



- تعليمات مهمة:**

 - يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
 - يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
 - يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
 - يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
 - يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.

مُسَوَّدَة، لا يتم تصحيحها

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Question 1: Multiple Choice Items**(14 marks)**

There are 14 multiple-choice items worth one mark each.

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

- 1) Which of the following statements about complexes is correct?
- ☐ They contain acidic and electrophilic ligands.
 - ☐ Hydrogen bonds form between each ligand and the metal ion.
 - ☐ To form complexes, the ligands are attracted to the metal ions.
 - ☐ The oxidation number of the metal is always the same as the charge on the complex ion.
- 2) Cu^+ ions form a linear complex with OH^- ions. Which of the following shows the correct structure of the complex and the electronic configuration of Cu^+ ion in this complex?

	Structure of the complex (complex ion)	Electronic configuration of Cu^+
<input type="radio"/>	$[\text{HO} \blacktriangleright \text{Cu} \cdots \text{OH}]$	$[\text{Ar}]3\text{d}^{10}4\text{s}^1$
<input type="radio"/>	$[\text{HO} \blacktriangleright \text{Cu} \cdots \text{OH}]^{1-}$	$[\text{Ar}]3\text{d}^{10}$
<input type="radio"/>	$[\text{HO} \blacktriangleright \text{Cu} \cdots \text{OH}]$	$[\text{Ar}]3\text{d}^9$
<input type="radio"/>	$[\text{HO} \blacktriangleright \text{Cu} \cdots \text{OH}]^{1-}$	$[\text{Ar}]3\text{d}^{10}4\text{s}^2$

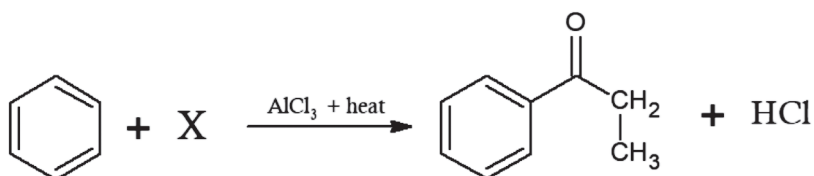
- 3) The oxidation state of (Mn) in MnO_4^- is + 7. Which of the following statements about (Mn) atom is correct?
- ☐ It lost 7 electrons from 3d subshell.
 - ☐ It gained 7 electrons from 3d subshell.
 - ☐ It lost 6 electrons from 3d subshell and 1 electron from 4s subshell.
 - ☐ It lost 5 electrons from 3d subshell and 2 electrons from 4s subshell.

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Question 1 continued

- 4) Which of the following statements is **incorrect** about the delocalised π -bond in benzene?
- ☐ It creates a planar hexagonal shape.
 - ☐ It causes all C-C bond lengths to be equal.
 - ☐ It makes benzene more stable than cyclohexatriene.
 - ☐ It prevents benzene undergoing substitution reactions.

Study the following reaction to answer question 5.



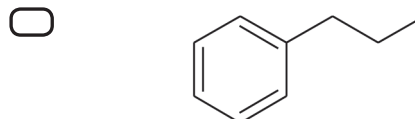
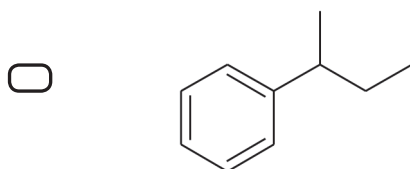
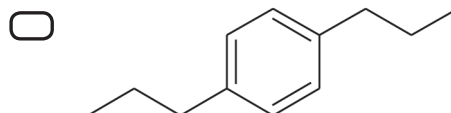
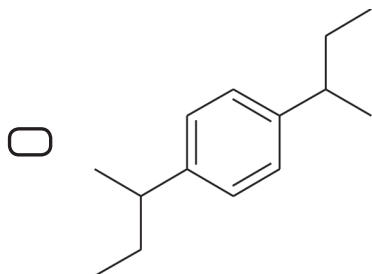
- 5) Which of the following options is correct about the type of the reaction and reagent X?

	Type of reaction	Reagent X
<input type="checkbox"/>	Alkylation	$\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$
<input type="checkbox"/>	Alkylation	$\text{CH}_3\text{CH}_2\text{COCl}$
<input type="checkbox"/>	Acylation	$\text{CH}_3\text{CH}_2\text{COCl}$
<input type="checkbox"/>	Acylation	$\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$

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Question 1 continued

- 6) Which of the following would be a possible product from the Friedel-Crafts alkylation of benzene with C_4H_9Br ?

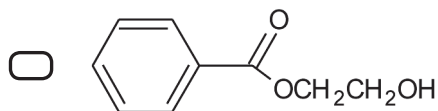
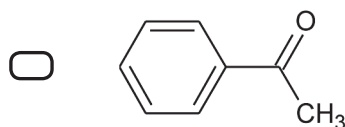
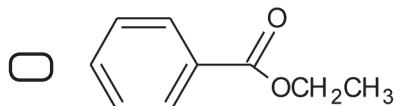
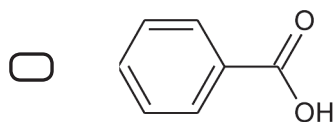
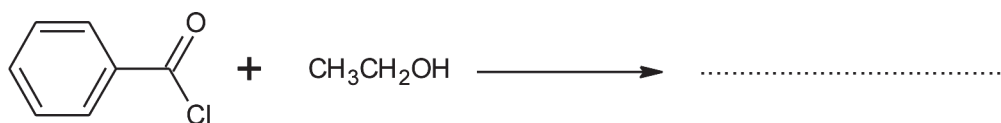


- 7) Why the boiling points of acyl chlorides are increased to about 10-15 °C compared to halogenoalkanes with similar shapes?

- ☐ Electron donating effect of the carbonyl group increases the dipole-dipole attraction.
- ☐ Electron donating effect of the carbonyl group decreases the dipole-dipole attraction.
- ☐ Electron withdrawing effect of the carbonyl group increases the dipole-dipole attraction.
- ☐ Electron withdrawing effect of the carbonyl group decreases the dipole-dipole attraction.

