

INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION 2
in preparation for General Certificate of Education Advanced Level
Higher 1

CANDIDATE
NAME

CLASS

INDEX NUMBER

CHEMISTRY

8872/01

Paper 1 Multiple Choice

24 Sept 2014

50 minutes

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your name and class on all the work you hand in.

Write in soft pencil.

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

There are **thirty** questions on this paper. 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 choice 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 **13** 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 When methane, CH_4 , undergoes incomplete combustion, a mixture of carbon dioxide and carbon monoxide is produced. Water vapour is also produced.

What is the volume of the resultant gaseous mixture when 10 cm^3 of methane is burnt in 40 cm^3 of oxygen?

- A 10 cm^3
- B 32.5 cm^3
- C 52.5 cm^3
- D 60 cm^3

- 2 Which one of the following has the same number of particles as one mole of magnesium atoms?

- A the number of ions in 2 dm^3 of 0.25 mol dm^{-3} of aqueous hydrochloric acid
- B the number of delocalised electrons in one mol of copper metal
- C the number of atoms in 71 g of chlorine gas
- D the number of ions in 58.5 g of sodium chloride

- 3 A $0.100 \text{ mol dm}^{-3}$ solution of $\text{Ca}(\text{OH})_2 \cdot x\text{H}_2\text{O}$ was found in the laboratory cupboard left in an open beaker. A week later, a student used the solution for titration with $0.100 \text{ mol dm}^{-3}$ HNO_3 and discovered his titres were lower than expected.

Which one of the following explains why the volumes of HNO_3 used were lower than expected?

- A Some water had evaporated from the calcium hydroxide solution.
- B The concentration of HNO_3 was less than the stated $0.100 \text{ mol dm}^{-3}$.
- C The calcium hydroxide crystals had less water of crystallisation than stated.
- D Some of the calcium hydroxide had reacted with carbon dioxide in the air to form solid calcium carbonate.

- 4 Which one of the following particles would, on losing an electron, have a half-filled set of p orbitals?

- A N
- B N^-
- C O^+
- D O^-

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

The ^{68}Ge isotope of the Group IV element germanium is medically useful because it undergoes a natural radioactive process to give a gallium isotope, ^{68}Ga , which can be used to detect tumours. This transformation of germanium occurs when an electron enters the nucleus, changing a proton into a neutron.

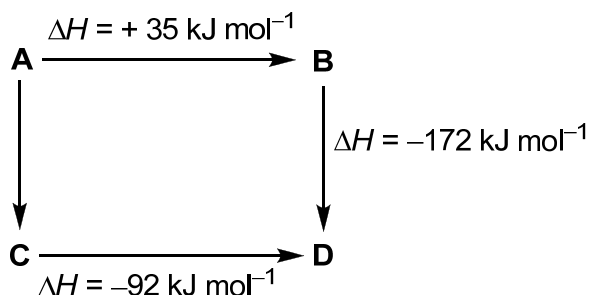
Which statement about the composition of an atom of the gallium isotope is **correct**?

- A It has 37 neutrons.
 - B Its proton number is 32.
 - C It has a total of 32 electrons.
 - D It has 4 electrons in its outer shell.
- 6 Methyl isocyanate, $\text{CH}_3\text{—N=C=O}$, is a toxic liquid which is used in the manufacture of some pesticides.

What is the approximate angle between the bonds formed by the N atom?

- A 104°
 - B 109°
 - C 120°
 - D 180°
- 7 Which of the following species is **not** planar?
- A benzene, C_6H_6
 - B aluminium chloride, AlCl_3
 - C methanal, CH_2O
 - D sulfate(IV) ion, SO_4^{2-}
- 8 The bond dissociation energy of H—Cl is 431 kJ mol^{-1} . In which of the following processes is 431 kJ of energy released?
- A $\text{HCl(g)} \longrightarrow \text{H(g)} + \text{Cl(g)}$
 - B $\text{H(g)} + \text{Cl(g)} \longrightarrow \text{HCl(g)}$
 - C $\text{HCl(g)} \longrightarrow \frac{1}{2}\text{H}_2\text{(g)} + \frac{1}{2}\text{Cl}_2\text{(g)}$
 - D $\frac{1}{2}\text{H}_2\text{(g)} + \frac{1}{2}\text{Cl}_2\text{(g)} \longrightarrow \text{HCl(g)}$

- 9 The diagram below illustrates the energy changes for a set of reactions.



