

Virtual University of Pakistan

CHE201

Physical Chemistry

MCQs for Finals

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Course Instructor

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CHE-201 MCQ's FOR FINALS PREPARATION

- 1) The study of the underlying physical principles that govern the properties and behavior of chemical systems.
 - a) Thermodynamics
 - b) Physics
 - c) Physical chemistry**
 - d) Analytical chemistry
- 2) ----- is based on the concept of molecules.
 - a) Macroscopic viewpoint**
 - b) Microscopic viewpoint
- 3) ----- large-scale properties of matter explicit use of the molecule concept.
 - a) Microscopic viewpoint
 - b) Macroscopic viewpoint**
- 4) ----- is the study of heat, work, energy, and the changes they produce in the states of systems.
 - a) Physical chemistry
 - b) Thermodynamics**
 - c) Chemistry
 - d) Analytical chemistry
- 5) Thermodynamics studies the relationships between the -----properties of a system
 - a) Macroscopic**
 - b) Microscopic
- 6) Independent of molecular theories of structures?
 - a) Equilibrium thermodynamics**
 - b) Irreversible thermodynamics
- 7) A non-isolated system is in equilibrium when the following conditions hold
 - a) The system's macroscopic properties remain constant with time
 - b) Removal of the system from contact with its surroundings causes no change in the properties of the system
 - c) Both a and b**
 - d) None
- 8) A homogeneous part of a system is called
 - a) Equilibrium
 - b) Phase**
 - c) Open system
 - d) Closed system
- 9) -----thermodynamic property is one whose value is equal to the sum of its values for the parts of the system.
 - a) Intensive
 - b) Extensive**
- 10) Volume, mass are examples of
 - a) Extensive thermodynamic property**

- b) Intensive thermodynamic property
 - c) Both
 - d) None
- 11) Density and pressure are examples of
- a) Extensive thermodynamic property
 - b) Intensive thermodynamic property**
 - c) Both
 - d) None
- 12) Values given to the thermodynamic property of an equilibrium state of thermodynamic system is called.
- a) Phase
 - b) State function
 - c) Intensive property
 - d) extensive property
- 13) Heat and work are not state functions. This statement is...
- a) True**
 - b) False
- 14) The pressure force always acts on a surface in a direction ----- or normal to the surface.
- a) Parallel
 - b) Perpendicular**
 - c) Horizontal
 - d) Vertical
- 15) 1atm = -----
- a) 101.325 kpa
 - b) 1001.326 kpa
 - c) 100 kpa
 - d) 99.34 kpa
- 16) The standard C-12 is used since
- a) 1961**
 - b) 1981
 - c) 1982
 - d) 1962
- 17) Avogadro's number of 12 C atoms has a mass of
- a) 6.02×10^{23}
 - b) 12 g**
 - c) 10 g
 - d) 6.02 g
- 18) The average mass of an atom is called
- a) Atomic mass**
 - b) Molecular mass
 - c) Avogadro's number
 - d) Molecular weight
- 19) The average mass of a molecule is called

- a) Atomic mass
 - b) Molecular mass**
 - c) Avogadro's number
 - d) Molecular weight
- 20) The mass per mole of a pure substance is called
- a) Atomic mass
 - b) Molecular mass
 - c) Molar mass**
 - d) Avogadro's number
- 21) Molar mass is expressed in
- a) g/mol**
 - b) Gram-mol
 - c) g/mol²
 - d) None
- 22) When we do calculations we assume that our gases are behaving as
- a) Real gases
 - b) Ideal gases**
- 23) Who is considered the father of chemistry
- a) Robert Boyle**
 - b) Jacques Charles
- 24) If the pressure = 0 then Boyles law hold for it
- a) True
 - b) False**
- 25) Boyles law holds for
- a) Real gases**
 - b) Ideal gases
 - c) Both
 - d) None
- 26) Relation between n and V is shown by
- a) Charles law
 - b) Avogadro's hypothesis**
 - c) Boyle's law
 - d) None
- 27) The energy change associated with a chemical reaction is called
- a) Internal energy
 - b) Enthalpy**
 - c) Heat
 - d) Work
- 28) $\Delta S_{\text{universe}} = \Delta S_{\text{system}} + \Delta S_{\text{surroundings}} > 0$ this equation show a
- a) Spontaneous process**
 - b) Equilibrium process
 - c) Both
 - d) None

- 29) Entropy of a perfect crystalline substance is zero at absolute zero defines
- 1st law of thermodynamics
 - 2nd law of thermodynamics**
 - 3rd law of thermodynamics**
 - 0th law of thermodynamics
- 30) What is the importance of third law?
- Allows to measure absolute temperature
 - Allows to measure absolute entropies**
 - Allows to measure absolute pressure
 - Allows to measure absolute volume
- 31) Entropy is measures in
- J/K**
 - J/mol
 - JK
 - All
- 32) Third law is helpful in measuring chemical affinity. Because of this it is known as
- Nernst theorem**
 - Phase equilibrium
 - None
- 33) Enthalpy is measured in
- J/K
 - J/mol
 - KJ
 - All
- 1) The quantitative study and measurement of heat and enthalpy changes is known as
- Thermodynamics
 - Thermochemistry**
 - Analytical chemistry
 - All
- 2) Enthalpy is a state function when
- Pressure is not constant
 - Volume is constant
 - Pressure is constant**
 - Volume is not constant
- 3) Thermochemical equation tells about the changes that take place in terms of
- Formulas
 - Physical states
 - Both**
 - None
- 4) What is the normal enthalpy of vaporization water
- 40.7 kJ / mol**
 - 40.7kJ/mol
 - 41.7 kJ/mol

- d) 42 kJ/mol
- 5) In the case of dissolved substances, the standard state of a solute is that in which the “effective concentration”, known as the-----, is -----
- a) Negativity , 1
 - b) Positivity , 2
 - c) **Activity , unity**
 - d) None
- 6) The heat associated with the formation of one mole of the compound from its elements in their standard states.
- a) **Enthalpy of formation**
 - b) Enthalpy of vaporization
 - c) Enthalpy of combustion
 - d) Enthalpy
- 7) Enthalpy of formation of water is
- a) 286 kJ /mol
 - b) **-286kJ /mol**
 - c) 280kJ/ mol
 - d) 268kJ /mol
- 8) The thermochemical equation defining H_f° is always written in terms of ----- of the substance.
- a) Two moles
 - b) Three moles
 - c) Four moles
 - d) **One mole**
- 9) The standard enthalpy of formation of gaseous atoms from the element is known as----- .
- a) Heat of combustion
 - b) Heat of formation
 - c) **Heat of atomization**
 - d) Heat of vaporization
- 10) The standard enthalpy of formation of an ion dissolved in water is expressed on a separate scale in which that of $H^+(aq)$ is defined as
- a) **Zero**
 - b) One
 - c) Two
 - d) Three
- 11) Henri Hess discovered his law in
- a) 1850
 - b) 1830
 - c) 1880
 - d) **1840**
- 12) Hess's law state that
- a) Enthalpy of a given chemical reaction is not constant
 - b) **Enthalpy of a given chemical reaction is constant**

