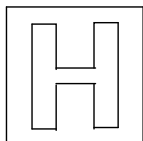


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RAFFLES INSTITUTION
2021 Year 6 Term 3 Common Test

HIGHER 2



CHEMISTRY

9729

1 July 2021
2 hours 45 minutes

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your name, 6-digit index number and civics tutorial group in the spaces provided on the OMR sheet and the cover sheet on page 21. Shade in your 6-digit exam index number on the OMR Answer Sheet.

This paper consists of three sections **A**, **B** and **C**.

Section A (15 marks) consists of 15 multiple-choice questions.

Answer this section first. Your OMR Answer Sheet will be collected after the first 30 minutes. Record your answers to this section in soft pencil on the separate OMR Answer Sheet.

Section B (40 marks) consists of 3 structured questions.

Answer all questions in the spaces provided in the question paper.

If additional space is required, you should use the pages at the end of the booklet for Section B (pages 19 – 20). The question number must be clearly shown.

Section C (40 marks) consists of 4 free-response questions.

Answer both C1 and C2 and answer only **one** of **C3 EITHER** or **C3 OR**. Write your answers in the spaces provided in the question paper.

If additional space is required, you should use the pages at the end of the booklet for Section C (pages 38 – 40). The question number must be clearly shown.

The number of marks is given in brackets [] at the end of each question or part question.

Write in dark blue or black pen. You may be subject to penalty for writing answers in pencil.

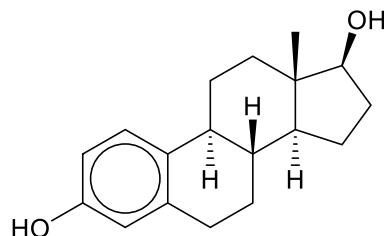
Answers to Sections **B** and **C** are to be handed in **separately**.

Question	Marks
B1	/ 17
B2	/ 13
B3	/ 10

Section A (15 marks)

For each question, there are four possible answers, **A**, **B**, **C**, and **D**. Choose the one you consider to be correct.

- 1** Estradiol ($M_r = 272.0$), $C_{18}H_{24}O_2$, is an important hormone found in the female body.



estradiol

What is the volume of gas formed when 76 mg of estradiol is reacted with excess sodium at s.t.p.?

- A** 3.17 cm³ **B** 3.35 cm³ **C** 6.34 cm³ **D** 6.71 cm³

- 2** *Use of the Data Booklet is relevant to this question.*

Which species has more electrons than neutrons? ($D = {}^2_1H$)

- A** ${}^{11}BD_4^-$ **B** CD_3^- **C** ND_4^+ **D** D_3O^+

- 3** The boiling point of butan-1-ol is greater than 2-methylpropan-2-ol.

Which statements can explain why this is the case?

- 1** The strength of the instantaneous dipole-induced dipole interactions is greater in butan-1-ol than in 2-methylpropan-2-ol.
- 2** The strength of the hydrogen bonds is greater in butan-1-ol than in 2-methylpropan-2-ol.
- 3** The extent of hydrogen bonding is greater in butan-1-ol than in 2-methylpropan-2-ol.

- A** 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 only

- 4 A student mixed 25.0 cm^3 of 2.0 mol dm^{-3} nitric acid to a **smaller** volume of $y \text{ cm}^3$ of 2.0 mol dm^{-3} potassium hydroxide. The temperature of the solution increases by 10.0°C .

You are given the following information.

$$\begin{aligned}\text{specific heat capacity of water} &= 4.18 \text{ kJ kg}^{-1} \text{ K}^{-1} \\ \text{enthalpy change of neutralisation} &= -57.3 \text{ kJ mol}^{-1}\end{aligned}$$

What is the value of y ?

- A 2.42 B 7.18 C 9.12 D 14.35

- 5 When a glow stick is bent, the inner glass chamber breaks and the reactants are mixed, triggering a series of reactions. Highly unstable 1,2-dioxetanedione is formed and it decomposes into the more stable carbon dioxide, causing the dye to be excited, forming dye*.



The excited dye* returns to ground state by emitting photons, which results in fluorescent light being emitted.



Which row of the table gives the correct signs of ΔH , ΔS and ΔG for the **overall** decomposition reaction of 1,2-dioxetanedione, which leads to the emission of fluorescent light?

	ΔH	ΔS	ΔG
A	+	+	-
B	-	+	-
C	-	-	+
D	+	-	+

- 6 Since its manufacture, a drug **X** has remained in storage for 3 years. Analysis shows that the rate constant for the drug's decomposition is $7 \times 10^{-2} \text{ year}^{-1}$.

The decomposition of **X** follows first-order kinetics, and the concentration of **X** decreases to $(\frac{1}{2})^n$ of its original concentration after n half-lives have passed.

What percentage of the original concentration of **X** remains after 3 years?

- A** 81% **B** 67% **C** 53% **D** 30%

- 7 Which of the following statements concerning the reaction $\text{A} \longrightarrow 2\text{B}$ is **always** correct?

- A** The reaction is a first-order reaction.
B Increasing the concentration of **A** increases the rate of the reaction.
C Adding a suitable catalyst to the reaction mixture affects the rate of the reaction.
D Removing product **B** as it is being formed during the reaction helps to increase the rate of the reaction.

- 8 Which solution is the most effective in resisting pH changes when a small amount of acid or base is added?

- A** a solution obtained by mixing 15 cm^3 of $1 \text{ mol dm}^{-3} \text{ CH}_3\text{CO}_2\text{Na}$ with 30 cm^3 of $1 \text{ mol dm}^{-3} \text{ HCl}$
B a solution obtained by mixing 20 cm^3 of $1 \text{ mol dm}^{-3} \text{ CH}_3\text{CO}_2\text{Na}$ with 10 cm^3 of $1 \text{ mol dm}^{-3} \text{ HCl}$
C a solution obtained by mixing 10 cm^3 of $1 \text{ mol dm}^{-3} \text{ CH}_3\text{CO}_2\text{H}$ with 20 cm^3 of $1 \text{ mol dm}^{-3} \text{ NaOH}$
D a solution obtained by mixing 30 cm^3 of $1 \text{ mol dm}^{-3} \text{ CH}_3\text{CO}_2\text{H}$ with 15 cm^3 of $1 \text{ mol dm}^{-3} \text{ NaOH}$

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9 Which solution can dissolve the greatest amount of silver chloride?

- A aqueous silver nitrate
- B aqueous ammonium chloride
- C dilute nitric acid
- D aqueous ammonia

10 In a rechargeable nickel-cadmium battery, the charging process takes place by passing an electric current through the cells.

During discharge, the battery acts as a voltaic cell. The half-equations of the reactions at the electrodes and their reduction potentials are as follows.



Which of the following species is formed at the negative electrode of the battery during discharge?

- A Cd(OH)_2
- B Cd
- C NiOOH
- D Ni(OH)_2

11 Use of the Data Booklet is relevant to this question.

Elements K, L and M are in Period 3.

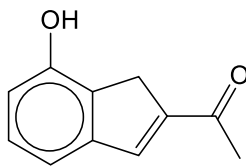
M has the highest melting point. The oxide of K dissolves in dilute potassium hydroxide. The pH of the chlorides in water decreases in the following order: $\text{L} > \text{M} > \text{K}$.

