3.10 Physics: Fields (Gravitational, Electric, Magnetic): 10-minute Pack

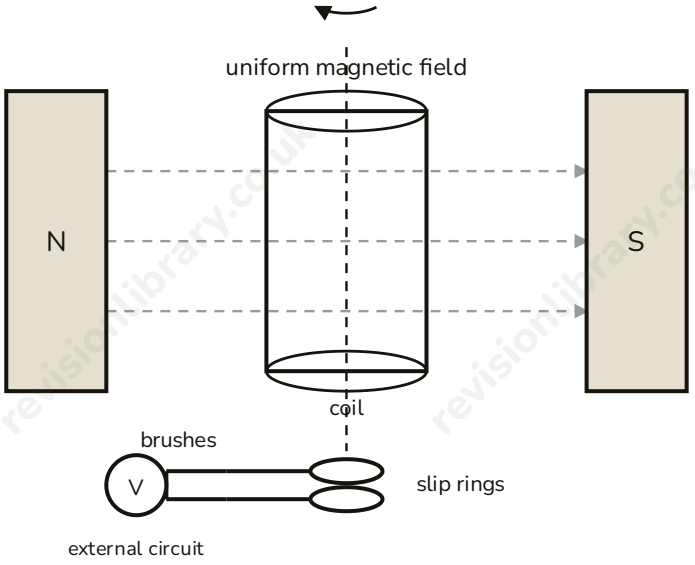
AQA 7408 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A simple a.c. generator consists of a rectangular coil of 300 turns, each of area 1.10×10^{-2} m^2, rotating at a constant angular frequency of 300 rad/s in a uniform magnetic field of flux density 0.0750 T. You are given: the EMF induced by a rotating coil, EMF = B*A*N*ω*sin(ω*t).



(a) Calculate the peak EMF generated by the coil. **(2)**

(b) Calculate the frequency of rotation of the coil, in Hz. **(2)**

(c) Describe how the induced EMF varies with time over one complete rotation of the coil, and explain, in terms of the rate of change of flux linkage, why the EMF is zero at certain points in the rotation. **(3)**

(Total for Question 1 is 7 marks)

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Mark scheme · 3.10 Physics: Fields (Gravitational, Electric, Magnetic): 10-minute Pack

Question 1

(a) substitutes into EMF0 = B*A*N*ω **M1**

(a) EMF0 = 74.3 V (awrt 3 sf) **A1**

(a) Answer: EMF0 = 74.3 V

(b) uses f = ω/(2*π) **M1**

(b) f = 47.7 Hz (awrt 3 sf) **A1**

(b) Answer: f = 47.7 Hz

(c) states the EMF varies sinusoidally with time, reaching peak values of about +74.3 V and -74.3 V, with period T = 2*π/ω = 0.0209 s **B1**

(c) states the EMF is zero twice per rotation, at the instants when the flux linkage through the coil is at a maximum or a minimum (a turning point of the flux linkage) **B1**

(c) explains that at these instants the rate of change of flux linkage is (momentarily) zero, and since the induced EMF is proportional to the rate of change of flux linkage, the EMF is also zero at these instants **B1**

(c) Answer: The EMF varies sinusoidally with time (period 0.0209 s, peak ±74.3 V) and is zero twice per rotation, when the flux linkage is at a maximum or minimum, because the rate of change of flux linkage is momentarily zero at those instants.

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