



سَلْطَنَةُ عُمَانِ
وَزَارَةُ التَّحْقِيقِ وَالتَّعْلِيمِ

امتحان دبلوم التعليم العام للمدارس الخاصة (ثنائية اللغة)

للعام الدراسي ١٤٣٧/١٤٣٨ هـ - ٢٠١٦ / ٢٠١٧ م

الدور الأول - الفصل الدراسي الأول

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

- تنبيه: المادة: الكيمياء.
- الأسئلة في (١٤) 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 ○
✓ × ◐ ◑ ◒ ◓

مُسَوَّدَة، لا يتم تصحيحها

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

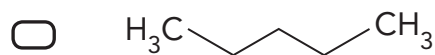
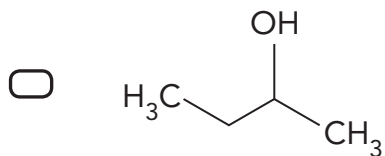
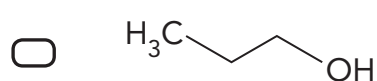
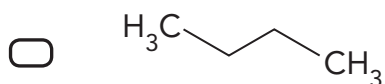
There are 14 multiple-choice items worth two marks each.

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

1) Which statement about ethylene glycol and ethanol is correct?

- ☐ They have different functional groups.
- ☐ They both can form hydrogen bonding.
- ☐ Ethylene glycol is a triol while ethanol is a diol.
- ☐ Ethylene glycol is a secondary alcohol while ethanol is a primary alcohol.

2) Which of the following compounds has the highest boiling point?



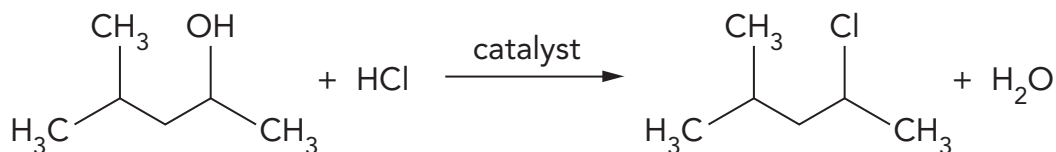
3) Which of the following compounds cannot be oxidized under ordinary conditions?

- ☐ 3-methylbutan-1-ol
- ☐ 2-methylbutan-1-ol
- ☐ 3-methylbutan-2-ol
- ☐ 2-methylbutan-2-ol

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Question 1 continued

4) For the following reaction:



What is the option that represents the type of this reaction and the catalyst used?

	Type of the reaction	Catalyst
<input type="checkbox"/>	Nucleophilic addition	ZnCl ₂
<input type="checkbox"/>	Nucleophilic addition	K ₂ Cr ₂ O ₇ / H ⁺
<input type="checkbox"/>	Nucleophilic substitution	ZnCl ₂
<input type="checkbox"/>	Nucleophilic substitution	K ₂ Cr ₂ O ₇ / H ⁺

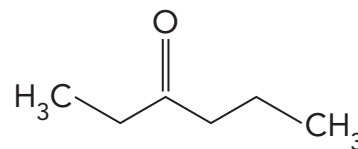
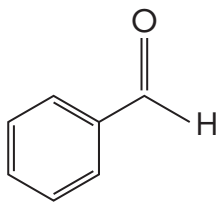
5) What type of organic product is produced when 3-methylbutanone is reacted with hydrogen and using nickel as a catalyst?

- ☐ an aldehyde
 ☐ a tertiary alcohol
☐ a secondary alcohol
 ☐ a carboxylic acid

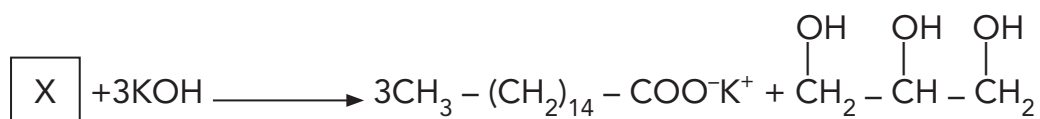
6) What is the correct structural formula for 4,4-diethyl-3-methylhexanal?

- ☐ C₂H₅C(C₂H₅)₂CH(CH₃)CH₂CHO
☐ C₂H₅C(CH₃)₂CH(C₂H₅)CH₂CHO
☐ C₂H₅CH(C₂H₅)C(CH₃)₂CH₂CHO
☐ C₂H₅CH(CH₃)C(C₂H₅)₂CH₂CHO

7) What is the correct test that can be used to practically distinguish between the following two compounds?