- c) Enthalpy of a given chemical reaction is variable.
d) All statements are true
- 13) 13. $\text{C}(\text{graphite}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) \quad \Delta H^\circ = -(\quad) \text{ kJ mol}^{-1}$
a) **-393.51**
b) 393.51
c) 390.51
d) -395.40
- 14) 14. $\text{C}(\text{diamond}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) \quad \Delta H^\circ = -(\quad) \text{ kJ mol}^{-1}$
a) -393.51
b) 393.51
c) 390.51
d) **-395.40**
- 15) 15. $\text{C}(\text{graphite}) \rightarrow \text{C}(\text{diamond}) \quad \Delta H^\circ = (\quad) \text{ kJ mol}^{-1}$
a) -393.51
b) 393.51
c) **1.89**
d) -395.40
- 16) 16. $q = \Delta H^\circ$ when both reactants and products have same
a) **Temperature**
b) Pressure
c) Volume
d) Option b and c
- 17) 17. The specific heat capacity of water (----- $\text{J g}^{-1} \text{ K}^{-1}$)
a) **4.184**
b) 5.184
c) 6.184
d) 3.184
- 18) 18. Combustion takes place in bomb calorimeter at
a) 1 atm
b) 2 atm
c) 3 atm
d) 4 atm
- 19) 19. In bomb calorimeter volume is
a) **Constant**
b) Variable
c) Change with time
d) Not observed
- 20) 20. Bomb calorimeter is used to determine the
a) Heat capacity
b) **Heat of combustion**
c) Heat of formation
d) Enthalpy
- 21) 21. Ice calorimeter is used to determine

- a) **Heat capacity**
 - b) Heat of combustion
 - c) Heat of formation
 - d) Enthalpy
- 22) 22. In ice calorimeter volume is
- a) Not Constant
 - b) **Variable**
 - c) Change with time
 - d) Not observed
- 23) 23. Expressed in units of thermal energy per degree temperature.
- a) **Heat capacity**
 - b) Heat of formation
 - c) Enthalpy
- 24) 24. Amount of heat needed to raise the system's temperature by one degree is called
- a) Heat of fusion
 - b) Heat of formation
 - c) Enthalpy
 - d) **Heat capacity**
- 25) 25. $q = \Delta T \times C \times m$ this equation expresses the
- a) Enthalpy
 - b) Heat
 - c) **Quantity of heat**
- 26) 26. In latent heat of vaporization temperature
- a) Changes
 - b) **Does not change**
 - c) Sometimes change
- 27) 27. In latent heat of fusion temperature
- a) Changes
 - b) **Does not change**
 - c) Sometimes change
- 28) 28. Substances change from solid to liquid and liquid to solid in
- a) specific latent heat of vaporization
 - b) **specific latent heat of fusion**
 - c) Both
 - d) None
- 29) 29. Substances change from gas to liquid and liquid to gas in
- a) **specific latent heat of vaporization**
 - b) specific latent heat of fusion
 - c) Both
 - d) None
- 30) 30. Throttling is a ----- process
- a) Reversible
 - b) **Irreversible**

- c) Both
- 31) 31. Mechanical friction occurring during a process due to some external source.
- a) External reversibility
 - b) Internal irreversibility
 - c) **External irreversibility**
 - d) Internal reversibility
- 32) 32. Unrestricted expansion of gas, viscosity and inertia of the gas.
- a) External reversibility
 - b) **Internal irreversibility**
 - c) External irreversibility
 - d) Internal reversibility
- 33) 33. Release of free energy from the system corresponds to a negative change in free energy, but to a positive change for the ----- in spontaneous change .
- a) **Surroundings**
 - b) System
 - c) Free energy
 - d) Reaction
- 34) 34. If a sufficiently large number of individual interactions are involved, then the direction will always be in the direction of---
- a) Decreased enthalpy
 - b) **Increased entropy**
 - c) Both
 - d) None
- 35) 35. The rate of reaction in spontaneous process depends on
- a) Spontaneity
 - b) **Chemical kinetics**
 - c) Stability
 - d) All of them

- 1) A spontaneous process is non spontaneous in the ----- direction
- a) Forward
 - b) **Reverse**
 - c) In between
 - d) Both a and b
- 2) In endergonic reaction the standard change in free energy is ----- and energy is ----- .
- a) **Positive , absorbed**
 - b) Negative, released
 - c) Negative , absorbed
 - d) positive ,released
- 3) The total amount of energy of non spontaneous reaction is
- a) Positive
 - b) At equilibrium

- c) **Negative**
 - d) None
- 4) In which state of reaction there is no net change over time ?
- a) Reversible reaction
 - b) Spontaneous reaction
 - c) **At equilibrium**
 - d) Forward reaction
- 5) The equilibrium constant is used to determine the----- of each compound that present at equilibrium.
- a) **Amount**
 - b) Units
 - c) Rate
 - d) Energy
- 6) K_c changes with temperature. This is ----
- a) **True**
 - b) False
- 7) K_c is written
- a) With units
 - b) **Without units**
 - c) None
- 8) If $K < 1$ then it favors
- a) **Reactants**
 - b) Products
 - c) Will be at equilibrium
 - d) None
- 9) If $Q > K_c$ then which reaction will occur
- a) Forward
 - b) **Reverse**
- 10) If $Q < K_c$ then which reaction will occur
- a) **Forward**
 - b) Reverse
- 11) If ΔG is negative then the reaction will be
- a) Non spontaneous
 - b) **Spontaneous**
 - c) Both
- 12) If ΔG is negative then
- a) K would be very small
 - b) **K would be very large**
 - c) Both
- 13) If ΔG is positive then the reaction will be
- a) **Non spontaneous**
 - b) Spontaneous
 - c) Both

- 14) At standard conditions activities of all reactants and products is not equal to unity .
a) **True**
b) False
- 15) If ΔG is positive then the----- reaction will be spontaneous.
a) **Reverse**
b) Forward
c) Equilibrium
- 16) The Gibbs-Helmholtz equation provides information about the ----- dependence of the Gibbs free energy.
a) Pressure
b) Volume
c) **Temperature**
- 17) Activity is more accurate in more ---- solutions
a) Dilute
b) **Concentrated**
c) Mix
d) All of above
- 18) Fugacity is the measure of
a) Ideality of liquid
b) Non ideality of solutions
c) **Non ideality of gases**
d) Ideality of gases
- 19) Determines the real chemical potential for a real solution rather than an ideal one.
a) Fugacity
b) **Activity**
c) Ideality
d) Non ideality
- 20) ----- can be used to calculate equilibrium constants and reaction rates.
a) Activity
b) Concentration
c) **Both**
d) None
- 21) Dealing with more concentrated solutions, the difference in the observed concentration and the calculated concentration in equilibrium -----.
a) Remains constant
b) Decreases
c) **Increases**
d) Becomes diluted
- 1) Measure of the relative amounts of products and reactants present in a reaction at a given time.
a) Reaction concentration
b) **Reaction quotient**
c) Equilibrium constant

