Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Physical

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Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Q1.

Aspirin can be produced by reacting salicylic acid with ethanoic anhydride.
An incomplete method to determine the yield of aspirin is shown.

1. Add about 6 g of salicylic acid to a weighing boat.
2. Place the weighing boat on a 2 decimal place balance and record the mass.
3. Tip the salicylic acid into a 100 cm^3 conical flask.
4. _____
5. Add 10 cm^3 of ethanoic anhydride to the conical flask and swirl.
6. Add 5 drops of concentrated phosphoric acid.
7. Warm the flask for 20 minutes.
8. Add ice-cold water to the reaction mixture and place the flask in an ice bath.
9. Filter off the crude aspirin from the mixture and leave it to dry.
10. Weigh the crude aspirin and calculate the yield.

(a) Describe the instruction that is missing from step **4** of the method.

Justify why this step is necessary.

Instruction _____

Justification _____

_____

_____

(2)

(b) Suggest a suitable piece of apparatus to measure out the ethanoic anhydride in step **5**.

_____

(1)

(c) Identify a hazard of using concentrated phosphoric acid in step **6**.

_____

(1)

(d) Complete the equation for the reaction of salicylic acid with ethanoic anhydride to produce aspirin.

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(1)

(e) A 6.01 g sample of salicylic acid (M_r = 138.0) is reacted with 10.5 cm^3 of ethanoic anhydride (M_r = 102.0).
In the reaction the yield of aspirin is 84.1%

The density of ethanoic anhydride is 1.08 g cm^{-3}

Show by calculation which reagent is in excess.

Calculate the mass, in g, of aspirin (M_r = 180.0) produced.

Reagent in excess _____

Mass of aspirin _____ g

(5)

(f) Suggest **two** ways in which the melting point of the crude aspirin collected in step **9** would differ from the melting point of pure aspirin.

Difference 1 _____

_____

Difference 2 _____

_____

(2)

(g) The crude aspirin can be purified by recrystallisation using hot ethanol (boiling point = 78 °C) as the solvent.

Describe **two** important precautions when heating the mixture of ethanol and crude aspirin.

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Precaution 1 _____

_____

Precaution 2 _____

_____

(2)

(h) The pure aspirin is filtered under reduced pressure.
A small amount of cold ethanol is then poured through the Buchner funnel.

Explain the purpose of adding a small amount of cold ethanol.

_____

_____

_____

(1)

(i) A sample of the crude aspirin is kept to compare with the purified aspirin.

Describe **one** difference in appearance you would expect to see between these two solid samples.

_____

_____

_____

(1)

(Total 16 marks)

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Q2.

This question is about citric acid, a hydrated tricarboxylic acid. Its formula can be represented as $H_3Y.xH_2O$

(a) A 1.50 g sample of $H_3Y.xH_2O$ contains 0.913 g of oxygen by mass.
The sample burns completely in air to form 1.89 g of CO_2 and 0.643 g of H_2O

Show that the empirical formula of citric acid is $C_3H_5O_4$

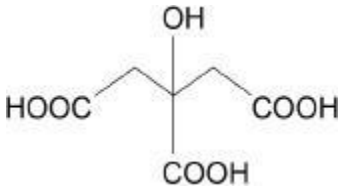
(5)

(b) A 3.00 g sample of $H_3Y.xH_2O$ (M_r = 210.0) is heated to constant mass. The anhydrous H_3Y that remains has a mass of 2.74 g

Show, using these data, that the value of x = 1

(2)

The figure shows the structure of H_3Y



(c) Complete this IUPAC name for H_3Y

_____ propane-1, 2, 3-tricarboxylic acid

(1)

(d) State the number of peaks you would expect in the ^{13}C NMR spectrum for H_3Y

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(1)

(Total 9 marks)

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