



# THE SCHOOL FOR EXCELLENCE (TSFX)

## VCE CHEMISTRY UNITS 3 & 4

### WRITTEN EXAMINATION 2018

Reading Time: 15 minutes  
Writing Time: 2 hours 30 minutes

### QUESTION AND ANSWER BOOK

Student  
Number:

Letter

#### Structure of Book

Section	Number of questions	Number of questions to be answered	Number of marks
A	30	30	30
B	10	10	90
			<b>Total 120</b>

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

#### Materials Supplied

- Question and answer book of 39 pages.
- Data book
- Answer sheet for multiple choice questions.

#### Instructions

- Write your **student number** in the space provided above on this page.
- All written responses must be in English.

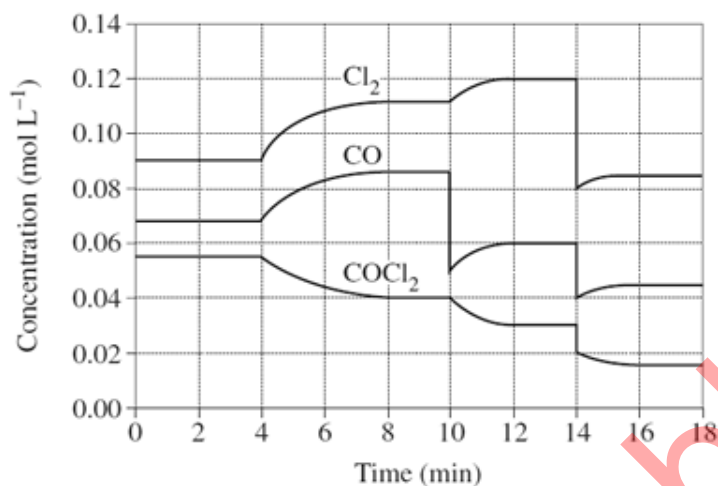
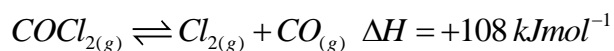
#### At the End of the Examination

Place the answer sheet for multiple-choice questions inside the front cover of this book.

Students are **NOT** permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

**QUESTION 10**

The concentration vs time graph of the following reaction is shown below:



What are the changes that occurred at 4 minutes and 14 minutes?

**4 minutes**

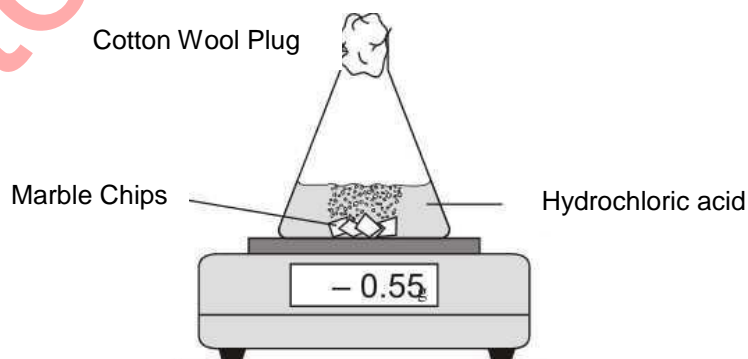
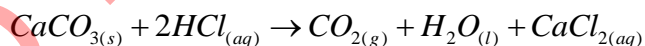
- A. Decrease in Temperature
- B. Decrease in Temperature
- C. Increase in Temperature
- D. Increase in Temperature

**14 minutes**

- Increase in volume
- Decrease in volume
- Increase in volume
- Decrease in volume

**Use the following information to answer Questions 11 and 12.**

Solid calcium carbonate chips are reacted with hydrochloric acid to produce carbon dioxide, calcium chloride and water.



Time (min)	0	15	30	45	60	75	90
Mass Loss (g)	0	0.81	1.29	1.50	1.61	1.70	1.70

### QUESTION 11

Consider the following statements:

- I There was no mass loss at time 0 minutes because the cotton wool prevented water from escaping.
- II The mass loss was due to  $HCl$  evaporating from the conical flask, as the reaction is exothermic.
- III At 75 minutes the reaction was complete.
- IV The fastest reaction rate occurred from 0 to 15 minutes when the concentration of the reactants are at its greatest values.
- V At 75 minutes the reaction had reached equilibrium.

