



JURONG JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 1

CHEMISTRY

8872/01

Paper 1 Multiple Choice

16 September 2016

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*.

SECTION A

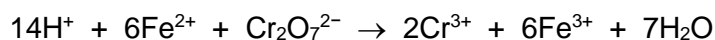
For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider to be correct.

- 1 How many O atoms are there in 500 cm³ of oxygen measured at s.t.p.?

A 1.25×10^{22}
B 1.34×10^{22}
C 2.50×10^{22}
D 2.68×10^{22}

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

Ferrochrome, an alloy of iron and chromium, can be dissolved in dilute sulfuric acid to produce a mixture of FeSO₄ and Cr₂(SO₄)₃. The FeSO₄ reacts with Na₂Cr₂O₇ in acid solution according to the following equation.

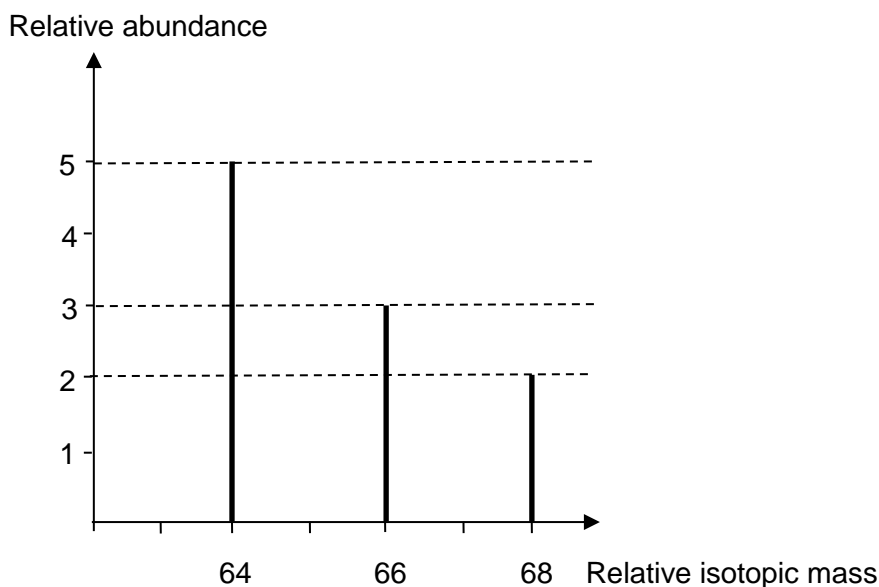


When 1.00 g of ferrochrome is dissolved in dilute sulfuric acid, and the resulting solution titrated, 13.10 cm³ of 0.100 mol dm⁻³ Na₂Cr₂O₇ is required for complete reaction with Fe²⁺ ions.

What is the percentage by mass of Fe in the sample of ferrochrome?

A 1.22 **B** 4.39 **C** 12.2 **D** 43.9

- 3 The relative abundances of naturally-occurring isotopes of a sample of zinc are shown below.



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

A 63 **B** 64 **C** 65 **D** 66

- 4 Carbon-14 is radioactive and is used by archaeologists in carbon dating.
Which species has both the same number of neutrons and the same number of electrons as an atom of carbon-14?

A $^{14}\text{N}^+$ B $^{16}\text{O}^{2+}$ C $^{17}\text{F}^+$ D ^{28}Si

- 5 A proton and an electron both move at the same speed perpendicular to a uniform electric field.

What deflection is observed?

- A They are deflected in opposite directions. The electron is deflected more.
B They are deflected in opposite directions. The proton is deflected more.
C They are deflected in the same direction. The electron is deflected more.
D They are deflected in the same direction. The proton is deflected more.

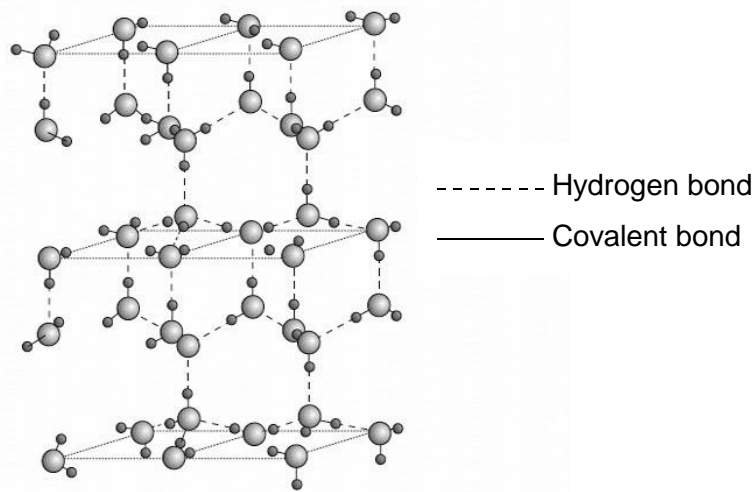
- 6 The successive ionisation energies of two elements, **P** and **Q**, are given below.

