Diploma Programme
Programme du diplôme
Programa del Diploma

Chemistry
Standard level
Paper 1A

ANSWERS (?)

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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8825–6210

Section A

1. Which methods for separating the given mixtures into their components are correct?

	Mixture	Method
I.	A mixture of solid in a liquid in which solubility of the solid varies with temperature	Crystallization
II.	A mixture of a solid in a liquid in which the solid is not dissolved	Filtration
III.	A mixture of two miscible liquids with different boiling points	Distillation

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

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2. What is the number of subatomic particles in $^{137}Ba^{2+}$?

	Protons	Neutrons	Electrons
A.	58	81	54
B.	56	81	54
C.	56	137	58
D.	58	137	58

3. Which orbital diagram represents a correct ground state electron configuration based on the Pauli exclusion principle and Hund's rule?

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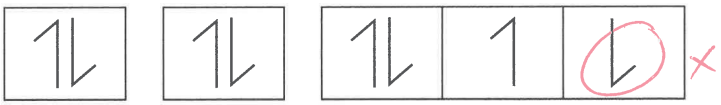
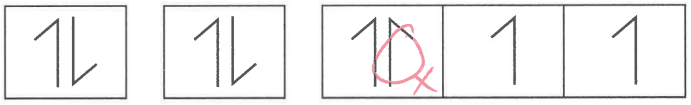
A.

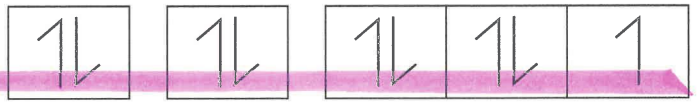


B.

C.



D.



4. 5.72 g of $Na_2CO_3 \cdot 10H_2O$ ($M_r = 286\,g\,mol^{-1}$) is dissolved in water to prepare 0.4 dm^3 of aqueous solution.

What is the concentration of sodium ions, in mol dm^{-3}, in the resulting solution?

A. 0.02

B. 0.04

C. 0.05

D. 0.10

$n = \frac{5.72g}{286} = 0.02$

$conc. = n/v$

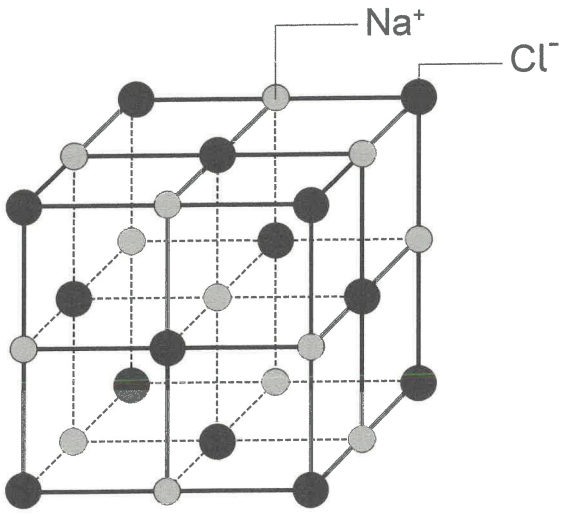
$= \frac{0.02}{0.4} = 0.05$

5. In which of the following sets of conditions does the gas exhibit behaviour closest to an ideal gas ?

	Gas	Pressure / kPa	Temperature / K
A.	H_2	100	273
B.	NH_3	50	473
C.	H_2	50	473
D.	NH_3	100	273

low pressure
high temp.
minimal intermolecular forces.

6. An expanded view of the NaCl lattice is given in the figure.



Which statement is correct for the lattice structure of NaCl?

A. The ions are held together in the lattice by covalent bonds. ✗

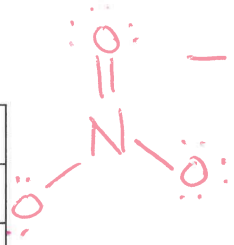
B. The forces of attraction in the lattice are very weak. ✗

C. Each sodium ion is surrounded by four chloride ions. ✗ ×6

D. The structure breaks apart when dissolved in water.

7. Which row shows the correct electron domain geometry and molecular geometry for the nitrate ion, NO_3^-?

	Electron domain geometry	Molecular geometry
A.	Trigonal planar	Trigonal planar
B.	Trigonal planar	Trigonal pyramidal
C.	Trigonal pyramidal	Trigonal planar
D.	Trigonal pyramidal	Trigonal pyramidal



e⁻ domain = 3 ∴ trig plan
bonding domain = 3
∴ trig planar

8. Which substance has dipole-dipole forces between molecules?

A. CCl_4 × non-polar ← polar

B. O_2 × non-polar

C. C_2H_6 × non polar

D. H_2CO ✓ polar

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9. Which statement best explains the malleability of magnesium metal?

