The direction of the induced current is such as to oppose the change causing it

Question 15 *(8 marks)*

(*a*) Give a clear statement of Lenz's law.

(*b*) A thin ohmic conductor in the form of a ring of electrical resistance 0.1 Ω is placed in the horizontal plane. A magnetic field points vertically upwards (Figure 5) and is *uniform* within the area of 10 cm^2 that is enclosed by the ring. However, the field is not *static*. At a certain instant, the magnitude of the field is known to be *decreasing* at a rate of 0.1 T s^{-1}. What are the magnitude and direction of the current induced in the ring at that moment?

$i = \frac{1}{R}\left|\frac{d\phi}{dt}\right|$

$= \frac{1}{R}\left|\frac{d(BA)}{dt}\right|$

$= \frac{1}{0.1} \times |10^{-3} \times 0.1|$

$= 10^{-3}$ A

Anticlockwise

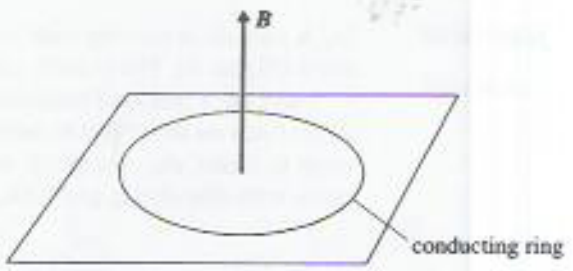

Figure 5

Question 16 *(7 marks)*

(*a*) State the Pauli exclusion principle and Hund's rule as applied to electrons in heavy atoms.

(*b*) Oxygen (chemical symbol O) contains 8 protons in its nucleus. Write the electronic structure of the oxygen atom in its ground state in the box notation.

(*c*) An isotope of oxygen contains 8 neutrons. Is a single (neutral) atom of this isotope a fermion or a boson? Explain your answer.

16) a) No two electrons in an atom may have the same set of quantum numbers n, l, m_l, m_s
Hunds rule - the spin of the electrons in an atom in its ground state sums to the most poss. value

b) O ↑↓ ↑↓ ↑ ↑ ↑

$1s^2\ 2s^2\ 2p^4$

c) 8 protons + 8 neutrons + 8 electrons = 24 fermions
24 is an even number, hence the atoms of this isotope are bosons