

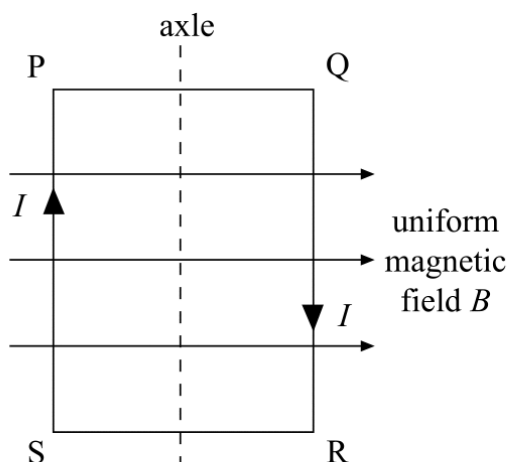
## Multiple Choice Magnetic Fields Paper Questions Jan 2002—Jan 2010 (old spec)

- 11 Which line, **A** to **D**, gives correct units for both magnetic flux and magnetic flux density?

**Jan 2002**

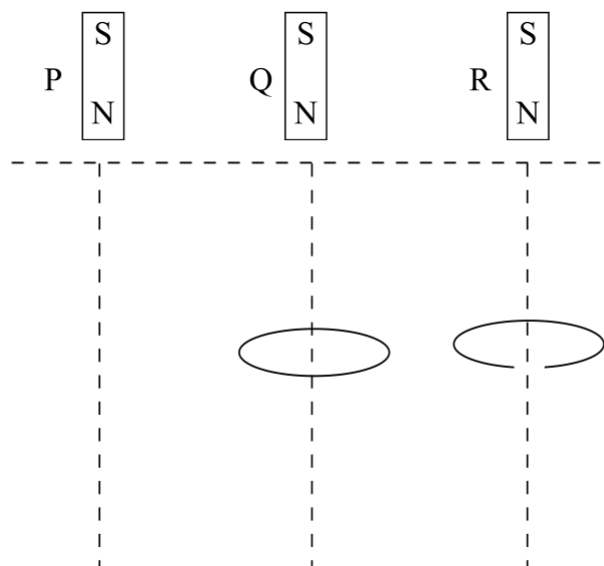
	magnetic flux	magnetic flux density
<b>A</b>	$\text{Wb m}^{-2}$	$\text{Wb}$
<b>B</b>	$\text{Wb}$	$\text{T}$
<b>C</b>	$\text{Wb m}^{-2}$	$\text{T m}^{-2}$
<b>D</b>	$\text{T m}^{-2}$	$\text{Wb m}^{-2}$

12



A coil, mounted on an axle, has its plane parallel to the flux lines of a uniform magnetic field  $B$ , as shown. When a current  $I$  is switched on, and before the coil is allowed to move,

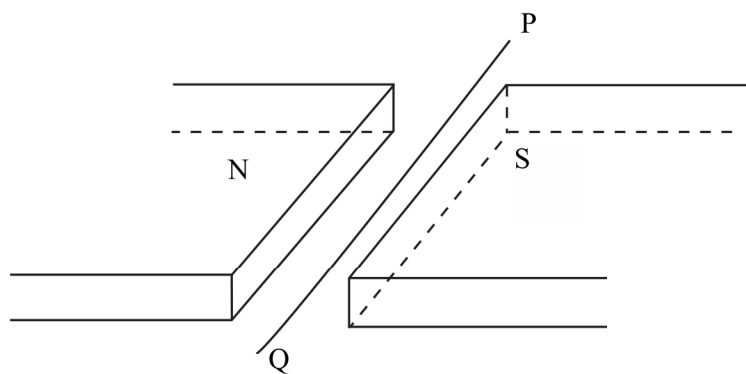
- A** there are no forces due to  $B$  on the sides  $SP$  and  $QR$ .
- B** there are no forces due to  $B$  on the sides  $PQ$  and  $RS$ .
- C** sides  $SP$  and  $QR$  tend to attract each other.
- D** sides  $PQ$  and  $RS$  tend to attract each other.



