



## الدور الأول - الفصل الدراسي الأول

- 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.

- 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 ( ) مسقط ( )  
 الدوحة ( ) أبو ظبي ( )

**ملاحظة:** يتم تظليل الشكل ( ) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ( ) غير صحيح ( )

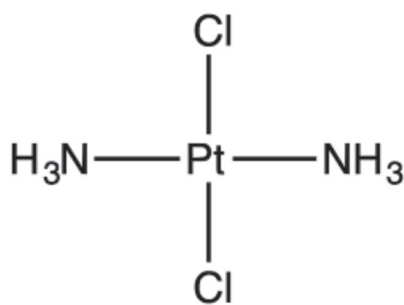
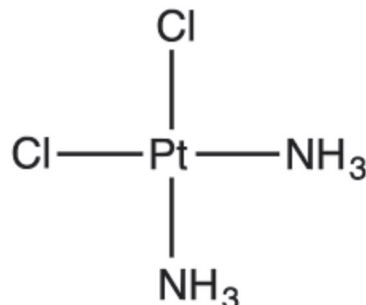
مُسَوَّدَة، لا يتم تصحيحها

**Question 1: Multiple Choice Items****(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 is correct about the two isomers of complex platinum shown below?

**isomer (1)****isomer (2)**

- ☐ Isomer (1) is *cis*-platin, but isomer (2) is *trans*-platin
- ☐ Isomer (2) is neither *cis* nor *trans*-platin
- ☐ Both isomers have tetrahedral shape.
- ☐ Only isomer (2) is very effective in treating cancer.
- 2) A cation of  $\text{Cu}^{2+}$  forms a linear complex with  $\text{OH}^-$ . Which of the following options shows the correct structure and electronic configuration of  $\text{Cu}^{2+}$  ion for this complex? (Atomic number of Cu=29)

	Structure of the complex ion	Electronic configuration of $\text{Cu}^{2+}$
<input type="checkbox"/>	$[\text{HO} \blacktriangleright \text{Cu} \cdots \cdots \text{OH}]$	$[\text{Ar}]3\text{d}^{10}4\text{s}^1$
<input type="checkbox"/>	$[\text{HO} \blacktriangleright \text{Cu} \cdots \cdots \text{OH}]^{1-}$	$[\text{Ar}]3\text{d}^{10}$
<input type="checkbox"/>	$[\text{HO} \blacktriangleright \text{Cu} \cdots \cdots \text{OH}]$	$[\text{Ar}]3\text{d}^9$
<input type="checkbox"/>	$[\text{HO} \blacktriangleright \text{Cu} \cdots \cdots \text{OH}]^{1-}$	$[\text{Ar}]3\text{d}^94\text{s}^2$

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## Question 1 continued

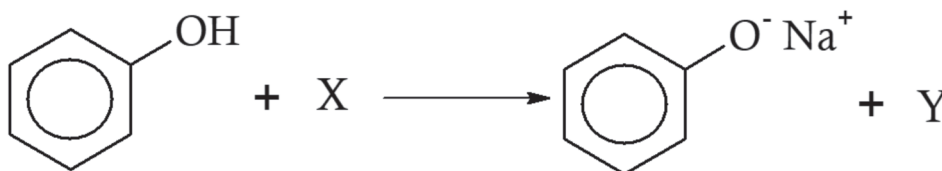
3) Which of the following options is correct for the complex ion in  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl}$ ?

	Oxidation state of Cr	Expected shape	Number of ligands
<input type="radio"/>	+6	Tetrahedral	4
<input type="radio"/>	+3	Octahedral	4
<input type="radio"/>	+6	Tetrahedral	6
<input type="radio"/>	+3	Octahedral	6

4) Which of the following statements is incorrect about benzene?

- ☐ All of its bond angles are  $120^\circ$ .
- ☐ Its atoms are arranged in a regular hexagon.
- ☐ It undergoes nucleophilic addition reactions readily.
- ☐ The bonds between carbon atoms have the same length.

5) For the reaction below:



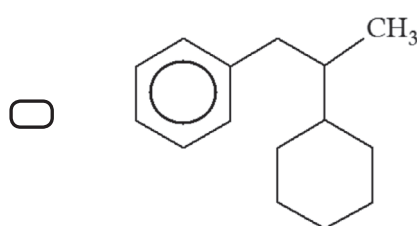
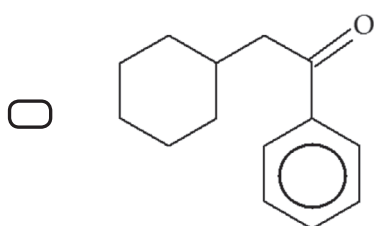
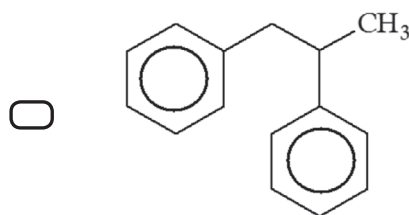
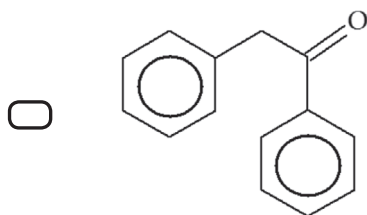
Which of the following options is correct about reagent (X) and product (Y)?

