Diploma Programme
Programme du diplôme
Programa del Diploma

Chemistry
Higher level
Paper 1B

15 May 2026

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

Session number

2 hours [Paper 1A and Paper 1B]

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 paper 1B is **[35 marks]**.
- The maximum mark for paper 1A and paper 1B is **[75 marks]**.

2226 – 4223

15 pages

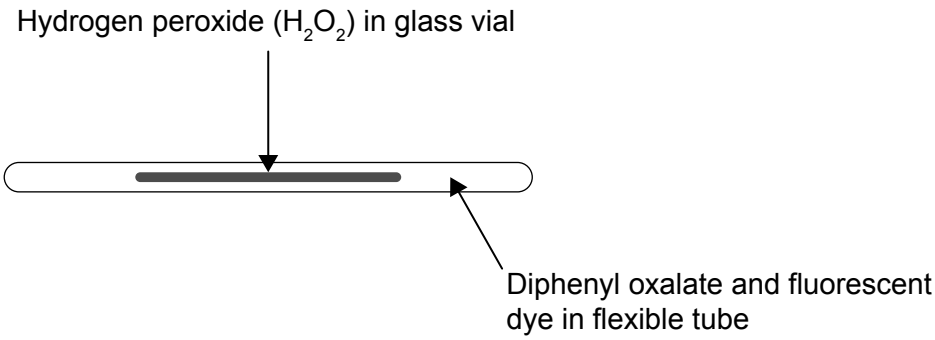
Please **do not** write on this page.

Answers written on this page
will not be marked.

Section B

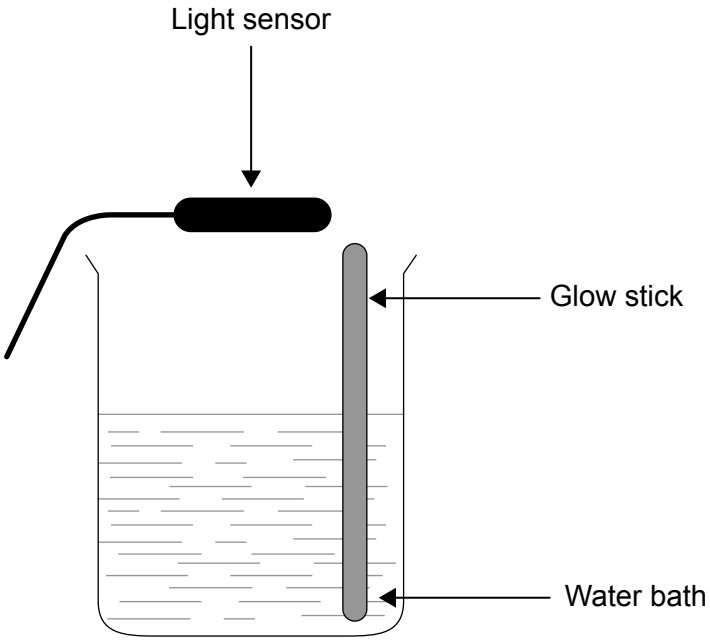
Answer **all** questions. Answers must be written within the answer boxes provided.

1. A student investigated the effect of temperature on the light intensity and duration of a glow stick.



Glow sticks emit light when the inner glass vial is broken, allowing the hydrogen peroxide to mix with the diphenyl oxalate and fluorescent (light-emitting) dye.

