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Chemistry

Standard level

Paper 2

18 May 2026

Zone A morning | Zone B morning | Zone C morning

Session number

1 hour 30 minutes

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Instructions to students

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes 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 this examination paper is **[50 marks]**.

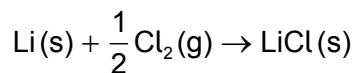


Answer **all** questions. Answers must be written within the answer boxes provided.

1. Binary ionic compounds contain metals and non-metals.

- (a) (i) Explain, using electron configurations, how ions are formed by lithium and chlorine and how these ions form a compound.

[3]



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- (ii) Explain why the element chromium, Cr, is an exception to the Aufbau principle using electron configurations.

[2]

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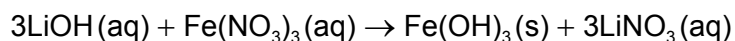
(Question 1 continued)

(b) Lithium also forms compounds with polyatomic ions.

- (i) 35.0 cm³ of a 0.550 mol dm^{–3} lithium hydroxide, LiOH, solution is mixed with 35.0 cm³ of 0.250 mol dm^{–3} of an iron(III) nitrate, Fe(NO₃)₃, solution.

Determine the limiting reactant and mass of iron(III) hydroxide, Fe(OH)₃, produced showing your working. Use sections 1 and 7 of the data booklet.

[3]



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- (ii) Calculate the percentage yield of iron(III) hydroxide from part (b)(i) if 0.542 g of the product was collected.

If you did not obtain an answer in part (b)(i), use 0.763 g, although this is not the correct answer.

[1]

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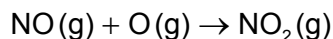
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2. Nitrogen dioxide is a covalently bonded compound.

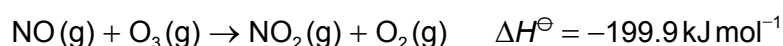
(a) (i) Nitrogen monoxide reacts with monatomic oxygen in the atmosphere.

Determine the enthalpy change, $\Delta H^\ominus$, in kJ mol^{-1} , for the reaction:



given these reactions and enthalpy values:

[2]



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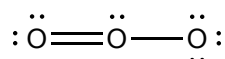
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(ii) Suggest the value of the bond angle and molecular geometry of ozone based on the Lewis formula.

[2]



Bond angle:

Molecular geometry:

(This question continues on the following page)



(Question 2 continued)

- (iii) Calculate the volume, in dm^3 , of 1.75 mol of ozone gas at 75.0°C and 115 kPa.

Use sections 1 and 2 of the data booklet.

[1]

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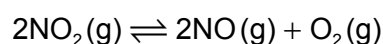
- (iv) Explain **one** limitation of the ideal gas model.

[1]

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- (b) The decomposition of nitrogen dioxide, NO_2 , is an equilibrium reaction.



- (i) State the equilibrium constant expression, K , for the reaction.

[1]

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- (ii) Explain, with a reason, how increasing the pressure at constant volume and temperature will affect the equilibrium position and the value of the equilibrium constant, K .

[2]

Equilibrium position:

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Value of equilibrium constant:

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(This question continues on page 7)



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(Question 2 continued)

- (iii) Explain why increasing the temperature will increase the rate of the reaction. [2]

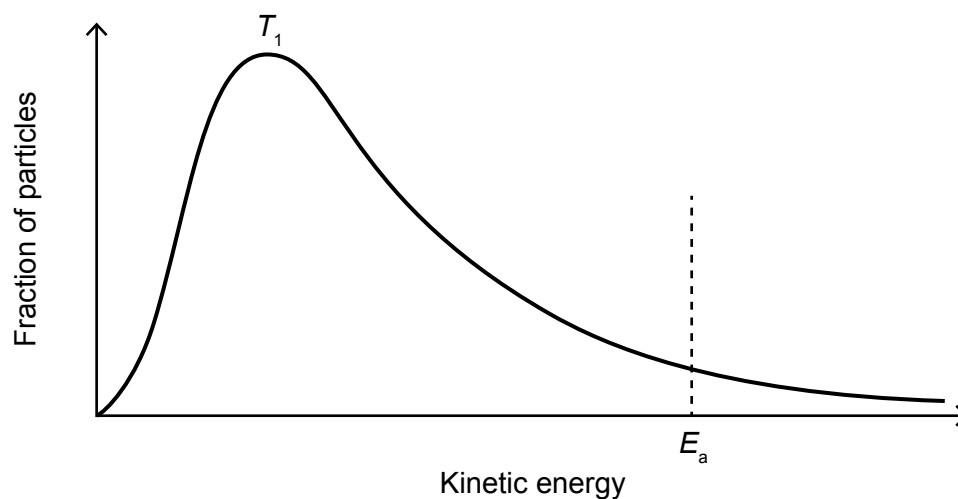
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- (iv) Consider the Maxwell–Boltzmann energy distribution curve at temperature T_1 .



Sketch a curve on the graph at a higher temperature and label it T_2 . [1]

- (v) State the effect of an increase in temperature from T_1 to T_2 on the activation energy, E_a . [1]

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3. Iridium is a transition metal.

(a) Iridium has two stable abundant isotopes with an average atomic mass of 192.22 amu.

Isotope	Atomic mass	Percent abundance
Ir-191	190.96	
Ir-193	192.96	

(i) Determine the percent abundance of the isotopes showing your work. [2]

Ir-191:

 Ir-193:

(ii) State the number of subatomic particles in $^{193}\text{Ir}^{4+}$. [1]

Subatomic particles	Number
Protons	
Neutrons	
Electrons	

(This question continues on the following page)



(Question 3 continued)

(b) Sodium and aluminium are metals of the same period.

