Coaching Report

Participant	student1 s	**Student detail**	User_48
Group	ntc.hu ats.hu	**Status**	Ended normally
Assessment name	Analyical Chemistry 3 - EN V4	**Final Score**	13
Time Used	00:02:36	**Time limit (min)**	60
Date taken	15-09-2016 16:40:21		

Questions - presented: 30, answered: 30

1	**Phenol (C6H5OH) can be determined by coulometric titration with in situ generated bromine according the reaction scheme: How many coulombs (C) correspond to 1 mole of phenol? (1 Faraday = 96485 C/eq)**

❌

Question type	Multiple Choice
Topic	Electrochemical Methods
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	96485 / 3 C
Answer	0) 96485 C
	1) 2 x 96485 C
	2) 96485 / 3 C
	3) 3 x 96485 C

4) 6 x 96485 C

<table>
<tr><td>**2**</td><td style="color:red">**Which one of the following equations must be applied for the exact calculation of [H+] in an aqueous solution of HCl at any analytical concentration CHCl?**

(Kw = 1x10-14 M2)</td></tr>
</table>

Question type	Multiple Choice
Topic	Classical Analysis
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	[H+] = CHCl - Kw / [H+]
Answer	0) [H+] = CHCl + Kw / [H+]
	1) [H+] = CHCl
	2) [H+] = CHCl - Kw / [H+]
	3) [H+] = CHCl + Kw

<table>
<tr><td>**3**</td><td style="color:red">**A method for the determination of Ni in a nickel ore is known to yield results precise to within 0.6%. How many independent analytical results must be obtained and averaged, in order to obtain a result precise to within 0.2%.**</td></tr>
</table>

Question type	Multiple Choice
Topic	Data Analysis
Difficulty	1/3
Score	3.30
Score max	1
Answer choosen	9

Answer	0) 9
	1) 3
	2) 4
	3) 12

Question type	Multiple Choice
Topic	Data Analysis
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	Achievement of a linear relation between the analytical signal and the concentration of the analyte.
Answer	0) Increasing the analytical signal as much as possible.
	1) Improvement of the signal-to-noise ratio.
	2) Achievement of a linear relation between the analytical signal and the concentration of the analyte.
	3) Reduction of the measurement time.

5 **The true mean of a series of normally distributed measurements is 20.0 and the relative standard deviation is known to be 1.0%. Which one of the following ranges is expected to embrace about 95% of the measurements?**

Question type	Multiple Choice
Topic	Data Analysis
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	19.2 to 20.8
Answer	0) 19.8 to 20.2
	1) 19.6 to 20.4
	2) 19.4 to 20.6
	3) 19.2 to 20.8

6 An instrumental technique and the standard known addition method are applied for the quantification of the unknown concentration CX of the compound X in an aqueous sample solution. P0 is the analytical signal obtained by a direct measurement and P1 is the analytical signal after increasing the concentration of X in the sample by DCX.
Assuming that the analytical signal always remains proportional to the concentration of X, that the known addition does not change significantly the sample volume and referring to the concentration measures A and B shown in the figure, indicate which one of the following expressions gives the unknown concentration CX?

Question type	Multiple Choice
Topic	Data Analysis
Difficulty	1/3
Score	0.00

Score max	1
Answer choosen	CX = B
Answer	0) CX = A
	1) CX = A + B
	2) CX = B - A
	3) CX = B

7	A mixture of n-pentane and n-octane is injected into a gas-chromatograph. Which one of the following chromatograms is the most probable to be obtained?

Question type	Multiple Choice
Topic	Separation Chromatographic Methods
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	Chromatogram C.
Answer	0) Chromatogram A.
	1) Chromatogram B.
	2) Chromatogram C.
	3) Chromatogram D.

8	Which of the following detectors is the most sensitive one for use in UV/Vis spectrophotometry?

Question type	Multiple Choice
Topic	Spectrochemical Methods
Difficulty	1/3

Score	0.00
Score max	1
Answer choosen	The photoconductor.
Answer	0) The photomultiplier tube.
	1) The phototube.
	2) The photodiode.
	3) The photographic film.
	4) The photoconductor.

9 **The determination of inorganic species by UV/Vis spectrophotometry is generally done by one of the following procedures:**

Question type	Multiple Choice
Topic	Spectrochemical Methods
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	Indirectly but always after its complexation with inorganic ligands.
Answer	0) Directly, since all inorganic ions and molecules show strong absorbance in the UV/Vis region.
	1) Indirectly but always after its complexation with inorganic ligands.
	2) Indirectly, and most often after derivatization or complexation with chromogenic organic compounds.

