MELBOURNE HIGH SCHOOL

UNIT 3 CHEMISTRY

TRIAL EXAMINATION

2010

QUESTION AND ANSWER BOOKLET

Thursday 27th May 2010
Reading time: 15 minutes
Writing time: 90 minutes

Section	*Number of questions*	*Number of questions to be answered*	Number of marks	Suggested time (minutes)
A	20	20	20	23
B	10	10	60	67
		Total	80	90

Materials : * Question and answer booklet consisting of a cover page and 15 pages of questions - pages are numbered 2 to 16
* Answer sheet for multiple-choice questions.

Instructions : * Multiple choice items are to be answered by filling in the appropriate box which corresponds to the answer of your choice in the question booklet.
* Short answer questions are to be answered in the spaces provided.
* All written responses must be in English.
* Chemical equations and half equations must include symbols of state.
* Numerical answers are to be given to appropriate numbers of significant figures.
* A unit must be given in numerical answers that require a unit for complete specification.
***Students must bring into the examination a clean, stapled copy of the data book.**
* 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 graphics calculators, mobile phones and/or any other electronic communication devices into the examination room, blank sheets of paper, white out liquid/tape**.

Submission : * At the conclusion of the exam, place the Multiple Choice answer sheet inside this booklet.

Section A **/ 20**

Section B **/ 60**

Total **/ 80**

2010 UNIT 3 SECTION A

Specific instructions for Section A

- This section consists of 20 multiple-choice items, which are to be answered by shading the box on the answer sheet that corresponds to your answer in **lead pencil**.
- If you wish to change an answer, erase the original answer completely.
- A correct answer scores 1 mark and an incorrect answer scores 0 marks.
- 1 × 20 = 20 marks, 23 minutes

The following information refers to the **next two** questions.
The percentage by mass of sodium ions in the form of sodium chloride in a particular cereal was determined using gravimetric analysis. A 3.65 g sample of the cereal was ground into a powder, dissolved in water and filtered. Excess silver nitrate was added to the remaining solution to precipitate the chloride ions as silver chloride. The precipitate was collected, washed and dried. Its mass was found to be 0.241g.

1 The percentage by mass of sodium ions in the cereal is closest to

A 0.0387 %
B 1.06 %
C 1.47 %
D 2.69 %

2 The calculated percentage by mass of sodium chloride is lower than stated on the label on the packaging. This may be due to

A inadequate washing of the precipitate.
B the precipitate not being dried to constant mass.
C incomplete precipitation of the chloride ions.
D co-precipitation of another unknown anion.

3 In a titration of a strong base with a strong acid, the following procedure was used:
1. A burette was filled with the standard acid.
2. A pipette was rinsed with some base solution.
3. A conical flask was rinsed with some base solution.
4. A pipette was used to transfer a measured volume of base solution into the conical flask.
5. Indicator was added to the base sample and it was titrated to the endpoint with the acid.

Which statement is correct?

A The calculated base concentration will be correct.
B The calculated base concentration will be too low.
C The calculated base concentration will be too high.
D No definite conclusion can be reached about the base concentration.

4 Which one of the following chemical reactions represents a redox reaction?

A $Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$
B $Cr_2O_7^{2-}(aq) + 2OH^-(aq) \rightarrow 2CrO_4^{2-}(aq) + H_2O(l)$
C $Cu(NH_3)_4^{2+}(aq) + 4H_3O^+(aq) \rightarrow Cu(H_2O)_4^{2+}(aq) + 4NH_4^+(aq)$
D $SO_3^{2-}(aq) + ClO_3^-(aq) \rightarrow SO_4^{2-}(aq) + ClO_2^-(aq)$

5 The concentration of a hydrochloric acid solution was determined by reacting it with 20.00 mL of a 0.050 M sodium carbonate solution as described by the chemical equation:

$$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

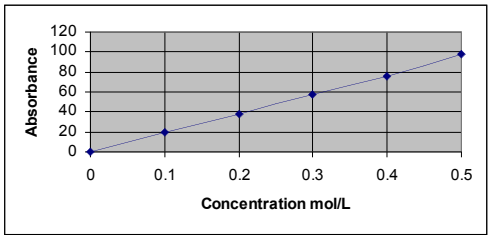
A student might carry out the following procedures in the above experiment:

M - the burette was rinsed with acid prior to use
N - the burette was rinsed with water prior to use
O - the conical flask was rinsed with sodium carbonate prior to use
P - the conical flask was rinsed with water prior to use
Q - a 20.00 mL pipette was rinsed with sodium carbonate prior to use
R - a 20.00 mL pipette was rinsed with water prior to use

Which procedures should be used to obtain an accurate result in this experiment:

A procedures M, O, Q.
B procedures N, P, R.
C procedures M, O, R.
D procedures M, P, Q.

