The Royal College of Pathologists

Part 1 examination

Clinical Biochemistry: First paper

Tuesday 25 September 2007

Candidates must answer FOUR of the following questions ONLY

Time allowed: 3 hours

1 Describe the audit cycle. Discuss how the audit cycle could be applied to laboratory workload demand management.

2 Discuss the use of non-isotopic labels in immunoassays, indicating any advantages these labels have over the use of radioisotopes.

3 Describe the methodologies used for measurement of sodium in clinical biochemistry laboratories.

4 Describe the metabolic effects of chronic renal failure.

5 Outline the biochemical and clinical features of congenital adrenal hyperplasia and describe the role of the laboratory in its diagnosis and management.

6 Describe the metabolic and biochemical complications that may occur during long term Home Parenteral Nutrition, and outline an appropriate strategy for laboratory monitoring of this patient group.

The Royal College of Pathologists

Part 1 examination

Clinical Biochemistry: First paper

Tuesday 27 March 2007

Candidates must answer FOUR of the following questions ONLY

Time allowed: 3 hours

1. Describe the factors that make up the overall cost of a biochemistry test. Discuss the cost impact of transferring the location of analysis of a single test from the local laboratory to a central referral laboratory in a different hospital.

2. Describe and compare the principles of immunoturbidimetry and immunonephelometry. Discuss their uses and limitations.

3. Outline the different bilirubin fractions present in serum and describe the analytical methods available for their measurement.

4. Describe the factors that may lead to vitamin D deficiency in adults. Discuss the methods available for assessment of vitamin D status, indicating the problems associated with them.

5. Describe the normal physiology of renal potassium ion homeostasis and the pathophysiology of hypokalaemia due to inappropriate renal potassium losses.

The Royal College of Pathologists

Part 1 examination

Clinical Biochemistry: Second paper

Tuesday 27 March 2007

Candidates must answer FOUR of the following questions ONLY

Time allowed: 3 hours

1. **EITHER:** Discuss the differential diagnosis and investigation of a previously healthy 20-year old patient admitted with a metabolic acidosis and raised anion gap.

   OR: Describe the analytical principles underlying measurement of hydrogen ions, and partial pressures of carbon dioxide and oxygen by blood gas analysers.

2. Outline the biochemical pathway for the metabolism of haem. Describe the pathophysiology and clinical presentation of the porphyrias that are associated with skin lesions, indicating in each case the diagnostic biochemical abnormalities present.

3. Describe the clinical features of gluten sensitive enteropathy (coeliac disease), and discuss the role of laboratory tests in its diagnosis and management.

4. Discuss the place of apolipoprotein analysis in the investigation, diagnosis and management of dyslipidaemia. Where applicable, your answer should compare the role of apolipoprotein analysis with that of measurement of lipids and lipoprotein fractions.

5. Describe the analytical factors responsible for the generation of clinically misleading immunoassay results. Discuss the methods that are used both to reduce this risk and to investigate samples in which it may have occurred.

The Royal College of Pathologists

Part 1 examination

Clinical biochemistry: First paper

Tuesday 19 September 2006

Candidates must answer FOUR of the following questions ONLY

Time allowed: 3 hours

1 Describe the processes by which clinicians may make electronic requests for laboratory tests. Assess the risks and benefits associated with electronic requesting.

2 Describe the principles of mass spectrometry, making particular reference to tandem mass spectrometry. Citing specific examples, discuss the advantages and disadvantages of tandem mass spectrometry compared to other methods used in clinical biochemistry.

3 Describe the methods for glycated haemoglobin analysis, including procedures for the harmonisation of results between methods.

4 Outline the causes of diabetes insipidus. Discuss its diagnosis and investigation and the principles of its management.

5 Describe and explain the normal physiological changes in reproductive hormones in the female from birth to menopause (inclusive), including the effects of pregnancy.

The Royal College of Pathologists

Part 1 examination

Clinical biochemistry: Second paper

Tuesday 19 September 2006

Candidates must answer FOUR of the following questions ONLY

Time allowed: 3 hours

1 **EITHER:**

An 80-year-old woman was found collapsed at home with bradycardia and hypothermia. A blood glucose concentration of 2.0 mmol/L was recorded using a near-patient testing device. Discuss the differential diagnosis and laboratory investigation of this case.

OR:

Critically discuss methods for the measurement or estimation of total, HDL and LDL-cholesterol.