Three identical magnets P, Q and R are released simultaneously from rest and fall to the ground from the same height. P falls directly to the ground, Q falls through the centre of a thick conducting ring and R falls through a ring which is identical except for a gap cut into it. Which one of the statements below correctly describes the sequence in which the magnets reach the ground?

- A P and R arrive together followed by Q.
- B P and Q arrive together followed by R.
- C P arrives first, followed by Q which is followed by R.
- D All three magnets arrive simultaneously.

Jun 2002

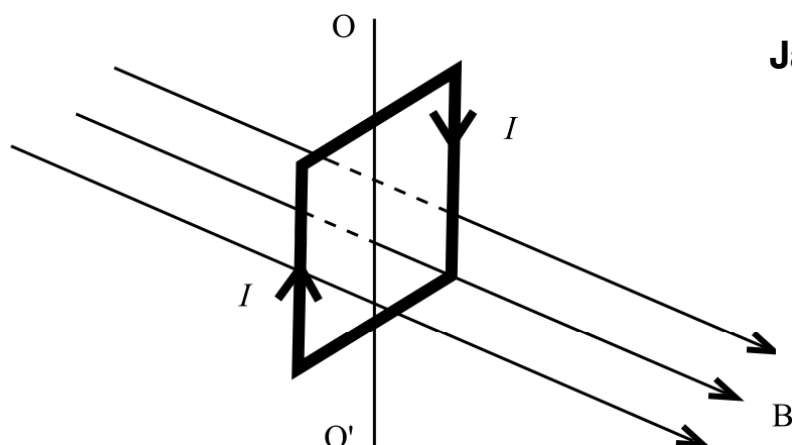


A wire lies perpendicularly across a horizontal uniform magnetic field of flux density  $20 \times 10^{-3} \text{ T}$  so that  $0.30 \text{ m}$  of the wire is effectively subjected to the field. If the force exerted on this length of wire due to a current in it is  $30 \times 10^{-3} \text{ N}$  downward, what is the current in the wire?

- A 0.45 A from P to Q
- B 0.45 A from Q to P
- C 5.0 A from P to Q
- D 5.0 A from Q to P

- 14 An electron moves due North in a horizontal plane with uniform speed. It enters a uniform magnetic field directed due South in the same plane. Which one of the following statements concerning the motion of the electron in the magnetic field is correct?
- A It continues to move North with its original speed.
- B It slows down to zero speed and then accelerates due South.
- C It is accelerated due West.
- D It is accelerated due North.

- 14 The diagram shows a vertical square coil whose plane is at right angles to a horizontal uniform magnetic field  $B$ . A current,  $I$ , flows in the coil, which can rotate about a vertical axis  $OO'$ .



Jan 2003

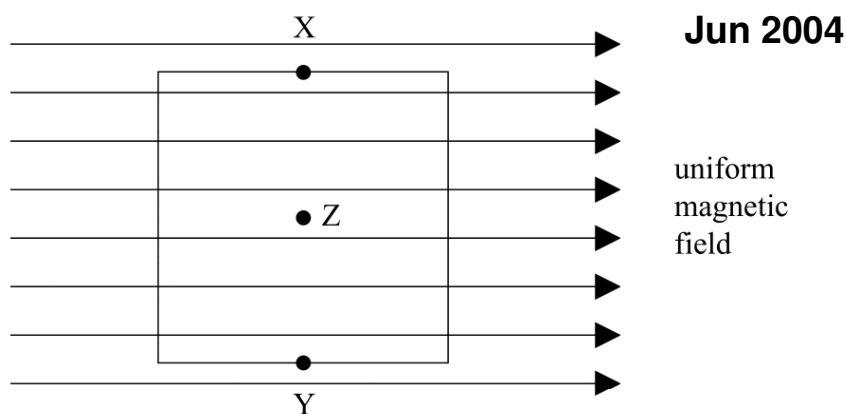
Which one of the following statements is correct?