What could be the identities of K, L and M?

	K	L	M
1	P	Mg	Al
2	Si	Na	Mg
3	Al	Mg	Si

- A 1 only
- B 2 and 3 only
- C 2 only
- D 1, 2 and 3

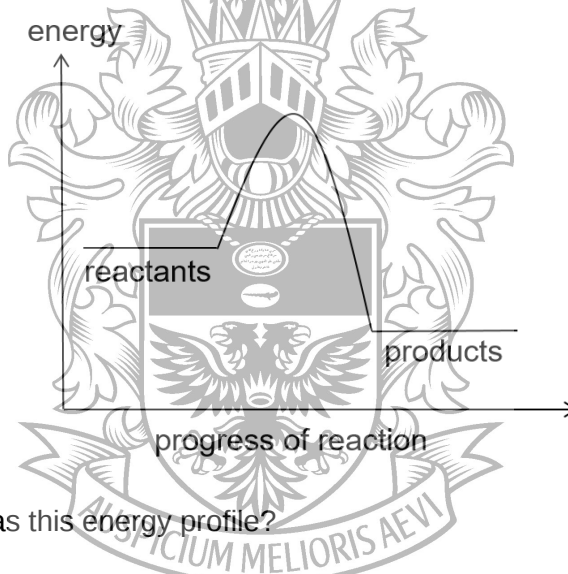
- 12 Which statements about the following compound are correct?



- 1 It reacts with $\text{Br}_2(\text{aq})$ to produce a major product with three bromine atoms.
- 2 It reacts with $\text{Na}_2\text{CO}_3(\text{aq})$ to produce CO_2 gas.
- 3 It reacts with LiAlH_4 in dry ether to produce a compound with two chiral centers.

A 1 only B 3 only C 1 and 3 only D 2 and 3 only

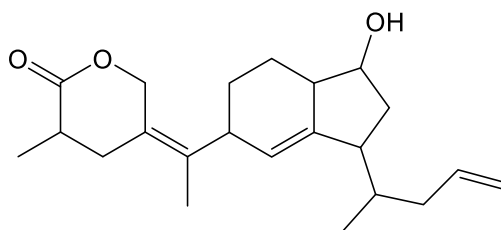
- 13 The diagram represents the energy profile of a chemical reaction.



Which reaction has this energy profile?

- A $\text{C}_6\text{H}_5\text{Cl} + \text{CN}^- \longrightarrow \text{C}_6\text{H}_5\text{CN} + \text{Cl}^-$
- B $\text{CH}_3\text{COCH}_3 + \text{HCN} \longrightarrow \text{CH}_3\text{C}(\text{CN})(\text{OH})\text{CH}_3$
- C $\text{CH}_2=\text{CHCH}_3 + \text{HBr} \longrightarrow \text{CH}_3\text{CHBrCH}_3$
- D $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{Br} + \text{OH}^- \longrightarrow \text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{OH} + \text{Br}^-$

- 14 What is the maximum number of stereoisomers for the molecule below?



- A 2^5 B 2^6 C 2^7 D 2^8

- 15 Cyclopentylbenzene undergoes substitution with chlorine gas. What is a possible by-product for this reaction?

A

B

C

D



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Section B (40 marks)

This section consists of **3** questions.
Answer **all** the questions in this section.

B1 Phenylamine, $\text{C}_6\text{H}_5\text{NH}_2$, is one of the most widely used reactants for organic synthesis. The $\text{p}K_{\text{b}}$ for phenylamine at 25°C is 9.40.

(a) The conjugate acid of phenylamine is phenylammonium ion.

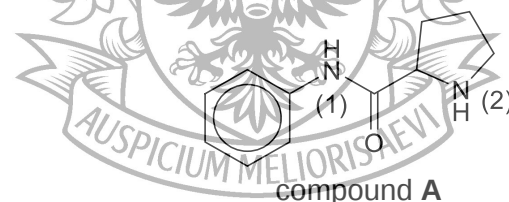
(i) Write the equation for hydrolysis of phenylammonium ion.

.....[1]

(ii) Calculate the pH of a $0.100 \text{ mol dm}^{-3}$ phenylammonium chloride solution.

[2]

(b) Phenylamine can be used to synthesise compound **A**.



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Name the two nitrogen-containing functional groups in compound **A**.

Explain which of the two nitrogen-containing groups, (1) or (2), has a higher $\text{p}K_{\text{b}}$ value.

.....

.....

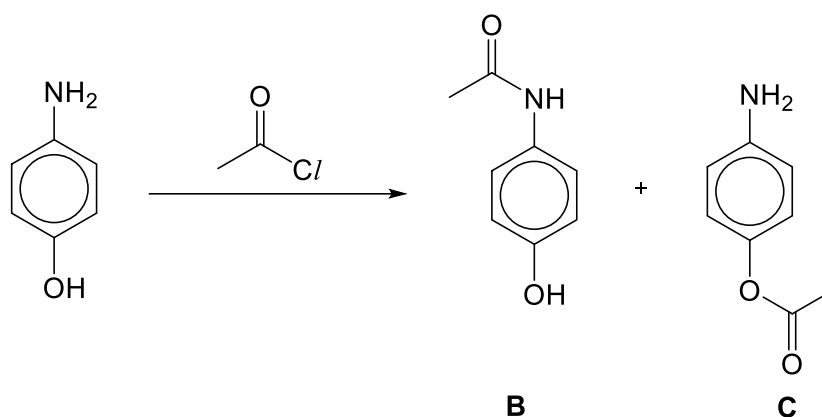
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.....

.....[2]

- (c) 4-Aminophenol reacts with ethanoyl chloride according to the following reaction.



- (i) Explain why **B** is the major product of this reaction.

.....

[1]

- (ii) Suggest a suitable reagent which can be added to 4-aminophenol to increase the yield of **C**.

.....[1]

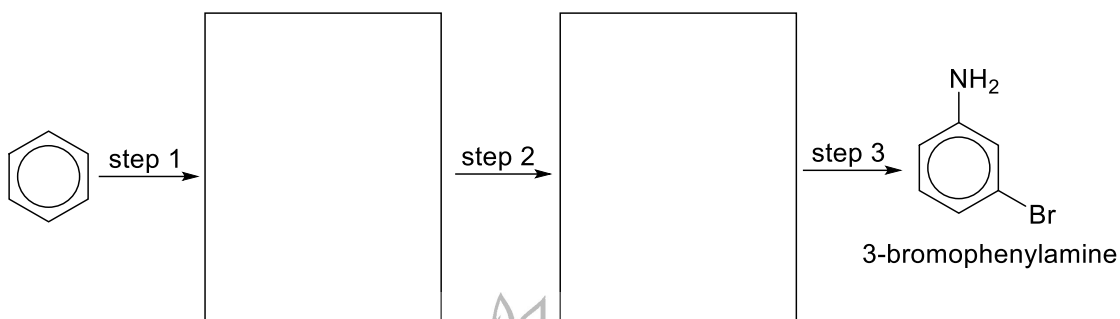
- (iii) Draw the structures of the products formed when **C** is heated with dilute HCl.

