H2

MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
CAMBRIDGE INTERNATIONAL EDUCATION
General Certificate of Education Advanced Level

CHEMISTRY **9476/01**

Paper 1 Multiple Choice **For examination from 2026**

SPECIMEN PAPER **1 hour**

You must answer on the multiple choice answer sheet.

0123456789

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)
Data booklet

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and index number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid or tape.
- Do **not** write on any bar codes.
- You may use an approved calculator.

INFORMATION

- The total mark for this paper is 30.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

Singapore Examinations and Assessment Board

CAMBRIDGE International Education

1 Why is the first ionisation energy of neon higher than that of fluorine?

A Fluorine is more electronegative than neon.

B Neon has a complete octet, but fluorine does **not**.

C The atomic radius of fluorine is less than that of neon.

D The nuclear charge in neon is greater than that in fluorine.

2 Use of the data booklet is relevant to this question.

Which particle, on gaining an electron, would have a half-filled set of p orbitals?

A C^+ **B** N **C** Si^- **D** P^+

3 Covalent bonds are formed by orbital overlap. The shape of unsaturated hydrocarbon molecules can be explained in terms of hybridisation of orbitals.

Which bond is **not** present in $HC \equiv CCH_2CH = CH_2$?

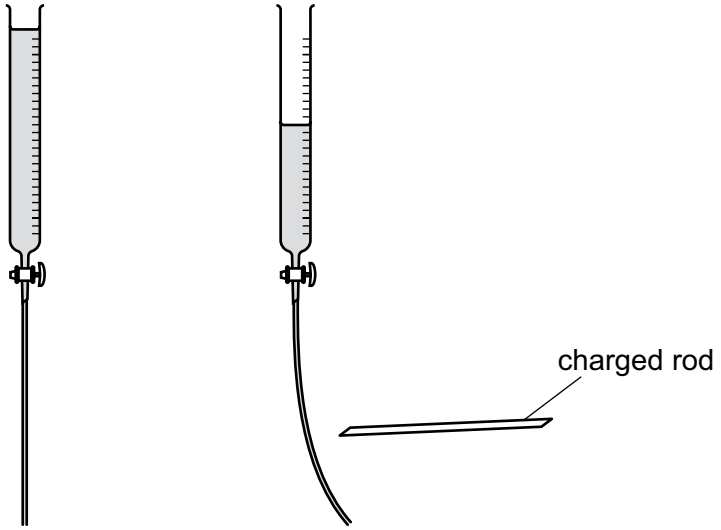
A a π bond formed by 2p – 2p overlap

B a σ bond formed by 1s – 2sp overlap

C a σ bond formed by 2sp – $2sp^2$ overlap

D a σ bond formed by $2sp^2$ – $2sp^3$ overlap

4 A stream of liquid containing polar molecules shows a significant deflection when an electrostatically charged rod is held next to it.



Which of these could be the liquid?

1 H_2O 2 CCl_4 3 $(CH_3)_2CO$ 4 CS_2

A 1 and 2

B 1 and 3

C 2 and 4

D 3 and 4

5 Yttrium, barium and copper form a series of mixed oxides, $YBa_pCu_qO_r$. One such oxide has the following composition by mass.

Y, 13.3%; Ba, 41.2%; Cu, 28.7%; O, 16.8%

What are the values of *p*, *q* and *r*, and what is the M_r?

	p	***q***	***r***	M_r
A	2	3	6	286
B	2	3	6	650
C	2	3	7	294
D	2	3	7	666

6 Use of the data booklet is relevant to this question.

Some properties of phosphorus and sulfur may be expressed as ratios.

$$\rho = \frac{\text{value of property of phosphorus}}{\text{value of property of sulfur}}$$

For which properties is ρ greater than or equal to 1?