	Reagent (X)	Product (Y)
<input type="radio"/>	Na	HCl
<input type="radio"/>	Na	$\frac{1}{2}\text{H}_2$
<input type="radio"/>	NaOH	HCl
<input type="radio"/>	NaOH	$\frac{1}{2}\text{H}_2$

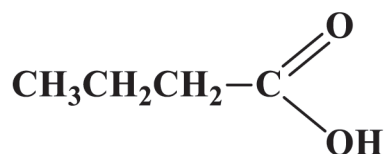
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**Question 1 continued**

- 6) Which of the following would be a possible organic product from the Friedel-Crafts acylation of benzene with  $(C_6H_{11})-CH_2COCl$ ?



- 7) Which of the following statements about the reactions of acyl chlorides is **incorrect**?
- ☐ They undergo nucleophilic substitution reaction.
  - ☐ They react with amines to produce amides.
  - ☐ They react with alcohols to produce carboxylic acids.
  - ☐ They react readily with phenols to produce esters.
- 8) Which of the following statements is correct about the compound below?



- ☐ It is a strong carboxylic acid.
- ☐ It evolves  $H_{2(g)}$  when reacts with carbonates.
- ☐ Its acidity strength is decreased by the alkyl group.
- ☐ It dissociates to a large extent when dissolved in aqueous solution.

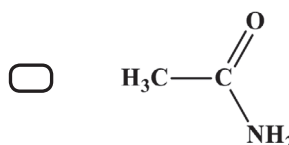
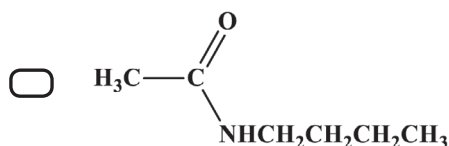
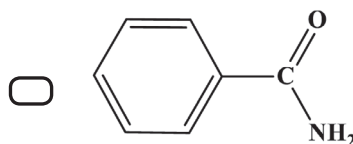
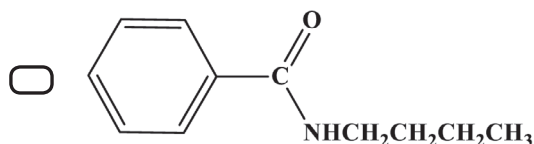
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## Question 1 continued

A compound *R* has the following properties:

- It is an aryl compound.
- It is produced by reacting acyl chloride with primary amine.

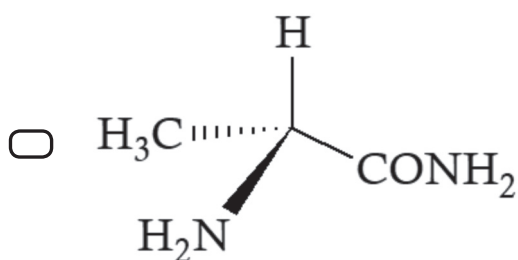
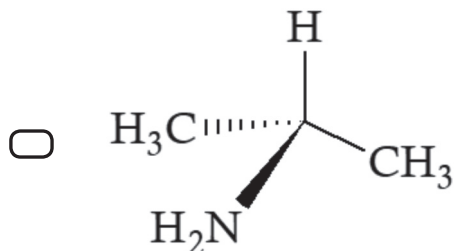
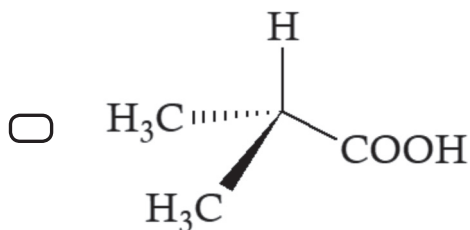
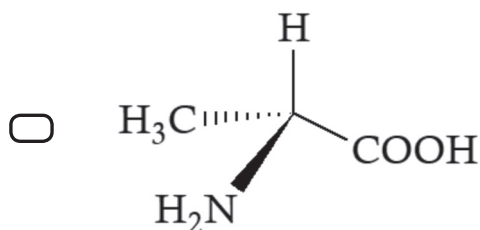
9) Which structure could represent *R*?



10) Which of the following properties is incorrect about ethylamine?

- ☐ It is a primary amine.
- ☐ It is soluble in water.
- ☐ It reacts with alkyl halides.
- ☐ It is a weaker base than ammonia.