- d) All of above
- 2) Q can be calculated when the reaction is at
 - a) Equilibrium
 - b) Not at equilibrium
 - c) **Both**
 - d) None
- 3) $Q > K$, this suggests that we have more-----present than we would have at equilibrium.
 - a) Reactants
 - b) **Products**
- 4) $Q > K$, this will favors the
 - a) Forward reaction
 - b) **Reverse reaction**
 - c) Equilibrium reaction
 - d) None
- 5) Determine how the equilibrium constant for a reaction or process will vary with temperature.
 - a) **Van't Hoff equation**
 - b) Gibbs free energy
 - c) Henry's law
 - d) Le Chatelier's principle
- 6) At constant pressure, a plot with $\ln K_{eq}$ on the y-axis and $1/T$ on x-axis has a slope given by.
 - a) $\Delta H / R$
 - b) H / R
 - c) $-\Delta R / H$
 - d) **$-\Delta H / R$**
- 7) What is considered the origin of Le Chatelier's principle?
 - a) **Van't Hoff equation**
 - b) Gibbs free energy
 - c) Henry's law
- 1) For an endothermic reaction, the slope $-\Delta H / R$ is negative and so as the temperature ----- the equilibrium constant ----- .
 - a) Increases, decreases
 - b) Decreases, increases
 - c) **Increases, increases**
 - d) Decreases, decreases
- 2) For an exothermic reaction, the slope $-\Delta H / R$ is ----- and so as temperature increases, the equilibrium constant -----
 - a) Negative, decreases
 - b) **Positive, decreases**
 - c) Positive, increases
 - d) Negative, increases
- 3) The van't Hoff equation provides information about the ----- dependence of the equilibrium constant.
 - a) Pressure

- b) **Temperature**
 - c) Volume
- 4) Gibbs-Helmholtz equation, which gives the temperature dependence of the -----
- a) **Gibbs free energy**
 - b) Equilibrium constant
 - c) Both
 - d) Temperature
- 5) Principle which states that any change to a system at equilibrium will adjust to compensate for that change.
- a) **Le Châtelier's**
 - b) Henry's law
 - c) Van't Hoff equation
 - d) None
- 6) When did the principle of Le Châtelier's principle was given ?
- a) 1886
 - b) **1884**
 - c) 1889
 - d) 1880
- 7) Le Châtelier's principle gives the explanation for the changes at molecular level?
- a) Yes
 - b) **No**
- 8) If there is an increase in products, the reaction quotient, Q_c is ----- making it ----- than the equilibrium constant, K_c .
- a) **Increased, greater**
 - b) Decreased, smaller
 - c) Increased, smaller
- 9) If pressure is decreased at left hand side of the reaction then the reaction will be
- a) **Reverse**
 - b) Forward
 - c) Equilibrium
- 10) If Q_c is greater than K_c the reaction will be
- a) **Reversed**
 - b) Forward
 - c) Equilibrium
- 11) Adding an inert gas into a gas-phase equilibrium at constant volume result in a shift.
- a) True
 - b) **False**
- 12) By adding an inert gas the total pressure of the system
- a) **increases**
 - b) decreases
 - c) stay at equilibrium

- 13) When the volume of a mixture is reduced, a net change occurs in the direction that produces -
--- moles of gas
- a) more
 - b) **fewer**
 - c) less
 - d) no gas
- 14) When volume is increased the change occurs in the direction that produces more moles of gas.
- a) **more**
 - b) fewer
 - c) less
 - d) no gas
- 15) if the temperature of exothermic reaction is increased then it will move to left to ----- the extra heat
- a) release
 - b) **absorb**
 - c) extract
 - d) emit
- 16) if we want to increase the amount of product by increasing the temperature in an exothermic reaction then
- a) it is possible
 - b) it is not possible
 - c) it is a wrong approach
- 17) Decreasing the temperature favors ----- in a reversible reaction at equilibrium.
- a) endothermic reaction
 - b) **exothermic reaction**
- 18) Liquids are more dense and less compressible than
- a) Solids
 - b) Liquids
 - c) **Gases**
 - d) Air
- 19) Intermolecular forces (non-covalent bonds) influence the ----- properties of liquids.
- a) **Physical**
 - b) Chemical
 - c) Both
- 20) Gases have a low density and are --- compressible.
- a) Less
 - b) **Highly**
 - c) Lightly
- 21) In liquids are in constant motion, and their kinetic energy depends on their ----.
- a) Pressure
 - b) Density
 - c) Volume

- d) **Temperature**
- 22) The energy required to increase the surface area of a liquid by a unit amount.
- a) **Surface tension**
 - b) Viscosity
 - c) Cohesive forces
 - d) All
- 23) The magnitude of the force that controls the shape of the liquid is called
- a) **Surface tension**
 - b) Viscosity
 - c) Cohesive forces
 - d) All
- 24) A molecule at the surface of a liquid experiences
- a) **Net inward cohesive forces.**
 - b) Net outward cohesive forces.
 - c) Both
 - d) None
- 25) The energy state of the molecules on the interior is ---- than that of the molecules on the exterior.
- a) Greater
 - b) **Lower**
 - c) High
 - d) Less
- 26) ----- is also often referred as the thickness of a fluid.
- a) Tension
 - b) **Viscosity**
 - c) Refractive index
- 27) The ---- is a ratio of the speed of light in a medium relative to its speed in a vacuum.
- a) Tension
 - b) Viscosity
 - c) **Refractive index**
- 28) The factors which affect the value of the refractive index
- a) Temperature
 - b) Wavelength of light
 - c) **Both**
 - d) none
- 29) The speed of light changes in other medium because the atom of other medium--- the light particles.
- a) Absorb
 - b) Reemit
 - c) **Both a and b**
 - d) Reflect
- 30) At ---- temperature the liquid becomes less dense and less viscous, causing light to travel faster in the medium.