- A The forces on the two vertical sides of the coil are equal and opposite.
- B A couple acts on the coil.
- C No forces act on the horizontal sides of the coil.
- D If the coil is turned through a small angle about  $OO'$ , it will remain in position.

- 12 Which line, **A** to **D**, correctly describes the trajectory of charged particles which enter, at right angles, (a) a uniform electric field, and (b) a uniform magnetic field?

	(a) uniform electric field	(b) uniform magnetic field
<b>A</b>	circular	circular
<b>B</b>	circular	parabolic
<b>C</b>	parabolic	circular
<b>D</b>	parabolic	parabolic

Jan 2004



The diagram shows a square coil with its plane parallel to a uniform magnetic field. Which one of the following would induce an emf in the coil?

- A** movement of the coil slightly to the left
- B** movement of the coil slightly downwards
- C** rotation of the coil about an axis through XY
- D** rotation of the coil about an axis perpendicular to the plane of the coil through Z

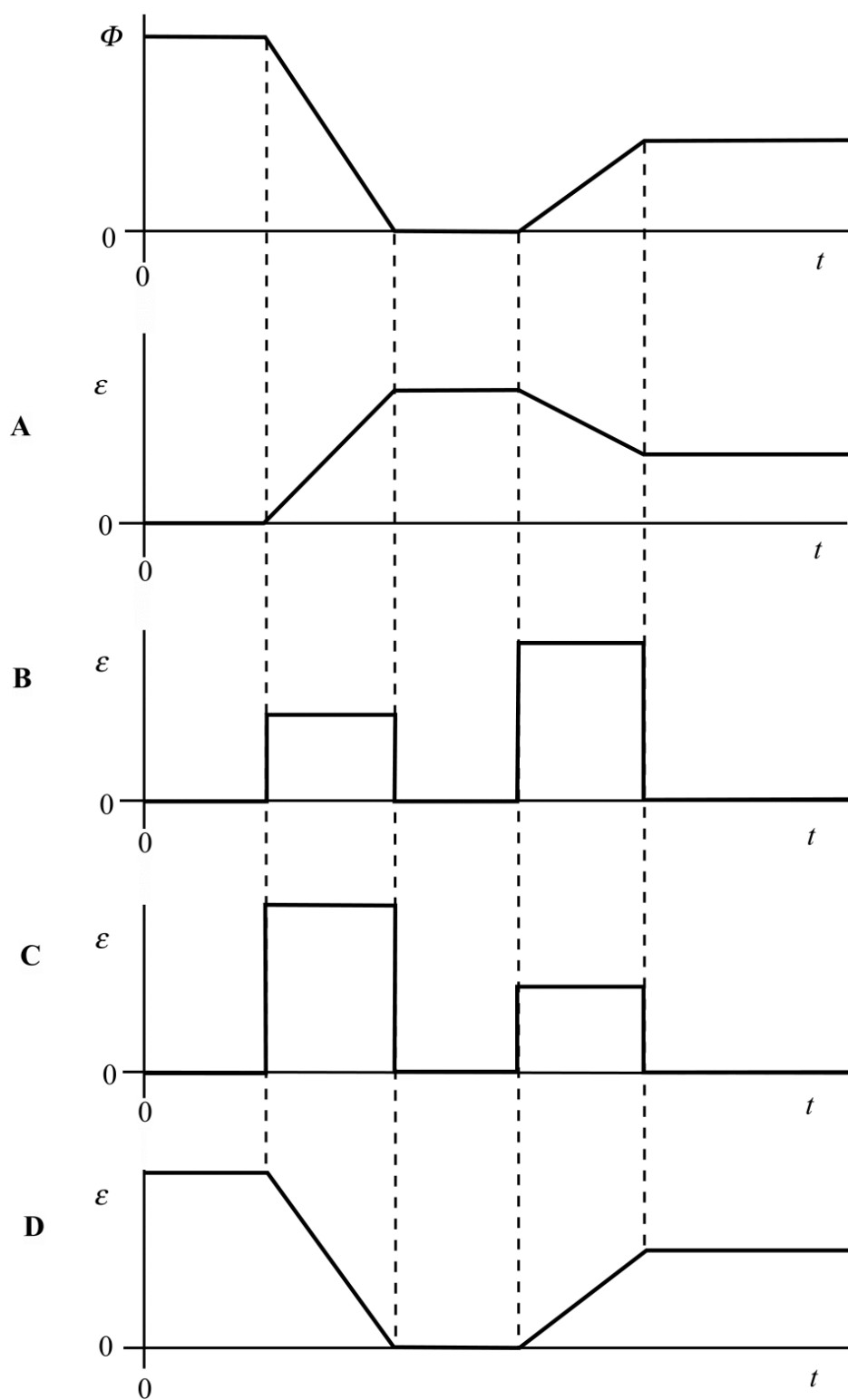
- 
- 12** The path followed by an electron of momentum  $p$ , carrying charge  $-e$ , which enters a magnetic field at right angles, is a circular arc of radius  $r$ .  
What would be the radius of the circular arc followed by an  $\alpha$  particle of momentum  $2p$ , carrying charge  $+2e$ , which entered the same field at right angles?

