



سَلْطَنَةُ عُمَانِ
وَزَارَةُ التَّحْرِيقِ وَالتَّعْلِيمِ

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٣٨/١٤٣٩ هـ - ٢٠١٧ / ٢٠١٨ م

الدور الثاني - الفصل الدراسي الأول

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

- تنبيه: المادة: الكيمياء.
- الأسئلة في (١٣) صفحة.

تعليمات مهمة:

- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- 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.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وألات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الذاكرة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أيّاً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفيتش داخل المركز طوال أيام الامتحان.

صحيح () غير صحيح ()
✓ ✗ ◐ ◑ ◒ ◓

مُسَوَّدَة، لا يتم تصحيحها

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

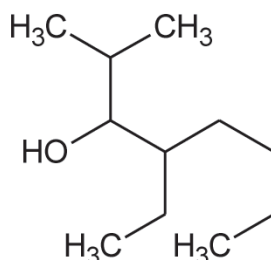
There are 14 multiple-choice items worth two marks each.

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

1) Which of the following statements about ethylene glycol is incorrect?

- ☐ It is a diol.
- ☐ It is used as antifreeze.
- ☐ It has a non-toxic nature
- ☐ It can form hydrogen bonds with water.

2) What is the IUPAC name for the compound below?



- | | |
|---------------------------------------------------------|---------------------------------------------------------|
| <input type="checkbox"/> 4-ethyl-2-methyloctan-3-ol | <input type="checkbox"/> 5-ethyl-7-methyloctan-6-ol |
| <input type="checkbox"/> 3-ethyl-2,2-dimethyloctan-3-ol | <input type="checkbox"/> 4-ethyl-7,7-dimethyloctan-6-ol |

3) Which of the following reagents are used to prepare propyl butanoate?

- ☐ $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{COOH}$ using strong base.
- ☐ $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{COOH}$ using strong acid.
- ☐ $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ using strong base.
- ☐ $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ using strong acid.

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Question 1 continued

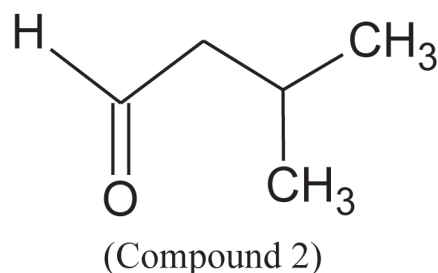
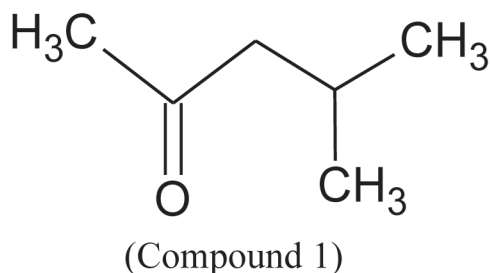
- 4) In which of the following choices the reaction is linked to its correct reagent and type?

	reaction	reagent	Type
<input type="checkbox"/>	Propan-2-ol \longrightarrow 2-Chloropropane	HCl / H_2SO_4	Nucleophilic addition
<input type="checkbox"/>	Propan-2-ol \longrightarrow 2-Chloropropane	HCl / ZnCl_2	Nucleophilic substitution
<input type="checkbox"/>	Propan-2-ol \longrightarrow 2-bromopropane	KBr / H_2SO_4	Nucleophilic addition
<input type="checkbox"/>	Propan-2-ol \longrightarrow 2-bromopropane	KBr / ZnCl_2	Nucleophilic substitution

- 5) Which of the following compounds gives a positive test with Tollens' reagent, but gives a negative test with Fehling's solution?

- ☐ Ethanal
 ☐ Butanone
☐ Propanone
 ☐ Phenylmethanal

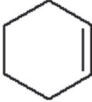
- 6) Which compound shown below reacts faster when added to a nucleophile and which one is more readily oxidized?

