

Aptitude Test

1. Cordite, an explosive material is prepared from:
 - (a) 93% Nitro-glycerine and 7% Gun-cotton
 - (b) Cool mixture of HNO_3 and H_2SO_4
 - (c) Gelatinized combination of Nitro-glycerine and Nitro-cellulose
 - (d) 79% Potassium Chloride and 21% Nitro-benzol

2. Consider the following materials:
 1. Sand
 2. Granite
 3. Clay Brick
 4. Steel

What is the correct sequence in the increasing order of their bulk density?

- (a) 1, 3, 2 and 4
- (b) 3, 1, 2 and 4
- (c) 1, 3, 4 and 2
- (d) 3, 4, 1 and 2

3. The equation: $\lambda = \frac{h}{m \cdot v} = \frac{h}{p}$ describes:

where: λ is the wavelength of the particle, h is the Plank's constant and p is the momentum of the particle

- (a) Sommerfeld's relative atomic model
- (b) Bohr's Quantum atomic model
- (c) Thomson's Plum pudding atomic model
- (d) De-Broglie's atomic model

4. Which one of the following is **not** a neutral refractory material?

- (a) Carbon
- (b) Bauxite
- (c) Chromite
- (d) Dolomite

5. Flint glass is also called as:

- (a) Soda-lime glass
- (b) Potash- lime glass
- (c) Potash- lead glass
- (d) Borosilicate glass

6. The yield of concrete per bag of cement for a concrete mix of 1: 2: 4 proportions is nearly:
- (a) $0.18 m^3$
 - (b) $0.16 m^3$
 - (c) $0.14 m^3$
 - (d) $0.12 m^3$
7. Which one of the following minerals is *not* found in the sedimentary rocks?
- (a) Calcite
 - (b) Gypsum
 - (c) Magnesite
 - (d) Feldspar
8. Which one of the following oils is the commonly used as vehicle of a paint?
- (a) Nut oil
 - (b) Linseed oil
 - (c) Poppy oil
 - (d) Tung oil
9. Which one of the following is an example for a biodegradable plastic?
- (a) Polybutadienehydroxide
 - (b) Chlorofluorocarbon
 - (c) Polyhydroxyalkanoate
 - (d) Melamine formaldehyde

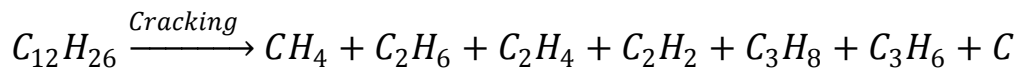
10. Bitumen completely dissolves in which one of the following solvents?
- (a) Water
 - (b) Carbon monoxide
 - (c) Carbon dioxide
 - (d) Carbon bisulphide
11. Which one of the following gases is having the composition of: $CH_4 = 70\%-90\%$, $C_2H_6 = 05\%-10\%$, $H_2 = 03\%$ and $CO + CO_2 = \text{rest}$?
- (a) Coal gas
 - (b) Oil gas
 - (c) Natural gas
 - (d) Producer gas
12. Which of the following are the properties of *CNG*?
- 1. It ignites at a higher temperature
 - 2. The conversion is very easy
 - 3. The operating cost is much lower
 - 4. Combustion of this gas leads to more *CO* emission
 - 5. Emission contain no unregulated pollutants
- (a) 1, 2, 3 and 4 only
 - (b) 1, 3, 4 and 5 only
 - (c) 1, 2, 3 and 5 only
 - (d) 2, 3, 4 and 5 only

13. Consider the following steps for manufacturing of coal gas:

1. The gas is scrubbed by passing through a hydraulic main
2. Coal is carbonized in absence of air about 1300°C
3. Tar and ammonia, present in the gas are removed by scrubbing with water in a scrubber
4. Tar is removed by cooling the gas in a huge water cooled heat exchanger called condenser
5. The gas is freed from hydrogen sulphide by passing it over moist ferric oxide, contained in a purifier
6. The cooled gas is then scrubbed with creosote oil which dissolves benzol and naphthalene

What is the correct sequence of steps occurred?

- (a) 2, 1, 4, 3, 6 and 5
 - (b) 1, 2, 4, 3, 5 and 6
 - (c) 1, 2, 3, 4, 5 and 6
 - (d) 2, 3, 1, 3, 6 and 5
14. Consider the following reaction:



Which one of the following gas can be manufactured by above reaction?

- (a) Coal gas
- (b) Water gas
- (c) Producer gas
- (d) Oil gas

15. Consider the following zones for the production reaction of producer gas:

1. Ash zone
2. Reduction zone
3. Distillation zone
4. Combustion zone

What is the correct sequence of order for production?