3) Directly, but only after very careful

adjustment of the pH of the solution.

| 10 | **Which one of the following materials is more appropriate for the construction of a cell for measurements in the IR-range of the spectrum?** |

Question type	Multiple Choice
Topic	Spectrochemical Methods
Difficulty	1/3
Score	0.00
Score max	1
Answer choosen	Common glass
Answer	0) KBr
	1) Quartz
	2) Common glass
	3) Poly(styrene)
	4) None of the above

| 11 | **When an Internal Standard is used in a quantification technique, then if PX and PS are the measured signals for the analyte (X) and the internal standard (S) respectively, the resulting calibration graph used is usually a plot of:** |

Question type	Multiple Choice
Topic	Data Analysis
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	PX vs. [X] / [S].

Answer

0) (PX / PS)   vs.   [X].

1) PX   vs.   [X] / [S].

2) (PS / PX)   vs.   [X].

3) (PX / PS)   vs.   [X] / [S].

4) { (PX + PS) / PS }   vs.   [X].

12	The standard deviation of the results obtained by making 3 measurements of the concentration of Al(III) in a natural water sample by a fluorometric method is 0.5 mg/L. Calculate the minimum number of individual analyses required in order to reduce this standard deviation to 0.2 mg/L or less? Minimum number of individual analyses for each final result:

Question type	Numeric
Text	
Topic	Data Analysis
Difficulty	2/3
Score	0.0
Score max	1
Answer choosen	proteins
Answer	0) 19.0

13	Measurements of fluoride activity with a fluoride-ion selective electrode require careful control of pH of the measured samples/standards because: (a) HF is a relatively weak acid and (b) hydroxide-anions contribute to the developed potential. Which one of the curves A-D shown in the figure is expected to describe best the effect of pH on the potential of the electrode during the measurement of a dilute solution of a fluoride salt?

Question type	Multiple Choice
Topic	Electrochemical Methods
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	Curve A.
Answer	0) Curve A.
	1) Curve B.
	2) Curve C.
	3) Curve D.

14 **The relative intensity of the light source and the relative sensitivity of the detector linked with a spectrophotometer are shown in the figure. In which one of the following spectral regions are expected more precise absorbance measurements?**

Question type	Multiple Choice
Topic	Spectrochemical Methods
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	400-500 nm
Answer	0) 300-400 nm
	1) 400-500 nm
	2) 500-600 nm
	3) 600-700 nm

| 15 | A volume Vw of an aqueous solution of compound X is extracted n times with a volume Vo of a water-immiscible organic solvent. If D is the distribution ratio of X between the organic phase and the aqueous phase, the fraction fn of X remaining in the aqueous phase after n consecutive extractions is given by which equation: |

Question type	Multiple Choice
Topic	Separation Chromatographic Methods
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	
Answer	0)
	1)
	2)
	3)
	4)

| 16 | The commonly used backbone of ion-exchange resins is cross-linked polystyrene, prepared by co-polymerization of styrene and p-divinylbenzene (see figure, X: the ion-exchange group). Which one of the following properties of the resulting polymeric resin is affected by the ratio of these two monomers in the resin? |

Question type	Multiple Choice
Topic	Separation Chromatographic Methods

Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	The ion-exchange capacity of the resin.
Answer	0) The possibility to separate ions of the same electric charge.
	1) The solubility of the resin in water.
	2) The resistance of the resin towards strongly acidic or basic solutions.
	3) The grain-size of the resin.
	4) The ion-exchange capacity of the resin.

17 **Molecular iodine (I2) can easily be extracted from an aqueous solution by a water immiscible solvent such as n-hexane. The efficiency of this extraction is influenced by the presence of iodide ions (I-) in the aqueous phase. The equilibria involved are shown below:**

Which one of the following expressions describes the distribution ratio (D) of I2 in the system n-hexane:water? KD is the distribution constant of I2 in this system and [I-]w is the concentration of free iodide in the aqueous phase.

