5 **(a)** State the laws of electromagnetic induction.

.....

.....

.....

.....

..... [3]

(b) A conducting square loop, of area 0.090 m^2 and resistance 12.0 Ω, is rotated by an external force in a magnetic field, as shown in Fig. 5.1. The magnetic field strength is 0.500 T and the loop is rotated at a constant frequency of 50.0 Hz. Assume the magnetic field to be uniform and the plane of the loop is perpendicular to the magnetic field at t = 0 s

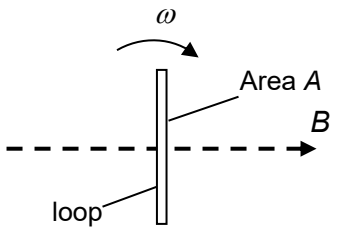

Fig. 5.1

(i) Determine the angular frequency of the rotational motion.

angular frequency = ... rad s^{-1} [2]

(ii) Calculate the maximum induced e.m.f. generated in the loop.

e.m.f = ... V [2]

(iii) Calculate the maximum induced current in the loop.

current = ... A [2]

(iv) Suggest a reason, why in practice, the value in **(b)(iii)** may differ slightly.

.....

.....

..... [1]

.....

.....

(v) On Fig. 5.2, sketch a graph of e.m.f generated in the loop against time for two rotations of the loop, starting from t = 0s.

[2]