6 A garden fungicide contains copper as its main ingredient. Colorimetry is used to analyse the copper content. A calibration curve is shown below



A 20.0 g sample of fungicide was dissolved in 250.0 ml of water. A sample was tested in the colorimeter and its absorbance was found to be 28.0 %.
The % by mass of copper, as Cu^{2+}, in the fungicide is closest to

A 4.0 %
B 15.9 %
C 11.9 %
D 47.6 %

7 Some antacids have as their primary active ingredient the compound $NaAl(OH)_2CO_3(s)$. This compound reacts with stomach acids as described by the chemical equation:

$$NaAl(OH)_2CO_3(s) + 4HCl(aq) \rightarrow NaCl(aq) + AlCl_3(aq) + 3H_2O(l) + CO_2(g)$$

What mass of this compound is required to neutralise 25.0 mL of 0.100 M HCl(aq)?

A 6.25×10^{-4} g
B 2.50×10^{-3} g
C 9.00×10^{-2} g
D 3.60×10^{-1} g

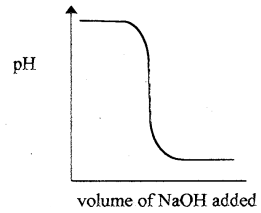
8 A 50.00 g sample of canned tuna was analysed for its salt (NaCl) content. The sample was added to water, stirred and filtered. The salt present in the filtrate was precipitated as silver chloride (AgCl) and 5.68 g of precipitate was obtained. The percentage of salt (NaCl) in the tuna was:

A 11.4 %
B 4.63 %
C 2.81 %
D 0.08 %

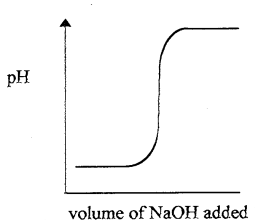
9 An analyst was required to find the concentration of ethanoic acid, CH_3COOH, in vinegar. The analyst took a sample of the vinegar, diluted it with *distilled water* and made it up in a volumetric flask. Several aliquots of the diluted vinegar solution were titrated with freshly standardised sodium hydroxide, NaOH, solution using a suitable indicator.

Which of the following graphs represent the change in pH during titration?

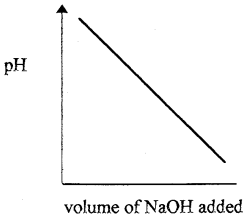
A.



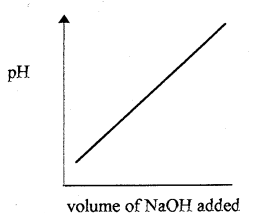
B.



C.



D.



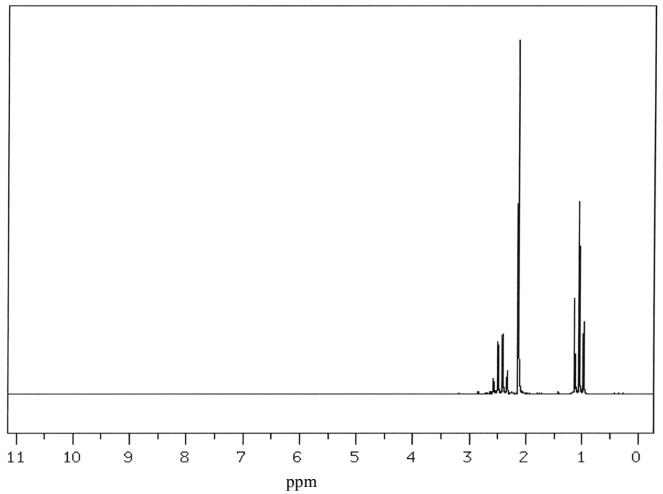
10 Aspirin is an organic compound widely used in headache preparations. The concentration of aspirin in a particular tablet is best determined by