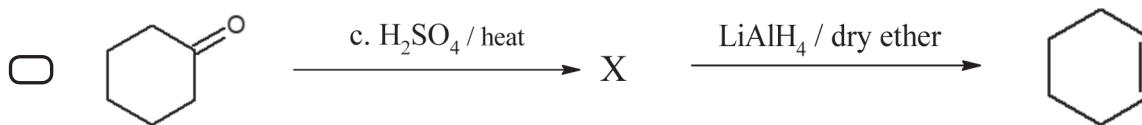
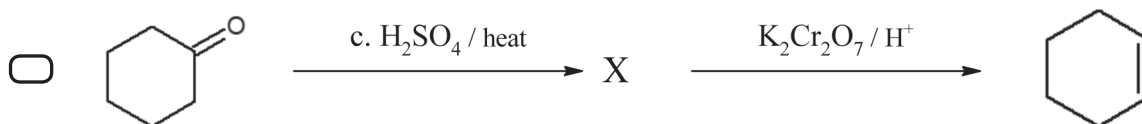
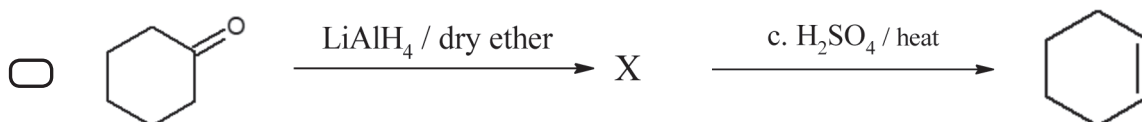
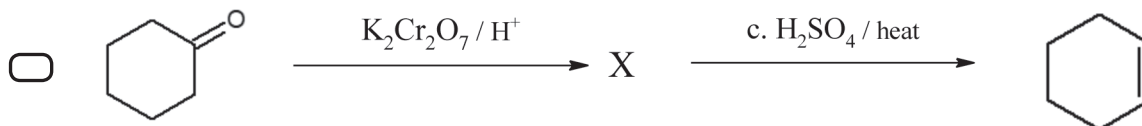


- ☐ Compound 1 will react faster with a nucleophile, but compound 2 is more readily oxidized.
☐ Compound 2 will react faster with a nucleophile, but compound 1 is more readily oxidized.
☐ Compound 1 will react faster with a nucleophile and is more readily oxidized.
☐ Compound 2 will react faster with a nucleophile and is more readily oxidized.

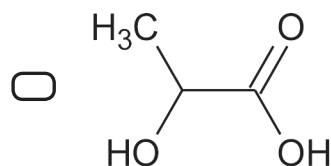
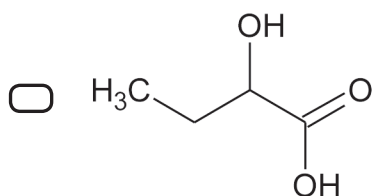
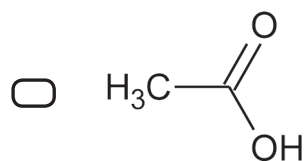
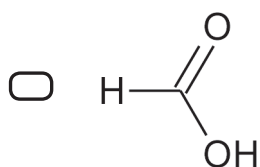
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Question 1 continued

- 7) Which of the following series reactions shows the correct synthesis of  ?
(Note: X represents an intermediate product)



- 8) Which of the following carboxylic acids provides the sting from biting ants and nettles?



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Question 1 continued

Use the following information to answer questions 9 & 10.

The table below shows the boiling points for three different organic compounds that have almost the same molecular mass and represented by (X, Y and Z)

Organic compound	Boiling point/ °C
X	141
Y	38
Z	119

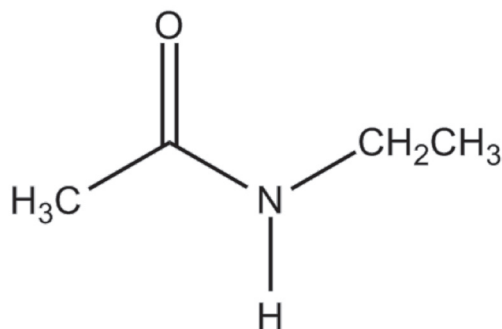
9) Which of the following choices represents the three organic compounds?

	<u>X</u>	<u>Y</u>	<u>Z</u>
<input type="radio"/>	Carboxylic acid	Alcohol	Alkane
<input type="radio"/>	Alcohol	Carboxylic acid	Alkane
<input type="radio"/>	Alkane	Alcohol	Carboxylic acid
<input type="radio"/>	Carboxylic acid	Alkane	Alcohol

10) Which compound(s) can form hydrogen bonds?

- ☐ Only X.
 ☐ Only Y.
 ☐ Only X & Z.
 ☐ All of them.

11) What is the type of organic nitrogen compound shown below?



- ☐ Amide.
 ☐ Amine.
 ☐ Nitrile.
 ☐ Amino acid.

