



JURONG JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 1

CHEMISTRY

8872/01

Paper 1 Multiple Choice

14 September 2017

50 minutes

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 name, class and shade your exam index number on the Answer Sheet in the spaces provided.

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.

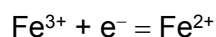
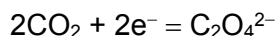
The use of an approved scientific calculator is expected, where appropriate.

A *Data Booklet* is provided. Do not write anything on the *Data Booklet*.

2
SECTION A

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

- 1 Three half-equations are given below.



Acidified MnO_4^- ions can oxidise both ions in iron(II) ethandioate, FeC_2O_4 .

What is the mole ratio of MnO_4^- : FeC_2O_4 in a complete oxidation?

	MnO_4^-	FeC_2O_4
A	2	5
B	3	5
C	5	2
D	5	3

- 2 A compound is made up of two elements, **Y** and **Z**.
Each atom of **Y** and of **Z** has exactly 2 unpaired electrons in its outermost p orbitals.

What could the compound be?

- A** CO_2 **B** CF_4 **C** NF_3 **D** NO_2

- 3 What is the electronic configuration of vanadium atom, proton number 23?

- A** $1\text{s}^2 2\text{s}^2 2\text{p}^6 3\text{s}^2 3\text{p}^6 3\text{d}^4 4\text{s}^1$ **B** $1\text{s}^2 2\text{s}^2 2\text{p}^6 3\text{s}^2 3\text{p}^6 4\text{s}^2 4\text{p}^3$
C $1\text{s}^2 2\text{s}^2 2\text{p}^6 3\text{s}^2 3\text{p}^6 3\text{d}^5$ **D** $1\text{s}^2 2\text{s}^2 2\text{p}^6 3\text{s}^2 3\text{p}^6 3\text{d}^3 4\text{s}^2$

- 4 Nitrogen and phosphorus are both in Group 15 of the Periodic Table. Phosphorus forms a chloride with the formula PCl_5 but nitrogen does not form NCl_5 .

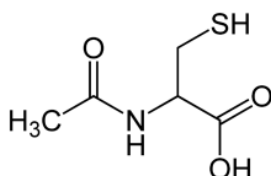
Which statement helps to explain this?

- A** Nitrogen is less electronegative than phosphorus.
B Nitrogen cannot have an oxidation state of +5.
C Nitrogen's outer shell cannot contain more than eight electrons.
D Nitrogen only has three unpaired electrons in the valence shell.

5 Which compound has more than one type of chemical bond?

- A** Ammonium nitrate **B** Calcium chloride
C Silicon(IV) oxide **D** Diamond

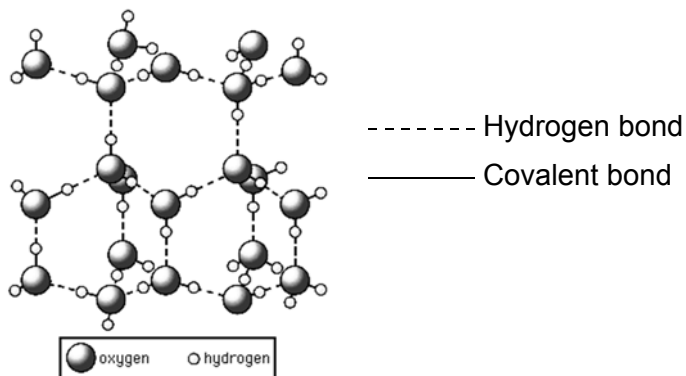
6 Flumucil is a medicine used to loosen thick mucus in individuals with chronic obstructive pulmonary disease. Its structure is shown below.



How many lone pair of electrons are present in one molecule of fluimucil?

- A** 5 **B** 6 **C** 8 **D** 9

7 Ice is the crystalline form of water. The diagram below shows part of the structure of ice.



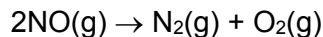
Which of the following statements is **not** true about ice?