A flame tests
B atomic absorption spectroscopy
C paper chromatography
D high performance liquid chromatography

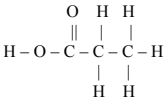
11 In NMR spectroscopy the main factor influencing the position of chemical shift is

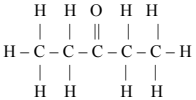
A the arrangement of the particles in the nucleus being investigated.
B the number of atoms around the nucleus being investigated.
C the arrangement of bonding electrons around the nucleus being investigated.
D the arrangement of inner electrons around the nucleus being investigated.

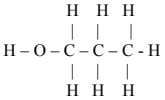
12 The ^{1}H NMR spectrum of an unknown compound is shown below

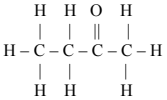


The structure of the compound could be

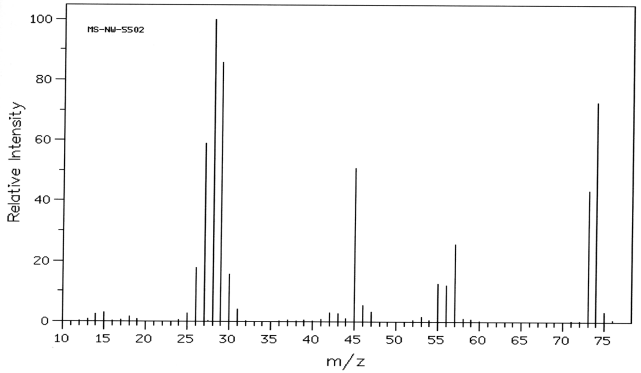
A 

B 

C 

D 

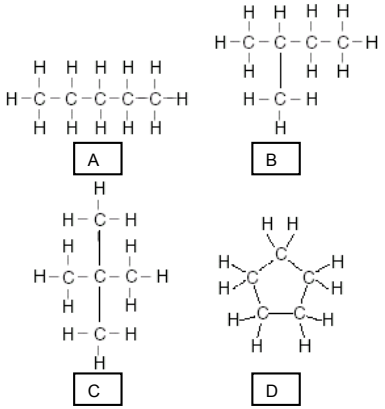
13 The mass spectrum of propanoic acid is given below.



What fragment must have been lost from the molecular ion to account for the high peak at m/z 73

A H
B H^+
C H_2
D H_2^+

14 Which structures below, represent a molecule that is **not** an isomer of pentane, C_5H_{12}?



15 Cysteine is an amino acid, which contains an S-H group in its structure. When it reacts with other amino acids to form a protein, condensation reactions will occur between

A the – NH_2 and – SH groups
B the – SH and – COOH groups
C the - NH_2 and – COOH groups
D the - NH_2, - SH and – COOH groups.

16 The following list of steps refers to an experimental plan for making an ester in a flask.
Some of the steps in the list may **NOT** be required for this experiment.
The steps are **NOT** in the correct sequence.

1. Heat the mixture under reflux.
2. Add three drops of concentrated sulfuric acid.
3. Add 1 mL of ethanol.
4. Add 1 mL of ethene.
5. Add 1 mL of ethanoic acid.
6. Distil the mixture.
7. Add three drops of phenolphthalein indicator.

Which alternative is the best sequence for making an ester?

A 3, 5, 7, 1
B 4, 3, 7, 6
C 5, 4, 2, 6
D 5, 3, 2, 1

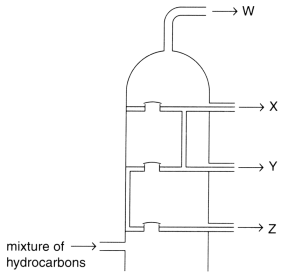
17 The semi-structural formula of a particular organic compound is

$(CH_3)_2C(OH)CHClCH_2CH_3$

The systematic name of this compound is

A 3-chloro-dimethyl butan-2-ol
B 3-chloro-2-methyl pentan-2-ol
C 3-chloro-4,4-dimethyl butan-2-ol
D 3-chloro-4-methyl pentan-4-ol

18 The diagram below represents a section of a fractionating tower used to separate four hydrocarbons (W, X, Y and Z) from each other.



