Copper and Electricity: Generation

Answers

1. a) Is the output voltage a.c. or d.c.?

It is an alternating voltage as the generator has slip rings instead of a commutator and brushes.

b) What is the effect on the voltage of reversing the direction in which the coil rotates?

The voltage phase changes by 180
- i.e. it goes out of phase when the direction is swapped.
If you said it is reversed, this is true but a bit simplistic.

c) When the coil turns faster, two features of the output voltage change. What are they?

The frequency and the peak value of the voltage.

d) When the output voltage is greatest, what is the position of the coil?

It is flat - i.e. the plane of the coil is parallel with the magnetic field.

e) When the output voltage is greatest, what is the direction of movement of the sides of the coil compared with the magnetic field?

The sides of the coil are moving at right angles to the field.

2. a) Why is the current in the opposite direction to the electrons' movement?

The electrons have a negative charge. And conventional current is in the same direction as a flow of positive charge.

b) Explain why there is a force on a wire from which we take an induced current.

The wire is in a magnetic field and it is carrying a current. Therefore, there is a force on it.

c) The direction of the force opposes the motion that led to the induced current. Describe what would happen if this were not the case.

The wire would not be slowed down (indeed, it might even be speeded up). So we would be able to take out a current without the wire slowing down. Therefore, we would be getting something for nothing or we have the basis for a machine that creates energy from nothing. This goes against the idea of the conservation of energy.

d). Whose law is this?

Lenz's law.

3. a) What is the area of magnetic field the wire has passed through?

Area = $0.4 \times 0.1 = 0.04\ m^2$

b) Calculate the magnetic flux the wire passes through?

$\phi = BA = 2 \times 0.04 = 0.08$ Wb

c) After 5 seconds, the wire will have moved through the field. How far will it have moved?

15 cm (speed × time) = 0.15 m

d) By how much will the flux have increased in those 5 seconds?

$0.15 \times 0.4 \times 2 = 0.12$ Wb

c) What is the EMF induced in the wire?

Rate of change of flux = $0.12 \div 5 = 0.024$ V

Return to Copper and Electricity: Generation