Which of the following statements is **not** correct?

- A The magnitude for the enthalpy change for the transformation $\text{A} \longrightarrow \text{D}$ is 137 kJ mol^{-1} .
- B The transformation $\text{A} \longrightarrow \text{D}$ is exothermic.
- C The transformation $\text{C} \longrightarrow \text{B}$ is endothermic.
- D The enthalpy change for the transformation $\text{A} \longrightarrow \text{C}$ is -172 kJ mol^{-1} .
- 10 For which equilibrium does K_c have **no** units?
- A $\text{C(s)} + \text{H}_2\text{O(g)} \rightleftharpoons \text{CO(g)} + \text{H}_2\text{(g)}$
- B $\text{N}_2\text{(g)} + 3\text{H}_2\text{(g)} \rightleftharpoons 2\text{NH}_3\text{(g)}$
- C $\text{N}_2\text{O}_4\text{(g)} \rightleftharpoons 2\text{NO}_2\text{(g)}$
- D $\text{CH}_3\text{OH(l)} + \text{CH}_3\text{COOH(l)} \rightleftharpoons \text{CH}_3\text{COOCH}_3\text{(l)} + \text{H}_2\text{O(l)}$
- 11 What is the final pH of a solution formed by mixing equal volumes of two separate solutions of pH 2.0 and pH 4.0?
- A 2.0
- B 2.3
- C 3.0
- D 3.3

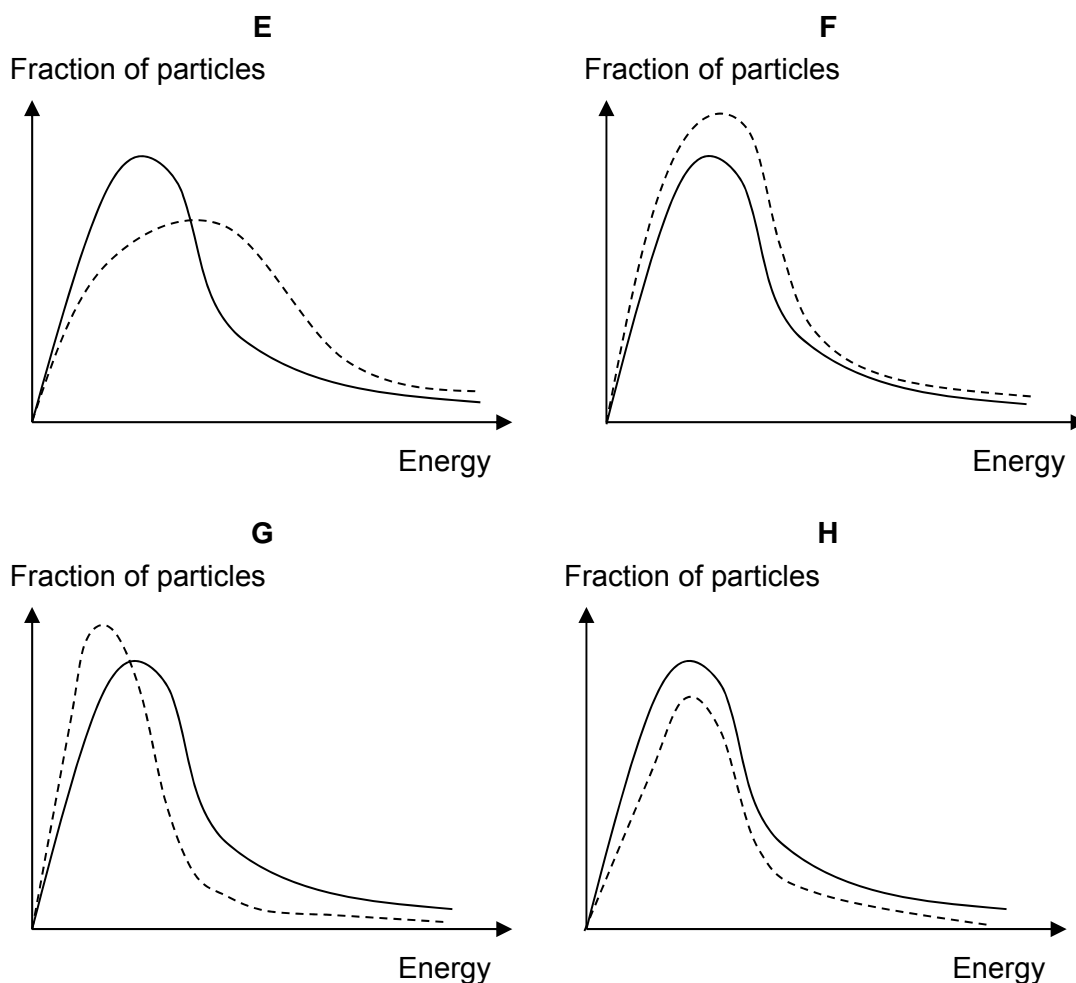
- 12 The dissociation constant, K_w , for the ionisation of water, $\text{H}_2\text{O} \rightleftharpoons \text{H}^+ + \text{OH}^-$, at different temperatures is given below.

