

NATIONAL JUNIOR COLLEGE
SH2 PRELIMINARY EXAM

Higher 1

CANDIDATE
NAME

SUBJECT
CLASS

REGISTRATION
NUMBER

CHEMISTRY
Paper 1 Multiple Choice

Additional Materials: Multiple Choice Answer Sheet
 Data Booklet

8872/01

Friday 16 Sept 2016

50 minutes

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, subject class and registration number on the Answer Sheet in the spaces provided unless this has been done for you.

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.

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 paper consists of **14** printed pages.

Instructions on how to fill in the Optical Answer Sheet

1. Enter your NAME (as in NRIC). TAN AH TECK
2. Enter the SUBJECT TITLE. CHEMISTRY
3. Enter the TEST NAME. SH2 Prelim 2016
4. Enter the CLASS. 1505648

RUB OUT ERRORS THOROUGHLY

USE PENCIL ONLY
FOR ALL ENTRIES ON THIS SHEET

0	1	2	3	4	5	6
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	1	2	3	4	5	6
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Example:

Shade the index number in a 5 digit format on the optical answer sheet: 2nd digit and the last 4 digits of the Registration Number.

Student	Example of Registration No.	Shade
Tan Ah Teck	1<u>505648</u>	55648

1 3 g of hydrogen reacted with 160 g of bromine to give hydrogen bromide, HBr.

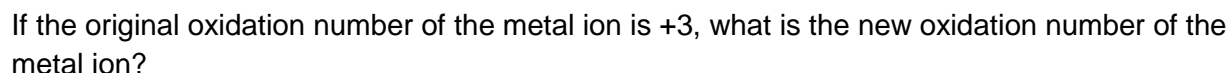
A 6.02×10^{23}

C 12.0×10^{23}

B 9.03×10^{23}

D 15.1×10^{23}

- The half-equation for the oxidation of sulfite ion is shown below:



A 0

B +1

C +2

D +4

- Which compound would fit the above data?

A $\text{C}_2\text{H}_8\text{N}_2$

B $\text{C}_2\text{H}_7\text{N}$

C $\text{C}_6\text{H}_5\text{NO}_2$

D $\text{C}_4\text{H}_{14}\text{N}_4$

- A** Iodine has a much larger molar mass than water.

B Iodine has stronger and more extensive covalent bonds between its atoms in its molecular structure.

C The van der Waals' forces of attraction between iodine molecules are stronger than the intermolecular hydrogen bonds in water.

D The intermolecular hydrogen bonding between water molecules is stronger than the intermolecular van der Waals' forces of attraction in iodine.

- 5 Which standard enthalpy change of reaction allows you to determine the bond energy of the P–Cl bond?

- A $\text{PCl}_5(l) \rightarrow \text{PCl}_5(g)$
- B $\frac{5}{2} \text{Cl}_2(g) + \text{P}(s) \rightarrow \text{PCl}_5(g)$
- C $\text{PCl}_5(g) \rightarrow \text{P}(g) + 5 \text{Cl}(g)$
- D $\text{PCl}_5(g) \rightarrow \text{PCl}_3(g) + \text{Cl}_2(g)$

- 6 The successive ionisation energies (IE) of two elements, **A** and **B**, are given below.

IE / kJ mol^{-1}	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th
A	738	1451	7732	10542	13630	18020	21711	25661
B	1251	2298	3822	5159	6542	9362	11018	33604

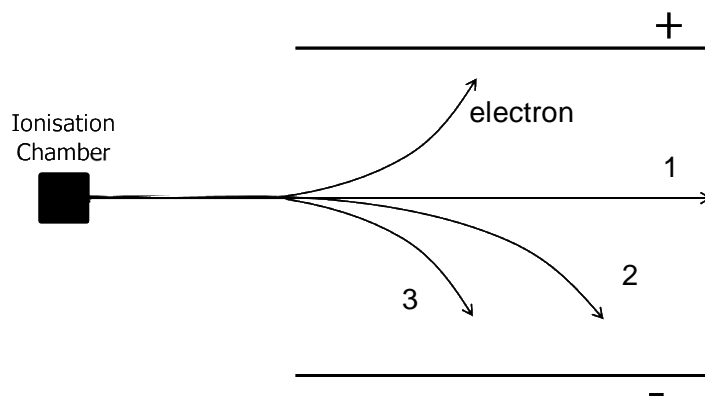
What is the likely formula of the compound that is formed when **A** reacts with **B**?

