

ST ANDREW'S JUNIOR COLLEGE**JC2 Preliminary Examination****Chemistry Higher 1****8872/01****Paper 1 Multiple Choice****19 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.

There are **30** 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.

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.

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.*

How many carbon atoms are there in 11.5 g of ethanol? [L = Avogadro Constant]

- A** $\frac{L}{4}$ **B** $\frac{L}{2}$ **C** L **D** $2L$

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

CFC-150a is a molecule that is widely used as solvents for plastic, oils and fats as well as a fumigant in insecticide sprays.

The percentage composition by mass of CFC-150a is: C, 24.2%; H, 4.1%; Cl, 71.2%.

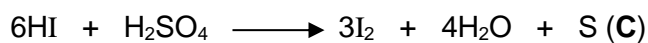
Which structural formula could be that of CFC-150a?

- A** CH_3Cl **B** CH_2Cl_2 **C** CH_3CCl_3 **D** $\text{CH}_2\text{ClCH}_2\text{Cl}$

- 3** When sodium iodide is added to concentrated sulfuric acid, the following reaction took place.



The hydrogen iodide produced would then react with concentrated sulfuric acid in the following series of reactions.



Which of the above reaction shows the greatest change in oxidation number for sulfur?

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

P and **Q** are elements in the same period.

P has more protons than **Q**.

The 1st ionisation energy of **P** is lower than **Q**.

P has one less unpaired electron than **Q**.

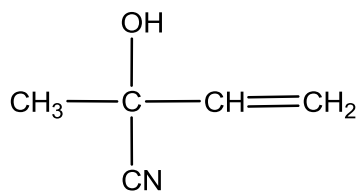
What are the identities of **P** and **Q**?

	P	Q
A	aluminium	Magnesium
B	fluorine	Boron
C	oxygen	Nitrogen
D	sodium	Silicon

- 5 Which solid has more than one type of chemical bond?

- A** calcium nitrate
- B** magnesium sulphide
- C** Potassium
- D** silicon dioxide

- 6 The diagram below shows the structure of compound **R**.



compound **R**

Which of the following set of bond angles are in compound **R**?

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

7 Consider the following four compounds with similar molecular mass.

1. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$
2. $\text{C}(\text{CH}_3)_4$
3. $\text{CH}_3\text{CH}_2\text{COCH}_3$
4. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

Which of the following statements about them is true?

- A** The boiling points of the four compounds decrease from compound 4 > 3 > 2 > 1.
- B** The melting point of compound 1 and 2 are the same as they have the same molecular mass.
- C** The predominant intermolecular force in compounds 3 and 4 are the same.
- D** The predominant intermolecular force in compound 1 and 2 are the same.
- 8 The table shows the enthalpy change of neutralisation, ΔH , for various acids and bases.

acid	base	$\Delta H / \text{kJ}$
nitric acid	potassium hydroxide	- 57.0
J	potassium hydroxide	- 55.0
nitric acid	L	- 52.0
M	calcium hydroxide	- 114.0

What are **J**, **L** and **M**?

	J	L	M
A	hydrochloric acid	sodium hydroxide	sulfuric acid
B	hydrochloric acid	ethylamine	hydrochloric acid
C	propanoic acid	ethylamine	sulfuric acid
D	propanoic acid	sodium hydroxide	hydrochloric acid

- 9 ClO_2 is a yellow explosive gas that decomposes to form chlorine and oxygen gas. The equation for this decomposition is as follows:



Given that the enthalpy change of the above reaction is $+70 \text{ kJ mol}^{-1}$, what is the enthalpy change of formation of ClO_2 ?

- A -140 kJ mol^{-1} B -35 kJ mol^{-1} C $+35 \text{ kJ mol}^{-1}$ D $+140 \text{ kJ mol}^{-1}$
- 10 The rate equation for a reaction between **E** and **F** is

$$\text{rate} = k[\text{E}][\text{F}]^2$$

When the concentration of **E** was halved, what must be done to the concentration of **F** to make the reaction proceed at double of its former rate?

