ANDERSON SERANGOON JUNIOR COLLEGE

2025 JC2 PRELIMINARY EXAMINATION

NAME:_____ ( ) **CLASS:** 25 /____

CHEMISTRY **9729/01**

Paper 1 Multiple Choice **2 September 2025**

1 hour

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the Answer Sheet.

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.

Multiple Choice Answer Sheet

Write your name, class and NRIC / FIN number, **including** the reference letter.

Shade the NRIC / FIN number.

Exam Title: JC2 PRELIM

Exam Details: H2 Chemistry / Paper 1

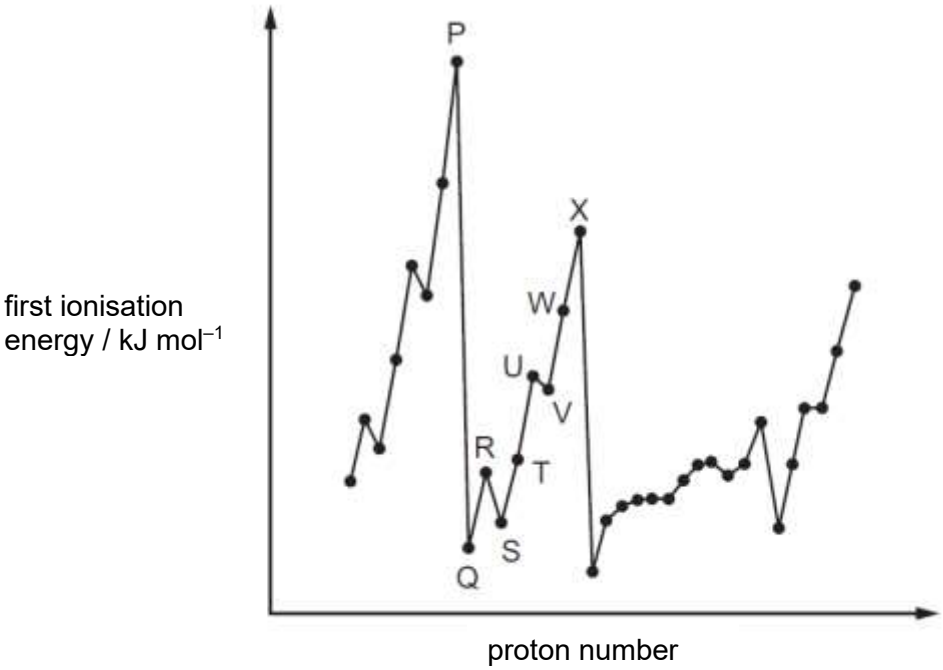
This document consists of **15** printed pages and **1** blank page.

1 Sodium azide, NaN_3 is an explosive used to inflate airbags in cars when they crash. It consists of positive sodium ions and negative azide ions.

What are the number of electrons in the sodium ion and the azide ion?

	sodium ion	azide ion
A	10	20
B	10	22
C	12	20
D	12	22

2 The graph shows the variation of the first ionisation energy with proton number for some elements. The letters used are not the actual symbols for the elements.



Which statement about the elements is correct?

A P and X are in the same period in the Periodic Table.

B The general increase from Q to X is due to increasing atomic radius.

C The small decrease from R to S is due to decreased shielding.

D The small decrease from U to V is due to repulsion between paired electrons.

3 The table identifies the shape and polarity of four molecules.

Which row is correct?

	molecule	molecular shape	polarity
A	boron trichloride	trigonal pyramidal	polar
B	nitrogen trichloride	trigonal planar	non-polar
C	sulfur dioxide	bent	polar
D	trichloromethane	tetrahedral	non-polar

4 The element tin exists in two forms, grey tin and white tin.

Some properties of grey tin and white tin are shown.

	grey tin	white tin
boiling point	2543 °C	2533 °C
electricial conductivity	none in solid or liquid	good in solid and liquid
malleability	brittle	malleable

Which structural change might take place when grey tin changes to white tin?

