

NATIONAL JUNIOR COLLEGE

SH2 PRELIMINARY EXAMINATION

Higher 1

CANDIDATE
NAME

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SUBJECT
CLASS

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REGISTRATION
NUMBER

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CHEMISTRY

8872/01

Paper 1 Multiple Choice

Thursday 17 Sept 2015

Additional Materials: Multiple Choice Answer Sheet

50 minutes

Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your name, subject class and registration number on the Answer Sheet in the spaces provided and shade the appropriate boxes for your registration number.

There are **thirty** questions in 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 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.

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

This paper consists of 10 printed pages including this cover 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. Use of the *Data Booklet* is relevant to this question.

Element **X** forms ion X^{2+} with 4 unpaired electrons.

What could be element **X**?

- A** Magnesium
- B** Chromium
- C** Titanium
- D** Nickel

2. A solution of Sn^{2+} ions can reduce an acidified solution of MnO_4^- ions. The Sn^{2+} ions are oxidised to Sn^{4+} ions in this reaction.

How many moles of MnO_4^- ions are required to react completely with a solution containing 9.5 g of SnCl_2 ($M_r = 190$)?

- A** 0.010
- B** 0.020
- C** 0.050
- D** 0.125

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

Magnesium nitrate, $\text{Mg}(\text{NO}_3)_2$, will decompose when heated to give a white solid, MgO , and a mixture of gases. One of the gas is an oxide of nitrogen.

7.4 g of anhydrous magnesium nitrate is heated until no further reaction takes place.

What is the mass of the white solid formed?

- A** 1.5 g
- B** 2.0 g
- C** 3.0 g
- D** 4.6 g

4. AlCl_3 vapour forms molecules with formula Al_2Cl_6 as it is cooled.

What happens to the bond angles during the change from AlCl_3 to Al_2Cl_6 ?

- A** Some decrease, some remain the same.
- B** Some increase, some remain the same.
- C** They all decrease.
- D** They all increase.

5. The table below shows the physical properties of four substances.

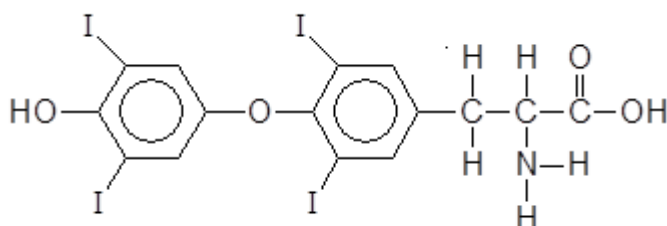
Which substance has a giant covalent structure?

	Melting point/ °C	Boiling point/ °C	Electrical conductivity of solid	Electrical conductivity of liquid	Electrical conductivity of aqueous solution
A	119	239	Good	Good	Insoluble
B	800	1210	Poor	Good	Good
C	993	1695	Poor	Poor	Good
D	1610	2230	Poor	Poor	Insoluble

6. What is the order of increasing melting point for the four chlorides shown?

	Lowest melting point \longrightarrow Highest melting point			
A	SiCl_4	PCl_5	MgCl_2	NaCl
B	PCl_5	SiCl_4	NaCl	MgCl_2
C	SiCl_4	PCl_5	NaCl	MgCl_2
D	NaCl	MgCl_2	SiCl_4	PCl_5

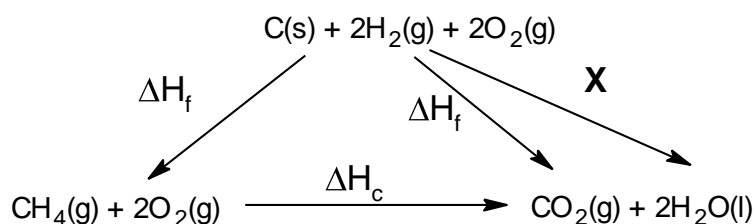
7. Which bond angle is **not** found in the following molecule?