- a) **High**
 - b) Low
 - c) Room temperature
 - d) All of above
- 31) At the high temperature the value for the refractive index of liquid is
- a) Large
 - b) **Small**
 - c) Very small
 - d) Very high
- 32) The refractive index varies with wavelength
- a) Inversely
 - b) **Linearly**
 - c) Transversely
- 33) It is important to use ----- light to prevent dispersion of light into different colors.
- a) Dichromatic
 - b) Trichromatic
 - c) **Monochromatic**
- 34) The sodium D line at ---- is the most frequently used wavelength of light for a refractometer.
- a) **598 nm**
 - b) 589 nm
 - c) 550 nm
 - d) 560 nm
- 35) ----- is the measure of net molecular polarity.
- a) Dipole attraction
 - b) **Dipole moment (μ)**
 - c) Ionic interaction
 - d) Covalent bond
- 36) Dipole moments tell us about the ----- in a molecule.
- a) **Charge separation**
 - b) Charge interaction
 - c) Charges
 - d) All
- 37) ---- is non polar molecule
- a) Carbon
 - b) Oxygen
 - c) **Carbon dioxide**
 - d) Water
- 38) The biggest impact dipole interactions have on living organisms is seen with?
- a) **Protein folding.**
 - b) Glucose formation
 - c) Energy formation
 - d) All
- 39) ---- % of our bodies being water.

- a) 60%
 - b) **65%**
 - c) 80%
 - d) 70%
- 40) Besides mercury, ---- has the highest surface tension for all liquids.
- a) **Water**
 - b) Liquid nitrogen
 - c) Carbon dioxide
 - d) hydronium
- 41) Water's high surface tension is due to the ---- in water molecules.
- a) Covalent bonds
 - b) **Hydrogen bonding**
 - c) Molecular interactions
 - d) all
- 42) Vaporization is ----- reaction.
- a) Exothermic reaction
 - b) **Endothermic reaction**
 - c) Both
 - d) None
- 43) Water's heat of vaporization is-----.
- a) **41 kJ/mol**
 - b) 42 kJ/mol
 - c) 43 kJ/mol
 - d) 44 kJ/mol
- 44) Vapor pressure is----- related to intermolecular forces.
- a) Directly
 - b) **Inversely**
 - c) Not related
 - d) None
- 45) Liquids with stronger intermolecular interactions are usually ---- viscous than liquids with weak intermolecular interactions.
- a) **More**
 - b) Less
- 46) Cohesion is intermolecular forces between --- molecules.
- a) **Like**
 - b) Unlike
 - c) Both
- 47) In the form of ice the volume of water increases about --- .
- a) 19%
 - b) 18%
 - c) 10%
 - d) **9%**

- 48) It is very rare to find a compound that lacks ----- to be a liquid at standard temperatures and pressures.
- a) **Carbon**
 - b) Nitrogen
 - c) Oxygen
 - d) Hydrogen
- 49) Chemist Jacobus van't Hoff was the first to describe
- a) Colligative properties
 - b) **Anomalous colligative properties**
 - c) Both
- 50) Who succeeded in explaining anomalous values of colligative properties
- a) **Svante Arrhenius**
 - b) Jacobus van't Hoff
- 51) The solutions which obey Raoult's law at all compositions of solute in solvent at all temperature are called ---- .
- a) **Ideal solution**
 - b) Non ideal solution
 - c) Both
- 52) An ideal solution or ideal mixture is a solution in which the enthalpy of solution is
- a) **Zero**
 - b) Non zero
 - c) One
- 53) The enthalpy ideal solution is zero, the change in Gibbs energy on mixing is determined solely by the ---- of mixing.
- a) Enthalpy
 - b) Free energy
 - c) **Entropy**
- 54) Ethyl chloride and ethyl bromide n-hexane and n-heptane CCl_4 and SiCl_4 these are examples of
- a) **Ideal solutions**
 - b) Non ideal solutions
 - c) both
 - d) none
- 55) It has been found that on increasing ----- , a non-ideal solution tend to be ideal.
- a) Concentration
 - b) **Dilution**
 - c) Solute particles
- 56) When a substance is dissolved in a solution, the vapor pressure of the solution will generally ----.
- a) Increase
 - b) Remains constant
 - c) **Decreases**

- 57) The decrease in vapor pressure of ideal solution will be greater than that calculated by Raoult's Law for.
- a) **Dilute solutions**
 - b) Concentrated
 - c) Both
 - d) None
- 58) Freezing point depression is directly proportional to
- a) Molarity of solute
 - b) **Molality of the solute**
 - c) Molality of solvent
- 59) The freezing points of solutions are --- than that of the pure solvent
- a) Higher
 - b) **Lower**
 - c) Equal to
- 60) Adding solutes to an ideal solution results in ---- in entropy
- a) Decrease
 - b) No change
 - c) **Increase**
 - d) None
- 61) The maximum depression of the freezing point is about ----
- a) -17°C (0°F)
 - b) -19°C (0°F)
 - c) **-18°C (0°F)**
- 62) If the ambient temperature is high then NaCl will be effective. this statement is
- a) **True**
 - b) False
- 63) The boiling points of solutions are --- than that of the pure solvent
- a) **Higher**
 - b) Lower
 - c) Very low
 - d) Equal to
- 64) The determination of colligative properties allows us to determine
- a) concentration of a solution
 - b) molar masses of solutes
 - c) **both**
 - d) none
- 65) The osmotic pressure of a solution is proportional to the molar concentration of the ---- in solution.
- a) **solute particles**
 - b) solvent
 - c) molar concentration
- 66) Semipermeable membranes do not let the ---- pass through.
- a) **Solute**

- b) Solvent
 - c) Both
 - d) Water
- 67) Henry's law is one of the gas laws formulated by William Henry in
- a) **1803**
 - b) 1809
 - c) 1888
 - d) 1880
- 68) "At a constant temperature, the amount of a given gas that dissolves in a given type and volume of liquid is directly proportional to the partial pressure of that gas in equilibrium with that liquid." it is
- a) **Henry's law**
 - b) Van't hoff equation
 - c) Stability law
- 69) The solubility of a gas in a liquid is directly proportional to the partial pressure of the gas above the liquid this is
- a) **Henry's law**
 - b) Gas law
 - c) Raoult's law
- 70) Positive non-ideal behavior of the vapor pressure of a solution follows Henry's Law at ----- and Raoult's Law at -----.
- a) **Low concentration, high concentration**
 - b) High concentration, low concentration
 - c) Both correct
- 71) Conditions of henry's law
- a) Works if the molecules are at equilibrium.
 - b) Does not work for gases at high pressures
 - c) Does not work if there is a chemical reaction between the solute and solvent
 - d) **All of above**
- 72) Solution that generally contains ions, atoms or molecules that have lost or gained electrons, and is electrically conductive.
- a) **Electrolyte solutions**
 - b) Ideal solutions
 - c) Ionic solutions
- 73) To form a compound
- a) ion-dipole forces < interionic bonds
 - b) **ion-dipole forces > interionic bonds**
 - c) ion-dipole forces = interionic bonds
- 74) Breaking apart the ionic compound is.
- a) **Endothermic**
 - b) Exothermic
- 75) Hydrating cation and anion is.