- A** Ice has a lower density than water at 0 °C due to its open structure.
- B** The bond angle about oxygen in ice is 109.5°.
- C** Ice does not conduct electricity.
- D** The hydrogen bonds are stronger than the O-H covalent bond.

8 Which set of bond angles are present in the molecule shown below?

- A** 90 °, 109 ° and 120 ° only
- B** 105 ° and 120 ° only
- C** 107 ° and 180 ° only
- D** 109 °, 120 ° and 180 ° only

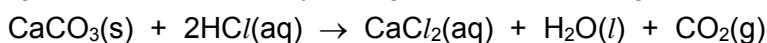
- 9 The standard enthalpy change of formation of nitrogen(II) oxide, NO, is $+90 \text{ kJ mol}^{-1}$. What is the enthalpy change of the reaction shown below?



A -180 kJ mol^{-1} **B** -90 kJ mol^{-1} **C** $+90 \text{ kJ mol}^{-1}$ **D** $+180 \text{ kJ mol}^{-1}$

- 10 In an experiment to measure the enthalpy change for the reaction between hydrochloric acid and calcium carbonate, 20 cm^3 of solution containing 0.04 mol of HCl is placed in a plastic cup of negligible heat capacity. When 2.0 g (0.02 mol) of calcium carbonate was added, the temperature rises by 15 K .

Given that the heat capacity per volume of the final solution is $4.2 \text{ J K}^{-1} \text{ cm}^{-3}$, what is the magnitude of the enthalpy change for the reaction given below?



A $\frac{(20 + 2) \times 4.2 \times 15}{0.02} \text{ J mol}^{-1}$

B $\frac{(20 + 2) \times 4.2 \times 15}{0.04} \text{ J mol}^{-1}$

C $\frac{20 \times 4.2 \times 15}{0.04} \text{ J mol}^{-1}$

D $\frac{20 \times 4.2 \times 15}{0.02} \text{ J mol}^{-1}$

- 11 Given the following information:

$$\Delta H_c \text{ of C(s)} = -394 \text{ kJ mol}^{-1}$$

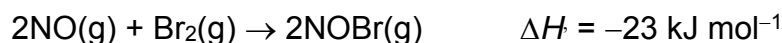
$$\Delta H_f \text{ of H}_2\text{O(l)} = -286 \text{ kJ mol}^{-1}$$

$$\Delta H_f \text{ of CH}_3\text{OH(l)} = -239 \text{ kJ mol}^{-1}$$

Which one of the following is the correct enthalpy change of combustion of liquid methanol, CH_3OH , in kJ mol^{-1} ?