Which of the following is consistent with the information presented in the diagram?

A The boiling points of the four hydrocarbons decrease in the order W, X, Y, Z.
B Z is more chemically reactive than either W, X or Y.
C The relative molecular masses of the four hydrocarbons increase in the order W, X, Y, Z.
D Z is the hydrocarbon most likely to be a gas at room temperature.

19 What is one possible reason why the production of bio-ethanol from cellulose is more difficult to achieve than from starch rich feedstock?

A The enzymes used produce a wide range of other compounds that do not readily ferment into ethanol.
B Cellulose decomposes and does not form the required sugars during hydrolysis stage of the process.
C Cellulose is not as readily hydrolysed as starch is to form the required sugars that will ferment to form ethanol.
D The enzymes used to hydrolyse the cellulose only produce very small quantities of the required sugars.

20 Which one of the following statements is incorrect about an enzyme?

A Enzymes can be deactivated by changing the pH of the reaction medium.
B An enzyme can function over a wide range of temperatures.
C The rate of reactions catalysed by enzymes are significantly higher than those catalysed by inorganic catalysts.
D The major component of enzymes are polypeptide molecules.

2010 UNIT 3 SECTION B

Specific instructions for Section B

- **This section consists of 10 short answer questions which are to be answered in the spaces provided.**
- **Numerical answers must be given to the appropriate number of significant figures.**
- **Symbols of state must be included in all equations and half equations.**
- **No credit will be given for an incorrect numerical answer unless it is supported by working.**
- **60 marks, 67 minutes**

1 [8 marks, 10 minutes]
The contents of a laboratory reagent bottle, containing solid potassium hydroxide, KOH(s), have been contaminated by moisture. To determine the extent of contamination the solution of this KOH is titrated with a standardised hydrochloric acid solution of pH 1.00. The following procedure was followed.

- **Step 1:** 4.10 g of the contaminated KOH(s) was dissolved in deionised water made up to 500.0 mL in a standard flask.
- **Step 2:** A burette was filled with this solution and use to titrate a 20.00 mL sample of the HCl(aq) using a suitable indicator.
- **Step 3:** Titrations were repeated until a consistent end point was obtained.

After completing the titrations, the following data was obtained:

- Titration end point = 15.80 mL of KOH(aq) .
- pH of HCl (aq) = 1.00.
- Titration reaction is: $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$.

a Calculate the concentration of $H^+(aq)$ in the HCl(aq).

b Calculate the number of moles of $H^+(aq)$ used in each titration.

c Determine the concentration of OH^- in the KOH(aq) solution.

d Determine the mass of KOH(s) in the 500.0 mL of solution originally prepared.

e Calculate the percentage, by mass, of moisture in the contaminated KOH(s).

(1 + 1 + 2 + 2 + 2 = 8 marks)

2 [5 marks, 6 minutes]

A chemistry student decided to use volumetric analysis to determine the aspirin, $C_9H_8O_4$, content of a certain brand of headache tablet. The manufacturer claimed that each tablet contained 300 mg of aspirin.

To check the manufacturer's claim, the student carried out the following procedure.

(i) The average mass of one tablet was determined to be 0.331 g.

(ii) One tablet was placed into a conical flask, slowly dissolved in 50 mL of deionised water and some phenolphthalein indicator added.

(iii) The contents of the conical flask were then titrated from a burette with a standardized 0.0988 M sodium hydroxide solution.

(iv) Steps (ii) and (iii) were repeated twice and the average titre was found to be 16.95 mL.

The ionic equation for the reaction between aspirin and sodium hydroxide is:

$$CH_3COOC_6H_4COOH(aq) + OH^-(aq) \rightarrow CH_3COOC_6H_4COO^-(aq) + H_2O(1)$$

a Determine the average amount of sodium hydroxide that reacted with the aspirin in the titrations.

b Calculate the mass of aspirin in each tablet. Express your answer in mg of aspirin per tablet.