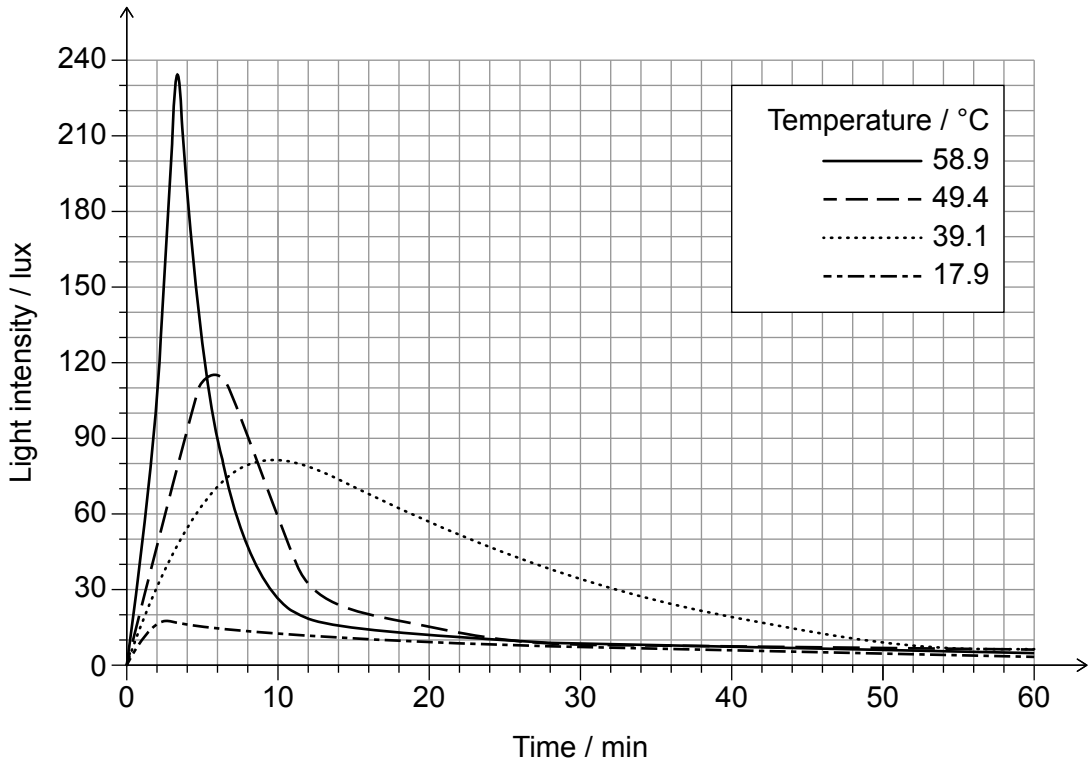
Four glow sticks were tested. Each one was bent to break the glass vial, briefly shaken, and placed in a water bath at a different temperature, with a light sensor mounted next to it.



(This question continues on the following page)

(Question 1 continued)

The following graph was obtained:



(a) State the dependent and independent variables. [1]

Dependent: . . . . . .

Independent: . . . . . .

(b) State **two** variables to be controlled. [2]

. . . . . .

. . . . . .

(This question continues on the following page)

(Question 1 continued)

(c) Discuss the range and quantity of the data. [2]

Range: . . . . . .

. . . . . .

Quantity: . . . . . .

. . . . . .

(d) Suggest why the light intensity increased for several minutes. [1]

. . . . . .

. . . . . .

(e) Suggest how the total light output of each glow stick could be determined from the graph. [1]

. . . . . .

. . . . . .

(f) Explain how the instantaneous rate of change in light intensity could be determined from the graph. [2]

. . . . . .

. . . . . .

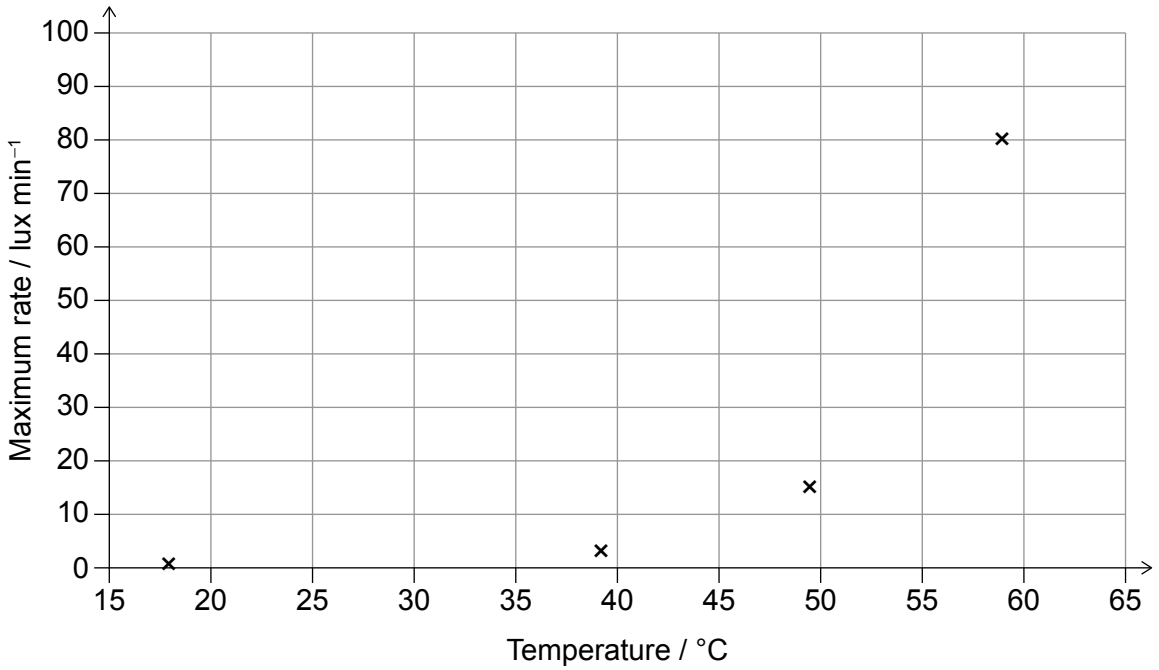
(This question continues on page 7)

Please **do not** write on this page.