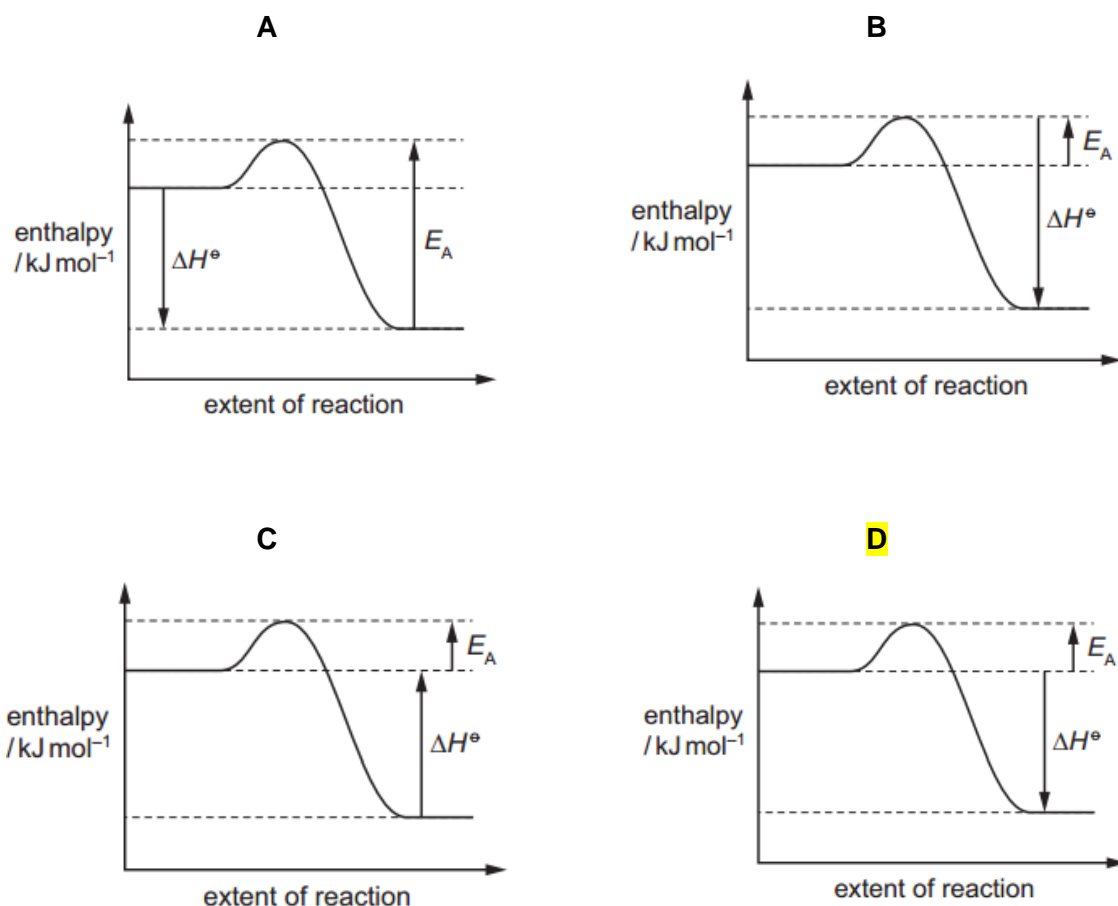
A -441 **B** -727 **C** -919 **D** -1205

- 12 Nitric oxide, NO, and bromine vapour react together according to the following equation.



The reaction has an activation energy of $+5.4 \text{ kJ mol}^{-1}$.

What is the correct reaction pathway diagram for the above reaction?



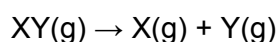
- 13 A piece of magnesium ribbon was added to 25 cm^3 of dilute hydrochloric acid. The magnesium was completely dissolved and the total volume of hydrogen gas evolved was measured.

In a second experiment, an identical piece of magnesium ribbon of the same mass was used. This was added to another 50 cm^3 of the same dilute hydrochloric acid. The total volume of hydrogen gas evolved was measured.

How will the initial rate of reaction and total volume of hydrogen evolved in the second experiment compare to the first experiment?

	Initial rate of reaction	Total volume of hydrogen evolved
A	Increase	Increase
B	Increase	No change
C	No change	Increase
D	No change	No change

- 14 The following reaction has a first-order kinetics.

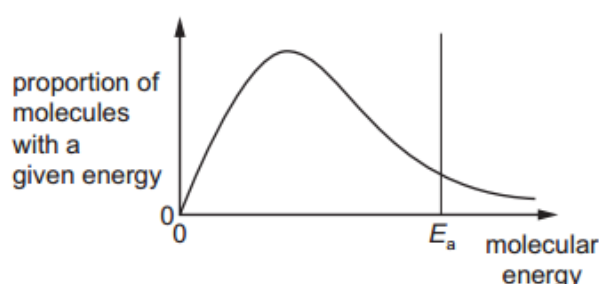


It takes 64 seconds for 4 g of XY to decompose till 2 g of XY was left.

How long will it take for 0.25 g of XY to react till 0.125 g?