Ionisation energies / kJ mol^{-1}	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th
P	740	1450	7720	10540	13630	18020	21700	25660
Q	1011	1907	2910	4960	6270	21270	25431	29872

What is the formula of the compound formed when **P** reacts with **Q**?

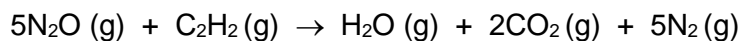
- A P_2Q_3 C P_3Q_2
B P_2Q_5 D P_5Q_2

- 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** Ice has a giant covalent structure.
- 8 Which of the following pairs of substances **does not** include a giant structure and a simple molecular structure?
- A** aluminum and silicon(IV) oxide
- B** aluminium oxide and aluminium chloride
- C** silicon and chlorine
- D** silicon and silicon(IV) chloride
- 9 Dinitrogen oxide, N=N=O, burns in ethyne in the gaseous phase to produce water vapour, carbon dioxide and nitrogen gases as the only products.



The nitrogen-oxygen and nitrogen-nitrogen bond energies in dinitrogen oxide is 686 kJ mol⁻¹ and 418 kJ mol⁻¹ respectively.

Using appropriate information from the *Data Booklet*, what is the enthalpy change in kJ mol⁻¹ for the above reaction?

- A** -190 **B** -1670 **C** -2160 **D** -3342

- 10** In an experiment to measure the enthalpy change for the reaction between hydrochloric acid and calcium carbonate, 20 cm³ 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 JK⁻¹cm⁻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:

$$\Delta H_{\text{c}}(\text{C}) = -394 \text{ kJ mol}^{-1}$$

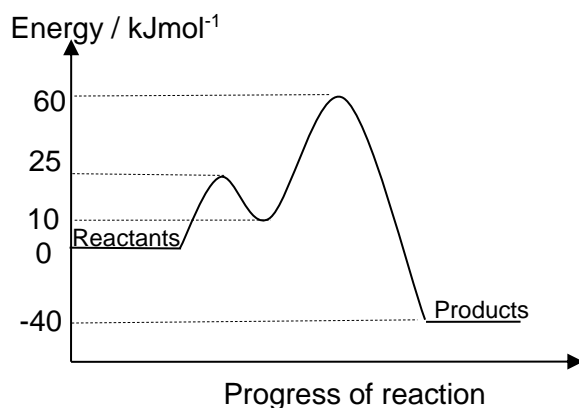
$$\Delta H_{\text{f}}(\text{H}_2\text{O}) = -286 \text{ kJ mol}^{-1}$$

$$\Delta H_{\text{f}}(\text{CH}_3\text{OH}) = -239 \text{ kJ mol}^{-1}$$

Which one of the following is the correct enthalpy change of combustion of methanol, CH₃OH, in kJ mol⁻¹?

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

12



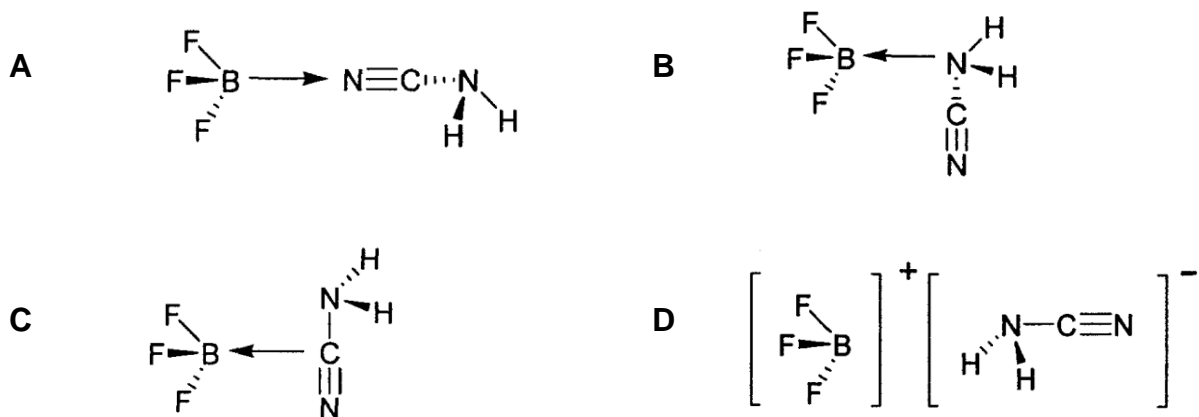
The above diagram is a reaction profile of a two-step reaction.

