

Candidate's Name: _____

Class

Reg Number

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MERIDIAN JUNIOR COLLEGE
JC 2 Preliminary Examination
Higher 1

Chemistry

8872/01

22 September 2017

Paper 1 Multiple Choice

50 minutes

Additional Materials: OMR Sheet and *Data Booklet*

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided at the top of this page.

There are **thirty** questions in this section. Answer **all** questions. For each question, there are four possible answers labelled **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the OMR answer sheet.

Read very carefully the instructions on the use of OMR answer sheet.

You are advised to fill in the OMR Answer Sheet as you go along; no additional time will be given for the transfer of answers once the examination has ended.

Use of OMR Answer Sheet

Ensure you have written your name, class register number and class on the OMR Answer Sheet.

Use a **2B** pencil to shade your answers on the **OMR sheet**; erase any mistakes cleanly. Multiple shaded answers to a question will not be accepted.

For shading of class register number on the **OMR sheet**, please follow the given examples:
If your register number is **1**, then shade **01** in the index number column.
If your register number is **21**, then shade **21** in the index number column.

Section A

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

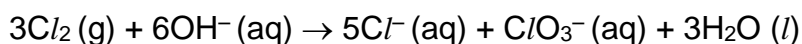
- 1 *Use of the Data Booklet is relevant to this question.*

The relative abundances of the isotopes of a sample of zirconium are shown in the table below.

relative isotopic mass	90	91	92	94	96
relative abundance (%)	51.3	11.3	17.2	17.4	2.8

What is the relative atomic mass of zirconium in this sample?

- A** 91.21
B 91.22
C 91.31
D 91.32
- 2 Hydrocarbon **E** consists of 84.3% carbon. What could hydrocarbon **E** be?
- A** hexane
B hexene
C cyclohexene
D benzene
- 3 When 7.5×10^{-3} mole of gaseous chlorine at room temperature and pressure is reacted with 50 cm^3 hot excess aqueous sodium hydroxide, the following reaction occurs.



The resulting solution is diluted to 250 cm^3 . It was found that 25.0 cm^3 of this resulting solution required 21.00 cm^3 of 0.10 mol dm^{-3} aqueous hydrochloric acid for complete reaction.

What is the initial concentration of the hot aqueous sodium hydroxide used?

- A** 0.12 mol dm^{-3}
B 0.36 mol dm^{-3}
C 0.57 mol dm^{-3}
D 0.72 mol dm^{-3}

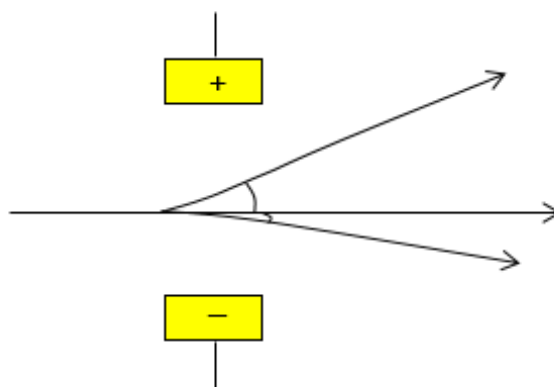
- 4 Ions of vanadium with different oxidation states can exhibit various colours as shown in the following table.

Ions	V^{2+}	V^{3+}	VO^{2+}	VO_2^+	VO_3^-
Colours	violet	green	blue	yellow	yellow

A sample of 0.015 mole of zinc powder reacts exactly with 0.010 mole ammonium vanadate(V), NH_4VO_3 .

What is the final colour seen for the solution?

- A violet B green C blue D yellow
- 5 A beam of particles containing $^{27}Al^{2+}$, ^{35}Cl atoms and $^{35}Cl^{3-}$ was passed through an electric field. The angle of deflection for $^{35}Cl^{3-}$ is 4.5° .



Which of the following statements is correct?

