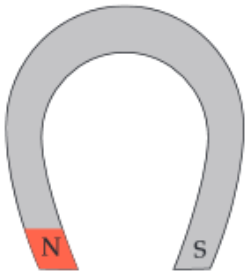
Magnetic Force Problems 2020

1 Draw magnetic field lines for each of the following situations.

a

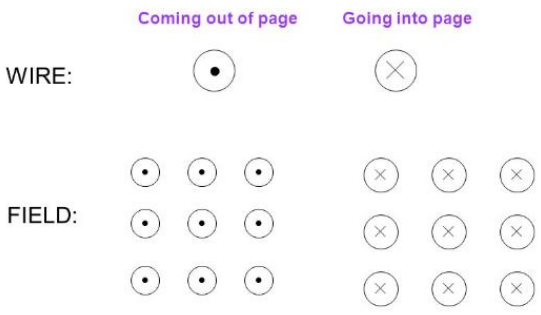
b



c

(a wire)

Reminder of how to draw directions in and out of page:



2 For each of the following situations, draw the magnetic field lines and state whether the magnetic force would be one of attraction or repulsion.

a

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b

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c

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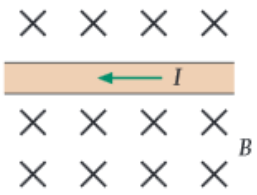
3 The diagrams show conductors carrying currents in magnetic fields. Find the direction of the force on each conductor.

a



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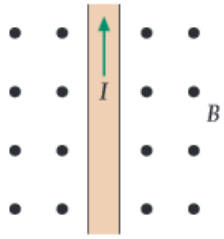
b



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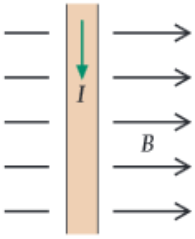
c



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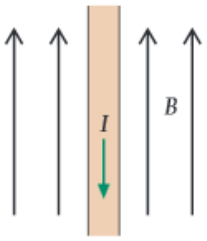
d



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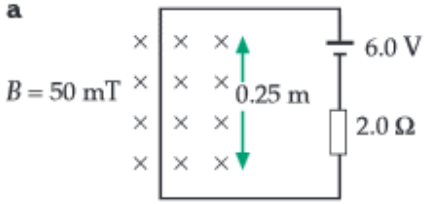
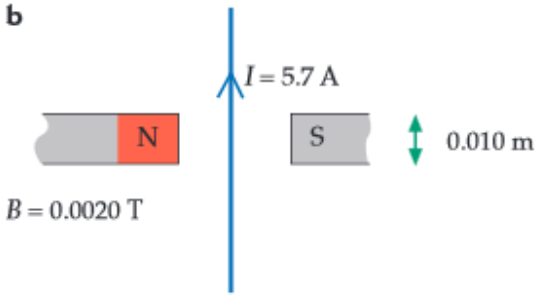
4 A 1.5 A current flows upwards in a wire. 0.070 m of the wire is exposed to a magnetic field of strength 0.10 T. Find the size and direction of the force acting on the wire.

5 Find the size and direction of the magnetic force on the wire in each of the following situations.

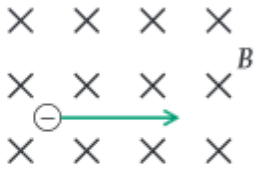
a



b



6 In a particular TV set, the electrons travel towards the screen with a speed of 2×10^{-7} m s^{-1} through a magnetic field of strength 0.7 T. The diagram shows the direction of the field and the electron velocity. The charge on an electron is 1.6×10^{-19} C.



Find the force on the electron, size and direction.

7 An electron ($e = -1.6 \times 10^{-19}$ C) is moving at a speed of 1.2×10^{6} m s^{-1} in a uniform magnetic field. It experiences a downward force of 2.5×10^{-13} N. Find the strength and direction of the magnetic field.

electron

8 **a** Calculate the force on a positively charged particle (charge = 3.2×10^{-19} C) moving at 200 m s^{-1} through a 5.0 T magnetic field as shown below.

b On the diagram above, show the direction of the magnetic force acting on the moving charge.

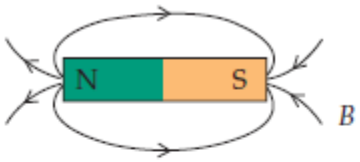
c On the diagram above, show the path that the charge will take as it moves through the magnetic field.

9 Find the size and direction of the magnetic force exerted by a uniform magnetic field of strength 1.2 T on:

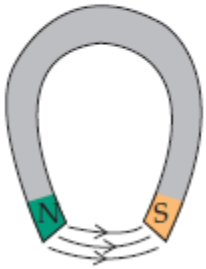
a a negative charge of 6.0 μC moving at 200 m s^{-1} in the direction shown

Answers:

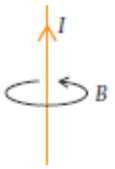
1 a



b



c

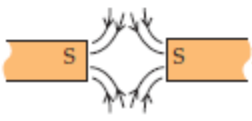


d

2 a

b

c



3 **a** Down page. **c** Out of page.
b Right. **d** Zero force.

4 $F = 0.0105$
$\Rightarrow 0.011$ N (2 sig figs)
Direction: out of the page.

5 **a** $\rightarrow$, 0.0375 N
($\Rightarrow 0.038$ N to 2 sig figs)
b $\times$ (into the page),
1.14×10^{-4} N
($\Rightarrow 1.1 \times 10^{-4}$ N to 2 sig figs)

6 2.2×10^{-26} N down the page.

7 1.3 T into the page.

8 **a** $F = 5 \times 3.2 \times 10^{-19} \times 200$
$= 3.2 \times 10^{-16}$ N
b $\downarrow$
c

(since $F \perp v$, the force is centripetal)

9 **a** $F = Bqv$
$= 1.2 \times 6 \times 10^{-6} \times 200$
$= 1.4 \times 10^{-3}$ N $\uparrow$
b $I = 0.12$ A
$F = 1.2 \times 0.12 \times 0.048$
$= 6.9 \times 10^{-3}$ N