- (a) 1, 4, 2 and 3
 - (b) 3, 4, 2 and 1
 - (c) 1, 4, 3 and 2
 - (d) 3, 2, 4 and 1
16. When a mixture of combustible gases, CO and H_2 , with a little non-combustible gases, CO_2 and N_2 is made by passing alternatively steam and little air through a bed of red hot coal or coke maintained at about $900^\circ C$ to $1000^\circ C$ in a reactor, consisting of a steel vessel, about 3 m wide and 4 m high, the gas produced would be :
- (a) Oil gas
 - (b) Coal gas
 - (c) Producer gas
 - (d) Water gas

17. Consider the following statements with reference to the *water gas*:
1. In order to enhance calorific value of water gas, it is carburetted by adding gaseous hydrocarbons
 2. Its calorific value is about $6,500 \text{ Kcal/m}^3$
 3. It is employed for heating and illumination purpose
 4. It contains about 55% of hydrogen

Which of the above statements are correct?

- (a) 1 and 4 only
 - (b) 2 and 4 only
 - (c) 1 and 3 only
 - (d) 2 and 3 only
18. What is the significance of '*Saponification Number*'?
- (a) To determine the materials that may cause abrasion and wear
 - (b) To ascertain whether the oil under reference is animal and vegetable oil or mineral oil or a compounded oil containing mineral and vegetable oils
 - (c) To determine free acid present in the oil
 - (d) To judge the suitability of a lubricant under conditions of very high pressure
19. When oil is cooled slowly, the temperature at which it becomes hazy in appearance is called its:
- (a) Flash point
 - (b) Fire point
 - (c) Pour point
 - (d) Cloud point

20. The percentage of asphalt present in oil is known as:

- (a) Neutralization number
- (b) Saponification number
- (c) Emulsification number
- (d) Precipitation number

21. The Van der Waals equation of state for a gas is:

- (a) $\left[P + \frac{a}{v^2}\right][v + b] = \bar{R}T$
- (b) $\left[P + \frac{a}{v^2}\right][v - b] = \bar{R}T$
- (c) $\left[P - \frac{a}{v^2}\right][v - b] = n\bar{R}T$
- (d) $\left[P - \frac{a}{v^2}\right][v + b] = n\bar{R}T$

22. If the standard efficiency of the thermodynamics cycle is given by:

$$\eta = 1 - \frac{T_4 - T_1}{\gamma (T_3 - T_2)}$$

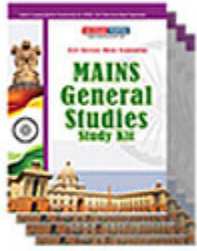
The cycle is:

- (a) Diesel cycle
- (b) Brayton cycle
- (c) Otto cycle
- (d) Atkinson's cycle

23. The theoretical amount of air required for the complete combustion of 1 kg of acetylene (C_2H_2) to CO_2 and H_2O is:
- (a) 11.4 kg
 - (b) 13.2 kg
 - (c) 15.4 kg
 - (d) 17.2 kg
24. Solar energy is used to warm the collector plate. $1880 \text{ kJ/m}^2 \text{ h}$ of energy is collected when the plate is operated at $90^\circ C$. For an atmospheric temperature $20^\circ C$ and producing 1 kW of useful shaft power, the minimum area required for the collector plate is:
- (a) 20 m^2
 - (b) 15 m^2
 - (c) 10 m^2
 - (d) 5 m^2
25. A cold storage is to be maintained at $-5^\circ C$, while the surrounding temperature is $35^\circ C$. The heat leakage from the surroundings into the storage is estimated to be 29 kW . The actual COP of the refrigeration plant is $\frac{1}{3}$ that of an ideal plant. The power required to drive the plant is:
- (a) 19 kW
 - (b) 17 kW
 - (c) 15 kW
 - (d) 13 kW

26. What is the correct sequence of the following substances in the increasing order with their triple point temperature?
- (a) Nitrogen < Hydrogen < Oxygen < Argon < Water
 - (b) Hydrogen < Argon < Nitrogen < Oxygen < Water
 - (c) Nitrogen < Oxygen < Hydrogen < Argon < Water
 - (d) Hydrogen < Oxygen < Nitrogen < Argon < Water
27. In the Orsat apparatus the relative proportions of the measured three gases are:
- (a) CO_2 , O_2 and CO
 - (b) CO_2 , SO_2 and CO
 - (c) CO , O_2 and N_2
 - (d) CO , N_2 and CO_2
28. The commonly used gaseous coolants in refrigeration are:
- (a) Ammonia, Sulphur dioxide, Carbon dioxide and Hydrogen
 - (b) Nitrogen, Nitrogen dioxide, Carbon dioxide and Freon
 - (c) Ammonia, Sulphur dioxide, Carbon dioxide and Freon
 - (d) Nitrogen, Sulphur dioxide, Nitrogen dioxide and Hydrogen

