NATIONAL JUNIOR COLLEGE
SH2 TIMED PRACTICE
Higher 2

CANDIDATE NAME			
SUBJECT CLASS		REGISTRATION NUMBER	

CHEMISTRY **9476/01**
Paper 1 Multiple Choice **16 July 2026**
1 hour

Additional Materials: Optical 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, subject class and registration number on the Answer Sheet in the spaces provided unless this has been done for you.

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.

Instructions on how to fill in the Optical Mark Sheet
Shade the index number in a 5 digit format on the optical mark sheet:
2nd digit and the last 4 digits of the Registration Number.

Example:

Student	Examples of Registration No.	Shade:
	2505648	**55648**

This document consists of **16** printed pages including 1 blank page..

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

Which sample of gas contains twice the number of atoms as 4 g of helium gas, He?

A 4 g of hydrogen, H_2

B 8 g of methane, CH_4

C 12 g of steam, H_2O

D 22 g of carbon dioxide, CO_2

2 The isotope of an element has a nucleon number of 112. It forms an ion with a charge of +2 with the electron configuration $[Kr]4d^{10}$.

How many protons, neutrons, and electrons are present in this ion?

A 46 protons, 66 neutrons, 44 electrons

B 46 protons, 66 neutrons, 46 electrons

C 48 protons, 64 neutrons, 46 electrons

D 48 protons, 64 neutrons, 44 electrons

3 An element **R** consists of four isotopes. The table below shows the percentage abundance of the isotopes.

Relative isotopic mass	Percentage abundance /%
90.0	50.0
91.0	10.0
92.0	20.0
94.0	20.0

What is the relative atomic mass of **R**?

A 91.00 **B** 91.30 **C** 91.75 **D** 92.00

4 An element **X** has the following successive ionisation energies.

	1st	2nd	3rd	4th	5th
Ionisation energy /kJ mol^{-1}	786	1580	3230	4360	16000

Given that the oxide of **X** is acidic and is insoluble in water, which statement about **X** is correct?

A **X** is a gas at room temperature.

B **X** forms a chloride with a formula **X**Cl_5.

C The oxide of **X** has a linear shape with no dipole moment.

D The oxide of **X** has a giant covalent lattice with a high melting point.

5 Which option correctly describes the shape and polarity of the species?

	species	shape	polarity
A	$AlCl_3$	trigonal planar	polar
B	SiF_4	square planar	non-polar
C	BrF_3	trigonal pyramidal	polar
D	$BeCl_2$	linear	non-polar

6 When 10 cm^3 of a gaseous hydrocarbon was sparked with excess oxygen gas and cooled to room temperature, the gaseous mixture contracted by 30 cm^3. When the residual gas was passed through aqueous potassium hydroxide, there was a further contraction of 40 cm^3.

What is the hydrocarbon?

A C_3H_8

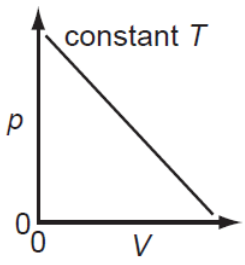
B C_4H_8

C C_4H_6

D C_4H_{10}

7 Which diagram correctly describes the behaviour of a fixed mass of an ideal gas?
(T is measured in K.)

A



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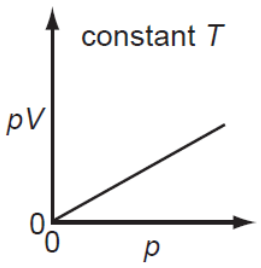

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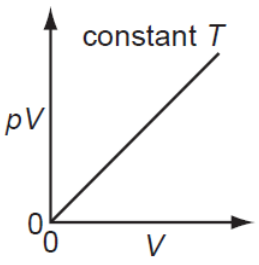

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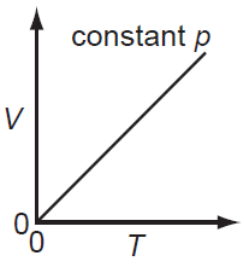


8 Liquefaction can be defined as a process that turns a gas into a liquid by increasing the pressure at a constant temperature. In the liquefaction of CH_4 and NH_3, the pressure needed for NH_3 is less than CH_4.

Which reason best explains this observation?

A NH_3 has stronger intermolecular forces of attraction than CH_4.

B NH_3 has lower bond energy than CH_4.

