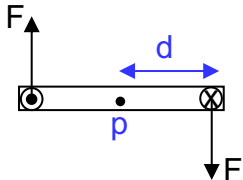




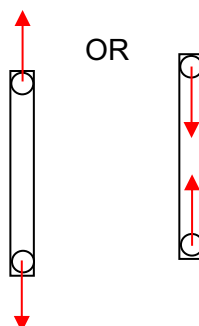
2026 S4 Assignment 18 Electromagnetism - Answers

1. (a) When the switch in the first circuit is closed, the current flows through the solenoid and magnetizes the soft iron core. The iron core attracts the section of the soft iron armature on its left. The L-shaped armature rotates about the pivot and pushes up on the contacts of the second circuit. This turns on the second circuit.
- (b) Any one of the following:
- The advantage of using a magnetic relay is that a small current in the first circuit can be used to switch on and off a second circuit that requires a large current, making it safer for an operator.
 - The first circuit can be placed a distance away from dangerous machines / unsafe environments operated by the second circuit.

2. (a)  Force arrows must be of equal lengths

- (b) The forces set up moments in the clockwise direction, hence the coil rotates clockwise.

- (c) Draw the coil in the vertical position:



(actually, this position is usually where the split rings swap connections between brushes and thus will momentarily experience a short break from the circuit and thus will not be experiencing any force.)

- (d) **Method:** Increase the current flow by increasing the e.m.f. of the d.c. voltage source applied to the rectangular coil.

Reason: Higher current will increase the magnetic field strength of the coil, and its interaction with the permanent magnetic field, hence producing a stronger force on each side of the coil. This will increase the net moments produced.

Method: Increase the number of turns in the coil.

Reason: Current in each turn of the coil will induce a magnetic field around the wire, hence the force acting on each side of the coil will increase. This will increase the net moments produced.

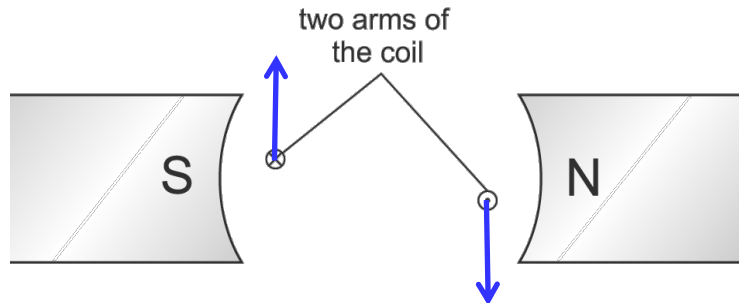
Method: Use a stronger permanent magnet

Reason: The stronger magnetic field of the permanent magnet will increase the interaction with the magnetic field of the coil, hence the force acting on each side of the coil will increase. This will increase the net moments produced.

Way 4: Insert a soft iron core within the coil

Reason: This would concentrate the magnetic field through the coil, and will increase the interaction with the magnetic field of permanent magnet, hence the force acting on each side of the coil will increase. This will increase the net moments produced.

3. (a)



Using Fleming's left-hand rule, the left side of the coil experiences an upward force and the right side of the coil experiences an equal downward force (shown in diagram). This pair of forces produces a clockwise moment to make the coil rotate clockwise.

- (b) The momentum (or inertia) of the rotating coil will carry it slightly beyond this vertical position and the carbon brushes will make contact with the commutator again for the current to flow in the coil.
- (c) She can replace the magnet with a stronger one or increase the number of turns in the coil.