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29. An e.m.f. in a thermocouple with the test junction at $t^\circ C$ on gas thermometer scale and reference junction at ice point is:

$$e = 0.20 t - 5 \times 10^{-4} t^2 \text{ mV}$$

The millivoltmeter is calibrated at ice and steam points. When the gas thermometer reads $50^\circ C$, the thermocouple will read:

- (a) $60.66^\circ C$
(b) $58.33^\circ C$
(c) $56.66^\circ C$
(d) $54.33^\circ C$
30. In a mercury manometer, if the difference in the height of mercury of two limbs is 562 mm , barometer reads 761 mm Hg , acceleration due to gravity is 9.79 m/s^2 and the density of mercury is $13,640 \text{ kg/m}^3$. The gas pressure will be:
- (a) 183 kPa
(b) 177 kPa
(c) 173 kPa
(d) 169 kPa
31. A compound with empirical formula $C_6H_{11}Cl$ has a molecular weight of 237. Its molecular formula will be:
- (a) $C_6H_{11}Cl$
(b) $C_{12}H_{11}Cl$
(c) $C_{12}H_{22}Cl_2$
(d) $C_6H_{22}Cl_{12}$

32. An organic compound (0.5 g) was Kjeldahlized and the ammonia evolved was absorbed in 50 ml of 1N H_2SO_4 which required 60 ml of $\frac{N}{2}$ NaOH for neutralization at the end of the operation. The nitrogen content in the compound will be:
- (a) 49 %
 - (b) 56 %
 - (c) 42 %
 - (d) 35 %
33. Two or more atoms of same or similar electronegativity achieve noble gas configuration by sharing of electrons is called as:
- (a) Ionic bonding
 - (b) Covalent bonding
 - (c) Metallic bonding
 - (d) Coordinate bonding
34. When the stretching frequency of a carbon-carbon double bond is 1650 cm^{-1} , the stretching frequency of a carbon-carbon triple bond is:
- (a) 2013 cm^{-1}
 - (b) 2015 cm^{-1}
 - (c) 2021 cm^{-1}
 - (d) 2027 cm^{-1}

35. The quality of a motor fuel relates to its rate of:
- (a) Combustion in an internal engine
 - (b) Premature ignition in an internal engine
 - (c) Ignition in an internal combustion engine
 - (d) Combustion in an internal combustion engine
36. 0.183 g of an aromatic monobasic acid is required for 15 ml of N/10 *Sodium Hydroxide* solution for exact neutralization. The molecular weight of the acid will be:
- (a) 112
 - (b) 122
 - (c) 128
 - (d) 138
37. When 7.00 mg of a liquid hydrocarbon is burned and found to yield 21.58 mg of CO_2 and 9.94 mg of H_2O , the mass percent of carbon and hydrogen in the original sample are:
- (a) 84.14 % and 13.43 %
 - (b) 74.14 % and 13.43 %
 - (c) 84.14 % and 15.86 %
 - (d) 74.14 % and 15.86 %

38. Which one of the following is used in the quantitative determination of elemental composition called elemental analysis?
- (a) Melting point
 - (b) Combustion
 - (c) Boiling point
 - (d) Temperature
39. What is the wavelength of the resonance line of the sodium atom if the excitation energy of the resonance level is 2.10 eV and with $hc = 12,330$?
- (a) 567.2 nm
 - (b) 573.7 nm
 - (c) 587.2 nm
 - (d) 593.7 nm
40. Consider the following statements regarding the principle of microscopic reversibility:
1. Forward and reverse reactions must have the same intermediates
 2. Forward and reverse reactions must have the same products and reactants
 3. Forward and reverse reactions must have the same rate-limiting transition states
 4. A catalyst must accelerate a reaction in forward and reverse direction
- Which of the above statements are correct?
- (a) 1, 2 and 3 only
 - (b) 1, 2 and 4 only
 - (c) 1, 3 and 4 only
 - (d) 1, 2, 3 and 4

41. Which one of the following chemical conversion reaction will be adopted in the process of 'Acylation'?
- (a) Electrolysis
 - (b) Esterification
 - (c) Double decomposition
 - (d) Fermentation
42. Consider the following characteristics of chemical conversions during their manufacturing:
- 1. Each chemical conversion is one of a family of numerous individual reactions that are similar in energy change, reaction pressure and /or temperature, reaction time, equilibrium or raw materials
 - 2. Frequently there is factory segregation wherein a building is devoted to making single product by means of a single type of chemical conversions
 - 3. Where production is small or products variable, equipment may be conveniently and economically transferred from the making of one chemical to that of another based on the same chemical conversion
 - 4. Since the basis of chemical conversion classification is a chemical one, stress is placed on the chemical reaction

Which of the above statements are correct?

