



سَلْطَنَةُ عُمَانِ  
وَزَارَةُ التَّحْقِيقِ وَالتَّعْلِيمِ

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٣٧/١٤٣٨ هـ - ٢٠١٦ / ٢٠١٧ م

الدور الثاني - الفصل الدراسي الأول

- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

- تنبيه: المادة: الكيمياء.
- الأسئلة في (١٥) صفحة.

#### تعليمات وضوابط التقدم للامتحان:

- الحضور إلى اللجنة قبل عشر دقائق من بدء الامتحان للأهمية.
- إبراز البطاقة الشخصية لمراقب اللجنة.
- يمنع كتابة رقم الجلوس أو الاسم أو أي بيانات أخرى تدل على شخصية الممتحن في دفتر الامتحان، وإلا ألغى امتحانه.
- يحظر على الممتحنين أن يصطحبوا معهم بمركز الامتحان كتباً دراسية أو كراسات أو مذكرات أو هواتف محمولة أو أجهزة النداء الآلي أو أي شيء له علاقة بالامتحان كما لا يجوز إدخال آلات حادة أو أسلحة من أي نوع كانت أو حقائب يدوية أو آلات حاسبة ذات صفة تخزينية.
- يجب أن يتقيد المتقدمون بالزي الرسمي (الدشداشة البيضاء والمصر أو الكمة للطلاب والدارسين والزي المدرسي للطالبات واللباس العماني للدارسات) ويمنع النقاب داخل المركز ولجان الامتحان.
- لا يسمح للمتقدم المتأخر عن موعد بداية الامتحان بالدخول إلا إذا كان التأخير بعذر قاهر يقبله رئيس المركز وفي حدود عشر دقائق فقط.
- يتم الالتزام بالإجراءات الواردة في دليل الطالب لأداء امتحان دبلوم التعليم العام.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (○) وفق النموذج الآتي:  
س - عاصمة سلطنة عمان هي:  
○ القاهرة      ○ الدوحة  
● مسقط      ○ أبوظبي
- ملاحظة: يتم تظليل الشكل (●) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.
- صحيح ● غير صحيح ○  
صحيح ○ خطأ ×  
صحيح ○ خطأ ×  
صحيح ○ خطأ ×  
صحيح ○ خطأ ×

مُسَوَّدَة، لا يتم تصحيحها

**Question 1: Multiple Choice Items****(28 marks)**

There are 14 multiple-choice items worth two marks each.

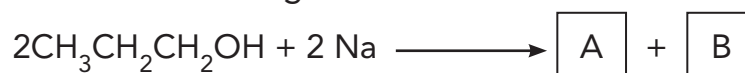
Shade in the bubble (☐) next to the **correct** answer for each of the following items.

1) Which of the following statements about alcohols is correct?

- ☐ Methanol is miscible with water.
- ☐ Ethanol is the simplest primary alcohol.
- ☐ All types of alcohols are oxidized under ordinary conditions.
- ☐ The boiling points of alcohols are higher than of corresponding carboxylic acids.

***Use the following information to answer questions (2 and 3)***

A student made the following conclusions about the reaction below:



- i. The alcohol is acting as an acid.
- ii. It is a nucleophilic substitution reaction.
- iii. The alcohol undergoes breaking O-H bond
- iv. This reaction is more vigorous than the reaction of water with Na.

2) Which conclusions are correct?

- ☐ i and ii
- ☐ ii and iii
- ☐ i and iii
- ☐ iii and iv

3) Which option shows the correct representation of products (A) and (B) in this reaction?

	Product(A)	Product(B)
<input type="radio"/>	Sodium propanoate	H <sub>2</sub>
<input type="radio"/>	Sodium propanoate	H <sub>2</sub> O
<input type="radio"/>	Sodium propoxide	H <sub>2</sub> O
<input type="radio"/>	Sodium propoxide	H <sub>2</sub>

