Diploma Programme
Programme du diplôme
Programa del Diploma

Chemistry
Standard level
Paper 1A

31 October 2025

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

1 hour 30 minutes [Paper 1A and Paper 1B]

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- A calculator is required for this paper.
- A clean copy of the **chemistry data booklet** is required for this paper.
- The maximum mark for paper 1A is **[30 marks]**.
- The maximum mark for paper 1A and paper 1B is **[55 marks]**.

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Section A

1. What is the name of this change of state?

$$CO_2(g) \rightarrow CO_2(s)$$

A. Condensation

B. Deposition

C. Sublimation

D. Freezing

2. What is the best evidence that energy levels are closer together as distance from the nucleus increases?

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A. Hydrogen has a line emission spectrum in each of the UV, visible and IR regions.

B. First ionization energies decrease down a group.

C. Lines in an emission spectrum converge at higher energy.

D. First ionization energy generally increases across a period.

3. How many ions are present in 0.20 mol of $(NH_4)_2SO_4$?

A. $0.20 \times 1 \times 6 \times 10^{23}$

B. $0.20 \times 2 \times 6 \times 10^{23}$

C. $0.20 \times 3 \times 6 \times 10^{23}$

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D. $0.20 \times 7 \times 6 \times 10^{23}$

4. What is the volume, in dm^3, of ethane gas, $C_2H_6(g)$, produced when $0.25\,dm^3$ of ethyne, $C_2H_2(g)$, reacts with $0.40\,dm^3$ of hydrogen gas, $H_2(g)$?

All volumes are measured under the same conditions.

$$C_2H_2(g) + 2H_2(g) \rightarrow C_2H_6(g)$$

A. 0.20

B. 0.25

C. 0.40

D. 0.45

5. A fixed volume of an ideal gas, initially at 30 °C and with a pressure of **P** Pa, was heated to 60 °C. What is the resulting pressure in Pa?

A. Half of **P**

B. A little less than **P**

C. A little more than **P**

D. Two times **P**

6. What are the electron domain geometry and molecular geometry of sulfur dichloride, SCl_2?

	Electron domain geometry	Molecular geometry
A.	Tetrahedral	Linear
B.	Tetrahedral	Bent
C.	Linear	Linear
D.	Trigonal planar	Bent

7. Which molecule is most polar?

A. CF_4

B. CO_2

C. NBr_3

D. NH_3

8. Which allotropes of carbon are electrical conductors?

I. Graphite

II. Diamond

III. Graphene

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

9. Which metal has the strongest metallic bond?

A. Mg

B. Al

C. K

D. Ga

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10. Which type of material is a good conductor of heat and electricity in solid and liquid states, is insoluble in water, and typically has a high melting point?

A. Covalent molecular

B. Covalent network

C. Ionic

D. Metallic

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11. Which element is a p-block metal?

A. Sn

B. Te

C. Cd

D. At

12. Which two elements form a compound with the strongest ionic attraction?

A. Li and O

B. Li and Se

C. K and O

D. K and Se

13. Which oxide is the most basic?

A. MgO

B. Al_2O_3

C. SiO_2

D. SO_3

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14. Which compound has the highest boiling point?

A. $CH_3CH_2CH_2CH_3$

B. $CH_3CH_2CH_2CH_2CH_2CH_3$

C. $(CH_3)_3CCH_2CH_3$

D. $CH_3CH_2CH(CH_3)CH_2CH_3$

15. What is the sum of the coefficients when 1 mol of propan-1-ol, C_3H_7OH, undergoes complete combustion?

$$\_\_C_3H_7OH(l) + \_\_O_2(g) \rightarrow \_\_CO_2(g) + \_\_H_2O(l)$$

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A. 11.5

B. 12

C. 12.5

D. 13

16. Consider these equations:

$$S(s) + O_2(g) \rightarrow SO_2(g) \qquad \Delta H^{\ominus} = x \text{ kJ mol}^{-1}$$

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g) \qquad \Delta H^{\ominus} = y \text{ kJ mol}^{-1}$$

What is the value of $\Delta H^{\ominus}$, in kJ mol^{-1}, for this reaction?

$$S(s) + \frac{3}{2} O_2(g) \rightarrow SO_3(g)$$

A. $x + y$

B. $x + \frac{1}{2} y$

C. $x - \frac{1}{2} y$

D. $x - y$

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17. Which statement is a disadvantage of using biofuels instead of fossil fuels?

A. Land is used that could be used to grow food.

B. Combustion releases more energy per mol of fuel.

C. Emissions of CO_2 to the atmosphere are lower overall.

D. Crop waste can be used as a fuel.

18. What is the theoretical yield, in g, of ethanamide, CH_3CONH_2, that can be produced from the reaction of 4.00 g of ammonium carbonate, $(NH_4)_2CO_3$, with excess ethanoic acid, CH_3COOH?