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[2]

- (d) Another substituted phenylamine, 3-bromophenylamine, can be prepared in a 3-step process.

Complete the reaction scheme to show how 3-bromophenylamine can be synthesised from benzene. Show the structures of the intermediate compounds and state the reagents and conditions for each step.



step 1

step 2

step 3

[3]

The hydrolysis reaction of amide bonds in proteins is an important process in living systems.

- (e) A kinetics study on the basic hydrolysis of secondary amides was carried out and the results are given in Table 1.1.

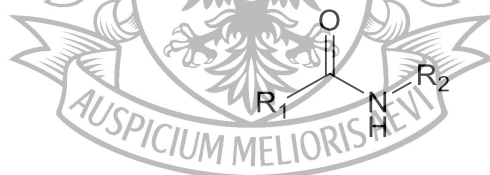


Table 1.1

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experiment	R ₁	R ₂	relative rate of hydrolysis
1	CH ₃ –	CH ₃ –	1.5
2	ClCH ₂ –	CH ₃ –	5.0
3	CH ₃ –		?

- (i) Using appropriate data, explain the relative rates of hydrolysis of experiments 1 and 2.

.....

[1]

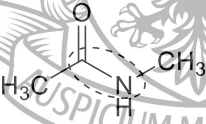
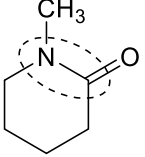
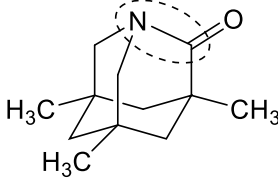
- (ii) Predict whether the relative rate for experiment 3 is larger or smaller than experiment 1. Briefly explain why.

.....

[1]

The C–N bond lengths of some compounds are given in Table 1.2.

Table 1.2

compound	C–N bond length / $\times 10^{-10}$ m
$\text{H}_3\text{C}-\text{NH}_2$	1.469
	1.334
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 Kirby's twisted amide	1.475

- (iii) With reference to the C–N bond lengths given, explain why Kirby's twisted amide undergoes a much faster hydrolysis reaction than other amides.

.....

[1]

- (iv) By considering the structure of the compound, account for the C–N bond length of the Kirby's twisted amide compared to the other compounds in the table.

.....

[2]

[Total: 17]

B2 Zinc blende is a common ore used in the extraction of zinc metal. It contains a high percentage of zinc sulfide, with iron and lead compounds as the major impurities.

The extraction of zinc involves the following steps in a blast furnace operating at 1850 K to remove the metal impurities.

Step 1: Roasting is first carried out to form zinc oxide.



Step 2: Zinc oxide is then heated with coke (carbon) and reduced to zinc.



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Table 2.1 gives the $\Delta H_f^\ominus$ values for the species in the blast furnace.

Table 2.1

species	$\Delta H_f^\ominus / \text{kJ mol}^{-1}$
CO ₂	–393.5
SO ₂	–296.8
ZnO	–350.5
ZnS	–206.0

- (a) (i) Calculate $\Delta H^\ominus$ of the reaction in Step 1.

[1]

- (ii) Comment on the sign of $\Delta S^\ominus$ for the reaction in Step 1.

.....
[1]

- (iii) Calculate $\Delta G^\ominus$, in J mol^{-1} , at 1850 K for the reaction in Step 1.

[1]

- (iv) Using your answer in (iii), calculate the $E^\ominus_{\text{cell}}$ of Step 1.

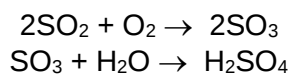


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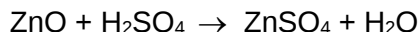
[2]

In some chemical plants, zinc oxide is processed differently from Step 2.

The sulfur dioxide formed from Step 1 is further oxidised to sulfur trioxide, which is then dissolved in water to produce sulfuric acid.



The impure zinc oxide is then reacted with the sulfuric acid to form zinc sulfate solution.



This solution contains dissolved impurities such as iron(II) ions which need to be removed before electrolysis.

The removal of the impurities is performed by adding powdered zinc to the impure zinc sulfate solution. Zinc is oxidised and dissolves, with the reduction of the impurities back to their metallic form.

- (b) (i) Suggest an advantage of using this method instead of reducing zinc oxide with carbon in the blast furnace.

.....
[1]

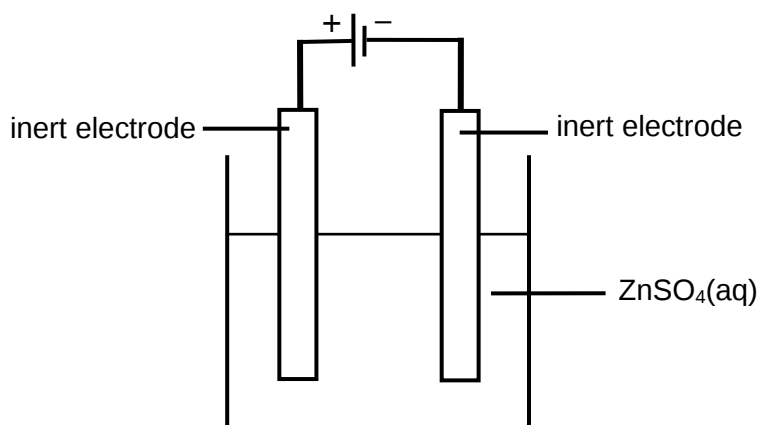
- (ii) Adding powdered zinc to impure zinc sulfate solution reduces iron(II) ions.
 By using relevant data from the *Data Booklet*, calculate the $E^\ominus_{\text{cell}}$ value for the reaction.

.....

[1]

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After the impurities have been removed, electrolysis of the aqueous zinc sulfate is then carried out as shown in the diagram below to obtain pure zinc.



- (c) (i) *Use of the Data Booklet is relevant to this question.*

Write half-equations for the reactions occurring at the anode and cathode.

anode:

cathode: [2]

- (ii) The pH of the electrolyte is maintained at neutral pH by adding an alkali at regular intervals.

Explain why it is necessary to maintain the pH of the electrolyte at neutral pH.

.....

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.....[2]

- (iii) During electrolysis, a current was passed for 30 minutes and the mass of the cathode increased by 2.00 g. Calculate the current applied.

[2]

[Total: 13]

B3 This question discusses the kinetics and thermodynamics of iodine and its compounds.

(a) Explain why HI is thermally less stable than HCl.

.....

.....

.....

.....

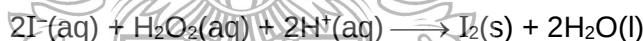
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.....[2]

(b) Iodine reacts with ascorbic acid (Vitamin C) as shown.



This reaction between iodine and ascorbic acid can be utilised in the study of kinetics for the oxidation of iodide ions by hydrogen peroxide in aqueous solutions in a clock reaction.



By using the solutions given below, the order of reaction with respect to H_2O_2 may be determined by performing a series of experiments and then graphically analysing the results.

FA1 is 0.88 mol dm^{-3} hydrogen peroxide, H_2O_2 .

FA2 is 0.20 mol dm^{-3} potassium iodide, KI.