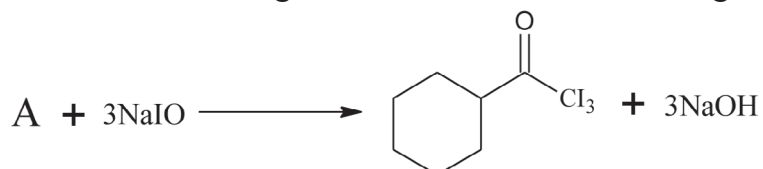
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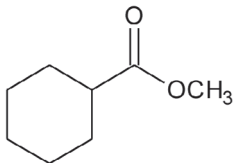
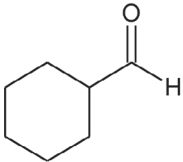
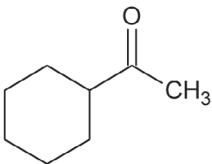
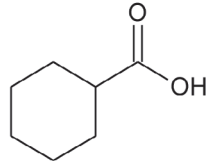
## Question 1 continued

- 4) If the boiling points of pentane and propanoic acid are 36°C and 141°C respectively. What is the boiling point of butan-1-ol more likely to be?

- ☐ 28 °C
 ☐ 118°C  
☐ 156°C
 ☐ 173°C

- 5) What is the starting material (A) for the following reaction?



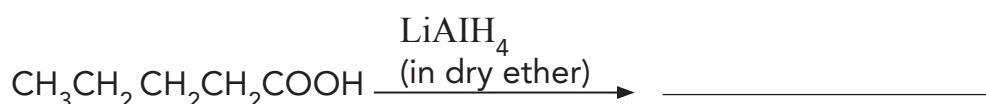
- ☐ 
☐   
☐ 
☐ 

- 6) Tollens' reagent and iodoform reaction are used to practically distinguish between aldehydes and ketones, what is the option that gives the correct test results?

	Compound	Tolles' reagent	iodoform reaction
<input type="radio"/>	CH <sub>3</sub> CH <sub>3</sub> COCH <sub>3</sub>	Negative	Positive
<input type="radio"/>	CH <sub>3</sub> CHO	Positive	Negative
<input type="radio"/>	CH <sub>3</sub> CH <sub>3</sub> COCH <sub>2</sub> CH <sub>3</sub>	Positive	Negative
<input type="radio"/>	CH <sub>3</sub> CH <sub>2</sub> CHO	Negative	Positive

## Question 1 continued

- 7) Which of the following compounds cannot be oxidized under ordinary conditions?
- ☐  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CHO}$ 
☐  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{COCH}_3$   
☐  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{OH}$ 
☐  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}(\text{OH})\text{CH}_3$
- 8) Which of the following statements is incorrect about ethanoic acid?
- ☐ It forms dimers in water.  
☐ It dissociates completely in water.  
☐ Its boiling point is higher than of ethanol.  
☐ It reacts with sodium hydroxide to produce sodium ethanoate and water.
- 9) An unbranched ester has five carbon atoms. The carbonyl group ( $\text{C}=\text{O}$ ) is the carbon number two. What is the IUPAC name of this ester?
- ☐ Ethyl propanoate.  
☐ Propyl ethanoate.  
☐ Butyl methanoate.  
☐ Methyl butanoate.
- 10) For the following reaction, what is the option that represents the type of this reaction, and the type of organic product?



	Type of reaction	Product
<input type="checkbox"/>	Reduction	Aldehyde
<input type="checkbox"/>	Oxidation	Secondary alcohol
<input type="checkbox"/>	Reduction	Primary alcohol
<input type="checkbox"/>	Oxidation	Aldehyde

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## Question 1 continued

11) Which amine matches its correct classification?

	Amines	Classification
<input type="radio"/>	$(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_3\text{N}$	secondary
<input type="radio"/>	$\text{C}_6\text{H}_5\text{NHC}_6\text{H}_5$	tertiary
<input type="radio"/>	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$	primary
<input type="radio"/>	$(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_2\text{NCH}_2\text{CH}_2\text{CH}_3$	secondary

12) What is the option that shows the incorrect comparison between benzene and phenol?

	Benzene	Phenol
<input type="radio"/>	Liquid at room temperature	Solid at room temperature
<input type="radio"/>	Does not affect litmus papers	Change blue litmus paper to red
<input type="radio"/>	Undergoes substituted reaction less readily than phenol.	Undergoes substituted reaction more readily than benzene.
<input type="radio"/>	Forms white (ppt) when reacted with $\text{Br}_2$ without a catalyst.	It requires a catalyst to react with $\text{Br}_2$ .

