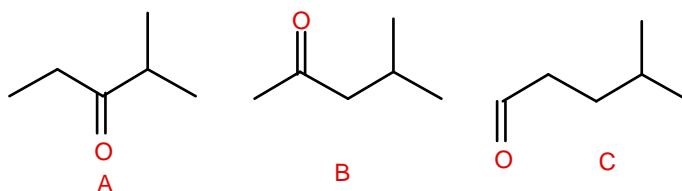


1. (a) The mass spectrum for two amines is given in your packet.
- Propose how an investigator might prepare an aqueous solution of these for analysis.
  - Comment on any pattern you observe common to both fragmentation processes
  - By devising suitable fragmentations identify an ion common to both spectra **and** one ion specific to each spectrum
- (b) The mass spectrum shown belongs to one of the following isomers. Identify which isomer is responsible for the spectrum shown and give your reasoning :



2. A bloody crime has been committed and a swab from the victim is found to have the DNA profile shown in your packet. The frequencies of these alleles are also given. Three suspects have been identified, S1-S3.
- Given the DNA profiles in the accompanying table *exclude two* of these (S1-S3) as suspects **and** give your reasoning
  - For the **one** suspect remaining calculate the *Random Match Probability* and evaluate the *Likelihood Ratio* to be used in assessing the suspect's guilt / innocence.
  - For one of the two previously *excluded* suspects propose a technical reason that a prosecutor might use to state that they still might be guilty

	D3S1358	VWA	FGA	D8S1179	D7S820
Victim	14,17	14,17	22,23	11,11	10,12
S1	15,16	18,20	19,23	11,12	8,11
S2	15,16	18,20	19,22	12,12	8,10
S3	16,16	18,20	19,21	11,11	11,11

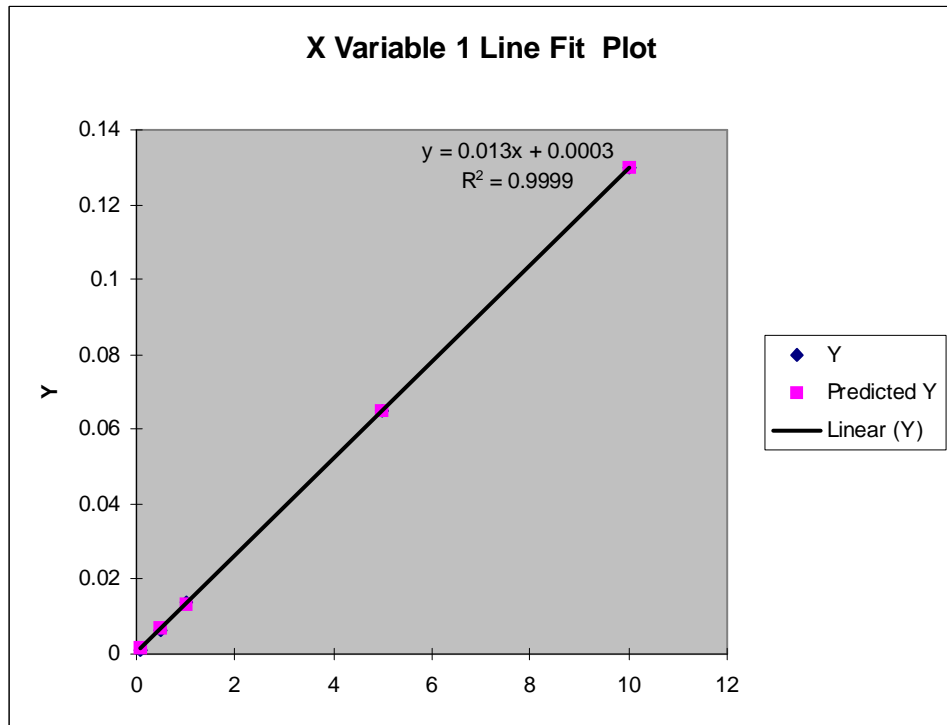
3. (a) The allele frequencies for locus D16S2622, from a recently (1999) completed genomic study in Brazil, are given in your packet.
- Calculate the Power of Discrimination, PD, for this locus
  - If this locus is said to have a *heterozygosity*, *h*, of 0.63 explain briefly what this means **and** why *h* is often given as both an *observed* and an *expected* value

(b) Also included in your packet is the complete DNA profile obtained using an InviSorb<sup>TM</sup> STR profiler kit. Identify the locus that might have the best *Power of Discrimination* (PD) and give your reasoning

4. A standard calibration plot for an Atomic Absorption spectrometer, an instrument that detects metal ions, is given in your packet.
- Calculate the  $[Na^+]$  for the unknown sample.
  - Briefly explain how the data clearly shows that it was critical to use an internal standard
  - Briefly explain why the forensic chemist did not use the point (0,0) in the construction of the calibration plot.