- A Both ^{35}Cl atoms and $^{35}Cl^{3-}$ ions will deflect towards the positive terminal.
- B The ^{35}Cl atoms will deflect towards both the positive and negative terminals.
- C The $^{27}Al^{2+}$ ions have an angle of deflection of 3.9° .
- D The $^{27}Al^{2+}$ ions will have a larger angle of deflection than $^{35}Cl^{3-}$ ions.
- 6 Which of the following statements is true for Cr^+ ?
- A There are a total of six p orbitals being occupied.
- B There are a total of three d orbitals being occupied.
- C There are a total of four s subshells being occupied.
- D There are a total of seven s, p and d subshells being occupied.

7 Four substances **F**, **G**, **H** and **I** have physical properties as shown.

substance	melting point/ °C	boiling point/ °C	electrical conductivity	
			of solid	of liquid
F	17	45	Poor	Poor
G	64	759	Good	Good
H	1132	1950	Poor	Good
I	3550	3825	Good	Unknown

What could be the identities of **F**, **G**, **H** and **I**?

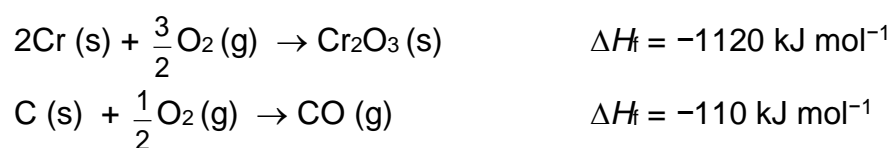
	F	G	H	I
A	PCl ₅	SO ₃	Na ₂ O	Al ₂ O ₃
B	PCl ₅	Al ₂ O ₃	K	Na ₂ O
C	SO ₃	PCl ₅	C (graphite)	Na ₂ O
D	SO ₃	K	Na ₂ O	C (graphite)

8 Which pair of compounds below satisfy the following conditions?

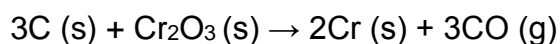
- The first compound has a larger bond angle than the second compound.
- The first compound is more polar than the second compound.

	first compound	second compound
A	NF ₃	SF ₆
B	AlCl ₃	PCl ₃
C	CO ₂	SO ₂
D	ICl ₅	PCl ₅

9 The enthalpy changes for two reactions are given below.

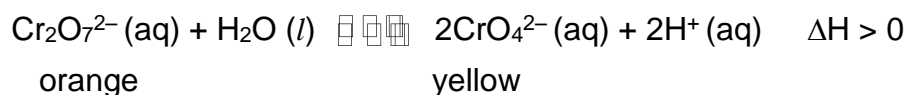


What is the quantity of heat absorbed when 19.2 moles of chromium is obtained from the reduction of chromium(III) oxide using excess carbon?



- A** 82 kJ
B 7 580 kJ
C 15 200 kJ
D 22 800 kJ

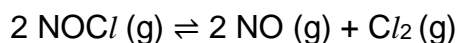
- 10** In aqueous solution, dichromate (VI) ions exist in equilibrium with chromate (VI) ions.



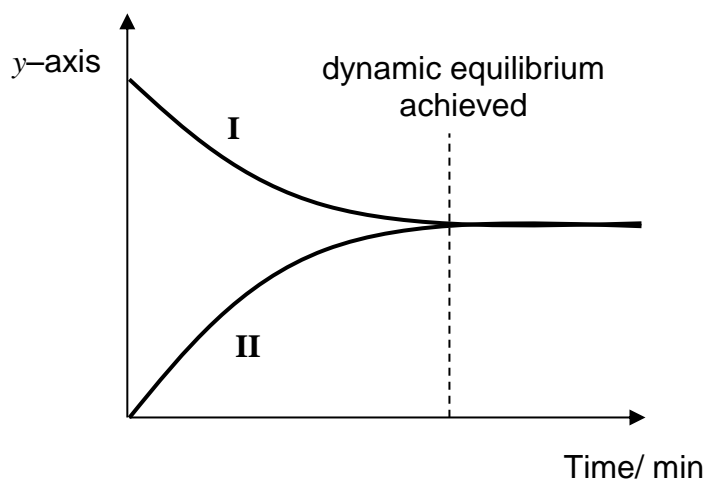
What is the colour of the solution under the following conditions?

	high temperature	high pH
A	yellow	orange
B	yellow	yellow
C	orange	yellow
D	orange	orange

- 11** At 250 °C, NOCl readily dissociates into NO and Cl_2 .