Question type	Multiple Choice
Topic	Separation Chromatographic Methods
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	not ok

0) D = KD / (1 + Kf [I-]w)

1) D = (KD + 1) / Kf [I-]w

2) D = Kf / (KD + Kf [I-]w)

3) D = KD (1 + Kf) / [I-]w

18 **A solution containing Na2CO3 and NaHCO3 is titrated with 0.100 M HCl and the titration curve shown in the figure was obtained. What was the molar ratio Na2CO3:NaHCO3 in this solution?**

Question type	Multiple Choice
Topic	Classical Analysis
Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	1:2
Answer	0) 1:1
	1) 2:1
	2) 1:2
	3) 2:3

19 **In each of three different experiments, 25.0 mL of a 0.0100 M Ca2+ solution are titrated with a 0.0100 M EDTA solution, resulting in the titration curves C1, C2 and C3 shown in the figure.**
Which one experimental parameter would change in the sequence of experiments?

Question type	Multiple Choice
Topic	Classical Analysis

Difficulty	2/3
Score	0.00
Score max	1
Answer choosen	The concentration of ethanol in the titrated solution increases from exp. 1 to exp. 3.
Answer	0) The pH of the titrated solution increases from exp. 1 to exp. 3. 1) The concentration of a competing complexant decreases from exp. 1 to exp. 3. 2) The ionic strength of the titrated solution decreases from exp.1 to exp. 3. 3) The concentration of ethanol in the titrated solution increases from exp. 1 to exp. 3. 4) The concentration of the metallochromic indicator decreases from exp. 1 to exp. 3.

20 **The thermogravimetric analysis of a sample of hydrated copper sulfate crystals (CuSO4 . xH2O) resulted the thermogram shown in figure.**

The graph demonstrates 3 steps of the loss of the water of hydration.

Calculate the value of x from the total mass loss. x =

Question type	Numeric
Text	
Topic	Miscelleanous
Difficulty	2/3
Score	0.0
Score max	1
Answer choosen	proteins
Answer	0) 5.0

21 **Synchronous scanning fluorometry is a technique sometimes used when analysing complex sample solutions. On which one of the following working protocols relies this technique?**

Question type	Multiple Choice
Topic	Spectrochemical Methods
Difficulty	3/3
Score	0.00
Score max	1
Answer choosen	The excitation wavelength and the emission wavelength are both fixed and the signal is monitored as the power of the light source is continuously increased/decreased.
Answer	0) The excitation wavelength is maintained at

a fixed value while the emission wavelength is continuously changed and monitored.

1) The emission wavelength is maintained at a fixed value while the excitation wavelength is continuously changed and monitored.

2) A constant difference between the excitation and emission wavelengths is maintained while the two wavelengths are continuously increased/decreased.

3) The excitation wavelength and the emission wavelength are both fixed and the signal is monitored as the power of the light source is continuously increased/decreased.

22	**Which one of the following is true for a Fourier Transform (FT) spectrometer?**

Question type	Multiple Choice
Topic	Spectrochemical Methods
Difficulty	3/3
Score	0.00
Score max	1
Answer choosen	FT-spectrometers require the use of a solid-state type radiation detector.
Answer	0) No monochromator is needed in a FT-spectrometer.
	1) FT-spectrometers require the use of a solid-state type radiation detector.

2) FT- spectrometers use only a pulsed-type light source (e.g. laser).

3) The wavelength resolving power of an FT-spectrometer is much higher than that of a conventional-type spectrometer.

4) Spectra obtained with an FT-spectrometer cover a much wider range of wavelengths compared to those obtained with conventional spectrometers.

| 23 | **The figure below shows three voltammographic scans obtained with aqueous samples containing a certain electroactive compound. Which one of the following parameters was altered and resulted in the change of the shape of the obtained voltammograms from 1 to 3?** |

Question type	Multiple Choice
Topic	Electrochemical Methods
Difficulty	3/3
Score	0.00
Score max	1
Answer choosen	The pH of the tested solutions was increased.
Answer	0) The scanning rate of the potential was increased.

1) The active surface of the working electrode was increased.

2) The pH of the tested solutions was increased.