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$$2CH_3COOH(l) + (NH_4)_2CO_3(s) \rightarrow 2CH_3COONH_4(aq) + H_2O(l) + CO_2(g)$$

$$CH_3COONH_4(aq) \rightarrow CH_3CONH_2(s) + H_2O(l)$$

$$M_r (NH_4)_2CO_3 = 96.11$$

$$M_r CH_3CONH_2 = 59.08$$

A. 1.23

B. 2.46

C. 4.92

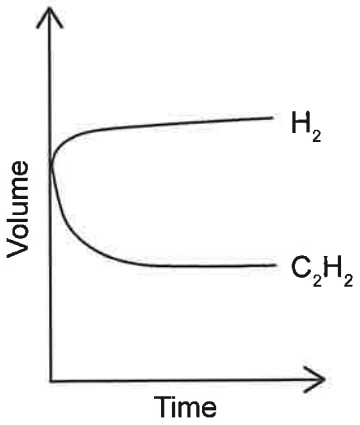
D. 6.51

19. The volume of ethyne as it reacts with hydrogen is shown in the graphs.

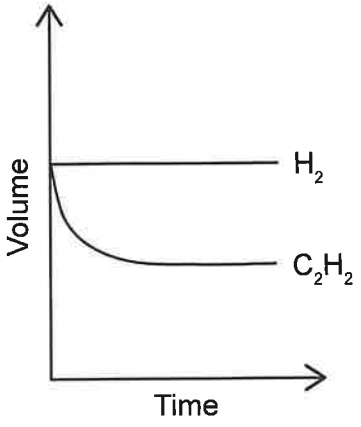
$$C_2H_2(g) + 2H_2(g) \rightarrow C_2H_6(g)$$

Which graph shows how the volume of hydrogen changes with time?

A.



B.



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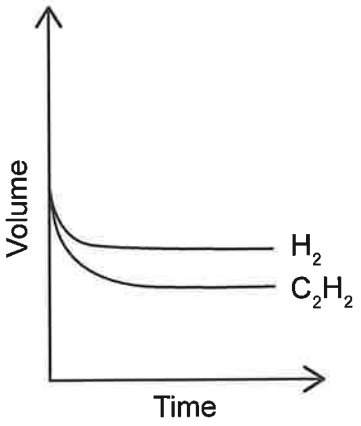

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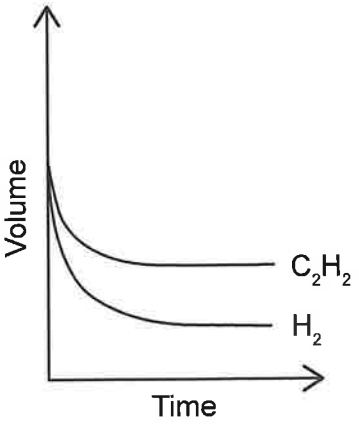

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20. Which conditions would increase the rate of reaction between bromine and nitrogen(II) oxide?

$$Br_2(g) + 2NO(g) \rightarrow 2NOBr(g)$$

I. Increasing temperature

II. Increasing pressure

III. Increasing volume

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

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21. Which statement about catalysts is correct?

A. Catalysts increase the kinetic energy of reacting particles.

B. Catalysts affect endothermic reactions more than exothermic reactions.

C. Catalysts increase reaction rate and are used up in a reaction.

D. Catalysts alter the mechanism of a reaction.

22. A crystal of copper(II) sulfate is in equilibrium with a copper(II) sulfate solution in a stoppered flask at constant temperature.

Which observation is possible?

A. The colour of the solution becomes darker.

B. The volume of the liquid decreases.

C. The shape of the crystal changes slowly over time.

D. The size of the crystal decreases.

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23. 2 mol of NO (g) and 1 mol of Cl_2 (g) were mixed together, and the system was allowed to reach equilibrium at 35 °C:

$$2NO(g) + Cl_2(g) \rightleftharpoons 2NOCl(g) \qquad K = 6.5 \times 10^4 \text{ at } 35\,^{\circ}C$$

Which relationship is correct for this equilibrium at 35 °C?

A. [NOCl] = [NO]

B. [NOCl] = 2[Cl_2]

C. [NOCl] >> [NO]

D. [NOCl] << [NO]

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24. What is the concentration of $OH^-(aq)$, in $mol\,dm^{-3}$, in a solution at 298.15 K with a pH of 4.50?

$pH = -\log_{10}[H^+]$ $[H^+] = 10^{-pH}$ $K_w = [H^+]\,[OH^-]$ $K_w = 1.00 \times 10^{-14}\ mol^2\,dm^{-6}$

A. 3.16×10^{-10}

B. 3.16×10^{-9}

C. 3.16×10^{-5}

D. 3.16×10^{-4}

25. Which aqueous solution has the lowest pH?

A. $1.0\,mol\,dm^{-3}\ HNO_3$

B. $2.0\,mol\,dm^{-3}\ HCl$

C. $1.0\,mol\,dm^{-3}\ CH_3COOH$

D. $2.0\,mol\,dm^{-3}\ NaOH$

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26. What are the oxidizing and reducing agents in this reaction?

$$ClO^-(aq) + SO_2(g) + H_2O(l) \rightarrow Cl^-(aq) + SO_4^{2-}(aq) + 2H^+(aq)$$

	Oxidizing agent	Reducing agent
A.	ClO^-	H_2O
B.	SO_2	SO_4^{2-}
C.	SO_2	ClO^-
D.	ClO^-	SO_2

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27. Which statement about electrochemical cells is correct?

A. Primary (voltaic) cells use electrical energy to produce a redox reaction.

B. Electrolytic cells are rechargeable.

C. Secondary cells can use electrical energy to produce a redox reaction.

D. Primary (voltaic) cells are rechargeable.

28. Which product may be obtained by the reduction of CH_3CH_2COOH?

A. $CH_3CH(OH)CH_3$

B. $CH_3CH_2CH_2OH$

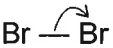
C. $CH_3CH_2OCH_3$

D. CH_3COOCH_3

29. Which species represents the product of the homolytic fission of Br_2 in the presence of UV light?

A. Br^-

B. 

C. 

D. Br•

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30. Which species is the electrophile?

$$CH_3Br + OH^- \rightarrow CH_3OH + Br^-$$

A. OH^-

B. Br^-

C. CH_3OH

D. CH_3Br

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