C NH_3 molecules are bigger than CH_4 molecules.

D NH_3 molecules possess less kinetic energy than CH_4 molecules.

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

Hexamine has an enthalpy change of combustion of –4288 kJ mol^{-1}.

12.4 g of hexamine tablets were burnt to heat up 850 g of water. Given that the process was 75% efficient and temperature of the water increased from 10°C to 90°C, what is the molar mass of hexamine?

A 124.7 g mol^{-1}

B 140.3 g mol^{-1}

C 187.1 g mol^{-1}

D 249.4 g mol^{-1}

10 *Use of Data Booklet is relevant to this question.*
Nitrous oxide, N_2O, commonly known as laughing gas, contains one N=N bond and one N=O bond per molecule. It burns in ethyne, HC≡CH, to produce water vapour, carbon dioxide and nitrogen gas as the only products.

$$5N_2O(g) + C_2H_2(g) \rightarrow H_2O(g) + 2CO_2(g) + 5N_2(g)$$

By making use of the following data:

	Bond energy / kJ mol^{-1}
N=N	418
N=O	686

Calculate the enthalpy change of the above reaction.

A +1930 kJ mol^{-1}

B +2260 kJ mol^{-1}

C –1680 kJ mol^{-1}

D –3980 kJ mol^{-1}

11 Using the enthalpy changes below, calculate the standard enthalpy change of formation of gaseous hydrogen chloride.

	enthalpy change/ kJ mol^{-1}
$N_2(g) + 3\ H_2(g) \rightarrow 2NH_3(g)$	–92
$N_2(g) + 4\ H_2(g) + Cl_2\ (g) \rightarrow 2NH_4Cl\ (s)$	–629
$NH_3(g) + HCl\ (g) \rightarrow NH_4Cl\ (s)$	–176

A – 46.3kJ mol^{-1}

B – 92.5 kJ mol^{-1}

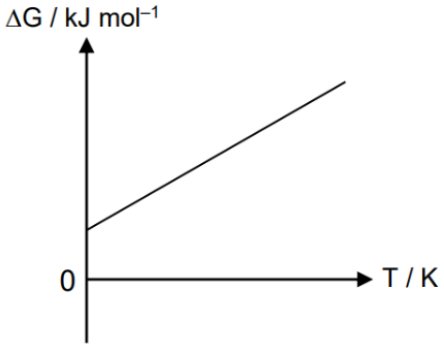
C –180 kJ mol^{-1}

D – 361 kJ mol^{-1}

12 Which graph corresponds to the combustion of liquid ethanedioic acid, $(COOH)_2$ at increasing temperature (before the boiling point of water)?

$$(COOH)_2(l) + ½\ O_2(g) \rightarrow 2CO_2(g) + H_2O\ (l)$$

A



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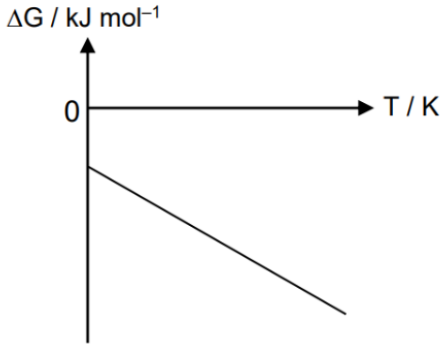

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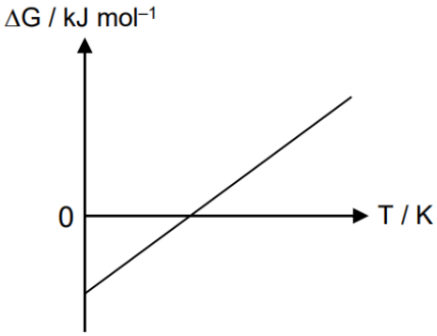

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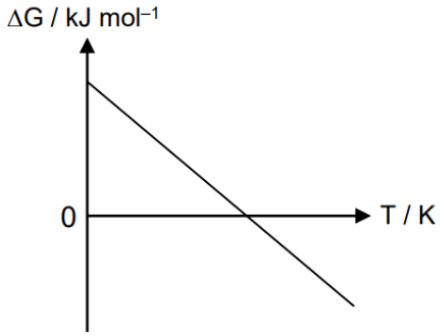


13 The rate equation for a reaction is: rate = k[**P**]²[**Q**].
If the concentration of **P** is tripled and the concentration of **Q** is halved, what would be the new rate compared to the original rate?

