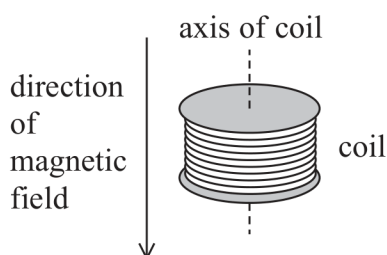


16 A search coil is used to investigate magnetic fields.

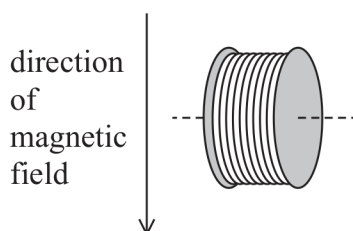
The search coil consists of a coil of thin copper wire connected to two output terminals, as shown.



A student placed the coil in a magnetic field with the axis parallel to the direction of the field, as shown.



The coil was rotated through  $90^\circ$  so the axis was perpendicular to the direction of the field, as shown.



As the coil was rotated, a potential difference (p.d.) was detected across the terminals.

(a) Explain why a p.d. was produced as the coil was rotated.

(2)

.....

.....

.....

.....

(b) Show that the initial value of magnetic flux in the coil is about  $9 \times 10^{-5} \text{ Wb}$ .

diameter of coil = 25 mm

magnetic flux density = 0.18 T

(3)

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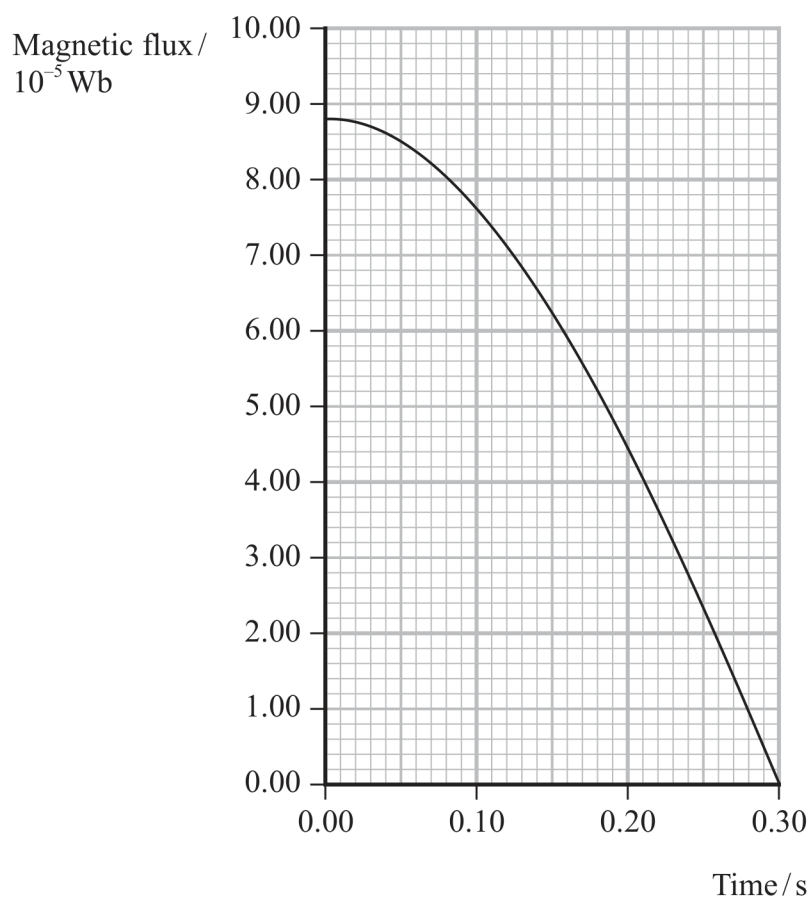
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P 7 6 8 7 9 A 0 1 5 3 2

(c) The graph shows the magnetic flux in the coil while the coil was being rotated.



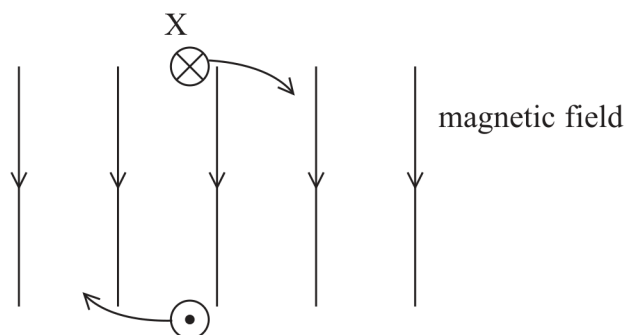
Determine the maximum p.d. produced across the terminals.

number of turns on coil = 5000

(4)

Maximum p.d. = .....

- (d) The output terminals of the coil are connected together, while the coil is in the magnetic field. The diagram shows a cross-section through one turn of the coil. X is on one side of the coil.



The coil is rotated clockwise in the magnetic field, causing a current in the coil. The student states that the current at X is into the page.

Deduce whether the student's statement is correct.  
You should refer to Lenz's law.

(4)