Question 22 **(14 marks)**

Moving molten iron in the Earth's core and magnetic field variations

(a) The Swarm satellite system allows scientists to look past the magnetic fields generated by the ionosphere (a layer of the atmosphere containing particles ionised by radiation). Infer how the ionosphere would generate magnetic fields. (2 marks)

(b) Estimate the strength of the magnetic field detected by a satellite at a height of 460 km above the Earth's surface, if the Earth's magnetic field measures 5×10^{-5} T at the surface. Express your answer in the appropriate significant figures. (4 marks)

Answer _____ T

(c) The Earth's magnetic field is thought to be generated by convection currents in the iron/nickel molten outer core. Explain how a magnetic field could be generated by a convection current of molten iron/nickel. (2 marks)

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(d) The jet is detected by changes in the Earth's magnetic field due to the presence of 'flux lobes'. Explain how the flux lobes are produced. (3 marks)

(e) In the article, one professor thought the 'acceleration of the jet was due to push-back from magnetic fields'. Elaborate, using appropriate physics principles. (3 marks)