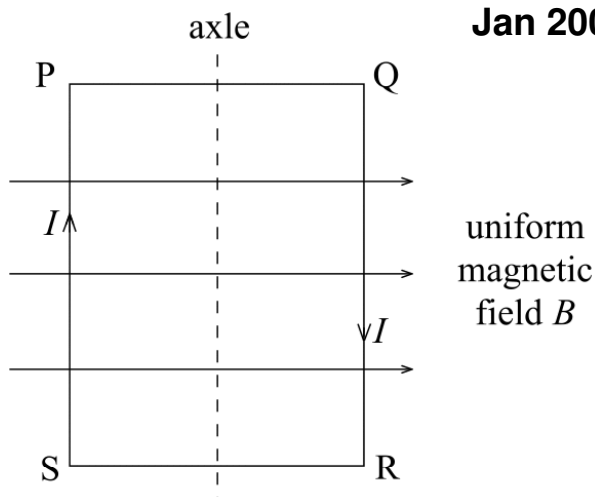
- A**  $\frac{r}{2}$
- B**  $r$
- C**  $2r$
- D**  $4r$

**Jan 2005**

- 15 The magnetic flux,  $\Phi$ , through a coil varies with time,  $t$ , as shown by the first graph. Which one of the following graphs, **A** to **D**, best represents how the magnitude,  $\varepsilon$ , of the induced emf varies in this same period of time?

Jun 2005





A coil, mounted on an axle, has its plane parallel to the flux lines of a uniform magnetic field  $B$ , as shown. When a current  $I$  is switched on, and before the coil is allowed to move,

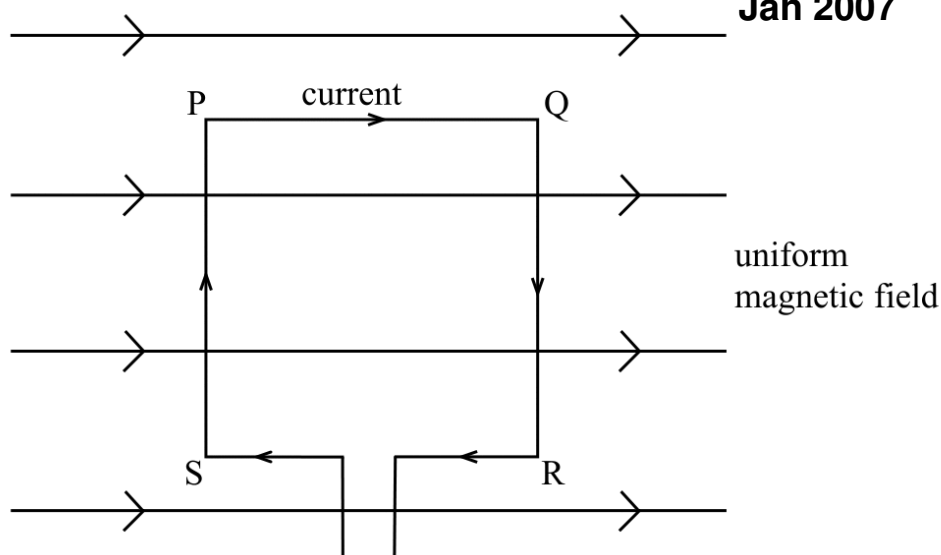
- A** there are no forces due to  $B$  on the sides PQ and RS.
  - B** there are no forces due to  $B$  on the sides SP and QR.
  - C** sides SP and QR attract each other.
  - D** sides PQ and RS attract each other.
- 13** Protons, each of mass  $m$  and charge  $e$ , follow a circular path when travelling perpendicular to a magnetic field of uniform flux density  $B$ . What is the time taken for one complete orbit?
- A**  $\frac{2\pi eB}{m}$
  - B**  $\frac{m}{2\pi eB}$
  - C**  $\frac{eB}{2\pi m}$
  - D**  $\frac{2\pi m}{eB}$