- A halve **[F]**
- B keep **[F]** constant
- C increase **[F]** by a factor of two
- D increase **[F]** by a factor of four
- 11 Which of the following graphs will **not** be a straight line?
- A concentration vs time graph for a first order reaction
- B concentration vs time graph for a zero order reaction
- C rate vs concentration graph for a first order reaction
- D rate vs concentration graph for a zero order reaction

- 12** When pressure is increased for a homogeneous gaseous system at equilibrium, the position of equilibrium shifted to the right.

Which of the following could be the units of the equilibrium constant, K_c , for this system?

- A** $\text{mol}^{-1} \text{dm}^3$
- B** mol dm^{-3}
- C** $\text{mol}^2 \text{dm}^{-6}$
- D** no units
- 13** What is the pH of the resultant solution when 50 cm^3 of $0.02 \text{ mol dm}^{-3} \text{ HCl}$ was mixed with 150 cm^3 of $0.03 \text{ mol dm}^{-3} \text{ HNO}_3$?
- A** 1.26 **B** 1.30 **C** 1.56 **D** 1.60

- 14** The table below show some data on two acid-base indicators.

indicator	approximate pH range of colour change	colour change	
		acid	alkali
bromocresol-green	3.8 – 5.5	yellow	blue
phenol-red	6.8 – 8.5	yellow	red

Which of the following shows the colour when these indicators were placed separately into a solution that has a $[\text{H}^+] = 1.00 \times 10^{-6} \text{ mol dm}^{-3}$?

	bromocresol-green	phenol-red
A	blue	red
B	blue	yellow
C	yellow	red
D	yellow	yellow

- 15 Water can partially dissociate according to the following equation.



Which of the following statements about water at 50°C is true?

- A More H^+ ions will be produced, making water more acidic.
 - B The concentration of OH^- ions will be less than 1×10^{-7} .
 - C The pH of water will become less than 7.
 - D The value of K_w will be less than 1×10^{-14} .
- 16 Which of the following series does **not** have a decreasing trend?
- A atomic radius of P, S and Cl
 - B electrical conductivity of Al, Si and P
 - C ionic radius of Na^+ , Mg^{2+} and Al^{3+}
 - D melting point of Si, P and S
- 17 Two unlabelled bottles in the laboratory either contains aluminium or silicon.

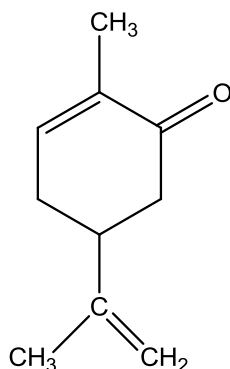
A student proposed the following methods to distinguish them.

1. Heat both metals in excess oxygen gas, followed by aqueous acid to the residues.
2. Heat both metals in excess chlorine gas, followed by aqueous base to the residues.

Which methods would enable the student to identify the metals?

- A 1 only
- B 2 only
- C 1 and 2
- D neither 1 or 2.

- 18 *Carvone* is responsible for the odour in spearmint.



Carvone

How many sp^2 and sp^3 hybridised carbons are there in *Carvone*?

	sp^2	sp^3
A	3	7
B	4	5
C	5	5
D	5	6

- 19 How many mono-chlorinated isomers can be formed when 1,3-dimethylcyclohexane undergoes a reaction with limited chlorine and sunlight?