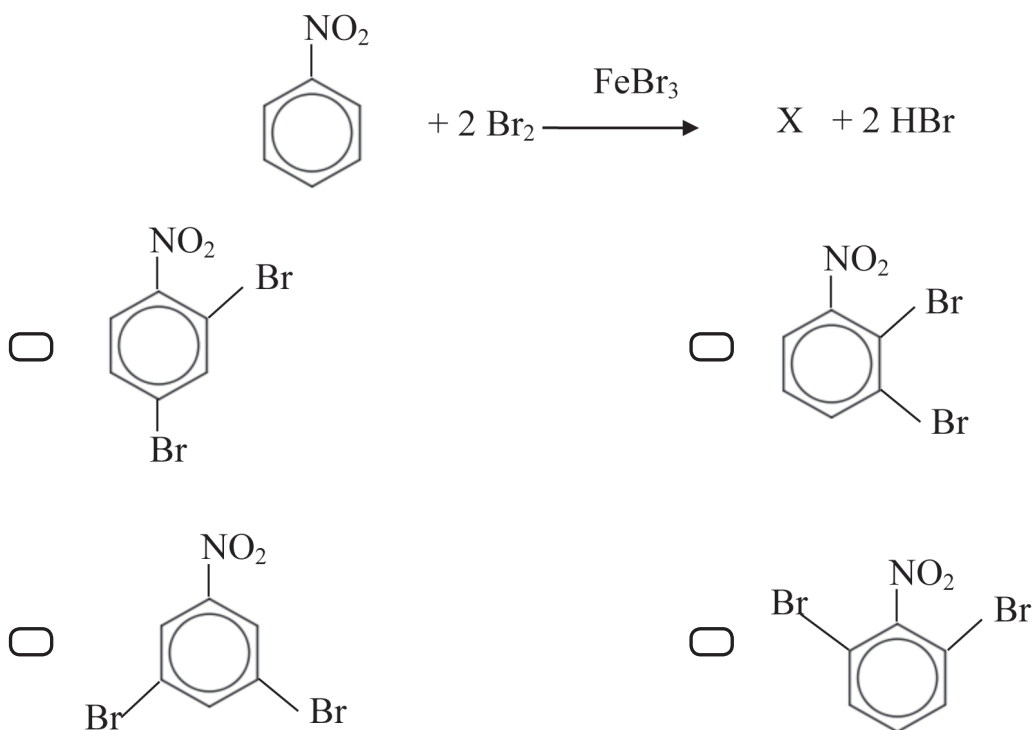
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Question 1 continued

12) Which of the following statements describes the reaction between phenol and 3 moles of Cl_2 ?

- ☐ The phenol can lose H^+ ion easily.
- ☐ The $-\text{OH}$ in phenol is an electron withdrawing group.
- ☐ The reaction undergoes nucleophilic substitution.
- ☐ The benzene ring is attacked at positions 3 and 5.

13) What is the structural formula of the organic compound represented by (X) in the following reaction?



14) Which of the following is incorrect about thermosets?

- ☐ They cannot be melted.
- ☐ They char and burn at low temperatures.
- ☐ Their chains cannot be separated easily.
- ☐ They have covalent bonds between their chains.

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Question 2: 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.

- 15) Four structural isomeric alcohols of molecular formula $C_4H_{10}O$ are shown below. Study them then answer the following questions.

A	$\begin{array}{c} \text{CH}_3 \\ \\ \text{H}-\text{C}-\text{CH}_2-\text{OH} \\ \\ \text{CH}_3 \end{array}$	B	$\begin{array}{c} \text{H} \quad \text{CH}_3 \\ \quad \\ \text{H}-\text{C}-\text{CH}-\text{OH} \\ \\ \text{CH}_3 \end{array}$
C	$\begin{array}{c} \text{CH}_3 \\ \\ \text{H}_3\text{C}-\text{C}-\text{OH} \\ \\ \text{CH}_3 \end{array}$	D	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{CH}_2-\text{CH}_2 \\ \quad \quad \\ \text{CH}_3 \quad \quad \text{OH} \end{array}$

- a. What is the classification of each of the following alcohols (primary, secondary or tertiary)?

(i) Alcohol (A): _____

(ii) Alcohol (B): _____

- b. Alcohols may be readily dehydrated.

- (i) What is meant by dehydration?

- (ii) What is the reagent used to dehydrate alcohols?

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Question 2 continued

- (iii) Draw the structural formula of the compound formed by the dehydration of alcohol (D)

- c. Alcohols can react with sodium metal.

- (i) Draw the structural formula of the salt produced when alcohol (C) reacts with sodium metal.

- (ii) Is the alcohol in the reaction with sodium acting as an acid or a base? Explain your answer.