A giant covalent to giant ionic

B giant covalent to giant metallic

C giant ionic to giant covalent

D giant ionic to giant metallic

5 0.01 mol of KIO_n reacts with 0.05 mol of KI stoichiometrically to produce I_2 under acidic conditions. In this reaction, all the iodine containing reactants were converted to I_2.

What is the value of n?

A 1

B 2

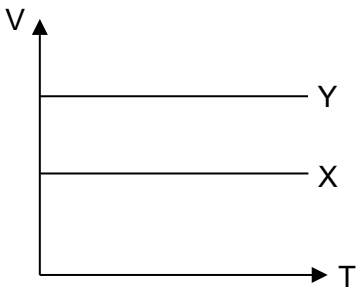
C 3

D 4

6 X and Y are two different samples of the same ideal gas.

Given that X contains a higher mass than Y, which graph shows the correct ideal gas relationship for the two samples of gas? (*T* is measured in K.)

A



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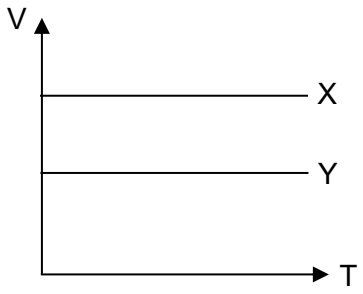

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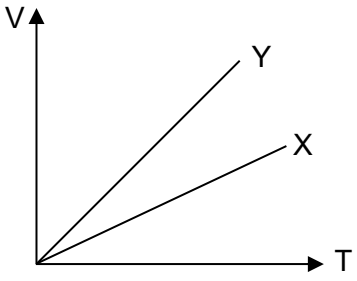
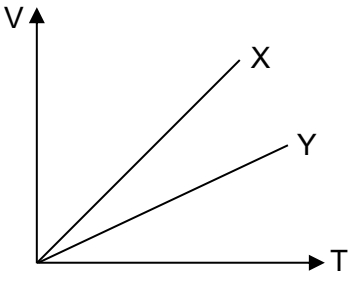


D



7 A student mixes 25.0 cm^3 of 0.350 mol dm^{-3} sodium hydroxide solution with 25.0 cm^3 of 0.350 mol dm^{-3} hydrochloric acid. The temperature increases by 2.5 °C. No heat is lost to the surroundings.

The final mixture has a specific heat capacity of 4.2 J g^{-1} K^{-1}.

What is the molar enthalpy change for the reaction?

A –150 kJ mol^{-1}

B –60 kJ mol^{-1}

C –30 kJ mol^{-1}

D –0.15 kJ mol^{-1}

8 Silane, SiH_4, exists as a gas at standard temperature and pressure. Hess' Law can be used to calculate the average Si–H bond energy in gaseous SiH_4. Which information is needed to perform the calculation?

A $\Delta H^{\ominus}_{atomisation}(Si)$, $\Delta H^{\ominus}_{combustion}(H_2)$, $\Delta H^{\ominus}_{formation}(SiH_4)$

B $\Delta H^{\ominus}_{atomisation}(Si)$, $\Delta H^{\ominus}_{atomisation}(H)$, $\Delta H^{\ominus}_{formation}(SiH_4)$

C $\Delta H^{\ominus}_{atomisation}(H)$, $\Delta H^{\ominus}_{combustion}(Si)$, $\Delta H^{\ominus}_{combustion}(SiH_4)$

D $\Delta H^{\ominus}_{combustion}(Si)$, $\Delta H^{\ominus}_{combustion}(H_2)$, $\Delta H^{\ominus}_{formation}(SiH_4)$

9 Group 2 hydroxides undergo thermal decomposition in a similar fashion to Group 2 carbonates.

Barium hydroxide undergoes decomposition as shown in the equation below:

$$Ba(OH)_2(s) \rightarrow BaO(s) + H_2O(g) \qquad \Delta H > 0$$

Which statements about this reaction are correct?