temperature / °C	$K_w / \text{mol}^2 \text{dm}^{-6}$
0	1.15×10^{-15}
25	1.00×10^{-14}
50	5.50×10^{-14}

What can be deduced from this information?

- A $[\text{H}^+]$ and $[\text{OH}^-]$ are equal only at 25°C.
- B The equilibrium lies furthest to the right at 0 °C.
- C The forward reaction is exothermic.
- D The pH of the water decreases as temperature increases.
- 13 Which of the following statements about the rate constant, k , of all chemical reactions is true?
- A The units for rate constant are always the same.
- B The rate constant increases when temperature is decreased.
- C The rate constant increases when concentration of the reactants is increased.
- D The rate constant increases when a catalyst is added.

- 14 The diagrams **E**, **F**, **G** and **H** show how a change in conditions affects the Maxwell-Boltzmann distribution of molecular energies for gas **J**. In each case, the original distribution is shown by a solid line and the distribution after a change has been made is shown by a dashed line.



Which statement about the change made is correct?

- A** The change shown in diagram **E** occurs when the temperature is decreased.
- B** The change shown in diagram **F** occurs when a catalyst is used.
- C** The change shown in diagram **G** occurs when the volume of the container which gas **J** occupies is increased.
- D** The change shown in diagram **H** occurs when less gas **J** is present at constant temperature.

- 15 The chloride of element **L** reacts exothermically with water, giving HCl(g) .

To which group of the Periodic Table could element **L** belong?

- A** group III, group IV or group V
B group III or group IV only
C group III or group V only
D group IV or group V only
- 16 The enthalpy change of fusion of a solid is defined as the amount of energy, in J or kJ, required to melt one mol of a solid at its melting point.

The table shows the enthalpy changes of fusion of four successive elements, **M** to **T**, in the third period (sodium to argon) of the Periodic Table.

Element	M	Q	R	T
Enthalpy change of fusion/ kJ mol^{-1}	10.8	46.4	0.6	1.4

Which sequence of elements is represented by **M** to **T**?