1 atomic radius

2 first ionisation energy

3 oxidation number of the element in their highest oxide

A 1, 2 and 3

B 1 and 2 only

C 1 only

D 2 only

7 Use of the data booklet is relevant to this question.

Which value is likely to be the standard electrode potential for the following reaction?

$$Sr^{2+} + 2e^- \rightleftharpoons Sr$$

A –2.32 V

B –2.43 V

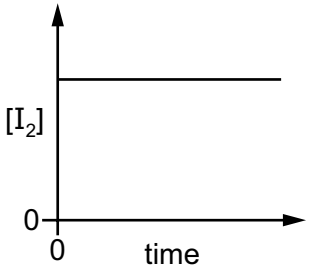
C –2.89 V

D –2.97 V

8 The reaction of iodine with propanone in the presence of aqueous acid is zero order with respect to iodine.

Which diagram represents the variation of $[I_2]$ with time?

A



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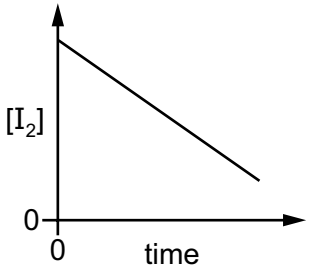

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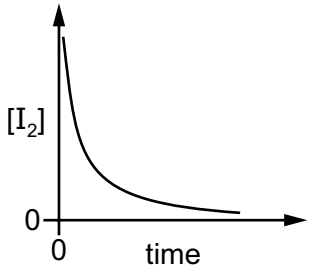
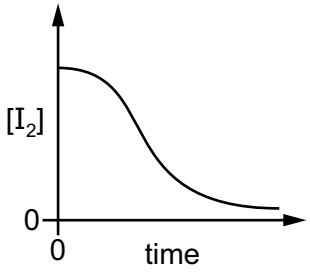
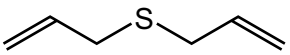


D



9 Use of the data booklet is relevant to this question.

Diallyl sulfide (M_r = 114) can be isolated from garlic.



diallyl sulfide

Which statements about diallyl sulfide are correct?

1 On complete combustion, 0.10 g of diallyl sulfide produces 0.23 g of CO_2.

2 On complete combustion, 0.10 g of diallyl sulfide produces 21 cm^3 of SO_2 measured under r.t.p.

3 On complete combustion, 0.10 g of diallyl sulfide produces 0.16 g of H_2O.

4 0.10 g of diallyl sulfide reacts with an excess of bromine to produce 0.38 g of product. Assume the sulfur in diallyl sulfide does not react with bromine.

A 1, 3 and 4 only

B 1, 2 and 4 only

C 2 and 3 only

D 2 and 4 only

10 The equation describes the equilibrium between solid silver chromate and its aqueous ions.

$$Ag_2CrO_4(s) \rightleftharpoons 2Ag^+(aq) + CrO_4^{2-}(aq) \qquad \Delta H^{\ominus} = +61\,kJ\,mol^{-1}$$

$$\Delta S^{\ominus} = -30\,J\,K^{-1}\,mol^{-1}$$

What can be deduced from the information about this equilibrium?

1 At 25 °C, $\Delta G^{\ominus}$ is negative.

2 At 25 °C, silver chromate is almost insoluble in water.

3 At 95 °C, silver chromate is more soluble in water than at 25 °C.

A 2 only

B 1 and 2 only

C 1 and 3 only

D 1, 2 and 3 only

11 The uncatalysed reaction between SO_2 and O_2 is slow.

$$2SO_2 + O_2 \rightarrow 2SO_3$$

The reaction is sped up in the presence of the homogeneous catalyst NO, which participates as follows.

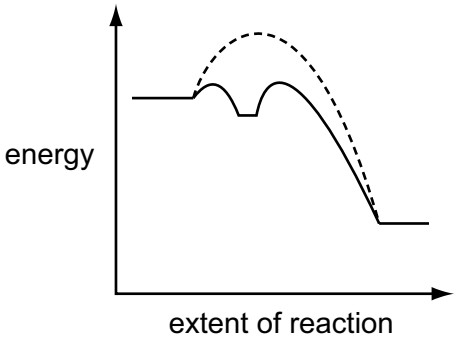
$$2NO + O_2 \rightarrow 2NO_2$$

$$2NO_2 + 2SO_2 \rightarrow 2NO + 2SO_3$$

Which reaction pathway diagram is most appropriate for describing the enthalpy changes occurring during the catalysed reaction?