- (a) 1, 2 and 3 only
- (b) 1, 3 and 4 only
- (c) 1, 2 and 4 only
- (d) 2, 3 and 4 only

43. '*Calcination*' reaction will be carried out by:
- (a) Pyrolysis
 - (b) Isomerisation
 - (c) Reduction
 - (d) Nitration
44. The role of '*Recording Instruments*' in the chemical process and control is:
- (a) To present the current data only
 - (b) To present the deviation from a norm only
 - (c) To permit study and analysis
 - (d) To present the current data and deviation from a norm
45. Which of the following are the benefits of research in chemical process industries?
- 1. New and improved process
 - 2. Variable cost of products
 - 3. Services and products never become known
 - 4. Domination by foreign control
 - 5. Adequate supply of materials previously obtained only as byproducts
 - 6. Stabilization of business and industrial employment
- (a) 1, 3, 5 and 6 only
 - (b) 1, 2, 4 and 5 only
 - (c) 2, 3, 4 and 5 only
 - (d) 2, 4, 5 and 6 only

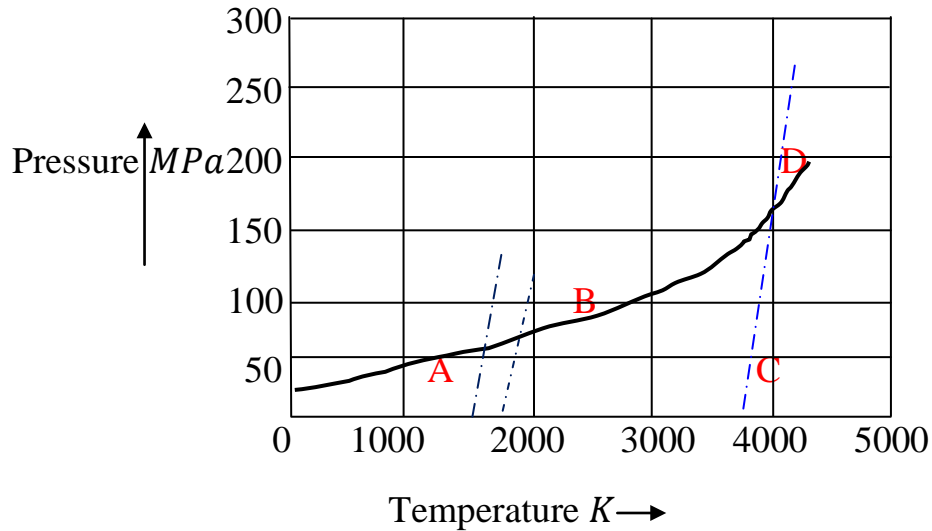
46. In which one of the following process, the natural gas is cracked to carbon black and hydrogen, at 1100°C to 1650°C in a refractory lined furnace in two cycle operation?
- (a) Channel black process
 - (b) Thermal black process
 - (c) Oil furnace process
 - (d) Black smoke process
47. Consider the following statements regarding chemical process industries:
- 1. It can be used as decolorant
 - 2. It is having a great surface area and pore volume
 - 3. It can be used in solution purification
 - 4. It can remove the taste and odors from water, vegetable oils, alcoholic beverages, chemicals and pharmaceuticals

The above properties are observed in:

- (a) Activated sludge
- (b) Activated carbon
- (c) Activated bone black
- (d) Coal powder

48. What is the correct sequence of steps involved in manufacturing of graphite?
1. Coke is selected and shipped to the graphite plant
 2. Calcined materials are carefully analyzed
 3. Green electrodes are baked at 900°C to carbonize the binder and furnish amorphous electrodes
 4. Graphite is shipped to industrial demands and the scrap is powdered
 5. Carbon materials is calcined to volatilize impurities
 6. Calcined materials are ground, screened, weighted, mixed with binder, formed by moulding into green electrodes and arranged in the furnace
 7. Amorphous electrodes are graphitized in the electric furnace at high temperature
- (a) 1, 5, 3, 6, 2, 7, and 4
- (b) 4, 5, 3, 6, 2, 7, and 1
- (c) 1, 5, 2, 6, 3, 7, and 4
- (d) 4, 5, 2, 6, 3, 7, and 1