1 The Gibbs free energy change can be positive or negative depending on the temperature.

2 The decomposition is spontaneous only at high temperature.

3 The entropy change is negative.

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

10 The reaction between NO and Br_2 is proposed to proceed via the following mechanism:

Step 1: $NO + Br_2 \rightleftharpoons NOBr_2$ (fast)

Step 2: $NOBr_2 + NO \longrightarrow 2NOBr$ (slow)

Which statements are correct?

1 $NOBr_2$ is a radical.

2 The rate equation for this reaction is rate = $k[Br_2][NO]^2$.

3 $NOBr_2$ is formed at the transition state.

A 1, 2 and 3

B 1 and 2 only

C 2 and 3 only

D 1 only

11 The kinetics of the following reaction is investigated, and the experimental data is given in the table below.

$$2R + 2S \longrightarrow T + U$$

[R] / mol dm^{-3}	[S] / mol dm^{-3}	initial rate / mol dm^{-3} s^{-1}
0.015	0.010	5.10×10^{-4}
0.030	0.020	4.08×10^{-3}
0.045	0.010	1.53×10^{-3}

What is the numerical value of the rate constant for this reaction?

A 0.00294 **B** 3.40 **C** 227 **D** 340

12 Ethanol is produced industrially by reacting ethene and steam.

$$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g) \qquad \Delta H = -50.3 \text{ kJ mol}^{-1}$$

K_p has a value of 1.8×10^{-5} and the partial pressures of the reactants at equilibrium are shown.

reactant	partial pressure / x 10^6 Pa
ethene	4.8
steam	2.8

Which statement is correct?

A Adding a catalyst increases the value of K_p for the reaction at equilibrium.

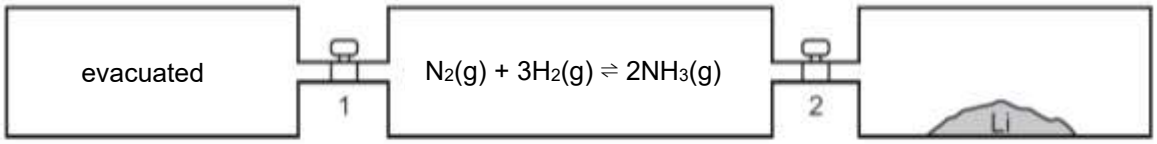
B The overall process is a nucleophilic addition reaction.

C Increasing the temperature will increase the K_p for the reaction.

D Partial pressure of ethanol at equilibrium is 242 x 10^6 Pa.

13 Lithium reacts with nitrogen at room temperature to form solid Li_3N.

Three vessels of equal volume are connected by taps 1 and 2 as shown.



At the start, taps 1 and 2 are closed, the left-hand vessel is evacuated, the middle vessel has the indicated reaction at equilibrium and the right-hand vessel contains lithium only.

Which action would allow the equilibrium mixture to contain the **most** ammonia?

A Keep both taps 1 and 2 closed.

B Open both taps 1 and 2.

C Open tap 1 only.

D Open tap 2 only.

14 The table below describes some indicators.

indicator	colour in acid	colour in alkali	pK_a	range of pH for colour change
methyl orange	red	yellow	3.7	3.2 – 4.4
thymol blue	yellow	blue	8.9	8.0 – 9.6

For the titration of NaOH(aq) against HCOOH(aq), which row shows the most suitable indicator and the corresponding colour change?

	indicator	colour change
A	methyl orange	red to orange
B	methyl orange	yellow to orange
C	thymol blue	yellow to green
D	thymol blue	blue to green

15 In this question, Q represents an atom of chlorine, bromine or iodine.

Which statement about their atoms, molecules or halide ions is correct?

A Down the Group, permanent dipole–permanent dipole forces between halogen molecules become stronger.

B The first ionisation energy $Q(g) \rightarrow Q^+(g) + e^-$ decreases.

C Q_2 reactivity as oxidising agent increases down the group.

D The enthalpy change of formation of hydrogen halides becomes more exothermic.

16 Magnesium, aluminium, silicon and phosphorus are consecutive elements in Period 3 of the Periodic Table.

Which of the following properties generally decreases from magnesium to phosphorus?