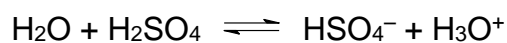
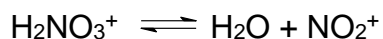
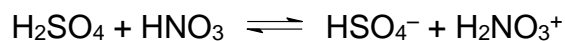
The following plot is obtained during the dissociation of NOCl .



Which of the following best describes the y-axis and the labels I and II?

	y-axis	I	II
A	concentration	[NOC/]	[NOC/] + [C/2]
B	concentration	[NOC/] + [C/2]	[NOC/]
C	rate	rate of forward reaction	rate of backward reaction
D	rate	rate of backward reaction	rate of forward reaction

- 12 The reaction between concentrated sulfuric acid and concentrated nitric acid occurs in the following steps.



Which of the following species is a conjugate acid in these reactions?

- A H_2NO_3^+
B HSO_4^-
C NO_2^+
D H_2O
- 13 Some data on two acid–base indicators are shown in the table below:

Indicator	Approximate working range	Colour in	
		Acid	Alkali
methyl orange	3.2 – 4.4	red	yellow
cresol red	7.5 – 8.8	yellow	purple

Which one of the following conclusions can be drawn about a solution in which both methyl orange and cresol red is yellow?

- A It is weakly acidic.
B It is weakly basic.
C It is neutral.
D No conclusion can be drawn.

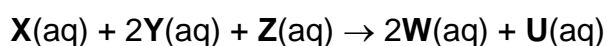
- 14 Elements **X** and **Y** react vigorously with chlorine to form compounds **P** and **Q** respectively. Element **Z** reacts slowly with chlorine to form compound **R**.

When dissolved in water, **P** gives a neutral solution while **R** gives a strongly acidic solution. **Q** reacts with a few drops of water to give off white fumes and a white solid.

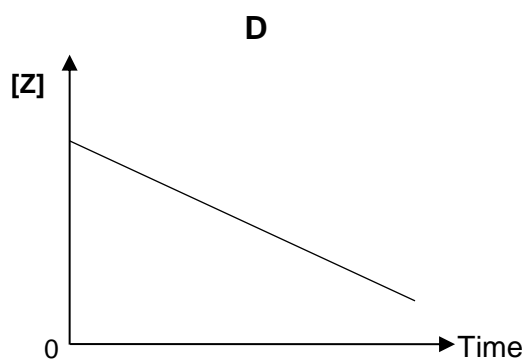
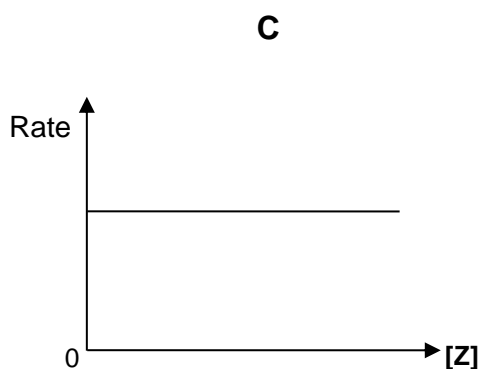
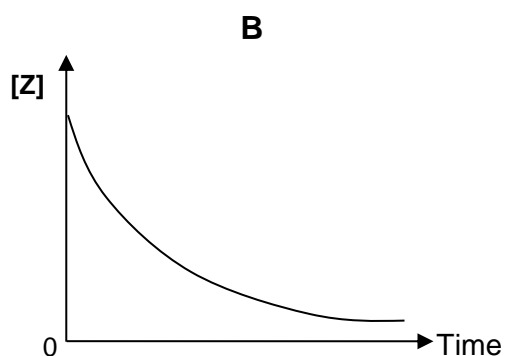
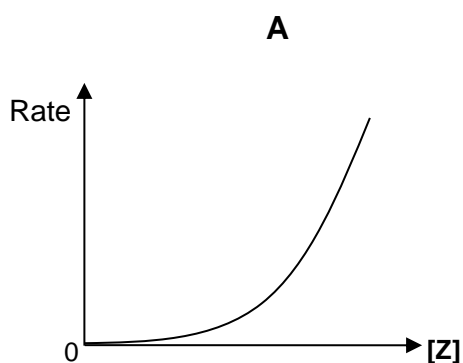
Given that elements **X**, **Y** and **Z** are Period 3 elements, what are the possible identities for **X**, **Y** and **Z**?