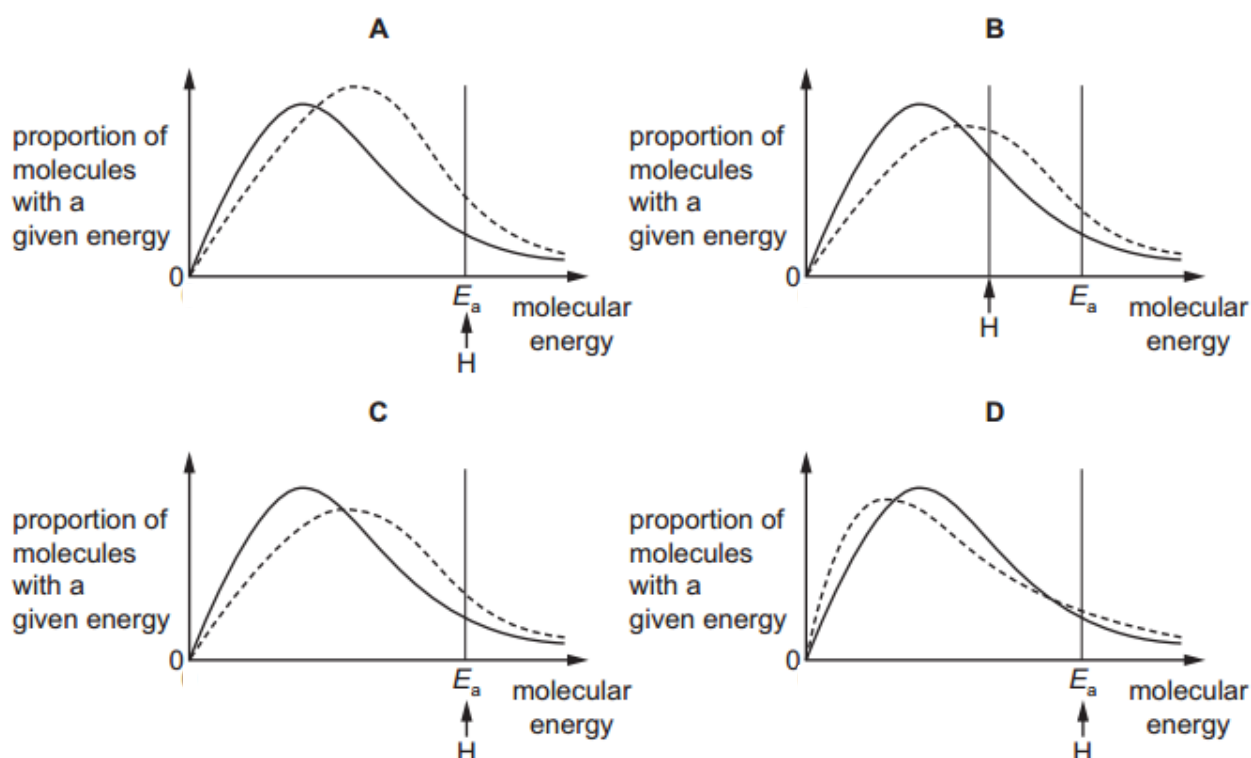
- A 4 s B 8 s **C** 64 s D 320 s

- 15 The diagram represents, for a given temperature, the Boltzmann distribution of the kinetic energies of the molecules in a mixture of two gases that react together. The activation energy for the reaction, E_a , is marked.



The dotted curves below show the Boltzmann distribution for the same reaction at a higher temperature. On these diagrams, H represents the activation energy at the higher temperature.

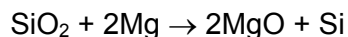
Which diagram is correct? **C**



16 Which series is correctly arranged in order of increasing values?

- A Atomic radius of P, S, Cl
- B** Lattice energy of NaF, MgF₂, AlF₃
- C First ionisation energy of Na, Mg, Al
- D Melting point of P, S, Cl

17 In the preparation of silicon, silicon dioxide is heated with magnesium.



The product mixture contains MgO and Si only.