- ☐ Using LiAlH_4 in dry ether.
- ☐ Test with Fehling's solution.
- ☐ Addition of acidified KMnO_4 solution.
- ☐ Reaction with an alkaline solution of iodine.
- 8) Which of the following carboxylic acids is found in the cow's milk?
- ☐ Ethanoic acid. ☐ Methanoic acid.
- ☐ 2-hydroxypropanoic acid. ☐ 3-hydroxybutanoic acid.
- 9) Which of the following properties is incorrect about carboxylic acids and esters?
- ☐ They both can produce salts when reacted with alkali.
- ☐ They both can be formed using strong acid as a catalyst.
- ☐ Their formation reaction can be speeded up by heating under reflux.
- ☐ The products of esterification can react to form carboxylic acid and water.
- 10) Which of the following statements is incorrect about the following reaction?



- ☐ Reactant (X) is called glycerol.
- ☐ $\text{CH}_3-(\text{CH}_2)_{14}-\text{COO}^-\text{K}^+$ is precipitated using NaCl.
- ☐ Reactant (X) is ester whereas $\text{CH}_3-(\text{CH}_2)_{14}-\text{COO}^-\text{K}^+$ is salt.
- ☐ The reaction requires boiling up reactant (X) with potassium hydroxide.

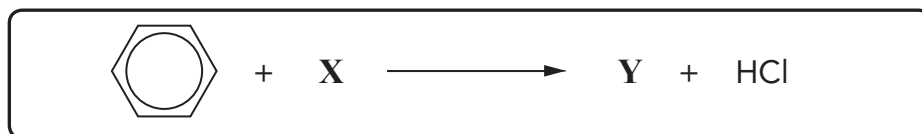
3

Question 1 continued

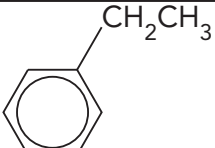
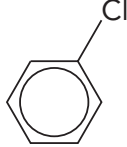
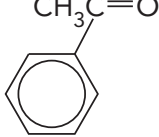
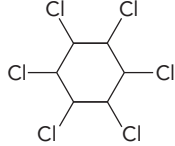
11) Which option shows the correct order for the three amine compounds according to their tendency to donate their nitrogen's lone pair more easily to an acid?

- ☐ $(\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{NH} > \text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2 > \text{C}_6\text{H}_5\text{NH}_2$
- ☐ $\text{C}_6\text{H}_5\text{NH}_2 > (\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{NH} > \text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$
- ☐ $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2 > (\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{NH} > \text{C}_6\text{H}_5\text{NH}_2$
- ☐ $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2 > \text{C}_6\text{H}_5\text{NH}_2 > (\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{NH}$

The following reaction takes place in the presence of a catalyst and a certain condition.



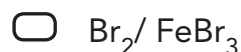
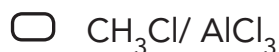
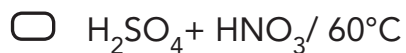
12) Which of the following options cannot represent (X) and (Y)?

	X	Y
<input type="radio"/>	$\text{CH}_3\text{CH}_2\text{Cl}$	
<input type="radio"/>	Cl_2	
<input type="radio"/>	$\text{CH}_3\text{C}(=\text{O})\text{Cl}$	
<input type="radio"/>	3Cl_2	

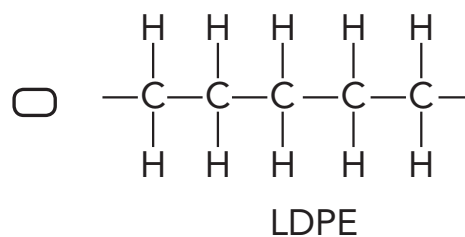
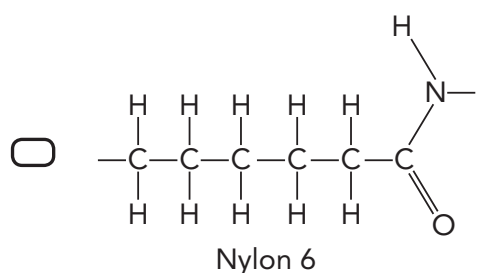
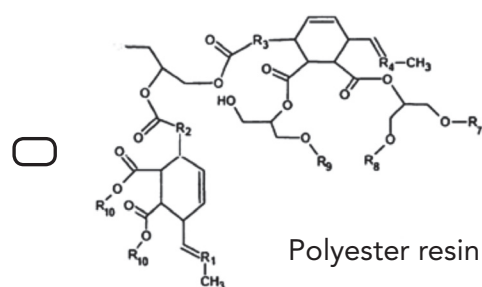
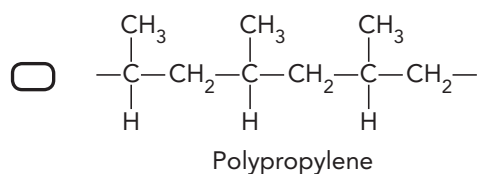
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Question 1 continued