FA3 is ascorbic acid solution, prepared by using two 500 mg Vitamin C tablets in 60 cm^3 of water.

Starch solution.

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It is known that the Vitamin C tablets take a long time (1-2 hours) to dissolve when placed directly into water and stirred, and the final mixture is a cloudy suspension (due to other less soluble components making up the tablets).

For the first set of the series of experiments, a teacher uses 10 cm^3 of **FA1**, 50 cm^3 of **FA2**, 2.5 cm^3 of **FA3** and 2.5 cm^3 of starch solution. Upon mixing, the faint-yellow mixture suddenly turns dark blue after some time.

Write a plan for such a series of experiments.

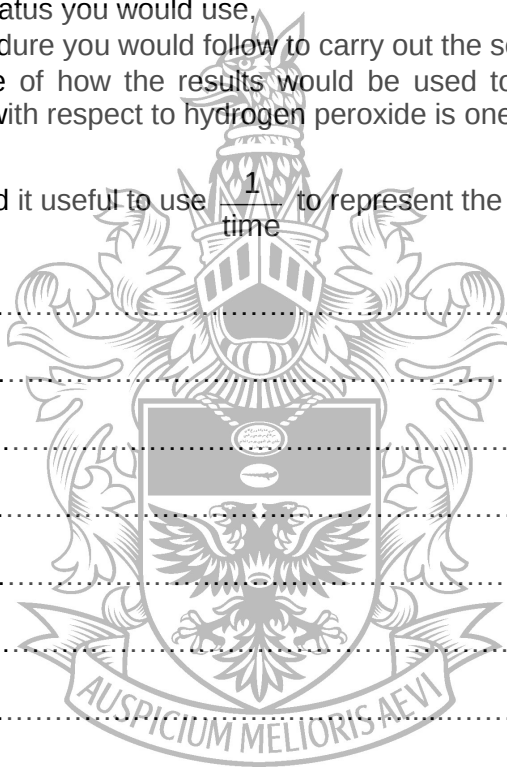
You may assume that you are provided with:

- **FA1** and **FA2**,
- starch solution,
- two 500 mg Vitamin C tablets,
- deionised water,
- a metal spoon,
- a box of filter paper,
- 3.0 cm³ syringes,
- a stopwatch,
- the apparatus normally found in a school or college laboratory.

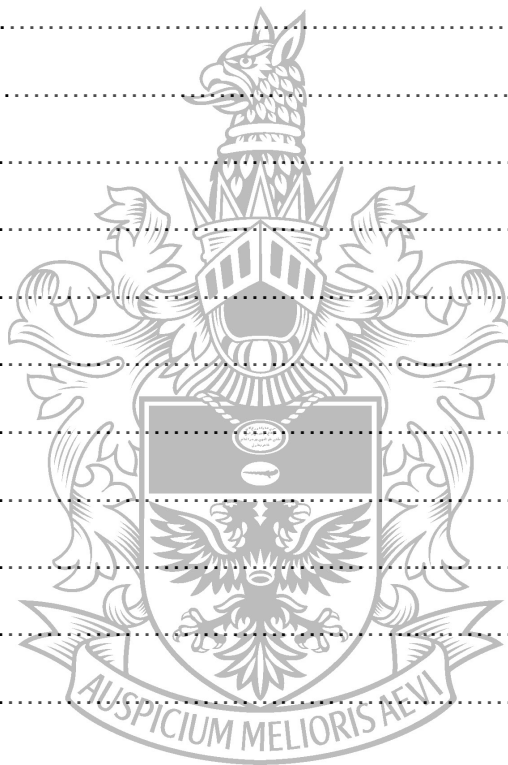
In your plan you should include brief details of:

- how you would prepare a clear solution of **FA3** within 5-10 minutes,
- the apparatus you would use,
- the procedure you would follow to carry out the series of experiments,
- an outline of how the results would be used to confirm that the order of reaction with respect to hydrogen peroxide is one.

You may find it useful to use $\frac{1}{\text{time}}$ to represent the reaction rate.



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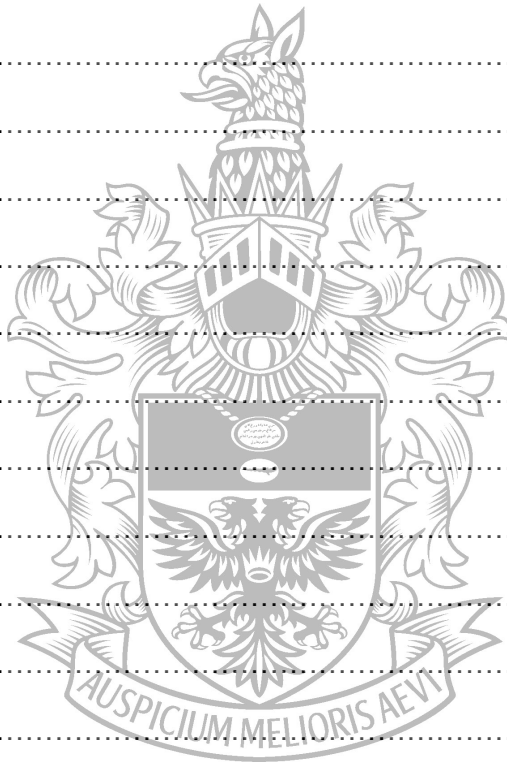
[8]

[Total: 10]

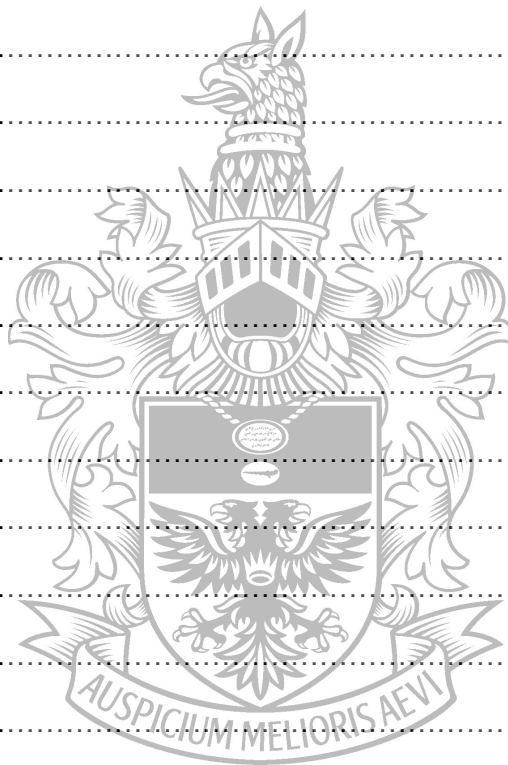
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Additional answer space

If you use the following pages to complete the answer to any question, the question number must be clearly shown.



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RAFFLES INSTITUTION
2021 Year 6 Term 3 Common Test
H2 Chemistry

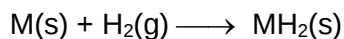
C

Name: _____ ()	Class: 21S0_____
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Section	Marks
A	/ 15
B	B1 / 17
	B2 / 13
	B3 / 10
C Answer both C1 and C2 .	C1 / 11
	C2 / 19
Circle the question you have answered.	C3 EITHER / 10
	C3 OR / 10
Total	/ 95
Percentage	/ 100
Grade	

- C1** Group 2 metal hydrides, MH_2 , can be prepared by reacting the metal with hydrogen under high temperature and pressure.