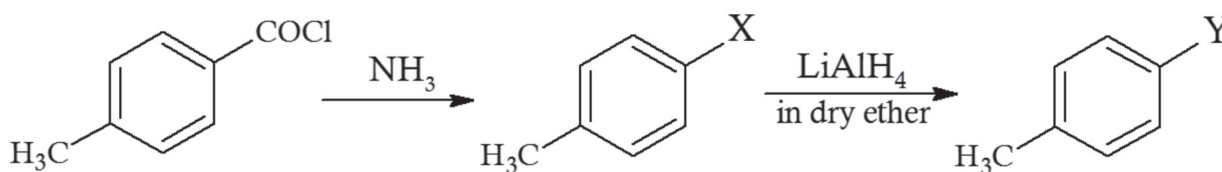
11) Which of the following compounds can form a zwitterion?



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## Question 1 continued

12) For the reaction sequence below:



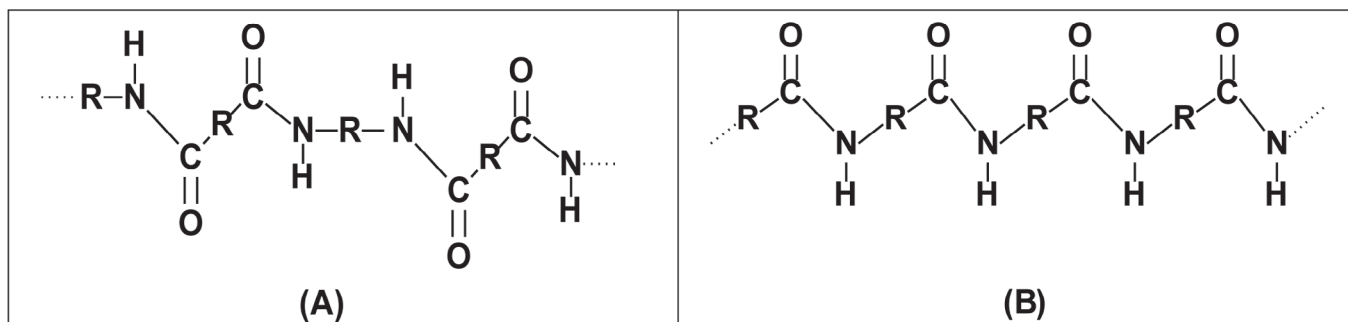
Which of the following options represents substituents (X) and (Y)?

	X	Y
<input type="radio"/>	$-\text{CH}_2\text{NH}_2$	$-\text{CONH}_2$
<input type="radio"/>	$-\text{CONH}_2$	$-\text{CH}_2\text{NH}_2$
<input type="radio"/>	$-\text{CONH}_2$	$-\text{COOH}$
<input type="radio"/>	$-\text{CH}_2\text{NH}_2$	$-\text{COOH}$

13) Which of the statements below is **incorrect** about polymerisation of polypropene?

- ☐ It involves Ziegler-Natta catalyst.
- ☐ The double bonds are converted into single bonds.
- ☐ All carbon atoms of the monomer become part of the chain.
- ☐ It forms propene subunits forming head-to-tail arrangement.

14) Which of the following is correct about polymers (A, B) ?



- ☐ Both of them are type II polymers.
- ☐ Both of them are formed by addition polymerisation.
- ☐ In both of them, the direction of the linkage is the same.
- ☐ Polymer (A) has a peptide bond, whereas polymer (B) does not.

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**Question 2: Extended Questions****(42 marks)**

15) A transition metal ion  $\text{Co}^{2+}$  can form a complex ion with six  $\text{Cl}^-$  ions.

a. What is meant by transition metal?

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b. Which one, cobalt or calcium metal has higher density? Explain your answer.

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c. Which one, zinc or cobalt has higher melting point?

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d. Write the electronic configuration of cobalt ion  $\text{Co}^{2+}$  using [Ar] to represent the argon core.

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e. How many pairs of electrons are donated by the six ligands for the expected complex ion?

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f. What is the type of ligand in this complex ion (monodentate or bidentate)? Explain your answer.

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## Question 2 continued

- g. Draw the complex ion formed by one  $\text{Co}^{2+}$  ion with six  $\text{Cl}^-$  ions. Your drawing should clearly show three-dimensional shape and should include the overall charge on the complex ion.