A. The metal lattice is held together by the attraction between magnesium ions. ×

B. The outer shell electrons of magnesium are free to move. × ← conductive

C. The layers of magnesium ions can slide relative to each other.

D. There are strong attractions between the magnesium ions and the free moving electrons. ×

bonds due to sliding electrostatic attraction of free roving e⁻

10. Which material is a good electrical conductor?

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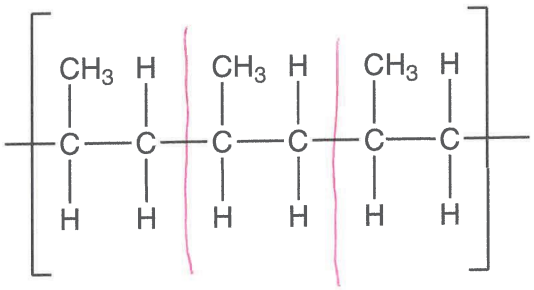
A. Diamond ×

B. Graphite ✓

C. Fullerene ×

D. Silicon ×

11. A section of a polymer containing three repeating units is shown.



Which monomer was used to make this polymer?

A. But-1-ene

B. But-2-ene

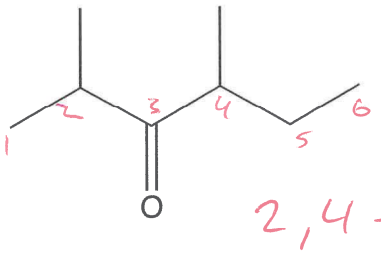
C. Methylpropene

D. Propene

12. What are the oxidation states of the elements in Na_2CrO_4?

	Sodium	Chromium	Oxygen
A.	+1	+6	–1
B.	+2	+3	–1
C.	+1	+6	–2
D.	+2	+3	–2

13. What is the IUPAC name of the molecule below?



A. 2-ethyl-4-methylpentan-3-one

B. 4-ethyl-2-methylpentan-3-one

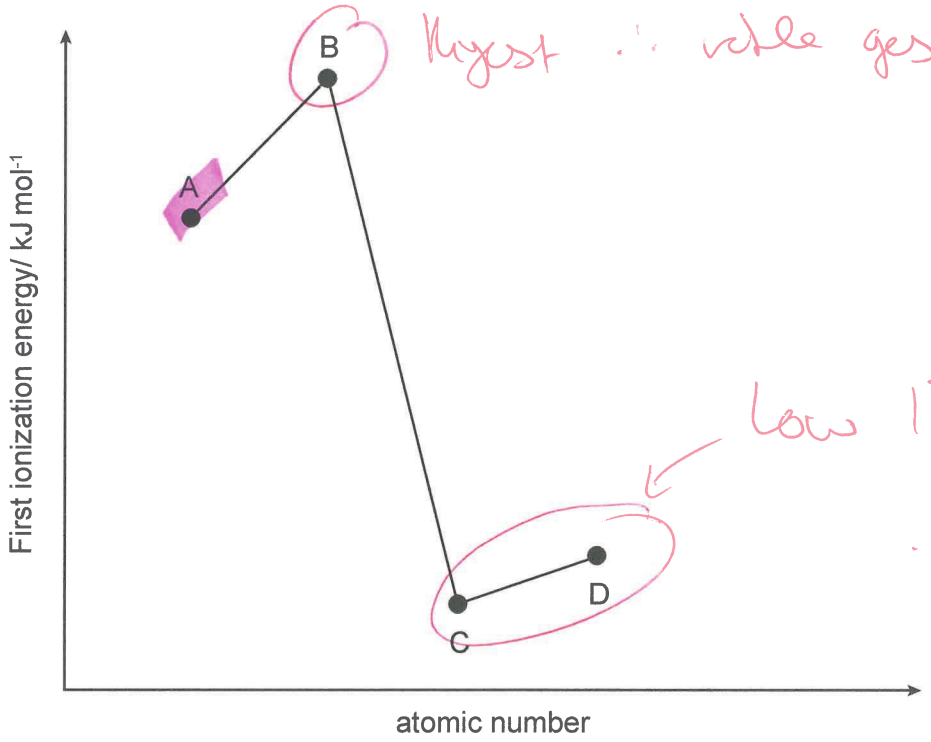
C. 2,4-dimethylhexan-3-one

D. 3,5-dimethylhexan-4-one

14. The relative values of the first ionization energies of four elements which have consecutive atomic numbers are shown.