Question 1 continued

8) What is the major organic product of the following reaction?



9) Why is CCl3COOH more acidic than CH3COOH?

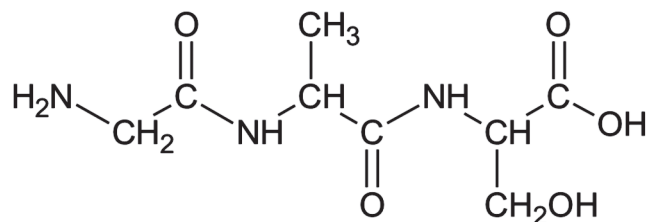
- ☐ Electron donating group decreases the acidity of carboxylic acid.
- ☐ Electron donating group increases the acidity of carboxylic acid.
- ☐ Electron withdrawing group decreases the acidity of carboxylic acid.
- ☐ Electron withdrawing group increases the acidity of carboxylic acid.

10) Which of the following properties is present in ethylamine and glycine?

- ☐ They both react with acids.
- ☐ They both form peptide bonds.
- ☐ They both can form zwitterion.
- ☐ They both contain two functional groups.

Question 1 continued

Study the following organic compound and then answer questions 11 and 12.



11) How many peptide bond(s) in the above compound?

☐ 1

☐ 2

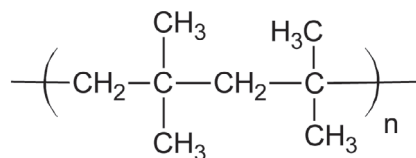
☐ 3

☐ 4

12) What are the structural formulae of the reactants that are used to produce the above compound?

☐ $\text{NH}_2\text{CH}_2\text{COH}$, $\text{NH}_2\text{CH}(\text{CH}_3)\text{COH}$, $\text{NH}_2\text{CH}(\text{CH}_2\text{OH})\text{COH}$
☐ $\text{NH}_2\text{CH}_2\text{COH}$, $\text{NH}_2\text{CH}(\text{CH}_3)\text{COH}$, $\text{NH}_2\text{CH}(\text{CH}_2\text{OH})\text{CO}_2\text{H}$
☐ $\text{NH}_2\text{CH}_2\text{CO}_2\text{H}$, $\text{NH}_2\text{CH}(\text{CH}_3)\text{CO}_2\text{H}$, $\text{NH}_2\text{CH}(\text{CH}_2\text{OH})\text{CO}_2\text{H}$
☐ $\text{NH}_2\text{CH}_2\text{CO}_2\text{H}$, $\text{NH}_2\text{CH}(\text{CH}_3)\text{COH}$, $\text{NH}_2\text{CH}(\text{CH}_2\text{OH})\text{CO}_2\text{H}$

13) What is the type of reaction that forms the following polymer?


☐ Addition

☐ Substitution

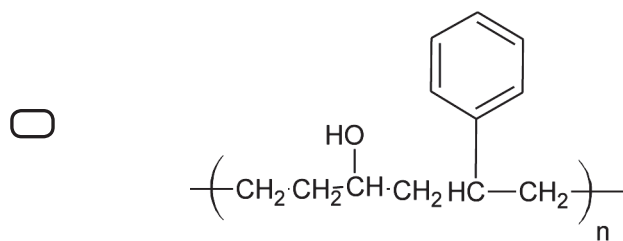
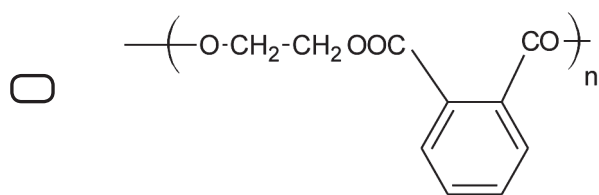
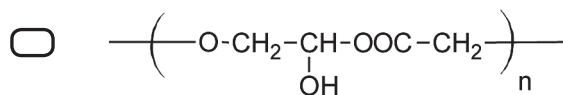
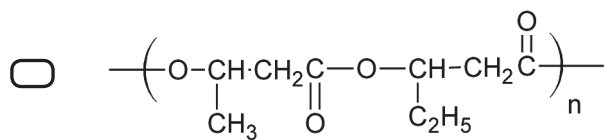
☐ Condensation

☐ Hydration

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Question 1 continued

- 14) In which of the following polymers, ethylene glycol ($\text{HOCH}_2\text{CH}_2\text{OH}$), is one of the monomers?

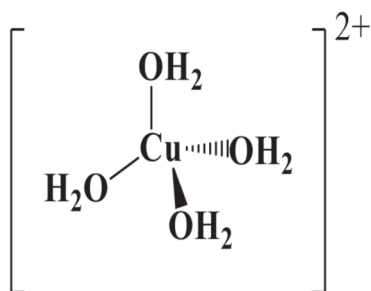


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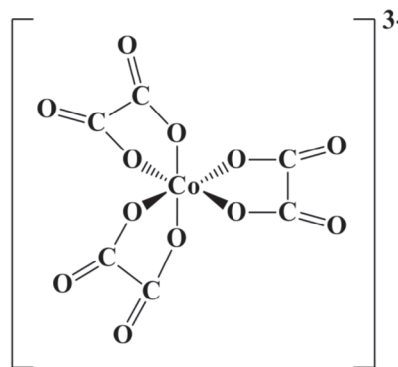
Question 2: Extended Questions**(56 marks)**

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) The structure of two complex ions of two transition elements are shown below. Study them to answer the following questions.



Complex ion (1)



Complex ion (2)

- a. Why Zn is excluded from the class of transition element?

- b. What is the name of the shape of complex ion (1)?

- c. What is the type of ligand in complex ion (2)?

☐ monodentate

☐ bidentate

Shade the correct answer

Explain your answer.

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Question 2 continued

d. Write the chemical formulae of the following:

(i) The metal ion in complex ion (1).

(ii) The ligand in complex ion (2).

e. How many coordination bonds are in:

(i) complex ion (1)?