In each case, the reaction pathway for the uncatalysed reaction is shown as a dashed line.

A



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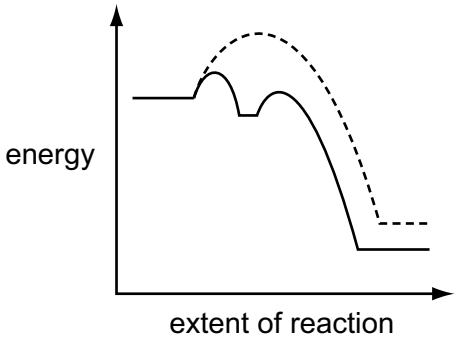

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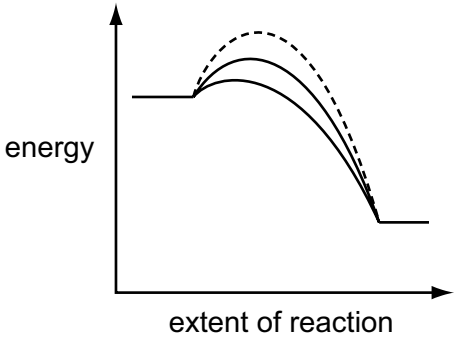

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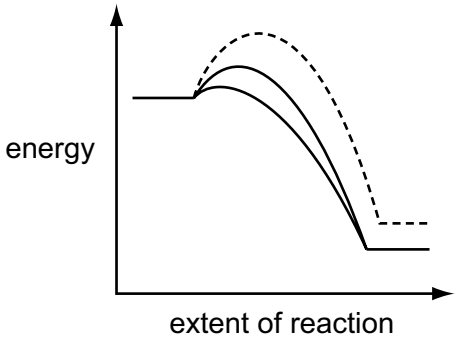


12 The rate equation for the reaction in which P, Q and R react together is given below.

$$\text{rate} = k[P]^x[Q]^y[R]^z$$

By experiment, it is found that the rate is independent of [Q] but directly proportional to [P]. When [R] is doubled, keeping [P] and [Q] constant, the rate increases by a factor of four.

What are the units of k?

A s^{-1} **B** $mol\,dm^{-3}\,s^{-1}$ **C** $mol^{-1}\,dm^3\,s^{-1}$ **D** $mol^{-2}\,dm^6\,s^{-1}$

13 Which statements about the Group 17 hydrides are correct?

1 Difference in electronegativity between halogen and hydrogen increases down the group.

2 The bonding pair of electrons gets closer to the halogen nucleus going down the group.

3 Thermal stability decreases down the group.

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

14 What is a satisfactory indicator for the titration of 0.1 mol dm^{-3} ethanoic acid with 0.1 mol dm^{-3} aqueous ammonia?

A bromothymol blue (pH range 6.0–7.6)

B methyl red (pH range 4.2–6.3)

C phenolphthalein (pH range 8.2–10.0)

D there is no satisfactory indicator

15 What is the pH of an aqueous solution containing 0.1 mol dm^{-3} sodium benzoate and 0.01 mol dm^{-3} benzoic acid?
[K_a (benzoic acid) = 6×10^{-5} mol dm^{-3}]

A 3.22 **B** 4.22 **C** 4.78 **D** 5.22

16 The silver halides AgCl and AgBr are both sparingly soluble in water. AgCl dissolves in dilute NH_3(aq), whereas AgBr requires concentrated NH_3(aq) in order to dissolve it.

Which statement helps to explain this observation?

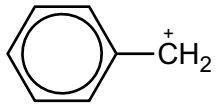
A The complex ion in a solution of $[Ag(NH_3)_2]C\mathit{l}$ is more stable than the complex ion in a solution of $[Ag(NH_3)_2]Br$.

