



VICTORIA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATIONS
Higher 1

CHEMISTRY

8872/01

Paper 1 Multiple Choice

22 September 2016

50 min

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your NRIC/FIN number, name and CT group on the Answer Sheet.

There are **thirty** questions. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choices in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

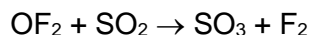
Any rough working should be done in this booklet.

This document consists of **11** printed pages and **1** blank page.

Section A

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

- 1 In oxygen difluoride, OF_2 , fluorine has an oxidation number of -1 . OF_2 will react with sulfur dioxide according to the following equation.



What is oxidised and what is reduced in this reaction?

	fluorine	oxygen in OF_2	sulfur
A	reduced	oxidised	reduced
B	reduced	reduced	oxidised
C	oxidised	oxidised	reduced
D	oxidised	reduced	oxidised

- 2 The shell of a chicken's egg makes up 5% of the mass of an average egg. An average egg has a mass of 50 g.

Assume the egg shell is pure calcium carbonate.

How many complete chicken's egg shells would be needed to neutralise 50 cm^3 of 2.0 mol dm^{-3} ethanoic acid?

- A** 1 **B** 2 **C** 3 **D** 4

- 3 Aluminium carbide, Al_4C_3 , reacts readily with aqueous sodium hydroxide. The two products of the reaction are NaAlO_2 and a hydrocarbon. Water molecules are also involved as reactants.

What is the formula of the hydrocarbon?

- A** CH_4 **B** C_2H_6 **C** C_3H_8 **D** C_6H_{12}

- 4 Which statement about the ammonium ion, NH_4^+ , is correct?

- A** All bond angles are 107° .
B Ammonium ions are formed when ammonia behaves as an acid.
C Ammonium ions are unreactive when heated with NaOH(aq) .
D The bonds are all the same length.

- 5 After the Fukushima nuclear disaster in 2011, a radioactive isotope of iodine, ^{131}I , was detected at water purification plants in Japan. Given that radioactive decay is a first order reaction, and that the half-life of radioactive ^{131}I is 8 days, how long will it take for 15 g of ^{131}I to decay to 3.75 g?

A 8 days B 16 days C 24 days D 30 days

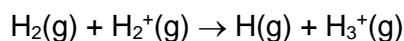
- 6 2-methylpropan-1-ol and butan-1-ol are structural isomers. 2-methylpropan-1-ol has a lower boiling point.

Which statement explains why the boiling point of 2-methylpropan-1-ol is lower than that of butan-1-ol?

- A 2-methylpropan-1-ol cannot form hydrogen bonds.
 B 2-methylpropan-1-ol has weaker covalent bonds than butan-1-ol.
 C 2-methylpropan-1-ol has weaker dispersion forces than butan-1-ol.
 D 2-methylpropan-1-ol molecules have more surface area than butan-1-ol molecules.

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

The most common ion-molecule reaction in gas clouds of the Universe is as shown.



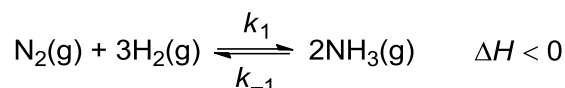
What could be the composition of an H_3^+ ion?

	protons	neutrons	electrons
A	2	1	1
B	2	1	2
C	3	0	1
D	3	0	2

- 8 Which of the following equilibria will experience a shift in the position of equilibrium to the right when the volume of the reaction vessel decreases at constant temperature?

- A $\text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{H}_2\text{O}(\text{g})$
 B $2\text{NO}(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + \text{O}_2(\text{g})$
 C $\text{C}_2\text{H}_4(\text{g}) + \text{H}_2(\text{g}) \rightleftharpoons \text{C}_2\text{H}_6(\text{g})$
 D $\text{H}_2\text{O}(\text{g}) + \text{CH}_4(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + 3\text{H}_2(\text{g})$

- 9 The Haber Process is used to manufacture $\text{NH}_3(\text{g})$ from $\text{N}_2(\text{g})$ and $\text{H}_2(\text{g})$ industrially, using Fe solid as the catalyst. The process can be represented by the equilibrium shown.



