

NANYANG JUNIOR COLLEGE  
JC 2 PRELIMINARY EXAMINATION  
Higher 1

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## CHEMISTRY

Paper 1 Multiple Choice

**8872/01**

**27 September 2016**

**50 minutes**

Additional Materials:      Multiple Choice Answer Sheet  
Data Booklet

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### READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and tutor's name on the Answer Sheet in the spaces provided unless this has been done for you.

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.

**[Turn over**

## Section A

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

1 Which of the following will give the largest number of the particles?

- A** fluorine molecules in 114 g of  $F_2$
- B** carbon atoms in 18 g of  $C_6H_{12}O_6$
- C** water molecules in 267.6 g of  $CuSO_4 \cdot 6H_2O$
- D** hydrogen atoms in 184 g of methylbenzene

2 The six successive ionisation energies of element **Q** are given below.

IE / kJ mol <sup>-1</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
<b>Q</b>	1060	2330	4600	6225	37500	44000

Which compound will be the least likely to be formed?

- A** **QO**                      **B** **QO<sub>2</sub>**                      **C** **QH<sub>3</sub>**                      **D** **QCl<sub>4</sub>**

3 Consider the following four compounds.

1.  $CH_3CH_2CH_2CH_3$
2.  $CH_3CH_2COOH$
3.  $CH_3CH_2CH_2Br$
4.  $(CH_3)_3CBr$

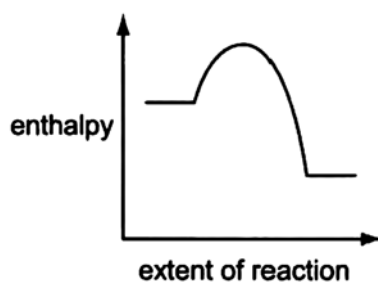
What is the order of **increasing** boiling point of these compounds?

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

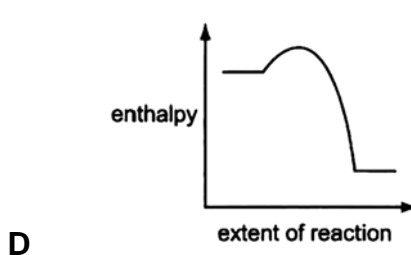
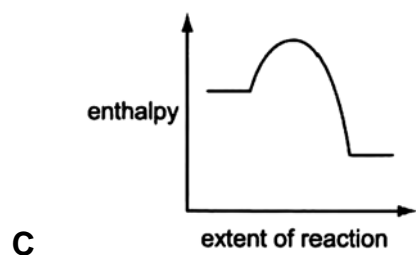
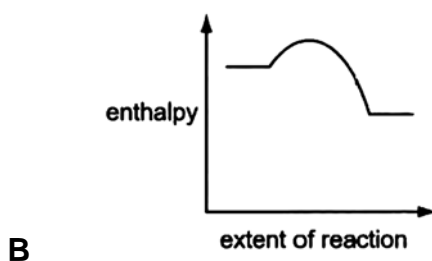
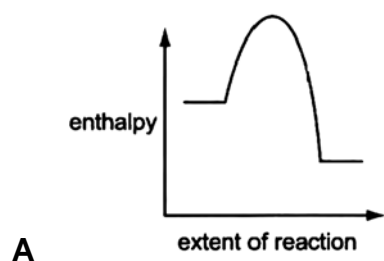
4 Which compound does **not** have a co-ordinate bond?

- A CO
- B CS<sub>2</sub>
- C NO<sub>3</sub><sup>-</sup>
- D NH<sub>4</sub><sup>+</sup>

5 The reaction pathway diagram for a reaction at 300 K is shown.



Which reaction pathway diagram represents the same reaction at a higher temperature?

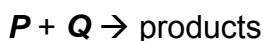


- 6 Phosphine reacts with hydrogen iodide to form phosphonium iodide in the reaction shown.



Given that  $\Delta H_f$  for  $\text{PH}_3 = +5.4 \text{ kJ mol}^{-1}$ , and  $\Delta H_f$  for  $\text{HI} = +26.5 \text{ kJ mol}^{-1}$ , what is the standard enthalpy change of formation of phosphonium iodide?

- A  $-133.7 \text{ kJ mol}^{-1}$   
 B  $-69.9 \text{ kJ mol}^{-1}$   
 C  $+133.7 \text{ kJ mol}^{-1}$   
 D  $+69.9 \text{ kJ mol}^{-1}$
- 7 The following reaction is first order with respect to  $[P]$  and zero order with respect to  $[Q]$ .