To separate the silicon from the product mixture, students proposed the following two methods.

1. Shake the mixture with aqueous hydrochloric acid and filter.
2. Heat the mixture gently and collect the evaporated silicon.

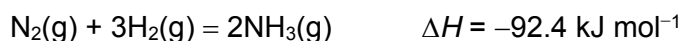
Which methods would work?

- | | |
|-----------------|-------------------------|
| A 1 only | B 1 and 2 |
| C 2 only | D Neither 1 or 2 |

18 What is meant by the term *dynamic equilibrium*?

- A an equilibrium that is constantly changing its position
- B an equilibrium where the forward and reverse reactions are taking place at different rates
- C** an equilibrium where the forward and reverse reactions are taking place at the same rates
- D an equilibrium which has not yet settled to a constant state

19 Hydrogen and nitrogen react to produce ammonia.



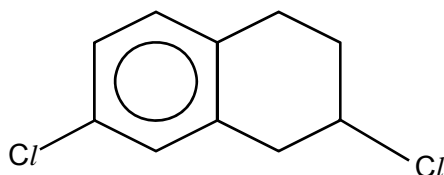
Which statement is correct?

- A Increasing pressure increases the value of the equilibrium constant.
- B Increasing the amount of iron catalyst increases the equilibrium yield of ammonia.
- C** Condensing the gaseous ammonia product shifts the equilibrium position to favour the formation of more ammonia.
- D Lowering the volume of the reaction vessel does not affect the rate of reaction and equilibrium yield of ammonia.

20 Which property of benzene results from the stability associated with the ring of delocalised π electrons?

- A It does not conduct electricity.
- B It is susceptible to attack by electrophiles.
- C** It undergoes electrophilic substitution instead of electrophilic addition.
- D All the carbon-carbon bonds have exactly the same bond length.

21 Which statement about the molecule below is correct?



- A It has an empirical formula of C_6H_6Cl .
- B** It has a molecular formula of $C_{10}H_{10}Cl_2$.
- C It has six sp^3 and six sp^2 carbon atoms.
- D It is a tertiary alkyl halide.

22 A $0.050 \text{ mol dm}^{-3}$ solution of strong acid **R** has a pH of 1.00.

Which acid is **R**?

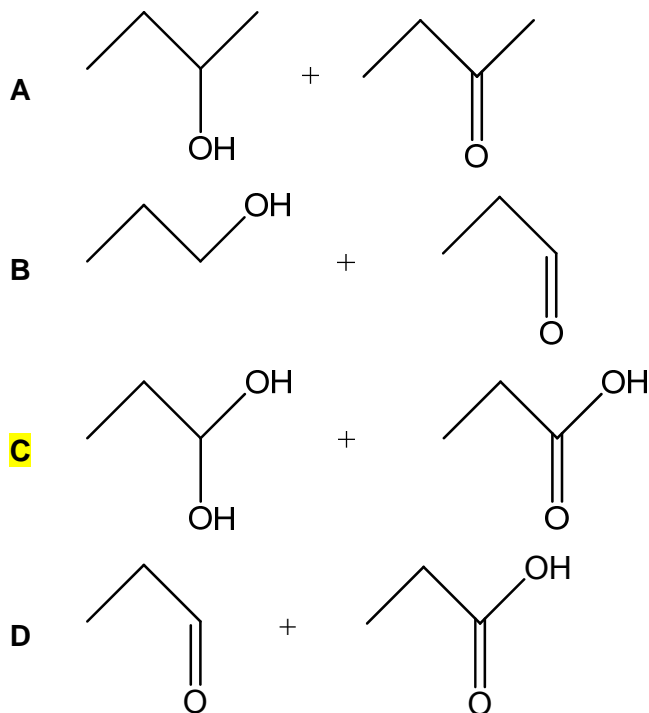
- A HCl
- B HNO_3
- C** H_2SO_4
- D H_3PO_4

23 10 cm^3 of aqueous silver nitrate was added to two separate samples of bromopropane and chloropropane. The resulting mixtures were allowed to stand.

