Standard method	31	27	26	35	23	31	33	
New method	26	22	23	30	24	28	30	25

Determine whether the precision of the new method differs significantly from that of the standard method. The critical value of F for 7 degrees of freedom is 2.13.

7. a) Briefly discuss the classification of analytical methods.   3+3+4=10
   b) Write a note on the categories of laboratory hazards.
   c) What are the sources of error in decomposition and dissolution?

8. a) Write briefly the instrumentation of Differential Thermal Analysis.   3+4+3=10
   b) Write a short note on the principle of Scanning Electron Microscopy.
   c) Discuss the applications of Atomic Absorption Spectroscopy.

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M.Sc. CHEMISTRY
FIRST SEMESTER
ANALYTICAL CHEMISTRY
MSC-101
(Use separate answer scripts for Objective & Descriptive)

Duration : 3 hrs.   Full Marks : 70

(**PART-A : Objective**)

Time : 20 min.   Marks : 20

Choose the correct answer from the following: *1x20=20*

1. Ostwald dilution law is applicable to:
   a. Strong electrolyte   b. Weak electrolyte
   c. Non-electrolyte   d. Strong and weak electrolyte

2. In which of the following case the reaction go farthest to completion?
   a. $K=10^2$ b. $K=10$
   c. $K=10^{-2}$ d. $K=1$

3. What will be the effect of pressure for a reaction in the state of equilibrium, if number of gaseous moles of reactant and product are same?
   a. Proceeds in forward direction   b. Proceeds in backward direction
   c. Reaction stop   d. No effect

4. The value of ΔG for a reaction in the state of equilibrium is:
   a. 1   b. Positive
   c. Negative   d. Zero

5. The unit of rate constant for a zero order reaction is:
   a. $molL^{-1}sec^{-1}$ b. sec^{-1}
   c. $molL^{-1}$ d. $mol^{-1}Lsec^{-1}$

6. Due to common ion effect, the dissociation of.................. is suppressed.
   a. Strong electrolyte   b. Weak electrolyte
   c. Ionic compound   d. Covalent compound

7. The equivalent mass of H_2SO_4?
   a. 98   b. 48   c. 49   d. 97

8. The unit of molality is:
   a. $Molkg^{-1}$ b. $Molkg$
   c. $MolL^{-1}$ d. None of these

9. 2mol $CaCO_3$=
   a. 200g   b. 100g   c. 300g   d. 250g

10. 0.5 mol NaCl=
    a. 6.02×10^{23} b. 3.01×10^{23}
    c. 6.02×10^{25} d. None of these

11. The mean of a distribution is 14 and the standard deviation is 5. What is the value of the coefficient of variation?
    a. 60.4%   b. 48.3%   c. 35.7%   d. 27.8%

12. For an instrument the degree of repeatability or reproducibility in measurements is an alternative way of expressing its:
 a. Precision
 b. Accuracy
 c. Linearity
 d. Sensitivity

13. The significant figures in the number 0.032040 is:
 a. 1
 b. 3
 c. 5
 d. 6

14. Which of the following error is caused by poor calibration of instrument?
 a. Random error
 b. Gross error
 c. Determinate error
 d. Precision error

15. In wet ashing, the decomposition process converts the organic sample to:
 a. CO_2 and CH_4
 b. CO_2 and N_2
 c. CO_2 and H_2O
 d. CH_4 and CO

16. The error that occurs when the weighing curve shifts by a constant amount is called:
 a. Sensitivity error
 b. Zero error
 c. Random error
 d. Linearity error

17. The measure of the systematic or determinate error of an analytical method is provided by:
 a. Precision
 b. Bias
 c. Sensitivity
 d. Selectivity

18. The role of condenser lens of scanning electron microscopy is to:
 a. Fire electrons at the sample.
 b. Narrow the electron beam.
 c. Control the diameter of the electron beam being passed.
 d. None of the above.

19. In flame photometer, the separation of all atoms in a chemical substance is called:
 a. Atomization
 b. Vaporization
 c. Excitation
 d. Emission

20. The two emission systems, FAES and ICP-AES, differ in the way atomic species are:
 a. Created
 b. Emitted
 c. Created and emitted
 d. Created and excited

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(**PART-B : Descriptive**)

Time : 2 hrs. 40 min.   Marks : 50

[Answer question no.1 & any four (4) from the rest]

1. a) The equilibrium constant for a reaction is 18.5 at 925 K and 9.25 at 1000 K. Calculate the enthalpy of reaction. *3+2+2+3=10*
   b) When 20g $CaCO_3$ dissolved in 90mL water calculate the mole fraction for both the component.
   c) Distinguish between systematic and random errors. Give an example of each type of error.
   d) Write briefly about the applications of thermogravimetry.

2. a) Derive the integrated rate expression for second order reaction, when two different reactants are involved. *6+4=10*
   b) A first order reaction is 40% complete in 50 minutes. Calculate the value of the rate constant? In what time will the reaction be 80% complete?

3. a) What is common ion effect? *2+4+4=10*
   b) Derive the relationship between equilibrium constant Kp and K_c.
   c) What will be the equilibrium constant K_c for the following reaction at 400 K?

   $$2\ NOCl\ (g) \rightleftharpoons 2\ NO\ (g)\ +\ Cl_2\ (g)$$

   Given, ΔH= 77.2 KJ/mol, ΔS= 122 $JK^{-1}mol^{-1}$ at 400 K.

4. a) What is diverse ion effect? *2+2+3+3=10*
   b) State Ostwald dilution law.
   c) A weak monobasic acid is found to be 4% ionized at 0.1 M concentration. Calculate the value of the ionization constant?
   d) At 500 °C, the equilibrium constant for the reaction is 6.02×10^{-2} lit^2mol^{-2}. What will be the value of K_p at the same temperature?

   $$N_2\ (g)\ +\ 3\ H_2(g) \rightleftharpoons 2\ NH_3(g)$$

5. a) Calculate the mass percent of element present in $C_6H_{12}O_6$. *2+3+2+3=10*
   b) Define molarity, molality, and equivalent mass of salt.
   c) Find the charge of 27g of Al^{3+} ions in coulombs.
   d) What weight of AgCl will be precipitated when a solution containing 4.77g NaCl is added to a solution of 5.77 g of $AgNO_3$?

6. a) Explain the terms: Precision, Standard deviation, Confidence limit and Q-test. *6*
   b) Two set of results, in mg/litre, one set obtained by a standard method and the other set by a new method are given below: *4*