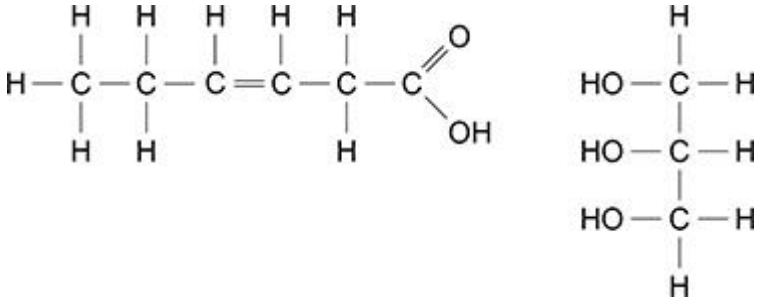
Q1.

(a) The figure below shows the structure of a fatty acid molecule and the structure of a glycerol molecule.



On the figure above, **draw a circle** around the part of the fatty acid molecule **and** the part of the glycerol molecule that is removed to form a bond in a triglyceride molecule.

Name the bond formed between a fatty acid and glycerol in a triglyceride molecule.

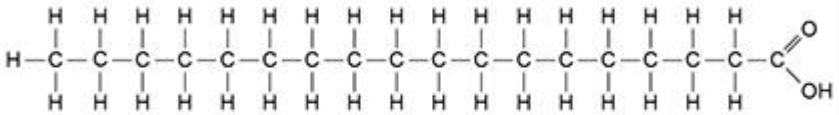
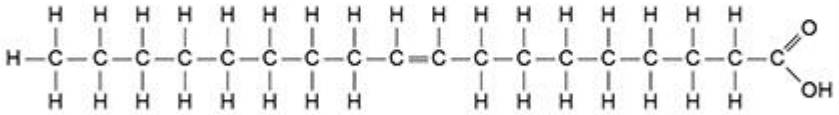
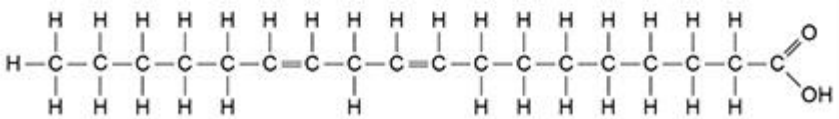
Name the reaction involved in forming a bond between a fatty acid and glycerol in a triglyceride molecule.

Bond _____

Reaction _____

(3)

The table below shows information about three fatty acids.

Name of fatty acid	Diagram of fatty acid structure	Fatty acid melting point / °C
Stearic acid		70
Oleic acid		14
Linoleic acid		–5

(b) Name the fatty acid shown in the table above that is a saturated fatty acid.

_____

(1)

(c) The melting point is the temperature at which a solid changes state to be a liquid.

Use the table above to describe the relationship between fatty acid structure and fatty acid melting point.

_____

_____

_____

(1)

(d) The ratio of saturated to unsaturated fatty acids in a cell-surface membrane determines the extent of the membrane's fluidity.

Scientists provided a cell culture of mouse phagocytes with liquid broth rich in unsaturated fatty acids.

The scientists observed:

- an increase in the proportion of phospholipids in the phagocytes containing unsaturated fatty acids
- more phagocytosis.

Suggest and explain why there was more phagocytosis.

_____

_____

_____

_____

_____

_____

_____

_____

_____

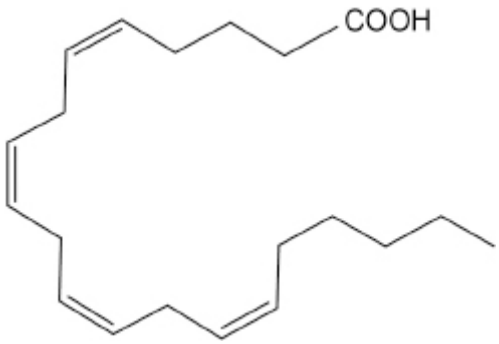
(3)

(Total 8 marks)

Q2.

(a) **Figure 1** shows a fatty acid that contains 20 carbon atoms and four double bonds.