- d. Alcohols can be oxidized.

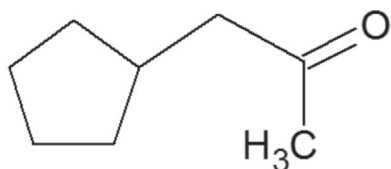
- (i) Write the chemical equation for the oxidation of alcohol (B)?

- (ii) Which of the above alcohols cannot be oxidised under normal conditions? Explain your answer.

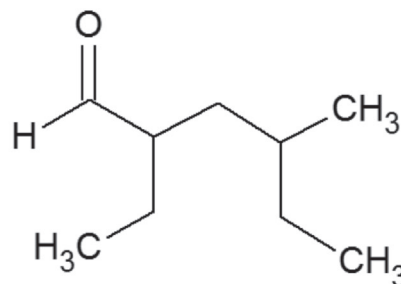
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Question 2 continued

- 16) Study the structural formulae of the organic compounds shown below, then answer the following questions.



Compound (A)



Compound (B)

- a. Compounds (A) and (B) have a common group. What is the name of this group?
- _____
- b. Compound (A) can react with (NaIO) producing an organic salt and a yellow precipitate. Write the structural formulae of these two products.
- _____
- _____
- c. Write the molecular formula of the precipitate formed when compound (B) reacts with Fehling's solution.
- _____
- d. Draw the structural formula of the compound formed when compound (B) is oxidised?
- _____
- e. Write the chemical equation for the reduction of compound (A)?
- _____
- f. Explain why compound (B) would not react with an alkaline solution of iodine?
- _____
- _____

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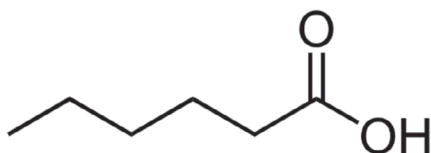
Question 2 continued

17) Carboxylic acids are found in many foods like vinegar and milk.

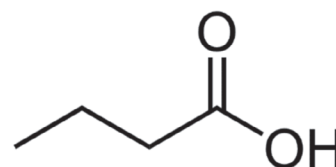
- a. What is the IUPAC name of the carboxylic acid found in the cow's milk?

- b. Write the chemical equation for the reaction of the carboxylic acid found in vinegar with PCl_5 ?

18) Study the two organic compounds shown below and answer the following questions.



Compound (A)



Compound (B)

- a. Which compound (A or B) has higher solubility in water? Explain your answer.

- b. Draw the structural formula of the organic product formed from the reaction between compound (B) and ethanol using concentrated sulphuric acid.

- c. Write the chemical equation that shows the reaction of compound (A) with KOH.

Do not write in this space

Question 2 continued

- 19) The following table shows four different organic nitrogen compounds (X, Y, Z, O). Study it and answer the questions below.

X	$ \begin{array}{c} \text{H} \\ \\ \text{H}_2\text{N}-\text{C}-\text{COOH} \\ \\ \text{CH}-\text{CH}_3 \\ \\ \text{CH}_2 \\ \\ \text{CH}_3 \end{array} $	Y	$ \begin{array}{c} \text{H} \\ \\ \text{C} \\ / \quad \backslash \\ \text{H}_2\text{N} \quad \text{COOH} \\ \\ \text{CH}_3 \end{array} $
Z	$ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{COOH} \\ \\ \text{NH}_2 \end{array} $	O	

- a. Which compound from the above table acts only as a base in its reactions?

- b. For compound (X):

- (i) How many chiral center(s) does it have?

- (ii) How many optical isomer(s) can it form?