	X	Y	Z
A	Na	Al	P
B	Na	Si	P
C	Mg	Al	P
D	Mg	Si	Al

- 15 The rate equation for the following reaction is $\text{rate} = k[\text{Y}]^2[\text{Z}]$.



Which of the following graphs is correct when **Y** is in large excess?



- 16 **L** and **M** are Period 3 elements. **M** has a larger atomic number than **L**.

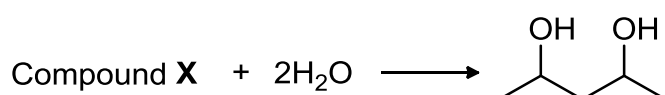
The number of moles of chlorine that react with 1 mole of **M** is twice the number of moles of chlorine that react with 1 mole of **L**.

L burns vigorously in oxygen with a bright white flame.

Which of the following statement is **incorrect**?

- A **M** is a solid at room temperature which is a poor conductor of electricity.
 - B Oxide of **M** is insoluble in water.
 - C **L** can form a basic oxide.
 - D **L** is in Group 13.
- 17 Which property generally decreases from sodium to aluminum?
- A Electrical conductivity
 - B Electronegativity
 - C Ionic radius
 - D First ionisation energy

- 18 Compound **X** reacts with two moles of H_2O (g) according to the following reaction:

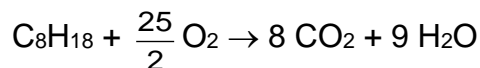


Given that there are no adjacent carbon–carbon double bonds in **X**, what is the total number of cis–trans isomers that **X** can exhibit?

- A 1 B 2 C 3 D 4

- 19 At gas stations, there are 4 different grades of gasoline for choice. The grade of the gasoline is dependent on the percentage by mass of octane (e.g. Grade 92 indicates 92% by mass of octane).

It was determined that 1 kg of a certain grade of gasoline requires 2.58 m³ of oxygen for complete combustion at room temperature and pressure according to the following equation.

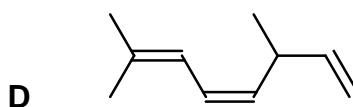
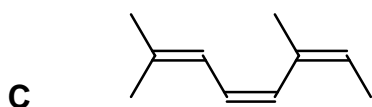
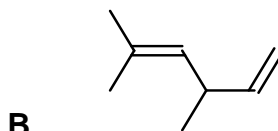
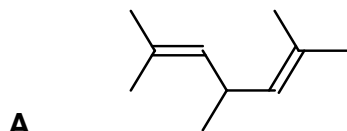


What is the grade of this particular gasoline?

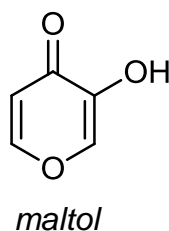
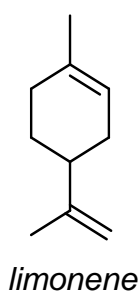
- A 90 B 92 C 95 D 98

- 20 Hydrocarbon **W** produces carbon dioxide, CH₃COCH₃ and CH₃CH(CO₂H)₂ as the only organic products on heating with an excess of hot concentrated acidic KMnO₄.

Which of the following **cannot** be **W**?



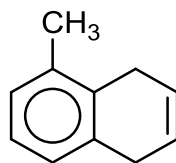
- 21 *Limonene* and *maltol* are some flavouring agents commonly used in food products.



Which of the following reagents, when added separately to the two compounds, would enable them to be distinguished from one another, assuming that the ether group, R–O–R, is unreactive?