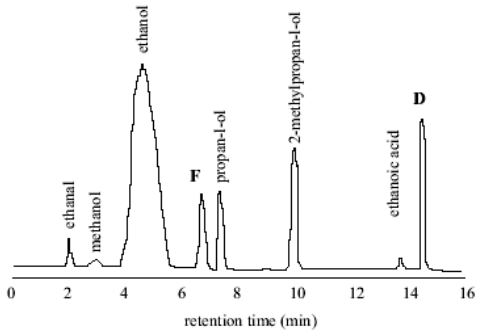
c What do you conclude about the manufacturer's claim from these results?

d What would be the effect on the results if each tablet was dissolved in 100 mL of deionised water instead of 50 mL?

(1 + 2 + 1 + 1 = 5 marks)

3 [5 marks, 5 minutes]

The components of a whiskey were separated using chromatography on a polar stationary phase, as shown in the chromatogram below:



a Three of the alcohols shown in the chromatogram above, methanol, ethanol, and propan-1-ol, have carbon chains of different lengths and have different retention times.
State the relationship between length of carbon chain and retention time.

b Explain how the components of the whiskey are separated by the column.

In determining the concentration of substance D in the sample mixture, a standard solution of substance D containing 40 mg per 200 mL was prepared and run through the column. The following results were recorded.

	Peak Area	**Retention Time**
Standard Solution D	97.077	14.4
Whiskey sample	25.896	14.4

c Calculate the mass of substance D in 50.0 mL of the whiskey sample.

(1 + 2 + 2 = 5 marks)

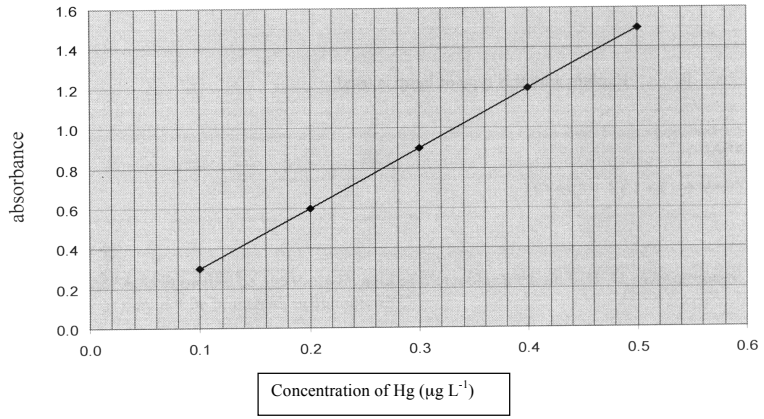
4 [7 marks, 8 minutes]

Mercury poisoning is a disease in humans caused by excessively high exposure to mercury (Hg). Due to safety concerns, the mercury content of commercially traded shellfish that is intended for consumption by humans should not exceed 0.5 mg kg^{-1}. One way to determine the mercury content in shellfish is to analyse samples using atomic absorption spectroscopy (AAS).

A mass of 0.1373 g of a freeze-dried sample of shellfish tissue is dissolved in 2.00 mL of nitric acid, heated for 3 hours at 125°C and transferred to a 500.0 mL volumetric flask, where it is made up to the mark with deionised water. A volume of 1.00 mL of this solution is then further diluted to 250.0 mL in a second volumetric flask. AAS is used to measure the absorbance of this solution, which is found to be 1.03.

Next, the absorbance of a series of Hg solutions of known concentration was measured using AAS and a calibration graph drawn.

Calibration graph



a What is the concentration, in μg L^{-1}, of mercury in the 250.0 mL volumetric flask?

b Calculate the mass, in mg, of mercury in the original shellfish sample.

c Should this shellfish be traded commercially? Justify your answer.

d i) What type of lamp would be used in the AAS for this analysis?

d ii) Explain why this type of lamp is used.

(1 + 2 + 2 + (1 + 1) = 7 marks)

5 [5 marks, 5 minutes]

The concentration of iron (II) ions, $Fe^{2+}(aq)$, in a solution can be determined by volumetric analysis. Shown below is the method used in one such analysis to determine the iron (II) content of lawn fertiliser.