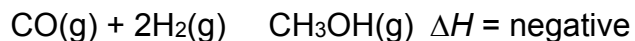
If the rate constant doubles for each  $10^\circ\text{C}$  rise in temperature, which of the following sets of conditions will give the greatest rate of reaction?

	$[P] / \text{mol dm}^{-3}$	$[Q] / \text{mol dm}^{-3}$	temperature / $^\circ\text{C}$
A	0.1	0.3	40
B	0.1	0.2	30
C	0.2	0.2	40
D	0.3	0.3	30

- 8 Which statement about the order of a chemical reaction is correct?
- A It is the sum of the number of species included in the rate equation.  
 B It is the sum of the number of species involved before the rate determining step.  
 C It is the sum of the powers of the concentrations of the species included in the rate equation.  
 D It is the sum of the number of moles on the left-hand side of the balanced chemical equation.

- 9 Methanol is increasingly being used as an additive for petrol and for making the esters that are components of biodiesel fuel.

Methanol is manufactured by the following reaction.



Which pair of changes will definitely increase the amount of methanol present at equilibrium?

	pressure	temperature
<b>A</b>	decrease	decrease
<b>B</b>	decrease	increase
<b>C</b>	increase	decrease
<b>D</b>	increase	increase

- 10 25.0 cm<sup>3</sup> of 0.1 mol dm<sup>-3</sup> CH<sub>3</sub>COOH was titrated against 0.1 mol dm<sup>-3</sup> NaOH.

What conclusion can be drawn about this titration?

- A** 12.50 cm<sup>3</sup> of NaOH is required to reach end-point.
- B** The resulting solution at end-point will be slightly alkaline.
- C** There will be NaOH remaining in the resulting solution at the end-point.
- D** A suitable indicator to determine the end-point would be methyl orange.

- 11 The dissociation constant,  $K_w$ , for the ionisation of water,  $2\text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$ , at different temperatures is given below.

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

What can be deduced from this information?

- A The pH of water at 50 °C is 6.6.
  - B The forward reaction is exothermic.
  - C The equilibrium lies more to the left as temperature increases.
  - D The  $[\text{H}_3\text{O}^+]$  increases while the  $[\text{OH}^-]$  decreases as temperature increases.
- 12 Nitrates are commonly added to soils as nitrogenous fertilisers but can be leached out of the soil into nearby streams. Soils can, however, retain nitrogen if the nitrate is converted into ammonium ions.

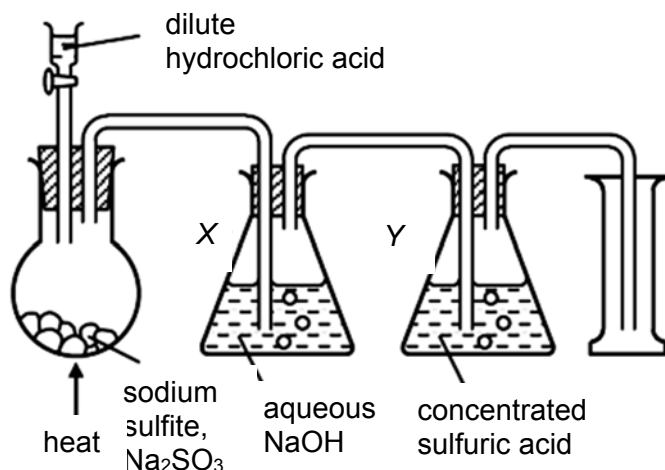
What conditions in the soil would improve the production and retention of ammonium ions?

- A acidic and oxidising
  - B acidic and reducing
  - C alkaline and oxidising
  - D alkaline and reducing
- 13 A  $25 \text{ cm}^3$  sample of  $0.20 \text{ mol dm}^{-3} \text{Ti}^+ \text{NO}_3^-$  required  $25 \text{ cm}^3$  of  $0.10 \text{ mol dm}^{-3}$  acidified  $\text{KMnO}_4$  to oxidise it to  $\text{Ti}^{3+}$  in solution.

What is the oxidation state of the manganese in the reduced form?