- A hot acidified KMnO₄
 B cold alkaline KMnO₄
 C hot acidified K₂Cr₂O₇
 D aqueous Br₂

22 Compound **Z** has the following structure as shown.



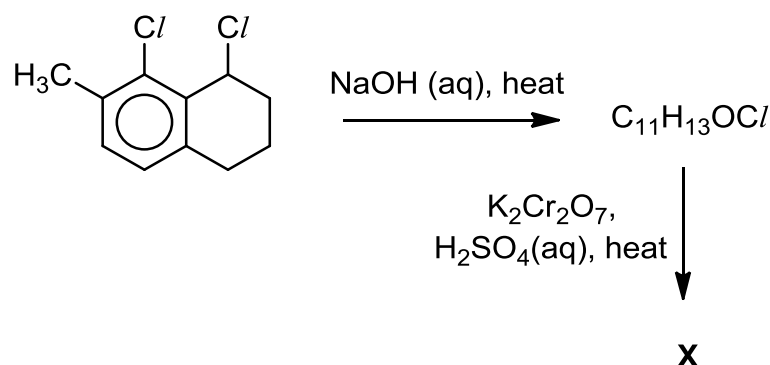
compound **Z**

Z undergoes both substitution and addition reactions with excess bromine in the presence of iron.

Which of the following statements is **false** about compound **Z**?

- A** All carbon atoms lie on the same plane.
- B** The π -bonding electrons are localised between two carbon atoms in the alkene.
- C** The π -electrons of benzene ring are delocalised throughout the ring, which makes the benzene ring very stable.
- D** Benzene would undergo substitution but not addition reaction to preserve the stable aromatic benzene ring structure.

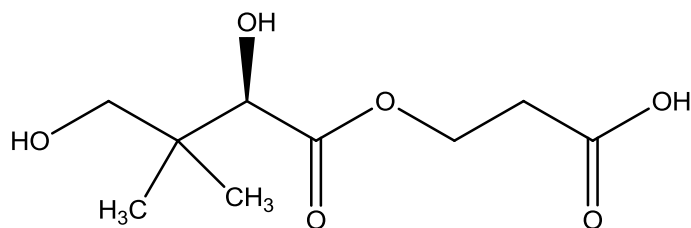
23 The reaction scheme below shows the synthesis of compound **X**.



Which of the following shows the structural formula of **X**?

- A**
- B**
- C**
- D**

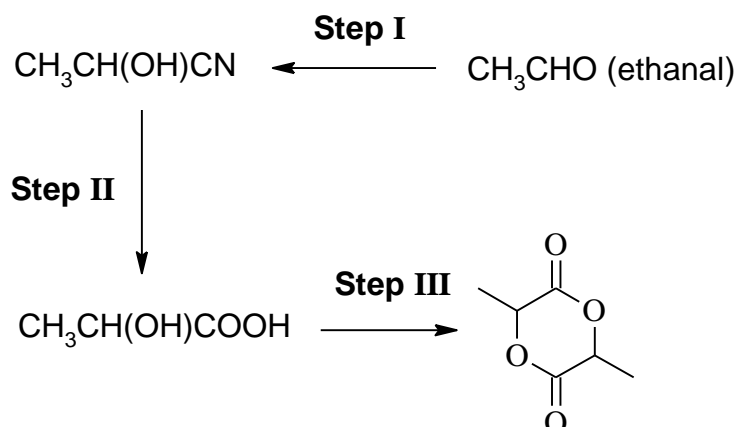
24 Vitamin B5 has the following structure.



Which of the following statement is correct?

- A One mole of Vitamin B5 reacts with three moles of Na.
- B One mole of Vitamin B5 reacts with three moles of cold KOH (aq).
- C One mole of Vitamin B5 after heating with HCl (aq), reacts with two moles of Na_2CO_3 .
- D One mole of Vitamin B5 reacts with two moles of 2,4-DNPH.

25 Ethanal, CH_3CHO , undergoes the reactions in the following reaction scheme.



Which are the types of reaction for steps I, II and III?

