

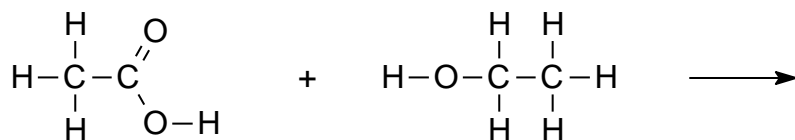


**Question One:**

For each of the following pairs of carboxylic acids and alcohols:

- a) Name the carboxylic acid and alcohol.
- b) Give the full structural formula of the ester formed by the reaction.
- c) Name the ester formed by the reaction.

**Ester One:**

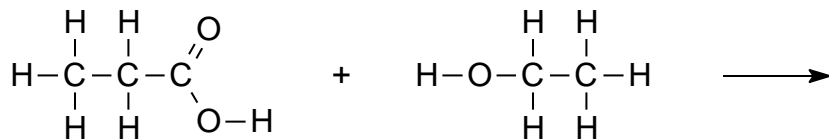


Name of carboxylic acid: .....

Name of alcohol: .....

Name of ester: .....

**Ester Two:**

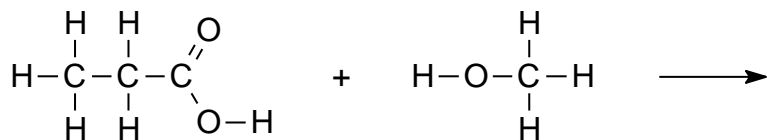


Name of carboxylic acid: .....

Name of alcohol: .....

Name of ester: .....

**Ester Three:**



Name of carboxylic acid: .....

Name of alcohol: .....

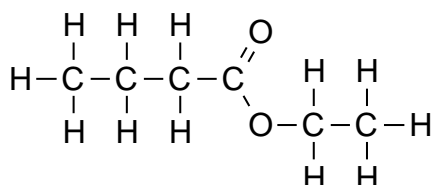
Name of ester: .....

**Question Two:**

For each of the following esters:

- a) Name the ester.
- b) Give the structural formulae of the carboxylic acid and alcohol used to synthesise the ester.
- c) Give the names of the carboxylic acid and alcohol used to synthesise the ester.

**Ester Four:**



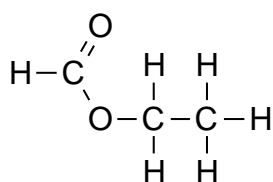
**Synthesised from:**

Name of ester: .....

Name of carboxylic acid: .....

Name of alcohol: .....

**Ester Five:**



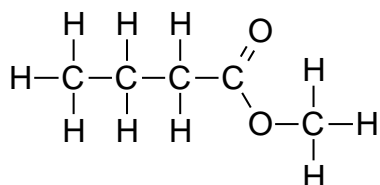
**Synthesised from:**

Name of ester: .....

Name of carboxylic acid: .....

Name of alcohol: .....

**Ester Six:**



**Synthesised from:**

Name of ester: .....

Name of carboxylic acid: .....

Name of alcohol: .....

### Additional Questions

3. The catalyst for this reaction is concentrated sulphuric acid. Define the term *catalyst* and explain how they work:

.....

4. Why can an *esterification reaction* also be called a *condensation reaction*?

.....

5. Water is produced as a side-product of the esterification reaction. How could you prove that the atom of oxygen contained within the water molecule originates from the acid and not the alcohol?

.....

.....

6. How will the chemical and physical properties of the ester differ from those of the original carboxylic acid and alcohol?

.....

.....

7. How can the ester be purified from the reaction mixture?

.....

8. An ester of relative molecular mass 88.0 was found to have the following percentage composition:

Carbon = 54.5%

Hydrogen = 9.1%

Oxygen = 36.4%

Calculate the simple empirical and true molecular formulae of the ester and hence propose possible structural formulae and names for the ester.

Note:  $A_r(\text{C}) = 12.0$ ,  $A_r(\text{H}) = 1.0$ ,  $A_r(\text{O}) = 16.0$

**For Class Discussion:** The chemical and physical properties of the ester are significantly different from those of the carboxylic acid and alcohol that were used to synthesise it. Give examples of other simple chemical reactions that produce a significant *change* in the chemical and physical properties of the reaction product in relation to the reactants.

- Scan the QR code given below to view the answers to this assignment.



[http://www.chemist.sg/organic\\_chem/worksheets/esterification\\_ans.pdf](http://www.chemist.sg/organic_chem/worksheets/esterification_ans.pdf)