

Part one (計分方式請見第4頁 Part Two)

Multiple Choice Questions

- The activity coefficients will
 - Always decrease with increase of ionic strength of solution.
 - Decrease with increase of ionic strength of solution first and then above a certain ionic strength it starts to increase with the increase of ionic strength of solution.
 - Increase above an ionic strength of approximately 1 M for most compound.
 - Of gases is called fugacity coefficient and will deviated from unity if the gas behavior is not an ideal gas.
 - Always will be unity for natural compound with all ion strength.
- The pH value of 2.0×10^{-7} M HCl solution is (a) 6.74. (b) 6.85. (c) 7.0. (d) 7.38.
- The over potential will not be influenced by
 - The material of electrode.
 - The concentration of reactants.
 - The temperature of reaction solution.
 - The surface area of electrode.
 - The desired reaction rate.
- Concentration polarization decreases the voltage of a galvanic cell and increases the magnitude of the voltage for electrolysis. Which of the following methods can decrease the concentration polarization?
 - Raise the temperature of reaction solution.
 - Increase stirring.
 - Increase electrode surface area.
 - Change ionic strength.
- What will be the pH value of a solution made by mixture of 10 mL 0.020 M NH_4Cl ($\text{p}K_a = 9.244$) and 0.032 M $(\text{CH}_3)_3\text{N}$ ($\text{p}K_a = 4.200$)?
 - 9.50
 - 9.81
 - 10.13
 - 1050
- Derivatization reactions are often used in preparation samples for chromatographic separation, which of the following statements are not the advantages of these reaction?
 - For increasing the detection sensitivity.
 - For increasing separation resolution.
 - For increasing the application range of chromatographic analysis.
 - For decreasing the analytes reaction with the separation column.
 - None of above
- Which of following gas chromatographic detector are nondestructive type?

(背面仍有題目,請繼續作答)

- (a) Flame ionization detector
(b) Flame photometric detector
(c) Thermo-conductance detector
(d) Nitrogen-phosphor detector
(e) Mass spectrometry detector
8. Which of the following factors will not influence the analyte retention time?
(a) The phase ratio of the separation column.
(b) The solvent strength of mobile phase or column temperature.
(c) The polarity of stationary phase.
(d) The mobile phase average speed.
(e) None of above.
9. A gas chromatographic column was used to separate a pair of compounds. The retention time for these two compound were 11.56 minutes and 11.71 minutes respectively. If the mobile phase dead time is 1.60 minutes and the plate height of this column was 0.28 mm under the separation condition, what are the column lengths (in meter) and peak width (in seconds) should be if they need to be totally resolved?
(a) 50 m, 6.5s (b) 55 m, 6.5s (c) 50 m, 7.5s (d) 55 m, 7.5s
10. Which of the following statements about electrophoresis are incorrect?
(a) The speed of electroosmotic flow (EOF) is proportional to the zeta potential of the electric double layer developed at the inner surface wall of fused-silica tubing.
(b) The speed of EOF is inversely proportional to the dielectric constant of the buffer solution.
(c) The speed of EOF is inversely proportional to the viscosity of the buffer solution.
(d) The EOF has a parabolic profile across the tube.
(e) The natural compounds can be separated by capillary gel electrophoresis.
11. A monochromater had a focal length of 0.65 m was equipped with an echellette grating of 2000 blazes per millimeter. If 3.0 centimeter of the grating were illuminated, please calculate the reciprocal linear dispersion (in nm/mm), resolving power, minimum difference of wavelength (in nm) can be resolved and slit width (in μm) of the instrument for the first-order spectra at approximately 560 nm.
(a) 0.77 nm/mm, 6.0×10^4 , 0.0093 nm, 0.012 μm .
(b) 0.57 nm/mm, 6.0×10^4 , 0.0063 nm, 0.012 μm .
(c) 0.57 nm/mm, 7.0×10^3 , 0.0093 nm, 0.022 μm .
(d) 0.77 nm/mm, 7.0×10^3 , 0.0063 nm, 0.022 μm .

12. Photomultiplier tube is used as a photon detector in what wavelength range?
- (a) 200 nm to 600 nm
 - (b) 400 nm to 900 nm
 - (c) 500 nm to 1200 nm
 - (d) 600 nm to 1500 nm
13. Which of the following radiation transducer is the most sensitive one?
- (a) Cds photoconductivity cell
 - (b) GaAs photovoltaic cell
 - (c) Photomultiplier tube
 - (d) Silicon photodiode
14. What kinds of ionic sources can be used in time of flight mass spectrometer?
- (a) electron impact
 - (b) field desorption
 - (c) electro spray ionization
 - (d) matrix assisted laser desorption/ionization
 - (e) fast atom bombardment and/or liquid secondary ionization
15. Laboratory samples of solids often contain water that is equilibrium with the atmosphere. Which of the following water should not be the type of nonessential water that contained in solid sample?
- (a) Adsorbed water.
 - (b) Sorbed water.
 - (c) Occluded water.
 - (d) Constituted water.
 - (e) Crystallized water.
16. Which of the following pipets should not be used for preparing of a standard solution of phenanthrene in pentane?
- (a) Volumetric pipet.
 - (b) Eppendorf micropipette.
 - (c) Ostwald-Folin pipet.
 - (d) Mohr pipet.
17. Which of the following statements are correct?
- (a) Relative standard deviation is used to measure the data precision.
 - (b) Relative errors are usually caused by the system error.
 - (c) Random errors usually affect the precision of data.
 - (d) Relative error can be reduced by increasing experiment number.
18. Which of the following test are used for determine system error?
- (a) Blank test.
 - (b) Duplicate test.
 - (c) Standard reference material test.
 - (d) Standard addition recover test.
19. Which of the following experiment procedures can be used for determine organic compound in sample?
- (a) Solid phase extraction.
 - (b) Acid digestion.
 - (c) Microwave extraction.
 - (d) Purge and trap.
20. Which of following reagents can be used for preparation of sand samples for

determining their metal content?

- (a) Nitric acid. (b) Aqua regia. (c) Sulfuric acid. (d) Hydrofluoric acid.

Part two

A: Scores for each question

3%: 2, 5, 7, 18, 19.

5%: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17.

7%: 9, 11, 13, 15, 20.

**答錯部分倒扣

Total: 5 questions

Total: 10 questions

Total: 5 questions

B: Equations:

$$R_s = \frac{\sqrt{N}}{4} \left(\frac{\alpha - 1}{\alpha} \right) \left(\frac{k_B}{1 + k_B} \right) \dots \dots \dots (1)$$

$$N = 16 \left(\frac{t_R}{W} \right)^2 \dots \dots \dots (2)$$

$$D^{-1} = \frac{d}{nF} \dots \dots \dots (3)$$

$$\Delta\lambda_{\text{eff}} = wD^{-1} \dots \dots \dots (4)$$

$$R = \frac{\lambda}{\Delta\lambda} = nN \dots \dots \dots (5)$$