What is the activation energy of the slow step?

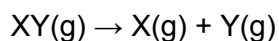
- A +25 kJ mol⁻¹
- B +50 kJ mol⁻¹
- C +60 kJ mol⁻¹
- D +100 kJ mol⁻¹

13 Cyanamide, NH₂CN, can form a product with boron trifluoride, BF₃.

Which of the following structures represents the product?



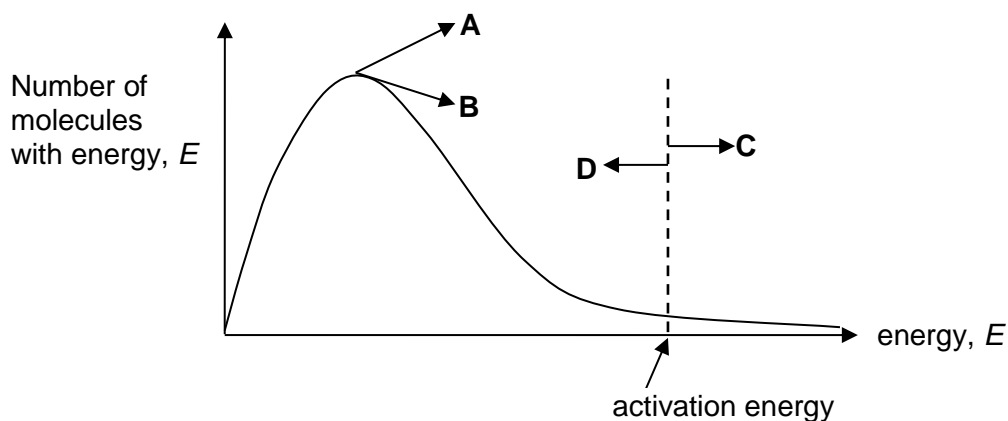
14 The following is the reaction for compound XY,



If the rate constant for the reaction is $5.78 \times 10^{-3} \text{ s}^{-1}$, what is the time taken for the concentration of a sample of XY to decrease from 1.80 mol dm^{-3} to $0.225 \text{ mol dm}^{-3}$?

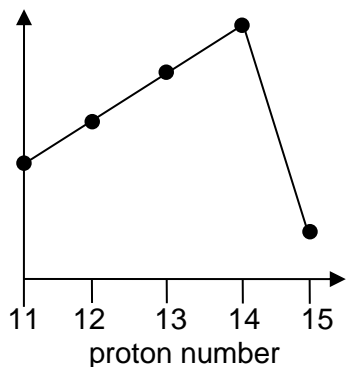
- A 120 s
- B 240 s
- C 360 s
- D 480 s

- 15 The diagram below represents the Boltzmann distribution of molecular energies of a reaction mixture at a given temperature.

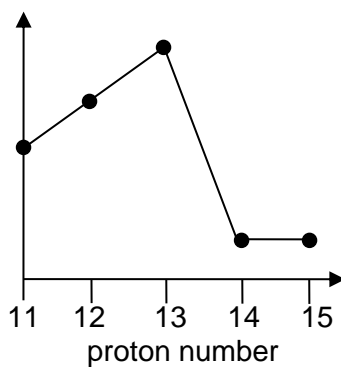


- Which of the following change will occur when a catalyst is added to the reaction mixture?
- A The peak of the graph will shift in the direction of A.
 - B The peak of the graph will shift in the direction of B.
 - C The activation energy will shift in the direction of C.
 - D The activation energy will shift in the direction of D.
- 16 Which of the following elements has an oxide with a giant structure and a chloride which is readily hydrolysed?
- A barium
 - B carbon
 - C phosphorus
 - D silicon
- 17 Which of the following trends across Period 3 (Na to Cl) is always true?
- A The electrical conductivity of the element decreases.
 - B The bonding in the oxides changes from ionic to covalent.
 - C The melting point of the oxides decreases.
 - D The electronegativity of the elements decreases.