- a) Endothermic
 - b) **Exothermic**
- 76) The ---- depends on the intermolecular forces of the solute and solvent.
- a) **Enthalpy of solution**
 - b) Entropy of solution
 - c) Both
- 77) Most versions of the equilibrium constant K utilizes ---- so that the units would disappear more fluently.
- a) Concentration instead of activity
 - b) **Activity instead of concentration**
- 78) For an ideal solution, the activity coefficient is 1 [x]/ o Celcius, thus when the concentration is dived by it to yield activity, it is ----.
- a) **Not changed**
 - b) Altered
 - c) Changed
- 79) This theory was discovered due to Arrhenius's theory having deficiencies.
- a) Ionic theory
 - b) Atomic theory
 - c) **Interionic Attractions**
- 80) The theory of electrolyte solution was brought about by Peter Debye and Erich Huckel in.
- a) **1923**
 - b) 1992
 - c) 1997
 - d) 1925

FINALS topics (71-145)

- 1) A concentration of a solution that contained 1 g solute and 1000000 mL solution (same as 1 mg solute and 1 L solution) would create a very small percentage concentration.
 - a) **ppm**
 - b) ppb
 - c) ppt
 - d) None
- 2) 1 ppb is ----more dilute than 1 ppm
 - a) 10000-fold
 - b) **1000-fold**
 - c) 100-fold
 - d) 10-fold
- 3) Parts per trillion (ppt) is -----more dilute than 1 ppm.
 - a) **1000000-fold**
 - b) 100000-fold
 - c) 10000fold
 - d) 1000-fold

- 4) The fraction of all of its molecules (or atoms) out of the total number of molecules (or atoms).
 - a) **Mole fraction**
 - b) Mole percent
 - c) Molality
 - d) Molarity
- 5) The sum of each of the solution's substances' mole fractions equals to
 - a) 2
 - b) 3
 - c) 0
 - d) **1**
- 6) The amount of moles of solute per liter of the solution.
 - a) Mole fraction
 - b) Mole percent
 - c) Molality
 - d) **Molarity**
- 7) Which is the right formula for molarity?
 - a)
$$\text{Molarity} = \frac{\frac{\text{Molar volume}}{\text{Molar Mass}}}{\text{Liters of Solution}}$$
 - b)
$$\text{Molarity} = \frac{\frac{\text{Mass}}{\text{moles}}}{\text{Liters of Solution}}$$
 - c) **$$\text{Molarity} = \frac{\frac{\text{Mass}}{\text{Molar Mass}}}{\text{Liters of Solution}}$$**
 - d)
$$\text{Molarity} = \frac{\frac{\text{Mass}}{\text{molar mass}}}{\text{Liters of Solution}}$$
- 8) The amount of moles of solute per kilogram of the solvent
 - a) Mole fraction
 - b) Mole percent
 - c) **Molality**
 - d) Molarity
- 9) A mixture of materials, one of which is usually a fluid is called
 - a) **Solution**
 - b) colloidal solution
 - c) dissolution
- 10) A material that flows, such as a liquid or a gas.
 - a) Solution
 - b) **Fluid**
 - c) Solvent
 - d) Solute
- 11) The fluid of a solution is usually the
 - a) Solution
 - b) Fluid
 - c) **Solvent**

- d) Solute
- 12) A solution of water and sugar is called.
- a) Brine
 - b) Saline
 - c) Ammonia water
 - d) **Syrup**
- 13) A solution of sodium chloride (common table salt) in water is called.
- e) **Brine**
 - f) Saline
 - g) Ammonia water
 - h) Syrup
- 14) A sterilized specific concentration (0.15 molar) of sodium chloride in water is called
- a) **Saline**
 - b) Brine
 - c) Ammonia water
 - d) Syrup
- 15) A solution of carbon dioxide in water is called
- a) Syrup
 - b) Ammonia water
 - c) **Seltzer**
 - d) Brine
- 16) A solution of ammonia gas in water is called.
- a) Syrup
 - b) **Ammonia**
 - c) Brine
 - d) Seltzer
- 17) The ----of a solution is some measurement of how much solute there is in the solution.
- a) Moles
 - b) **Concentration**
 - c) Mole fraction
 - d) None
- 18) A solution that is capable of dissolving more solute at a given temperature than it already contains, is known as
- a) **Unsaturated solution**
 - b) Saturated solution
 - c) Supersaturated solution
- 19) The solution which can dissolve no more amount of the solute, at a given temperature.
- a) Unsaturated solution
 - b) **Saturated solution**
 - c) Supersaturated solution

- 20) A solution that contains more dissolved solute than a saturated solution is called
- Unsaturated solution
 - Saturated solution
 - Supersaturated solution**
- 21) The maximum diameter for a solute particle is
- 2 nanometer
 - 1 nanometer**
 - 0.5 nanometer
 - 2.1 nanometer
- 22) The homogenous mixture does not separate on standing. This statement is
- True**
 - False
- 23) . In a gravity environment the solution will not come apart due to any difference in -----of the materials in the solution.
- Amount
 - Weight
 - Size
 - Density**
- 24) If you take a sample of the solution from any point in the solution, the proportions of the materials will be
- Different
 - Same**
 - Changing
- 25) The mixture shows no Tyndall effect. Light is not scattered by the solution. This statement is
- False
 - True**
- 26) At a saturation point the solvent dissolve --- of the solute.
- No more**
 - More
 - Sometimes dissolves more
- 27) The solution of an ionic material into water will result in an electrolyte solution. The ions of solute will separate in water to permit the solution to carry ---
- The reaction
 - Electric current**
 - Condensation
 - Precipitation
- 28) The solution shows an increase in osmotic pressure between it as the amount of solute is?
- Decreased
 - Lessened
 - Balanced
 - Increased**
- 29) The solution shows an increase in boiling point as the amount of solute is
- Decreased

- b) Lessened
- c) Balanced
- d) **Increased**

30) The solution shows a ----in melting point as the amount of solute is increased.

- a) **Decreased**
- b) Lessened
- c) Balanced
- d) Increased

31) A solution of a solid non-volatile solute in a liquid solvent shows a ----in vapor pressure above the solution as the amount of solute is increased.

- a) **Decreased**
- b) Lessened
- c) Balanced
- d) Increased

32) Particles having a diameter roughly between ---are suspended in a more lasting fashion

- a) 1 nm and 400 nm
- b) 2 nm and 500 nm
- c) **1 nm and 500 nm**

33) A suspended mixture of particles is called

- a) Colloid
- b) colloidal suspension
- c) colloidal dispersion
- d) **all of above**

34) Foams are liquids or solids with a ---dispersed into them.

- a) Solid
- b) Liquid
- c) **Gas**

35) Emulsions are liquids or solids with ----dispersed through them.