A 1.5 times **B** 3 times **C** 4.5 times **D** 9 times

14 Crotonaldehyde, $CH_3CH=CHCHO$, can be obtained by oxidising butadiene, $CH_2=CHCH=CH_2$, using air or oxygen. One method is to pass a mixture of butadiene and oxygen through a hot aqueous solution of palladium(II) ions, $Pd^{2+}(aq)$, which catalyses the reaction.

Which statements are correct about the action of the $Pd^{2+}(aq)$ ions?

1 Changing the concentration of $Pd^{2+}(aq)$ will have an effect on the rate of the reaction.

2 $Pd^{2+}(aq)$ increases the energy of the reacting molecules.

3 $Pd^{2+}(aq)$ lowers the activation energy for the reaction.

4 When $Pd^{2+}(aq)$ is used, the reaction proceeds by a different route.

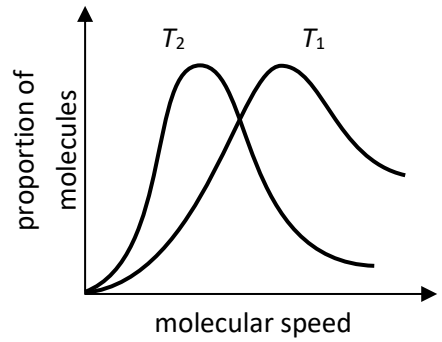
A 1, 2 and 3 **B** 2, 3 and 4 **C** 1, 3 and 4 **D** All correct

15 Initially, there was 1 mol of neon gas at temperature T_1 in an enclosed system. 0.5 mol of neon gas was added and the temperature was increased to T_2.

	Amount of neon gas/ mol	Temperature
Beginning	1	T_1
Final	1.5	T_2

Which diagram correctly represents the Boltzmann distribution of molecular speeds before and after the changes were made?

A



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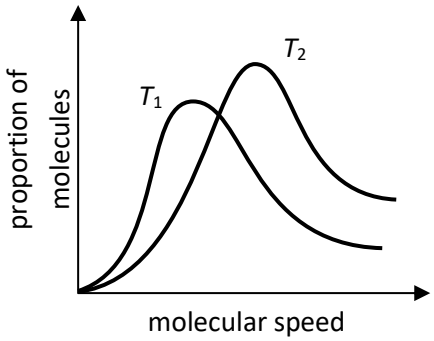

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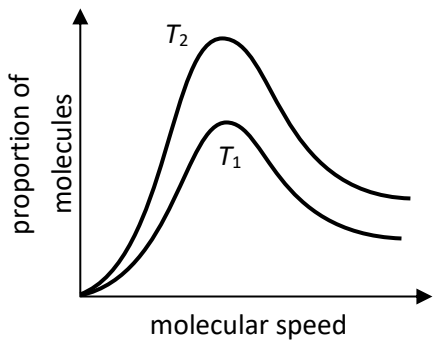

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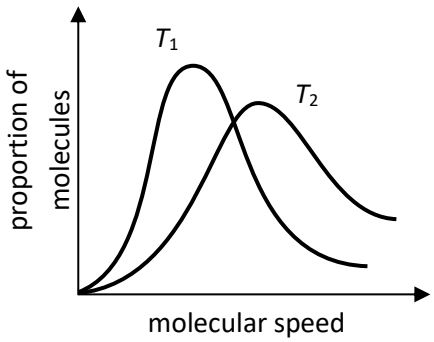
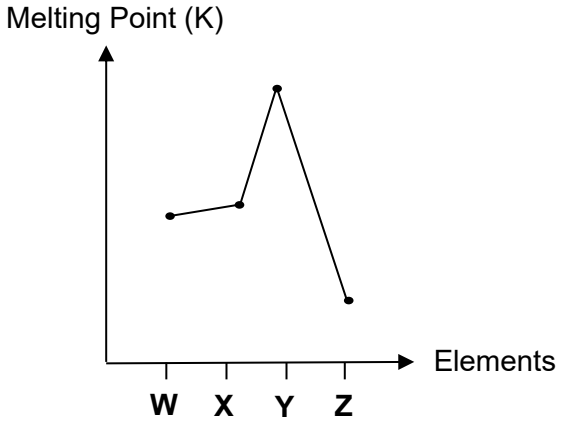
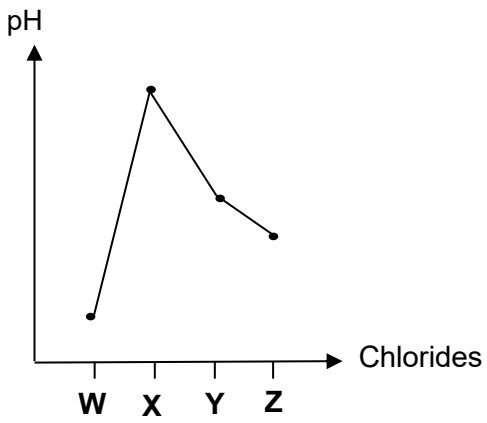