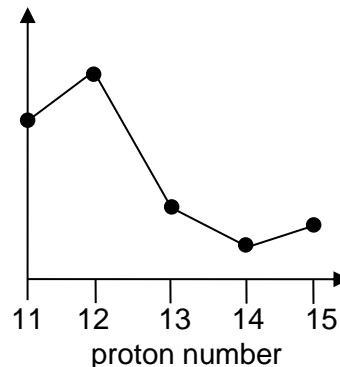
- 18 The following graphs show how three properties of the elements, Na to P, and their compounds, vary with proton number.



Graph 1



Graph 2



Graph 3

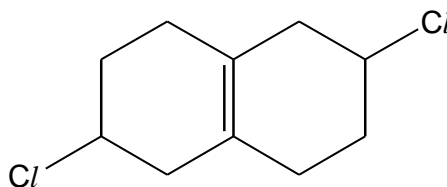
What properties are shown by the three graphs?

	Graph 1	Graph 2	Graph 3
A	Melting point of oxide	Melting point of chloride	Conductivity of element
B	Melting point of chloride	Melting point of element	Melting point of oxide
C	Melting point of oxide	Conductivity of element	Melting point of chloride
D	Melting point of element	Melting point of chloride	Conductivity of element

- 19 What is the resultant pH when equal volumes of a solution of pH 1.0 and pH 3.0 are added together?

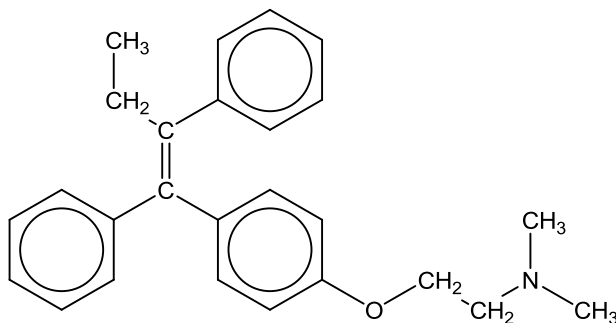
- A 1.3
- B 1.5
- C 2.0
- D 2.5

- 20 Which one of the following statements about the molecule below is correct?



- A It has a pair of geometric isomers.
- B It has an empirical formula of C_5H_8Cl .
- C It gives off CO_2 gas upon oxidation with hot $KMnO_4$.
- D It forms a tertiary alcohol upon reaction with steam and H_3PO_4 catalyst.

- 21 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.
- 22 Tamoxifen is widely used in the treatment of breast cancer.



Tamoxifen

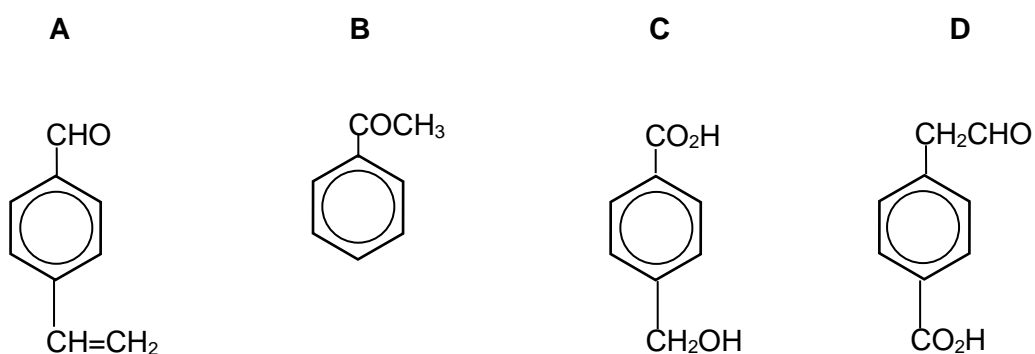
What is the number of sp^2 and sp^3 carbon atoms respectively after subjecting Tamoxifen to hydrogen gas under heat and in the presence of nickel?

	sp^2	sp^3
A	6	20
B	8	18
C	18	8
D	20	6

- 23 Compound **Q** was subjected to the following tests and the results are recorded below.