49. The 'Diamond farming' region in the following nickel carbon system is:



- (a) Region A
- (b) Region B
- (c) Region C
- (d) Region D

50. The air quality act in chemical process industries is provided for:

1. Additional research efforts and funds
 2. Additional state and regional grant programs
 3. National ambient air quality standards to be set by the government
 4. Complete designation of air quality control regions
- (a) 1, 2 and 3 only
 - (b) 1, 2 and 4 only
 - (c) 2, 3 and 4 only
 - (d) 1, 2, 3, and 4

51. When a suitable fraction from petroleum distillation (C_{12} and higher) is heated at high temperature ($500^{\circ}C$) in the presence of a catalyst the molecules break apart and rearrange to smaller, more highly branched alkanes having 5-10 carbon atoms. This process is called as:
- (a) Thermal cracking
 - (b) Catalytic cracking
 - (c) Octane rating
 - (d) Knocking
52. High speed engines require:
- (a) Same octane value fuel
 - (b) High octane value fuel
 - (c) Low octane value fuel
 - (d) Average octane value fuel
53. Which one of the following will act as a catalyst for selectoforming (a mild hydrogenation process) in petroleum refining?
- (a) Non-metals
 - (b) Non-noble metals
 - (c) Noble metals
 - (d) Transition metals

54. Hydrocracking is a process of cracking in the presence of:
- (a) Water
 - (b) Hydrogen
 - (c) Hydroxide
 - (d) Hydrides
55. Propane has a heat of vaporization of 101.8 cal/g at -42.1°C , and its critical constant is 96.7°C . The heat of vaporization at 80°C will be:
- (a) 50.4 cal/g
 - (b) 45.6 cal/g
 - (c) 40.4 cal/g
 - (d) 35.6 cal/g
56. Graphite is being used for rocket nozzles, and wing leading edges and nose cones of reentry vessels because of its:
- (a) Light weight and good mechanical strength at extremely high temperature
 - (b) Use with practically all mineral acids, salts solutions, alkalies and organic compounds
 - (c) Easy machining qualities, together with its availability in many size and shapes
 - (d) High thermal conductivity

57. Catalytic cracking is the most widely used refinery process for converting:
- (a) Light oils into gasoline of high octane value
 - (b) Light oils into gasoline of low octane value
 - (c) Heavy oils into gasoline of high octane value
 - (d) Heavy oils into gasoline of low octane value
58. H-Oil process is used for:
- (a) Desulphurizing and demetallising residua as well as produce low sulfur cat cracker feed stocks
 - (b) Desulphurizing and metallising residua as well as produce low sulfur cat cracker feed stocks
 - (c) Sulphurizing and metallising residua as well as produce low sulfur cat cracker feed stocks
 - (d) Desulphurizing and demetallising residua as well as produce high sulfur cat cracker feed stocks
59. Pure, strong phosphoric acid is manufactured from elementary phosphorous by:
- (a) Oxidation and hydration
 - (b) Oxidation and dehydration
 - (c) Oxidation, reduction and hydration
 - (d) Oxidation and hydroxylation

60. Aniline point of Diesel fuel is defined as:
- (a) The maximum temperature at which equal volumes of anhydrous aniline and oil mix together
 - (b) The maximum temperature at which unequal volumes of anhydrous aniline and oil mix together
 - (c) The minimum temperature at which equal volumes of anhydrous aniline and oil mix together
 - (d) The minimum temperature at which unequal volumes of anhydrous aniline and oil mix together
61. The ratio of heat transfer rate with fin to the heat transfer rate without fin is:
- (a) Fin conductance
 - (b) Fin efficiency
 - (c) Fin resistance
 - (d) Fin effectiveness
62. A 60 W lamp buried in soil ($k = 0.83\text{ W/mK}$) at 0°C is switched on. The soil temperature at 0.3 m away from the lamp at steady state is:
- (a) 18°C
 - (b) 19°C
 - (c) 20°C
 - (d) 21°C

63. An equation $Re = \frac{\rho u_m D}{\mu}$ with usual notations will be used for the calculation of:
- (a) Critical Reynolds number for flow over a flat plate
 - (b) Reynolds number in pipe flow
 - (c) Flow and heat transfer in a non circular duct, where D_h is hydraulic diameter
 - (d) Reynolds analogy for momentum and heat transfer for turbulent flow
64. The ratio of the buoyancy force to the viscous force acting on the fluid is:
- (a) Nusselt number
 - (b) Reynolds number
 - (c) Grashof number
 - (d) Prandtl number
65. Water flows with a velocity of 2.44 m/s through a tube having 2.54 cm inner diameter and 6.08 cm long. The head lost due to friction is 1.22 m of water. With the values of $\rho = 998 \text{ kg/m}^3$ and $C_p = 4.187 \text{ kJ/kg K}$, the surface heat transfer coefficient based on Reynolds analogy will be nearly:
- (a) $17.6 \text{ kW/m}^2 \text{ K}$
 - (b) $19.5 \text{ kW/m}^2 \text{ K}$
 - (c) $21.4 \text{ kW/m}^2 \text{ K}$
 - (d) $23.3 \text{ kW/m}^2 \text{ K}$

