire in the solenoid*
 - add more turns to the solenoid
*do **not** allow increase the number of coils*
 - use a spring with a lower spring constant
allow use a weaker spring

Q8.

- (a) (closing switch S) causes a current in the coil 1
allow switches on the electromagnet
- 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]

Q9.

(a) C B A

allow 1 mark for one letter in the correct box

2

[11]

Q10.

1

(a) **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]