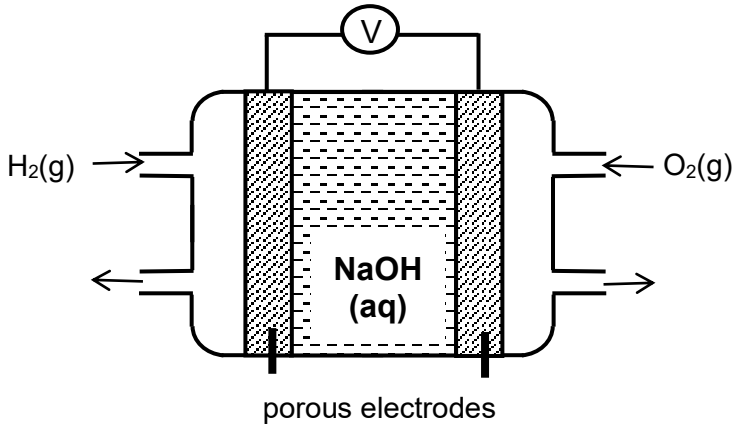
A electrical conductivity

B ionic radius

C melting point of their oxides

D electronegativity

17 A hydrogen-oxygen fuel cell is constructed using 1.00 mol dm^{-3} sodium hydroxide as the electrolyte. What is the change in pH of the solution around each electrode when the current is flowing?



	Cathode	Anode
A	increase	increase
B	increase	decrease
C	decrease	increase
D	decrease	decrease

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

In the electrolysis of molten aluminium oxide. 0.27 g of aluminium is liberated when 2904 coulombs of electricity is passed through molten aluminium oxide.

Which value of Avogadro's constant do **these figures** give?

A 6.02×10^{23}

B 6.05×10^{23}

C 1.82×10^{24}

D 2.02×10^{23}

19 10 cm^3 of an organic substance Z burns completely with exactly 75 cm^3 of oxygen to produce 50 cm^3 of carbon dioxide. All the volume are measured at the same temperature and pressure.

Which statements about the organic substance are correct?

1 Z may be an alcohol.

2 Z may be cycloalkane.

3 Z may decolorise aqueous bromine in the dark

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 3 only

20 Which compound has the greatest number of stereoisomers?

A 2-methylhex-2-ene

B 3-methylhex-2-ene

C 4-methylhex-2-ene

D 5-methylhex-2-ene

21 Which statement about methylbenzene and its properties is correct?

A Methylbenzene undergoes nucleophilic substitution and free radical substitution reactions with Br_2 in the presence of A*l*Br_3.

B The methylbenzene molecule is planar so hydrogen can easily undergo addition reactions with it without the use of a catalyst.

C The π electrons in the benzene ring are able to donate an electron pair to attack a carbocation to form a bond.

D The sideways overlap of p orbitals in benzene means the C–C bonds alternate between long, single bonds and short, double bonds.

22 Which pair of reagents react together in a redox reaction?

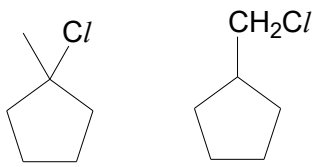
A $CH_3CHCH_2 + Br_2$

B $CH_3CH_2CH_2OH$ + concentrated H_3PO_4

C $CH_3COCH_3 + HCN$

D $HCO_2C_2H_5$ + dilute H_2SO_4

23 Methylcyclopentane can react with chlorine via free radical substitution to produce compound A and B as shown.



A B

Given the relative rate of substitution of tertiary and primary hydrogen atoms follows a 5 : 1 ratio.

What is the likely ratio of compound A and B formed?

A 1 : 15

B 1 : 3

C 3 : 5

D 5 : 3

24 K_a values for two acids are given.

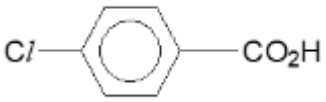
acid	K_a
$CH_3CH_2CO_2H$	1.34×10^{-5}
$C_6H_5CO_2H$	6.46×10^{-5}

Which statement is correct?