Figure 1

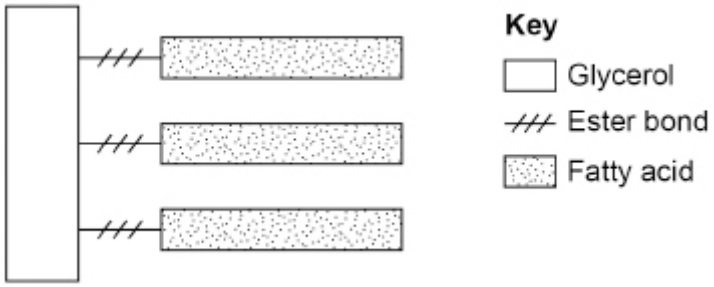


On **Figure 1**, draw a box around the R group of the fatty acid.

(1)

(b) **Figure 2** shows a triglyceride.

Figure 2



Describe **two** differences between the structure of the triglyceride shown in **Figure 2** and a phospholipid.

1 _____

_____

2 _____

_____

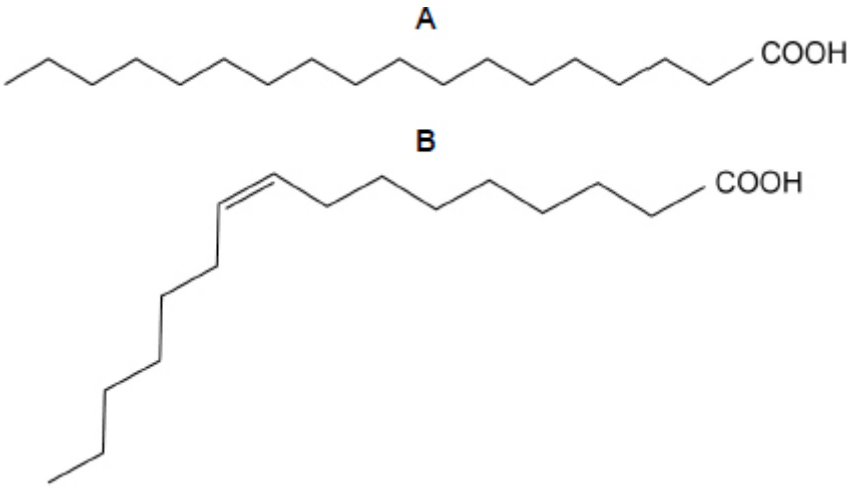
(2)

(c) Explain why phospholipids can form a bilayer but triglycerides cannot.

(3)

(d) **Figure 3** shows two fatty acids, **A** and **B**.

Figure 3



Scientists fed rats a diet with added fish oil for 4 months.

They obtained samples of red blood cells from the rats before starting this diet (0 months) and after 4 months on this diet.

For each red blood cell sample, they separated the cell-surface membranes and measured:

- the percentage of phospholipids containing each of the fatty acids **A** and **B**
- the fluidity of the membrane.

The table below shows the scientists' results.

Time sample of red blood cells obtained / months	Mean percentage of phospholipids containing fatty acid A	Mean percentage of phospholipids containing fatty acid B	Mean fluidity of the membrane / arbitrary units
0	19.8	1.7	31
4	11.7	9.0	97

Suggest why the fluidity of the membrane was higher after 4 months.

Use all the information provided in the question.

(3)

(Total 9 marks)

Q3.

(a) Describe the hydrolysis reactions involved in the digestion of triglycerides.

Do **not** write about the activity of lipase.

_____

_____

_____

_____

_____

_____

(2)

(b) All mammals produce a lipase called CEL.

CEL digests triglycerides.

CEL is activated by bile salts binding to the enzyme.

Describe **two** other functions of bile salts.

1 _____

_____

_____

2 _____

_____

_____

(2)

(c) Mammals feed their young on milk. CEL digests the triglycerides in milk. The ability to produce CEL occurred due to a gene mutation.

Describe how natural selection may have led to all mammals in a population producing CEL.

(4)

(Total 8 marks)