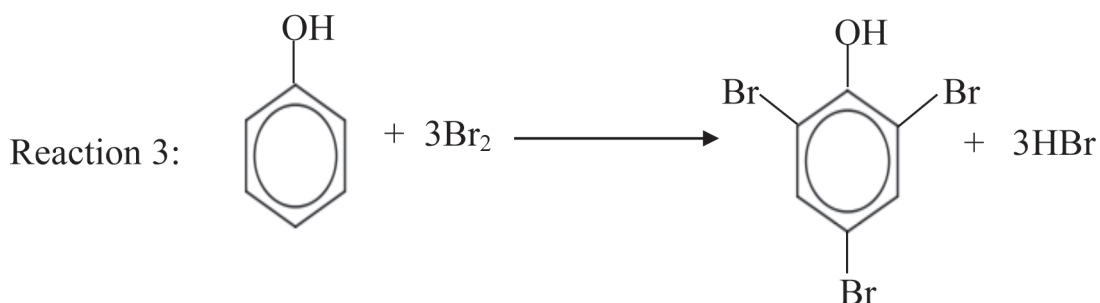
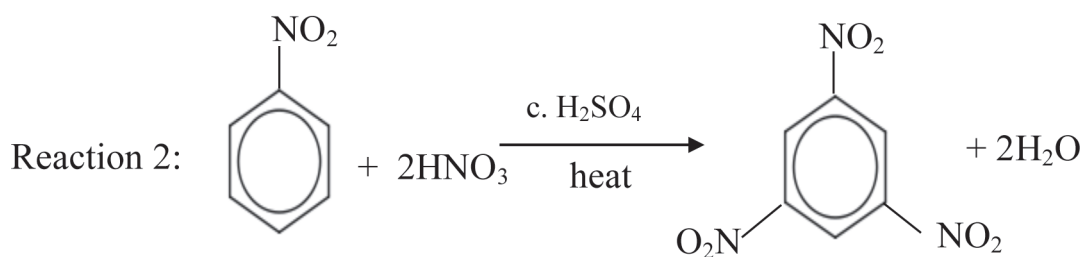
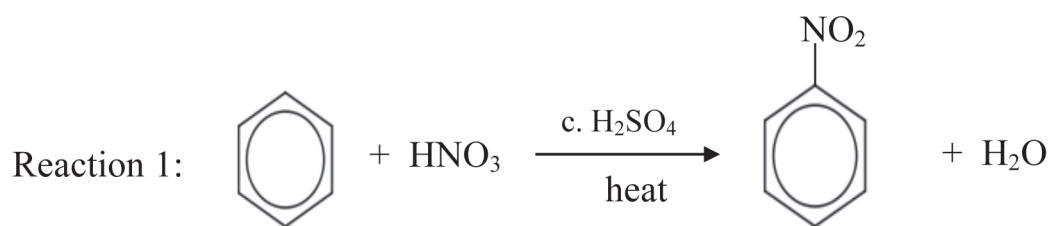
- c. Draw the optical isomer of compound (Y).

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Question 2 continued

- d. Which amino acid from the above table does not exhibit optical isomerism?
Explain your answer.

20) Study the following three reactions to answer the questions below.



- a. What is the type of reaction (3)?

- b. Write the formula of the electrophile in reaction (1).

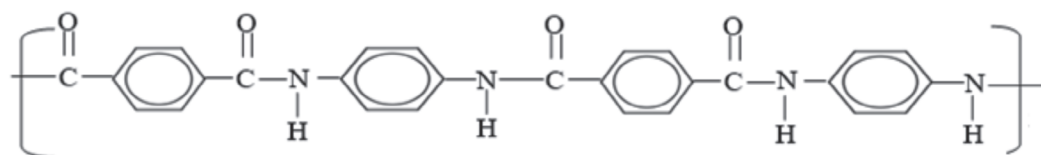
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Question 2 continued

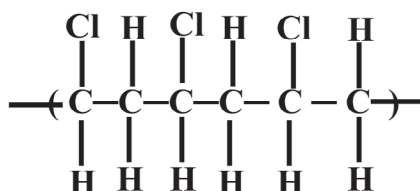
- c. Which reaction takes place more readily; reaction (1) or reaction (3)? Explain your answer.

- d. Which reactant from the above reactions contains an electron-donating group?

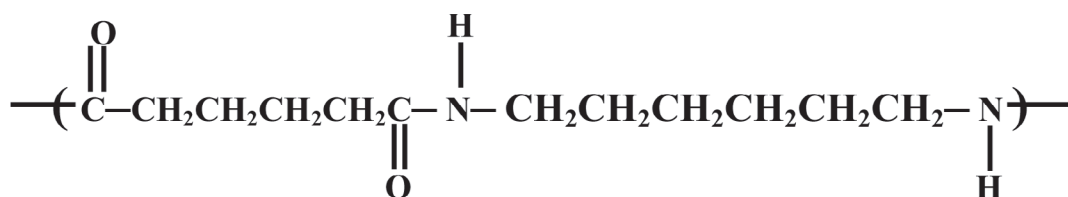
- 21) Study the three polymers shown below, and then answer the following questions.



Polymer (A)



Polymer (B)



Polymer (C)

- a. What is the name of polymer (C)?

Do not write in this space

Question 2 continued

b. What is the type of polymerization by which the following polymers are formed?