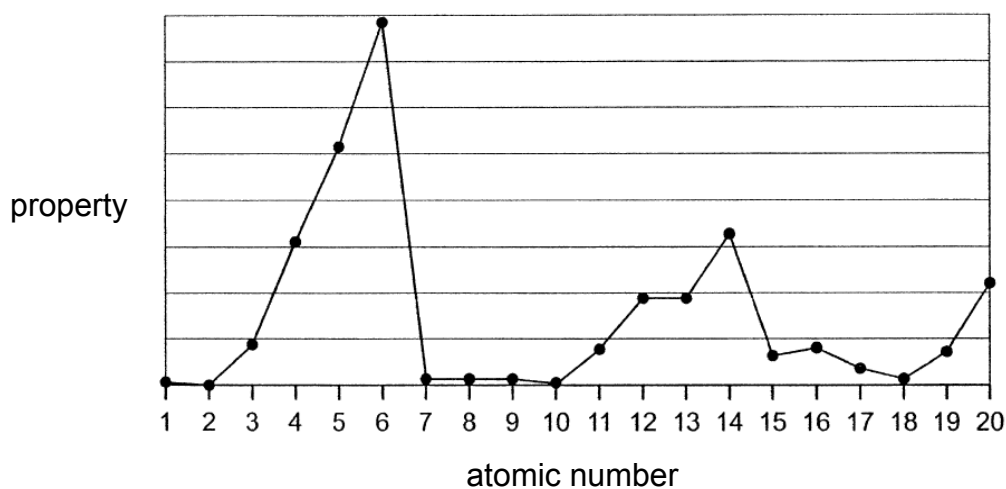
- A 2                      B 3                      C 4                      D 7

- 14 The diagram represents an unsuccessful attempt to prepare and collect sulfur dioxide.



Which modification would make the experiment successful?

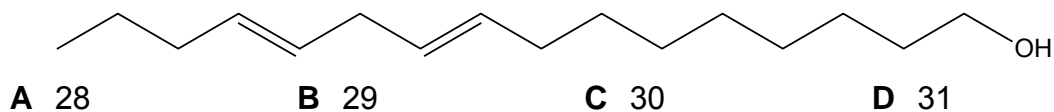
- A omitting flask X entirely
  - B omitting flask Y entirely
  - C using dilute sulfuric acid instead of hydrochloric acid
  - D collecting by upward delivery
- 15 The following shows the variation of a property of the first 20 elements in the Periodic Table with the atomic number of the element.



What is the property?

- A atomic radius
- B first ionisation energy
- C ionic radius
- D melting point

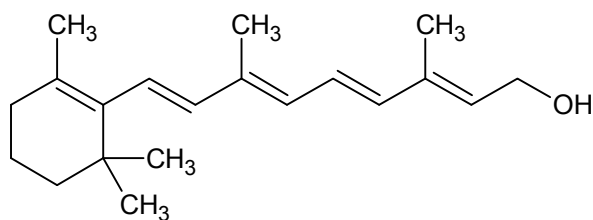
16 How many hydrogen atoms are present in one of these molecules?



17 Pentane was reacted with limited chlorine in the presence of uv light. Assuming that only mono-chlorination takes place and the reaction occurs at the same rate at all carbon atoms, predict the ratio of the products obtained.

	1-chloropentane	2-chloropentane	3-chloropentane
A	3	2	1
B	1	2	3
C	1	3	2
D	3	1	2

18 The structure of vitamin A is shown below.



vitamin A

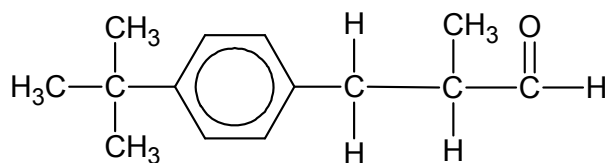
When it is reacted with hot acidified potassium manganate(VII), how many organic products will be formed?

- A 2  
B 3  
C 4  
D 5



- 19 Which reagent and conditions are used to bring about the reaction from methylbenzene to 4-chloromethylbenzene?
- A Chlorine in the dark
  - B Chlorine with uv light
  - C Chlorine with aluminum chloride
  - D Concentrated hydrochloric acid heated under reflux
- 20 Which of the following isomers of  $C_5H_{11}Br$  gives the greatest number of different alkenes on treatment with hot ethanolic sodium hydroxide?
- A  $CH_3CH_2CH(CH_3)CH_2Br$
  - B  $CH_3CH_2CH_2CHBrCH_3$
  - C  $CH_3CH_2CHBrCH_2CH_3$
  - D  $CH_3CH_2CH_2CH_2CH_2Br$
- 21 A particular alcohol contains only one  $-OH$  group in its molecule. Which reagent will not react with such an alcohol?
- A Sodium
  - B Aqueous bromine
  - C Ethanoic acid with a strong acid catalyst
  - D Concentrated sulfuric acid and aqueous sodium bromide
- 22 Which reaction will occur without a colour change being observed?
- A phenylpropanal,  $C_6H_5(CH_2)_2CHO$ , + Tollen's reagent
  - B phenylpropene,  $C_6H_5CH_2CH=CH_2$ , + cold dilute acidified potassium manganate (VII)
  - C propanol,  $CH_3(CH_2)_2OH$ , + aqueous alkaline iodine
  - D propanone,  $CH_3COCH_3$ , + HCN

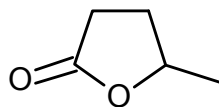
- 23 Lily aldehyde is used as a perfume in anti-perspirants.