Which statements are correct?

- A. I, III
- B. I, IV, V
- C. II, V
- D. III, IV

### QUESTION 12

Which one of the following options will increase the rate of reaction?

- I Increase the surface area of the  $HCl$  solution
- II Increase the surface area of the calcium carbonate
- III Increase the pressure in the conical flask
- IV Remove carbon dioxide gas
- V Increase the concentration of  $HCl$

- A. I, II
- B. I, III
- C. II, V
- D. II, IV

### QUESTION 13

Biodiesel is produced by which one of the following reactions?

- A. Triglycerides undergo transesterification with potassium hydroxide to form biodiesel.
- B. Triglycerides are reacted with methanol to produce fatty acid methyl esters and biodiesel.
- C. Fats are reacted with methanol to produce glycerol and fatty acid methyl esters.
- D. Fats are reacted with potassium hydroxide and methanol to form fatty acid methyl esters.

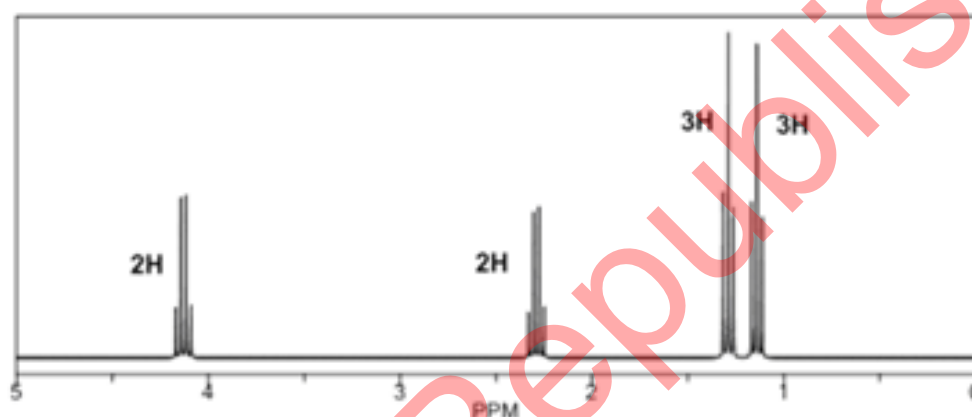
**QUESTION 20**

As the electronegativity of a substituent increases in proton NMR spectroscopy, the shielding effect \_\_\_\_\_, and the chemical shift of adjacent (neighbouring) protons' signal \_\_\_\_\_.

- A. Increases                      Increases
- B. Increases                      Decreases
- C. Decreases                    Increases
- D. Decreases                    Decreases

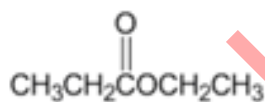
**QUESTION 21**

The  $^1\text{H}$  – NMR spectrum of a compound with formula  $\text{C}_5\text{H}_{10}\text{O}_2$  is given below.



Which structure produced this spectrum?

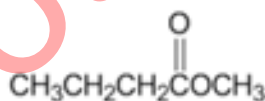
A.



B.



