

West Midlands Training Course in Clinical Biochemistry

Course Assessment – Spring 2005

Short Answer Questions. Answer all questions. Time allowed 1 hour.

- The plot shown below was constructed during the development of an assay for serum rhubarb involving the use of the enzyme rhubarbase: -
 - What is this type of plot called?
 - Using the graph calculate the maximum velocity of the reaction (V_{max}) in arbitrary units
 - Using the graph calculate the Michaelis-Menten constant (K_m) for the reaction.
 - At what substrate concentration will the velocity of the reaction equal 91% of the maximum?
- Briefly comment on the following set of data and suggest a further biochemical test that could be undertaken on the ward to indicate the nature of the ongoing pathology. The patient is a 74 year old man who has been receiving treatment for hyperlipidaemia. He was admitted complaining of having had muscle and chest pain for several days.

Serum	Ref Interval	Day 1	Day3	Day 5	Day 7
Sodium mmol/L	133-147	138	138	139	139
Potassium mmol/L	3.5 – 5.0	4.4	5.1	4.9	4.8
Urea mmol/L	2.5 – 7.5	13.4	18.5	21.6	17.9
Creatinine μ mol/L	85 - 125	399	535	23.7	489
Creatine Kinase (CK)	<200	2510	5727	12240	15827
Aspartate Aminotransferase (AST)	<35	91		410	541
CK-MB%	<6	2.6	3.5		
Alkaline phosphatase U/L	50-200			116	
Bilirubin μ mol/L	1 - 25			10	

- In healthy subjects the average within subject biological variation (CV_I) for creatinine in serum is 4.1% and the between subject (CV_G) 12.9%. Assume when answering the following that the analytical imprecision of creatinine assays at a value of 70 μ mol/L across the UK is 12.2% and that there is no assay bias between laboratories.

- a. What is the analytical goal for imprecision based on biological variation?
 - b. Calculate the index of individuality for creatinine.
 - c. Does the index of individuality support the application of population based reference intervals?
 - d. If the total error included only 1 analytical standard deviation what would be the expected range of creatinine concentrations seen across the UK in subjects having a mean creatinine concentration of 70 $\mu\text{mol/L}$.
4. A test for a disease with a prevalence of 1 in 500 has a diagnostic sensitivity of 80% and an overall diagnostic of efficiency of 80%. If applied to a population of 100,000 individuals what would be the negative and positive predictive values for the test.
 5. What volume of 10% w/v magnesium chloride solution would need to be added to 1L of 5% dextrose solution in order to infuse 50 mmol? What would be the final concentration of dextrose in the dextrose/magnesium solution produced. (MW Mg = 24, Cl 35.5, glucose 180).
 6. Using a diagram briefly illustrate the renin aldosterone axis.
 7. Alanine transaminase is performed by measuring the rate of conversion of NADH to NAD in a linked enzymic reaction. The change in absorbance with time is directly proportional to the enzyme activity. Given the following information calculate the concentration of ALT activity in U/L of serum: -

Reaction time = 5 minutes

Initial absorbance at 339 nm = 0.00

Final Absorbance at 339 nm = 0.75

Total volume in cuvette = 3.0 mL

Volume of serum specimen = 0.2 mL

μmolar absorptivity of NADH at 339 nm = 6.3×10^{-3}

8. Very **briefly** define each of the following: -
 - a. CSF xanthochromia
 - b. Froin's syndrome
 - c. Secondary hypertension
 - d. Conn's syndrome
9. If isotopic waste must be held until its activity falls to less than 1% of its original activity, how long would the following isotopes have to be stored?
 - a. ^{125}I $t_{1/2} = 60$ days
 - b. ^{60}Co $t_{1/2} = 5.26$ years
 - c. ^{131}I $t_{1/2} = 8.07$ days
 - d. ^3H $t_{1/2} = 12.26$ years
 - e. ^{32}P $t_{1/2} = 14.28$ days

10. The following results were obtained on analysis of serum from a 30 year old male with a history of depression with psychotic episodes and self harm. He presented at casualty on day 1 distressed and incoherent. The patient's carer stated that apart from the patient's psychiatric problems he was known to be in good health with no known other medical problems.

		<i>Ref Range</i>	Day 1	Day 2	Day 3	Day 4
Sodium	<i>mmol/L</i>	<i>133-147</i>	147	144	143	146
Potassium	<i>mmol/L</i>	<i>3.5-5.0</i>	4.1	2.9	3.2	3.5
Urea	<i>mmol/L</i>	<i>2.5-7.5</i>	5.0	8.0	10	14.1
Creatinine	<i>μmol/L</i>	<i>60-120</i>	115	152	295	538
Alkaline Phosphatase	<i>U/L</i>	<i>40-140</i>	170	184	156	129
Aspartate aminotransferase (AST)	<i>U/L</i>	<i>0-35</i>	273	22712	10787	2827
Total Bilirubin	<i>μmol/L</i>	<i>0-25</i>	38	49	45	43
Albumin	<i>g/L</i>	<i>35-48</i>	55	51	40	35
Total Protein	<i>g/L</i>	<i>60-85</i>	83	80	63	53
Glucose	<i>mmol/L</i>	<i>2.8-6.0</i>		8.9		

- What is the most likely causes of this patients abnormal biochemistry?
- What other biochemical investigations should have been undertaken on day1?
- What other laboratory test should have been ordered?
- In view of your answer to question a. are there any indicators of poor prognosis for this patient in the tabulated data?