- (a)** The reaction involving calcium requires a lower temperature than that with magnesium.

Using relevant data from the *Data Booklet*, suggest why calcium is more reactive than magnesium. [2]



- (b)** Both MgH_2 and CaH_2 can react with water to form a metal hydroxide and hydrogen.

- (i) Write an expression for the solubility product, K_{sp} , for $Mg(OH)_2$, giving its units. [1]

- (ii) The value of the K_{sp} for $Mg(OH)_2$ is 1.8×10^{-11} at $25^\circ C$. Calculate the solubility of $Mg(OH)_2$ in $mol\ dm^{-3}$. [1]

- (iii) Explain the effect on the solubility of $\text{Mg}(\text{OH})_2$ when a small amount of CaH_2 is added to a saturated solution of $\text{Mg}(\text{OH})_2$. [2]

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products formed when $\text{Mg}(\text{BH}_4)_2$ is decomposed.

$\text{Mg}(\text{BH}_4)_2$ decomposes according to the following reactions:

— $\rightarrow \text{MgH}_2(\text{s}) + 2\text{B}(\text{s}) + 3\text{H}_2(\text{g})$

— $\rightarrow \text{MgB}_2(\text{s}) + 4\text{H}_2(\text{g})$

$\Delta H_f^\ominus[\text{MgH}_2(\text{s})] = -75 \text{ kJ mol}^{-1}$, construct a thermodynamic cycle to calculate the standard enthalpy change of formation of $\text{Mg}(\text{BH}_4)_2$.

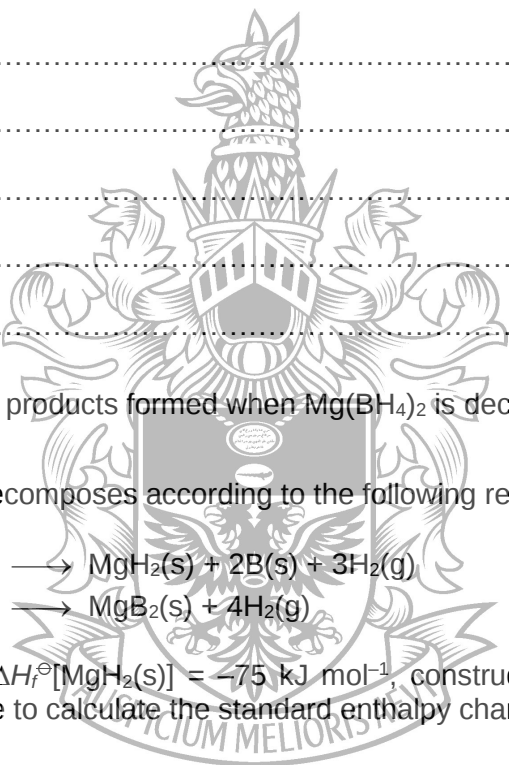
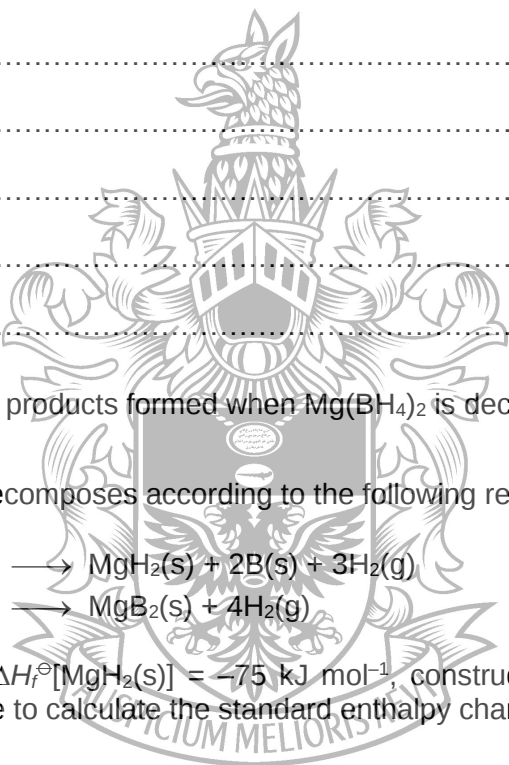
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— $\rightarrow \text{MgB}_2(\text{s}) + 4\text{H}_2(\text{g})$

$\Delta H_f^\ominus[\text{MgH}_2(\text{s})] = -75 \text{ kJ mol}^{-1}$, construct a Hess cycle to calculate the standard enthalpy change of formation of $\text{Mg}(\text{BH}_4)_2(\text{s})$.



products formed when $\text{Mg}(\text{BH}_4)_2$ is decomposed.

$\text{Mg}(\text{BH}_4)_2$ decomposes according to the following reactions:

— $\rightarrow \text{MgH}_2(\text{s}) + 2\text{B}(\text{s}) + 3\text{H}_2(\text{g})$

— $\rightarrow \text{MgB}_2(\text{s}) + 4\text{H}_2(\text{g})$

$\Delta H_f^\ominus[\text{MgH}_2(\text{s})] = -75 \text{ kJ mol}^{-1}$, construct a thermodynamic cycle to calculate the standard enthalpy change of formation of $\text{Mg}(\text{BH}_4)_2$.

[illegible]

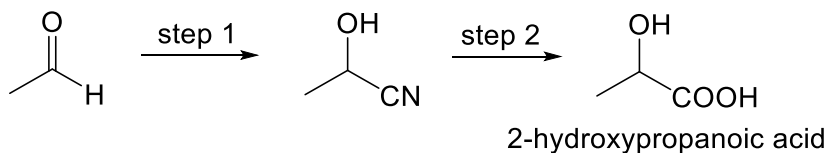
- Whether $\text{Ca}(\text{BH}_4)_2$ would decompose at a $\text{Ca}(\text{BH}_4)_2$. Explain your reasoning.

[illegible]

[Turn Over

C2 This question explores some “step-up” reactions in which the number of carbon atoms in the organic molecule increases.

- (a) Ethanal undergoes a “step-up” reaction to form 2-hydroxypropanoic acid, as shown in the following reaction scheme.



- (i) Step 1 is performed by adding KCN to ethanal in slightly acidic conditions.

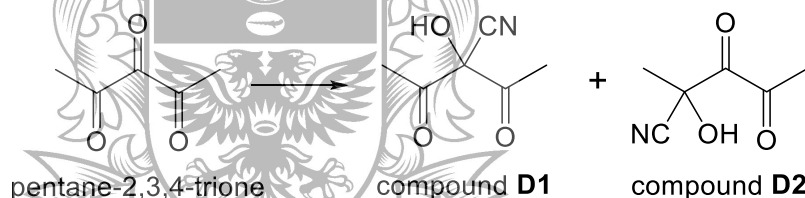
Draw a mechanism of the reaction in step 1 to form $\text{CH}_3\text{CH}(\text{OH})\text{CN}$.