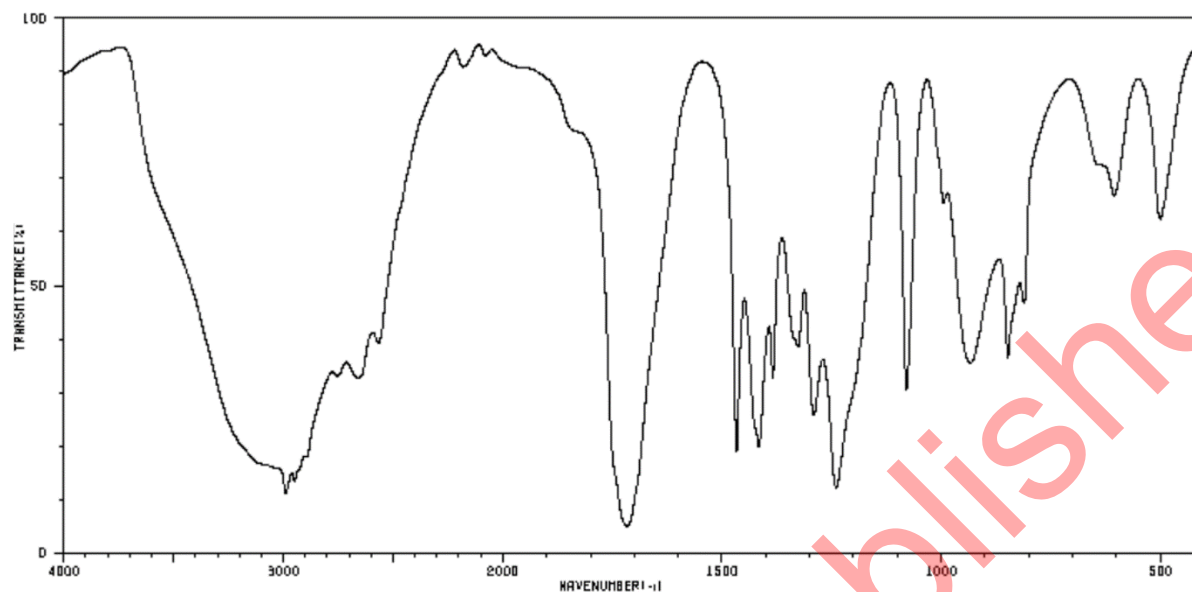
C.



D. None of the above

### QUESTION 22

Consider the infrared spectrum below.



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The compound most likely to produce this spectrum is

- A. an alcohol
- B. a carboxylic acid
- C. an ester
- D. a ketone

### QUESTION 23

Which of the following is capable of exhibiting cis-trans isomerism?

- A. ethene
- B. 1-butene
- C. 2-butene
- D. 1-pentene

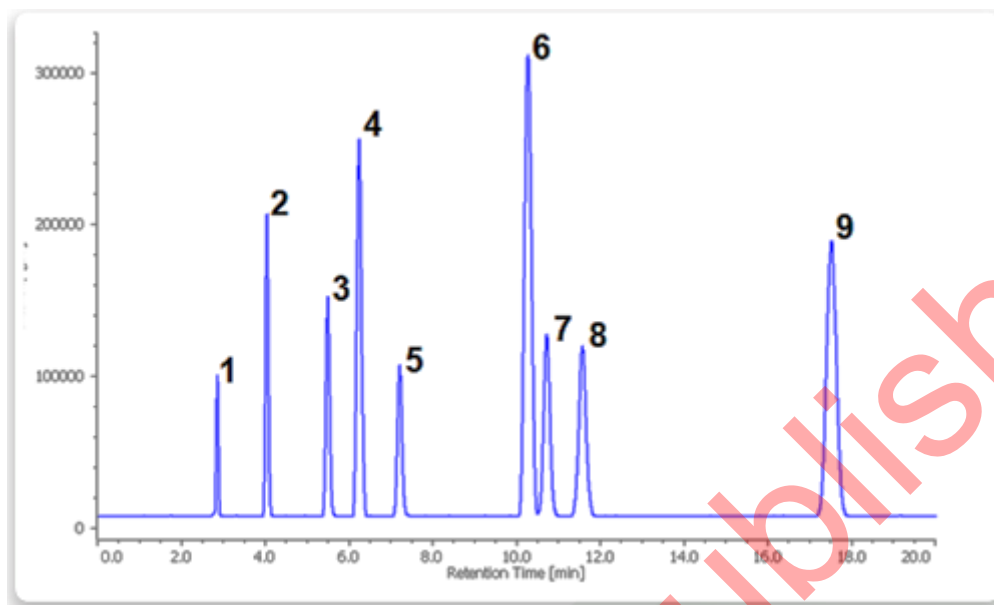
### QUESTION 24

Which of the following statements regarding Vitamin D is incorrect?

- A. Vitamin D does not readily react with acids or alkalis
- B. It is relatively resistant to oxidation
- C. It does not dissolve well in aqueous solutions
- D. It cannot be produced by humans and must therefore be supplied in the diet

**QUESTION 10** (10 marks)

Figure 1 shows a chromatogram of a standard mixture of 9 fatty acids that were separated using high pressure liquid chromatography (HPLC).