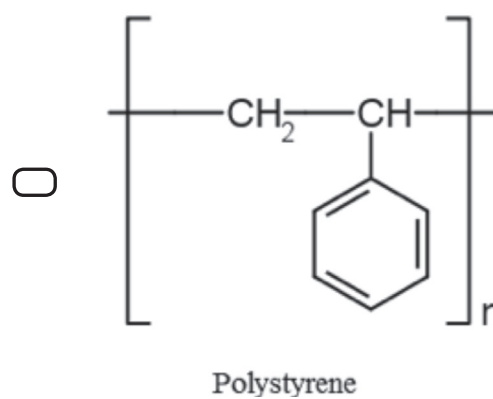
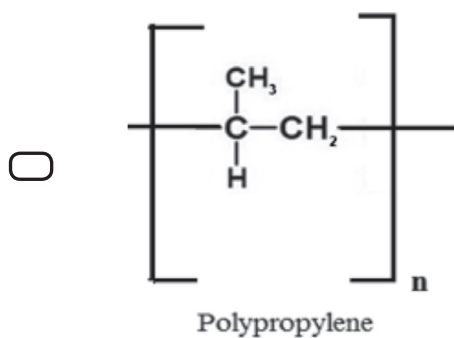
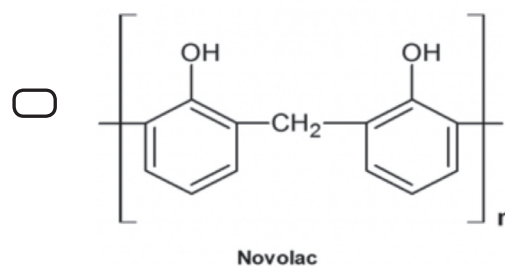
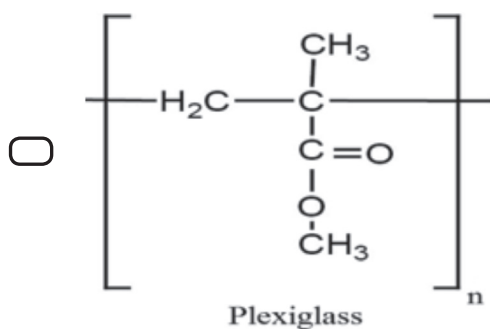
13) Which of the following reagents and reaction conditions are used in alkylation of benzene?

- |   |  |
|---|--|
| <input type="radio"/> $\text{H}_2\text{SO}_4 + \text{HNO}_3 / 60^\circ\text{C}$ | <input type="radio"/> $\text{CH}_3\text{COCl} / \text{AlCl}_3$ |
| <input type="radio"/> $\text{CH}_3\text{Cl} / \text{AlCl}_3$                    | <input type="radio"/> $\text{Br}_2 / \text{FeBr}_3$            |

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## Question 1 continued

14) Which of the following polymers is formed by condensation polymerization?



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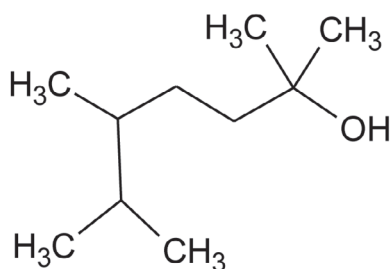
**Extended Questions****(42 marks)**

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Write your answer for each of the following questions in the space provided.  
Be sure to show all your work, including the correct units where applicable.

**Question 2****(14 marks)**

- 15) Study the structural formula of the compound shown below, then answer the following questions.



- a. What is the IUPAC name for this compound?

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- b. Draw the hydrogen bonding formed between two molecules in this compound?

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- c. What will happen to the color of orange acidified dichromate if added to this compound? Explain your answer.