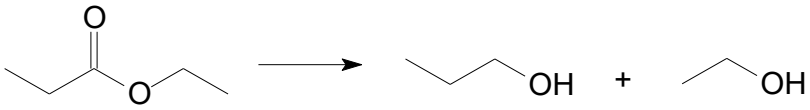
A The K_a of $CH_3C_6H_4OH$ is larger than 1.34×10^{-5}.

B The K_a of $CH_3CH(Cl)CO_2H$ is larger than 1.34×10^{-5}, but smaller than the K_a of $CH_2(Cl)CH_2CO_2H$.

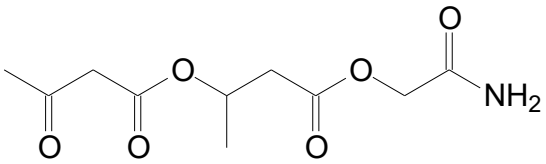
C In a mixture containing equal concentrations of $CH_3CH_2CO_2H$ and $C_6H_5CO_2H$, $[CH_3CH_2CO_2^-] = [C_6H_5CO_2^-]$.

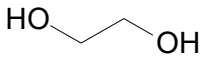
D In two separate solutions of  and $C_6H_5CO_2H$, which have the same pH, there is a greater concentration of $C_6H_5CO_2H$ in mol dm^{-3}.

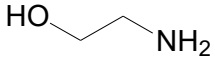
25 Esters can be reduced by $LiAlH_4$ in dry ether to give two alcohols as shown below.

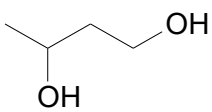


What are the possible products formed when the following compound is reacted with $LiAlH_4$ in dry ether?



1 

2 

3 

A 1 only

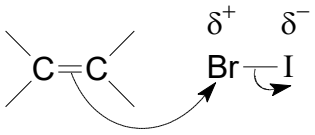
B 1 and 2 only

C 2 and 3 only

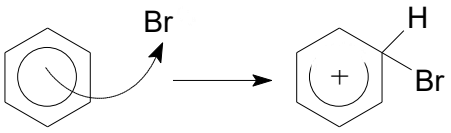
D 1, 2 and 3

26 Which of the following shows the most likely first step in the mechanism of a reaction?

A

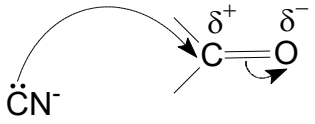


B

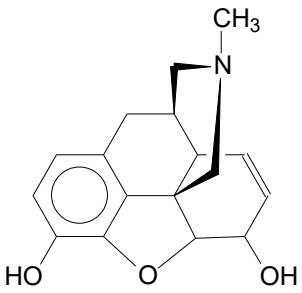


C

D



27 Morphine and codeine are both effective painkillers.



morphine

Which observation will be given by morphine?

1 the decolourisation of liquid bromine

2 the evolution of hydrogen with metallic sodium

3 the formation of green Cr^{3+} ions from an acidified solution of $Cr_2O_7^{2-}$

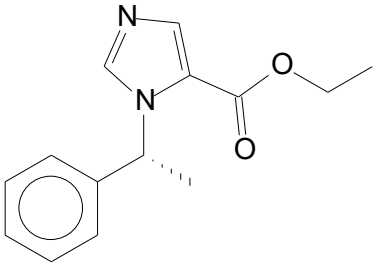
A 3 only

B 1 and 2 only

C 2 and 3 only

D 1, 2 and 3

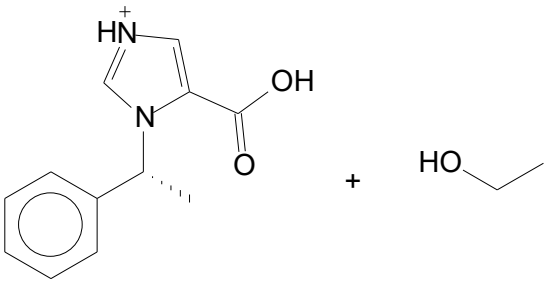
28 Etomidate is an anaesthetic agent that has been found in e-vaporisers. It will soon be listed by Singapore as a Class C drug under the Misuse of Drugs Act.