2 Outline the biochemical pathways responsible for the disposal of waste nitrogen. Discuss the clinical causes of hyperammonaemia.

3 Discuss the role of the laboratory in the identification, investigation and management of chronic kidney disease.

4 Describe the pathology and laboratory investigation of the inherited liver conditions that may present in adulthood.

5 Discuss the analytical performance of cardiac troponin assays in the diagnosis of acute coronary syndrome, with particular reference to issues of standardisation and sensitivity.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 14 March 2006

Clinical Biochemistry

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1 Outline the factors that should be taken into account when deciding whether and how a new diagnostic test should be introduced into the laboratory repertoire in response to clinical demand.

2 Critically discuss the advantages and disadvantages of automation and robotics in pre-analytical specimen processing.

3 Outline the principles of electrophoresis and review the advantages and disadvantages of conventional electrophoresis and capillary zone electrophoresis, giving examples of their use.

4 Describe the clinical biochemistry of sex hormone binding globulin and its use in clinical practice.

5 Describe the biochemical consequences of short bowel syndrome.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 14 March 2006

Clinical Biochemistry

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. EITHER:
   Discuss the differential diagnosis and management of a 50 year old woman who presents with a serum calcium concentration of 3.8 mmol/L.

   OR:
   Describe the principles underlying the use of enzymes as reagents, discussing factors that are important in the optimisation of enzymatic assays and with reference to specific examples.

2. Discuss the endocrine causes of hyponatraemia, including their pathophysiology and management.

3. Critically discuss the laboratory estimation of glomerular filtration rate.

4. Define the Metabolic Syndrome and describe its pathophysiology. Discuss the role of the laboratory in the investigation of patients who present with features of this syndrome.

5. Critically discuss the relative merits of determination of genotype versus phenotype in the investigation and treatment of disease, illustrating your answer with examples.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 20 September 2005

Clinical Biochemistry

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. Outline the ways in which pre-analytical factors can affect results in clinical chemistry. How can these effects be minimised in practice?

2. Describe the principles of spectrophotometry used in the clinical chemistry laboratory. What are the problems with this analytical technique and how are these overcome in practice?

3. Discuss the analytical methods for the estimation of creatinine in serum and urine. Discuss critically the standardisation of the assay and its accuracy at low concentrations.

4. Discuss the clinical biochemistry of acute hepatic failure.

5. Describe the biochemical and physiological abnormalities caused by gastrointestinal endocrine tumours.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 20 September 2005

Clinical Biochemistry

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. EITHER:
   Discuss the clinical and biochemical assessment of a patient referred for nutritional support. What factors should influence the method of feeding that is introduced if required?

   OR:

   Evaluate the laboratory methods that are utilized for the standardisation of enzyme assays.

2. Critically evaluate the role of the clinical chemistry laboratory in the investigation, diagnosis and monitoring of a patient thought to have acromegaly.

3. Describe the potential causes for, and appropriate clinical chemistry investigation of an infant presenting with failure to thrive.

4. Discuss critically the role of the laboratory in the diagnosis and monitoring of patients with a) Paget's disease of bone, b) osteomalacia and c) osteoporosis.

5. Discuss the role of the clinical chemistry laboratory in the diagnosis and management of patients with haematological malignancy.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 15 March 2005

Clinical Biochemistry

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. Discuss the laboratory services that are required to support an accident and emergency department in the management of patients with acute poisoning.

2. Describe the analytical principles that underlie the measurement of free hormones.

3. Define the term "trace element". Review the methods used in the clinical chemistry laboratory for their estimation.

4. Evaluate the use of tumour markers in the diagnosis and management of patients with cancer.

5. Discuss the variations of analyte concentration with time of day and season of year. How is the effect of this variation minimised in practice?

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 15 March 2005

Clinical Biochemistry

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. EITHER:
   Discuss the differential diagnosis and management of a 25 year old man presenting with abdominal pain who is found to have a triglyceride concentration of 76 mmol/L.

   OR:
   Critically discuss the methods available for the measurement of albumin in body fluids.

2. Describe the biochemical consequences of renal tubular acidosis, and the laboratory investigation of the condition.

3. Discuss the role of the biochemistry laboratory in the diagnosis and treatment of infertility.

4. Premature neonates are vulnerable to a range of biochemical disturbances. Outline the factors that contribute to this and describe the ways in which the biochemistry laboratory can assist in the management of these patients.