- a) **Liquids**
- b) Solids
- c) Gas

36) Aerosols are colloids with a gas as the dispersing medium and ---- as dispersant.

- a) Solid
- b) Liquid
- c) Gas
- d) **Both a and b**

37) Fine dust or smoke in the air are good examples of colloidal.

- a) Liquid in a gas
- b) **solid in a gas**
- c) solid in liquid

38) Fog and mist are examples of colloidal.

- a) **Liquid in a gas**

- b) solid in a gas
 - c) solid in liquid
- 39) The colloidal mixture does not separate on standing in a standard gravity condition. This statement is
- a) **True**
 - b) False
- 40) Shine a light beam through colloids the pathway of the light is visible from any angle. This scattering of light is called the
- a) **Tyndall effect**
 - b) Dispersing effect
 - c) Scattering
 - d) Reflection
- 41) There usually is ----sharp saturation point of colloids.
- a) A definite
 - b) **Not a definite**
- 42) The dispersant can be coagulated, or separated by
- a) clumping the dispersant particles with heat
 - b) an increase in the concentration of ionic particles in solution into the mixture.
 - c) **Both a and b**
- 43) There is usually only small effect of any of the colligative properties due to the
- a) **Dispersant**
 - b) Solvate
 - c) Solvent
 - d) Solution
- 44) The ---of a solution is a measure of how much of the solute can be dissolved into the solvent.
- a) Concentration
 - b) **Solubility**
 - c) Condensation
 - d) Precipitation
- 45) If any crystal is presented to a supersaturated solution, the crystallization of the solute onto it will occur
- a) Slowly
 - b) **Rapidly**
- 46) Double displacement reaction, depend upon ---of a salt as a possible product for the reaction to happen.
- a) **Insolubility**
 - b) Solubility
 - c) Concentration
- 47) Almost all simple ionic compounds with Group I elements or ammonium ion, $(\text{NH}_4)^+$ are
- a) **Soluble**
 - b) Insoluble
- 48) All nitrates $(\text{NO}_3)^-$, most sulfates, $(\text{SO}_4)^{2-}$, and most chlorides, Cl^- , are.
- a) **Soluble**

b) Insoluble

49) AgCl is ---- chloride.

a) **Insoluble**

b) Soluble

50) Most hydroxides, $(OH)^-$, carbonates, $(CO_3)^{2-}$ sulfides, S^{2-} , and phosphates, $(PO_4)^{3-}$, are insoluble

a) **Insoluble**

b) Soluble

51) The compound of Barium hydroxide, $Ba(OH)_2$ are

a) **Insoluble**

b) Soluble

52) Solute separates into ions or molecules, and each ion or molecule is surrounded by molecules of solvent.

a) Solution

b) Precipitation

c) Condensation

d) **Dissolution**

53) The interactions between the solute particles and the solvent molecules is called.

a) **Solvation**

b) Dissolution

c) Precipitation

54) A solvated ion or molecule is surrounded by

a) Solute

b) **Solvent**

c) Solution

55) Volatile means that it ---easily evaporate.

a) **Can**

b) Cannot

c) May be

56) δ means a partial charge which helps the solvent interact with (solvate) ions and polar molecules through

a) **Coulomb interactions**

b) Ionic interactions

c) Covalent interactions

57) Gas in our cars is a --- solvent.

a) Polar

b) **Non-polar**

58) **The** process of a compound coming out of solution. It is the opposite of dissolution or solvation.

a) Condensation

b) Evaporation

c) Precipitation

- 59) Precipitation and dissolution are a great example of a
- a) Kinetic equilibrium
 - b) Dynamic equilibrium**
 - c) Equilibrium
- 60) As the solution becomes more concentrated, the rate of precipitation will ----and the rate of dissolution will decrease.
- a) Increase**
 - b) Decrease
- 61) Solubility is the maximum possible concentration, and it is given in
- a) M
 - b) g/L
 - c) both**
- 62) Solubility changes with
- a) Temperature**
 - b) Concentration
 - c) Both
- 63) Precipitation can occur by
- a) Mixing two solutions together
 - b) Cooling
 - c) Evaporation
 - d) All of above**
- 64) Barium, calcium and lead sulfate are
- a) Insoluble**
 - b) Soluble
- 65) Sodium and potassium hydroxides are
- a) Soluble
 - b) Insoluble**
 - c) Dissolvable
- 66) ----are insoluble ionic solid products of a reaction, formed when certain cations and anions combine in an aqueous solution.
- a) Precipitates**
 - b) Sulfates
 - c) Solvates
 - d) Solutes
- 67) Buffer solution depend on ----
- a) Concentration
 - b) Temperature**
 - c) Solution
 - d) Time
- 68) Precipitation can be used to extract ---from seawater.
- a) Magnesium**
 - b) Salts

- c) Calcium
 - d) Water
- 69) Antigens and antibodies in our body show
- a) Dynamic reaction
 - b) Equilibrium reaction
 - c) **precipitation reaction**
- 70) Fractional distillation a process, such as heating or boiling, used to separate ---solutions from each other into simpler/fractional substances.
- a) Non-volatile liquid
 - b) **Volatile liquid**
 - c) Both
- 71) Ethanol will start to boil at
- a) 78.4 °C (351.5 K)
 - b) 70.4 °C (351.6 K)
 - c) **78.4 °C (351.6 K)**
 - d) 78.4 °C (351.4 K)
- 72) Petroleum refineries use distillation to separate
- a) **crude oil**
 - b) petroleum
 - c) petrol
 - d) gasoline
- 73) Azeotropes occur when fraction of the liquids--- be altered by distillation.
- a) **Cannot**
 - b) Can be
 - c) May be
- 74) The more volatile component tends to vaporize ---
- a) Later
 - b) **First**
 - c) At second
- 75) An example of ---would be benzene and toluene.
- a) **ideal solutions**
 - b) non ideal solution
 - c) both
- 76) Concentrated form of ethanol, an azeotrope, is around ---ethanol by weight
- a) 95.64%
 - b) 75.6%
 - c) **95.6%**
- 77) A positive azeotrope would have a ---- boiling point than any of its components
- a) **Lower**
 - b) Higher
 - c) In between
- 78) In fractional distillation liquid with a very low boiling point, you may need to surround the collecting flask with a beaker of ---