66. Consider the following statements with reference to dropwise condensation during heat and mass transfer:
1. Vapour condenses on the surface in the form of drops, and consequently a large part of cooling surface is always bare to vapour for undergoing condensation
 2. The rate of heat transfer is many times larger than what is achieved in film condensation
 3. It occurs on a non-wettable cooling surface where the liquid condensate drops do not spread

Which of the above statements are correct?

- (a) 1 and 2 only
 - (b) 1 and 3 only
 - (c) 2 and 3 only
 - (d) 1, 2 and 3
67. Consider the following statements regarding heat transfer coefficient for laminar flow:
1. When the buoyancy forces are in the same direction as the external forces, they increase the rate of heat transfer
 2. When the external and buoyancy forces act in opposite directions, the heat transfer is increased

Which of the above statements is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

68. Consider the following statements regarding velocity distribution in turbulent flow through pipe:

1. No fundamental theory is yet available to determine the velocity distribution
2. Empirical and semi-empirical relations are used to correlate the velocity field in turbulent flow

Which of the above statement is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

69. A very thin layer at the wall where viscous shear stress dominates is known as:

- (a) Buffer sublayer
- (b) Viscous sublayer
- (c) Turbulent sublayer
- (d) Buffer layer

70. Consider the following statements regarding rotating cylinders in heat and mass transfer:
1. Heat transfer by convection between a rotating body and a surrounding fluid is of importance in the thermal analysis of flywheels, turbine rotors and other rotating components of various machines
 2. With the heat transfer, a critical velocity is reached when the circumferential speed of the cylinder surface becomes approximately equal to the upward natural convection velocity at the side of heated stationary cylinder
 3. At speeds greater than critical the peripheral speeds Reynolds number becomes the un-controlling parameter

Which of the above statements are correct?

- (a) 1, 2 and 3
 - (b) 1 and 3 only
 - (c) 1 and 2 only
 - (d) 2 and 3 only
71. Consider the following conditions regarding ideal washing liquid:
1. It should have no dispersive action on the precipitate
 2. It should form volatile or insoluble product with the precipitate
 3. It should be easily volatile at the drying temperature of the precipitate
 4. It should have solvent action on the precipitate

Which of the above conditions are complying ideal washing liquid?

- (a) 1 and 4 only
- (b) 1 and 3 only
- (c) 2 and 4 only
- (d) 2 and 3 only

72. Consider the following procedure in chemical analysis:

1. Reduction of particle size
2. Mixing for homogeneity
3. Drying
4. Determination of sample weight or volume

During which one of the following stages the above procedure will be used in chemical analysis?

- (a) Sampling
- (b) Preparation of analytical sample
- (c) Dissolution of sample
- (d) Removal of interferences

73. Consider the following criteria regarding analytical method:

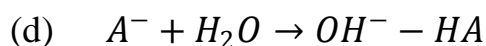
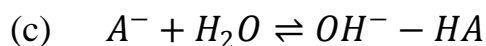
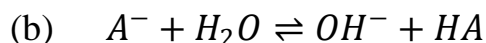
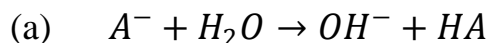
1. The type of analysis required: elemental or molecular, routine or occasional
2. Problems arising from the nature of the material to be investigated
3. Possible interference from components of the material other than those of interest
4. No need to investigate concentration range

Which of the above criteria require careful consideration to the choice of analytical method?

- (a) 1, 2 and 4 only
- (b) 1, 2 and 3 only
- (c) 1, 3 and 4 only
- (d) 2, 3 and 4 only

74. When metal ions are converted in to chelate compounds by treatment with suitable organic reagents; the resulting complexes are soluble in organic solvents and can be extracted from the aqueous solution. This method is known as:
- (a) Selective precipitation
 - (b) Selective oxidation
 - (c) Solvent extraction
 - (d) Ion exchange
75. A substance that alters the rate of a reaction without itself undergoing any net change is:
- (a) Metal
 - (b) Catalyst
 - (c) Non-metal
 - (d) Polymer
76. Sodium ethanoate is derived from:
- (a) Strong acids and strong base
 - (b) Weak acids and strong base
 - (c) Strong acids and weak base
 - (d) Weak acids and weak base

77. The equilibrium in a dilute solution of salt, mass action (MA) may be represented as:



78. What is the solubility product of silver chromate when its solubility is $2.5 \times 10^{-2} \text{ gL}^{-1}$ and $Ag_2CrO_4 \rightleftharpoons 2Ag^+ + CrO_4^{2-}$?