- 1: Capric acid (C10)
- 2: Lauric acid (C12)
- 3: Linolenic acid (C18)
- 4: Myristic acid (C14)
- 5: Linoleic acid (C18)
- 6: Palmitic acid (C16)
- 7: Oleic acid (C18)
- 8: Elaidic acid (C19)
- 9: Stearic acid (C18)

- a. (i) Is the stationary phase used for this separation polar or non-polar? Give a reason for your answer. 2 marks

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- (ii) Which fatty acid would produce biodiesel with the lowest cloud point? Give a reason for your answer. 2 marks

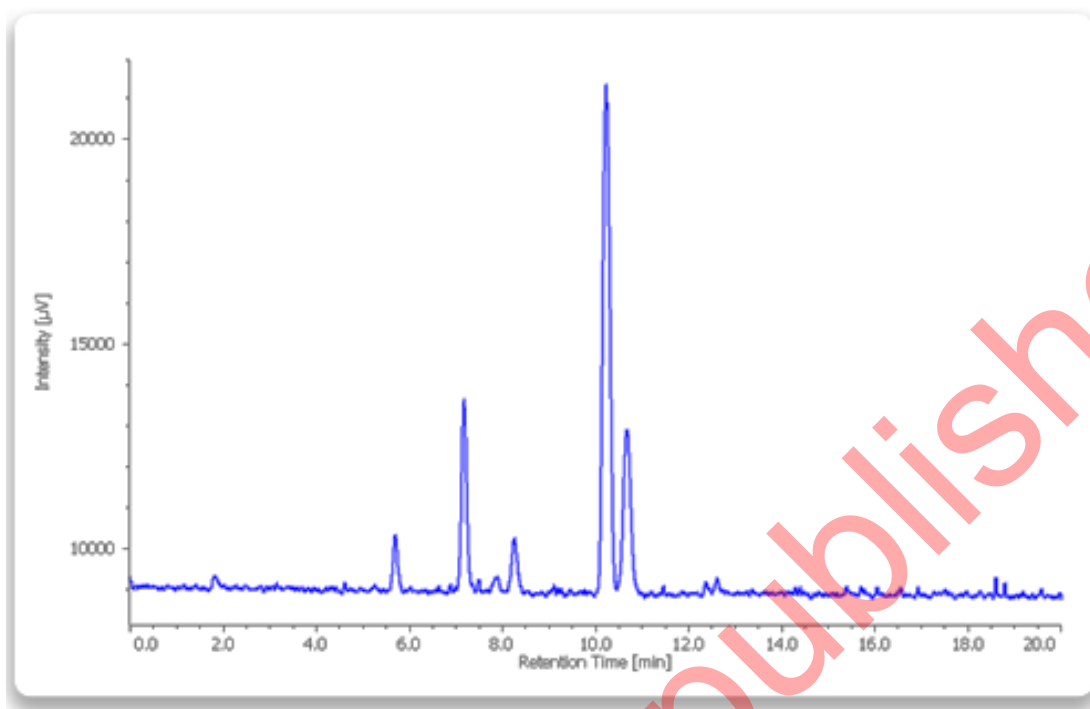
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The chromatogram of rice bran oil which was processed under identical conditions and using the same column is shown below.