Which of the following statements regarding the Haber Process is correct?

- A Fe lowers the activation energy of the forward reaction only.
 B Fe increases the value of the equilibrium constant.
 C Increasing the temperature increases the values of both k_1 and k_{-1} .
 D Increasing the temperature increases the value of the equilibrium constant.
- 10 20 cm^3 of 0.10 mol dm^{-3} sodium hydroxide solution is added to 25 cm^3 of 0.15 mol dm^{-3} hydrochloric acid.

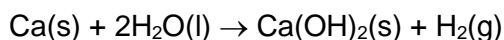
What is the approximate pH of the final solution?

- A 1.4 B 2.8 C 4.5 D 7.0
- 11 X and Y are both monoprotic weak acids of equal concentration. X is a stronger acid than Y.
- Which statement about X and Y is correct?
- A X is completely ionised in solution.
 B The solution of X is less ionised than the solution of Y.
 C The solution of X has a lower pH than the solution of Y.
 D 1 mol of Y requires a smaller volume of 1 mol dm^{-3} aqueous NaOH for neutralisation than 1 mol of X.

- 12 Which equation has a positive enthalpy change?

- A $\text{I}_2(\text{g}) \rightarrow \text{I}_2(\text{s})$
 B $2\text{ClI}(\text{g}) \rightarrow \text{Cl}_2(\text{g})$
 C $\text{Ca}(\text{g}) \rightarrow \text{Ca}^+(\text{g}) + \text{e}^-$
 D $\text{C}_2\text{H}_5\text{OH}(\text{l}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l})$

- 13 Calcium reacts with water to form calcium hydroxide and hydrogen.

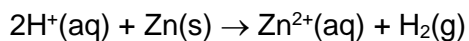


Which of the following information is needed to calculate the standard enthalpy change of formation of calcium hydroxide, ΔH_f^\ominus ?

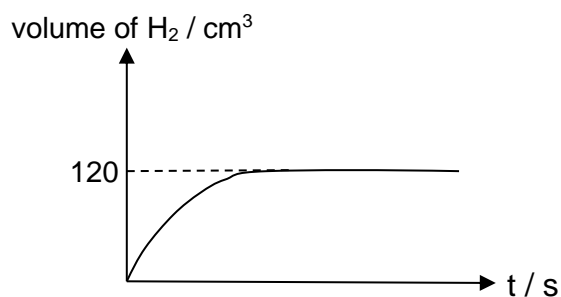
- I standard enthalpy change of formation of water
 II standard enthalpy change of formation of hydrogen
 III standard enthalpy change of reaction of calcium and water

- A III only B I and II C I and III D II and III

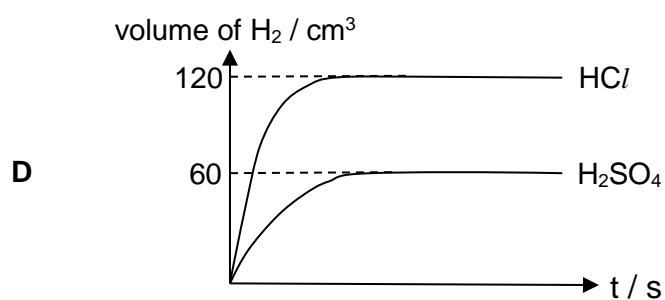
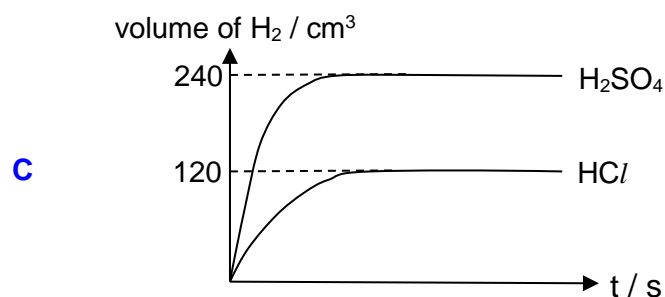
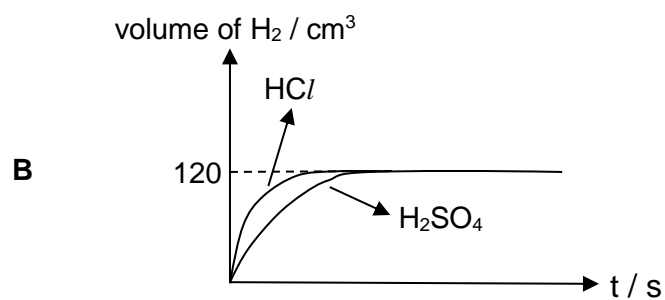
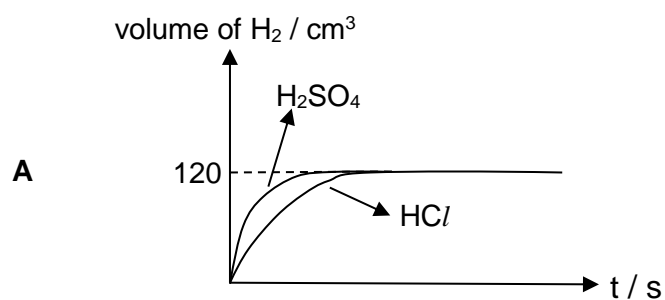
- 14 Acids react with Zn according to the following equation.



