



NAME :

First Name :

High School :

Problem 1 : Iodometry

1) Titration of an aqueous solution of iodine with a solution of sodium thiosulphate.

a) Record your measured values.

b) Calculate the molar concentration of iodine in your Lugol solution. Clearly state your reasoning and your calculations.

2) *Titration of ascorbic acid in pharmaceutical preparations.*

a) Record your measured values.

b) Calculate the mass of vitamin C in your tablet. Clearly state your reasoning and your calculations.

3) *Additional questions*

- a) Vitamin C, also known as ascorbic acid, is a substance that, with a pK_a of 4.17, is a stronger acid than acetic acid. Indicate within the structure of vitamin C, which one of the hydrogen atoms is responsible for the high acidity of the molecule and explain your reasoning.
- b) Draw the Lewis structure of the superoxide ion $\cdot\text{O}_2^-$, knowing that it is a radical species and indicate the oxidation number of the oxygen atoms.
- c) Write the redox equations (oxidation, reduction and redox reaction) of the reaction between vitamin C and the superoxide ion in an acidic medium, knowing that the latter is transformed into hydrogen peroxide.

Acetone ($\text{CH}_3\text{-CO-CH}_3$) can also be oxidised quantitatively by iodine. First, there is formation of triiodoacetone (substitution of three hydrogen atoms of the same carbon atom), followed by the rupture of the molecule on the level of the -CO- functional group, with formation of iodoform (triiodomethane).

- d) Write the equation for the substitution reaction of acetone with iodine.

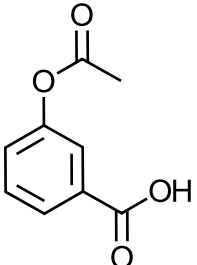
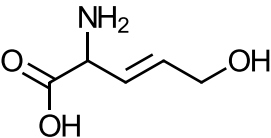
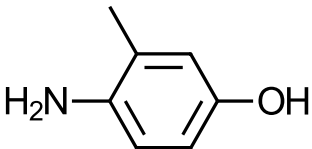
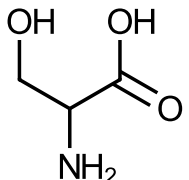
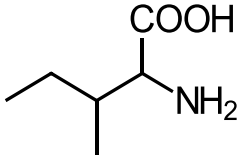
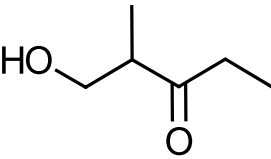
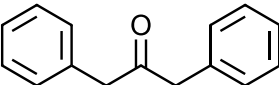
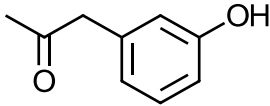
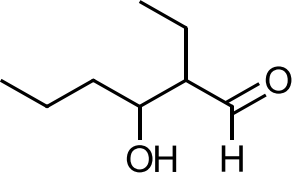
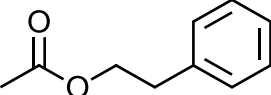
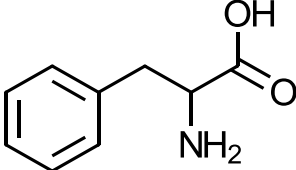
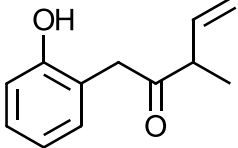
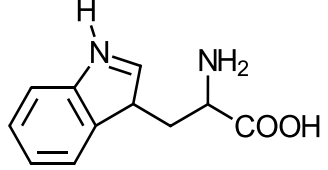
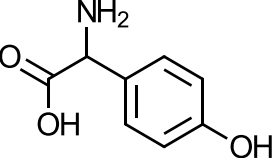
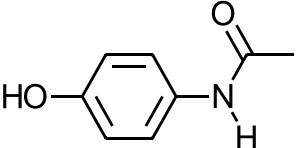
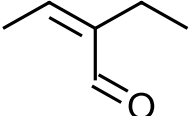
- e) Write the equation for the rupture of the molecule, knowing that under the action of NaOH , iodoform is produced, as well as an ionic organic compound.