Reagents & Conditions	Observations
Acidified KMnO_4 , heat	Solution turns from purple to colourless. A gas is evolved.
Fehling's reagent, heat	No precipitate observed.
Tollens' reagent, heat	Silver mirror observed.

What could **Q** be?



- 24 Which of the following gives the compounds in order of decreasing K_a ?

- | | | |
|--|---|--|
| A $\text{CH}_3\text{CH}_2\text{OH}$ | $> \text{C}_6\text{H}_5\text{OH}$ | $> \text{CH}_3\text{CO}_2\text{H}$ |
| B $\text{CH}_3\text{CF}_2\text{CO}_2\text{H}$ | $> \text{FCH}_2\text{CHFCO}_2\text{H}$ | $> \text{F}_2\text{CHCH}_2\text{CO}_2\text{H}$ |
| C $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$ | $> \text{ClCH}_2\text{CH}_2\text{CO}_2\text{H}$ | $> \text{CH}_3\text{CHClCO}_2\text{H}$ |
| D $\text{BrCH}_2\text{CO}_2\text{H}$ | $> \text{ClCH}_2\text{CO}_2\text{H}$ | $> \text{FCH}_2\text{CO}_2\text{H}$ |

- 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**?

- A** $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_3$
B $\text{C}_6\text{H}_5\text{COOCH}_3$
C $\text{CH}_3\text{CH}_2\text{OCOC}_6\text{H}_5$
D $\text{CH}_3\text{CH}_2\text{OCOCH}_3$

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 of the following changes can be regarded as oxidation of bromine?

- 1** $\text{Br}_2 \rightarrow \text{BrO}^-$
- 2** $\text{Br}_2 \rightarrow \text{BrF}$
- 3** $\text{Br}_2 \rightarrow \text{BrI}$

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

Which of the following conclusions can be drawn from this information?

- 1** The empirical formula of boron nitride is BN.
- 2** The boron and nitrogen atoms are likely to be arranged alternately in a hexagonal pattern.
- 3** Boron nitride has a layer structure with van der Waals' forces between the layers.

28 Covalent bonds are formed by orbital overlap. The shape of unsaturated hydrocarbon molecules can be explained in terms of hybridisation of orbitals.

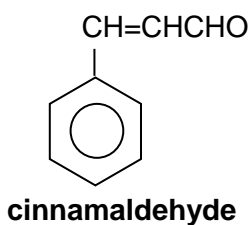
Which bond is **not** present in $\text{H}_2\text{C}=\text{C}=\text{CHCH}_2\text{CH}_3$?

- 1** a π bond formed by $2\text{sp} - 2\text{sp}^2$ overlap
- 2** a σ bond formed by $2\text{sp}^3 - 2\text{sp}^2$ overlap
- 3** a σ bond formed by $1\text{s} - 2\text{sp}^3$ overlap

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

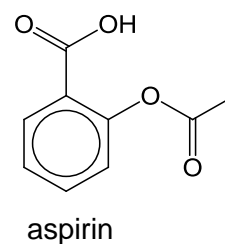
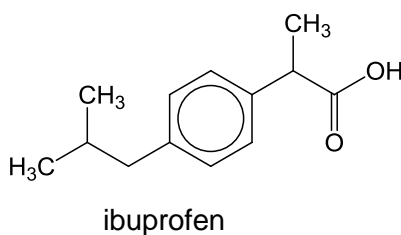
No other combination of statements is used as a correct response.

- 29 Cinnamaldehyde is an essential oil with the distinctive odour of cinnamon.



Which of the following statements about cinnamaldehyde are correct?

- 1 It reacts with aqueous bromine.
 - 2 It reacts with HCN in the presence of a trace amount of base.
 - 3 It contains one functional group that can undergo oxidation with acidified $\text{K}_2\text{Cr}_2\text{O}_7$.
- 30 Aspirin and ibuprofen are analgesic drugs used for pain, fever and inflammation. Their structures are shown below.



Which statements about **both** ibuprofen and aspirin are true?

- 1 They undergo hydrolysis with hot, aqueous HCl .
- 2 They undergo substitution with red P and Br_2 .
- 3 They react with LiAlH_4 to form alcohols.