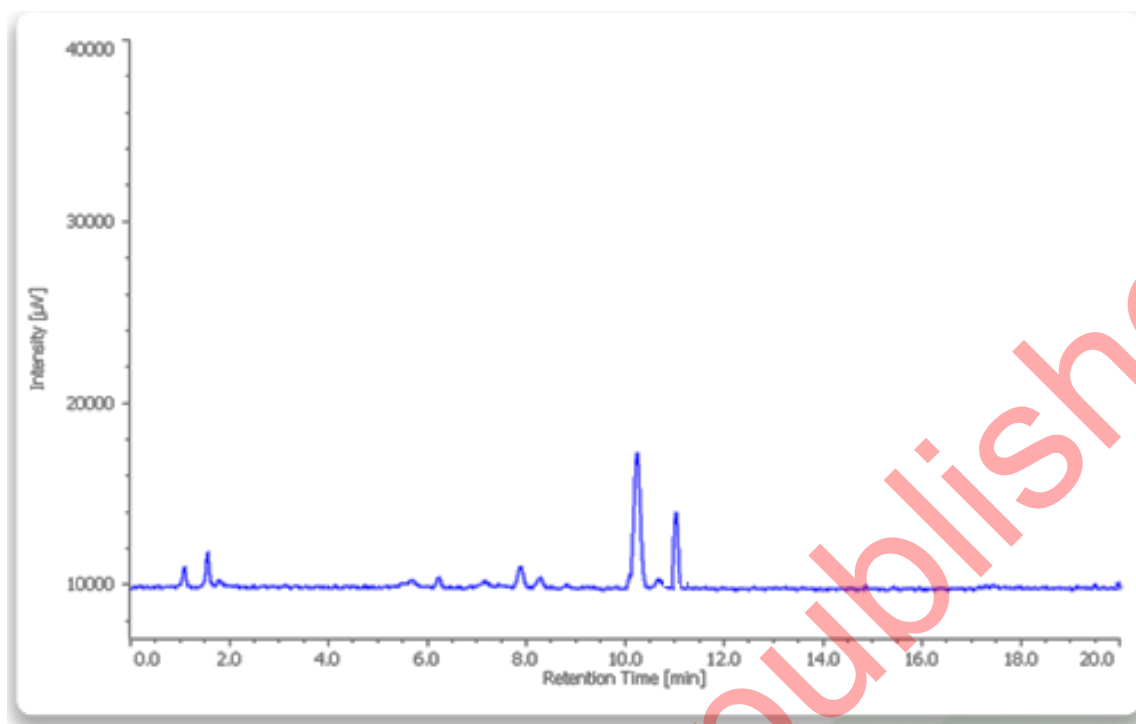
- b. Identify the fatty acid present in the highest concentration in rice bran oil. 1 mark

Elaidic acid is not found in natural vegetable oil. It is produced during the manufacturing process of hydrogenated oils such as margarine.

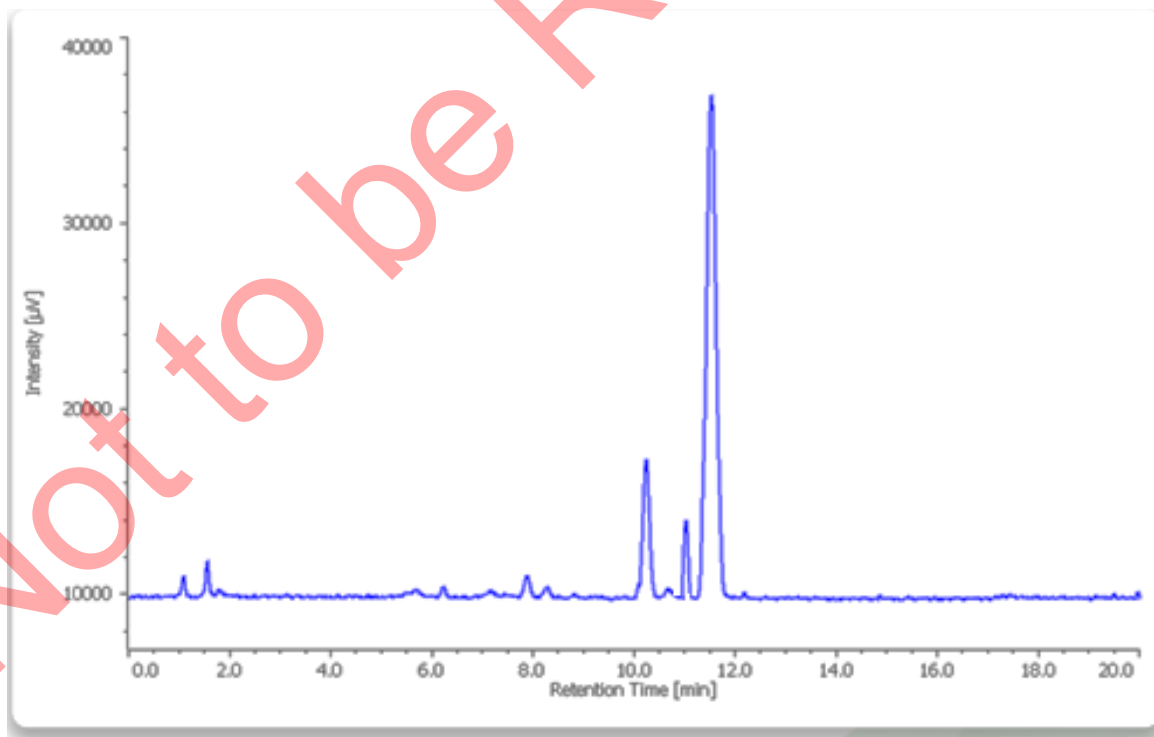
- c. A sample of rice bran oil was reacted with excess hydrogen gas in the presence of nickel catalyst at  $150^{\circ}\text{C}$ . Would you expect the HPLC retention time of the hydrogenated product(s) to increase, decrease or remain the same? Give a reason for your answer.