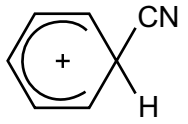
B Chlorine oxidises NH_3(aq) more easily than does bromine.

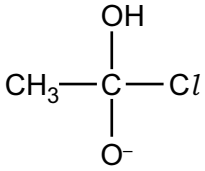
C The lattice energy of AgBr(s) is numerically larger than that of AgCl(s).

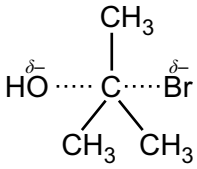
D The solubility product of AgBr(s) is smaller than that of AgCl(s).

17 Which species could be an intermediate in an S_N1 substitution?

A 

B 

C 

D 

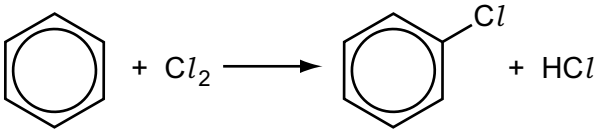
18 An amino acid has a relative molecular mass of *M*.

It forms a tripeptide X.

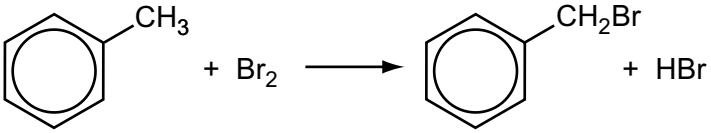
What is the relative molecular mass of X?

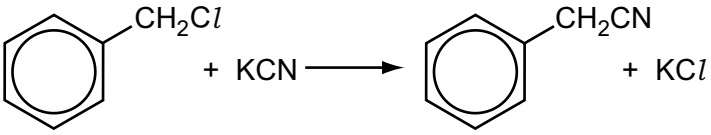
A $3M - 18$ **B** $3M - 36$ **C** $3M - 54$ **D** $4M - 54$

19 In which reaction is the inorganic reagent acting as a nucleophile?

A 

B $CH_2{=}CH_2 + Cl_2 \longrightarrow ClCH_2CH_2Cl$

C 

D 

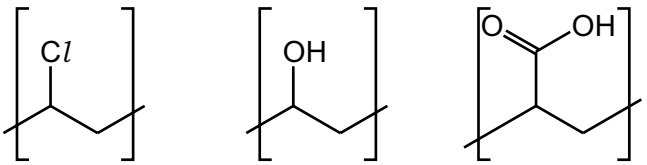
20 An organic compound X reacts with:

- sodium to produce hydrogen gas
- Tollens' reagent to produce a silver mirror.

What could be the molecular formula of X?

A $C_2H_2O_2$ **B** $C_2H_2O_4$ **C** $C_2H_4O_2$ **D** $C_2H_6O_2$

21 The structures of the repeat units for the different polymers 1, 2 and 3 are shown.



1 2 3

Which polymers are likely to be water soluble?

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

22 The ester 3-methylbutyl ethanoate can be produced by insects.

How may this ester be made in the laboratory?

A $CH_3COCl + (CH_3)_2CHCH_2CH_2OH \rightarrow$ ester + HCl

B $CH_3COCl + CH_3CH_2CH(CH_3)CH_2OH \rightarrow$ ester + HCl

C $(CH_3)_2CHCH_2CO_2H + CH_3CH_2OH \xrightarrow[\text{heat}]{H_2SO_4(aq)}$ ester + H_2O

D $(CH_3)_2CHCH_2CH_2CO_2H + CH_3CH_2OH \xrightarrow[\text{heat}]{H_2SO_4(aq)}$ ester + H_2O

23 Why are amides, $RCONH_2$, less basic than amines, RNH_2?

A Amides exist as a species with no overall charge containing a nitrogen atom which carries a positive charge.