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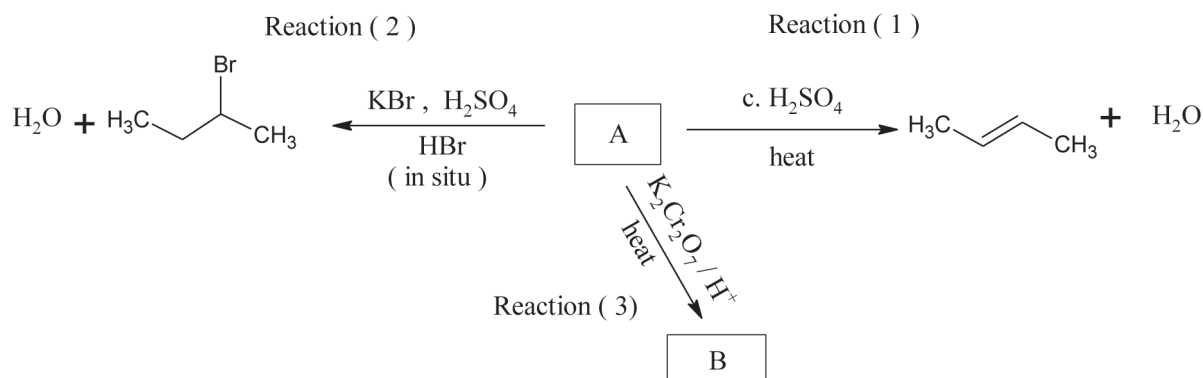
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## Question 2 continued

- 16) A series of chemical reactions was carried out as shown below. Study it then answer the following questions.

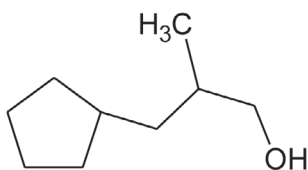


- a. Write the structural formulae of the organic compounds represented by (A and B).
  - (i) Compound (A): \_\_\_\_\_
  - (ii) Compound (B): \_\_\_\_\_
- b. Identify the type of the following reactions:
  - (i) Reaction (1): \_\_\_\_\_
  - (ii) Reaction (2): \_\_\_\_\_
- c. What is the nucleophile in reaction (2)?  
 \_\_\_\_\_
- d. Identify the bond broken in compound (A) when reacted with propanoic acid?  
 \_\_\_\_\_
- e. Explain why compound (B) cannot be farther oxidized?  
 \_\_\_\_\_

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## Question 2 continued

- 17) An aldehyde is used to synthesize the compound shown below in a particular reaction. Study it then answer the following questions.



- a. What is the name of this reaction and the reagent(s) that could be used?

\_\_\_\_\_

- b. Draw the structural formula of the aldehyde reactant.

\_\_\_\_\_

- c. Explain why this aldehyde does not react with an alkaline solution of iodine?

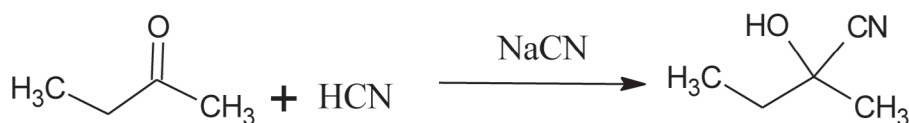
\_\_\_\_\_

\_\_\_\_\_

## Question 3

(14 marks)

- 18) Study the reaction below then answer the following questions.



- a. What is the type of this reaction?

\_\_\_\_\_

- b. Which carbon is attacked by  $\text{CN}^-$  ions?

\_\_\_\_\_

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### Question 3 continued

- c. If butanal is reacted with the same reagent in another reaction, which one of the two compounds (butanone or butanal) will be more readily attacked by  $\text{CN}^-$  ions? Explain your answer.

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- 19) Pentan-1-ol and butanoic acid can each form strong intermolecular forces between their molecules.

- a. What is the name of this intermolecular force?

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- b. These two compounds are produced together when an organic compound is broken down by water in the presence of sulfuric acid? What is the name of this reaction and the IUPAC name of the organic compound broken down?

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- c. Which one (pentan-1-ol or butanoic acid) would have stronger force between their molecules? Explain why and justify your answer by drawing.

- (i) Your choice:

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- (ii) Explanation:

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### Question 3 continued

(iii) Drawing:

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- 20) Starting with butyl propanoate, Show the synthesis of propanoyl chloride ( $\text{CH}_3\text{CH}_2\text{COCl}$ ) by using chemical equations, suitable reagents, catalysts and conditions.

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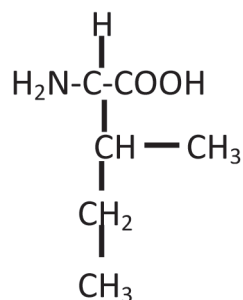
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## Question 3 continued

- 21) Isoleucine is an amino acid. Its structural formula is shown below. Study it then answer the following questions.