Method

16.80 g of lawn fertiliser is dissolved in water and the solution made up to 500.0 mL in a volumetric flask.
Approximately 20 mL of 1 M sulfuric acid is added to three separate 20.00 mL samples of this solution.
A 0.01000 M standard solution of potassium permanganate, $KMnO_4$, is used to titrate each of the samples.
In this reaction, the iron (II) ions are oxidised to iron (III) ions and the purple permanganate ions are reduced to colourless manganese (II) ions.

a Several actions that could occur during this analytical procedure are listed below (A-D).
For each action, indicate the likely effect on the calculated percentage of iron (II) ions in the fertiliser by placing a tick in the appropriate box.

Action	Calculated result would be too low	No effect on calculated result	Calculated result would be too high
A. The volumetric flask had been washed previously with distilled water, but not dried.			
B. A 25.00 mL pipette was unknowingly used instead of a 20.00 mL pipette.			
C. The mass of the fertiliser was recorded incorrectly. The recorded mass was 0.15 g less than the actual mass.			
D. The burette had been washed previously with distilled water only.			

b Explain your reasoning for the answer that you have given in the case of action B.

(4 + 1 = 5 marks)

6 [8 marks, 8 minutes]
A compound X, with a molecular formula of $C_5H_{10}O_2$, is known to be a carboxylic acid. The structure, which may or may not be branched, is unknown.

a In the boxes below, draw the structures showing all bonds, for the 4 possible carboxylic acids with the above formula.

carboxylic acid I	carboxylic acid II
carboxylic acid III	carboxylic acid IV

Compound X shows four peaks in a ^1H NMR spectrum and four peaks in a ^{13}C NMR spectrum.

b What conclusions about the structure of X can be determined from this information?

c i Identify the correct structure of compound X by circling the appropriate carboxylic acid below, which corresponding to the structures in part a.

carboxylic acid I, carboxylic acid II, carboxylic acid III, carboxylic acid IV

c ii What is the systematic name for this substance? _____

[4 + 2 + 2 = 8 marks]

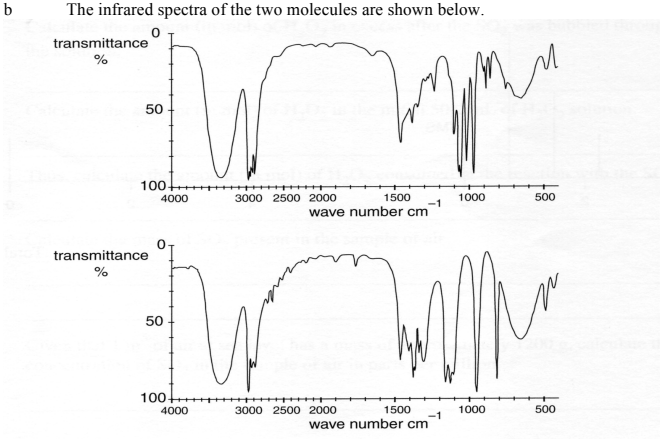
7 [9 marks, 11 minutes]
Propene reacts with water in the presence of a phosphoric acid catalyst to produce two product molecules, both of formula C_3H_8O. Both have very similar infrared spectra with a broad peak at around 3300 cm^{-1}.

a i) Name the type of reaction that has occurred to generate these products.

ii) Name and draw the structural formulae for each of these two possible product molecules, showing all bonds.

Structure A	Structure B
Name:_____	Name:_____

b The infrared spectra of the two molecules are shown below.



Why are their spectra so similar at wave numbers above 1500 cm^{-1}?

c The mass spectrum of one of the molecular products has a significant peak at a mass-to-charge ratio (m/z) of 29. Write the chemical formula of the fragment that would generate this peak, and state which parent molecule (structure A or B as drawn in part a ii) it originates from.

d State the number of peaks that would be observed in the ^{13}C NMR spectrum of:

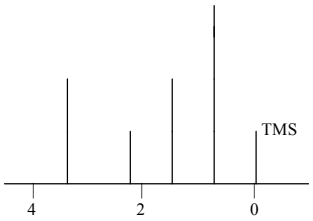
i) Structure A _____

ii) Structure B _____

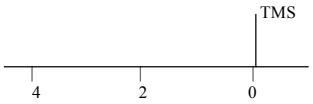
e The low resolution ^{1}H NMR spectrum of one of the product molecules is provided below.

