

Target grade:

Mark: / 39

Actual grade:

Percentage:

Homework 5 – Carboxylic acids, esters and amines

1. An ester **D** with the formula, $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}(\text{CH}_3)_2$, is used in rum flavouring.

(a) Draw a displayed formula of ester **D**.

[2]

(b) Outline how you could obtain a sample of ester **D**, starting with a named carboxylic acid and a named alcohol.

Include any essential reaction conditions and write an equation for the reaction. You do not need to include any details of the separation or purification of the ester.

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[6]

- (c) State a spectroscopic method that could be used to confirm that a sample of ester **D** has a molecular mass of 130.

Explain how you would obtain the molecular mass of **D** from the spectrum.

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[2]

[Total 10 marks]

2. Reaction of geraniol with ethanoic acid can be used to make ester **Z**, which is used in chewing gum and desserts.

- (i) Suggest why esters are used in the manufacture of foods.

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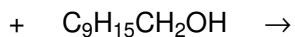
[1]

- (ii) State the conditions needed to make ester **Z** from geraniol and ethanoic acid.

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[2]

- (iii) Complete the equation for the formation of ester **Z**.



[3]

[Total 6 marks]

3. Glycerol trihexanoate is a triglyceride that can be made from glycerol (propane-1,2,3-triol) and hexanoic acid, $C_5H_{11}COOH$.

Draw the structure of glycerol trihexanoate. Show every bond in the functional groups.

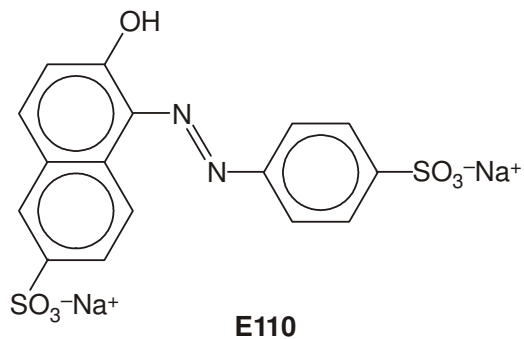
[Total 2 marks]

4. Explain why triglycerides are soluble in non-polar solvents and not in water.

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[Total 3 marks]

(b) The structure of E110 is shown below.



(i) On the structure above, draw a circle around the functional group that identifies this molecule as an azo dye.

[1]

(ii) Deduce how many carbon and hydrogen atoms are in a molecule of E110.

..... carbon atoms and hydrogen atoms.

[2]

(c) The solubility of E110 in water can be improved by converting the phenolic -OH group into a charged -O^- group.

Suggest a suitable reagent that will convert the -OH group in E110 into an -O^- group.

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[1]

- (d) In the boxes below, draw the structures of a phenol and an amine that could be used to make E110 by the method in part (a).

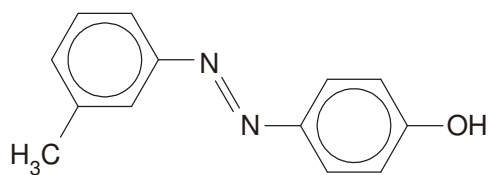
Assume that the $\text{SO}_3^- \text{Na}^+$ groups do not change during the process.

phenol		amine
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[2]

[Total 13 marks]

6. Compound **A**, shown below, is being considered as an azo dye by a chemical company. A chemist planned a two-stage synthesis of compound **A** starting from an aromatic amine.



compound A

The aromatic amine is first converted into a diazonium ion.

- Draw the displayed formula of the aromatic amine **and** of the diazonium ion.
- State the reagents and conditions for each stage in the synthesis of compound **A** from an aromatic amine.

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[Total 5 marks]