The following graph is obtained when excess zinc is added to 1 dm³ of 0.010 mol dm⁻³ HCl.



Which of the following represents the graph that will be obtained when excess zinc is added to 1 dm³ of 0.010 mol dm⁻³ H₂SO₄?



- 15 **X**, **Y** and **Z** are elements in the same short period of the Periodic Table. The oxide of **X** is amphoteric, the oxide of **Y** is basic and the oxide of **Z** is acidic. What is the order of increasing ionic radius for these elements?

A **X**, **Y**, **Z** **B** **X**, **Z**, **Y** **C** **Y**, **X**, **Z** **D** **Y**, **Z**, **X**

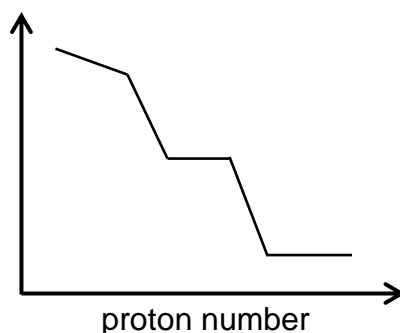
- 16 The proton number of the element **M** is less than 20.

The aqueous chloride of **M** is acidic, and gives a white precipitate when reacted with NaOH(aq). This precipitate dissolves on reacting either with NaOH(aq) or with H₂SO₄(aq).

In which Group of the Periodic Table is **M** likely to be found?

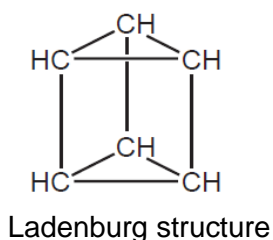
A II **B** III **C** IV **D** V

- 17 The graph below shows how a property of the elements in the third period of the Periodic Table varies with proton number.



What is the property?

- A** ionic radius
B melting point of the chloride
C pH of the oxide in water
D first ionisation energy
- 18 In 1869 Ladenburg suggested a structure for benzene, C₆H₆, in which one hydrogen atom is attached to each carbon atom.

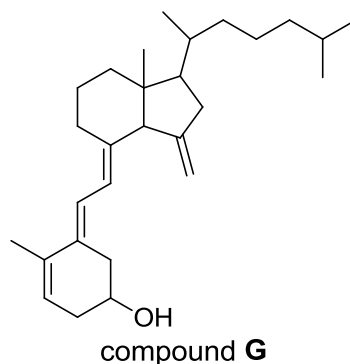


A compound C₆H₄Br₂ could be formed with the same carbon skeleton as the Ladenburg structure.

How many structural isomers would this compound have?

