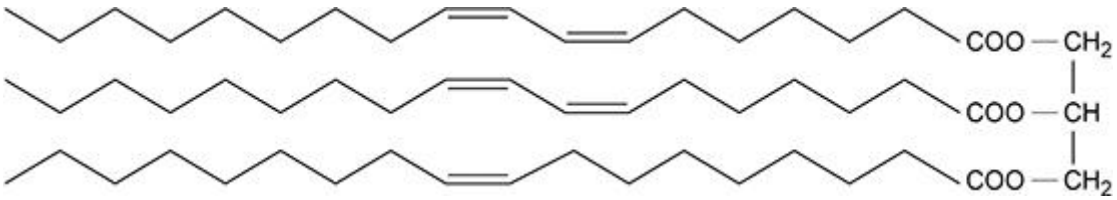
Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

This question is about olive oil.

A sample of olive oil is mainly the unsaturated fat **Y** mixed with a small amount of inert impurity.

The structure of **Y** in the olive oil is shown.
Y has the molecular formula $C_{57}H_{100}O_6$ (M_r = 880).



The amount of **Y** is found by measuring how much bromine water is decolourised by a sample of oil, using this method.

- Transfer a weighed sample of oil to a 250 cm^3 volumetric flask and make up to the mark with an inert organic solvent.
- Titrate 25.0 cm^3 samples of the olive oil solution with 0.025 mol dm^{-3} Br_2(aq).

(a) A suitable target titre for the titration is 30.0 cm^3 of 0.025 mol dm^{-3} Br_2(aq).

Justify why a much smaller target titre would **not** be appropriate.

Calculate the amount, in moles, of bromine in the target titre.

Justification _____

_____

_____

_____

Amount of bromine _____ mol

(2)

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(b) Calculate a suitable mass of olive oil to transfer to the volumetric flask using your answer to part (a) and the structure of **Y**.
Assume that the olive oil contains 85% of **Y** by mass.

(If you were unable to calculate the amount of bromine in the target titre, you should assume it is 6.25×10^{-4} mol. This is **not** the correct amount.)

Mass of olive oil _____ g

(5)

The olive oil solution can be prepared using this method.

- Place a weighing bottle on a balance and record the mass, in g, to 2 decimal places.
- Add olive oil to the weighing bottle until a suitable mass has been added.
- Record the mass of the weighing bottle and olive oil.
- Pour the olive oil into a 250 cm^3 volumetric flask.
- Add organic solvent to the volumetric flask until it is made up to the mark.
- Place a stopper in the flask and invert the flask several times.

(c) Suggest an extra step to ensure that the mass of olive oil in the solution is recorded accurately.

Justify your suggestion.

Extra step _____

_____

_____

Justification _____

_____

_____

(2)

(d) State the reason for inverting the flask several times.

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_____

_____

_____

(1)

(e) A sample of the olive oil was dissolved in methanol and placed in a mass spectrometer. The sample was ionised using electrospray ionisation. Each molecule gained a hydrogen ion (H^+) during ionisation.

The spectrum showed a peak for an ion with $\frac{m}{z}$ = 345 formed from an impurity in the olive oil.

The ion with $\frac{m}{z}$ = 345 was formed from a compound with the empirical formula $C_5H_{10}O$

Deduce the molecular formula of this compound.

Show your working.

Molecular formula _____

(2)

(Total 12 marks)

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Q2.

Tschermigite is a hydrated, water-soluble mineral, with relative formula mass of 453.2

The formula of tschermigite can be represented as M.$x$$H_2O$, where M represents all the ions present.

The table below shows its composition by mass.

Element	% by mass
N	3.09
H	6.18
Al	5.96
S	14.16
O	70.61

In an analysis, it is found that the mineral contains the ions NH_4^+, Al^{3+} and SO_4^{2-}

Calculate the empirical formula of tschermigite and the value of x in M.$x$$H_2O$

Describe the tests, with their results, including ionic equations, that would confirm the identities of the ions present.

(Total 6 marks)

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