Show all charges and relevant lone pairs and show the movement of electron pairs by using curly arrows. [2]

- (ii) State the reagents and conditions required in step 2. [1]

- (iii) Explain why step 2 is not considered to be an oxidation reaction. [1]

- (iv) When 1 mole of pentane-2,3,4-trione is reacted with 1 mole of HCN, the following products are formed.



Explain why compound **D1** is the major product. [1]

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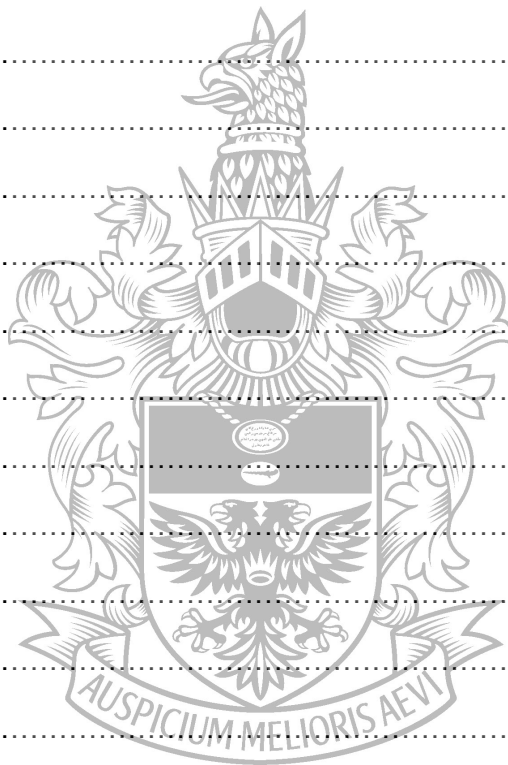
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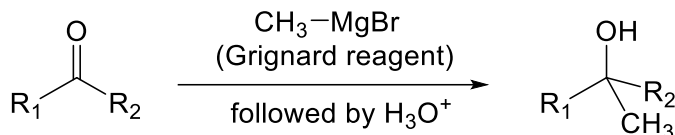


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- (b) Carbonyl compounds can also undergo “step-up” reactions with Grignard reagents.

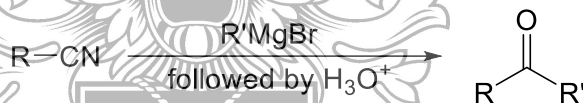
Grignard reagents ($R-MgBr$) provide a nucleophilic source of carbon (R^-) which can allow the addition of alkyl or aryl groups to an electrophilic carbon atom. The reaction is completed by the subsequent addition of an aqueous acid.

An example of this is shown below, where the Grignard reagent effectively provides a $:CH_3^-$ nucleophile.



- (i) Explain why the aqueous acid can only be added after the Grignard reagent is allowed to completely react with the carbonyl compound. [1]
- (ii) Apart from the toxicity of HCN, suggest one advantage that Grignard reagents have over HCN in “step-up” reactions. [1]

Similar to carbonyl compounds, nitriles also react with Grignard reagents as shown below.



- (iii) Explain why the nitrile group is susceptible to reaction with Grignard reagents. [1]
- (iv) Propose a two-step synthesis for the following conversion.



[3]

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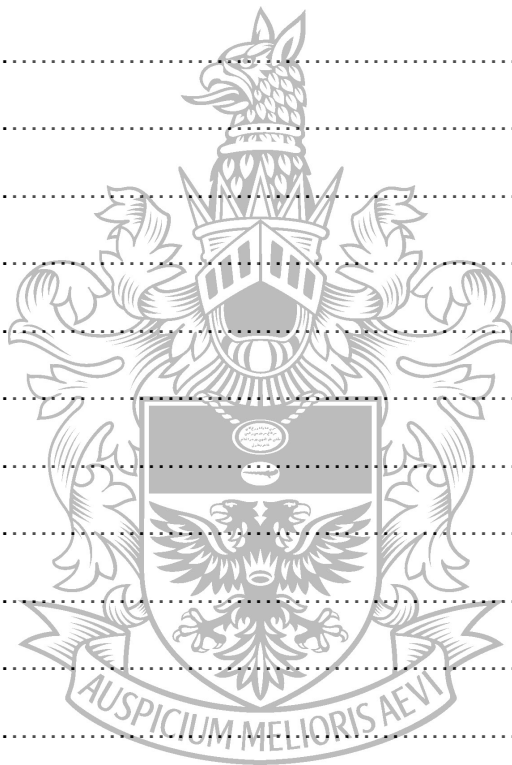
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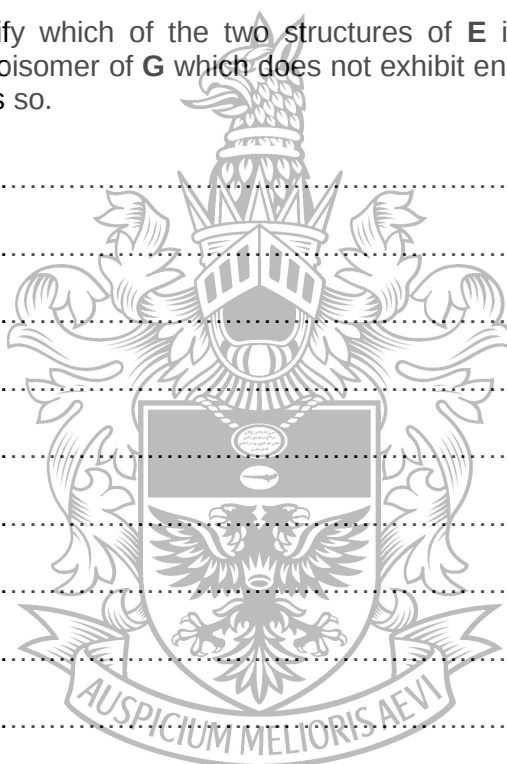
(c) Compound **E** has the molecular formula $C_9H_6O_4$. A series of tests was performed on **E** and the observations are listed below.

- **E** gives an orange precipitate with 2,4-dinitrophenylhydrazine.
- **E** reacts with sodium to produce an equimolar amount of hydrogen gas.
- **E** does not react with sodium hydroxide.
- **E** reacts with hot acidified potassium manganate(VII) to form **F**, $C_8H_6O_4$, as the only organic product. **F** is a 1,2-disubstituted benzene.

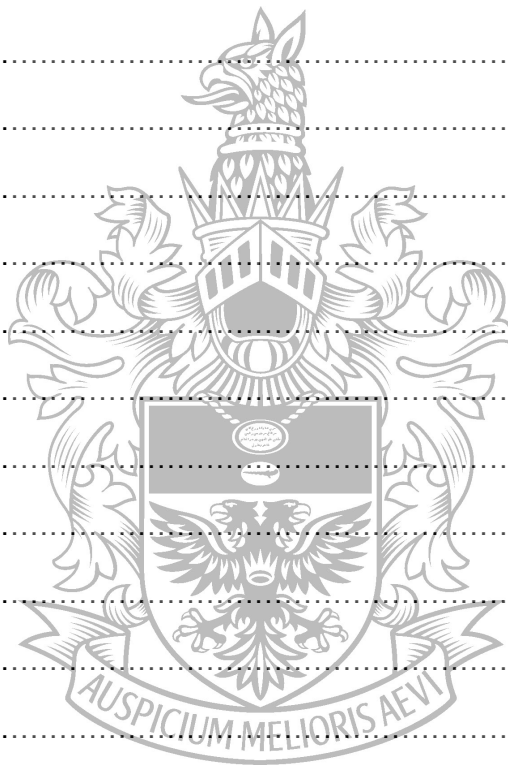
(i) Suggest the structure of **F** and the two possible structures of **E**, explaining the reactions involved. [6]

(ii) **E** is also known to react with excess CH_3-MgBr , followed by H_3O^+ to form **G**, which can exist as 3 stereoisomers.