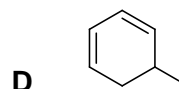
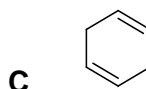
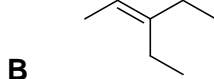
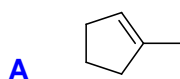
A 2 **B** 3 **C** 5 **D** 6

- 19 Compound **G** has the following structure.

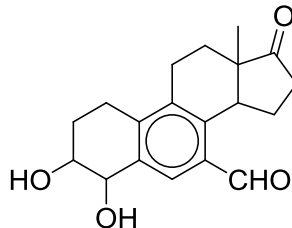


How many geometric isomers does compound **G** have?

- A** 2^1 **B** 2^2 **C** 2^3 **D** 2^4
- 20 Which of the following compounds react with hot acidified KMnO_4 to form products that will give positive results for the 2,4-dinitrophenylhydrazine and the tri-iodoform tests?

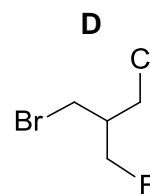
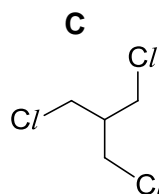
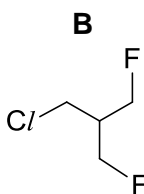
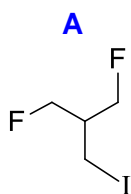


- 21 Which of the following statements about the compound below is correct?

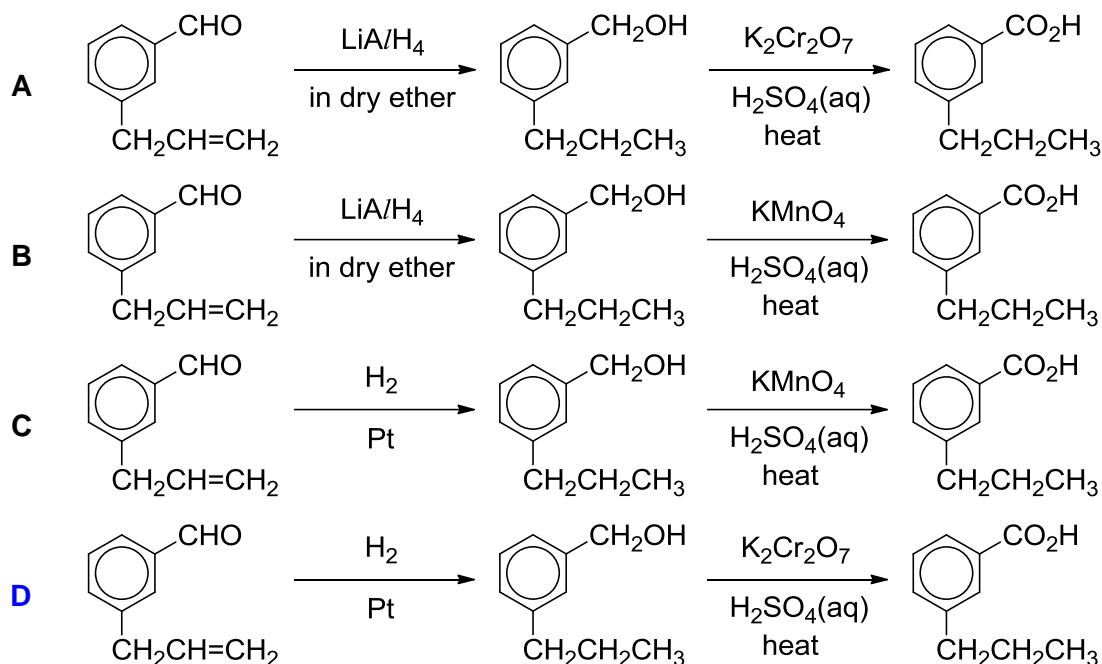
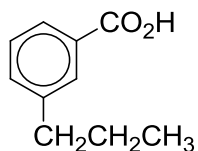


- A** It will react with sodium hydroxide.
B It will react with Fehling's solution.
C It will react with hydrogen cyanide in a substitution reaction.
D It can be oxidised by hot acidified potassium dichromate(VI) to a carboxylic acid.
- 22 The presence of a halogen in an organic compound may be detected by warming the organic compound with aqueous silver nitrate.

