AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



MARK SCHEME

4.7.1 PERMANENT AND INDUCED MAGNETISM, MAGNETIC FORCES AND FIELDS (PACK 2)

SCORE	PERCENTAGE
/110	%

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Q1.

(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

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

1

[12]

Q2.

(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]

Q3.

(a) gravity

1

(b) as the wire moves through the Earth's magnetic field

1

a potential difference is induced between the ends of the wire

1

the wire must be part of a complete circuit

1

(c) new trace shows:

twice the frequency

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1

twice the amplitude

1

(d) dynamo

dc generator is insufficient

1

(e) the alternator pd changes polarity, the 2nd type of generator does not

1

(f) $\frac{230}{V_s} = \frac{690}{57}$

1

$V_s = \frac{230 \times 57}{690}$

1

V_s = 19 (V)

*an answer of 19 (V) scores **3** marks*

1

[11]

Q4.

(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]

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Q5.

(a) in a longitudinal wave the oscillations / vibrations are parallel to the direction of energy transfer.

accept wave travel for energy transfer throughout

1

in a transverse wave the oscillations / vibrations are perpendicular to the direction of energy transfer.

1

(b) accept any sensible suggestion eg a vibrating drum skin does not move the air away to create a vacuum (around the drum)

1

(c) **Level 3 (5–6 marks):**
A detailed explanation linking variations in current to the pressure variations of a sound wave, with a logical sequence.

Level 2 (3–4 marks):
A number of relevant points made, but not precisely. A link between the loudspeaker and
a sound wave is made.

Level 1 (1–2 marks):
Some relevant points but fragmented with no logical structure.

0 marks:
No relevant content.

Indicative content

the current in the electrical circuit is varying

the current passes through the coil

the coil experiences a force (inwards or outwards)

reversing the current reverses the force

the size of the current affects the size of the force

the varying current causes the coil to vibrate

the (vibrating) coil causes the cone to vibrate

the vibrating cone causes the air molecules to move

the movement of the air molecules produces the pressure variations in the air needed for
a sound wave

the air molecules bunch together forming compressions and spread apart forming rarefactions

6

[9]

Q6.

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(a) motor effect

1

(b) increase the strength of the magnet

or

increase the current

1

(c) $4.8 \times 10^{-4} = F \times 8 \times 10^{-2}$

1

$F = 6 \times 10^{-3}$ (N)

1

$6 \times 10^{-3} = B \times 1.5 \times 5 \times 10^{-2}$

1

$B = \frac{6 \times 10^{-3}}{7.5 \times 10^{-2}}$

1

$B = 8 \times 10^{-2}$ or 0.08

1

*allow 8×10^{-2} **or** 0.08 with no working shown for **5** marks*

*a correct method with correct calculation using an incorrect value of F gains **3** marks*

Tesla

accept T

1

do not accept t

[8]

Q8.

(a) induced

1

(b) any **two** from:

- use the same (strength) magnet
  same size magnet is insufficient
- the speed that the magnet is moved
  accept movement of the magnet
- the area of the turns
  same type / length of wire is insufficient
- the magnetic pole being moved towards the coil (of wire).
  use the same voltmeter is insufficient

2

(c) (i) voltmeter misread
or
number of turns miscounted

result misread is insufficient

human error is insufficient

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allow the magnet was moved at a (slightly) different speed (into the coil) than for the other readings

allow spacing between the turns had changed

1

(ii) line of best fit passing through all points except (100, 0.034)

line does not need to go back to origin

1

(d) any **one** from:

- can re-check data / readings.

  accept can go back to data
- can take more readings (in a given time)

  can store data is insufficient
- easier to identify maximum value.

  automatically records data is insufficient

  accept is more accurate

  accept eliminates human error

1

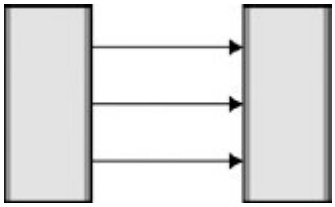
[6]

Q9.

(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

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(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]

Q10.

(a) plastic or rubber

accept any named plastic
*do **not** accept wood*

1

it is a (good) insulator **or** it is a poor conductor

ignore mention of heat if in conjunction with electricity

1

(b) *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*

Maximum of 2 marks if ideas not well expressed.

pulls iron bolt down **or** attracts the iron bolt **or** moves bolt out of plunger

answers in terms of charges attracting
or repelling gain no credit

1

plunger pushed / moved to the right (by spring) **or** plunger released

1

push switch opens / goes to off / goes to right

accept circuit is broken

for maximum credit the points must follow a logical sequence

*3 correct points but incorrect sequence scores **2** marks only*

ignore reset action

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1

[5]

Q11.

(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

allow 1 or 3

1

[7]

Q12.

(i) relay

accept solenoid

*do **not** accept magnetic switch*

1

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(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]

Q13.

(a) current flows
coil / core magnetised / electromagnet activated / energised / turned on
attracts iron bar causing bolt to be pulled out

each for 1 mark

4

(b) more turns
bigger current / e.m.f
softer iron core

any two for 1 mark each

2

(c) to relock door / return iron bar / to lock door

for 1 mark

1

(d) iron bar would still be attracted / coil still magnetised so still works

for 1 mark each

yes + wrong answer

0 marks

yes + current still flows

1 mark

yes + still magnetised / iron bar still attracted

2 marks

2

[9]

Q14.

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electromagnet becomes <u>stronger</u> (*not* becomes magnetic) iron moves left – implied OK
plunger goes up push switch goes to off or circuit broken unless plunger moves down

for 1 mark each

[4]

Q15.

Quality of written communication: One mark for correct sequencing.
bolt out ® plunger up ® switch off / circuit broken

1

any **five** from

- high current flows
- electromagnet is stronger
- the iron bolt is pulled out
- the plastic plunger moves up
- the switch is lifted / open / off

  accept circuit is broken
- no current flowing
- to re-set the plunger must be pushed down

5

[6]

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