(ii) complex ion (2)?

f. What is the oxidation state of the metal ion in complex ion (2)?

g. If all the ligands of complex ion (2) are replaced with four ligands of chloride ions to form new complex ion with same cobalt ion.

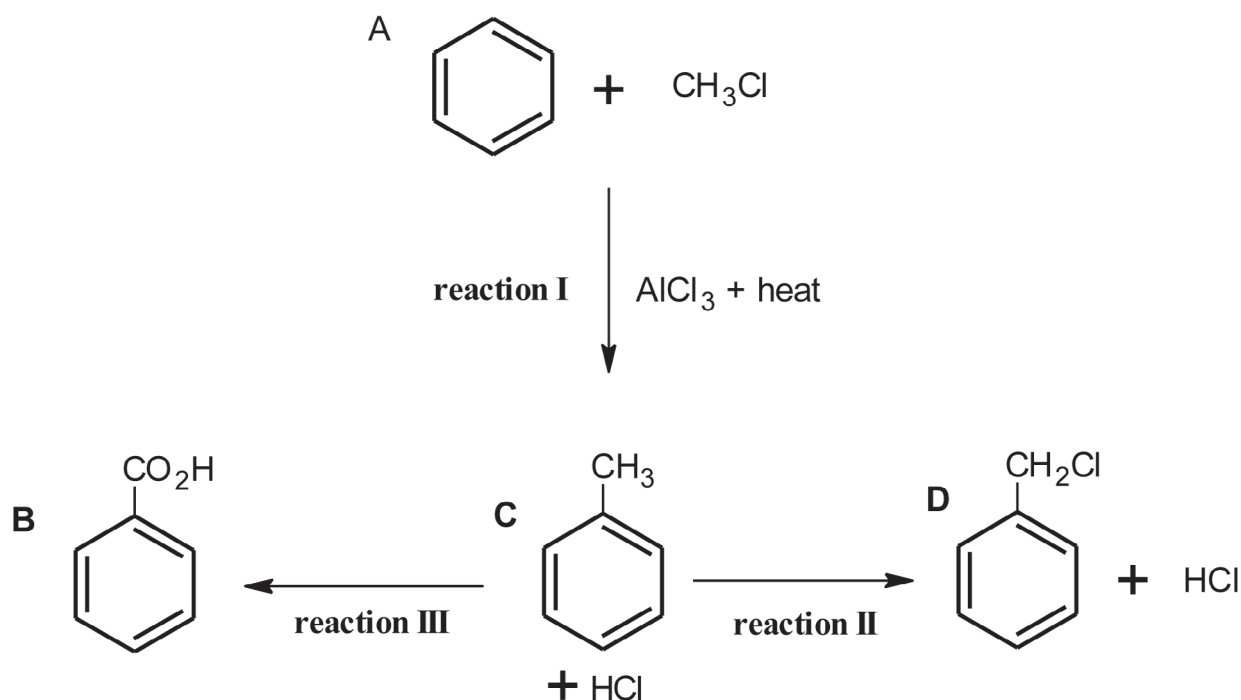
(i) Write the electronic configuration of cobalt ion using [Ar] to represent the argon core.

(ii) Draw the structural formula of the new complex ion. Your drawing should clearly show three-dimensional shape and should include the overall charge on the complex ion.

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Question 2 continued

- 16) A series of three chemical reactions was carried out as follows. Study it and answer the following questions.



- a. Write the formula of the electrophile in reaction I.

- b. State the reagents and conditions needed for:
 - (i) reaction II: _____
 - (ii) reaction III: _____
- c. Draw the structural formula of the predicted organic product if (CH₃CH₂COCl) is used instead of (CH₃Cl) in reaction I.

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Question 2 continued

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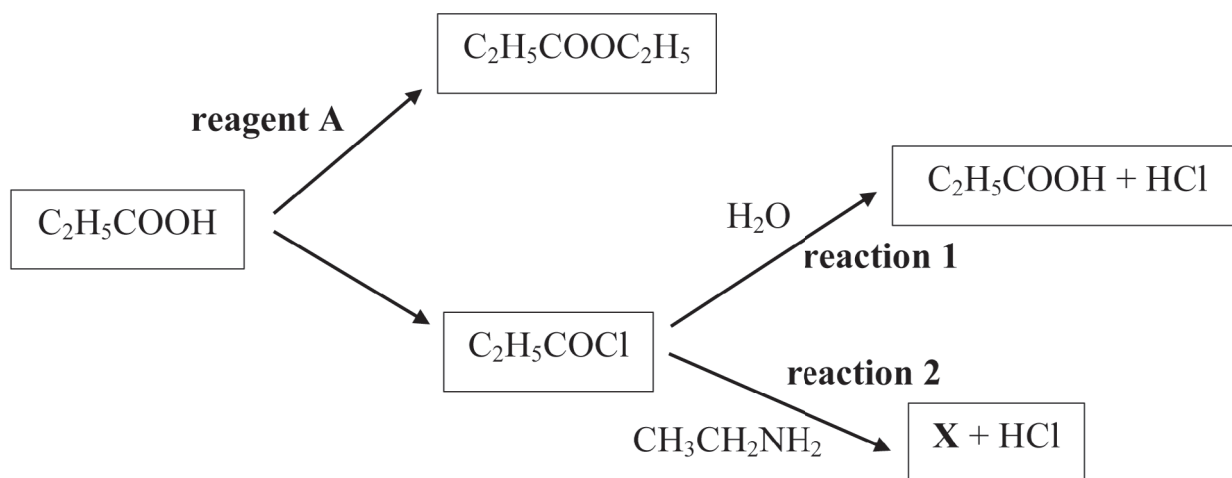
- d. Compound (B) undergoes nitration to form three compounds of disubstituted benzene of 1,2-, 1,3- and 1,4- substituents. Draw the structures of all these three compounds.

- e. Compound (C) undergoes chlorination to form two compounds with 1,2- and 1,4- substituents. Draw the structures of the intermediates of these two compounds.

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Question 2 continued

- 17) Some reactions of carboxylic acid, are shown below. Study them and answer the following questions.



