Question 1
You are given a list of drugs numbered 1 to 6

Indicate which drugs can cause the following biochemical abnormalities in therapeutic use (the side-effects listed may apply to more than one drug on the list):

a Hyponatraemia

1,3,4

b Hyperkalaemia

1

c Hyperprolactinaemia

4,6

d Increased CK

4,5,6

e Hypocalcaemia

2

f Increased creatinine

1

Question 2

You are provided with scans of a serum protein electrophoresis gel and the immunofixation gel for the sample in lane 1, and the urine protein electrophoresis of a urine sample from the same patient (lane 6) and the corresponding urine immunofixation. This sample comes from a patient with hypercalcaemia.

a. Write a report on the serum sample (lane 1 on the serum electrophoresis gel and immunofixation) from this patient.

Marks were given for:

Marked (heavy, strong etc) band in gamma region.
Partial immune paresis
Band types as IgG lambda

b. Report the urine electrophoresis (lane 6) and immunofixation.

Slow – running band at origin corresponding to serum band typing as intact IgG lambda.
Free lambda chains detectable (Bence Jones Protein)
Some glomerular leakage (or generalised proteinuria etc.)

c. Comment on the significance of this result and indicate further useful investigations.

Free light chains and hypercalcaemia bad prognostic signs
Probable myeloma
Needs Full blood count and film, marrow, skeletal survey, LDH, quantitative immunoglobulins including monoclone concentration. (Accept urine b2 microglobulin)

Question 4

a) What do the plots show about the performance of analyser B compared to analyser A ?

Good correlation between A and B up to about 500. Slight dose dependent positive bias (B on A) at low values. At values above 1000 marked positive bias

b) Give possible reasons for the changes observed for hCG values above and below 1000 IU/L

Investigate dilution limit, suspect changes above 1000-1200 occur when dilution undertaken. If on-board then either analytical problem with matrix post-dilution or simple dilution error (e.g. mechanical problem with syringe etc.

c) What experiments would you do to confirm your reasoning ?

Take a sample with a high value and dilute down manually. Show dilution works for values >500. Use international standard to check response to high values.

Question 5

You are provided with three clinical scenarios. Assume that you have been telephoned asking about the appropriate samples that need to be collected and the tests that should be requested. Give the above in each case and indicate the correct sample container and any special precautions that have to be observed such as when the sample should be taken or precautions to be observed during sample collection.

a)

Clotted blood sample for electrophoresis, quantitative immunoglobulins, and whatever profile covers at minimum, total protein, albumin, calcium, alkaline phosphatase, urea and creatinine. (Lactate dehydrogenase may be used in staging).
Full blood count and film.
Spot urine for Bence Jones protein, plain container, no preservative, first early morning void best.

b)

Fasting clotted blood sample for bone profile or equivalent to contain at least calcium, albumin, phosphate, alkaline phosphatase and creatinine.
Second morning void urine (or timed collection) for urine calcium and creatinine to calculate calcium/creatinine clearance ratio.
If other family members available then testing their serum calcium may also be beneficial in making the diagnosis.

c)

Clotted blood for serum digoxin taken between 2 p.m. and 4 p.m. (6-8 hours post dose). Should also check urea and electrolytes if not done recently as dosage should be reduced in renal failure and hypokalaemia potentiates digoxin toxicity.

Question 6

A method is being set up for the assay of enzyme activity on a batch analyser. The enzyme catalyses the oxidation of a substrate with reduction of NAD to NADH. Initial plots are provided for the reaction utilising varying volumes of serum to start the reaction as indicated on the right of the graph. The serum is added between points 2 and 3. The absorbances measured at 340 nm for 31 points during each of the reactions are provided on the accompanying data sheet and the resulting data plotted on the accompanying graph.
DO NOT MARK THE GRAPH, USE THE DATA PROVIDED.

a) Choosing the curve which provides the optimum conditions, calculate the activity of the enzyme.

Marks given for:
Using points 10-20, curve for 10mL (6mL also acceptable)
Absorbances 0.0667-0.0325. DAbsorbance = 0.0342/2.5 min^{-1}
Concentration change = DAbs/el = 0.01368/6.3x10^{-3}x0.7
Correction for dilution x240/10 (or 6 as appropriate)

b) Give an explanation for the shape of the curve when 20µL serum is used.

The curve suggest product (NADH) is used up not just inhibiting reaction. This is either due to a competing reaction or second reaction that uses up the product.

Question 9

You are provided with brief clinical histories and the results of urine analyses on 3 patients. Give possible diagnoses and list useful further investigations for each patient.

a) Possible diagnoses

haemolytic anaemia, sickle cell disease, porphyria

Further investigations

Full blood Count and film, liver function tests (esp. LDH, AST, bilirubin), urine porphobilinogen

b) Possible diagnoses

Urinary tract infection, (esp. proteus infection (high pH)), renal stones,

Further investigations

Mid stream specimen of urine for culture and sensitivity/ microbiology. Blood sample for Urea and electrolytes, calcium, phosphate, uric acid.

c) Possible diagnoses

Acute nephritis (e.g. post-streptococcal disease but cause can not be determined from information given.

Further investigations

Blood pressure, Mid stream specimen of urine for microscopy (cells and casts) culture and sensitivity, urea and electrolytes.

Question 10

a) Indicate the test(s) you would undertake on sample A to answer the question posed on the form.

The most definitive test is identification of tau protein ($ß_2$-transferrin), which is present in csf, by electrophoresis.

b) Indicate the test(s) you would undertake on sample B to answer the question posed on the form.

Take simultaneous wound, blood and urine samples and analyse for urea and creatinine. Wound drainage will approximate to serum levels whereas urine contamination will show much higher urea and creatinine concentrations.

Question 11

You are provided with the abnormal results from 3 samples which have been forwarded to the authorising bench before reporting. Indicate what you would check on these samples prior to reporting.

a) ***Check whether sample haemolysed and age of sample (date of collection). Also check for EDTA contamination (calcium and alk. phos. low).***

b) ***Check TSH on 2nd sample which is in lab.***
Check for heterophilic antibodies (blocking tubes)
Try dilution to see if dilutes linearly, if not suspect artefact
Send to another laboratory for alternative assay method.

c) ***This looks like dextrose contamination from drip.***
Check if patient actually on drip and what was being given at time of sample.
Check from where sample was taken (patient can often remember).
Check glucose in sample.

Question 12

You are provided with the data for a batch of samples for which the growth hormone concentrations have been determined. The analyst for this batch wants to know which samples if any can be authorised.

a) Indicate, giving your reasons, which samples if any can be authorised and how you would deal with the remaining samples.

Most would pass samples whose concentrations were below highest QC which was within limits (mid not high QC as many suggested). Thus samples B, C, D and G could be passed for reporting (with repeat if possible).
A – cannot report – repeat
E – Request further information from sending lab. if possible
F – Probable suppression, although true value of sample at start not certain – may be reportable as such.
H – stimulation adequate but values uncertain, needs discussion with clinicians if cannot be repeated

b) What would you want to know to optimise quality control in this assay ?

Marks were given for:
Need to know what QC performance was on old assay – was high running high before. What EQA performance has been like.
If performance continues to provide problems, it would be useful to know what performance of new calibrators was on old assay. (This is sometimes assessed when major lot changes occur before the old calibrators run out.)
Unable to comment after just one run with new calibrators but next run could include some samples run on old assay, especially with high values to see if QC problem also seen in patient samples.

c) Comment on the results from patient C (assuming the assay was performing correctly).

Normal suppression