LUI | | | | | | | | | | | School code | | | | |

School name

Given name/s

Family name

Attach your barcode ID label here

Book of books used

External assessment 2022

Question and response book

Chemistry

Paper 1

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- QCAA-approved calculator permitted.
- QCAA formula and data book provided.
- Planning paper will not be marked.

Section 1 (20 marks)

- 20 multiple choice questions

Section 2 (31 marks)

- 7 short response questions

Clear zone — margin trimmed off after completion of assessment

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

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Section 1

Instructions

- Choose the best answer for Questions 1–20.
- This section has 20 questions and is worth 20 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	●	○	○	○

	A	B	C	D
1.	○	○	○	○
2.	○	○	○	○
3.	○	○	○	○
4.	○	○	○	○
5.	○	○	○	○
6.	○	○	○	○
7.	○	○	○	○
8.	○	○	○	○
9.	○	○	○	○
10.	○	○	○	○
11.	○	○	○	○
12.	○	○	○	○
13.	○	○	○	○
14.	○	○	○	○
15.	○	○	○	○
16.	○	○	○	○
17.	○	○	○	○
18.	○	○	○	○
19.	○	○	○	○
20.	○	○	○	○

Section 2

Instructions

- Write using black or blue pen.
  - If you need more space for a response, use the additional pages at the back of this book.
  - On the additional pages, write the question number you are responding to.
  - Cancel any incorrect response by ruling a single diagonal line through your work.
  - Write the page number of your alternative/additional response, i.e. See page …
  - If you do not do this, your original response will be marked.
- This section has seven questions and is worth 31 marks.

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QUESTION 21 (4 marks)

a) Identify whether 2-bromopropane is a saturated or unsaturated compound.
Explain your reasoning. *[2 marks]*

b) Determine whether 2-bromopropane is a primary, secondary or tertiary halogenoalkane.
Explain your reasoning. *[2 marks]*

QUESTION 22 (2 marks)

Calculate the concentration of HF (hydrogen fluoride) in an aqueous solution with a pH of 4.00 ($K_a = 7.2 \times 10^{-4}$). Show your working.

Concentration = _____ mol L^{-1} (to two significant figures)

Do not write outside this box.

QUESTION 23 (4 marks)

Ibuprofen is manufactured using two different processes.

Process	Number of reagents used	Reagents		Ibuprofen		Waste products	
		Atoms	M_r	Atoms	M_r	Atoms	M_r
1	7	$C_{20}H_{42}NO_{10}ClNa$	514.5	$C_{13}H_{18}O_2$	206.0	$C_7H_{24}NO_8ClNa$	308.5
2	4	$C_{15}H_{22}O_4$	266.0	$C_{13}H_{18}O_2$	206.0	$C_2H_4O_2$	60.0

Calculate the atom economy for each process and draw conclusions about the economic and environmental impact of each process.

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QUESTION 24 (7 marks)

This electrochemical cell was constructed using copper and platinum electrodes.

$$Cu(s) \mid Cu^{2+}(aq)\ (1M) \parallel Fe^{3+}(aq)\ (1M),\ Fe^{2+}(aq)\ (1M) \mid Pt(s)$$

a) Compare the standard electrode potential ($E°$) of the two half-cells. *[3 marks]*

Similarity: _____

_____

Difference: _____

_____

Significance: _____

_____

b) Write a balanced redox equation for the electrochemical cell. *[1 mark]*

_____

_____

c) Determine the cell potential (in volts) for the electrochemical cell. *[1 mark]*

_____

_____

Cell potential = _____ V (to two significant figures)

d) Determine the oxidising agent. Explain your reasoning. *[2 marks]*

_____

_____

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QUESTION 25 (5 marks)

Three unknown gases are combined in a sealed flask and allowed to reach equilibrium as shown by the equation.

$$3A_2(g) + X_2(g) \rightleftharpoons 2XA_3(g)$$

a) Determine whether the gases reach a state of dynamic equilibrium. Explain your reasoning. *[3 marks]*

b) Determine if the relative position of equilibrium lies towards the products or reactants, if the molar concentrations at equilibrium are 3.4 mol L^{-1} for A_2, 1.8 mol L^{-1} for X_2 and 4.2 mol L^{-1} for XA_3. Explain your reasoning. *[2 marks]*

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QUESTION 26 (4 marks)

Three unknown 0.1 M solutions, A, B and C, are found to have the following properties.

Solution	$[H^+]$ (mol L^{-1})	pH	pOH
A	0.0001		10.0
B		2.0	
C	0.063		

a) Determine the pH of solution A. *[1 mark]*

pH = _____ (to one decimal place)

b) Determine the concentration of hydrogen ions $[H^+]$ in solution B. *[1 mark]*

$[H^+]$ in solution B = _____ mol L^{-1} (to two significant figures)

c) Calculate the pOH of solution C. Show your working. *[2 marks]*

pOH = _____ (to one decimal place)

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QUESTION 27 (5 marks)

Five colourless 0.1 M solutions of NH_3, HCl, KOH, H_2SO_4 and CH_3CH_2COOH have lost their labels. The substances are randomly relabelled A, B, C, D and E. The conductivity of each solution and the colour of the solution when phenol red was added are shown.

Solution	Conductivity (S/m)	Colour with phenol red
A	4.1	yellow
B	0.14	red
C	0.08	yellow
D	6.7	yellow
E	4.9	red

Identify the five solutions. Explain your reasoning.

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ADDITIONAL PAGE FOR STUDENT RESPONSES

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