- 13** Particles of mass  $m$  carrying a charge  $Q$  travel in a circular path of radius  $r$  in a magnetic field of flux density  $B$  with a speed  $v$ . How many of the following quantities, if changed one at a time, would change the radius of the path?

**Jun 2006**

- $m$
- $Q$
- $B$
- $v$

- A** one
- B** two
- C** three
- D** four



The diagram shows a square coil PQRS placed in a uniform magnetic field with the plane of the coil parallel to the lines of magnetic field. A constant current is passed round the coil in the direction shown, causing a force to act on side PS of the coil. Which one of the following statements about the forces acting on the other sides of the coil is correct?

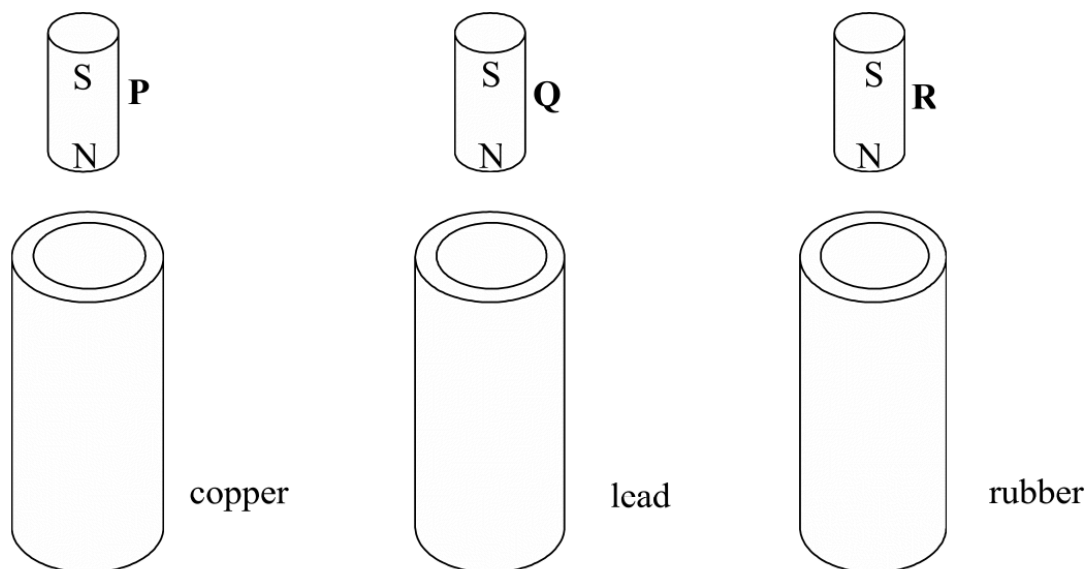
- A A force acts on each of the other sides of the coil.
- B No force acts on sides PQ and RS of the coil.
- C A force acts on side RS and an equal and opposite force to this force acts on side PQ.
- D A force acts on side QR in the same direction as the force that acts on PS.