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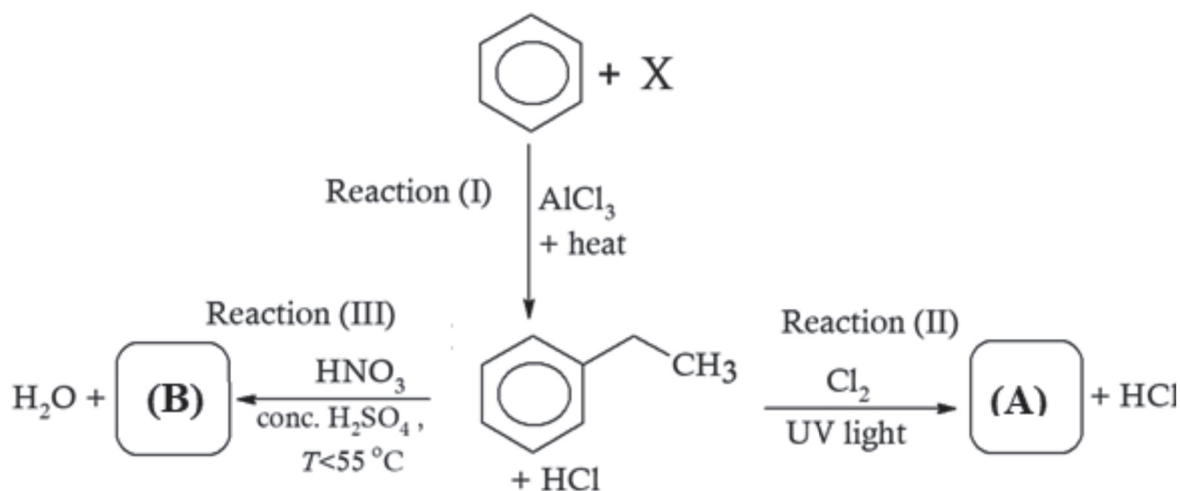
- h. If all ligands ( $\text{Cl}^-$  ions) of this complex ion are replaced with  $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$  ligand to form new complex ion with cobalt ion  $\text{Co}^{2+}$ , how many ligands of  $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$  are needed to form the new complex ion. Explain your answer.

(i) Number of ligands: \_\_\_\_\_

(ii) Explanation: \_\_\_\_\_

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



- a. Write the structural formula of the carbocation intermediate formed in the chlorination of benzene?

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## Question 2 continued

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b. For reaction (I):

(i) What is the type of this reaction?

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(ii) Write the structural formula of reagent X.

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(iii) Name the organic product formed in reaction (I).

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c. For reaction (II):

(i) Write the structural formula of compound (A).

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(ii) Write the structural formula of the predicted organic product if warm  $\text{AlCl}_3$  is used instead of UV light?

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d. For reaction (III):

(i) What is the type of this reaction?

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(ii) Write the structural formula of compound (B).

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## Question 2 continued

17) Phenol decolourises a dilute solution of bromine in water at room temperature.

a. Write the equation for this reaction.

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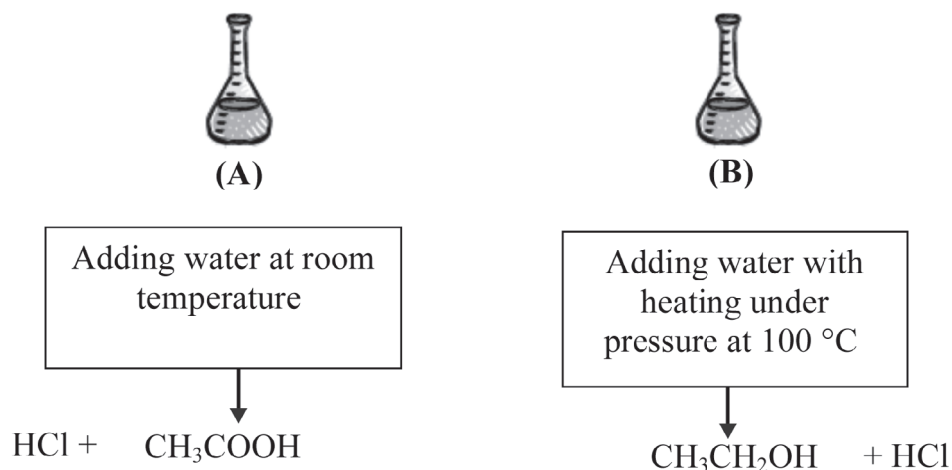
b. Explain why phenol is more reactive with bromine than benzene.

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18) A group of students carried out two reactions on two unknown compounds (A and B). One of them is acyl chloride and the other is chloroalkane. Their steps and results are shown in the diagram below. Study it to answer the questions below.



a. For compounds (A) and (B):

(i) Write the structural formula for:

Compound (A)? \_\_\_\_\_

Compound (B)? \_\_\_\_\_

(ii) Which would you expect to have higher boiling point, compound (A) or compound (B)? Explain your answer.

Higher boiling point is: \_\_\_\_\_

Explanation: \_\_\_\_\_

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## Question 2 continued

b. For the organic products resulted from the two reactions:

(i) Which one is more acidic  $\text{CH}_3\text{COOH}$  or  $\text{CH}_3\text{CH}_2\text{OH}$ ? Explain your answer.

More acidic is: \_\_\_\_\_

Explanation: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(ii) If those two products are mixed by adding strong acid with heating under reflux, write the structural formula of the produced organic product?

