Question 39 **(18 marks)**

The oil extracted from the seeds of a particular Australian tree contains tripalmitin. The presence of tripalmitin, which is a triglyceride, means that this oil can be used to make ethyl palmitate, a type of biodiesel. The condensed structural formulae of tripalmitin and ethyl palmitate are given below.

Tripalmitin (a type of triglyceride)	**Ethyl palmitate (a type of biodiesel)**
$H_2COOC(CH_2)_{14}CH_3$ | $HCOOC(CH_2)_{14}CH_3$ | $H_2COOC(CH_2)_{14}CH_3$	$CH_3(CH_2)_{14}COOCH_2CH_3$

(a) Demonstrate, by using a series of balanced reaction equations, how ethyl palmitate can be synthesised from tripalmitin. Your synthesis method **must** use ethene and lipase. You can also use water and any common laboratory acids.

Use condensed structural formulae to represent organic compounds. State symbols are only required for inorganic substances. (8 marks)

A chemist investigated the synthesis step involving lipase referred to in part (a). The results obtained by the chemist are shown in the following table.

Temperature of reaction system (°C)	Biodiesel yield (%)
20	65
30	78
35	85
40	88
50	91
55	92
60	85
65	75

(b) Construct a question that the chemist might be trying to answer in this investigation.

(1 mark)

(c) Graph the data presented in the table on the following grid. (5 marks)

(d) Describe the relationship observed in the graph. (2 marks)

(e) Explain how the use of lipase in the synthesis contributes to the relationship described in part (d). (2 marks)