13 Which one of the following is **not** a unit of magnetic flux?

- A  $\text{Nm A}^{-1}$
- B Wb
- C  $\text{Tm}^2$
- D  $\text{Vs}^{-1}$

13 The magnetic flux through a coil of 5 turns changes uniformly from  $15 \times 10^{-3} \text{ Wb}$  to  $7.0 \times 10^{-3} \text{ Wb}$  in 0.50 s. What is the emf induced in the coil due to this change in flux?

- A 14 mV
- B 16 mV
- C 30 mV
- D 80 mV



Three vertical tubes, made from copper, lead and rubber respectively, have identical dimensions. Identical, strong, cylindrical magnets **P**, **Q** and **R** are released simultaneously from the same distance above each tube. Because of electromagnetic effects, the magnets emerge from the bottom of the tubes at different times.

Which line, **A** to **D**, in the table shows the correct order in which they will emerge?

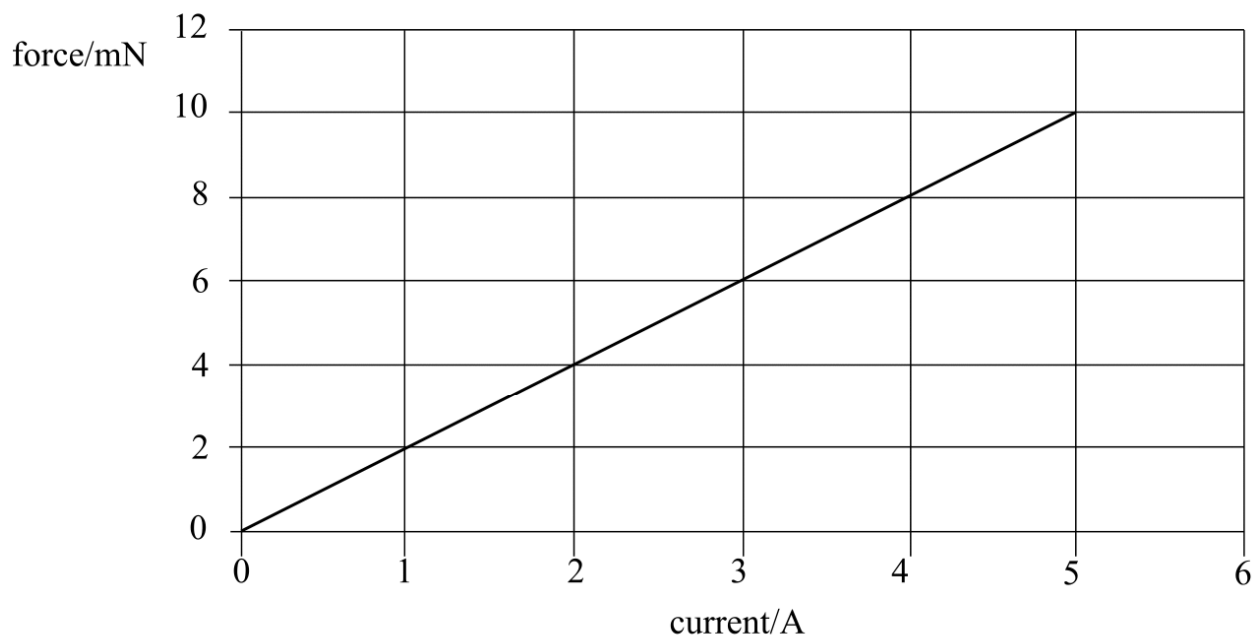
resistivity of copper =  $1.7 \times 10^{-8} \Omega \text{m}$   
 resistivity of lead =  $22 \times 10^{-8} \Omega \text{m}$   
 resistivity of rubber =  $50 \times 10^{13} \Omega \text{m}$

	emerges first	emerges second	emerges third
<b>A</b>	<b>P</b>	<b>Q</b>	<b>R</b>
<b>B</b>	<b>R</b>	<b>P</b>	<b>Q</b>
<b>C</b>	<b>R</b>	<b>Q</b>	<b>P</b>
<b>D</b>	<b>P</b>	<b>R</b>	<b>Q</b>



- 14 A wire of length 0.50 m, forming part of a complete circuit, is positioned at right angles to a uniform magnetic field. The graph shows how the force acting on the wire due to the magnetic field varies as the current through the wire is increased.