- a) Hot water
 - b) **Cold water**
 - c) Water
- 79) The closer the boiling point of two boiling liquids are together ---the column has to be.
- a) **Longer**
 - b) Shorter
 - c) Short
 - d) Taller
- 80) If a mixture has a high vapor pressure it means that it will have a ---
- a) High boiling point
 - b) **Low boiling point**
 - c) Maximum boiling point
- 81) Boiling point of pure ethanol is ---
- a) **78.5°C**
 - b) 78.2°C
 - c) 78.56°C
- 82) Mixtures of nitric acid and water, there is a maximum boiling point of ---when the mixture contains ---by mass of nitric acid.
- a) 122.5°C, 68%
 - b) 120.6°C, 70%
 - c) **120.5°C, 68%**
- 83) Boiling point of pure nitric acid ---
- a) **86°C**
 - b) 87°C
 - c) 120.5°C
- 84) Fractional distillation of dilute nitric acid will enable you to collect pure water from the ----of the fractionating column.
- a) Bottom
 - b) **Top**
 - c) Middle
- 85) Chemical kinetics is the measure of
- a) How quickly chemical reactions occur
 - b) Rate of chemical reactions
 - c) How the reaction occurs
 - d) **All of above**
- 86) Kinetic reaction studies help in understanding
- a) Biological processes
 - b) Environmental chemistry
 - c) Atmospheric chemistry
 - d) **All of above**
- 87) The measure of the change in concentration of the reactants or the change in concentration of the products per unit time.
- a) **Reaction rate**

- b) Chemical reaction
 - c) Reaction kinetics
- 88) If there are low concentrations of an essential element or compound, the reaction will be---.
- a) **Slower**
 - b) Faster
 - c) Medium
 - d) At equilibrium
- 89) A type of assay used to easily measure the progress of a reaction at discrete time points and is commonly used for determining initial rates and inhibition values
- a) **Continuous Flow**
 - b) Relaxation Methods
 - c) Spectrophotometry
 - d) Stopped Flow
- 90) The apparatus used for continuous flow assays will have reactants initially ---in chambers
- a) **Separated**
 - b) Non-separated
 - c) Reactive
- 91) Which of the following is the advantage of the continuous flow?
- a) High degree of accuracy at each time point
 - b) Useful to measure inhibition
 - c) **Both**
- 92) For gases, experimenters use a ---to measure the change in volume produced at different times.
- a) Glass tube
 - b) Filtration
 - c) **Burette**
 - d) All of above
- 93) Reagent concentration decreases as the reaction proceeds, giving a---number for the change in concentration.
- a) Positive
 - b) **Negative**
- 94) Which of the following shows more accurate value?
- a) **Instantaneous reaction rate**
 - b) Average reaction
 - c) Both of them
- 95) The rate at which the reagents are first brought together.
- a) Rate of reaction
 - b) **Initial rate of reaction**
 - c) Final rate of reaction
- 96) To find initial rate of reaction, experimenter must simply find the slope of the line tangent to the reaction curve when
- a) **$t=0$**
 - b) $t=1$

- c) $t=unity$
 - d) $t=-1$
- 97) Rate of a reaction is the function of
- a) **Concentration**
 - b) Time
 - c) Molarity
 - d) Product
- 98) Concentration is the function of
- a) **Time**
 - b) Concentration
 - c) Rate
 - d) Molarity
- 99) If we double the concentration and the rate increases by two folds then it is a
- a) **First order reaction**
 - b) Second order reaction
 - c) Third order reaction
- 100) If we double the concentration and the rate increases by four folds then it is a
- d) First order reaction
 - e) **Second order reaction**
 - f) Third order reaction
- 101) The change in equilibrium is controlled by the ---of the reaction in relaxation method.
- a) **Constants**
 - b) Rate
 - c) Concentration
- 102) By observing the --- of the reaction, the rates can be discovered in the relaxation method
- a) **Relaxation time**
 - b) Concentration
 - c) Temperature
 - d) Pressure
- 103) Spectrophotometry is one of the most useful methods of -----analysis in various fields
- a) **Quantitative**
 - b) Qualitative
 - c) Both
- 104) In physical chemistry it can be used to calculate the rate of reaction by measuring the amount of substrate or product at any specific time.
- a) **Spectrophotometry**
 - b) Chemical kinetics
 - c) Stopped flow
- 105) The method uses light over the ultraviolet range (185 - 400 nm) and range (400 - 700 nm) of electromagnetic radiation spectrum.
- a) **UV-visible spectrophotometer**
 - b) IR spectrophotometer

- 106) This method uses light over the range (700 - 15000 nm) of electromagnetic radiation spectrum
- a) UV-visible spectrophotometer
 - b) **IR spectrophotometer**
- 107) A solution sample that absorbs light over all visible ranges (i.e., transmits none of visible wavelengths) appears ----in theory.
- a) Blue
 - b) **Black**
 - c) Brown
 - d) White
- 108) If all visible wavelengths are transmitted (i.e., absorbs nothing), the solution sample appears ---.
- a) Blue
 - b) Black
 - c) Brown
 - d) **White**
- 109) If a solution sample absorbs red light (~700 nm), it appears ---- because ---is the complementary color of red.
- a) Orange
 - b) Yellow
 - c) **Green**
 - d) Black
- 110) Visible spectrophotometers use---- to narrow down a certain range of wavelength so that the particular beam of light is passed through a solution sample.
- a) **Prism**
 - b) Glass
 - c) Water
 - d) Spectrophotometer
- 111) Produces a desired range of wavelength of light.
- a) Photometer
 - b) Spectrophotometer
- 112) P-nitrophenol (acid form) has the maximum absorbance at approximately
- a) 300 nm
 - b) 310 nm
 - c) **320 nm**
 - d) 400 nm
- 113) P-nitrophenolate (basic form) absorb best at
- a) **400nm**
 - b) 320nm
 - c) 700nm
 - d) 430nm
- 114) The appearance of an isosbestic point in a reaction demonstrates that an intermediate is --
-----to form a product from a reactant.

- a) **Not required**
 - b) Required
 - c) May be required
- 115) The amount of photons that goes through the cuvette and into the detector is dependent on the
- a) length of the cuvette
 - b) the concentration of the sample
 - c) **both**
 - d) none
- 116) ----is the fraction of light that passes through the sample
- a) **Transmittance**
 - b) Absorbance
 - c) Evaluation
- 117) -----stands for the amount of photons that is absorbed.
- a) Transmittance
 - b) **Absorbance**
- 118) The -----allows for the evaluation of solution-based kinetics on a milliseconds timescale with a very small volume of reactants used.
- a) Continuous Flow
 - b) Relaxation Methods
 - c) Spectrophotometry
 - d) **Stopped Flow**
- 119) The reaction rate usually increases as the
- a) concentration of the reactants increases
 - b) temperature increases.
 - c) **Both**
- 120) If the reactants are uniformly dispersed in a single homogeneous solution, then the number of collisions per unit time depends on
- a) Concentration
 - b) Temperature
 - c) **Both of them**
- 121) The reaction rate of a heterogeneous reaction depends on the surface area of the ----- condensed phase
- a) **More**
 - b) Less
 - c) More or less
- 122) Automobile engines use surface area effects to---- reaction rates.
- a) **Increase**
 - b) Decrease
 - c) Lessened
- 123) A sodium acetate solution reacts with methyl iodide in an exchange reaction to give methyl acetate and sodium iodide. This reaction occurs ---more rapidly in the organic solvent
- a) 11 million times