On the set of axes provided, draw the high resolution ^{1}H NMR spectrum of the same molecule, clearly showing the number of peaks into which each signal would split.

low resolution ^{1}H NMR spectrum

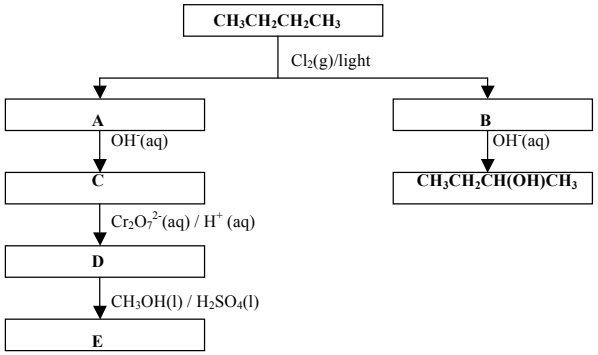


high resolution ^{1}H NMR spectrum



((1 + 2) + 1 + 2 + (½ + ½) + 2 = 9 marks)

8 [6 marks, 6 minutes]
A reaction pathway starting from butane is shown below.



8a Identify the products A to E by writing their semi-structural formula and stating their systematic names.

A _____ _____

B _____ _____

C _____ _____

D _____ _____

E _____ _____

b What property can be used to separate the compounds A and B produced in the first reaction?

_____

9 [3 marks, 4 minutes]
Biodiesel is made up by reacting lipids with methanol in the presence of a strong base.
The main fatty acid present in canola oil is the trans fatty acid, erucic acid, $CH_3(CH_2)_7CH=CH(CH_2)_{11}COOH$.

a Name a strong base suitable for this reaction. _____

b Draw the structure of the triglyceride of this lipid.

c Draw the structure of the biodiesel that forms from erucic acid.

(1 + 1 + 1 = 3 marks)

10 [4 marks, 4 minutes]
Proteins are biomolecules produced from α-amino acids.

a Draw a structure using the amino acid alanine combined with the amino acid phenylalanine, in that order.

bi) Name the link formed between the 2 amino acids.

_____

bii) Circle this link on the structure you drew above.

c Draw the structure of alanine in an aqueous solution that has a pH of 3.

(1 + (1 + 1) + 1 = 4 marks)

END of PAPER

Source of Questions - 2010

2010 Unit 3 Questions

MC

1 **Insight Exam 1 Q 2**
2 **Insight Exam 1 Q 3**
3 **Disk Question 3 C**
4 **Berry Q 74**
5 **Berry Q 30**
6 **Disk Question 10** **C**
7 **Berry Q 46**

8 **Disk Question 18** **B ?**

9
10

11 **Berry Q 190**
12 Insight Test 3 Q 11 p36 ? (D)
13 Insight Test 3 Q 10 pg 35
14 **Disk Question 1 D**
15 **Berry AoS2 Q90**
16 **Disk Question 17** **D**
17 **NEAP 2.1.2 p 26**
18 neap smart study 2.1.4 p27
19 **Berry AoS2 Q110**
20 **Berry AoS2 Q95**

Berry Q 92 pg 92
Which one of the following is least effected when a protein biomolecule is denatured?
A The primary structure
B The secondary structure
C The tertiary structure
D The shape of the protein

Question 22 **C**
Pyruvic acid is produced by the enzyme-catalysed reaction of glucose within the body. Analysis of this compound establishes its percentage composition as 40.91% carbon, 4.545% hydrogen and 54.55% oxygen. The empirical formula of pyruvic acid is

A. CHO
B. $C_2H_3O_2$
C. $C_3H_4O_3$
D. CH_2O

Test 3 Q 15

Test 3 19

SECTION B
1 **Question 7** (10 marks - 12 minutes)