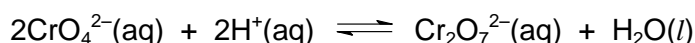
- A** 107°
B 109°
C 120°
D 180°
8. Which process is endothermic?
- A** Condensation of steam
B Dissolving glucose in water
C Neutralization between strong acid and weak base
D Burning of charcoal

9. Enthalpy changes that are difficult to measure directly can often be determined using Hess' Law to construct an enthalpy cycle.

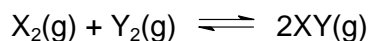
Which enthalpy change is indicated by **X** in the enthalpy cycle shown?



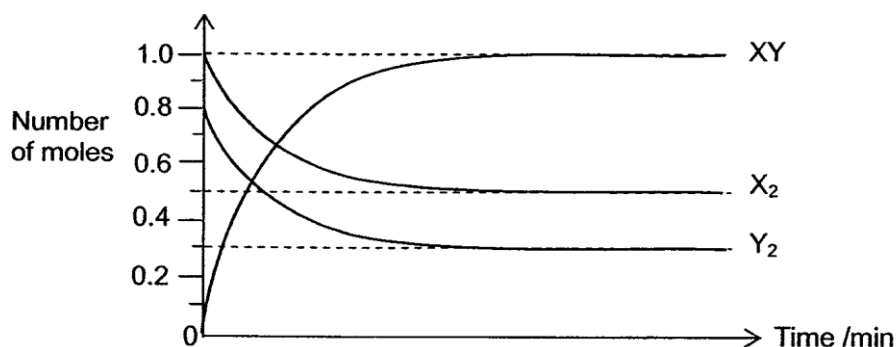
- A $-4 \times$ enthalpy change of combustion of hydrogen
 B $+4 \times$ enthalpy change of combustion of hydrogen
 C $-2 \times$ enthalpy change of formation of water
 D $+2 \times$ enthalpy change of formation of water
10. Which statement concerning the equilibrium reaction given below is correct?



- A A redox reaction is taking place.
 B The equilibrium constant, K_c , has no units.
 C A decrease in pH will result in an increase in the concentration of $\text{Cr}_2\text{O}_7^{2-}$.
 D The addition of a catalyst will result in an increase in the concentration of $\text{Cr}_2\text{O}_7^{2-}$.
11. The gases, X_2 and Y_2 react as follows,



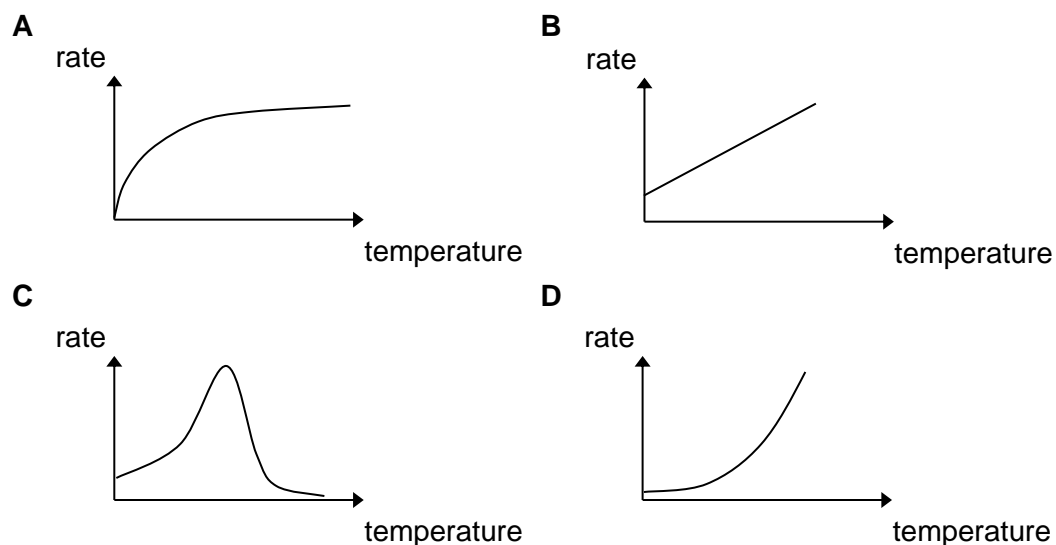
A mixture containing 1.0 mol of X_2 and 0.8 mol of Y_2 is heated in a closed container and the reaction is allowed to reach equilibrium. The graph below shows the variation of the number of moles of each gas with time.