An element X reacts with oxygen to form an acidic oxide.

Which element could be X?



15. Which formula represents an amide?

A. $C_6H_5NH_2$

B. CH_3CONH_2

C. $(CH_3)_2NH$

D. NH_2CH_2COOH

18. Which of the following statements best describes an environmental implication associated with the use of fossil fuels?

A. Increased biodiversity due to the establishment of habitats through mining

B. Decreased emission of greenhouse gases leading to global cooling

C. Enhanced soil fertility due to the deposition of coal dust

D. Acid rain formation from the release of sulfur dioxide and nitrogen oxides

19. Equal volumes of X_2 and Y_2 gases are allowed to react in a sealed container to form XY_3 gas. After completion of the reaction, the volume of XY_3 is measured to be 40 cm^3.

What was the volume, in cm^3, of X_2 gas at the beginning?

$$X_2(g) + 3Y_2(g) \rightarrow 2XY_3(g)$$

A. 20

B. 40

C. 60

D. 120

$X_2 = V\,cm^3$ To use all of X_2 you need 3× of Y_2, but they are equal ∴ Y_2 limiting

$Y_2 = V\,cm^3$

3 vol. Y_2 → 2 vol. XY_3

∴ $\frac{2}{3}V = 40\,cm^3$ ∴ $V = 40 \times \frac{3}{2} = 60\,cm^3$

20. What is the volume of nitrogen dioxide, in cm^3, produced at STP when 1.28 g of copper reacts with excess nitric acid?

$$Cu(s) + 4HNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2NO_2(g) + 2H_2O(l)$$

Molar volume of an ideal gas at STP is 22.7 $dm^3\,mol^{-1}$

A. 227

B. 456

C. 684

D. 914

$n_{Cu} = \frac{1.28\,g}{63.5\,g\,mol^{-1}} = 0.020$

$n_{HNO_3} = 2 \times n_{Cu}$

$= 0.020 \times 2$

$= 0.040$

$n = V/V_m$ $V_m = 22.7$

∴ $V = 0.040 \times 22.7$

$= 0.915\,dm^3$

$= 915\,cm^3$

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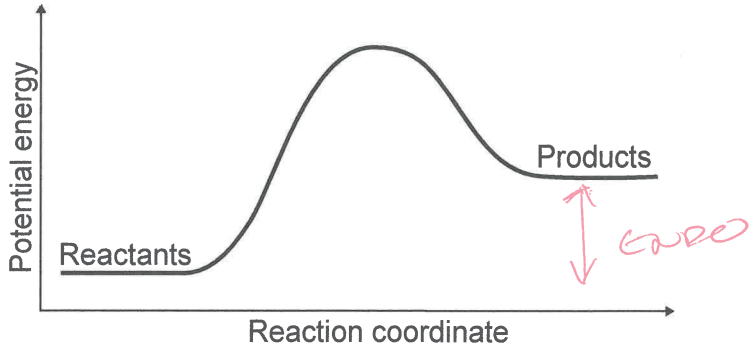
16. The potential energy profile of a reaction is shown.



Which reaction has this energy profile?

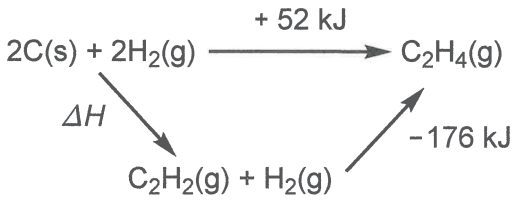
A. $N_2(g) + O_2(g) \rightarrow 2NO(g)$

B. $2H(g) \rightarrow H_2(g)$

C. $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

D. $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

17. What is ΔH, in kJ, in the energy cycle below?



A. +52 −176

B. +52 +176

C. −52 +124

D. −52 −176

24. Which statement regarding the chemical equilibrium explains why it is described as dynamic?

A. There is a continuous shift in the equilibrium position.

B. The reactants and products continue to react.

C. The concentrations of reactants and products continue to change.

D. The rates of forward and reverse reactions continue to change.

25. In which of the following reactions does ammonia behave as a Brønsted–Lowry base?

A. $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

B. $NH_3 + H_2O + CO_2 \rightarrow (NH_4)HCO_3$

C. $NH_3 + CH_3CH_2Cl \rightarrow CH_3CH_2NH_2 + HCl$

D. $2NH_3 + 2K \rightarrow 2KNH_2 + H_2$

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26. Which compound undergoes oxidation when heated with acidified potassium dichromate?