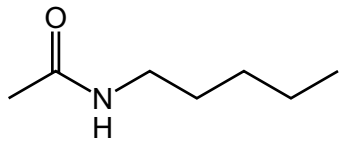
B Delocalisation of the lone pair of electrons on the nitrogen atom in amides occurs because of the presence of a more electronegative oxygen atom.

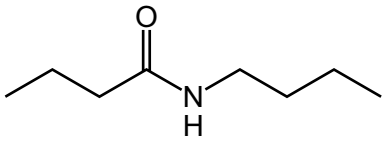
C Electrons on the nitrogen atom move on to the C–N bond giving it some double bond character so that it is more difficult to break.

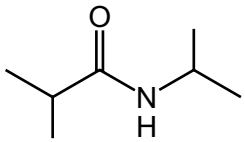
D The amide carbonyl group withdraws electrons from the NH_2 group to make the hydrogen atoms acidic.

24 An amide, X, has the empirical formula $C_7H_{15}ON$. When X is hydrolysed by heating under reflux with dilute hydrochloric acid, a carboxylic acid with empirical formula C_2H_4O is obtained as one of the products.

What could be the skeletal formula of X?

1 

2 

3 

A 1 only

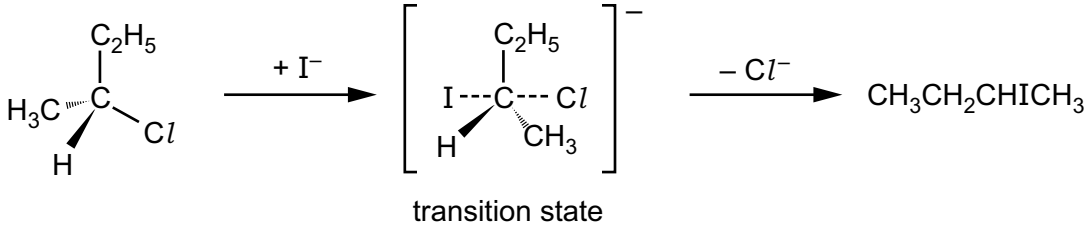
B 3 only

C 2 and 3 only

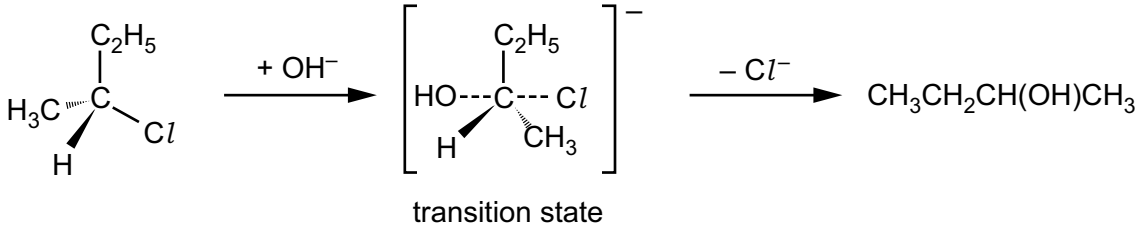
D 1, 2 and 3 only

25 An enantiomer which rotates plane-polarised light in a clockwise direction is known as the (+) form. The other enantiomer, which rotates plane-polarised light in an anticlockwise direction, is known as the (–) form.
When (+)-2-chlorobutane is warmed with NaI in propanone, (–)-2-iodobutane is produced.
When (+)-2-chlorobutane is warmed with aqueous NaOH, racemic butan-2-ol is produced.

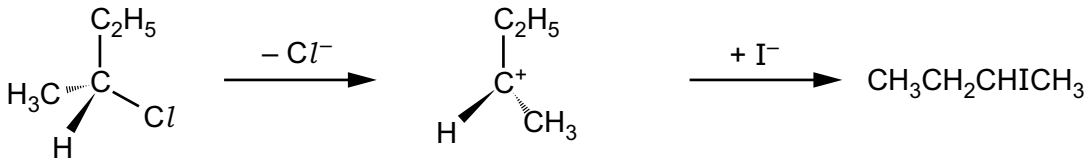
Which reaction pathways explain these observations?