	Step I	Step II	Step III
A	addition	hydrolysis	addition
B	addition	hydrolysis	substitution
C	reduction	acidification	addition
D	reduction	acidification	substitution

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 place 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 What factors contribute to the lattice energy of MgCl_2 being numerically greater than that of NaBr ?

- 1** The radius of the chloride ion is smaller than that of the bromide ion.
- 2** The charge on the magnesium ion is greater than that on the sodium ion.
- 3** Chlorine is more electronegative than bromine.

27 AlCl_3 dimerises to form Al_2Cl_6 .

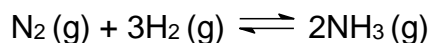
Which statements about Al_2Cl_6 are correct?

- 1** It is an ionic compound.
- 2** It contains coordinate (dative) bonding between the Al and Cl atom.
- 3** The bonds around Al atoms are tetrahedrally arranged.

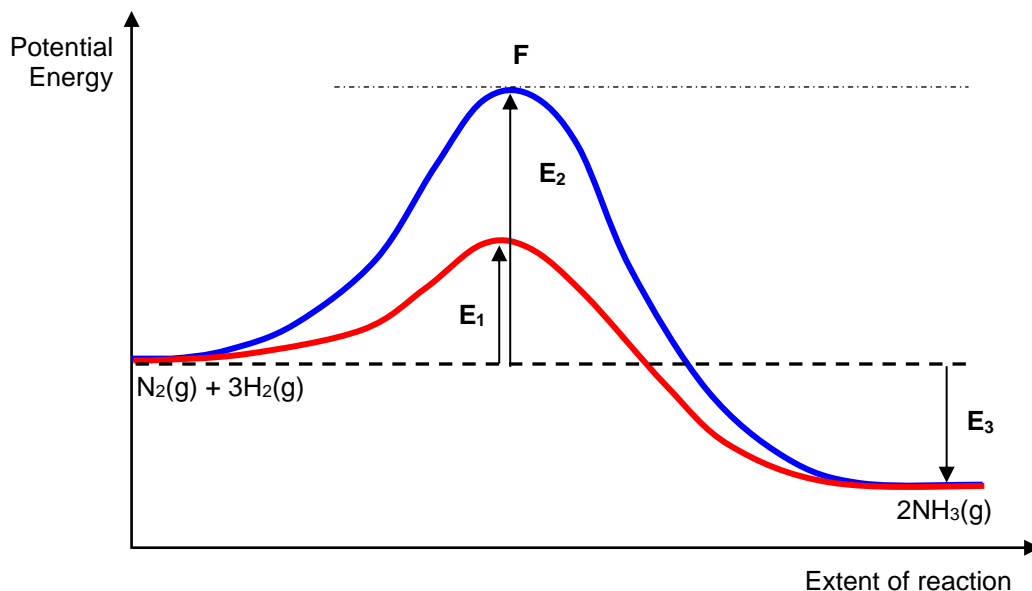
28 Which of the following reactions have only one π -bond broken in the organic reactant?

- 1** Reaction of propanone with hot alkaline I_2 .
- 2** Reaction of propene with cold, alkaline KMnO_4 .
- 3** Reaction of propanal with HCN with trace NaCN .

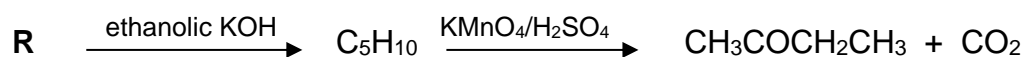
- 29 The diagram below illustrates the energy profile diagram for the Haber Process in the presence of iron catalyst.



Which of the following statements are true about the energy profile diagram below?



- 1 E_1 corresponds to the activation energy of the reaction pathway of the catalysed reaction.
 - 2 The reaction is exothermic.
 - 3 F is the intermediate formed.
- 30 Compound R undergoes the following reaction scheme.



Which reagents can be used in a chemical test to confirm that all reactants and intermediates have been converted to products?

- 1 2,4-DNPH
- 2 aqueous NaOH with AgNO_3
- 3 aqueous Br_2

End of Paper 1