- f) The hydrogen iodide formed under point d) is neutralised with NaOH . Write the corresponding reaction equation.










- g) Write the combining reaction equation for the 3 previous steps.

Problem 2 : Analysis of organic functional groups

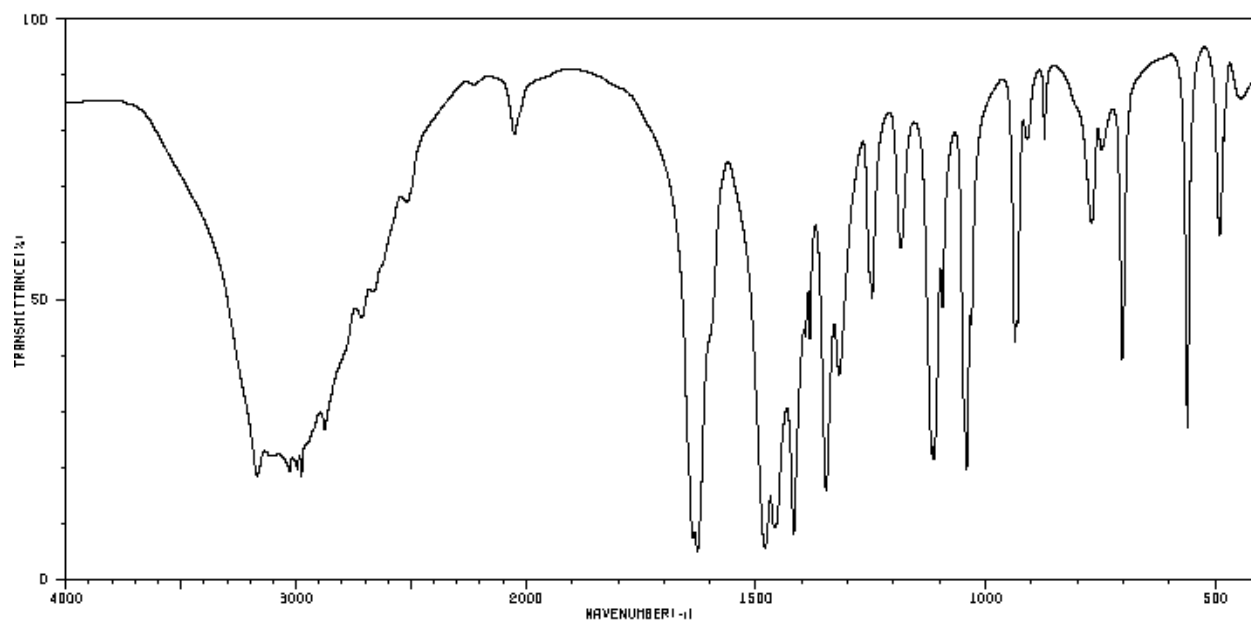
List of substances:

Substance 1 	Substance 2 	Substance 3 	Substance 4 
Substance 5 	Substance 6 	Substance 7 	Substance 8 
Substance 9 	Substance 10 	Substance 11 	Substance 12 
Substance 13 	Substance 14 	Substance 15 	Substance 16 