5. Describe current techniques and clinical applications for in-vivo biochemical monitoring.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 21 September 2004

Clinical Biochemistry

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1 Describe the audit cycle. Discuss, with examples, the role of audit in quality improvement in the clinical biochemistry service.

2 Discuss the principles involved in the standardisation of assays. How are these principles applied in the standardisation of hormone immunoassays?

3 Compare and contrast the methods available for the measurement of calcium in body fluids. What pre-analytical factors have to be taken into account for the measurements to be valid?

4 Discuss the biochemical complications of cystic fibrosis. What biochemical monitoring is indicated for patients with this disease?

5 Describe the mechanisms ensuring the delivery of oxygen to the tissues and the adaptation in disease.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 21 September 2004

Clinical Biochemistry

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1 EITHER:
A five year old boy is brought to the accident and emergency department after being found unconscious in the kitchen. Discuss the differential diagnosis and appropriate investigation of this child.

OR:
Discuss the principles behind the measurement of ions using ion-selective electrodes.

2 Compare and contrast the clinical presentation and biochemical findings in MCAD (Medium Chain Acyl CoA Dehydrogenase deficiency), Galactosaemia, and Phenylketonuria.

3 Discuss the effects of diabetes on the kidney. How can the renal complications be modified by treatment?

4 Discuss the role of analysis of bicarbonate and chloride in the routine urea and electrolyte profile.

Please turn over for Question 5

5 Write short notes on each of the following:

a) Reverse transcription-polymerase chain reaction (RT-PCR)

b) TaqMan assay for mutation detection

c) Single nucleotide polymorphisms.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 16 March 2004

CLINICAL BIOCHEMISTRY

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. Describe the essential features of a quality system for point of care testing of blood gases or blood glucose.

2. Define the terms precision, bias and accuracy – how can these be assessed when initiating an assay and how are they monitored long term?

3. Outline the physical principles behind mass spectrometry. Describe the analytical systems in which this technique can be used in biochemistry and the advantages it offers over standard analytical methods.

4. Write short notes on:

    a) Alpha-1-antitrypsin
    b) Plasma cholinesterase
    c) Pancreatic faecal elastase

5. Describe the biochemical adaptation to starvation and the consequent metabolic problems associated with refeeding.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 16 March 2004

CLINICAL BIOCHEMISTRY

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. **EITHER**
   A 32 year old woman presents with a blood pressure of 160/105 mm/Hg. Discuss the possible pathophysiology of the hypertension and the biochemical investigations required in this patient.

   OR
   Critically discuss methods for the measurement of alkaline phosphatase isoenzymes.

2. Outline the synthesis and metabolism of bilirubin. Discuss the appropriate use of biochemical tests in the differential diagnosis of jaundice in adult patients.

3. Outline the clinical biochemistry of hypothyroidism. Discuss the role of the laboratory in the diagnosis and management of this condition.

Please turn over for Questions 4 and 5

4. Discuss the pre-analytical problems encountered in the biochemical assessment of paediatric patients.

5. Discuss the role of the laboratory in ante-natal screening.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 23 September 2003

CLINICAL BIOCHEMISTRY

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. Discuss the role of risk management in laboratory quality procedures. What practical steps can be taken in the laboratory to minimise risk?

2. Discuss the use of computerised decision support in the clinical chemistry laboratory. What are the advantages and disadvantages of using such computer assistance?

3. Describe the methods for the assessment of cerebrospinal fluid xanthochromia. What are the indications for its measurement and the precautions that need to be observed in interpreting the results?

4. Describe the metabolic products of tyrosine. Outline the clinical disorders associated with defects in the associated metabolic pathways.

5. Outline the physiology behind the following tests, and briefly indicate their use in clinical medicine:

   a) Short synacthen test
   b) Glucose tolerance test
   c) Water deprivation test

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 23 September 2003

CLINICAL BIOCHEMISTRY

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. **EITHER**
   Describe the clinical and biochemical consequences of ingestion of ethylene glycol. How can the laboratory assist in the management of a case of poisoning with ethylene glycol?

   OR
   Discuss critically the methods available for the detection and estimation of ethanol in body fluids.

2. Discuss critically the biochemical tests available for the detection and monitoring of pancreatic disease.

3. Discuss the pathophysiology of the biochemical abnormalities encountered in cardiac failure. How can the laboratory assist in the detection and monitoring of patients with this condition?