3) The concentration of the electroactive

compound was increased.

| 24 | **The determination of traces of Zn(II) in the presence of relatively high concentrations of Cu(II) by Anodic Stripping Voltammetry usually fails unless special measures are taken. Which of the following explanations is applicable?** |

Question type	Multiple Choice
Topic	Electrochemical Methods
Difficulty	3/3
Score	0.00
Score max	1
Answer choosen	Zn is much more electropositive than Cu and Cu(II) species oxidize the deposited Zn.
Answer	0) Stable intermetallic compounds between Zn and Cu are formed.
	1) Zn is much more electropositive than Cu and Cu(II) species oxidize the deposited Zn.
	2) The working electrode is coated with metallic Cu, which lowers the hydrogen overpotential thus inhibiting the deposition of Zn.
	3) Cu catalyses the reduction of water and the hydrogen evolved inhibits the deposition of Zn.

| 25 | **The mean diffusion limited current of a polarographic wave is given by the Ilkovic equation:** |

id(mean) $= 607nD^{1/2} m^{2/3} t^{1/6} C^*$

where n is the number of electrons participating in the electrode reaction, D is the diffusion coefficient of the electroactive species (in cm2/s), m is the flow rate of Hg (in mg/s), t is the Hg drop time (in s), and C* is the bulk concentration of the electroactive species (in mmol/L).

If the Hg drop size remains the same and the Hg drop time is reduced to half its previous value, the average current will be:

Question type	Multiple Choice
Topic	Electrochemical Methods
Difficulty	3/3
Score	3.30
Score max	1
Answer choosen	(21/2)id(mean)
Answer	0) (21/2)id(mean)
	1) (2-1/6)id(mean)
	2) (22/3)id(mean)
	3) (2-1/2)id(mean)
	4) (2-1/3)id(mean)

26 What is the underlying principle on which pulse voltammetric techniques are based and show higher sensitivities compared to the conventional techniques based on linear potential scans? (WE: working electrode)

Question type	Multiple Choice
Topic	Electrochemical Methods

Difficulty	3/3
Score	3.30
Score max	1
Answer choosen	The possibility to discriminate faradaic from capacitive currents due to the faster decay of the latter after a step change of the imposed in WE potential.
Answer	0) The possibility to discriminate faradaic from capacitive currents due to the faster decay of the latter after a step change of the imposed in WE potential.
	1) Step potential changes imposed on the WE cause the development of extremely high but brief faradaic current peaks.
	2) The sharp increase of the negative charge accumulated in the double layer of the WE during a step potential change attracts more electroactive cations.
	3) The electroactive species are subjected to successive reduction/oxidation cycles so they are repeatedly used thus enhancing thus the current flowing through the cell.

27	**Partial Least Squares (PLS) regression and Principal Component Regression (PCR) are two important chemometric techniques. In this respect, which one of the following statements is correct?**

Question type	Multiple Choice
Topic	Data Analysis
Difficulty	3/3
Score	0.00
Score max	1
Answer choosen	In PLS, variables which show only a partial correlation with the response variables are given extra weight.
Answer	0) In PCR, the principal components are chosen so that they describe as much of the variation in the predictors as possible, irrespectively of the strengths of the relationships between the predictor and response variables.
	1) In PLS, variables which show only a partial correlation with the response variables are given extra weight.
	2) PLS can only be applied when the response consists of a single variable.
	3) PCR requires that the number of predictor variables is the same as or less than the number of calibration specimens.

28 **For a set of analytical data, the median is considered as a robust statistic compared to the mean. Which one of the following statements is correct?**

Question type	Multiple Choice

Topic	Data Analysis
Difficulty	3/3
Score	0.00
Score max	1
Answer choosen	The use of the median is recommended when the statistical distribution is not known.
Answer	0) The median is more resistant to the presence of outliers.
	1) The median is calculated algorithmically (sorting of data is required), whereas the mean is given by an explicit function.
	2) The use of the median is recommended when the statistical distribution is not known.
	3) The use of the median is preferable to the use of the mean in cases of drifting results.

29 A volume of 100 mL of a 0.0519 M Zn(II) aqueous solution was subjected to four consecutive extractions with 25 mL of toluene each time (containing 10% v/v tributylphosphate). At the end it was found that the aqueous phase contained 0.0060 M zinc. Calculate the distribution ratio, D, of Zn(II) between the two solvents.

D =

Question type	Numeric
Text	
Topic	Separation Chromatographic Methods
Difficulty	3/3

Score	0.0
Score max	1
Answer choosen	proteins
Answer	0) 2.86

30	**Which one of the following acid-base titration techniques provides precise and accurate results regardless of the strength of the acid (or base), when it is titrated with a strong base (or acid)?**

🏴

Question type	Multiple Choice
Topic	Miscelleanous
Difficulty	3/3
Score	3.30
Score max	1
Answer choosen	Thermometric titration.
Answer	0) Thermometric titration.
	1) Conductimetric titration.
	2) Photometric titration.
	3) Potentiometric titration.
	4) Coulometric titration.