Answers
1
Question 7 solution
a) $[H^+] = 10^{-pH} = 10^{-1.00} = \underline{0.100\ M}$ ❶

b) n = c x V = 0.100 x 20/1000 = 0.00200 mol ❶

c) $n(OH^-) = n(H^+) = 0.00200$mol❶
c = n/V = 0.00200/0.0158= 0.127 M ❶

d) n = c x V = 0.127 x 500/1000 = 0.0635 mol ❶

m = n x M = 0.0635 x 56.1 = 3.56 g ❶

e) mass water = mass of contaminated KOH - mass KOH = 4.10 - 3.56 = 0.54g ❶
%water = mass water/ mass contaminated sample x 100 = 0.54/4.10 x 100 = 13.2 % ❶

3

Answers Question 11 solution

a) As the chain length (or molecular size) increases, the retention time increases. ❶
b) The components have differing attractions to the stationary phase. ❶ The components adsorb to the stationary phase by differing extents and travel different rates through the column. ❶
c) 40 mg (in 200ml) : 97.077 (peak area)
x mg : 25.896 x = 10.67 mg in 200ml ❶ → **2.67mg** in 50ml ❶

1	[8 marks, 10 minutes]	Disk Q7
2	[5 marks, 6 minutes]	Berry Q21 p 38
3	[5 marks, 5 minutes]	Disk **Question 10 or 11?**
4	[7 marks, 8 minutes] Insight Q 2 p 42	
5	[5 marks, 5 minutes] Insight exam 3 part Q 1 pg 40 - 42	
6	[8 marks, 8 minutes] Insight Test 3 Q4 pg 45	
7	[9 marks, 11 minutes] Q3 Neap trial exam 2009	47/ 53
8	[6 marks, 6 minutes] Berry aos 2 p104 q12	53/59
9	[3 marks, 4 minutes] Berry AoS2 Q43 p 111	56/63
10	[4 marks, 4 minutes] Berry Q22/24 rearranged p 107	60/67

Source of Questions - 2010

Question 7 (10 marks - 12 minutes)

The contents of a laboratory reagent bottle containing solid potassium hydroxide, KOH (s), has been contaminated by moisture. You have been given the job of determining the extent of contamination. This is to be done by titrating a solution of this KOH with a standardised hydrochloric acid solution (HCl) of pH 1.0. You are to use the following procedure:

- **Step 1:** Dissolve 4.10 g of the contaminated KOH (s) into 500.0 mL of solution.
- **Step 2:** Fill a burette with this solution and use it to titrate a 20.00 mL sample of the HCl (aq) using a suitable indicator.
- **Step 3:** Repeat the titrations until a consistent end point is obtained.

After completing the titrations, the following data is available:

- Titration end point = 15.80 mL of KOH (aq) .
- pH of HCl (aq) = 1.00.
- Titration reaction is: $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$.

a) Calculate the concentration of H^+ (aq) in the HCl (aq). (2 marks)

b) Calculate the number of moles of H^+ (aq) used in each titration. (2 marks)

c) Hence, determine the concentration of OH^- in the KOH (aq) solution. (2 marks)

d) Determine the mass of KOH (s) in the 500.0 mL of solution originally prepared. (2 marks)

e) Calculate the percentage, by mass, of moisture in the contaminated KOH (s) . (2 marks)

Question 7 solution

a) $[H^+] = 10^{-pH} = 10^{-1.00} =$ 0.100 M ❶❶

b) n = C x V = 0.100 x 20/1000 = 0.00200 mol ❶❶

c) $n(OH^-) = n(H^+) = 0.00200$mol❶
C = n/V = 0.00200/0.0158= 0.127 M ❶

d) n = C x V = 0.127 x 500/1000 = 0.0635 mol ❶

m = n x M = 0.0635 x 56.1 = 3.56 g ❶

e) mass water = mass of contaminated KOH - mass KOH = 4.10 - 3.56 = 0.54g ❶
%water = mass water/ mass contaminated sample x 100 = 0.54/4.10 x 100 = 13.2 % ❶

Question 11 solution

d) As the chain length (or molecular size) increases, the retention time increases. ❶
e) The components have differing attractions to the stationary phase. ❶ The components adsorb to the stationary phase by differing extents and travel different rates through the column. ❶
f) 40 mg (in 200ml) : 97.077 (peak area)
x mg : 25.896 x = 10.67 mg in 200ml ❶ → **2.67mg** in 50ml ❶