- a. Write the structural formulae of reagent **A**, which is needed for the formation of $\text{C}_2\text{H}_5\text{COOC}_2\text{H}_5$ and the reaction condition.

(i) Reagent **A**: _____

(ii) Condition: _____

- b. Compound $\text{C}_2\text{H}_5\text{COCl}$ undergoes two different reactions: **1** and **2**.

(i) What are the two main intermolecular forces in compound $\text{C}_2\text{H}_5\text{COCl}$?

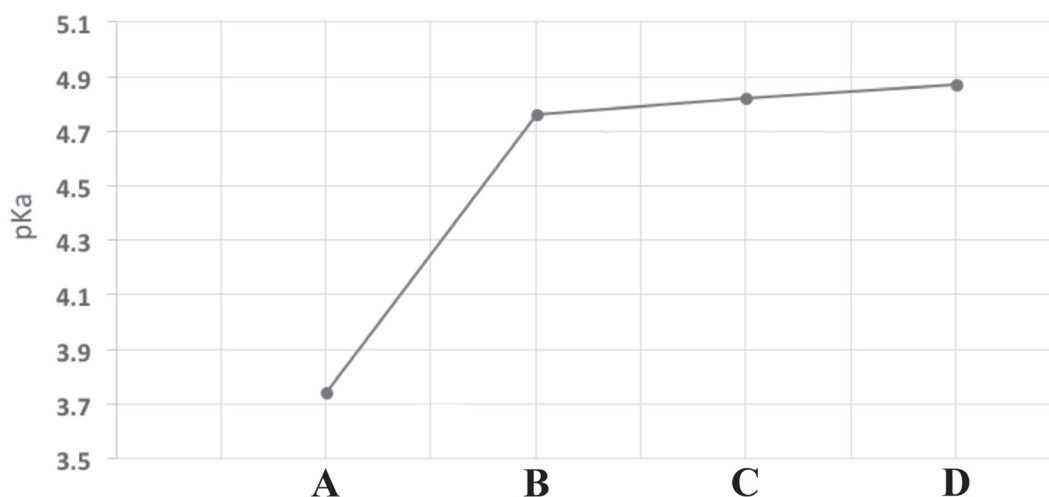
(ii) Draw the structural formula of the organic compound **X**.

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Question 2 continued

(iii) Use curly arrows to outline the mechanism of reaction 1.

- 18) The following chart shows the pK_a values for four different carboxylic acids (ethanoic, hexanoic, methanoic and butanoic acids) represented by (A, B, C or D) randomly. Study it to answer the following questions.



- a. Which carboxylic acid (A, B, C or D) represents butanoic acid?
-
- b. Which carboxylic acid (A, B, C or D) represents the acid with the lowest dissociation in solutions with same concentration?
-

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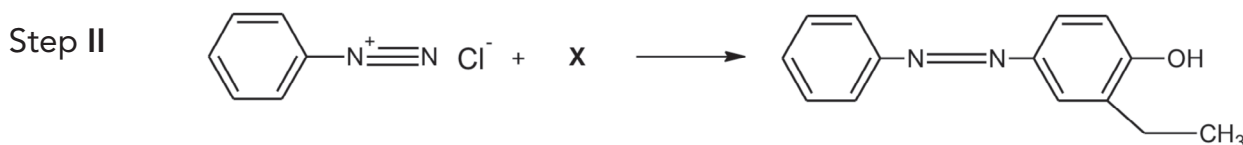
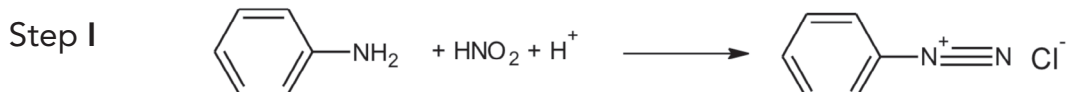
Question 2 continued

- c. Which carboxylic acid (A, B, C or D) can be further oxidised with Fehling's reagent?
Write the chemical equation that shows this reaction.

Carboxylic acid: _____

The equation: _____

- 19) An azo compound, that can be made from phenylamine, is shown below, study it and answer the following questions.



- a. Explain why phenylamine is a basic compound.

- b. What are the reagents and condition needed in step I?

- c. What is the name of the reaction in step II?

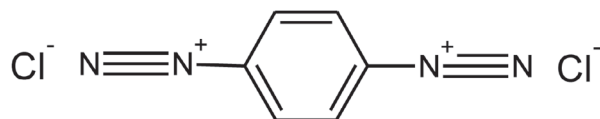
- d. Is step II a nucleophilic or an electrophilic substitution reaction?

- e. Draw the structural formula of X.

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Question 2 continued

- f. If **X** reacts with the following compound, what is the structural formula of the produced azo compound?

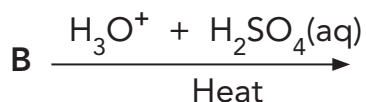


- 20) The following structures show different organic compounds. Study them then answer the following questions.

<p>A</p>	<p>B</p>
<p>C</p>	<p>D</p>

- a. Which compound can form zwitterion?

- b. Write the product(s) for the following reaction.



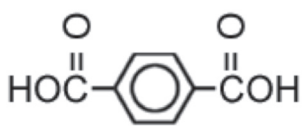
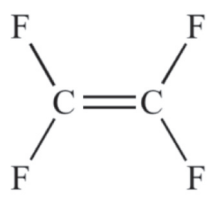
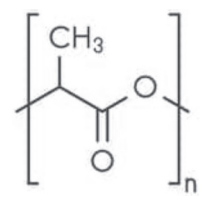
- c. Explain why compound (**D**) can react with acid or base solutions.

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Question 2 continued

- d. Write the structural formula of the organic product formed by reduction of compound (C) by H_2 and Ni.

- 21) The following grid shows the formulae of six compounds. Study them and answer the following questions.