	M	Q	R	T
A	Al	Si	P	S
B	Na	Mg	Al	Si
C	P	S	Cl	Ar
D	Si	P	S	Cl

- 17 Which statements concerning the third period elements (sodium to argon) and their compounds are correct?
- A** The elements become less electronegative from sodium to chlorine.
B Aluminium oxide is the only oxide which is amphoteric.
C The maximum oxidation state is shown by silicon.
D The first ionisation energy of Mg is lower than Al.
- 18 Which formula could represent a compound which has cis–trans isomers?
- A** C_3H_8
B C_3H_6
C C_4H_8
D $\text{C}_2\text{H}_3\text{OH}$

- 19 Butane can react with chlorine in a substitution reaction. Two monosubstituted halogenoalkanes are obtained, 1-chlorobutane and 2-chlorobutane. What is the expected ratio of 1-chlorobutane to 2-chlorobutane?

A 1:4
 B 3:2
 C 2:3
 D 4:1

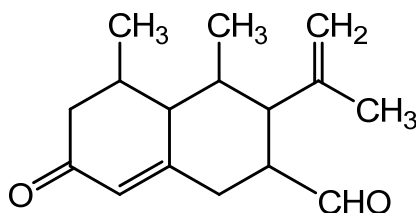
- 20 An organic compound, **U** has the following properties:

- It can react with sodium.
- It can be oxidised to form a ketone.

What is the organic compound **U**?

A $\text{CH}_3\text{CH}_2\text{CHO}$
 B $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
 C $\text{CH}_3\text{COOCH}_3$
 D $\text{CH}_3\text{CH}_2\text{OH}$

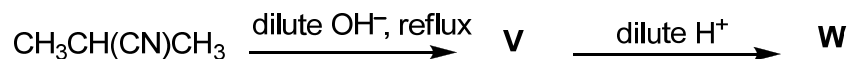
- 21 Nootkatone is one of the organic compounds found in grapefruit. The derivative of Nootkatone's structure is as shown below.



Which of the following reagents will **not** show a visible observation when the reagent is added to the compound?

A acidified potassium dichromate(VI) solution
 B 2,4-dinitrophenylhydrazine
 C aqueous silver nitrate
 D Fehling's solution

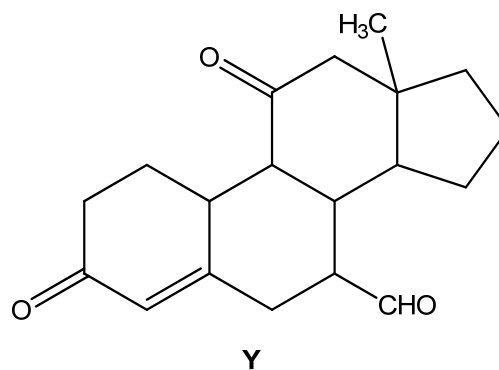
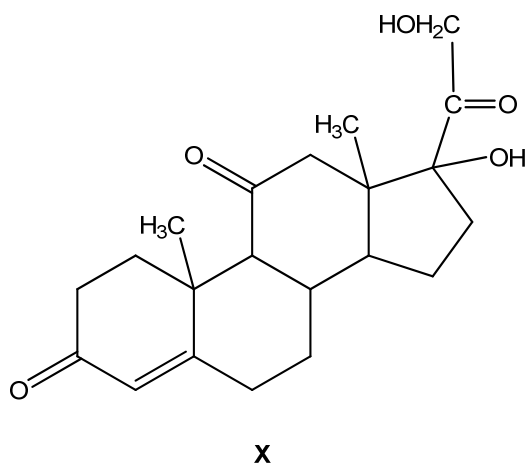
- 22 A reaction scheme is given below:



Which one of the following structures represent the product, **W**?

- A $\text{CH}_3\text{CH}(\text{CHO})\text{CH}_3$
- B $\text{CH}_3\text{CH}(\text{COO}^-)\text{CH}_3$
- C $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
- D $\text{CH}_3\text{CH}(\text{COOH})\text{CH}_3$

- 23 Which one of the following reagents can be used to distinguish between the two compounds **X** and **Y**?