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



14) Which of the following polymer structures is thermoset?



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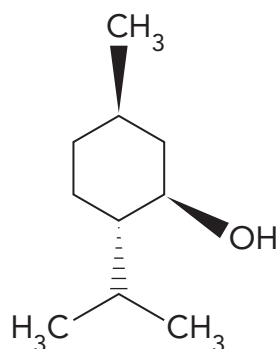
Extended Questions**(42 marks)**

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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) Menthol is an organic compound made synthetically or obtained from corn mint and peppermint. The structural formula of menthol is shown below. Study it and answer the following questions.

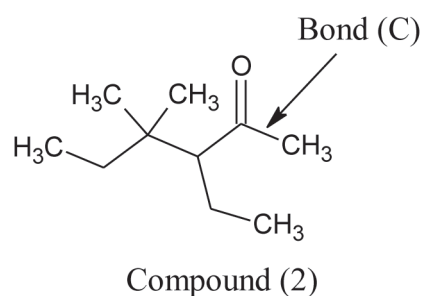
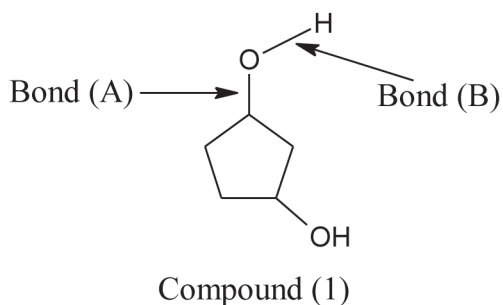


- a. What type of alcohol is menthol? (primary or secondary or tertiary)
- _____
- b. What is the suitable reagent and condition that can be used for converting menthol to alkene?
- _____
- c. Draw the structural formula of the compound produced when menthol is heated with acidified potassium dichromate (VI) solution.
- _____
- _____
- _____

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Question 2 continued

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



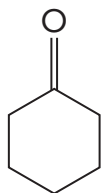
- a. What is the IUPAC name for both compounds?
- (i) Compound (1): _____
- (ii) Compound (2): _____
- b. You have studied different reactions in which (C-O) or (C-C) or (O-H) bonds are broken. Suggest a type of reaction in which each of the following bonds is broken.
- (i) Bond (A): _____
- (ii) Bond (B): _____
- (iii) Bond (C): _____
- c. Which one of the two compounds can form hydrogen bonds with its molecules? Explain your answer.

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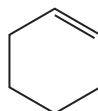
Question 2 continued

- 17) Starting with cyclohexanone, show how cyclohexene can be synthesized using chemical equations, suitable reagents, conditions and catalysts. You also need to name the type of reaction in each step.

(Hint: more than one step is required to produce cyclohexene from cyclohexanone)



cyclohexanone



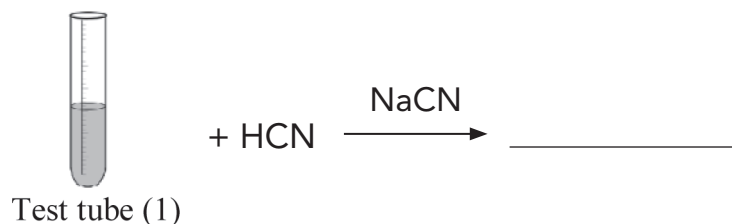
cyclohexene

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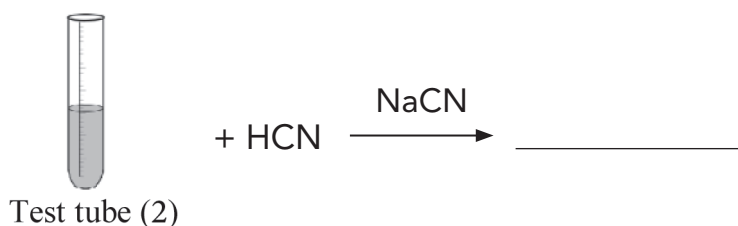
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Question 3**(14 marks)**

- 18) A student carried out two reactions, one for butanal and the other for butanone as shown in the diagram below. Study it then answer the following questions.