What is the numerical value of K_c ?

- A 0.0750
 B 0.150
 C 6.67
 D 13.3

12. Which graph describes the kinetics of an enzyme-catalysed reaction against temperature?



13. An experiment is conducted by reacting $\text{NO}_2(\text{g})$ with $\text{F}_2(\text{g})$. What is the order of reaction with respect to $\text{NO}_2(\text{g})$ and the overall order, given the following rate data at a certain temperature?

$[\text{NO}_2(\text{g})]/\text{mol dm}^{-3}$	$[\text{F}_2(\text{g})]/\text{mol dm}^{-3}$	Rate/ $\text{mol dm}^{-3} \text{ min}^{-1}$
0.1	0.2	0.1
0.2	0.2	0.4
0.1	0.4	0.2

	order with respect to $\text{NO}_2(\text{g})$	overall order
A	First	First
B	First	Second
C	Second	Second
D	Second	Third

14. When equal volumes of hydrochloric acid solution of pH 1 and pH = 4 are mixed, what is the pH of the resultant mixture?

- A 1
B 1.3
C 2
D 2.5

15. Which pair of chemicals will produce an alkaline buffer?

- A 20cm^3 of 1 mol dm^{-3} of HCl and 20cm^3 of 0.5 mol dm^{-3} of NH_3
B 20cm^3 of 1 mol dm^{-3} of NH_3 and 20cm^3 of 0.5 mol dm^{-3} of HCl
C 20cm^3 of 1 mol dm^{-3} of H_2SO_4 and 20cm^3 of 0.5 mol dm^{-3} of NH_3
D 20cm^3 of 1 mol dm^{-3} of NH_3 and 20cm^3 of 0.5 mol dm^{-3} of H_2SO_4

16. Which reagent, when mixed and heated with ammonium sulfate, liberates an alkaline gas?

- A Aqueous bromine
- B Dilute hydrochloric acid
- C Lime water
- D Potassium dichromate(VI) in acidic solution

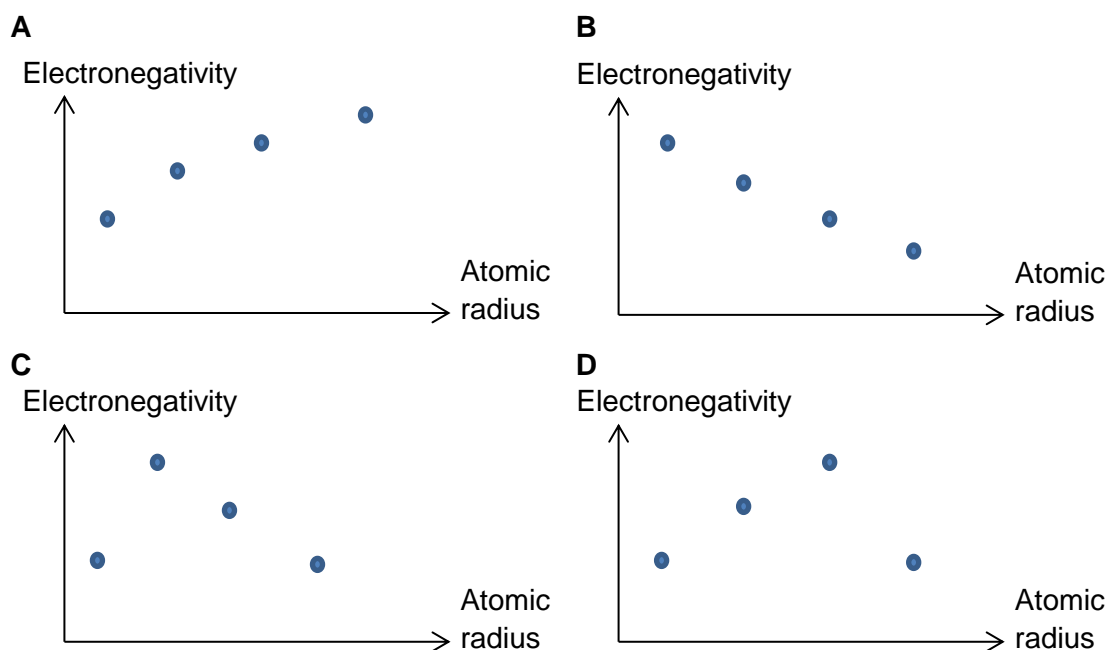
17. When water is added to 1 mole of chloride of **X**, 2 moles of HCl gas are given out as white fumes.