- A bromine
 - B aqueous sodium hydroxide
 - C sodium metal
 - D ethanoic acid
- 24 Which of the following represents the correct structural formula of the organic product of the reaction between $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{COOH}$?
- A $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_3$
 - B $(\text{CH}_3)_2\text{CHCOOCH}_2\text{CH}_3$
 - C $\text{CH}_3\text{CH}_2\text{COOCH}(\text{CH}_3)_2$
 - D $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_3$

25 Which of the following reacts with ethanoic acid, CH_3COOH under suitable conditions?

- A** sodium hydroxide
- B** propanoic acid
- C** hydrogen chloride
- D** Fehling's solution

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** Carbon forms double bonds with each of the Group VI elements oxygen, sulfur and selenium. In each case, the double bond is polar.

In the molecules carbon dioxide (CO₂), carbonyl sulfide (COS) and carbonyl selenide (COSe), the polarities of these double bonds do not necessarily cancel.

	overall polarity of molecule
CO ₂	0
COS	0.71
COSe	0.73

Which factors could account for these observations?

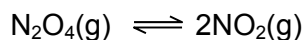
- 1** The C=S bond is more polar than the C=Se bond.
- 2** The C=O bond is more polar than the C=S bond.
- 3** The C=Se bond is more polar than the C=O bond.

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.

27 For the reaction:



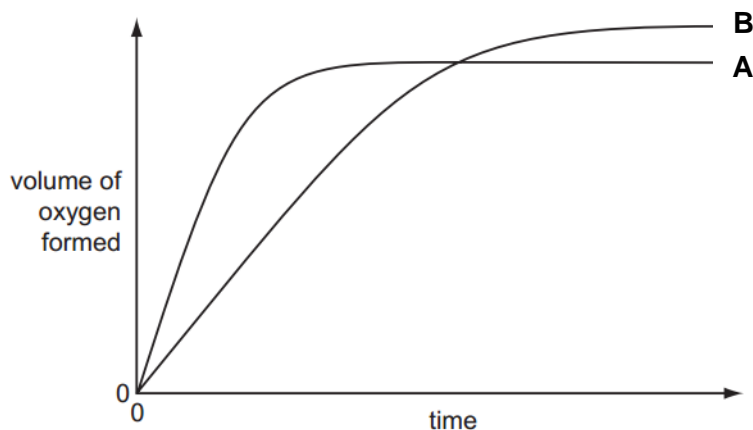
the numerical values of K_c at two different temperatures are given as follows:

temperature/ K	K_c
x	1.53
298	4.64×10^{-3}

Which of the following statement(s) is / are correct?

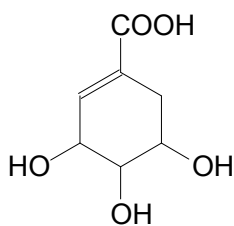
- 1** The proportion of NO_2 in the equilibrium mixture is increased by decreasing the pressure.
- 2** The value of **x** is higher than 298K.
- 3** The units for K_c are $\text{mol}^2 \text{dm}^{-6}$.

- 28 Two graphs, **A** and **B** were plotted to investigate on the rate of decomposition of 100 cm^3 of 1.0 mol dm^{-3} hydrogen peroxide, catalysed by manganese(IV) oxide.



Which of the following changes to the experimental conditions would produce graph **B**?

- 1 add 50 cm^3 of 0.1 mol dm^{-3} hydrogen peroxide
 - 2 increase the temperature
 - 3 add more manganese(IV) oxide
- 29 Under what conditions will bromine react with methylbenzene?
- 1 in the presence of uv light
 - 2 in the presence of Al/Br_3
 - 3 in the presence of water
- 30 Shikimic acid, is an important biochemical intermediate in plants and microorganisms.



shikimic acid

What type(s) of reaction will shikimic acid undergo?

- 1 addition
- 2 substitution
- 3 elimination