A 3 **B** 4 **C** 5 **D** 6

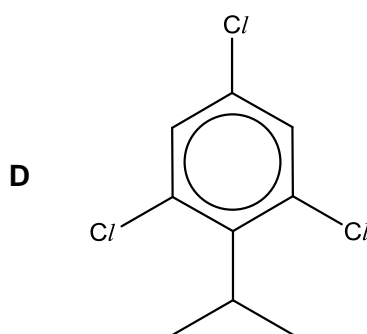
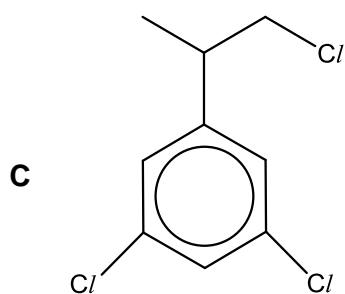
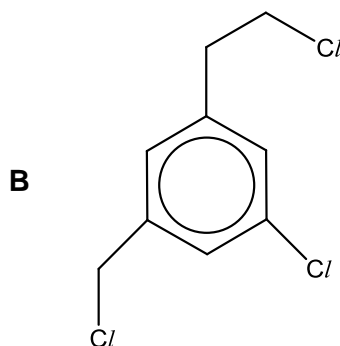
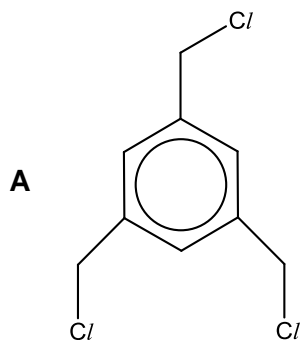
- 20 What is the final organic product when butan-1-ol undergoes the following series of reactions?

- Step 1: PCl_5 , room temperature
- Step 2: ethanolic KOH, heat
- Step 3: $KMnO_4$, $KOH(aq)$, heat

A butanoic acid
B propanoic acid
C sodium butanoate
D sodium propanoate

- 21** Compound **G** is an organic compound that contains carbon, hydrogen and chlorine. When 0.1 moles of compound **G** was heated with NaOH (aq), cooled and followed by the addition of excess AgNO₃ (aq), 28.7 g of precipitate was obtained when the solution was filtered.

What is the structure of compound **G**?



- 22** An alkene, **H**, of molecular formula C₅H₁₀ undergoes vigorous oxidation to produce ethanoic acid and propanone.

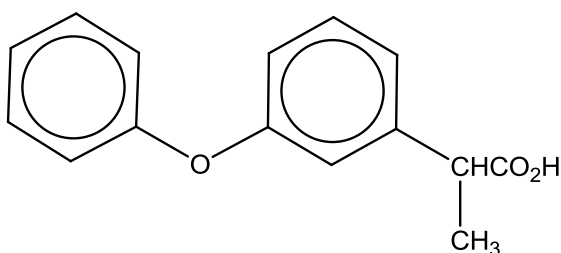
What is **H**?

- A** 2-methylbut-1-ene
- B** 2-methylbut-2-ene
- C** pent-1-ene
- D** pent-2-ene

23 Which of the following pairs of compounds are positional isomers and can be distinguished via oxidation?

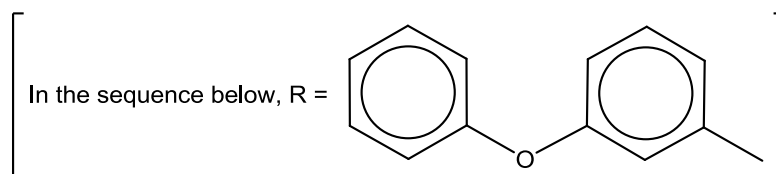
- A** pentan-2-one and pentan-3-one
- B** pentan-2-one and pentanal
- C** propan-1-ol and propan-2-ol
- D** 2-methylpropan-2-ol and butan-2-ol

24 *Fenoprofen* is an anti-arthritis agent.



Fenoprofen

Which of the following could be part of a reaction sequence for synthesising *Fenoprofen*?