\_\_\_\_\_

c. If two groups of  $\text{—Cl}$  are added on the opposite side of the  $\text{—COOH}$  group of  $\text{CH}_3\text{COOH}$  to be  $\text{Cl}_2\text{CHCOOH}$ . What will be the effect on the acidity of  $\text{CH}_3\text{COOH}$ ?

\_\_\_\_\_

19) Use curly arrows to draw the mechanism for the reaction of  $\text{CH}_3\text{CH}_2\text{CH}_2\text{—COCl}$  with water.

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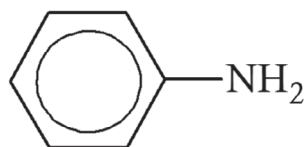
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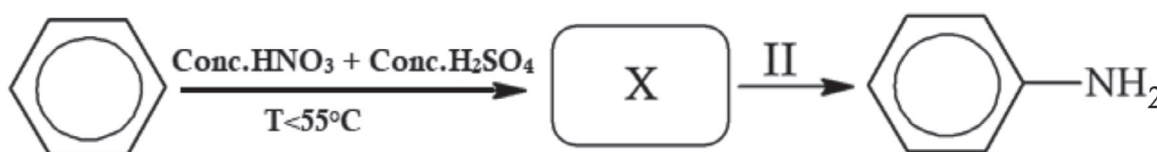
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## Question 2 continued

- 20) Phenylamine is an important organic compound for the production of dyes and other industrial chemicals.



- a. Phenylamine can be synthesised from benzene in two steps



- (i) Write the structural formula of compound (X) shown in the scheme above.

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- (ii) Suggest suitable reagents and conditions for step II.

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- b. Phenylamine is a base.

- (i) Write an equation for the reaction of phenylamine with HCl.

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- (ii) Which is less basic phenylamine or ethylamine? Explain your answer.

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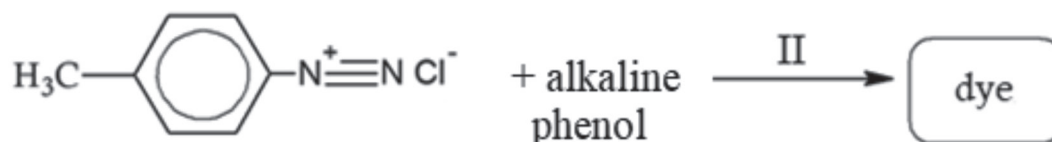
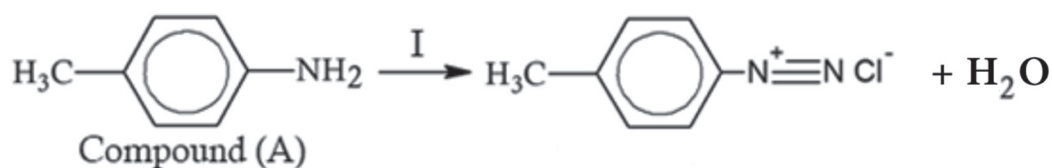
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## Question 2 continued

21) A dye can be made as shown below.



a. For step (I):

(i) State the required reagents and conditions.

\_\_\_\_\_

(ii) What do we call this type of salt produced in step (I)?

\_\_\_\_\_

b. For step (II):

(i) What is the name of the reaction?

\_\_\_\_\_

(ii) Write the structural formula of the dye formed in the above scheme.

\_\_\_\_\_

c. Write the structural formula of the organic compound formed when compound (A) is added to  $\text{CH}_3\text{CH}_2\text{COCl}$ .