Reaction Rate

slow



fast

- a. Draw the structural formulae of the organic compounds produced from both reactions?

- b. Which test tube contains butanal? Explain your answer.

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Question 3 continued

- 19) An unbranched ester with six carbon atoms was produced by esterification reaction.

The carbonyl group ($\text{--}\overset{\text{O}}{\underset{\text{||}}{\text{C}}}\text{--}$) in this ester is the carbon number two.
Use the previous information to answer the following questions.

- a. Which reactant acts as a nucleophile in this esterification reaction?

- b. Write the chemical equation for this reaction.

- 20) The table below contains three compounds. Consider it to answer the following questions.

Compound	A	B	C
Formula	HCOOH	CH ₃ OH	HNO ₃

- a. Which compound (A or B) forms stronger hydrogen bonds between its molecules?
Explain your answer.

- b. Compound (A) is a stronger acid than compound (B). Give two reasons.

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Question 3 continued

- c. Compounds (A) and (C) of equal concentrations both undergo usual reactions of acids, but with different rates. Explain why compound (A) undergoes slower reactions than compound (C).

- d. Write a chemical equation for the reaction between compound (A) and KOH.

- 21) Isoleucine is an amino acid. It has an aliphatic side chain ($\text{CH}_3\text{---CH}_2\text{---CH}$) as a branch. Consider the above information to answer the following questions.

- a. Draw the structural formula of isoleucine.

- b. Isoleucine contains an acidic and a basic functional group. Identify them.

The acidic group: _____

The basic group: _____

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Question 3 continued

- c. How many chiral center(s) in isoleucine?

- d. How many optical isomer(s) of isoleucine can be formed?

- e. How can the optical isomer(s) of isoleucine be distinguished from each other?

Question 4

(14 marks)

- 22) A primary aliphatic amine is considered to be the simplest in its group. It was reacted with water and they produced an amine solution that turned red litmus paper blue.

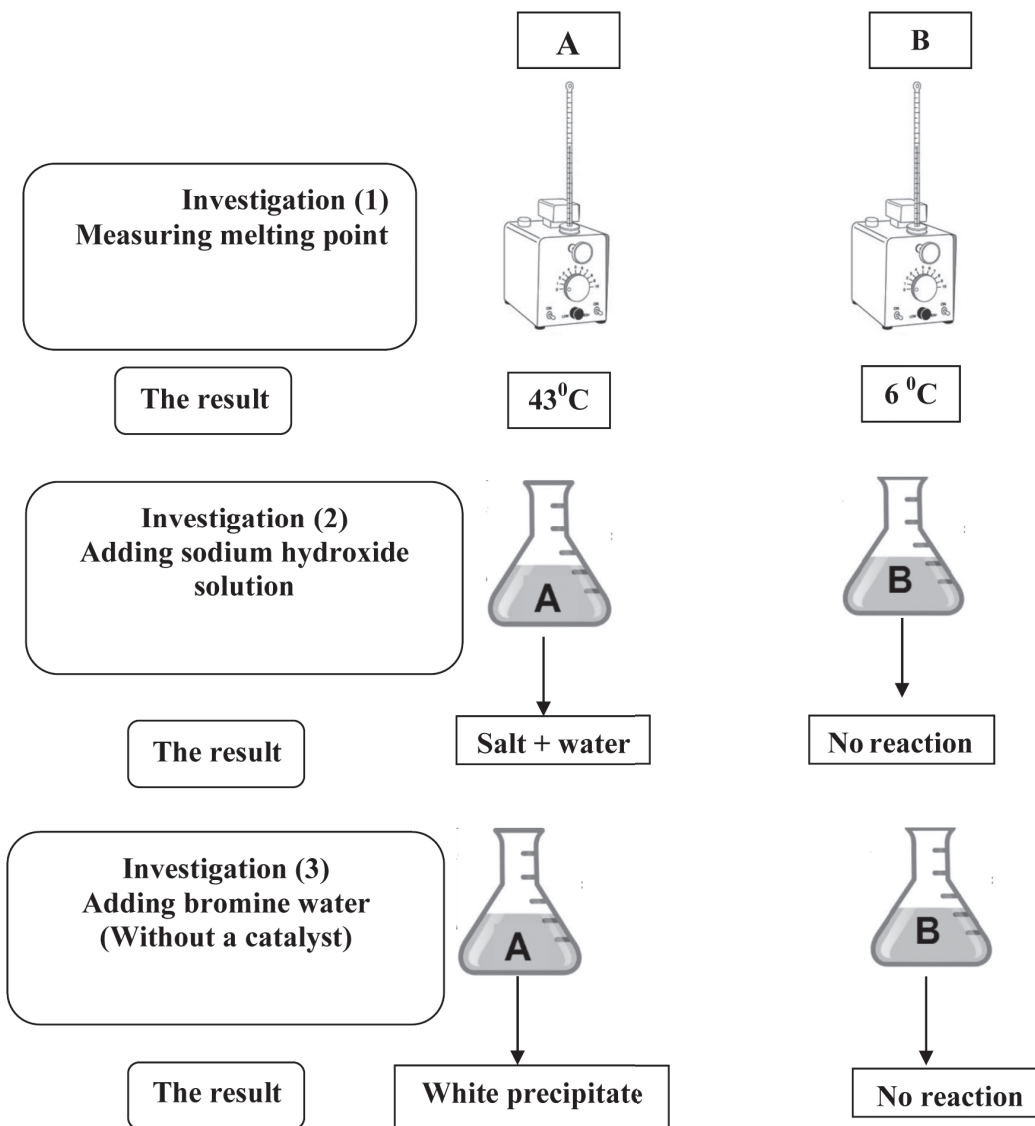
- a. Write the chemical equation for this reaction.