Answers written on this page
will not be marked.

(Question 1 continued)

(g) The graph shows the maximum rate of decrease in light intensity vs. temperature.



(i) Draw the best fit curve on the graph. [1]

(ii) Suggest **two** possible conclusions to the investigation. [2]

. . . . . .

. . . . . .

. . . . . .

(h) Suggest **two** ways the experiment could be modified to improve the reliability of the data. [2]

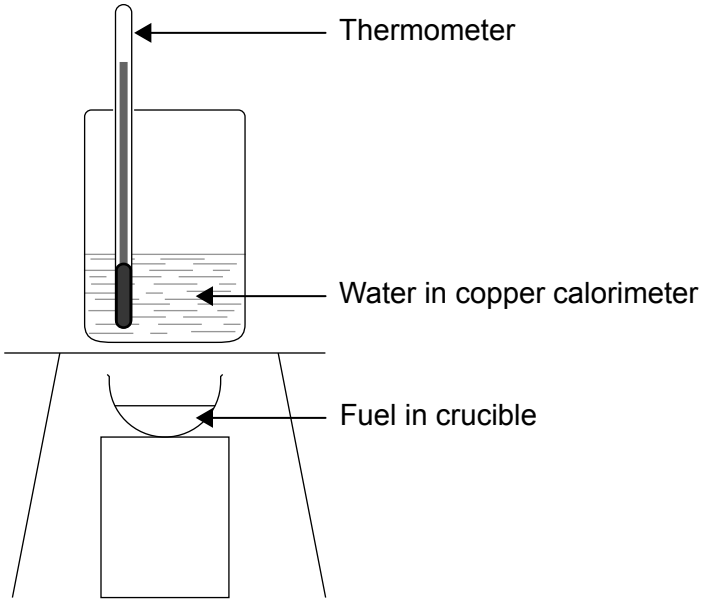
. . . . . .

. . . . . .

. . . . . .

2. Specific energy is the heat energy produced per unit mass of fuel.

A student determined the specific energy of a gel camping fuel. The diagram shows the apparatus used.



Crucible with fuel	**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**	**Trial 5**
Initial mass ±0.001 g	26.800	27.610	26.926	26.861	26.720
Final mass ±0.001 g	26.147	26.953	26.410	26.228	26.119

Water in calorimeter	**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**	**Trial 5**
Initial temperature ±0.05 °C	25.00	25.50	28.00	26.00	26.00
Final temperature ±0.05 °C	35.00	36.50	32.00	36.00	35.50

(a) Calculate the change in temperature and its uncertainty for trial 5.

Express the temperature change to an appropriate number of decimal places and the uncertainty to an appropriate number of significant figures. [2]

Temperature change: . . . . . .

. . . . . .

Uncertainty: . . . . . .

. . . . . .

(This question continues on the following page)

(Question 2 continued)

(b) The student decided to disregard the uncertainty in the mass of fuel when calculating the specific energy.

Discuss the validity of the student's decision, referring to the percentage uncertainties for trial 5. [2]

Percentage uncertainty in mass: . . . . . .

. . . . . .

Percentage uncertainty in temperature: . . . . . .

. . . . . .

Validity of student's decision: . . . . . .

. . . . . .

(c) Calculate the specific energy of the fuel for trial 5, in $J\,g^{-1}$. Refer to sections 1 and 2 of the data booklet. [2]

$$\text{Specific energy} = \frac{Q}{m_{\text{fuel}}}$$

$$m_{\text{water}} = 95.5\,\text{g}$$

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(This question continues on page 11)

Please **do not** write on this page.

Answers written on this page
will not be marked.

(Question 2 continued)

(d) Determine the average specific energy of the fuel, explaining your method.

If you did not obtain an answer for (c), use $6500\,J\,g^{-1}$, although this is not the correct answer. [2]

	Trial 1	**Trial 2**	**Trial 3**	**Trial 4**	**Trial 5**
Specific energy / J g^{-1}	6113	6684	3094	6306	

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(e) Calculate the percentage error in the specific energy of the fuel.

Literature value of specific energy of fuel $= 21.5\,kJ\,g^{-1}$ [1]

. . . . . .

. . . . . .

. . . . . .

(f) Suggest **two** ways of reducing the error. [2]

1: . . . . . .

. . . . . .

2: . . . . . .

. . . . . .