Identify which of the two structures of **E** is correct. Hence, draw the stereoisomer of **G** which does not exhibit enantiomerism, explaining why this is so. [2]



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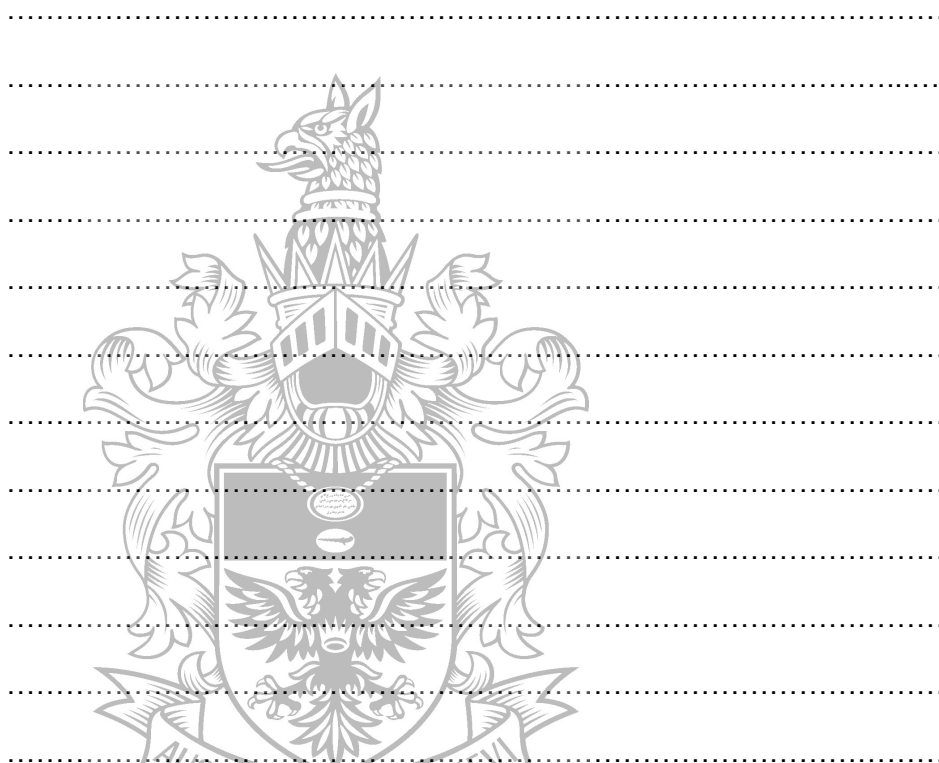
Answer either **C3 EITHER** or **C3 OR**.

C3 EITHER

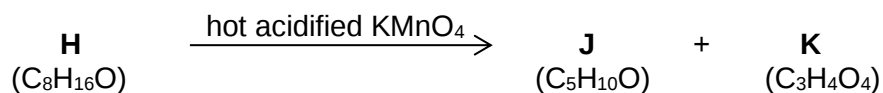
(a) Some compounds of chromium undergo similar reactions as those of aluminium.

(i) Write an equation, with state symbols, for the reaction between Cr_2O_3 and excess aqueous NaOH . [1]

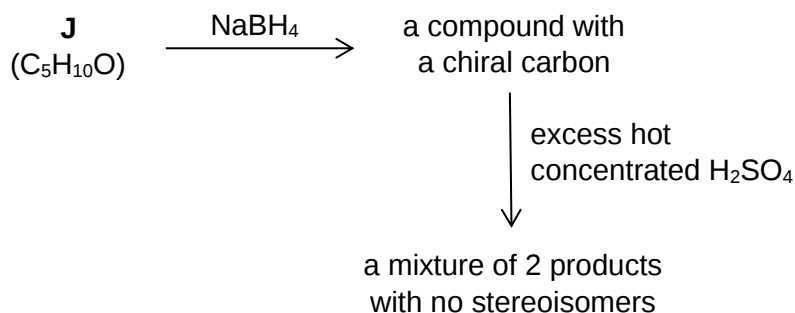
(ii) With the aid of an equation, explain why an aqueous solution of CrCl_3 is acidic. [2]



(b) When **H**, $\text{C}_8\text{H}_{16}\text{O}$, is heated in the presence of acidified KMnO_4 , **J** and **K** are formed.



Compound **J** undergoes the following sequence of reactions.



(i) Give the structural formulae of **H**, **J** and **K**. [3]

(ii) **H** reacts with hot acidified $\text{K}_2\text{Cr}_2\text{O}_7$ to form **L**. Identify **L**. [1]

(iii) **H** can also be oxidised by pyridinium chlorochromate (PCC). The product, **M**, decolourised $\text{Br}_2(\text{aq})$ and reduced $[\text{Ag}(\text{NH}_3)_2]\text{NO}_3$.

Draw the structure of **M**. [1]

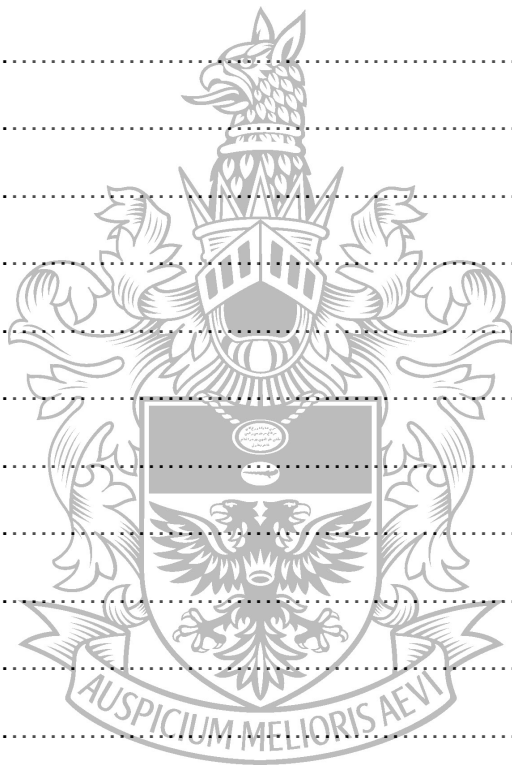
(iv) By referring to the changes in oxidation states of the relevant carbon atoms in **H**, **J**, **K**, **L** and **M**, rank the following oxidising agents in increasing oxidising strengths.