- | | step 1 | | step 2 |
|----------|--|--|--|
| A | $\text{RCH}(\text{CH}_3)\text{COOCH}_3 \xrightarrow[\text{heat}]{\text{NaOH (aq)}} \text{intermediate}$ | | $\xrightarrow[\text{heat}]{\text{H}^+ \text{ (aq)}} \text{Fenoprofen}$ |
| B | $\text{RCH}(\text{CH}_3)\text{OCOCH}_3 \xrightarrow[\text{heat}]{\text{NaOH (aq)}} \text{intermediate}$ | | $\xrightarrow[\text{heat}]{\text{H}^+ \text{ (aq)}} \text{Fenoprofen}$ |
| C | $\text{RCH}(\text{CH}_3)\text{CH}_2\text{Br} \xrightarrow[\text{heat}]{\text{NaCN (ethanolic)}} \text{intermediate}$ | | $\xrightarrow[\text{heat}]{\text{H}^+ \text{ (aq)}} \text{Fenoprofen}$ |
| D | $\text{RCHBrCH}_2\text{CH}_3 \xrightarrow[\text{heat}]{\text{NaCN (ethanolic)}} \text{intermediate}$ | | $\xrightarrow[\text{heat}]{\text{H}^+ \text{ (aq)}} \text{Fenoprofen}$ |

- 25** Which of the following properties of benzene is **not** attributed to its ring of delocalised electrons?
- A** Benzene attracts electrophiles rather than nucleophiles.
 - B** Benzene undergoes substitution rather than addition reactions.
 - C** Benzene is more stable than its alkene equivalent, cyclohexa-1,3,5-triene.
 - D** Benzene is planar molecule with each carbon being sp^2 hybridised.

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** Why does a reaction take place more quickly when the temperature is increased?
- 1** The molecules collide more frequently when the temperature is increased.
 - 2** A higher proportion of molecules are able to overcome the energy barrier of the reaction when the temperature is increased.
 - 3** The activation energy of the reaction is lowered when the temperature is increased.
- 27** Which of the following solutions have a pH of 13?
- 1** 10 cm³ of 0.1 mol dm⁻³ potassium hydroxide
 - 2** 30 cm³ of 0.05 mol dm⁻³ barium hydroxide
 - 3** 50 cm³ of 0.1 mol dm⁻³ ammonia

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

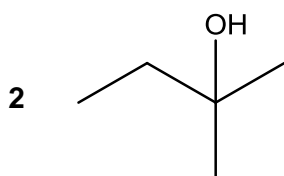
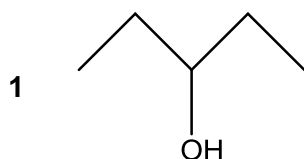
A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

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

28 Which statements concerning the third period elements (sodium to argon) and their compounds are correct?

- 1** The elements become more electronegative from sodium to chlorine.
- 2** The nature of their oxides change from basic to acidic.
- 3** The maximum oxidation state is shown by silicon

29 Which of the following compounds would yield a product that can exhibit geometric isomerism after undergoing elimination?

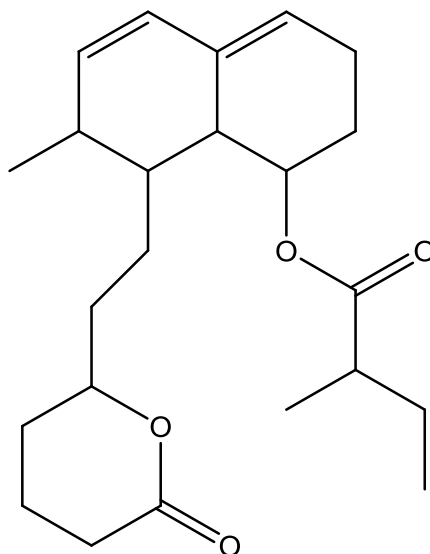


The responses **A** to **D** should be selected on the basis of

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.

- 30.** The compound below belongs to a group of drugs that are used to lower cholesterol levels in humans.



Which of the following type of reactions would this compound undergo?

- 1** Condensation
- 2** Hydrolysis
- 3** Substitution

~~~ **END** ~~~

**Answers:**

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