- b. What caused the solution to turn the red litmus paper blue?

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Question 4 continued

- 23) A Lab technician has two compounds in two containers, one is labelled A and the other is labelled B. He knows that one of these two compounds is benzene and the other is phenol. He did three different investigations to identify each compound as shown below, and he got the following results. Study these results and answer the questions below.



- a. Identify each compound.

Compound A : _____

Compound B : _____

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Question 4 continued

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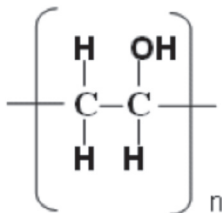

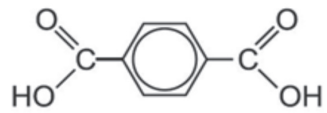
b. Write a balanced equation for the reactions of compound (A) with:

(i) Sodium hydroxide solution.

(ii) (3 moles) of bromine water.

c. In investigation (3) for the reaction of compound (B) with Bromine water, the reaction could occur if the lab technician added a catalyst. Suggest a suitable catalyst that the lab technician could use.

24. The following table shows different organic structures. Study them and answer the questions.

L	 <p>Poly(ethenol)</p>	M	$\text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$ <p>ethane-1,2-diol</p>
N	 <p>Teflon</p>	O	 <p>benzene-1,4-dicarboxylic acid</p>

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Question 4 continued

- a. Which structure represents a biodegradable water soluble plastic?

- b. (M) and (O) react to form a popular polymer.

- (i) Draw the structural formula of this polymer.

- (ii) What is the common commercial name of this polymer?

- (iii) What is the type of polymerization by which this polymer is formed?

- (iv) Is this polymer a polyester or a polyamide? Explain your answer.

- (v) Give one example or application shows that the products of this polymer can be recycled.

[End of Examination]

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مُسَوِّدَة

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MARKING GUIDE



GENERAL EDUCATION DIPLOMA BILINGUAL PRIVATE SCHOOLS SEMESTER ONE - FIRST SESSION

CHEMISTRY

2016 / 2017

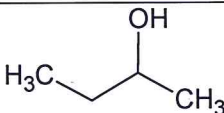
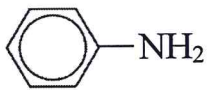
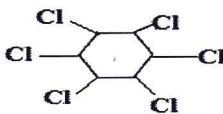
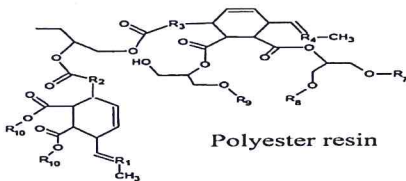