<p>A</p> $\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{HO}-\text{C}-\text{C}-\text{OH} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	<p>B</p> $\left[\begin{array}{cc} \text{H} & \text{Cl} \\ & \\ -\text{C} & -\text{C}- \\ & \\ \text{H} & \text{H} \end{array} \right]_n$	<p>C</p> 
<p>D</p> $\begin{array}{c} \text{---CH}_2 \quad \text{CH}_2\text{---} \\ \diagdown \quad \diagup \\ \text{C} = \text{C} \\ \diagup \quad \diagdown \\ \text{H}_3\text{C} \quad \text{H} \end{array}$	<p>E</p> 	<p>F</p> 

- a. Which compound is:

(i) Poly (chloroethene): _____

(ii) Polylactic acid: _____

- b. Draw the structural formula of the polymer that is formed from the polymerisation of compound E.

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Question 2 continued

c. Identify the type of polymerisation for:

(i) compound **B**.

(ii) compound **F**.

d. Which compound from the above is an electrical conductor polymer? Explain your answer.

e. What is the functional group found in the polymer that forms by reacting compounds **A** and **C**?

f. Explain why compound **D** allows further addition reactions to take place.

22) Vulcanisation is a well-known process in synthetic rubber.

a. What is meant by vulcanisation?

b. State one property of the produced substance from this process.

[End of Examination]

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PERIODIC TABLE OF THE ELEMENTS

<div>Atomic Number → 1</div> <div>Symbol → H</div> <div>1.008 ← Atomic Mass</div> <div>Hydrogen ← Name</div>																		<div>2 He 4.002602 Helium</div>																																																																																																																																																																																																																																																											
<div>3 Li 6.94 Lithium</div>				<div>4 Be 9.0121831 Beryllium</div>														<div>9 F 18.998403163 Fluorine</div>				<div>10 Ne 20.1797 Neon</div>																																																																																																																																																																																																																																																							
<div>11 Na 22.98976928 Sodium</div>				<div>12 Mg 24.305 Magnesium</div>														<div>17 Cl 35.45 Chlorine</div>				<div>18 Ar 39.948 Argon</div>																																																																																																																																																																																																																																																							
<div>19 K 39.0983 Potassium</div>				<div>20 Ca 40.078 Calcium</div>				<div>21 Sc 44.955908 Scandium</div>				<div>22 Ti 47.867 Titanium</div>				<div>23 V 50.9415 Vanadium</div>				<div>24 Cr 51.9961 Chromium</div>				<div>25 Mn 54.938044 Manganese</div>				<div>26 Fe 55.845 Iron</div>				<div>27 Co 58.933194 Cobalt</div>				<div>28 Ni 58.6934 Nickel</div>				<div>29 Cu 63.546 Copper</div>				<div>30 Zn 65.38 Zinc</div>																																																																																																																																																																																																																																	
<div>37 Rb 85.4678 Rubidium</div>				<div>38 Sr 87.62 Strontium</div>				<div>39 Y 88.90584 Yttrium</div>				<div>40 Zr 91.224 Zirconium</div>				<div>41 Nb 92.90637 Niobium</div>				<div>42 Mo 95.95 Molybdenum</div>				<div>43 Tc 98 Technetium</div>				<div>44 Ru 101.07 Ruthenium</div>				<div>45 Rh 102.90550 Rhodium</div>				<div>46 Pd 106.42 Palladium</div>				<div>47 Ag 107.8682 Silver</div>				<div>48 Cd 112.414 Cadmium</div>				<div>49 In 114.818 Indium</div>				<div>50 Sn 118.710 Tin</div>				<div>51 Sb 121.760 Antimony</div>				<div>52 Te 127.60 Tellurium</div>				<div>53 I 126.90447 Iodine</div>				<div>54 Xe 131.293 Xenon</div>																																																																																																																																																																																																									
<div>55 Cs 132.90545196 Caesium</div>				<div>56 Ba 137.327 Barium</div>				<div>57/71 La 138.90547 Lanthanum</div>				<div>72 Hf 178.49 Hafnium</div>				<div>73 Ta 180.94788 Tantalum</div>				<div>74 W 183.84 Tungsten</div>				<div>75 Re 186.207 Rhenium</div>				<div>76 Os 190.23 Osmium</div>				<div>77 Ir 192.217 Iridium</div>				<div>78 Pt 195.084 Platinum</div>				<div>79 Au 196.966569 Gold</div>				<div>80 Hg 200.592 Mercury</div>				<div>81 Tl 204.38 Thallium</div>				<div>82 Pb 207.2 Lead</div>				<div>83 Bi 208.98040 Bismuth</div>				<div>84 Po 209 Polonium</div>				<div>85 At 210 Astatine</div>				<div>86 Rn 222 Radon</div>																																																																																																																																																																																																									
<div>87 Fr 223 Francium</div>				<div>88 Ra 226 Radium</div>				<div>89/103 La 138.90547 Lanthanum</div>				<div>104 Rf 267 Rutherfordium</div>				<div>105 Db 268 Dubnium</div>				<div>106 Sg 269 Seaborgium</div>				<div>107 Bh 270 Bohrium</div>				<div>108 Hs 269 Hassium</div>				<div>109 Mt 278 Meitnerium</div>				<div>110 Ds 281 Darmstadtium</div>				<div>111 Rg 281 Roentgenium</div>				<div>112 Cn 285 Copernicium</div>				<div>113 Uut 286 Ununtrium</div>				<div>114 Fl 289 Flerovium</div>				<div>115 Uup 289 Ununpentium</div>				<div>116 Lv 293 Livermorium</div>				<div>117 Uus 294 Ununseptium</div>				<div>118 Uuo 294 Ununoctium</div>																																																																																																																																																																																																									
<div>Lanthanide Series</div>																		<div>Actinide Series</div>																																																																																																																																																																																																																																																											
<div>57 La 138.90547 Lanthanum</div>																		<div>58 Ce 140.116 Cerium</div>																		<div>59 Pr 140.90766 Praseodymium</div>																		<div>60 Nd 144.242 Neodymium</div>																		<div>61 Pm 145 Promethium</div>																		<div>62 Sm 150.36 Samarium</div>																		<div>63 Eu 151.964 Europium</div>																		<div>64 Gd 157.25 Gadolinium</div>																		<div>65 Tb 158.92535 Terbium</div>																		<div>66 Dy 162.500 Dysprosium</div>																		<div>67 Ho 164.93033 Holmium</div>																		<div>68 Er 167.259 Erbium</div>																		<div>69 Tm 168.93422 Thulium</div>																		<div>70 Yb 173.054 Ytterbium</div>																		<div>71 Lu 174.9668 Lutetium</div>																	
<div>89 Ac 227 Actinium</div>																		<div>90 Th 232.0377 Thorium</div>																		<div>91 Pa 231.03588 Protactinium</div>																		<div>92 U 238.02891 Uranium</div>																		<div>93 Np 237 Neptunium</div>																		<div>94 Pu 244 Plutonium</div>																		<div>95 Am 243 Americium</div>																		<div>96 Cm 247 Curium</div>																		<div>97 Bk 247 Berkelium</div>																		<div>98 Cf 251 Californium</div>																		<div>99 Es 252 Einsteinium</div>																		<div>100 Fm 257 Fermium</div>																		<div>101 Md 258 Mendelevium</div>																		<div>102 No 259 Nobelium</div>																		<div>103 Lr 266 Lawrencium</div>																	