(i) Polymer (A) : _____

(ii) Polymer (B) : _____

c. Draw the structural formulae of the following:

(i) the monomer(s) that form(s) polymer (A).

(ii) Polymer B with syndiotactic structure.

d. How are the chains of polymer (A) held to each other?

22) Explain how bacterial thermoplastic decomposes naturally?

[End of Examination]

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مُسَوِّدَة

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MARKING GUIDE



GENERAL EDUCATION DIPLOMA BILINGUAL PRIVATE SCHOOLS SEMESTER ONE - SECOND SESSION

CHEMISTRY

2017 / 2018

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
Total	100%	14	28	3	42	21	35	14	70

Distribution of cognitive domains and marks.

Item	Mark	Unit	Page	Cognitive domain	Output
1	2	Alcohols	201	knowing	8
2	2	Alcohols	195	Applying	4
3	2	Alcohols	197	Applying	6.iii
4	2	Alcohols	198-199	Reasoning	6.iv
5	2	Aldehydes & ketones	222	knowing	5.i
6	2	Aldehydes & ketones	222,224	Applying	5.i ,5.iv
7	2	Aldehydes & ketones	223	Reasoning	5.iii
8	2	Carboxylic acids	229	Knowing	1
9	2	Carboxylic acids	229	Applying	2
10	2	Carboxylic acids	229	Reasoning	2
11	2	Nitrogen compounds	239-244	Applying	1
12	2	Aromatic compound	216	Knowing	4
13	2	Aromatic compound	213,216,217	Applying	2iii,4
14	2	Polymers	254	Knowing	1,4,5
15.a	2	Alcohols	196	Applying	3
15.b	3	Alcohols	199	Knowing/ Applying	6.v
15.c	2	Alcohols	197	Applying /knowing	6.ii
15.d	3	Alcohols	196	Applying+ Reasoning	6.i
					6.i
16.a	1	Aldehydes & ketones	223	knowing	5.iii
16.b	2	Aldehydes & ketones	223	Applying	5.ii
16.c	1	Aldehydes & ketones	222	knowing	5.i
16.d	1	Aldehydes & ketones	222	Applying	5.i
16.e	1	Aldehydes & ketones	223	Applying	5.iii
16.f	1	Aldehydes & ketones	223	Reasoning	5.ii

General Education Diploma, Semester One, Second Session
Bilingual Private Schools, Chemistry, 2017/2018

Item	Mark	Unit	Page	Cognitive domain	Output
17.a	1	Carboxylic acids	229	knowing	1
17.b	2	Carboxylic acids	231	knowing	5.i
18.a	1	Carboxylic acids	229	Reasoning	2
18.b	1	Carboxylic acids	234	Reasoning	5.iii
18.c	2	Carboxylic acids	224	Applying	5.iv
19.a	1	Nitrogen compounds	240	Knowing	4
19.b i	1	Nitrogen compounds	247	Applying	3
19.b ii	1	Nitrogen compounds	247	Applying	4
19.c	1	Nitrogen compounds	247	Applying	4
19.d	3	Nitrogen compounds	247	Reasoning	4
20.a	1	Aromatic compound	213,216	Knowing	2iii,4
20.b	1	Aromatic compound	217	Applying	4
20.c	2	Aromatic compound	216,217	Applying	2iii,4
20.d	1	Aromatic compound	216	Applying	2iii,4
21.a	1	Polymers	254,255	Knowing	1,5
21.b	2	Polymers	252-256	Applying	1,4,5
21.c.i	1	Polymers	254,255	Applying	1,5
21.c.ii	1	Polymers	252	Reasoning	1,4
21.d	1	Polymers	251	Applying	3
22	1	Polymers	259	Applying	7

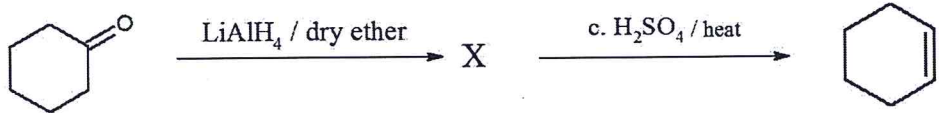
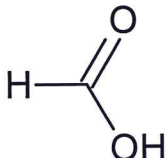
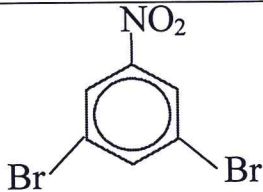