4. Describe the clinical syndromes associated with deficiency of water-soluble vitamins. What are the indications for measurement of plasma concentrations of these vitamins?

5. Outline the principal determinants of biological variability in analytes. How can the contribution of this to total variation in analyte concentration be minimised?

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 18 March 2003

CLINICAL BIOCHEMISTRY

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. Outline the factors involved in deciding whether to refer samples to a distant laboratory for analysis of infrequently required tests, instead of providing the service locally. What are the responsibilities of the laboratory sending the samples and the laboratory undertaking the analysis?

2. Outline the principles underlying high-pressure liquid chromatography (HPLC). Discuss, with examples, the factors that are important in optimising an assay utilizing HPLC.

3. External quality assurance surveys often reveal marked discrepancies in the results from different immunoassay systems. Discuss the origin of these differences and how such assays may be standardised.

4. Describe the metabolism of vitamin D in health and disease.

5. Discuss the mechanisms underlying water homeostasis in health and the disturbances found in disease.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 18 March 2003

CLINICAL BIOCHEMISTRY

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. **EITHER**
Outline the biochemical mechanisms underlying lactic acidosis. What are the principal causes in clinical practice, and how are they treated?

OR
Critically evaluate the methods in general use for the measurement of the concentration of bilirubin and its fractions in plasma or serum.

3. Describe the characteristic biochemical abnormalities found in Wilson's Disease. How can the laboratory assist in the diagnosis and monitoring of this condition?

3. Outline the criteria for a valid screening test. Illustrate your answer by reference to the screening tests for phenylketonuria, haemochromatosis and prostate cancer.

4. Write short notes on:
Pseudohyponatraemia,
Pseudohypoparathyroidism,
Porphyria cutanea tarda.

5. Discuss critically the clinical utility of biochemical markers of metabolic bone disease.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 24 September 2002

CLINICAL BIOCHEMISTRY

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. Discuss the level of analytical and interpretive clinical biochemistry service that is required for a hospital providing acute medical and surgical care outside normal working hours. What problems does this pose for the staffing of the laboratory and how can these be minimised?

2. Explain how you would introduce a new method for an existing analyte into the routine laboratory service.

3. Outline the physical principles underlying atomic absorption spectrophotometry. Explain the techniques used to optimise selectivity for the element required and reduce non-specific interferences.

4. Write short notes on:
   (a) Thyroglobulin,
   (b) Macroprolactin,
   (c) Procalcitonin.

5. Discuss critically the methods available for the assessment of glomerular filtration rate.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Tuesday 24 September 2002

CLINICAL BIOCHEMISTRY

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. **EITHER**
   Give a differential diagnosis for a 45 year old man admitted with a sodium concentration of 109 mmol/L. Discuss the investigation and the principles of management of hyponatraemia.

   OR
   Discuss critically the methods available for the measurement of glucose in body fluids. What non-invasive techniques are available for monitoring this analyte?

2. Outline the biochemical defects that give rise to the clinical picture of familial hypercholesterolaemia. What is the biochemical basis of the treatments used to lower cholesterol in patients with this condition?

3. Describe the principal components of the acute phase response to inflammation. How can the acute phase response affect the interpretation of biochemical results?

4. Outline the biochemical pathways involved in the metabolism of catecholamines. Discuss strategies for optimising the detection of tumours producing excess catecholamines.

5. Describe the principles of the polymerase chain reaction (PCR). Explain how PCR can be used for the detection of allelic variations.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Wednesday 17 April 2002

CLINICAL BIOCHEMISTRY

First Paper

Candidates must answer FOUR questions ONLY

Time allowed – THREE HOURS

1. The decision is made to merge the administration of a 200 bed maternity hospital with a neighbouring large acute hospital. Pathology will be centralised at the larger general hospital. Discuss how you provide a clinical biochemistry service to the maternity hospital which has obstetric wards and a special care baby unit, and is situated 3 km away across a city centre.

2. Discuss critically the methods used for the detection of drugs of abuse. How would you introduce an analytical service for a drug rehabilitation programme?

3. What is meant by glycated haemoglobin and how is it formed? Outline the methods available for the measurement of glycated haemoglobin. Discuss the problems encountered in the standardisation of the assay.