16 The graph below shows the melting points of four consecutive Period 3 elements **W** to **Z**.



Which graph represents the correct trend of the stated property for **W** to **Z**?

A



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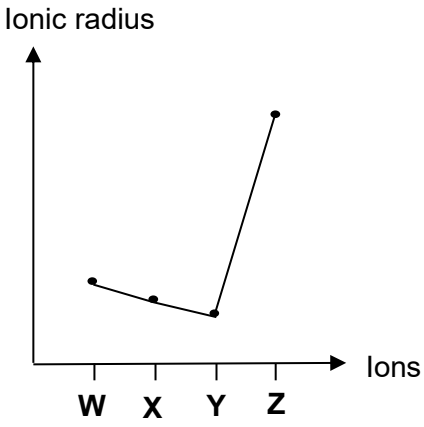

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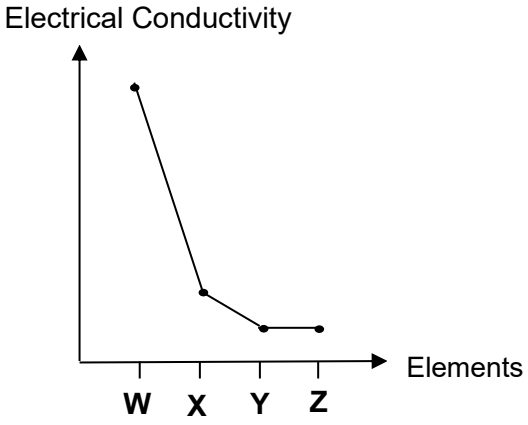

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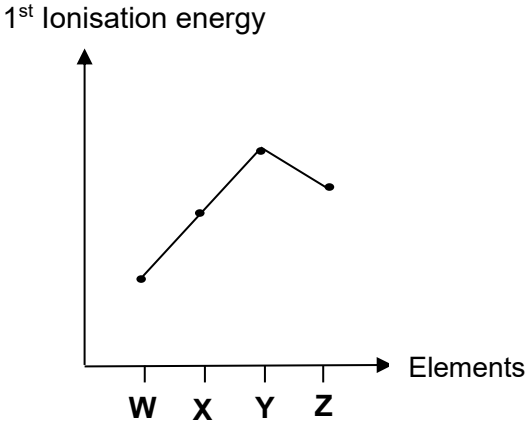


17 **X**, **Y** and **Z** are three elements in Group 17.

- $\mathbf{X_2}$ has weaker covalent bonds than $\mathbf{Y_2}$.
- $\mathbf{X_2}$ has stronger instantaneous dipole–induced dipole interactions between its molecules than $\mathbf{Z_2}$.
- $\mathbf{Y_2}$ is a stronger oxidising agent than $\mathbf{Z_2}$.

What could be **X**, **Y** and **Z**?

	X	**Y**	**Z**
A	I	C*l*	Br
B	I	Br	C*l*
C	C*l*	Br	I
D	Br	C*l*	I

18 Solid sodium carbonate, Na_2CO_3, is added gradually added to a solution containing a mixture of Mg^{2+}, Ca^{2+} and Ag^{+} ions, each at 0.002 mol dm^{-3}.

compound	K_{sp}
$MgCO_3$	3.6×10^{-8}
$CaCO_3$	2.8×10^{-9}
Ag_2CO_3	8.4×10^{-12}

What is the order of precipitation of the carbonates?

	first		**last**
A	$MgCO_3$	$CaCO_3$	Ag_2CO_3
B	$MgCO_3$	Ag_2CO_3	$CaCO_3$
C	Ag_2CO_3	$CaCO_3$	$MgCO_3$
D	$CaCO_3$	Ag_2CO_3	$MgCO_3$