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MARKING GUIDE



GENERAL EDUCATION DIPLOMA

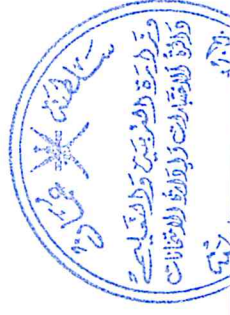
BILINGUAL PRIVATE SCHOOLS

SEMESTER ONE - FIRST SESSION

CHEMISTRY

2018 / 2019

Detailed Exam: Specifications for Semester One:



Topics of the units	Weighting %	Multiple choice (20%)		Extended response (80%)		Cognitive levels			Total
		No. of Items	Marks	No. of questions	Marks	Knowing (30%)	Applying (50%)	Reasoning (20%)	
An introduction to the chemistry of transition elements	22%	3	3	10	12	5	7	3	15
Arenes and phenols	18%	3	3		10	4	7	2	13
Carboxylic acids and derivatives	20%	3	3		11	4	7	3	14
Nitrogen compounds	22 %	3	3		12	5	7	3	15
Polymerization	18%	2	2		11	4	7	2	13
Total	100%	14	14		56	22	35	13	70

**Distribution of cognitive domains and marks.**

Serial. No	Question Number	Item	Mark	Unit	Page	Cognitive domain	Out-comes
1	1	1	1	Transition elements	398+ 403	Knowing	1.2a 1.3a 1.3b.i
2	1	2	1	Transition elements	399+ 403+ 404	Applying	1.2b 1.2d
3	1	3	1	Transition elements	398+ 402+ 404	Applying	1.2a 1.2d
4	1	4	1	Arenes and phenols	415	Knowing	2.1c
5	1	5	1	Arenes and phenols	423+ 424	Applying	2.1b 2.1d.i
6	1	6	1	Arenes and phenols	426	Applying	2.1diii
7	1	7	1	Carboxylic acids and derivatives	443	Knowing	3.2a
8	1	8	1	Carboxylic acids and derivatives	443	Applying	3.2c
9	1	9	1	Carboxylic acids and derivatives	441	Reasoning	3.1d
10	1	10	1	Nitrogen compounds	453+ 464	Knowing	4.1b+ 4.2e
11	1	11	1	Nitrogen compounds	464	Applying	4.2e
12	1	12	1	Nitrogen compounds	464	Reasoning	4.2e
13	1	13	1	Polymerization	470	Applying	5.2a
14	1	14	1	Polymerization	476	Reasoning	5.3c,d



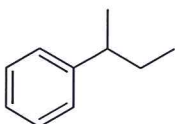
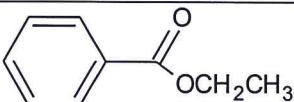
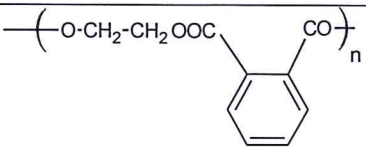
Serial. No	Question Number	Item	Mark	Unit	Page	Cognitive domain	Output
	2	15.a	1	Transition elements	398	Knowing	1.2a
	2	15.b	1	Transition elements	404	Knowing	1.3f
	2	15.c	2	Transition elements	403+ 408	Knowing	1.3h
	2	15.d(i)	1	Transition elements	403+ 408	Applying	1.3c+ 1.3g
	2	15.d(ii)	1	Transition elements	403+ 408	Applying	1.3h+ 1.3g
	2	15.e(i)	1	Transition elements	408	Applying	1.3f
		15.e(ii)	1	Transition elements	408	Applying	1.3f
	2	15.f	1	Transition elements	399	Applying	1.2e
	2	15.g(i)	1	Transition elements	398+ 399	Applying	1.2b
	2	15. g(ii)	2	Transition elements	404	Reasoning	1.3f
	2	16.a	1	Arenes and phenols	426	Knowing	2.1diii
	2	16.b(i)	1	Arenes and phenols	429	Knowing	2.1g
	2	16.b(ii)	1	Arenes and phenols	430	Knowing	2.1div
	2	16.c	2	Arenes and phenols	426	Applying	2.1diii
	2	16.d	3	Arenes and phenols	424	Applying	2.1dii
	2	16.e	2	Arenes and phenols	424	Reasoning	2.1di
	2	17.a	1	Carboxylic acids and derivatives	309	Knowing	3.1aii
	2	17.b(i)	2	Carboxylic acids and derivatives	443	Knowing	3.2a
	2	17.b(ii)	2	Carboxylic acids and derivatives	444	Applying	3.2c
	2	17.b(iii)	2	Carboxylic acids and derivatives	445	Applying	3.2e
	2	18.a	1	Carboxylic acids and derivatives	441-442	Applying	3.1c
	2	18.b	1	Carboxylic acids and derivatives	441-442	Applying	3.1c