What could be the identity of the element?

- A Mg
- B Al
- C Si
- D P

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

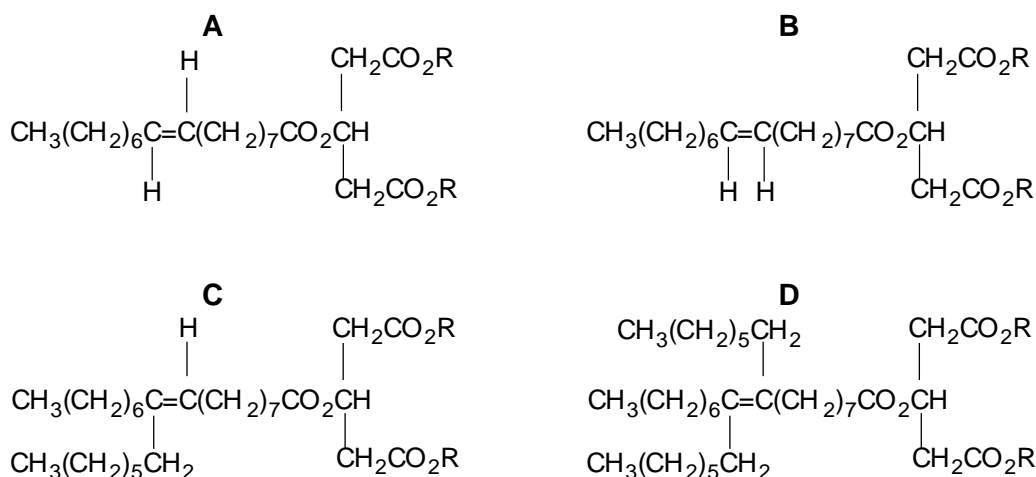
Which graph correctly shows relative electronegativity plotted against relative atomic radius for the elements Na, Mg, Al and Si?



19. Some vegetable oils contain “trans fats” that are associated with undesirable increases in the amount of cholesterol in blood.

In the structures below, R is a hydrocarbon chain.

Which structure correctly illustrates a “trans fat”?

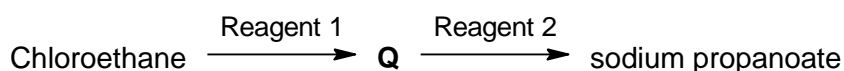


20. Many organic reactions need to be heated before any reaction occurs, but some do not require heating.

Which reaction occurs quickly at room temperature?

- A** $\text{C}_2\text{H}_4 + \text{Br}_2 \longrightarrow \text{C}_2\text{H}_4\text{Br}_2$
B $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \longrightarrow \text{CH}_3\text{CH}_2\text{OH}$
C $\text{CH}_3\text{CH}_2\text{OH} \longrightarrow \text{C}_2\text{H}_4 + \text{H}_2\text{O}$
D $\text{CH}_3\text{CH}_2\text{OH} + \text{HBr} \longrightarrow \text{CH}_3\text{CH}_2\text{Br} + \text{H}_2\text{O}$

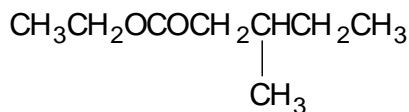
21. Chloroethane can be used to make sodium propanoate.



Which are the correct reagents for the above reaction?