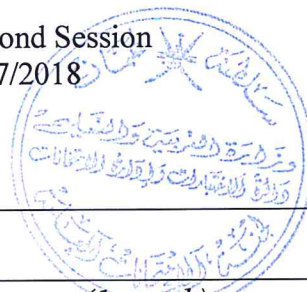
TOTAL MARKS: 70

PAGES: 5

Question One (28 Marks)

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

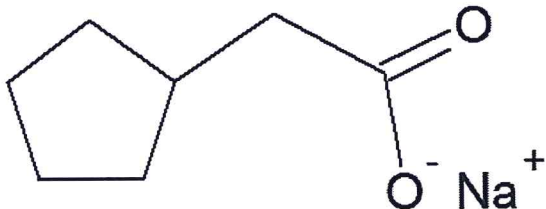
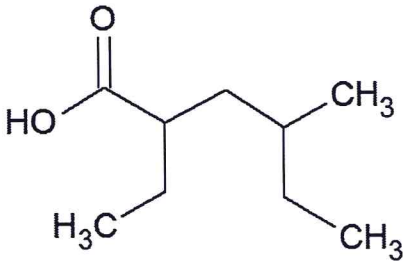
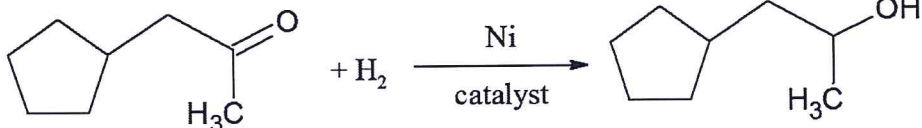
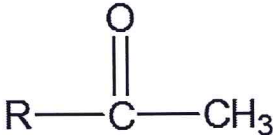
Item No.	Correct option
1	c. It has a non-toxic nature.
2	a. 4-ethyl-2-methyloctan-3-ol
3	d. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ using strong acid.
4	b. Propan-2-ol 2-Chloropropane $\text{HCl} / \text{ZnCl}_2$ Nucleophilic substitution
5	d. Phenylmethanal
6	d. Compound 2 will react faster with a nucleophile and is more readily oxidized.
7	b) 
8	a. 
9	d. X : Carboxylic acid, Y: Alkane, Z : Alcohol
10	c. Only X and Z.
11	a. Amide
12	a. The phenol can lose H^+ ion easily.
13	c. 
14	b. They char and burn at low temperatures.



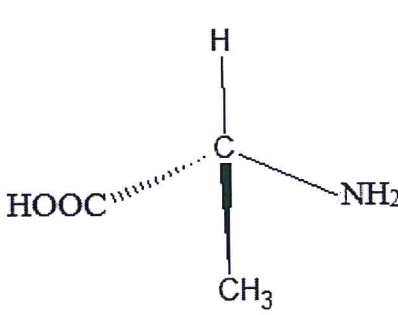
Question Two (42 Marks)

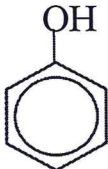
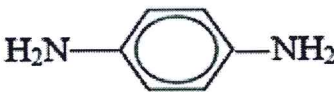
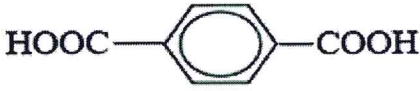
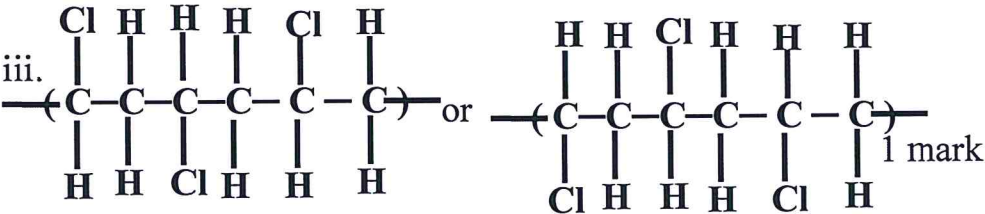
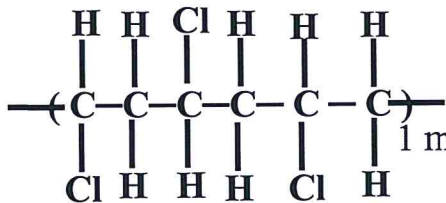
<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
15	a	i. Primary alcohol. (1 mark) ii. Secondary alcohol. (1 mark)	2 marks
	b	i. Dehydration is the removal of a water molecule from a reactant, i.e. – H ₂ O (1 mark) ii. strong acid or H ₂ SO ₄ (1 mark) iii. (1 mark) $\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{CH}=\text{CH}_2 \\ \\ \text{CH}_3 \end{array}$	3 marks
	c	i. (1 mark) $\begin{array}{c} \text{CH}_3 \\ \\ \text{H}_3\text{C}-\text{C}-\text{O}^- \text{Na}^+ \\ \\ \text{CH}_3 \end{array}$ ii. Acid (1/2 mark) It loses an H ⁺ from the hydroxyl, -OH, group. (1/2 mark)	2 marks
	d	i. $\begin{array}{c} \text{H} \quad \text{CH}_3 \\ \quad \\ \text{H}-\text{C}-\text{CH}-\text{OH} \\ \\ \text{CH}_3 \end{array} \xrightarrow[\text{heat}]{\text{K}_2\text{Cr}_2\text{O}_7 / \text{H}^+} \begin{array}{c} \text{H} \quad \text{O} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$ (1/2 mark) (1/2 mark) If the student uses KMnO ₄ mark is given. ii.- Alcohol (C) (1 mark) -It is a tertiary alcohol. - it does not have a hydrogen atom attached to the carbon atom bonded to the hydroxyl group - It is impossible to oxidize a tertiary alcohol without breaking the C-C bond. (1 mark) Any answer from above mark is given	3 marks