	2	18.c	2	Carboxylic acids and derivatives	441-442	Reasoning	3.1c + 1.3bi
	2	19.a	1	Nitrogen compounds	456	Knowing	4.1b
	2	19.b	1	Nitrogen compounds	451	Knowing	4.1dii
	2	19.c	1	Nitrogen compounds	451	Knowing	4.1e
	2	19.d	1	Nitrogen compounds	456	Knowing	4.1e
	2	19.e	1	Nitrogen compounds	456	Reasoning	4.1e
	2	19.f	1	Nitrogen compounds	456	Reasoning	4.1e
	2	20.a	1	Nitrogen compounds	462	Applying	4.2e
	2	20.b	2	Nitrogen compounds	460	Applying	4.2d
	2	20.c	2	Nitrogen compounds	462	Applying	4.2b + 4.2e
	2	20.d	1	Nitrogen compounds	458	Applying	4.1a
	2	21.a(i)	1	Polymerisation	470	Applying	5.1a
	2	21.a(ii)	1	Polymerisation	474	Applying	5.1a
	2	21.b	1	Polymerisation	476	Reasoning	5.3c
	2	21.c(i)	1	Polymerization	470	Applying	5.2b
	2	21.c(ii)	1	Polymerization	474	Applying	5.2b
	2	21.d	2	Polymerization	482	Applying Knowing	5.3e
	2	21.e	1	Polymerization	474-475	Applying	5.3d
	2	21.f	1	Polymerization	470	Knowing	5.1a+ 5.2b
	2	22.a	1	Polymerization	471	Knowing	5.3e
	2	22.b	1	Polymerization	471	Knowing	5.3e

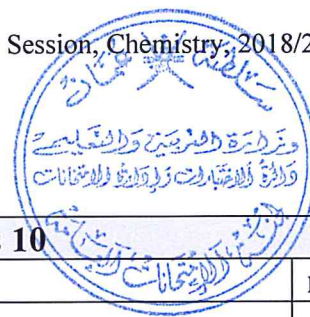


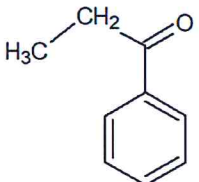
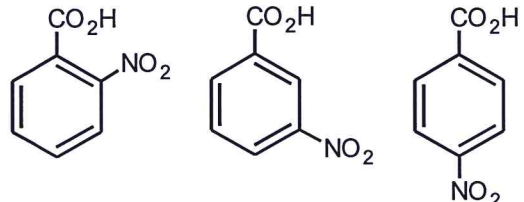
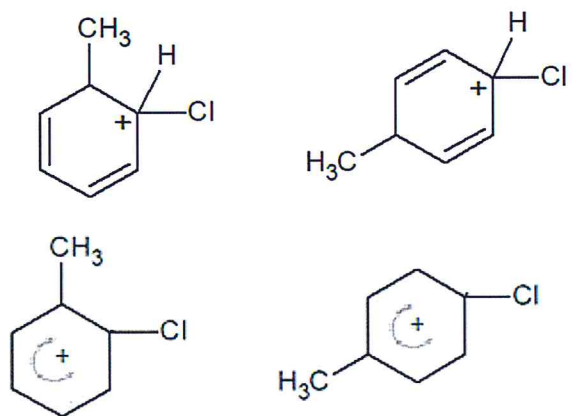
Question ONE TOTAL MARKS: 14 . There are 14 multiple-choice items. Each correct answer is worth ONE mark.

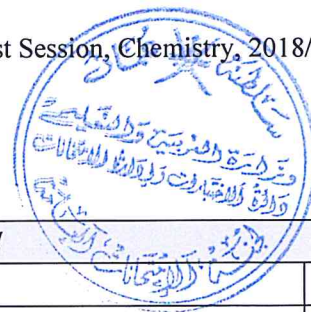
Item No.	Correct option	
1	To form complexes, the ligands are attracted to the metal ions.	
2	$[\text{HO} \blacktriangleright \text{Cu} \cdots \cdots \text{OH}]^{1-}$	$[\text{Ar}]3d^{10}$
3	It lost 5 electrons from 3d subshell and 2 electrons from 4s subshell.	
4	It prevents benzene undergoing substitution reactions.	
5	Acylation	$\text{CH}_3\text{CH}_2\text{COCl}$
6		
7	Electron withdrawing effect of the carbonyl group increases the dipole-dipole attraction.	
8		
9	Electron withdrawing group increases the acidity of carboxylic acid	
10	They both react with acids.	
11	2	
12	$\text{NH}_2\text{CH}_2\text{CO}_2\text{H}$, $\text{NH}_2\text{CH}(\text{CH}_3)\text{CO}_2\text{H}$, $\text{NH}_2\text{CH}(\text{CH}_2\text{OH})\text{CO}_2\text{H}$	
13	Addition	
14		

**Question TWO: TOTAL MARKS: 56**

Item 15		Total marks 12	
item	answer	marks	
15	<p>a</p> <ul style="list-style-type: none"> - Zn forms only the colourless Zn^{2+} ion. - it has 10 electrons in 3d subshell. - it has filled 3d orbital. - has one oxidation state. <p>Any answer from above mark is given.</p>	1	
	b Tetrahedral	1	
	<p>c Bidentate (1 mark)</p> <ul style="list-style-type: none"> - Because each ligand ($\text{C}_2\text{O}_4^{2-}$) joins by two bonds to the metal ion (Co^{3+}). - Because each ligand ($\text{C}_2\text{O}_4^{2-}$) is attached by two coordinate bonds to the metal ion (Co^{3+}). - Because five-membered ring is formed between each ligand. ($\text{C}_2\text{O}_4^{2-}$) and the metal ion ($\text{Co}^{3+}$). - Because each ligand ($\text{C}_2\text{O}_4^{2-}$) forms chelates. - Because each ligand ($\text{C}_2\text{O}_4^{2-}$) contains two groups that have a lone pair of electrons. <p>Any answer from above mark is given. (1 mark)</p>	1 1	
	d(i) Cu^{2+}	1	
	<p>d(ii) $\text{C}_2\text{O}_4^{2-}$ <u>or</u> $^-\text{O}_2\text{CCO}_2^-$ <u>or</u></p>	1	
	e(i) 4 or four	1	
	e(ii) 6 or six	1	
	f +3 (1 mark)	1	
	g(i) $[\text{Ar}]3d^6$	1	
	<p>g(ii)</p> <p>1mark for drawing the three-dimensional shape (the tetrahedral shape) of the complex ion.</p> <p>1mark for writing the correct overall charge on the complex ion (1-).</p>	2	