- A **A₂B**
- B **AB₂**
- C **A₅B**
- D **AB₅**

7 Use of the Data Booklet is relevant to this question.

$^{222}_{86}\text{Rn}$

can undergo nuclear decay, where it emits an α -particle (which is a He nucleus) and electrons in an ionisation chamber to form an element **C**.



What is the identity of the element **C** and the path of the emitted α -particle in an electric field?

	Chemical symbol of C	Path of (α -particles)
A	$^{218}_{86}\text{C}$	2
B	$^{218}_{86}\text{C}$	1
C	$^{218}_{84}\text{C}$	2
D	$^{218}_{84}\text{C}$	3

8 The rate of removal of paracetamol, a pain-killing drug, from the body is a first order reaction with a rate constant, $k = 0.26 \text{ h}^{-1}$.

How long will it take to remove 75% of the paracetamol that a patient consumes?

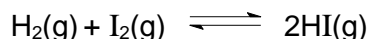
A 0.20 h

B 0.26 h

C 2.7 h

D 5.3 h

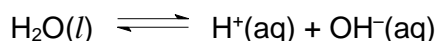
- 9 Measured amounts of hydrogen and iodine are allowed to reach an equilibrium at 300 °C in a container of known volume.



From which experimental method can the equilibrium constant, K_c , be determined?

- A measuring the total pressure in the container
- B slow cooling to 25 °C, breaking open the container under aqueous potassium iodide, and titrating the iodine present with aqueous sodium thiosulfate
- C rapid cooling to 25 °C, breaking open the container under aqueous potassium iodide, and titrating the iodine present with aqueous sodium thiosulfate
- D withdrawal of a measured sample of the equilibrium mixture, followed by complete decomposition of the hydrogen iodide present, and then titrating the total amount of iodine with aqueous sodium thiosulfate

- 10 Water dissociates into ions to establish following equilibrium:



Which is true about the dissociation of water?

- A Dissociation of water is an exothermic process.
- B When temperature increases, pH becomes lower than pOH.
- C Water is only neutral at room temperature.
- D For pure water, the values of its dissociation constant (K_a), ionic product (K_w) and concentration of H^+ increase in the order: $K_a < K_w < [\text{H}^+]$

- 11 Using a colorimeter, the following reaction is studied by finding the time taken for a coloured reactant, **D**, to decolourise. The reaction is catalysed by **Y**.



The following results are obtained:

Experiment	Vol of solution added / cm ³				Time taken / s
	D	E	Y	H ₂ O	
1	10	20	10	10	20
2	10	10	10	20	40
3	10	20	5	15	40
4	5	20	10	15	10

What is the rate equation for the reaction?

A rate = $k[\text{D}][\text{E}]$

C rate = $k[\text{E}][\text{Y}]$

B rate = $k[\text{D}][\text{Y}]$

D rate = $k[\text{D}][\text{E}][\text{Y}]$

- 12 Four compounds of some Period 3 elements are listed below.



Water is added separately to each compound. Pairs of the resulting solutions are mixed together.

Which pair of solutions would give a solution of pH 7?

A NaCl and Na_2O

C NaCl and SO_2

B Na_2O and SiCl_4

D SiCl_4 and SO_2

- 13 The alkanes used to be known as the paraffin hydrocarbons – paraffin meaning “lack of affinity” (i.e. unreactive).

Which statement best explains the “lack of affinity” in alkanes?

A The atoms are arranged tetrahedrally around each carbon atom.

B The alkanes have van der Waals forces of interaction.

C There are no significant dipole moments in C–H and C–C bonds.

D There is free rotation about C–C single bonds.

- 14 The labels had become detached from four bottles in the laboratory. A student realised that the contents of one of them could be easily identified because, on addition of water it would not give fumes of hydrogen chloride.

Which did **not** give the acid fumes?

- | | |
|---------------------|-------------------|
| A Al_2Cl_6 | C PCl_5 |
| B $MgCl_2$ | D $SiCl_4$ |

- 15 Which oxide will not dissolve in sodium hydroxide?