(i) Outline why the strength of the metallic bond increases from sodium, Na, to aluminium, Al.

[2]

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(ii) Write an equation for the reaction of sodium, Na, with water, including state symbols.

[2]

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(iii) Outline why the electronegativity of sodium, Na, is greater than that of caesium, Cs.

[1]

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(c) (i) Outline **one** reason why alloys are often harder than pure metals.

[1]

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(ii) State **one** additional property, other than hardness, that could be modified by forming an alloy.

[1]

Property:

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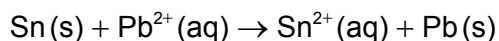
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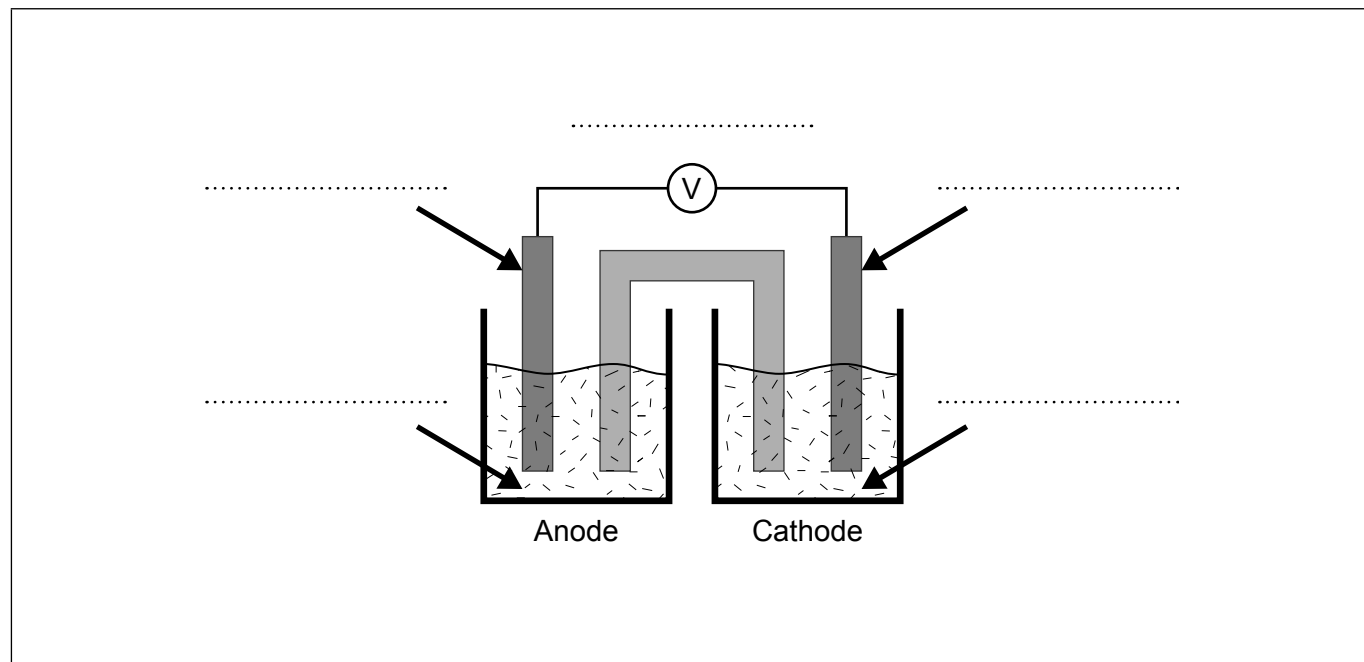
(Question 3 continued)

- (d) Metals can be used to design voltaic cells.



- (i) Annotate the diagram with the appropriate electrodes, electrolyte solutions, and direction of electron flow.

[2]



- (ii) The redox reactions in some voltaic cells can be reversed.

Explain the process of recharging the voltaic cell in part (d)(i).

[3]

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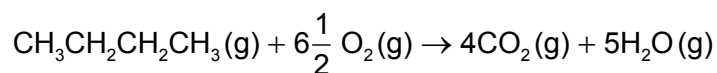
4. Organic compounds can be produced by a variety of reactions.

- (a) Reactions of halogenoalkanes with hydroxide ions are an example of nucleophilic substitution.

Deduce the equation, showing the movement of electrons, for the reaction of 1-bromobutane with sodium hydroxide using curly arrows.

[3]

- (b) Butane undergoes combustion.



- (i) Calculate the enthalpy change of reaction, ΔH , in kJ mol^{-1} , for the combustion of butane.

Use section 12 of the data booklet.

[3]

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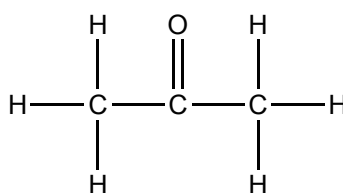


(Question 4 continued)

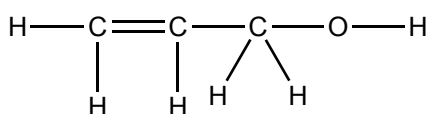
- (ii) State the oxidation state for **carbon-1** in butane and carbon in carbon dioxide. [2]

Compound	Oxidation state
$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$	
CO_2	

- (c) The following compounds have the same molar mass.



Propanone



Prop-2-en-1-ol

Explain, with reasons, why prop-2-en-1-ol has a higher boiling point than propanone.

[2]

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(This question continues on the following page)



(Question 4 continued)

(d) Methane, CH_4 , reacts with chlorine, Cl_2 , to produce chloromethane, CH_3Cl .

Deduce the initiation and **two** propagation steps for the mechanism of this reaction.

[3]

Initiation:

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Propagation:

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16EP15

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16EP16