- a. How many chiral center(s) in the isoleucine? Circle the chiral center(s) in the structure above.

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- b. Draw the two optical isomers of the isoleucine.

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- c. Draw the structural formula of the zwitterion ion of isoleucine.

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**Question 4****(14 marks)**

- 22) The following table shows the formulae of four organic compounds. Study it then answer the questions below.

A	B	C	D
ethylamine	ethannitrile	ethanamide	aminoethanoic acid

Write the suitable symbol (A, B, C or D) shown in the table for the following statements

- a. It is not the simplest in its group.

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- b. It is neutral and optically inactive.

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- 23) Benzene is an important industrial chemical and is used in a wide range of manufacturing processes. Over time our understanding of the structure and bonding of benzene has changed and various models have been proposed.

- a. State two physical properties of benzene?

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- b. Draw the structure of benzene ring showing bonds lengths and angles based on X-ray diffraction studies.

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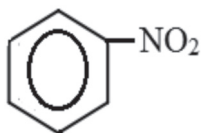
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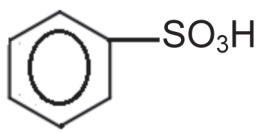
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## Question 4 continued

- c. The two compounds below are two products of two different benzene reactions. Study them then answer the following questions.

**1**

nitrobenzene

**2**

benzenesulphonic acid

- (i) What is the name of each benzene reaction producing each of the above two compounds?

Reaction of compound 1: \_\_\_\_\_

Reaction of compound 2: \_\_\_\_\_

- (ii) Identify the electrophile in each reaction

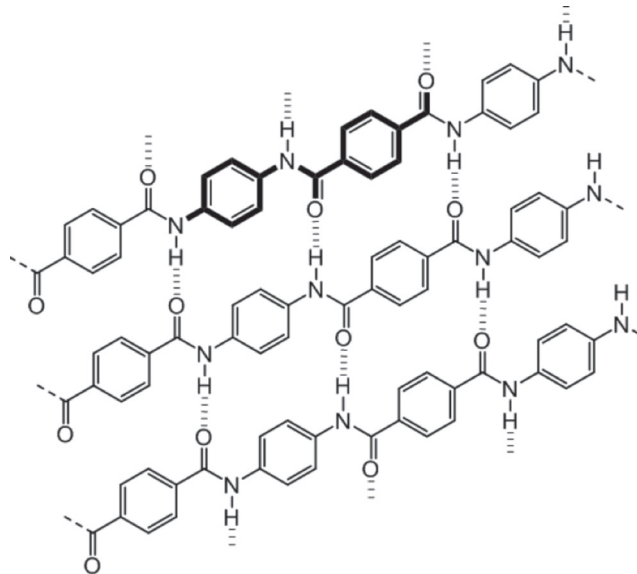
Compound (1): \_\_\_\_\_

Compound (2): \_\_\_\_\_

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## Question 4 continued

- 24) The following figure shows the structure of Kevlar, study it and answer the questions below



- a. Draw the structural formula of the monomer(s) that form(s) Kevlar.

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- b. What is the functional group found in Kevlar?

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- c. There is extensive strong bonds between the chains of Kevlar:

- (i) What is the name of these bonds?

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## Question 4 continued

- (ii) How these types of bonds along with the flat polymer chains affect Kevlar properties? (state two)

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- d. State two uses of Kevlar.

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[ End of Examination ]

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# MARKING GUIDE



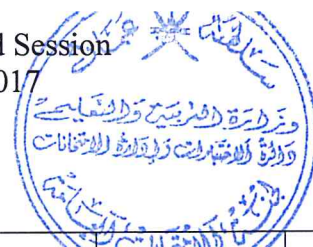
## GENERAL EDUCATION DIPLOMA BILINGUAL PRIVATE SCHOOLS SEMESTER ONE - SECOND SESSION