19 Which pair is not a Brønsted–Lowry conjugate acid–base pair?

A HPO_4^{2-} and PO_4^{3-}

B H_2O_2 and HO_2^-

C NH_3 and NH_2^-

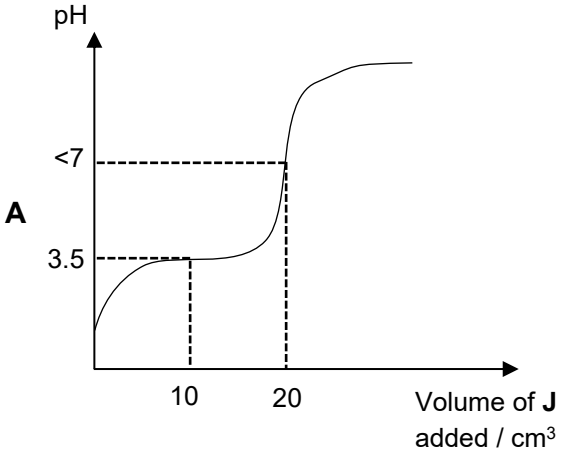
D H_2CO_3 and CO_3^{2-}

20 **J** is a monoacidic weak base with a pK_b of 3.5.

A total of 50 cm^3 of 0.1 mol dm^{-3} of **J** was added dropwise to 20 cm^3 of 0.1 mol dm^{-3} HNO_3.

Which pH curve correctly describes the changes in the pH of the resultant solution as **J** was added to HNO_3?

A



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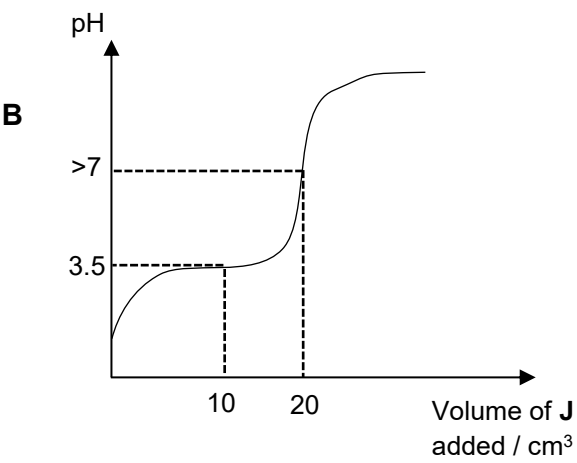

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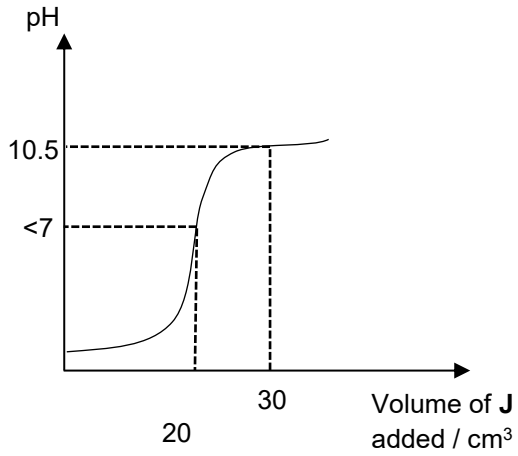

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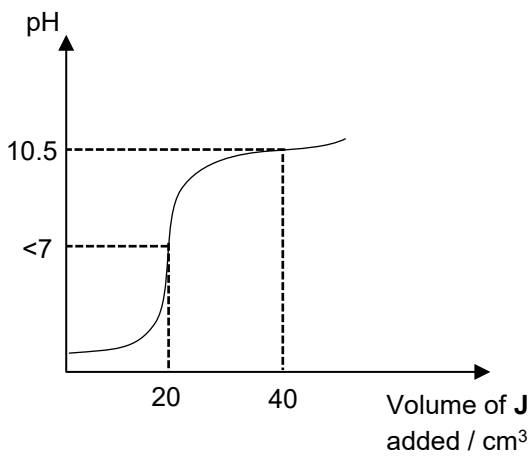


21 Which statements about the bonding in prop-2-en-1-ol, $CH_2{=}CH{-}CH_2OH$ are correct?

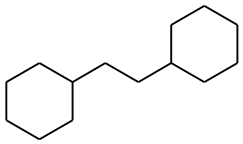
1 All carbon atoms in the molecule are in the same plane.

