ATAR PHYSICS 12 2018

ELECTROMAGNETISM PRACTICE TEST

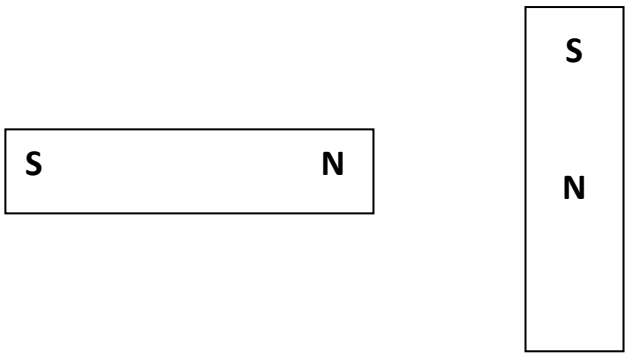
Total Marks = 38

Answer all questions in the spaces provided. Where appropriate show all working and express final numerical answers to three (3) significant figures.

Question 1

Sketch the pattern of the magnetic flux lines around each of the following:

a) Two bar magnets arranged as shown

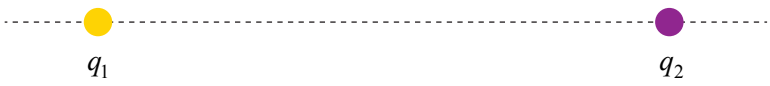


b) A long straight wire carrying a large electric current directed **out** of the page.

[4 marks]

Question 2

The diagram below shows two small charged conducting spheres q_1 and q_2, with a line through their centres. Sphere q_1 has a positive charge of 4.0 μC and sphere q_2 has a positive charge of 2.5 μC. The distance between the centres of the spheres is 0.015 m.



Calculate the magnitude and direction of the force exerted by q_1 on sphere q_2.

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$$

[4 marks]

Question 3

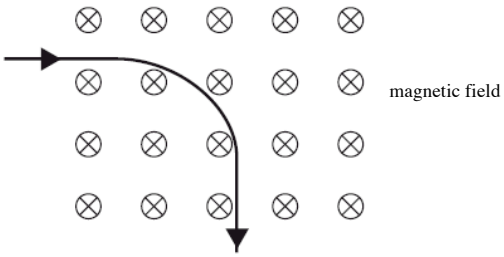
Two small charged plastic balls are located 1.7 m apart and are each experiencing an 8.0 N repulsive electrostatic force. One of the balls carries a charge of 40 μC. What is the charge on the other ball?

[3 marks]

$$F = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r^2}$$

Question 4

An electron with a speed of 4.60 x 10^7 ms^{-1} enters a uniform magnetic field and then moves in a circular path of radius 0.440 m, as shown in the diagram below. What is the strength of the magnetic field?

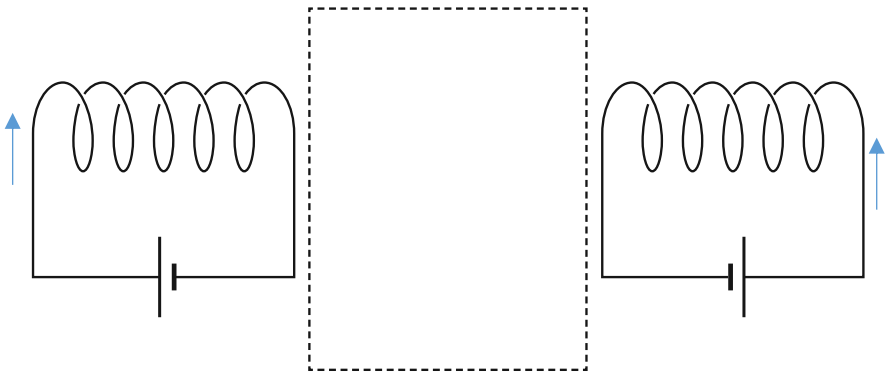


[3 marks]

Question 5

Two solenoids are shown in the diagram below. Current is flowing through their coils and both are generating magnetic fields.