- hot acidified KMnO_4
- hot acidified $\text{K}_2\text{Cr}_2\text{O}_7$
- PCC

[2]



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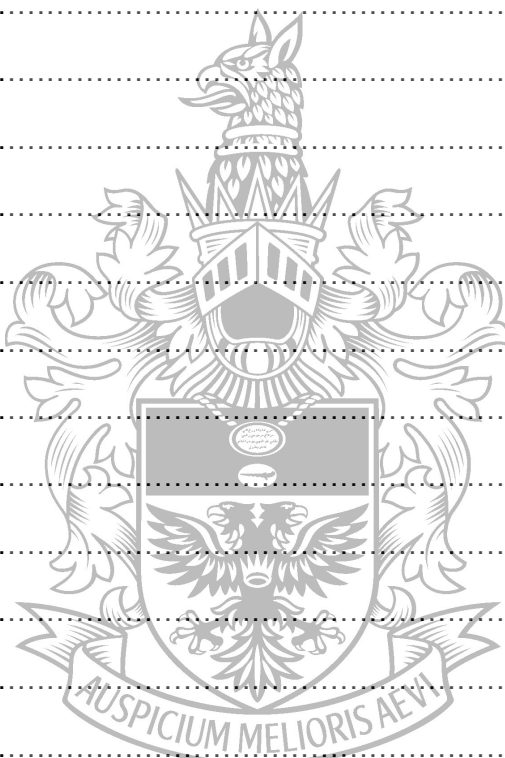


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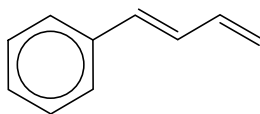
(ii) Explain the trend for the first ionisation energy from F to I. [2]

(iii) Periodic acid can exist as HIO_4 or H_5IO_6 . Given that there is an $\text{I}=\text{O}$ bond and the oxidation state of all oxygen atoms is -2 in H_5IO_6 , draw the structure of H_5IO_6 . [1]



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- (b) Using the [O] notation, write an equation for the reaction between the following compound and hot alkaline KMnO_4 .



[1]

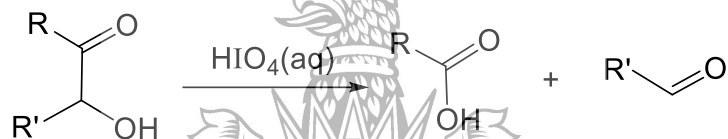
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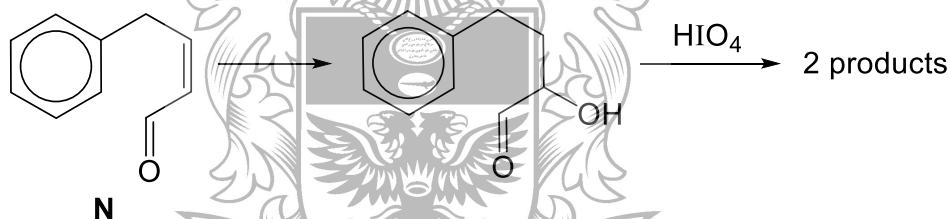
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- (c) Periodic acid, HIO_4 oxidises hydroxycarbonyl compounds as shown below.



R and R' = H or alkyl

N undergoes the following reaction scheme.



Draw the structures for the two products in the above reaction scheme.

[2]

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- Suggest a structure for **R**. [1]



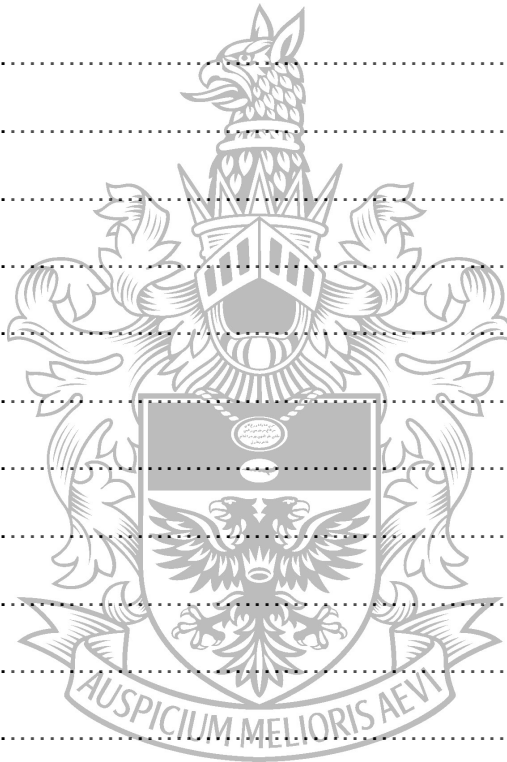
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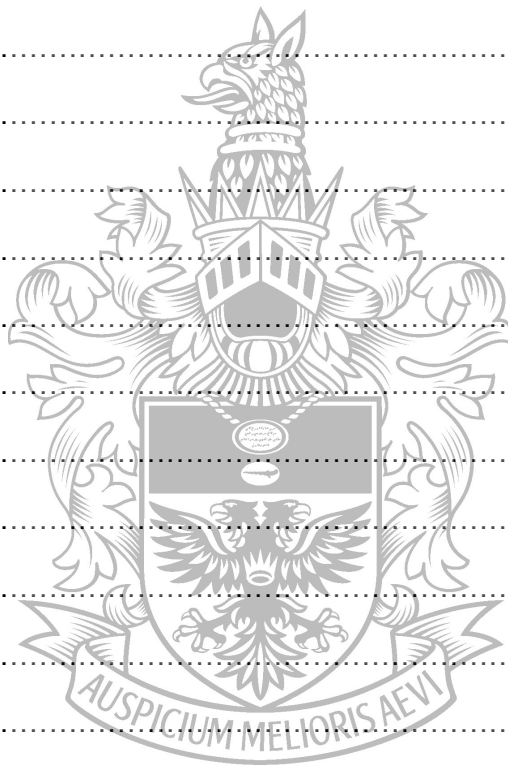
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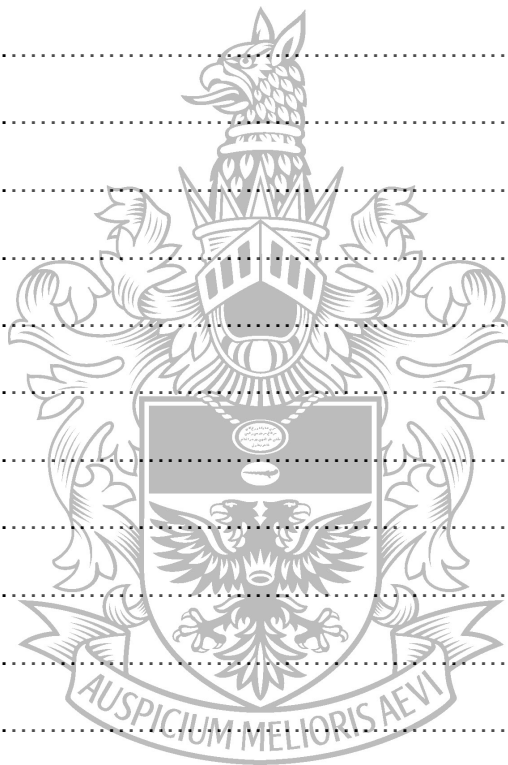
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