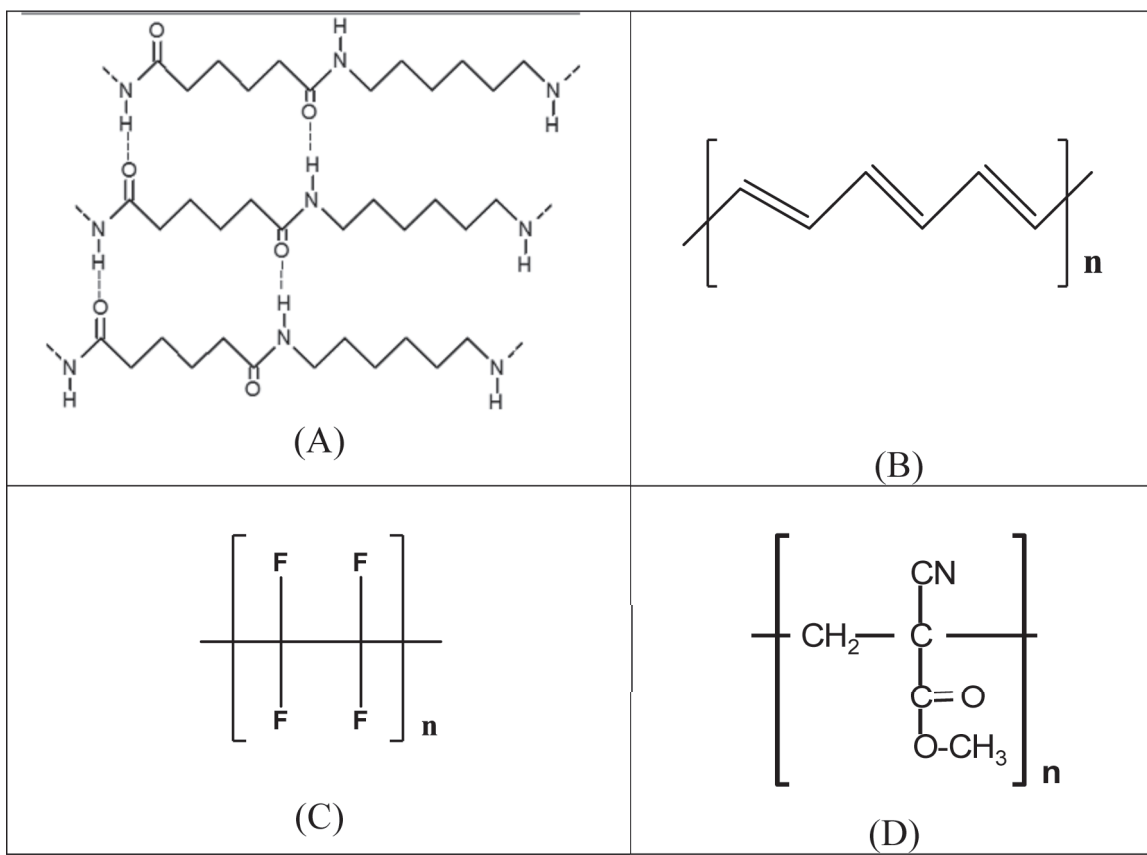
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## Question 2 continued

22) Study the following polymers and answer the questions below.



a. Identify the type of polymerisation (addition or condensation) for each polymer?

(i) Polymer A: \_\_\_\_\_

(ii) Polymer B: \_\_\_\_\_

(iii) Polymer C: \_\_\_\_\_

(iv) Polymer D: \_\_\_\_\_

b. What makes polymer (A) one of the strongest polymers?

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## Question 2 continued

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- c. Write the structural formula(e) of the monomer(s) for polymer (D) .

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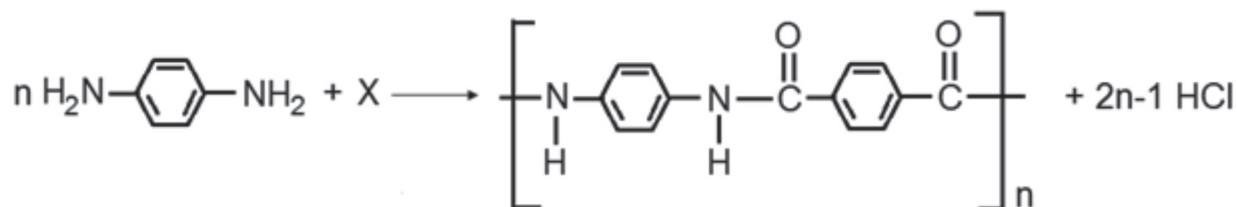
- d. Which polymer represents Nylon 6.6?

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- e. Which polymer is a non-sticking polymer?

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- 23) Study the following reaction and answer the question below.



- a. What is meant by polymerisation?

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- b. Write the structural formula of monomer X.

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- c. What is the name of the functional group formed in the produced polymer?

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[ End of Examination ]

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## PERIODIC TABLE OF THE ELEMENTS

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

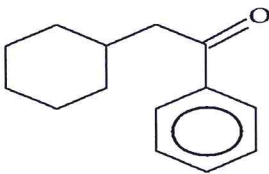
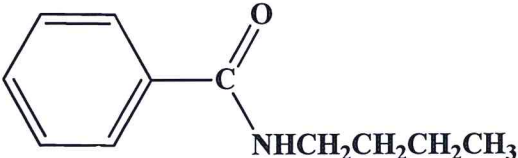
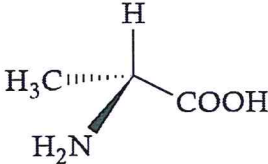
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**TOTAL MARKS: 70**

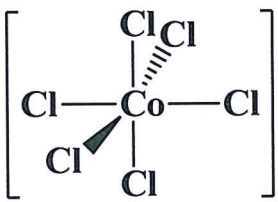
**Question One (14 Marks)**

**There are 14 multiple-choice items. Each correct answer worth ONE mark.**

Item No.	Correct option
1	d. Only Isomer (2) is very effective in treating cancer
2	c. $\left[ \text{HO} \blacktriangleright \text{Cu} \cdots \cdots \text{OH} \right]$ $[\text{Ar}]3d^9$
3	d. +3 Octahedral 6
4	c. It undergoes nucleophilic addition reactions readily.
5	b. $\text{Na} \quad \frac{1}{2}\text{H}_2$
6	c. 
7	c. They react with alcohols to produce carboxylic acids.
8	c. Its acidity strength is decreased by the alkyl group.
9	a. 
10	d. It is a weaker base than ammonia.
11	a. 
12	b. $-\text{CONH}_2$ $-\text{CH}_2\text{NH}_2$
13	c. All carbon atoms of the monomer become part of the chain.
14	a. Both of them are type II polymers.