Jan 2008



What is the flux density of the magnetic field?

- A 2 mT
- B 4 mT
- C 15 mT
- D 25 mT

- 12 An  $\alpha$  particle and a  $\beta^-$  particle both enter the same uniform magnetic field, which is perpendicular to their direction of motion. If the  $\beta^-$  particle has a speed 15 times that of the  $\alpha$  particle, what is the value of the ratio

Jun 2008

$$\frac{\text{magnitude of the force on the } \beta^- \text{ particle}}{\text{magnitude of the force on the } \alpha \text{ particle}} ?$$

- A 3.7
- B 7.5
- C 60.0
- D 112.5

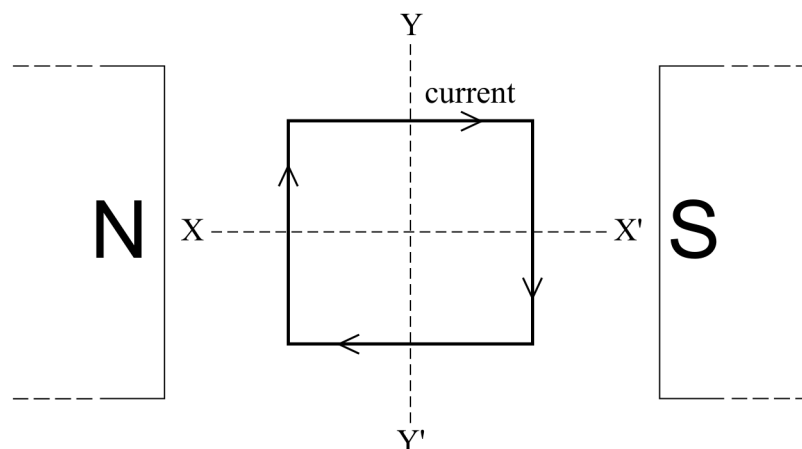
- 13 An  $\alpha$  particle moves in a circular path at a speed of  $7.5 \times 10^6 \text{ m s}^{-1}$  in a plane perpendicular to a uniform magnetic field of flux density  $1.5 \times 10^{-2} \text{ T}$ . The force acting on the  $\alpha$  particle is

Jan 2009

- A  $1.8 \times 10^{-14} \text{ N}$  parallel to the direction of the field.
- B  $3.6 \times 10^{-14} \text{ N}$  parallel to the direction of the field.
- C  $1.8 \times 10^{-14} \text{ N}$  perpendicular to the direction of the field.
- D  $3.6 \times 10^{-14} \text{ N}$  perpendicular to the direction of the field.

- 11 A rectangular coil is placed in a uniform magnetic field between the poles of a magnet, as shown in the diagram.

**Jun 2009**



When a current is passed round the coil in a clockwise direction,

- A the coil is attracted towards the N pole of the magnet.  
B the coil is attracted towards the S pole of the magnet.  
C the coil turns about the axis XX'.  
D the coil turns about the axis YY'.
- 12 A long straight wire carrying a current of 2.5 A is placed perpendicular to a magnetic field. The magnetic flux density rises uniformly from 0.5 mT to 1.5 mT. What is the average magnetic force per metre acting on the wire while the flux density is increasing?

- A 1.3 mN  
B 1.9 mN  
C 2.5 mN  
D 3.8 mN

- 12 Particles of mass  $m$  carrying a charge  $Q$  travel in a circular path of radius  $r$  in a magnetic field of flux density  $B$  with a speed  $v$ . How many of the following quantities, if changed one at a time, would change the radius of the path?

**Jan 2010**

- $m$
- $Q$
- $B$
- $v$

- A one  
B two  
C three  
D four