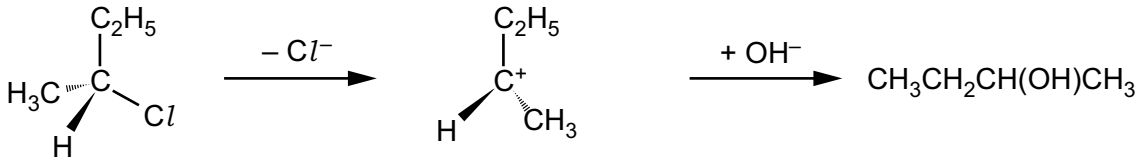
1 

transition state

2 

transition state

3 

4 

A 1 and 2 only

B 2 and 3 only

C 1 and 4 only

D 3 and 4 only

26 A comparison is made of the rate of hydrolysis of four halogenocompounds by warm NaOH(aq).

CH_3CH_2COCl	C_6H_5Cl	$(CH_3)_3CCl$	$(CH_3)_3CBr$
W	X	Y	Z

How will these rates compare?

	fastest ⟶			**slowest**
A	W	Y	Z	X
B	W	Z	Y	X
C	X	Z	Y	W
D	Z	Y	X	W

27 The redox potential of the system $V^{3+} + e^- \rightleftharpoons V^{2+}$ is –0.26 V, whereas that of the system $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$ is +0.77 V.

Which statement is correct?

A V^{2+} will reduce Fe^{3+}, but Fe^{2+} will **not** reduce V^{3+}.

B V^{2+} will reduce Fe^{3+}, and Fe^{2+} will reduce V^{3+}.

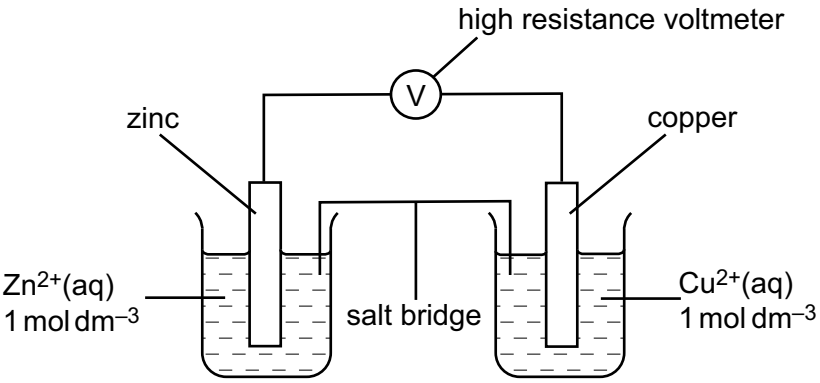
C V^{2+} will **not** reduce Fe^{3+}, and Fe^{2+} will **not** reduce V^{3+}.

D V^{2+} will **not** reduce Fe^{3+}, but Fe^{2+} will reduce V^{3+}.

28 Which factors determine the number of atoms of copper deposited on the cathode of an electrolytic cell?

	$[Cu^{2+}(aq)]$	**current**	**time**
A	✓	✓	×
B	✓	×	×
C	×	✓	✓
D	×	×	✓

29 A student set up the cell shown.



The following values for the cell potential were measured as a change was continuously made.

reading number	cell potential / V
1	1.100
2	1.090
3	1.081
4	1.074
5	1.064

What continuous change in the copper half-cell could produce these results?

A decreasing the surface area of copper immersed in the solution

B adding solid copper(II) sulfate and stirring

C adding solid sodium hydroxide and stirring

D adding solid sodium sulfate and stirring

30 When aqueous ammonia is added to a solution containing hexaaquairon(III) ions, $[Fe(H_2O)_6]^{3+}$, a red-brown precipitate is formed which does not dissolve when excess ammonia is added.

What is the role of the ammonia molecules in this reaction?

A Brønsted–Lowry base

B Lewis acid

C ligand

D reducing agent

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