### CHEMISTRY

2016 / 2017

**Exam Specifications:**

Topics of the units	Weighting	Multiple choice (40%)		Extended response (60%)		Cognitive levels			Total
		Number of questions	Marks	Number of questions	Marks	Knowing (30%)	Applying (50%)	Reasoning (20%)	
Alcohols	25 %	4	8	3	10	5	9	4	18
Aldehydes & ketones	18 %	3	6		7	4	6	3	13
Carboxylic acids	18%	3	6		7	4	6	3	13
Nitrogen compounds	12%	1	2		6	3	4	1	8
Aromatic compounds	15 %	2	4		6	3	5	2	10
Polymers	12 %	1	2		6	2	5	1	8
<b>Total</b>	<b>100%</b>	<b>14</b>	<b>28</b>	<b>3</b>	<b>42</b>	<b>21</b>	<b>35</b>	<b>14</b>	<b>70</b>



**Distribution of cognitive domains and marks.**

Serial. No	Question number	Item	Mark	Unit	Page	Cognitive domain	Output
1.	1	1	2	Alcohols	196	knowing	2
2.	1	2	2	Alcohols	197	Applying	6.ii
3.	1	3	2	Alcohols	197	Applying	6.ii
4.	1	4	2	Alcohols	195	Reasoning	2
5.	1	5	2	Aldehydes & ketones	223	Applying	5.ii
6.	1	6	2	Aldehydes & ketones	222-223	Applying	5.i , 5.ii
7.	1	7	2	Aldehydes & ketones	222	Reasoning	5.i
8.	1	8	2	Carboxylic acids	229-231	Knowing	1,2,3,5i
9.	1	9	2	Carboxylic acids	231	Applying	5iii
10.	1	10	2	Carboxylic acids	231	Reasoning	5ii
11.	1	11	2	Nitrogen compounds	239-241	Applying	1
12.	1	12	2	Aromatic compound	216-209-213	Applying	2-4
13.	1	13	2	Aromatic compound	214	Applying	2iv
14.	1	14	2	Polymers	254	applying	5
15.	2	15.a	1	Alcohols	195	knowing	4
16.	2	15.b	1	Alcohols	195	knowing	2
17.	2	15.c	1	Alcohols	196	knowing	6.i
18.	2	16.a.i	1	Alcohols	199	Applying	6.v
19.	2	16.a.ii	1	Alcohols	196	Applying	6.i
20.	2	16.b.i	1	Alcohols	199	Applying	6.v
21.	2	16.b.ii	1	Alcohols	199	Applying	6.iv
22.	2	c	1	Alcohols	199	Applying	6.iv
23.	2	d	1	Alcohols	197	Reasoning	6.iii
24.	2	e	1	Aldehydes & ketones	222	Applying	5.i
25.	2	17.a	2	Aldehydes & ketones	223	knowing	5.iii



General Education Diploma, Semester One, Second Session  
Bilingual Private Schools, Chemistry, 2016/2017



Serial. No	Question number	Item	Mark	Unit	Page	Cognitive domain	Output
26	2	17.b	1	Aldehydes & ketones	221	knowing	3,4
27	2	17.c	1	Aldehydes & ketones	223	Reasoning	5.ii
28	3	18.a	1	Aldehydes & ketones	224	knowing	5.iv
29	3	18.b	1	Aldehydes & ketones	224	Applying	5.iv
30	3	18.c	1	Aldehydes & ketones	224	Reasoning	5.iv
31	3	19a	1	Carboxylic acids	229	Knowing	1,2,3
32	3	19b	1	Carboxylic acids	231	Knowing	5iii
33	3	19c	2	Carboxylic acids	229	Applying	1,2,3,4
34	3	20	3	Carboxylic acids	231	1Applying+ 2Reasoning	6,5iv
35	3	21a	1	Nitrogen compounds	246,247	Knowing	1,2,4
36	3	21b	2	Nitrogen compounds	247	Knowing	1,2,4
37	3	21c	1	Nitrogen compounds	246	Reasoning	2,4
38	4	22a	1	Nitrogen compounds	239-246	Knowing	1,2
39	4	21b	1	Nitrogen compounds	246	Applying	1,2,4
40	4	23A	2	Aromatic compound	209	Knowing	1
41	4	23B	1	Aromatic compound	210	knowing	1
42	4	23C	1	Aromatic compound	212-213	applying	2i,ii
43	4	23D	2	Aromatic compound	212-213	reasoning	2i,ii
45	4	24.A	2	Polymers	255	Applying	1
46	4	24.B	1	Polymers	255	Applying	5
47	4	24.C.i	1	Polymers	256	Knowing	3
48	4	24.C.ii	1	Polymers	256	Knowing	6
49	4	24.D	1	Polymers	256	Knowing	6

