6 The isotope Iron-59 is a β-emitter with a half-life of 45 days. In order to estimate engine wear, an engine component is manufactured from iron throughout which the isotope Iron-59 has been uniformly distributed. The mass of the engine component is 2.4 kg and its initial activity is 8.5×10^7 Bq.

The component is installed in the engine 60 days after manufacture of the component, and then the engine is tested for 30 days. During the testing period, any metal worn off the component is retained in the surrounding oil. Immediately after the test, the oil is found to have a total activity of 880 Bq.

Calculate

(a) **(i)** the decay constant for the isotope Iron-59,

decay constant = ………………………… s^{-1} [2]

(ii) the total activity of the component when it was installed,

activity = ………………………… Bq [2]

(iii) the mass of iron worn off the component during the test.

mass of iron = ………………………… g [4]

(b) State and explain how your results in **(a) (iii)** will change if background radiation is included in the total activity of 880 Bq.

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Section B

Answer **one** question from this Section in the spaces provided.