<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
16	a	Carbonyl group	1 mark
	b	 <div style="display: inline-block; vertical-align: middle; margin-left: 20px;"> $+ \text{CHI}_3$ </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> (1 mark) (1 mark) </div>	2 marks
	c	Cu_2O	1 mark
	d		1 mark
	e	 <div style="display: flex; justify-content: space-around; margin-top: 10px;"> (1/2 mark) (1/2 mark) </div> <p>- If the student use LiAlH_4 in dry ether or NaBH_4 in aqueous solution mark is given.</p>	1 mark
	f	<p>Because it does not contain the methyl group ($-\text{CH}_3$) attached to the carbonyl group. Or Because the compound does not have the following structure:</p> <div style="text-align: center; margin-top: 20px;">  </div>	1 mark



<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
17	a	2-hydroxypropanoic acid	1 mark
	b	$\text{CH}_3\text{COOH} + \text{PCl}_5 \longrightarrow \text{CH}_3\text{COCl} + \text{POCl}_3 + \text{HCl}$ <div style="display: flex; justify-content: space-around; width: 100%;"> ½ mark ½ mark ½ mark ½ mark </div>	2 mark
18	a	<p>Compound (B) 1 mark</p> <p>Because compound (B) has more ability to form hydrogen bonds with water than compound (A) . 1 mark</p> <p>Or</p> <p>Compound (B) has shorter non-polar hydrocarbon chain than compound (A) , so it will have smaller effect , and acid gets more soluble.</p> <p>Or</p> <p>Compound (A) has longer non-polar hydrocarbon chain than compound (B) ,so it starts to have a greater effect, and the acid gets less soluble.</p>	2 mark
	b	$\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_3$	1 mark
	c	$\text{CH}_3(\text{CH}_2)_4\text{COOH} + \text{KOH} \longrightarrow \text{CH}_3(\text{CH}_2)_4\text{COO}^-\text{K}^+ + \text{H}_2\text{O}$ <div style="display: flex; justify-content: space-around; width: 100%;"> 1 mark 1 mark </div>	2 mark
19	a	Compound O	1 mark
	b	i. 2 chiral centers 1 mark	2 mark
		ii. 4 optical isomers 1 mark	
	c		1 mark
	d	<p>Compound (Z) 1 mark</p> <p>Because it does not have a chiral center <u>or</u> it does not have a carbon atom attached to four different groups. 1 mark</p>	2 mark

<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
20.	a.	Electrophilic substitution or halogenation or bromination	(1 mark)
	b.	NO_2^+	(1 mark)
	c.	reaction (3) 1 mark because the hydroxyl group -OH in phenol is an electron donating group or phenol can lose H^+ more readily than benzene 1 mark	(2 mark)
	d.	Phenol or 	(1 mark)
21.	a.	Nylon(6-6)	(1 mark)
	b.	i. Polymer (A) : condensation ii. Polymer (B) : Addition Each answer is worth $\frac{1}{2}$ mark	(1 mark)
	c.	i.  $\frac{1}{2}$ mark  $\frac{1}{2}$ mark iii.  or  1 mark	(2 mark)
	d.	By hydrogen bonding	(1 mark)
22.		By the action of bacteria , fungi , algae , which may be found in the soil , rivers , lakes and oceans	(1 mark)

This is the end of the Marking Guide