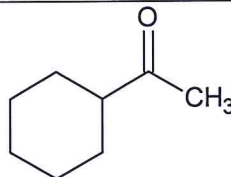
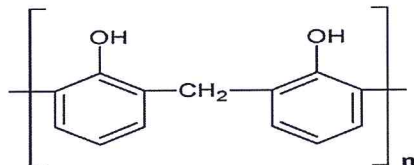


**TOTAL MARKS: 70**

**PAGES: 6**

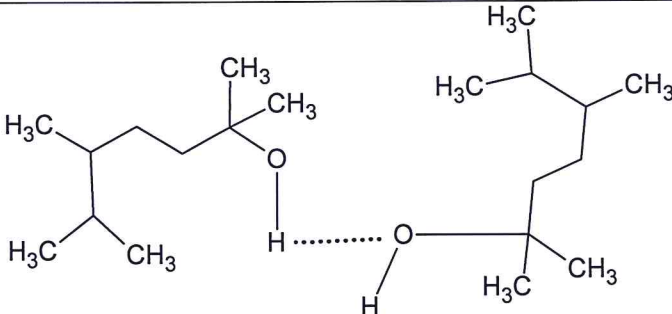
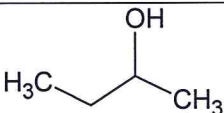
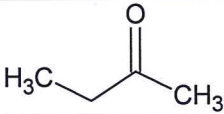
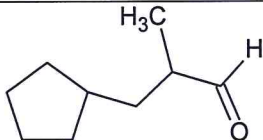
**Question One (28 Marks)**

**There are 14 multiple-choice items. Each correct answer worth TWO marks.**

Item No.	Correct option		
1	Methanol is miscible with water.		
2	i and iii		
3	Sodium propoxide	$H_2$	
4	118 °C		
5			
6	$CH_3CH_2COCH_3$	Negative	Positive
7	$CH_3CH(CH_3)CH_2COCH_3$		
8	It dissociates completely in water.		
9	Propyl ethanoate.		
10	Reduction	Primary alcohol	
11	$CH_3CH_2CH_2CH_2NH_2$	primary	
12	Forms white (ppt) when reacted with $Br_2$ without a catalyst.		It requires a catalyst to react with $Br_2$ .
13	$CH_3Cl/AlCl_3$		
14	 Novolac		



## Question Two (14 Marks)

<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
15	a	2,5,6-Trimethylheptan-2-ol	1 mark
	b		1 mark
	c	No change , it is a tertiary alcohol will not oxidize.  *0.5 mark for each part	1 mark
<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
16	a.i		1 mark
	a.ii		1 mark
	b.i	Dehydration.	1 mark
	b.ii	Halogenation.or bromination or nucleophilic substitution or substitution by bromine	1 mark
	c	Br <sup>-</sup> or bromide ion	1 mark
	d	Breaking the O-H bond in the alcohol.	1 mark
	e	Because compound (b) is a ketone, its carbonyl group is not bonded to a hydrogen so it cannot be oxidized under this ordinary conditions or the C-C bond in ketone is only broken under sever conditions.	1 mark
17	a	Reduction H <sub>2</sub> /Ni or NaBH <sub>4</sub> /H <sub>2</sub> O or LiAlH <sub>4</sub> (in dry ether).	1 mark 1 mark
	b		1 mark
	c	Because this compound does not contain the methyl group ( -CH <sub>3</sub> ) bonded to the functional group or does not have the general formula R-COCH <sub>3</sub>	1 mark





### Question Three (14 marks)

<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
18	a	Nucleophilic addition	1 mark
	b	The carbonyl carbon or carbonyl group or C=O	1 mark
	c	Butanal Because aldehydes undergo nucleophilic addition more readily than ketones, since the carbonyl carbon in the aldehydes has larger $\delta^+$ charge. <i>*0.5 mark for selection and 0.5 mark for explanation</i>	1 mark