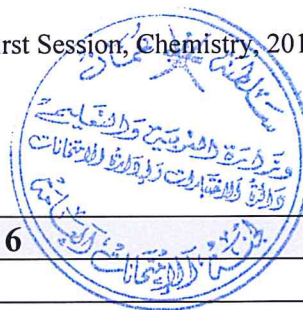


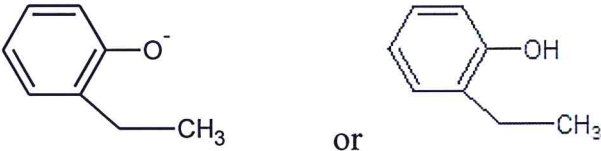
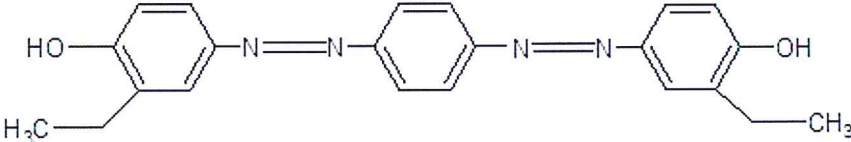
Item 16		Total marks 10	
item	answer		marks
16	a	CH_3^+	1
	b(i)	Cl_2 1/2 mark UV light or boiling 1/2 mark	1
	b(ii)	KMnO_4 (or $\text{Cr}_2\text{O}_7^{2-}$) 1 mark heat with OH^- 1 mark	2
	c		1
	d	 <p>3 marks: each compound 1 mark</p>	3
	e	 <p>One compound is required.</p>	2

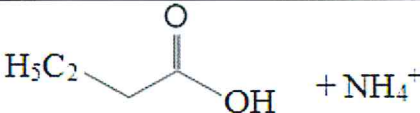
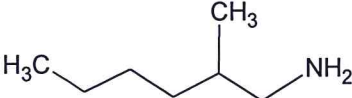


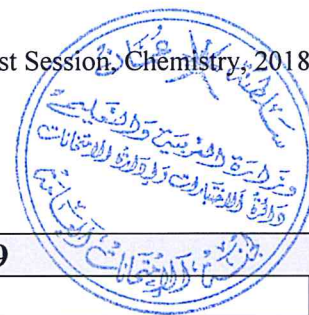
Item 17		Total marks 7	
item	answer	marks	
17 a(i)	CH ₃ CH ₂ OH or C ₂ H ₅ OH	1	
a(ii)	H ⁺ or H ₂ SO ₄	1	
b(i)	Van der Waals' force. (1 mark) And dipole-dipole force. (1 mark)	2	
b(ii)	CH ₃ CH ₂ CONHCH ₂ CH ₃ or C ₂ H ₅ CONHCH ₂ CH ₃	1	
b(iii)	<p>2 marks: each step 1/2 mark</p>	2	

Item 18		Total marks 4	
item	answer	marks	
18 a	C	1	
b	D	1	
c	<p>A (1 mark)</p> <p>$\text{HCOOH} + 2\text{Cu}^{2+}_{(\text{aq})} + 6\text{OH}^- \rightarrow 3\text{CO}_3^{2-}_{(\text{aq})} + 2\text{CuO}_{(\text{s})} + 4\text{H}_2\text{O}$ (1 mark)</p> <p>-To get the mark all components of the equation should be correct.</p> <p>-Balancing equation and physical states are unnecessary.</p>	2	



Item 19		Total marks 6
item	answer	marks
19 a	<ul style="list-style-type: none"> - It react with acids to form salts. - it can gain proton. - it can donate electrons. - it reacts with water to form OH^-. - $\text{C}_6\text{H}_5\text{-NH}_2 + \text{H}^+ \longrightarrow \text{C}_6\text{H}_5\text{-NH}_3^+$. - the lone pair in nitrogen make it a good nucleophile. Any answer from above mark is given. (1 mark)	1
b	$\text{NaNO}_2 + \text{HCl}$ 1/2 mark $\text{T} < 5^\circ\text{C}$ (low $\text{T} < 10^\circ\text{C}$) 1/2 mark	1
c	Coupling reaction.	1
d	electrophilic substitution	1
e		1
f		1

Item 20		Total marks 6
item	answer	marks
20 a	D	1
b	 Each product 1 mark	2
c	Because it contains an <u>acidic group (-COOH)</u> and <u>basic group (-NH2)</u> . I mark 1 mark	2
d		1



Item 21		Total marks 9
item	answer	marks
21 a(i)	B	1
a(ii)	F	1
b	$\left(\text{CF}_2 - \text{CF}_2 \right)_n \quad \text{or} \quad \left(\begin{array}{c} \text{F} \quad \text{F} \\ \quad \\ -\text{C} - \text{C}- \\ \quad \\ \text{F} \quad \text{F} \end{array} \right)_n$	1
c(i)	Addition polymerisation.	1
c(ii)	Condensation polymerisation.	1
d	D [1 mark] - Because it has conjugated double bonds. - The π bonds on adjacent alkene units overlap and the π electrons become delocalized throughout the whole length of rubber chain. Any answer from above mark is given [1mark]	2
e	Ester group. Or -COO- or R-COO-R'	1
f	Because it has double bonds or unsaturated bonds.	1

Item 22		Total marks 2
item	answer	marks
22 a	Heating natural polymer (or rubber) with sulfur.	1
b	- Higher melting point. - Greater strength -Durable - Resist environmental conditions. - Stay longer. Any answer from above mark is given [1mark]	1

End of mark scheme