2 The C–C bond in the $=CH{-}CH_2OH$ is stronger than those in ethanol.

3 The molecule contains a π-bond formed by the side-on overlap of two 2p orbitals.

A 1, 2 and 3 **B** 1 and 2 **C** 2 and 3 **D** 1 only

22 Compound **R**, $C_{14}H_{26}$, reacts with chlorine gas in the presence of UV light.



R

Which statement about this reaction is correct?

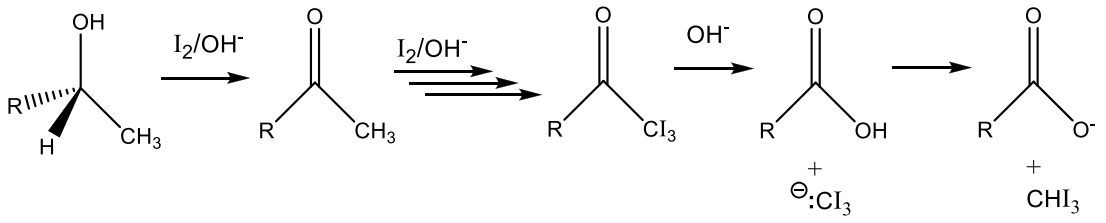
A The maximum number of mono-chlorinated structural isomers with formula $C_{14}H_{25}Cl$ is 5.

B $C_{28}H_{52}$ is present in small quantities in the product.

C Homolytic fission occurs only in the initiation step.

D HC*l* is formed in the termination step.

23 The reaction of methyl alcohols with alkaline aqueous iodine can be described by the simplified scheme as shown below:



Which reactions have taken place?

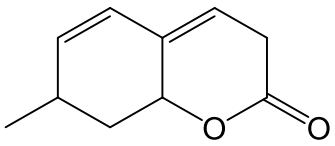
1 Oxidation

2 Acid-base reaction

3 Nucleophilic addition

A 1 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3 only

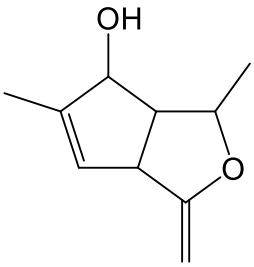
24 The diagram shows compound **M**.



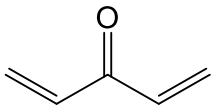
M

Which molecule has the same empirical formula as compound **M**?

A



B



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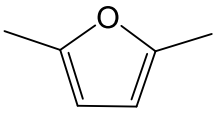

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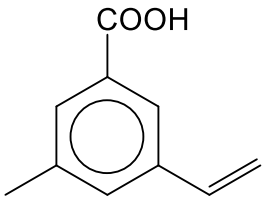


25 Which statement about propanoyl chloride is correct?

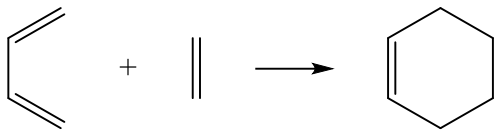
A It reacts with aqueous ammonia to produce $CH_3CH_2CONH_2$.

B It reacts with 2-methyl-propan-2-ol to produce $(CH_3)_3CCO_2CH_2CH_3$.

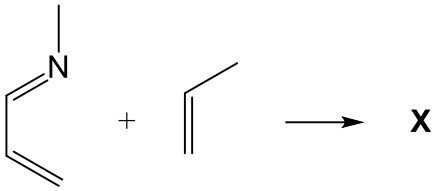
C It reacts with ethanol to produce $CH_3CH_2COCH_2CH_3$.

D It reacts with water to produce $CH_3CH_2CO_2H$.

26 Buta-1,3-diene can react with ethene to form cyclohexene.

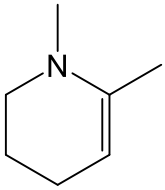


In a separate reaction, compound **X** can be made using similar method.



Which molecules are possible structure of compound **X**?

1



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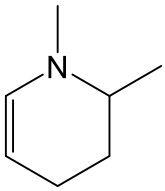

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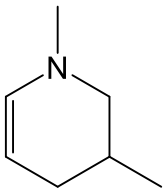
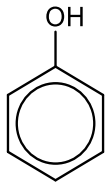


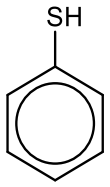
A 1 only **B** 2 only **C** 1 and 2 only **D** 2 and 3 only

27 Thiophenol and phenol are both acting as weak acids in aqueous solutions.



phenol

pK_a = 10.0



thiophenol

pK_a = 6.50

Which statements are correct?