<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
19.	a.	Hydrogen bonding	1 mark
	b.	Acid hydrolysis or hydrolysis/ pentyl butanoate <i>*0.5 mark for each part.</i>	1 mark
	c.	butanoic acid ( $\frac{1}{2}$ mark) because the Hydrogen bonding in the carboxylic acid is stronger than alcohol pentan-1-ol as their molecules pair up forming dimers ( $\frac{1}{2}$ mark) <div style="text-align: center;"> <p style="text-align: center;"> <math>\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-C}\begin{matrix} \text{O} \\ \parallel \end{matrix} \text{H} \cdots \text{O} \text{C}\begin{matrix} \text{O} \\ \parallel \end{matrix} \text{CH}_2\text{-CH}_2\text{-CH}_3</math> </p> </div> <p>(For each Hydrogen bonding (indicated by           ) <math>\frac{1}{2}</math> mark is given.</p>	2 mark
20		$\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3 \xrightleftharpoons{\text{acid}} \text{CH}_3\text{CH}_2\text{COOH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ <p style="text-align: center;"> <math>(\frac{1}{2} \text{ mark}) \quad (\frac{1}{2} \text{ mark}) \quad (\frac{1}{2} \text{ mark}) \quad (\frac{1}{2} \text{ mark})</math> </p> <p>Acid or HCl or H<sub>2</sub>SO<sub>4</sub></p> $\text{CH}_3\text{CH}_2\text{COOH} + \text{PCl}_5 \rightarrow \text{CH}_3\text{CH}_2\text{COCl} + \text{POCl}_3 + \text{HCl}$ <p style="text-align: center;"> <math>(\frac{1}{2} \text{ mark}) \quad (\frac{1}{2} \text{ mark})</math> </p> <p>Or <math>\text{CH}_3\text{CH}_2\text{COOH} + \text{SOCl}_2 \rightarrow \text{CH}_3\text{CH}_2\text{COCl} + \text{SO}_2 + \text{HCl}</math></p> <p style="text-align: center;"> <math>(\frac{1}{2} \text{ mark}) \quad (\frac{1}{2} \text{ mark})</math> </p>	(3 mark)

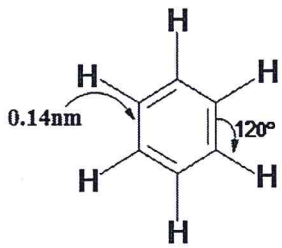


<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
21	a.	<p>2 or two (½ mark)</p> <p> </p> <p>For showing both indications (½ mark)</p>	(1mark)
	b.	<p>Mirror</p> <p> </p> <p>For each image 1 mark is given.</p>	(2mark)
	c.	<p> </p> <p>For writing cation (½ mark) is given, and for writing anion (½ mark) is given.</p>	(1mark)

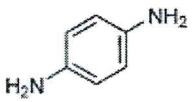
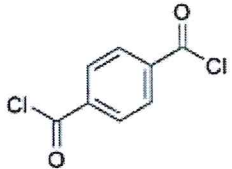
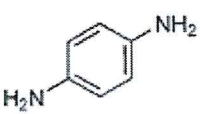
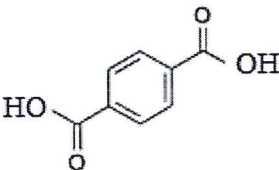


### Question Four (14 Marks)

<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
22	1	A or ethylamine	(1 mark)
	2	D or aminoethanoic acid	(1 mark)

<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
23	a	Colourless, smelly, ododr volatile, good solvent for organic compound, immiscible, highly toxic, carcinogen (Only two- each 1 mark)	2 mark
	b	 <p>* 0.5 mark for correct angles and 0.5mark for correct bond length.</p>	1 mark
	ci	Compound 1:nitration ( 0.5 mark)  Compound 2: sulphonation ( 0.5 mark)	1 mark
	cii	Compound 1: NO <sub>2</sub> <sup>+</sup> ( 1mark)  Compound 2: SO <sub>3</sub> ( 1mark)	2 mark



<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
24	a.	 and  <u>OR</u>  and  <i>*1 mark for each monomer</i>	2 mark
	b.	Amide or peptide or –CONH–	1 mark
	c.i	Hydrogen bonds	1 mark
	c.ii	Very strong – flexible – resistant to fire and abrasion • Only two- each ½ mark	1 mark
	d	Make bullet-proof vests, ropes, fire protective clothing, reinforce other materials such as rubber, wings of fighter jets, and the latest tennis rackets. • Only two- each ½ mark	1 mark

**This is the end of the Marking Guide**