	Reagent 1	Reagent 2
A	NaOH(aq), heat	KMnO ₄ , NaOH(aq), heat
B	NaCN, ethanol, heat	NaOH(aq), heat
C	HCN, trace NaCN	NaOH(aq), heat
D	Conc. H ₂ SO ₄ , 170 °C	K ₂ Cr ₂ O ₇ , NaOH(aq), heat

22. An ester with an odour of banana has the following formula.

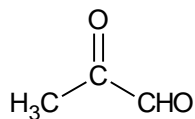


- A $\text{CH}_3\text{CH}_2\text{OH} + \text{CH}_3\text{CH}_2\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{OH}$
- B $\text{CH}_3\text{CH}_2\text{CO}_2\text{H} + \text{CH}_3\text{CH}_2\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{OH}$
- C $\text{CH}_3\text{CH}_2\text{OH} + \text{CH}_3\text{CH}_2\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\text{CO}_2\text{H}$
- D $\text{CH}_3\text{CH}_2\text{CO}_2\text{H} + \text{CH}_3\text{CH}_2\underset{\text{CH}_3}{\text{CH}}\text{OH}$

23. Considering all the structural isomers of alcohol with the molecular formula $\text{C}_4\text{H}_{10}\text{O}$, what is the number of each type of alcohol formed?

	1° alcohol	2° alcohol	3° alcohol
A	1	2	3
B	1	2	1
C	2	1	1
D	2	1	2

24. Burnt sugar has a characteristic smell caused partly by the following compound.



This compound contains two functional groups.

Which reagent will react with only one of the functional groups?

- A Alkaline copper(II) complex
- B PCl_5
- C Hydrogen cyanide
- D Sodium hydroxide

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

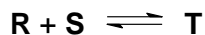
A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

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

When the liquid N_2F_4 is heated, it decomposes into a single product, **X**. Which statements are correct?

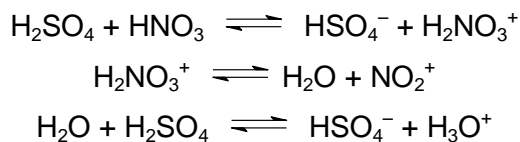
- 1** N-F bonds are broken during this decomposition.
- 2** The enthalpy change when N_2F_4 decomposes into **X** is approximately $+160 \text{ kJ mol}^{-1}$.
- 3** Molecules of **X** are non-linear.

26. **R** and **S** react to form **T** according to the equation shown below.



Which factors affect the rate of the forward reaction?

- 1** The temperature of the reaction
 - 2** The enthalpy change of the reaction
 - 3** The equilibrium constant of the reaction
- 27.** When concentrated sulfuric acid and concentrated nitric acid are mixed, the following reactions occur.



Which species are conjugate bases in these reactions?

- 1** HSO_4^-
- 2** HNO_3
- 3** H_2O

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

- 28.** Pollutant oxide **Y**, which contains non-metallic element **X**, is formed in a car engine.

Further oxidation of **Y** to **Z** occurs in the atmosphere. In this oxidation, 1 mol of **Y** reacts with 0.50 mol of gaseous oxygen molecules.

Possible identity of element **X** is nitrogen or sulfur.

Which statements about **X**, **Y** and **Z** can be correct?

- 1** The oxidation number of **X** increases by two from **Y** to **Z**.
- 2** **Y** has an unpaired electron in its molecule.
- 3** **Y** is a polar molecule.

- 29.** The molecule responsible for the pineapple flavour used in sweets is $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{CH}_2\text{CH}_3$.

Which statements about this molecule are correct?

- 1** The name of this compound is ethyl butanoate.
- 2** This compound is a structural isomer of hexanoic acid.
- 3** When this compound is heated with aqueous sodium hydroxide, the products are butan-1-ol and ethanoic acid.

- 30.** Which statements about pentan-1,4-diol or its oxidation products are correct?

- 1** When one mole of pentan-1,4-diol reacts with an excess of sodium metal, one mole of hydrogen molecule is produced.
- 2** At least one of the possible oxidation products of pentan-1,4-diol will react with 2,4-dinitrophenylhydrazine.
- 3** Dehydration of pentan-1,4-diol could produce a compound with empirical formula C_5H_8 .

Answers:

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