TOTAL MARKS: 70

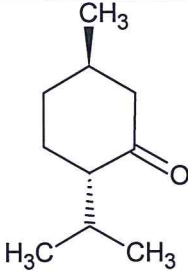
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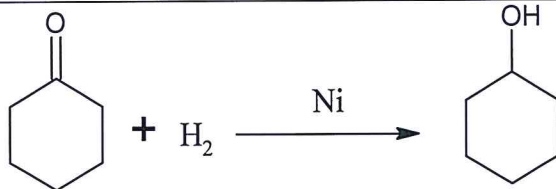
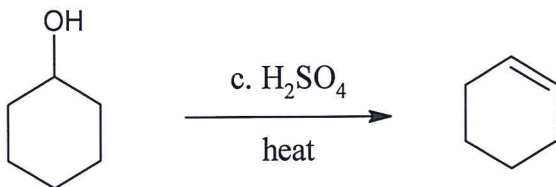
Question One (28 Marks)

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

Item No.	Correct option
1	They both can form hydrogen bonding.
2	
3	2-methylbutan-2-ol
4	Nucleophilic substitution ZnCl_2
5	a secondary alcohol
6	$\text{C}_2\text{H}_5\text{C}(\text{C}_2\text{H}_5)_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CHO}$
7	Addition of acidified KMnO_4 solution.
8	2-hydroxypropanoic acid.
9	The products of esterification can react again to form carboxylic acid and water.
10	Reactant (X) is called glycerol.
11	$(\text{CH}_3\text{CH}_2\text{CH}_2)_2\text{NH} > \text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2 > $ 
12	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>X</p> <p>3Cl_2</p> </div> <div style="text-align: center;"> <p>Y</p>  </div> </div>
13	$\text{CH}_3\text{COCl} / \text{AlCl}_3$
14	 <p>Polyester resin</p>

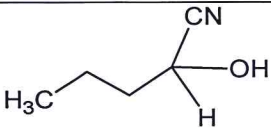
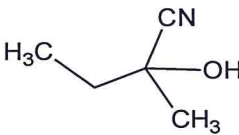
Question Two (14 Marks)

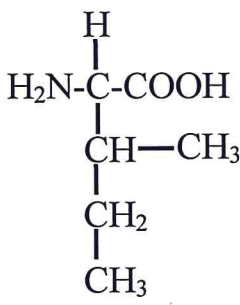
<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
15	a	a secondary alcohol	1 mark
	b	c. H_2SO_4 with heating * 0.5 mark for H_2SO_4 and 0.5 mark for heating	1 mark
	c		1 mark

<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
16	a.i	cyclopentane-1,3-diol	1 mark
	a.ii	3-ethyl-4,4-dimethylhexan-2-one	1 mark
	b.i	Nucleophilic substitution or Halogenation	1 mark
	b.ii	Reaction with carboxylic acids or esterification or reaction with metals such as sodium.	1 mark
	b.iii	Iodoform reaction	1 mark
	c	Compound (1) Because it has O-H bond that can bonds to another alcohol molecule while compound (2) has carbonyl group (C=O) with no hydrogen to bond with another molecule.	1 mark 1 mark
17		<p>step 1 Reduction</p>  <p>1 mark</p> <p>1 mark</p>	2 marks
		<p>step 2 Dehydration</p>  <p>1 mark</p> <p>1 mark</p> <p><i>* To get the mark all components of the equation should be correct. * If the student use LiAlH₄, (in dry ether) or NaBH₄/H₂O as reducing agents mark is given.</i></p>	2 marks



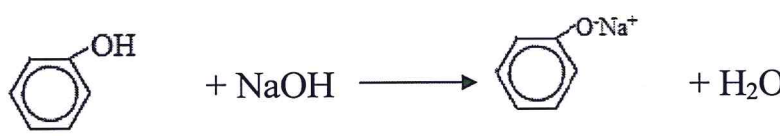
Question Three (14 marks)