1) Test results for your substance A










Test 1		Test 2		Test 3	
Test 4		Test 5		Test 6	
Test 7		Test 8		Test 9	

Infrared spectrum of your substance A

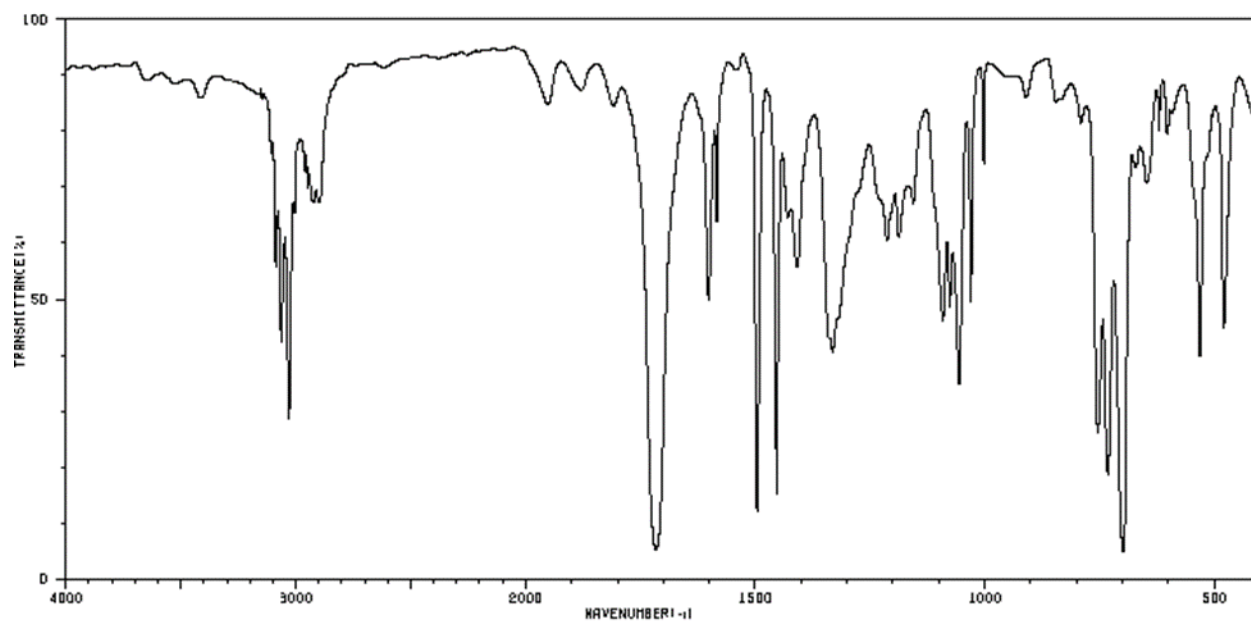


Identify your substance A. Explain your reasoning in a detailed and comprehensible manner.

2) *Test results for your substance B*










Test 1		Test 2		Test 3	
Test 4		Test 5		Test 6	
Test 7		Test 8		Test 9	

Infrared spectrum of your substance B



Identify your substance B. Explain your reasoning in a detailed and comprehensible manner.

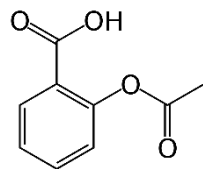
3) *Substance C*

Test 1		Test 2		Test 3	
Test 4		Test 5		Test 6	
Test 7		Test 8		Test 9	

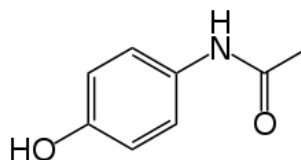
Suggest a possible structure for your *substance C* by yourself, knowing its chemical formula is $C_9H_8O_3$. Explain your reasoning in a detailed and comprehensible manner.

4) *Additional questions :*

Aspirin and paracetamol are widely known painkillers :



Aspirin



Paracetamol

a) Which test(s) could be used to discern between aspirin and paracetamol?

b) Which organic products are to be expected from the reaction of those two molecules with a solution of NaOH?

Aspirin + NaOH	Paracetamol + NaOH

Problem 3 : Identification of substances

1) Give a brief description of your experimental plan.

2) Record your data / observations.

3) Identify the solutions :

- Solution A : _____
- Solution B : _____
- Solution C : _____
- Solution D : _____
- Solution E : _____

4) Write the appropriate net ionic equations for reactions that you utilized to identify the solutions in the vials.

Draft Sheet