- | | |
|------------------|----------------------|
| A Na_2O | C P_4O_{10} |
| B SiO_2 | D Al_2O_3 |

- 16 The high reactivity of fluorine is largely due to the low energy of the F–F bond.

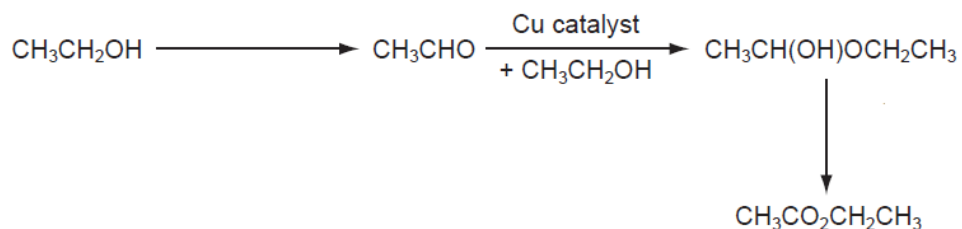
Which statement best accounts for the weak F–F bond?

- A** The F–F bond is weak because of the repulsion between the non-bonding electrons.
- B** The F–F bond is weak because of the short bond length.
- C** The F–F bond is weak because of the small nuclear charge of fluorine atom.
- D** The F–F bond is weak because of the small size of fluorine atom.

- 17 Which statement explains how graphite acts as a lubricant?

- A** Graphite consist of carbon bonded to 3 other carbon atoms.
- B** Graphite has delocalised electrons throughout its layers.
- C** Graphite has weak van der Waals' attraction between layers.
- D** Graphite has a flat hexagonal arrangement of atoms in its layers.

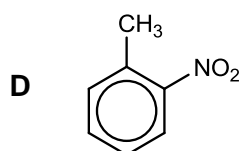
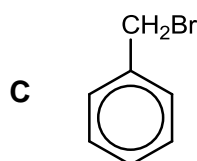
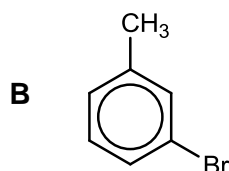
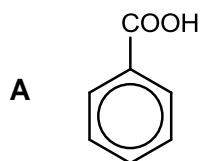
- 18 Which statement about the effect of a catalyst on a reversible reaction is correct?
- A It increases the yield of the product in an equilibrium.
 - B It reduces the activation energies of the forward reaction and the reverse reaction.
 - C It reduces the rate constant for both the forward reaction and the reverse reaction.
 - D It increases the rate of collisions between the reacting particles.
- 19 Which enthalpy change is **always** exothermic?
- A Formation
 - B Lattice energy
 - C Ionisation energy
 - D Bond energy
- 20 A new industrial preparation of ethyl ethanoate has been developed using cheap sources of ethanol.



Which type of reaction is involved at some stage of this reaction sequence?

- A nucleophilic addition
- B condensation
- C disproportionation
- D reduction

- 21 Which compound is *least* likely to be prepared directly from methylbenzene?



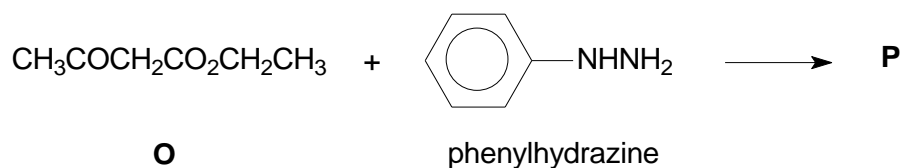
- 22 Complete combustion of compound **X** gives carbon dioxide and water only. A sample of **X** is mixed with aqueous potassium(V) dichromate and boiled under reflux for one hour. The mixture is then distilled and the only organic substance present is boiled.

The organic substance collected reacts with sodium to give hydrogen, but does not react with 2,4-dinitrophenylhydrazine and does not react with ethanol in the presence of concentrated sulfuric acid to give an ester.

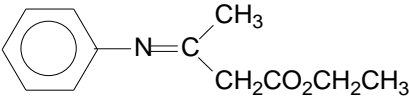
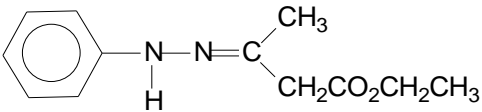
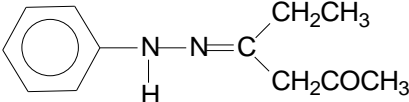
What can be deduced from this information?