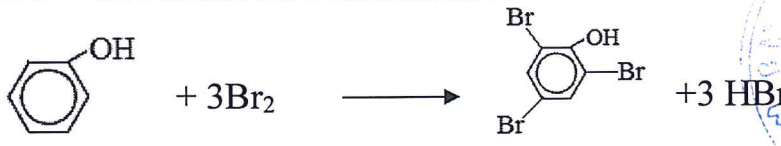
<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
18	a	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>1 mark</p> </div> <div style="text-align: center;">  <p>1 mark</p> </div> </div>	2 marks
	b	<p>Test tube (2) (0.5 mark)</p> <p>Because aldehydes undergo nucleophilic addition more readily than ketones, since the carbonyl carbon in the aldehydes has larger δ^+ charge. (0.5 mark)</p>	1 mark
<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
19.	a.	alcohol or butan1-ol or $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ or the oxygen atom of alcohol butan1-ol	(1 mark)
	b.	$\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} \xrightleftharpoons{\text{acid}} \text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ <p>($\frac{1}{2}$ mark) ($\frac{1}{2}$ mark) ($\frac{1}{2}$ mark) ($\frac{1}{2}$ mark)</p> <p>Acid or HCl or H_2SO_4</p>	(2 marks)
20	a.	compound (A) , HCOOH (0.5 mark) because its molecules can pair up forming dimmers (0.5 mark)	(1 mark)
	b.	<p>Because 1. Weakening of the O-H bond in the acid by the presence of the adjacent carbonyl group. ($\frac{1}{2}$ mark)</p> <p>2. the stability of the carboxylic anion when the H^+ ions leaves or because the negative charge is not concentrated on one oxygen atom but spread over the whole $-\text{COO}^-$ group or because the delocalisation of electrons stabilise the carboxylic anion and it is not as open to attack by H^+ ions and therefore is less likely to reform the original acid molecule again. ($\frac{1}{2}$ mark)</p>	(1 mark)
	c.	Because fewer of H^+ ions will be present <u>or</u> because k_a of compound A is less <u>or</u> compound A is a weaker acid.	(1 mark)
	d.	$\text{HCOOH} + \text{KOH} \rightarrow \text{HCOO}^-\text{K}^+ + \text{H}_2\text{O}$ <i>To get the mark all components of the equation should be correct.</i>	(1 mark)

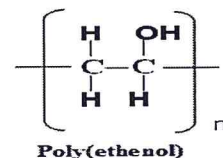
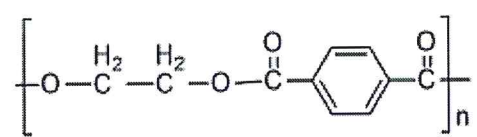
21	a.	<div style="text-align: center;">  </div>	(1 mark)
	b.	The acidic group : -COOH or carboxylic group (½ mark)	(1 mark)
	c.	The basic group : H ₂ N- or amine group (½ mark)	(½ mark)
	d.	Two or 2	(½ mark)
	e.	4	(½ mark)
		Based on the direction (left or right , clockwise or anti-clockwise each isomer will rotate polarised light or by writing (+) or (-) in front of the isomer's name.	(1 mark)

Question Four (14 Marks)

<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
22	a	$\text{CH}_3\text{NH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{N}^+\text{H}_3 + \text{OH}^-$ <p><i>To get the mark all components of the equation should be correct.</i></p>	(1 mark)
	b	The presence of hydroxide ions (OH ⁻) in the solution	(1 mark)

23	A.	A: Phenol (1 mark) B: Benzene (1mark)	2 marks
	Bi	<div style="text-align: center;">  </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 10px;">½</div> <div style="border: 1px solid black; padding: 2px 10px;">½</div> <div style="border: 1px solid black; padding: 2px 10px;">½</div> </div>	1½ mark

	Bii	 <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="border: 1px solid black; padding: 2px 10px;">$\frac{1}{2}$</div> <div style="border: 1px solid black; padding: 2px 10px;">$\frac{1}{2}$</div> <div style="border: 1px solid black; padding: 2px 10px;">$\frac{1}{2}$</div> </div>	1½ mark
	C	By using iron(III)bromide <u>or</u> aluminum bromide Or FeBr ₃ <u>or</u> AlBr ₃	1 mark

<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>The mark</u>
24	A.	(L)  Poly(ethanol)	1 mark
	B.i		1 mark
	B.ii	Terylene or PET	1 mark
	B.iii	Condensation	1 mark
	B.iv	Polyester (½ mark) Because it has –COO or ester group (½ mark)	1 mark
	B.v	The bottles of fizzy drinks can be recycled by melting them down and then used to make products such as carpets, anoraks,...etc. or PET lemonade bottles can be recycled and turned into T-shirt.	1 mark

This is the end of the Marking Guide