1 H^+ is less easily removed from thiophenol than phenol because the S–H bond is less polar than O–H bond.

2 The K_a value is smaller for phenol because the O–H bond is stronger than the S–H bond.

3 When pure liquid thiophenol and phenol are mixed together without water, the S–H bond in thiophenol is more likely to dissociate than the O–H bond in phenol.

A 1, 2 and 3 **B** 1 and 2 only **C** 2 and 3 only **D** 3 only

28 Equal amounts of two organic compounds, **Y** and **Z**, were added to water and the pH values of both solutions were determined. It was found that the pH of the aqueous solution of **Y** is higher.

Which pairs of compounds could be **Y** and **Z**?

	Y	**Z**
1	$(CH_3)_2NH$	CH_3NH_2
2	$CH_3COCH_2NH_2$	$CH_3CH_2CONH_2$
3	$C_6H_5O^-Na^+$	$C_6H_5CO_2^-Na^+$

A 1, 2 and 3 **B** 1 and 2 **C** 2 and 3 **D** 1 only

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

Peroxodisulfate ions convert iodide ions into iodine slowly according to reaction **1**.

$S_2O_8^{2-}(aq) + 2I^-(aq) \rightarrow 2SO_4^{2-}(aq) + I_2(aq)$ reaction **1**

The rate of the reaction can be increased by the addition of homogeneous catalysts such as aqueous iron(III) ions.

Step 1: $2Fe^{3+}(aq) + 2I^-(aq) \rightarrow I_2(aq) + 2Fe^{2+}(aq)$

Step 2: $S_2O_8^{2-}(aq) + 2Fe^{2+}(aq) \rightarrow 2SO_4^{2-}(aq) + 2Fe^{3+}(aq)$

Which statements are correct?

1 $S_2O_8^{2-}$ is a stronger oxidising agent than Fe^{3+}.

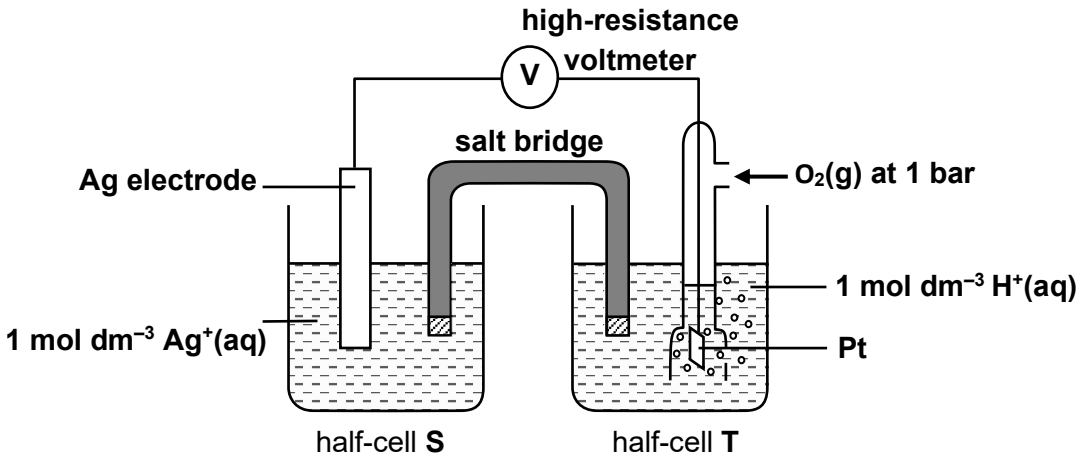
2 The $E_{cell}^{\ominus}$ for step 2 is more positive than step 1.

3 Aqueous cobalt(II) ions can also be used as a homogeneous catalyst in reaction **1**.

A 2 only **B** 1 and 3 **C** 1 and 2 **D** 1, 2 and 3

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

Which changes will result in a decrease in the cell potential for the following setup?



A Adding water to half-cell **S**.

B Adding potassium iodide to half-cell **S.**

C Adding water to half-cell **T**.

D Introduce O_2 (g) at 2 bar to half-cell **T**.

END