- A** **X** is a carboxylic acid
- B** **X** is a ketone
- C** **X** is an alcohol
- D** **X** is an alkane

- 23 The first stage in the synthesis of compound **P**, a drug used in reducing fever, is the reaction between compound **O** and phenylhydrazine.



What is **P** ?

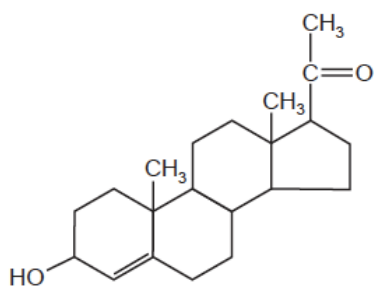
- A** $\text{CH}_3\text{COCH}_2\text{CONH}-\text{C}_6\text{H}_5$
- B** 
- C** 
- D** 

- 24 A common industrial solvent is a mixture of propanone, CH_3COCH_3 , and pentyl ethanoate, $\text{CH}_3\text{CO}_2(\text{CH}_2)_4\text{CH}_3$.

Which reagent would have no reaction with this industrial solvent?

- A** $\text{HCl}(\text{aq})$
- B** $\text{HCN}(\text{aq})$ with a little KCN
- C** $\text{Na}(\text{s})$
- D** NaBH_4

- 25 The compound shown is a hormone produced during pregnancy to suppress ovulation.



Which reagent would **not** give positive results with this compound?

- A Aqueous bromine
- B 2, 4-dinitrophenylhydrazine
- C Fehling's reagent
- D Na_2CO_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 (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** For which pair does the first species contain more unpaired electrons than the second species?

- 1** N^- , C^+
- 2** Mn^{2+} , Co^{2+}
- 3** Mn^{4+} , Co

- 27** At 298 K, the numerical values for the dissociation constant of the aliphatic carboxylic acids, RCO_2H and $\text{R}_1\text{CO}_2\text{H}$ in aqueous solution are 2.1×10^{-8} and 2.2×10^{-4} respectively.

Which can be inferred from the given information?

- 1** The pH of $1 \text{ mol dm}^{-3} \text{RCO}_2\text{H}$ is greater than $1 \text{ mol dm}^{-3} \text{R}_1\text{CO}_2\text{H}$.
- 2** The K_b of RCO_2^- is greater than that of R_1CO_2^- .
- 3** The acid strength of RCO_2H is greater than that of $\text{R}_1\text{CO}_2\text{H}$.

- 28** Which are correct about the role of ammonia in the reactions it is involved?

<i>reaction</i>	<i>role of ammonia</i>
1 $\text{CuO} + 6\text{NH}_3 \rightarrow [\text{Cu}(\text{NH}_3)_4]^{2+} + 2\text{NH}_2^- + \text{H}_2\text{O}$	Brønsted acid
2 $2\text{Na} + 2\text{NH}_3 \rightarrow 2\text{NaNH}_2 + \text{H}_2$	oxidising agent
3 $\text{CH}_3\text{Cl} + \text{NH}_3 \rightarrow \text{CH}_3\text{NH}_2 + \text{HCl}$	Brønsted base

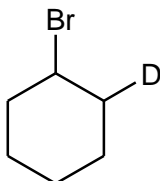
The responses **A** to **D** should be selected on the basis of

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

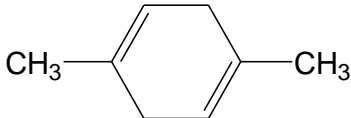
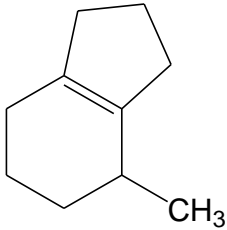
No other combination of statements is used as a correct response.

- 29** Deuterium, D, is the ^2_1H isotope of hydrogen. DBr has the same chemical properties as HBr.

Which compounds could be made by the reaction of DBr with another compound in a single reaction?

- 1** 
- 2** $\text{CHBr}_2\text{CHDBr}$
- 3** $\text{CH}_3\text{CHBr(OD)}$

- 30** Which compounds form a single organic product when each is heated separately with acidified potassium manganate(VII) solution?

- 1** 
- 2** 
- 3** $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2$

– End of Paper –