3. A titration was performed to determine the iodine concentration in a sample, using sodium thiosulfate solution and starch indicator.

$$2S_2O_3^{2-}(aq) + I_2(aq) \rightarrow S_4O_6^{2-}(aq) + 2I^-(aq)$$

Standard $0.050\,mol\,dm^{-3}$ sodium thiosulfate solution was used in a preliminary trial. The volume of titrant required was less than $5\,cm^3$, so the standard solution was diluted.

(a) Outline why a standard solution was used. [1]

. . . . . .
. . . . . .

(b) Suggest why the standard solution needed to be diluted. [1]

. . . . . .
. . . . . .

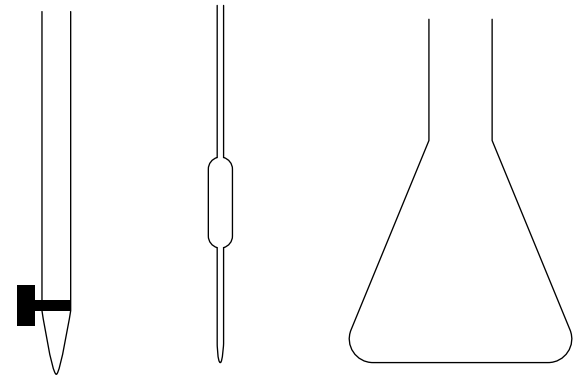
(c) State **two** pieces of glassware used to perform the dilution. [1]

. . . . . .
. . . . . .

(This question continues on the following page)

(Question 3 continued)

(d) The titration was performed using the apparatus shown.



Burette Pipette Conical flask (Erlenmeyer)

State which items used in the titration should be rinsed with the solution they will contain, and which should only be rinsed with distilled water. [2]

Rinsed with solution: . . . . . .

. . . . . .

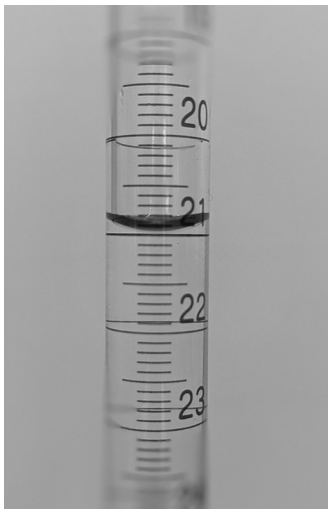
Rinsed with distilled water only: . . . . . .

. . . . . .

(This question continues on the following page)

(Question 3 continued)

(e) (i) Determine the final burette reading for trial 4 and complete the table. [1]



Burette reading / $cm^3 \pm 0.05$	**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**
initial	0.05	1.10	0.50	2.95
final	18.30	19.10	18.55	

(ii) Suggest, with a reason, whether more trials should be carried out. [1]

. . . . . .
. . . . . .

(f) Colorimetry is an alternative technique for determining concentration.

(i) Outline the reason that the concentration of an iodine solution can be measured using colorimetry. [1]

. . . . . .
. . . . . .

(This question continues on the following page)

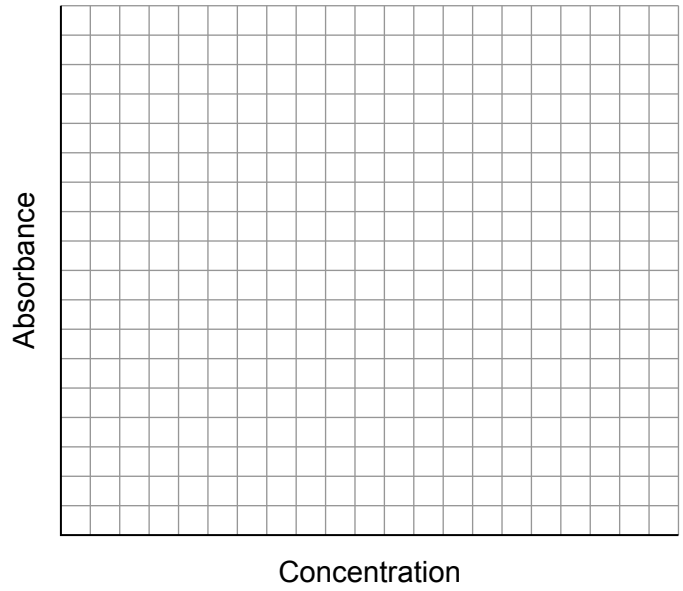
(Question 3 continued)

(ii) Predict a suitable wavelength to use in the colorimeter with an orange iodine sample. Use section 15 of the data booklet. [1]

. . . . . .

. . . . . .

(iii) Sketch the calibration curve obtained by measuring the absorbance of iodine solutions of known concentrations. [1]



Please **do not** write on this page.

Answers written on this page
will not be marked.