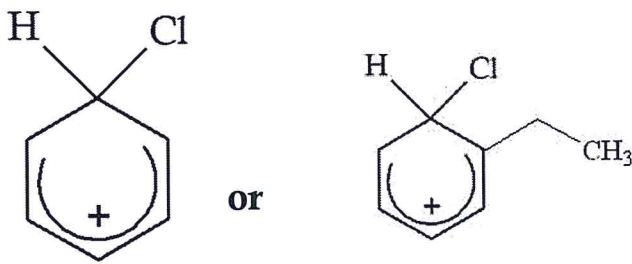
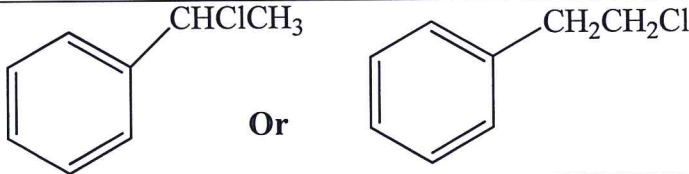
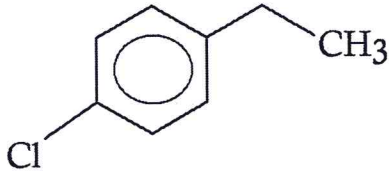
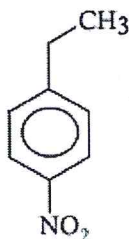
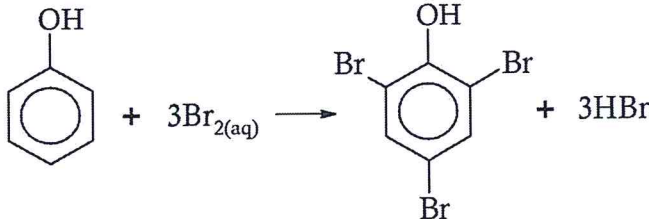


**QUESTION TWO: Extended response (56 marks)**

Part	Section	The answer	Marks
15	a.	In terms of d-block elements, forming one or more stable ions with incomplete d orbitals. <b>Or</b> transition metal is those metals in the block that show properties characteristically different from those in the s and d blocks. <b>Or</b> those elements that have electronic configuration from $[\text{Ar}]3d^14s^2$ to $[\text{Ar}]3d^{10}4s^2$ inclusive. <b>Any answer from above mark is given.</b>	1
	b.	Cobalt / Co (1mark) Because <u>the metallic radii tend to decrease across the period as the increasing nuclear charge</u> attracts the outer electrons more strongly. This decrease in metallic radii means that the density of the transition metal (Co) is higher than that of calcium. (1mark)	2
	c.	Cobalt / (Co)	1
	d.	$[\text{Ar}]3d^7$	1
	e.	6 pairs of electrons or 12 electrons	1
	f.	Monodentate (1 mark) Because each ligand ( $\text{Cl}^-$ ) joins by one bond to the metal ion ( $\text{Co}^{2+}$ ) <b>Or</b> because each ligand ( $\text{Cl}^-$ ) is attached by one coordinate bond to the metal ion ( $\text{Co}^{2+}$ ) or because each ligand ( $\text{Cl}^-$ ) contains one groups of a lone pair of electrons. (1 mark) <b>Any answer from above mark is given.</b>	2
	g.	4-  -1 mark for drawing the three-dimensional shape (the octahedral shape) of the complex ion. -1 mark for writing the correct overall charge on the complex ion (-4).	2
	h.	Three or 3 (1 mark) Because the ligand ( $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ ) is bidentate <b>Or</b> each ligand ( $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ ) joins by two bond to the metal ion ( $\text{Co}^{2+}$ ) <b>Or</b> because each ligand ( $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ ) is attached by two coordinate bond to the metal ion ( $\text{Co}^{2+}$ ) <b>Or</b> because each ligand ( $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ ) contains two lone pairs of electrons (1 mark) <b>Any answer from above mark is given.</b>	2