4. Outline the pathophysiology underlying an acute attack of gout. How can the laboratory assist in the diagnosis and management of such patients?

5. What are the mechanisms that maintain a constant hydrogen ion concentration in the body. Describe the acid-base disturbance in chronic obstructive pulmonary disease and explain how a normal hydrogen ion concentration is restored.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

Wednesday 17 April 2002

CLINICAL BIOCHEMISTRY

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed – THREE HOURS

1. **EITHER**
   Discuss the differential diagnosis in a 51 year old man who arrives in the accident and emergency department following a fit and is found to have a blood glucose of 2.1 mmol/L. Outline the biochemical investigations necessary to confirm the diagnoses you have described and the management in each case.

   OR
   Outline the methods used in the measurement of creatinine in body fluids. Discuss potential interferences and the techniques used to overcome them.

2. Outline the metabolic disorders that lead to myopathy. Discuss how the laboratory can assist in the diagnosis and investigation of patients thought to have metabolic myopathy.

3. Outline the biochemical changes that occur in anorexia nervosa. Discuss the metabolic problems encountered in the nutritional support of these patients.

4. Outline the factors leading to the formation of renal stones. Discuss critically the techniques for the analysis of the content of renal stones.

5. An increasing number of tests are becoming available for near-patient testing of urine and whole blood. Outline the technology employed in the devices and the factors that can lead to incorrect results.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

March 2001

CHEMICAL PATHOLOGY

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. Explain the principal elements of continuing professional development (CPD). Discuss how you would enable professional staff in the laboratory to maintain CPD.

2. Outline the core specification for a laboratory computer system. Indicate desirable features for the clinical biochemistry service.

3. Write short notes on:
   (ii) selective venous catheterisation
   (iii) applications of mass spectrometry in clinical chemistry
   (iv) capillary zone electrophoresis.

4. Discuss the current criteria for the diagnosis of diabetes mellitus and the laboratory support necessary to implement a diagnostic service.

5. Outline the physiological control of plasma sodium concentration. Describe the principal causes of hyponatraemia.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

March 2001

CHEMICAL PATHOLOGY

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. Outline the endocrine disorders which may present as medical emergencies. Which assay services should be available urgently for such emergencies.

   OR

   Discuss critically the methods used for the assay of protein in urine.

2. Outline the clinical disorders and the disturbances in biochemical mechanisms which result in elevation of plasma ammonia.

3. Discuss the causes and biochemical consequences of obesity.

4. Write short notes on:
   (ii) brain natriuretic peptide
   (iii) urine cross-linked N-telopeptide (NTx)
   (iv) apolipoprotein E genotypes.

5. Outline the pathological basis of haemochromatosis. Discuss the methods available for screening for this disease.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

September 2000

CHEMICAL PATHOLOGY

First Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. A scientific paper describes a new laboratory test. Discuss the factors that need to be considered in assessing its contribution to the evidence base for laboratory medicine.

2. Describe how you would determine the reference intervals for a new laboratory test. What statistical techniques need to be considered in setting the intervals?

3. Discuss the methods used for the measurement of high density lipoprotein cholesterol. What are the advantages and limitations of each method?

4. Outline the metabolism of folate. Discuss the analytical problems encountered in its measurement and the clinical utility of the test.

5. Discuss the role of urinary albumin as a marker of disease.

THE ROYAL COLLEGE OF PATHOLOGISTS

Part 1 Examination

September 2000

CHEMICAL PATHOLOGY

Second Paper

Candidates must answer FOUR questions ONLY

Time allowed - THREE HOURS

1. EITHER

Describe the causes of hyperkalaemia. Discuss the investigation and treatment of a patient found to have a serum potassium concentration of 7.5 mmol/L.

OR

Describe the methods available for the measurement of blood gases (Pco_2 and Po_2). Describe the derived parameters that are available from blood gas analysers and the assumptions that are made in their derivation.

2. Describe the principal multiple endocrine neoplasia syndromes. Discuss the role of biochemical and genetic screening within families affected by these disorders.

3. Discuss the biochemical tests indicated in the investigation of a 7 year old child who is below the 3rd centile for height.

4. Discuss the role of bile acids in health and disease. Review the indications for measurement of bile acids.

5. Discuss the uses and limitations of biochemical markers of cardiac damage. Outline the cost-effective protocol for the use of markers in the assessment of patients presenting acutely with chest pain.