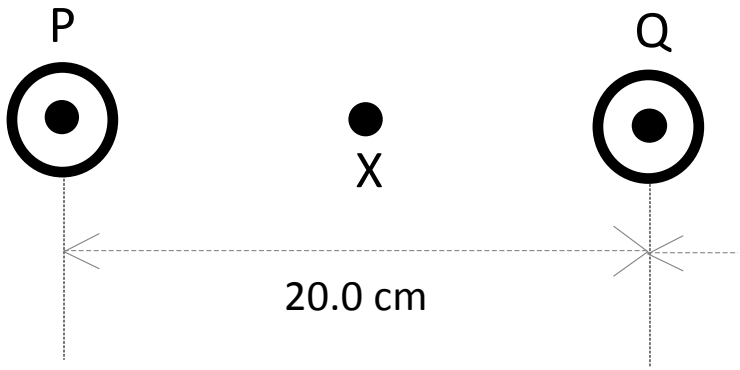
Sketch at least four field (flux) lines in the space enclosed by the dashed rectangle. Mark the direction of each field line that you draw.



[4 marks]

Question 6

Two parallel wires **P** and **Q**, 20.0 cm apart, both carry currents out of the page. Wire **P** carries 25.0 A and wire **Q** carries 5.00 A.



a) Draw three flux lines around **each** wire to represent the magnetic field created by the flow of current in each wire.

[3 marks]

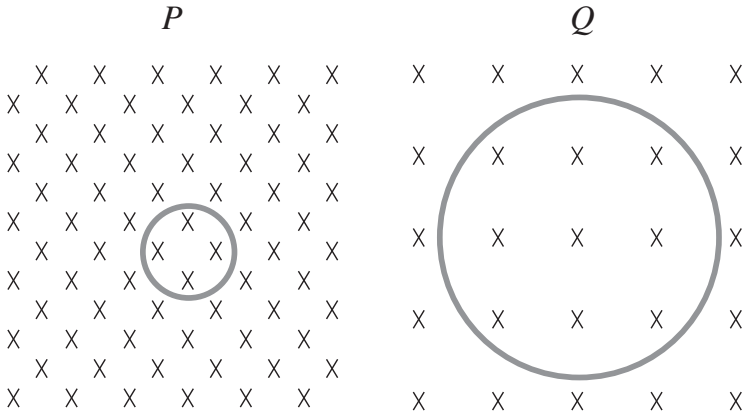
b) Point **X** is mid-way between the two wires **P** and **Q**. Calculate the strength of the magnetic field at **X** due to the current flowing in wire **P**.

$$B = \frac{\mu_0}{2\pi} \frac{I}{r}$$

[3 marks]

Question 7

Different magnetic field are passing through two copper rings **P** and **Q**, as shown in the **scale** diagram below.



a) Which ring has the greatest amount of **magnetic flux** passing through its area?

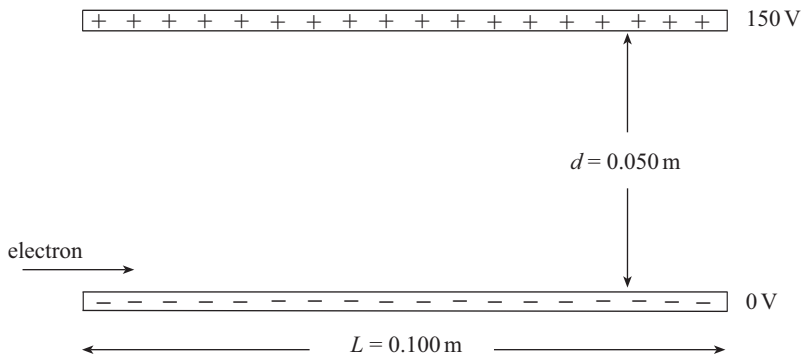
[1 mark]

b) Which ring has the **strongest magnetic field** passing through its area? You must justify your answer with an appropriate calculation.

[4 marks]

Question 8

An electron enters a uniform electric field produced by applying a potential difference of 150 V between two oppositely charged parallel plates in a vacuum. The plates are separated by a distance of 0.050 m and are of length L = 0.100m.



[*This diagram is not drawn to scale.*]

a) Calculate the strength of the electric field between the plates.

[2 marks]

The electron enters the electric field from the left, as shown, and is initially travelling at a speed of 1.0×10^{7} ms^{-1}.

b) Determine the magnitude and direction of the force experienced by the electron.

[3 marks]

c) Describe and explain the path followed by the electron in the uniform electric field. You may show your answer on the diagram if you wish.

[2 marks]

d) Show that the magnitude of the acceleration of the electron in the uniform electric field is 5.3×10^{14} m s^{-2}.

[2 marks]

END OF ASSESSMENT