(a) $1.7 \times 10^{-13} \text{ mol}^3\text{L}^{-3}$

(b) $1.2 \times 10^{-13} \text{ mol}^3\text{L}^{-3}$

(c) $1.7 \times 10^{-12} \text{ mol}^3\text{L}^{-3}$

(d) $1.2 \times 10^{-12} \text{ mol}^3\text{L}^{-3}$

79. Consider the following statements for reducing the systematic errors in chemical quantitative analysis:

1. Calibration of apparatus and application of corrections
2. Running of blank determination
3. Running a control determination
4. Running parallel determinations

Which of the above statements are correct?

(a) 1, 2 and 3 only

(b) 1, 2 and 4 only

(c) 1, 3 and 4 only

(d) 1, 2, 3 and 4

80. Aqua regia is:

- (a) 75 *vol* % Hydrochloric acid and 25 *vol* % Nitric acid
- (b) 75 *vol* % Sulfuric acid and 25 *vol* % Nitric acid
- (c) 75 *vol* % Hydrochloric acid and 25 *vol* % Sulfuric acid
- (d) 25 *vol* % Sulfuric acid and 75 *vol* % Nitric acid

81. For systems in which no termination is involved, as in the case of 'Living Polymers', an expression for the degree of polymerization can be found on the basis of:

- 1. The entire quantity of the initiator dissociation at the same time
 - 2. All the anions formed by the dissociation initiate chain growth essentially simultaneously
 - 3. All the anion compete equally for the monomer and the monomer is consumed more or less equally by all the anions
 - 4. The entire quantity of the monomer dissociation at the same time
- (a) 1, 3 and 4 only
 - (b) 1, 2 and 4 only
 - (c) 2, 3 and 4 only
 - (d) 1, 2 and 3 only

82. Consider the following statements regarding polymerization:

1. A high degree of polymerization can be achieved only at very low conversions and low temperatures
2. A high degree of polymerization can be achieved only at very high conversions
3. It is essential to start with exactly equimolar quantities of the reactants to achieve a high degree of polymerization
4. The presence of monofunctional impurities drastically reduces the degree of polymerization

Which of the above statements are correct?

- (a) 1, 2 and 3 only
- (b) 1, 2 and 4 only
- (c) 2, 3 and 4 only
- (d) 1, 3 and 4 only

83. The average degree of polymerization D_p can be correlated as:

1. $D_p = 2v$, when termination occurs by coupling
2. $D_p = 2v/N$, when termination occurs by coupling and disproportionation
3. $D_p = v$, when termination occurs by disproportionation
4. $D_p = v/N$, when termination occurs by disproportionation

Which of the above statements are correct?

- (a) 1, 2 and 3 only
- (b) 1, 2 and 4 only
- (c) 1, 3 and 4 only
- (d) 2, 3 and 4 only

84. The kinetic chain length ν is:

(a)
$$\frac{k_p [M]}{(k_d k_t f [I])^{\frac{1}{2}}}$$

(b)
$$\frac{k_p [M]}{2(k_d k_t f [I])^{\frac{1}{2}}}$$

(c)
$$\frac{k_p [M]}{3(k_d k_t f [I])^{\frac{1}{2}}}$$

(d)
$$\frac{k_p [M]}{(k_d k_t f [I])}$$

85. The osmotic pressure (π) of a polymer solution is related to the number-average molecular weight of the polymer by the relation:

(a)
$$\left(\frac{\pi}{RTC}\right)_{C \rightarrow 0} = \frac{1}{M_n}$$

(b)
$$\left(\frac{\pi}{RTC}\right)_{C \rightarrow 1} = \frac{1}{M + M_n}$$

(c)
$$\left(\frac{\pi}{RTC}\right)_{C \rightarrow \alpha} = \frac{1}{M_n}$$

(d)
$$\left(\frac{\pi}{RTC}\right)_{C \rightarrow \alpha - 1} = \frac{1}{M_n}$$

86. Dilatometric method is used to measure:

(a) Viscosity

(b) Atoms

(c) Expansion of coefficient of sample

(d) Accurate measurements of dimensional changes of polymeric samples

87. Which one of the following is used as the chain modifier in order to control the molecular weight in polymerization of butadiene?
- (a) Zeigler-Natta catalyst
 - (b) Dodecyl mercaptan
 - (c) Polybutadienes
 - (d) Syndiotactic 1, 2-Polybutadiene
88. Natural rubber is obtained in the form of latex from rubber tree called:
- (a) Acacia nilotica
 - (b) Bauhinia retusa
 - (c) Hevea brasiliensis
 - (d) Holarrhena floribunda
89. Ziegler-Natta catalysts are:
- (a) Single-component organometallic compounds
 - (b) Initiators of polymer catalyst
 - (c) Special type of coordination catalyst
 - (d) Resonance-stabilized polymer catalyst
90. In Group Transfer Polymerization (*GTP*), which one of the following pair functions as group transfer catalyst?
- (a) Ethyl trimethyl silyl acetate and trimethyl silyl cyanide
 - (b) α, β -unsaturated esters and nitrites
 - (c) Ethyl methyl silyl cyanide and methyl ethyl silyl acetate
 - (d) Carbonamides silyl cyanide and ketene

91. According to British Gas Engineers Handbook, the maximum allowed gas concentration of CO_2 , CO and H_2S in the environment are:
- (a) 5000 ppm, 200 ppm and 40 ppm
 - (b) 3000 ppm, 200 ppm and 20 ppm
 - (c) 5000 ppm, 100 ppm and 20 ppm
 - (d) 3000 ppm, 100 ppm and 40 ppm
92. In coal mining production of CH_4 gas by in-situ gasification, the reactions take place in three reaction zones, are:
- (a) Oxidation, reduction and hydrolysis
 - (b) Oxidation, reduction and pyrolysis
 - (c) Reduction, hydration and pyrolysis
 - (d) Reduction, hydration and hydrolysis
93. Coal, in its natural state in the seam is usually a material with low permeability and it is formed in layers under:
- (a) Low pressure and only by supplying oxygen at high pressure
 - (b) Great pressure only
 - (c) Low pressure and only by supplying oxygen at low pressure
 - (d) Great pressure and only by supplying oxygen at low pressure

94. Which one of the following coals is hard in nature, have little porosity, low reactivity as well as low volatile matter content with fixed carbon present in the coal ranges as high as 92% - 98%, semi metallic, ignite with difficulty and burns with short flame without smoke?
- (a) Anthracite coal
 - (b) Semi bituminous coal
 - (c) Bituminous coal
 - (d) Lignite or brown coal
95. Depolymerization of coal is accomplished by:
- (a) Oxidation, reduction and hydrogenation of reactive solvents
 - (b) Hydrogenation, oxidation, reduction and reactive solvents
 - (c) Oxidation, reduction and reactive solvents
 - (d) Hydrogenation, pyrolysis, oxidation and reactive solvents
96. The two steps acid treatments for the demineralization of coal are:
- (a) Aqua-regia to remove all metal salts and then is followed by a HCl treatment
 - (b) NH_4OH to remove all metal salts and then is followed by a HF treatment
 - (c) H_2SO_4 to remove all metal salts and then is followed by a HCl treatment
 - (d) HCl to remove all metal salts and then is followed by a HF treatment

97. Equilibrium moisture in coal is defined as, an amount of moisture contained in coal at:
- 30° C in a relative humidity of 96%-97%
 - 38° C in a relative humidity of 86%-87%
 - 46° C in a relative humidity of 76%-77%
 - 52° C in a relative humidity of 66%-67%
98. In acetylene production from coal by plasma process, the efficiency of the process depends upon:
- Physical nature, non-volatile matter content and oxygen percentage in the coal
 - Particle size, volatile matter content and oxygen percentage in the coal
 - Physical nature, volatile matter content and carbon dioxide percentage in the coal
 - Particle size, volatile matter content and carbon dioxide percentage in the coal
99. Which of the following procedures must *not* be conducted in platinum apparatus during quantitative chemical analysis?
- Fusion with sodium carbonate or fusion mixture
 - Evaporation with hydrochloric acid
 - Heating with Aqua regia
 - Heating with liquid mixtures which evolve bromine or iodine
- 1 and 2 only
 - 2 and 3 only
 - 3 and 4 only
 - 1 and 4 only

100. A 5% solution of K_2SO_4 with an electrode area A of 2.54 cm^2 having a distance between electrodes (L) of 0.65 cm has a specific conductance w of 0.178 ohm and with density of 1.0. The equivalent conductance of the solution will be:

- (a) $75.8 \text{ ohms/geq/cm}^2$
- (b) $71.8 \text{ ohms/geq/cm}^2$
- (c) $69.7 \text{ ohms/geq/cm}^2$
- (d) $65.7 \text{ ohms/geq/cm}^2$



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