The Royal College of Pathologists
Pathology: the science behind the cure

FRCPath Part 2 Practical Examination in Clinical Biochemistry - Practical

Autumn 2025

Time allowed: 3 hours total

This examination is divided into 3 parts (Parts A, B and C) and is of three hours' duration. Candidates must answer all questions. You are provided with all questions, and it is up to the candidate how long they spend on each section.

A global mark will be awarded for the entire practical according to overall performance.

You must write your candidate number clearly on the front page and at the top of every page within the answer books and on any loose sheets of paper (e.g. graph paper), which you use.

Candidates are reminded that examiners attach great importance to the clear, legible and orderly presentation of answers.

Pay particular attention to the questions asked, you will not get marks for information that is not requested.

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Tables and graphs must be presented where specifically stipulated in the question and may be used elsewhere if appropriate. They must be submitted in the answer book for the appropriate part.

Calculators but not computers or tablets are allowed. Textbooks are not allowed.

You must not remove the question paper from the examination hall, nor copy any question and remove it.

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Effect of Haemolysis on Serum Potassium Measurement

Section A — Experimental Planning

It is not uncommon for serum samples to have visible haemolysis, which can artefactually increase potassium results. Your laboratory analyser reports a haemolysis index (HI) in arbitrary units (AU), which correlates with free haemoglobin concentration. Published data suggest clinically significant potassium interference at approximately 0.5–1.0 g/L free Hb. You have been asked to investigate the effect of sample haemolysis on your laboratory's potassium assay.

Assay details:

- Potassium by ion selective electrode; linear up to 10.0 mmol/L.
- Analytical coefficient of variation (CV) = 1.5 %.
- Biological variation (within-person CV) = 4.0 %; between-person CV = 5.0 %.
- Use Reference Change Value (RCV) at Z = 2.56 for significance testing.
- Acceptable internal quality control (IQC) range 3.8 mmol/L – 4.2 mmol/L

Questions:

1. You are provided with a washed red cell concentrate (Free Hb concentration 50 g/L; K^+ ~20 mmol/L) lysed to release intracellular contents. Outline the design of a haemolysis-spiking experiment to assess potassium interference in a real laboratory setting, including:

- Number and range of haemolysis levels
- Preparation of spiked samples (volumes, materials)
- Use of calibrator and QC materials

2. State any assumptions and limitations when using HI as a proxy for free Hb concentration.

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Section B — Data Interpretation and Presentation

Assay details:

- Potassium by indirect ISE; linear up to 10.0 mmol/L.
- Analytical CV = 1.5 %.
- Biological variation (within-person CV) = 4.0 %; between-person CV = 5.0 %.
- Use Reference Change Value (RCV) at Z = 2.56 for significance testing.
- Acceptable QC range 3.8 mmol/L – 4.2 mmol/L

Dataset 1

Sample ID	Group	Free Hb g/L	HI_AU	Replicate	Potassium mmol/L
QC-1	QC			1	3.99
Baseline-R1	Baseline	0.0	0	1	4.19
Baseline-R2	Baseline	0.0	0	2	4.24
Baseline-R3	Baseline	0.0	0	3	4.19
Hb0.25-R1	Hb0.25	0.25	25	1	4.30
Hb0.25-R2	Hb0.25	0.25	25	2	4.42
Hb0.25-R3	Hb0.25	0.25	25	3	4.38
Hb0.50-R1	Hb0.50	0.5	50	1	4.63
Hb0.50-R2	Hb0.50	0.5	50	2	4.66

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Hb0.50-R3	Hb0.50	0.5	50	3	4.67
Hb1.00-R1	Hb1.00	1.0	100	1	5.19
Hb1.00-R2	Hb1.00	1.0	100	2	5.15
Hb1.00-R3	Hb1.00	1.0	100	3	5.11
Hb2.00-R1	Hb2.00	2.0	200	1	5.93
Hb2.00-R2	Hb2.00	2.0	200	2	5.91
Hb2.00-R3	Hb2.00	2.0	200	3	6.02

Questions:

Using Dataset 1:

1. Calculate the mean potassium concentration and standard deviation for each haemolysis level.
2. Plot potassium concentration against HI (or free Hb concentration).
3. Fit an appropriate line or curve or describe the observed relationship.
4. Calculate the RCV and determine the lowest haemolysis level at which the potassium change from baseline exceeds the RCV.
5. Comment on the analytical reliability of potassium results at each haemolysis level.

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Section C — Applied Conclusions

You are also provided with:

- **Dataset 2:** paired clinical samples with and without haemolysis.

Patient ID	Specimen Visual Assessment	HI	Potassium mmol/L
A	Non-haemolysed	0	4.49
A	Mild haemolysis	45	4.70
B	Non-haemolysed	0	3.99
B	Marked haemolysis	180	5.64

Tasks:

1. From Dataset 2, assess the impact of haemolysis on reported potassium in real patient samples.
2. Propose a laboratory reporting policy for potassium in haemolysed samples.

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