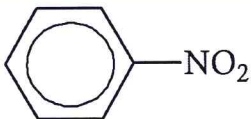
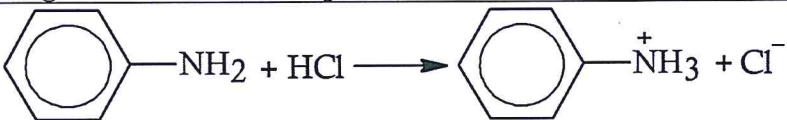
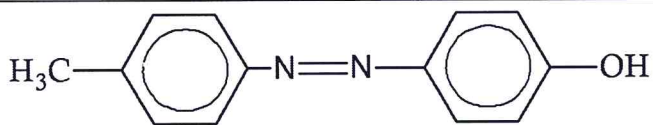
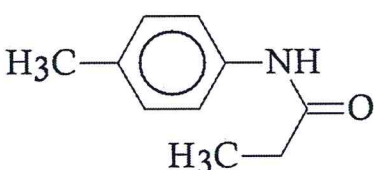




Part	Section	The answer	Marks
16	a	 <p>If the student draws any correct mesomere mark is given.</p>	1
	b.i	Friedel-Crafts <u>Alkylation</u>	1
	b.ii	CH <sub>3</sub> CH <sub>2</sub> Cl	1
	b.iii	Ethylbenzene	1
	c.i	 <p>Or</p>	1
	c.ii	 <p>If the student draws Cl on 2, 3, 5 or 6 position mark is given.</p>	1
	d.i	Nitration	1
17	d.ii	 <p>If the student draws NO<sub>2</sub> on 2, 3, 5 or 6 position mark is given.</p>	1
	a	 <p>To get the mark all components of the reaction should be correct.</p>	1
	b	Because of the delocalization of the lone pair of electrons on oxygen over the arene ring.	1

Part	Section	The answer	Marks
18	a.i	Compound (A): $\text{CH}_3\text{COCl}$ (1 mark) Compound (B): $\text{CH}_3\text{CH}_2\text{Cl}$ (1 mark)	2
	a.ii	Higher boiling point is: Compound (A) or $\text{CH}_3\text{COCl}$ (1 mark) Explanation: because of the extra electron-withdrawing effect of the carbonyl group of acyl chloride, resulting in extra dipole-dipole attractions compared with the halogenoalkane. (1 mark) <b>If the student selected compound (B) to be acyl chloride and his explanation is correct mark is given.</b>	2
	b.i	More acidic: is $\text{CH}_3\text{COOH}$ . (1 mark) Explanation: because the negative charge on the carboxylate anions of carboxylic acid can be delocalized over two electronegative oxygen atoms. <b>Or</b> because of the increasing ability of the molecular structures to delocalize the negative charge in the carboxylate anions of carboxylic acid rather than in the alkoxide of alcohol. (1 mark)	2
	b.ii	$\text{CH}_3\text{COOCH}_2\text{CH}_3$	1
	c.	increase	1
19		<p> <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{C}(=\text{O})\text{Cl} + \text{H}-\ddot{\text{O}}:^- \longrightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{C}(\text{O}^-)(\text{OH}_2^+)\text{Cl}</math>  <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{C}(\text{O}^-)(\text{OH}_2^+)\text{Cl} \longrightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{C}(=\text{O})\text{OH}_2^+ + :\text{Cl}^-</math>  <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{C}(=\text{O})\text{OH}_2^+ + :\text{Cl}^- \longrightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{C}(=\text{O})\text{OH} + \text{HCl}</math> </p> <p>-Each step worth 1 mark. -To get the mark all components of the equation should be correct. -To get the mark all the arrows should be drawn.</p>	3



Part	Section	The answer	Marks
20	a.i		1
	a.ii	Sn + Conc. HCl, heat 1 mark 1 mark To get the mark all components should be included.	2
	b.i	 To get the mark all components of the equation should be correct.	1
	b.ii	Phenylamine. 1 mark Because in ethylamine, the electron-donating alkyl group attached to the nitrogen atom increase the basicity that the lone pair of electrons on nitrogen will be more available to form a dative bond with a proton. Or, in the phenylamine the lone pair of electrons on nitrogen atom is delocalised over the benzene ring. 1 mark	2
21	a.i	HNO <sub>2</sub> , NaNO <sub>2</sub> , HCl, at T < 5 °C Each component is worth 0.5 mark	2
	a.ii	Diazonium	1
	b.i	a coupling reaction.	1
	b.ii		1
	c.		1





<u>Part</u>	<u>Section</u>	<u>The answer</u>	<u>Marks</u>
22	a	A: condensation, B,C &D: addition <b>Each polymer worth 1 mark</b>	4
	b	Because of the strong hydrogen bonds between the chains	1
	c	$\text{CH}_2=\text{C}(\text{CN})\text{CO}_2\text{CH}_3$	1
	d	A	1
	e	C	1
23	a	a process of reacting monomers molecules together in a chemical reaction to form polymer chains	1
	b	$\text{Cl}-\text{C}(=\text{O})-\text{C}_6\text{H}_4-\text{C}(=\text{O})-\text{Cl}$	1
	c	Amide or peptide	1

(6)

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