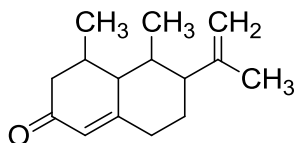
Which compound would be the quickest to produce a precipitate?



23 Which synthetic route will lead to the successful synthesis of the following product?



24 Nootkatone is one of the organic compounds found in grapefruit. Its structure is given below.



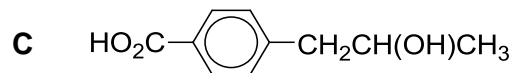
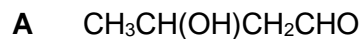
Which statement about nootkatone is correct?

- A** It forms a yellow precipitate with alkaline $\text{I}_2(\text{aq})$.
- B** It reacts with Tollens' reagent to give a silver mirror.
- C** It reacts with potassium cyanide in ethanol to form a nitrile.
- D** It reacts with hot acidified potassium manganate(VII) to form one organic product.

25 Compound **R** gives the following observations when reacted with the specific reagents.

- It forms orange precipitate with 2,4–dinitrophenylhydrazine.
- It liberates one mole of hydrogen gas with excess sodium.

Which of the following could be **R**?



Section B

For each of the questions in this section, one or more of the three numbered statements **1** to **3** may be correct.

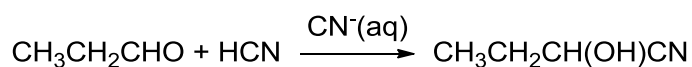
Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct).

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

No other combination of statements is used as a correct response.

26 A student wishes to study the kinetics of the following reaction.



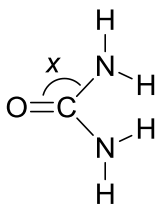
He conducted four experiments using $0.100 \text{ mol dm}^{-3}$ solutions of $\text{CH}_3\text{CH}_2\text{CHO}$, HCN , and CN^- . He summarised the results in the table below.

Expt	Temperature / °C	Volume of $\text{CH}_3\text{CH}_2\text{CHO}$ / cm^3	Volume of HCN / cm^3	Volume of CN^- / cm^3	Volume of H_2O / cm^3	Initial rate / $\text{mol dm}^{-3} \text{ s}^{-1}$
1	25	10	10	10	20	2.35×10^{-5}
2	25	10	10	20	10	4.68×10^{-5}
3	35	20	20	10	0	9.40×10^{-5}
4	25	20	10	10	10	4.71×10^{-5}

Given that the rate of reaction doubles for every 10°C rise in temperature, which of the following statements are correct?

- 1** The reaction is an addition reaction.
- 2** The rate equation is given by $\text{rate} = k[\text{CH}_3\text{CH}_2\text{CHO}][\text{CN}^-]$.
- 3** The units of the rate constant are $\text{mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$.

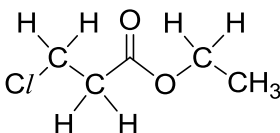
- 27 Urea is a product of animal metabolism. It can also be used as a fertiliser.



The diagram shows angle x in this molecule.

Which statements about the structure of urea are correct?

- 1 Angle x is approximately 120° .
 - 2 The molecule has one π bond.
 - 3 The molecule has only four lone pairs of electrons.
- 28 Which statements are correct about the chemical properties of the elements in the third period of the Periodic Table?
- 1 Al_2O_3 is soluble in both KOH and HCl .
 - 2 SiCl_4 reacts with water to give H^+ ions.
 - 3 S reacts with water to give an acidic solution.
- 29 What would be the products formed when the following compound is boiled with aqueous sodium hydroxide?



- 1 $\text{CH}_3\text{CH}_2\text{OH}$
 - 2 $\text{CH}_3\text{CH}_2\text{O}^-\text{Na}^+$
 - 3 $\text{C}/\text{CH}_2\text{CH}_2\text{CO}_2^-\text{Na}^+$
- 30 Which of the following will show effervescence when heated with acidified potassium manganate(VII)?