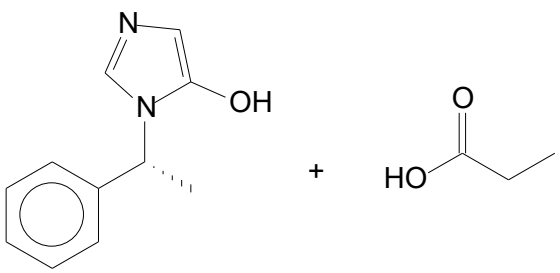
etomidate

What are the products when etomidate is hydrolysed by heating with a dilute acid?

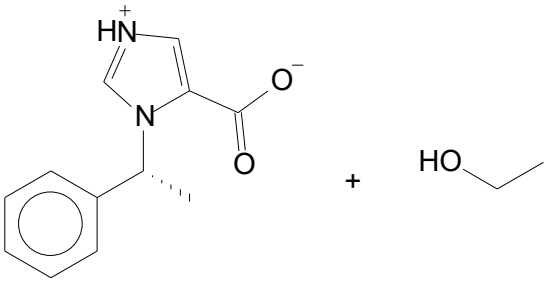
A



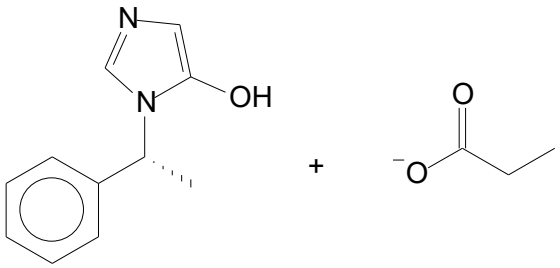
B



C



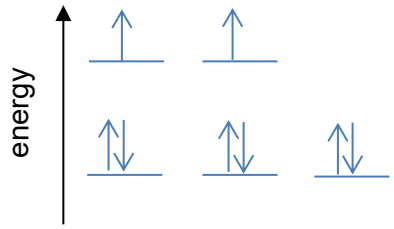
D



29 In a 'high spin' state, the electrons occupy all the d–orbitals singly, before starting to pair up in the lower energy d–orbitals.

Which energy diagram shows the electron arrangement in the 3d orbitals for a nickel in the +2 oxidation state in an octahedral complex in a 'high spin' state.

A



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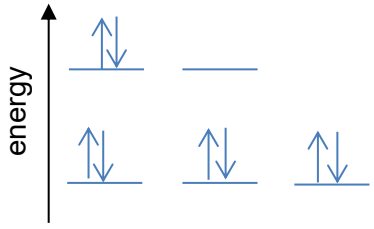
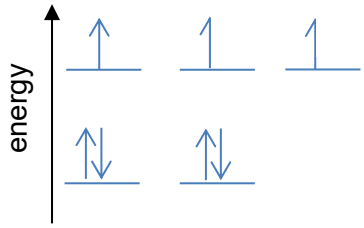
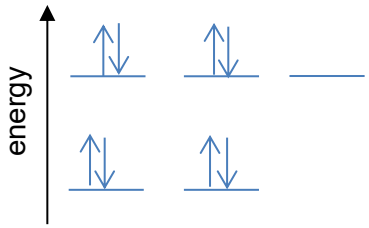


C



D



30 The rate of reaction between peroxodisulfate(VI) and iodide ions is increased by the presence of small concentrations of $Fe^{2+}(aq)$.

$$S_2O_8^{2-}(aq) + 2I^-(aq) \rightarrow 2SO_4^{2-}(aq) + I_2(aq)$$

Which property of iron allows it to act as a homogeneous catalyst?

A partially filled d subshell

B variable oxidation states

C low activation energy

D high charge density

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