### Problem 4

ppM Na+	Response	Standard (1000ppm Li+)	ratio Na/Li
0.1	0.11	86	0.00128
0.5	0.52	80	0.0065
1	1.8	128	0.0141
5	5.9	91	0.0648
10	9.4	73	0.1301
Unknown	4.4	95	0.0463



### Problem 3

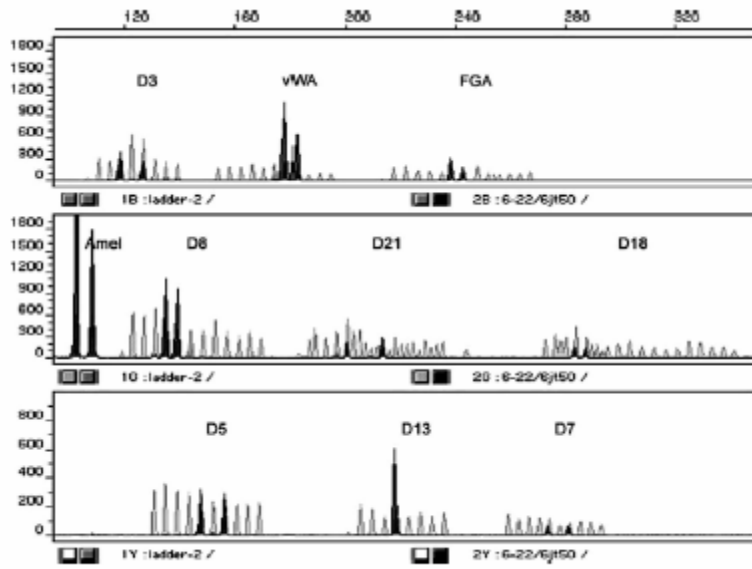
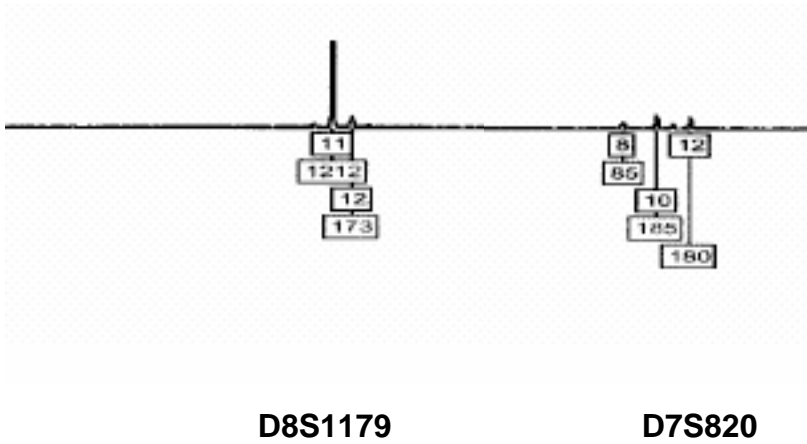
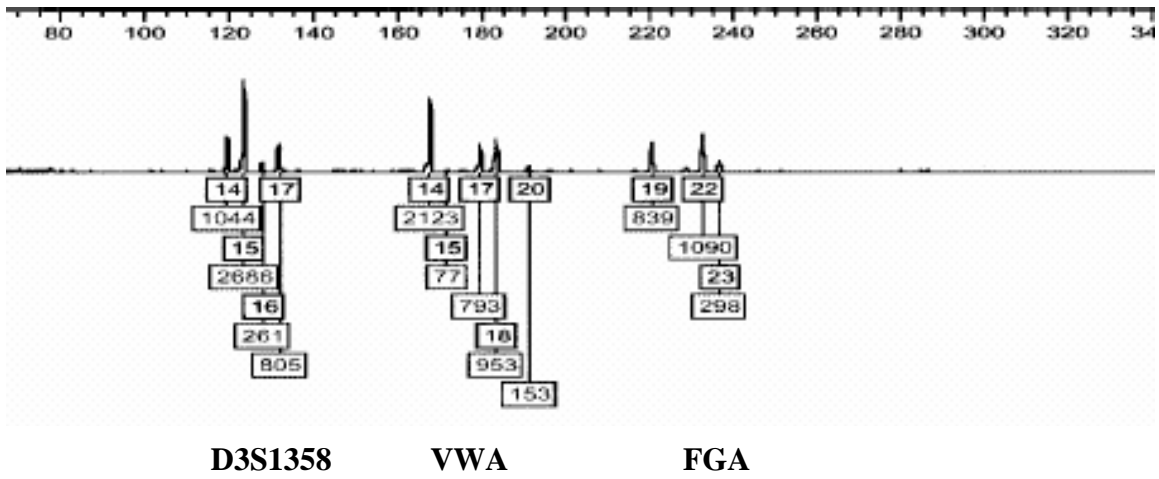


Fig. 3. Typical STR profile from 50s latent fingerprint, carried out with 38 PCR amplification cycles.

D16S2622  
(*N* = 7320)

Allele	Freq. (%)
68	0.07
72	1.97
76	6.60
80	31.82
84	50.74
88	8.37
92	0.44

Problem 2



Locus	Allele	Frequency (%)
D3S1358	14	15
D3S1358	15	7
D3S1358	16	26
D3S1358	17	11
vWA	14	10
vWA	17	8
vWA	18	22
vWA	20	12
FGA	19	8
FGA	21	3
FGA	22	9
FGA	23	14
FGA	24	11
D8S1179	11	24
D8S1179	12	18
D8S1179	13	11
D7S820	8	0.5
D7S820	10	10
D7S820	11	15
D7S820	12	8