I. $CH_3CH_2CH_2CH_2OH$

II. $CH_3C(CH_3)_2OH$

III. $CH_3CH(OH)CH_2CH_3$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

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27. A voltaic cell is constructed using iron and silver electrodes dipped into solutions of their respective ions, $Fe^{2+}(aq)$ and $Ag^{+}(aq)$, of equal concentrations.

What is correct when the voltaic cell is in operation?

	Negative electrode	Positive electrode	Anode	Cathode
A.	Fe	Ag	Fe	Ag
B.	Ag	Fe	Ag	Fe
C.	Ag	Fe	Fe	Ag
D.	Fe	Ag	Ag	Fe

21. Sulfur dioxide reacts with oxygen gas to produce sulfur trioxide.

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$$

The reaction of 96 grams of SO_2 with excess amount of O_2 produces 96 grams of SO_3.

What is the percentage yield of SO_3?

A. 20%

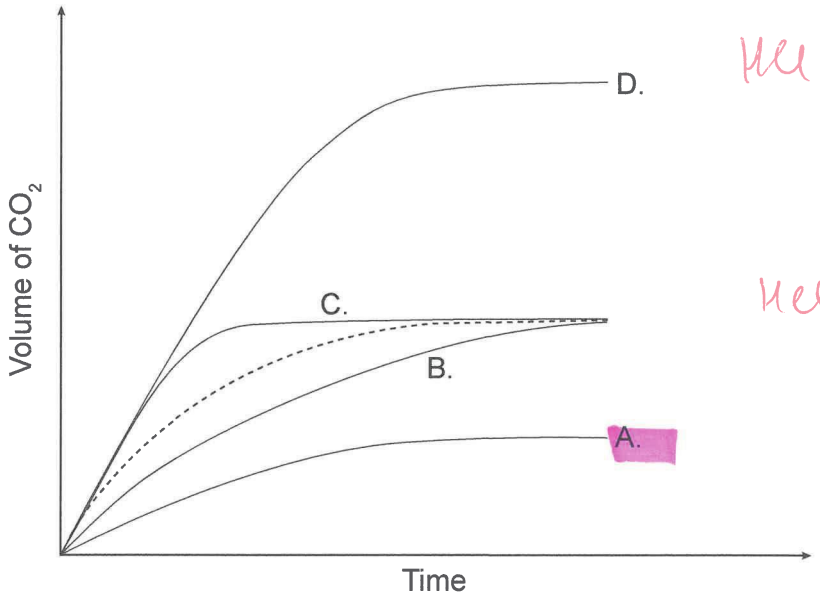
B. 60%

C. 80%

D. 100%

22. The dotted line represents the volume of carbon dioxide evolved when excess calcium carbonate is added into 100 cm^3 of 1.0 mol dm^{-3} of hydrochloric acid.

Which graph represents the production of carbon dioxide when excess calcium carbonate is added to the 200 cm^3 of 0.25 mol dm^{-3} of hydrochloric acid?



23. Which reaction has the lowest activation energy?

A. $Cl_2(g) \rightarrow 2Cl(g)$

B. $HCl(g) \rightarrow H(g) + Cl(g)$

C. $HCl(g) \rightarrow H^+(g) + Cl^-(g)$

D. $2H(g) \rightarrow H_2(g)$

28. What is the half equation for the reduction of nitric acid to nitrogen(II) oxide in acidic medium?

A. $HNO_3 + 3H^+ + 3e^- \rightarrow NO + 2H_2O$

B. $HNO_3 + 4H^+ + 4e^- \rightarrow NO + 2H_2O$

C. $HNO_3 + 2H_2O \rightarrow NO + 4H^+ + 4e^-$

D. $HNO_3 + 2H_2O \rightarrow NO + 3H^+ + 3e^-$

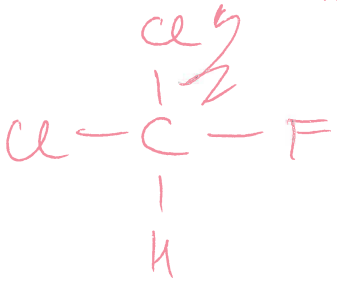
29. Which radical is most likely to form during the breakdown of one covalent bond of dichlorofluoromethane, $CHCl_2F$, in the upper atmosphere?

A. $\bullet CHClF$

B. $\bullet CCl_2F$

C. $\bullet CHCl_2$

D. $\bullet CHCl_2F$



30. But-2-ene undergoes a variety of addition reactions.

Which of the following is correct?

	Reagent added	Product
A.	H_2	But-1-ene
B.	H_2O	Butan-1-ol
C.	HBr	2-bromobutane
D.	Br_2	2,2-dibromobutane