2 marks

The chromatogram of margarine is given below.



Elaidic acid was added to a sample of the margarine and the following chromatogram was obtained.

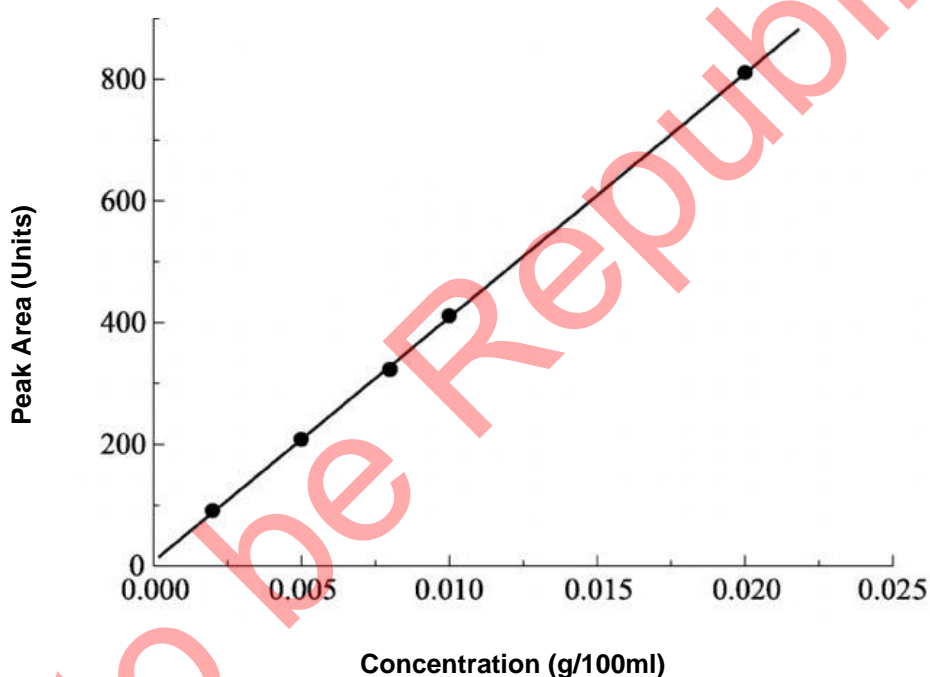




- d. Explain how the chromatogram indicates that the margarine has no elaidic acid present.

1 mark

Depending on the source, rice bran oil contains varying amounts of linolenic acid. To determine the concentration of linolenic acid in the rice bran oil,  $1.00\text{ cm}^3$  of different concentrations of pure linolenic acid were dissolved in acetone to make  $20.00\text{ cm}^3$  of solution, and passed through the HPLC column under the same conditions as that used for rice bran oil. The peak areas were determined, and the following calibration curve was obtained.



- e. If the peak area of linolenic acid in a sample of rice bran oil prepared in the same manner as the standards is 625 units, what is the concentration of linolenic acid in the oil? State your answer in  $\text{gL}^{-1}$ .

1 mark

END OF QUESTION AND ANSWER BOOK