Lily aldehyde

How many  $sp^2$  hybridised carbons are present in lily aldehyde?

- A 5                      B 6                      C 7                      D 8
- 24 Why is chloroethanoic acid,  $\text{ClCH}_2\text{CO}_2\text{H}$ , a stronger acid than ethanoic acid?
- A Chlorine releases electrons and destabilises  $\text{ClCH}_2\text{CO}_2^-$   
 B Chlorine releases electrons and stabilises  $\text{ClCH}_2\text{CO}_2^-$   
 C Chlorine withdraws electrons and destabilises  $\text{ClCH}_2\text{CO}_2^-$   
 D Chlorine withdraws electrons and stabilises  $\text{ClCH}_2\text{CO}_2^-$
- 25  $\gamma$ -valerolactone is a naturally occurring organic compound found in fruits and could be a possible bio-fuel alternative to ethanol.



$\gamma$ -valerolactone

Which statement about this compound is **not** correct?

- A It is a cyclic ester.  
 B It reacts readily with warm, aqueous alkali  
 C It reacts with 2,4-dinitrophenylhydrazine to give an orange precipitate.  
 D It can be prepared by warming 4-hydroxypentanoic acid,  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$ , in the presence of an acid catalyst.

## 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 which you consider to be correct).

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

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>1, 2 and 3</b> are correct	<b>1 and 2</b> only are correct	<b>2 and 3</b> only are correct	<b>1 only</b> is correct

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

- 26** A chloroalkane was heated with ammonia. The relative rate of the reaction can be calculated by inverting the time.

The following kinetics data was obtained.

experiment	[chloroalkane] / mol dm <sup>-3</sup>	[ammonia] / mol dm <sup>-3</sup>	Time taken for the reaction to be completed / min
1	0.0050	0.0050	30.2
2	0.0065	0.0050	23.1
3	0.0075	0.0075	13.3

Which conclusions can be drawn from this information?

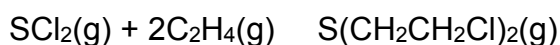
- 1** The overall order of reaction is 2.
- 2** The units for the rate constant is mol<sup>-1</sup> dm<sup>3</sup> min<sup>-1</sup>
- 3** Replacing the chloroalkane with bromoalkane will require a shorter time for the reaction to be completed.

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

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>1, 2 and 3</b> are correct	<b>1 and 2</b> only are correct	<b>2 and 3</b> only are correct	<b>1 only</b> is correct

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

- 27** A mixture of  $\text{SCl}_2$  and  $\text{C}_2\text{H}_4$  is allowed to react at room temperature. The product produced is mustard gas,  $\text{S}(\text{CH}_2\text{CH}_2\text{Cl})_2$  which is a blistering agent. The reaction is exothermic.



Which of the following statements are always true?

- 1** The reaction reaches dynamic equilibrium when the product and reactant concentrations are equal.
  - 2** The reaction reaches dynamic equilibrium when the forward and reverse rates are equal.
  - 3** The equilibrium constant of the reaction will decrease if the reaction takes place at a higher temperature.
- 28** Phosphorus is an element in the third period, Na to Ar, of the Periodic Table. What is true for phosphorus and not for the other elements in this period?
- 1** Phosphorus is the only element in this period with exactly four atoms in its molecule.
  - 2** Phosphorus is the only element in this period which forms two acidic oxides.
  - 3** Phosphorus is the only element in this period whose chlorides react with water to form acidic solutions.

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

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>1, 2 and 3</b> are correct	<b>1 and 2</b> only are correct	<b>2 and 3</b> only are correct	<b>1 only</b> is correct

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

**29** Halothane,  $\text{CF}_3\text{CHBrCl}$ , is a common general anesthetic.

Which statements about halothane are correct?

- 1** It is relatively unreactive.
- 2** It may cause a depletion of the ozone layer.
- 3** There are four structural isomers in total.

**30** For which type of compound are **all** of the following statements correct?

- They form esters
- They react with sodium
- They are unreactive towards sodium borohydride

- 1** aldehydes
- 2** carboxylic acids
- 3** tertiary alcohols

**Answers**

1	D	6	B	11	A	16	C	21	B	26	A
2	C	7	C	12	B	17	A	22	D	27	C
3	A	8	C	13	B	18	A	23	C	28	D
4	B	9	C	14	A	19	C	24	D	29	A
5	C	10	B	15	D	20	B	25	C	30	C