Which of the following shows the correct observation?

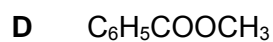
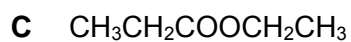
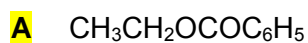
	bromopropane	chloropropane
A	white ppt formed immediately	cream ppt formed immediately
B	cream ppt formed after 2 hours	white ppt formed after 20 minutes
C	cream ppt formed after 20 minutes	white ppt formed after 2 hours
D	white ppt formed after 20 minutes	cream ppt formed after 2 hours

24 Which two compounds can react to produce an ester?



25 Compound **Q** was refluxed with aqueous sodium hydroxide and the resulting mixture was then distilled. The distillate gave a positive tri-iodomethane test. The residue in the distillation flask, after acidification, gave a white precipitate.

Which of these could be **Q**?



10
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.

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 Which molecules have an overall dipole moment?

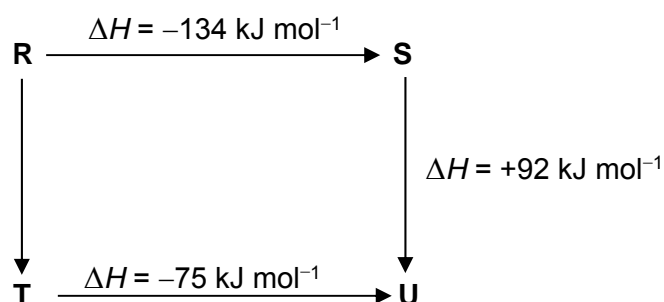
- 1** carbon monoxide, CO
- 2** dichloromethane, CH₂Cl₂
- 3** phosphine, PH₃

27 Boron is a non-metallic element which is found above aluminium in Group 13 of the Periodic Table. It forms a compound with nitrogen known as boron nitride which has a graphite structure.

Which conclusions can be drawn from this information?

- 1** The empirical formula of boron nitride is BN.
- 2** Boron nitride has a layer structure with instantaneous dipole-induced dipole interactions between the layers.
- 3** The boron and nitrogen atoms in a layer are likely to be arranged alternately in a hexagonal pattern.

28 The diagram illustrates the enthalpy changes of a set of reactions.



Which statements are correct?

- 1** The enthalpy change for the transformation **U** → **R** is +42 kJ mol⁻¹.
- 2** The enthalpy change for the transformation **T** → **S** is endothermic.
- 3** The enthalpy change for the transformation **R** → **T** is -33 kJ mol⁻¹.

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.

29 Which of the following gives the compounds in order of decreasing K_a ?

	highest K_a		lowest K_a
1	$\text{FCH}_2\text{CO}_2\text{H}$	$\text{ClCH}_2\text{CO}_2\text{H}$	$\text{BrCH}_2\text{CO}_2\text{H}$
2	$\text{CH}_3\text{CF}_2\text{CO}_2\text{H}$	$\text{FCH}_2\text{CHFCO}_2\text{H}$	$\text{F}_2\text{CHCH}_2\text{CO}_2\text{H}$
3	$\text{CH}_3\text{CH}(\text{OH})\text{CO}_2\text{H}$	$\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$	$\text{CH}_3\text{CH}(\text{CH}_3)\text{CO}_2\text{H}$

30 Compound **Z** was subjected to the following tests and the results are recorded below.

Reagents & Conditions	Observations
Acidified $\text{K}_2\text{Cr}_2\text{O}_7$, heat	Orange $\text{K}_2\text{Cr}_2\text{O}_7$ turns green.
Acidified KMnO_4 , heat	Purple KMnO_4 decolourise. A colourless gas formed.
Fehling's reagent, heat	Red brown precipitate formed.

What could be the identity of **Z**?