- b) 20 million times
 - c) 30 million times
 - d) **10 million times**
- 124) What is the dielectric constant for DMF?
- a) 34.7
 - b) 36.8
 - c) **36.7**
 - d) 33.7
- 125) What is the dielectric constant for methanol
- a) **32.6**
 - b) 31.6
 - c) 32.4
 - d) 36.6
- 126) Methanol is able to hydrogen bond with acetate ions, whereas DMF cannot.
- a) **True**
 - b) False
- 127) Hydrogen bonding ----the reactivity of the oxygen atoms in the acetate ion.
- a) **Reduces**
 - b) Increases
 - c) Decreases
- 128) The reaction rates of most reactions decrease rapidly with ----solvent viscosity.
- a) **Increasing**
 - b) Decreasing
 - c) Enhancing
- 129) A ---is a substance that participates in a chemical reaction and increases the reaction rate without undergoing a net chemical change itself.
- a) Substrate
 - b) Solvent
 - c) **Catalyst**
 - d) Enhancer
- 130) ---of the gross national product of the United States and other industrialized nations relies either directly or indirectly on the use of catalysts.
- a) 80%
 - b) **30%**
 - c) 70%
- 131) ----rate laws are generally used to describe what is occurring on a molecular level during a reaction
- a) **Differential**
 - b) Integrated
 - c) Both
 - d) None
- 132) ----rate laws are used for determining the reaction order and the value of the rate constant from experimental measurements.

- a) **Integrated**
 - b) Differential
 - c) Both
 - d) None
- 133) Rate is measured in
- a) **Molar/time**
 - b) 1/time
 - c) Both
- 134) Rate coefficient 'k' is measured in
- a) Molar/time
 - b) **1/time**
 - c) Both
- 135) Plotting $\ln[A]$ with respect to time for a first order reaction gives a straight line with the slope of the line equal to
- a) **$-k$**
 - b) k
 - c) -1
 - d) 0
- 136) The formation of double stranded DNA from two complementary strands, can be described using ---order kinetics.
- a) 1st
 - b) **2nd**
 - c) 3rd
 - d) All
- 137) If k is a second order rate constant its units are
- a) $M^{-1} \text{ min}^{-1}$
 - b) $M^{-1} \text{ s}^{-1}$.
 - c) **Both**
- 138) If k is a 1st order rate constant its units are
- a) min^{-1}
 - b) s^{-1}
 - c) **both**
- 139) If we double the concentration of A and quadruple the concentration of B at the same time, then the reaction rate is increased by a factor of
- a) **8**
 - b) 6
 - c) 4
 - d) 2
- 140) The differential rate law can show us how the ---changes in time, while the integrated rate equation shows how the ---changes over time.
- a) **rate of the reaction, concentration of species**
 - b) concentration of species, rate of the reaction
 - c) concentration, temperature

- 141) The concentration of reactants approaches zero more ---in a second-order, compared to that in a first order reaction.
- a) **Slowly**
 - b) Fastly
 - c) Heavy
- 142) The rates of ---order reactions do not vary with increasing nor decreasing reactants concentrations.
- a) 1st
 - b) **Zero**
 - c) 2nd
 - d) 3rd
- 143) If the number of enzyme molecules is limited in relation to substrate molecules, then the reaction may appear to be ----order.
- a) 1st
 - b) **Zero**
 - c) 2nd
 - d) 3rd
- 144) In zero order reaction the units of “k” are
- a) Molar/s-1
 - b) 1/time
 - c) Min-1
 - d) **M/s**
- 145) In zero order integral law graph slope is equal to
- a) **-ak**
 - b) ak
 - c) 0
 - d) a
- 146) In zero order reactions/kinetics, the rate of a reaction does not depend on the substrate concentration. This statement is
- a) **True**
 - b) False
- 147) By saturating the amount of substrate speed up the rate of the reaction in zero order reaction.
- a) True
 - b) **False**
- 148) The half-life of zero order reaction decrease as the concentration----.
- a) Increases
 - b) **Decreases**
 - c) None
- 149) For a zero order reaction the half life depends on
- a) the amount of initial concentration
 - b) rate constant
 - c) **both**

- 150) The length of half-life will be constant, independent of initial concentration in
- 1st order reaction**
 - Zero order reaction
 - Both
- 151) For first order reactions, the half-life depends
- on the reaction rate constant**
 - concentration
 - rate of reaction
- 152) The length of half-life increase while the concentration of substrate constantly decreases.
- 1st order reaction
 - 2nd order reaction**
 - 3rd order reaction
 - zero order reaction
- 153) For second order reactions, the half-life only depends on the
- initial concentration
 - the rate constant
 - both**
 - none
- 154) Arrhenius performed experiments that correlated chemical reaction rate constants with---
- Temperature**
 - Concentration
 - Reaction rate
- 155) As frequency factor A is related to molecular collision, it is--- dependent.
- Concentration
 - Temperature**
 - Rate
- 156) What is the unit of E_a in Arrhenius equation.
- kJ/mol**
 - k/mol
 - kJ/Jmol.
- 157) Enzymes are proteins or ---molecules that provide alternate reaction pathways with lower activation energies than the original pathways
- RNA**
 - DNA
 - Both
- 158) Enzymes ----the rate constant value.
- Decreases
 - Increases**
- 159) Which of the following is the Eyring equation?
- $\ln K^\ddagger = -\frac{\Delta S^\ddagger}{RT} + \frac{\Delta S^\ddagger}{T}$
 - $\ln K^\ddagger = -\frac{\Delta H^\ddagger}{ST} + \frac{R^\ddagger}{T}$
 - $\ln K^\ddagger = -\frac{\Delta H^\ddagger}{RT} + \frac{\Delta S^\ddagger}{R}$**

- 160) The higher the activation enthalpy, the ---energy is required for the products to form
- a) More**
 - b) Less
 - c) Very less
- 161) In general, a reaction proceeds ----if E_a and ΔH^\ddagger are small.
- a) Faster**
 - b) Slower
 - c) Very fast
 - d) Very slow
- 162) E_a for a radical reaction is
- a) 0**
 - b) 1
 - c) Negative
 - d) Positive
- 163) An Arrhenius plot of a radical reaction has no slope and is independent of ---?
- a) Concentration
 - b) Temperature**
 - c) Kinetic energy
- 164) The reaction with a higher E_a has a steeper slope; the reaction rate is thus ---sensitive to temperature change.
- a) Less
 - b) Very**
 - c) More
- 165) Chemical reactions are studied in terms of reaction rate, reaction orders with respect to reactants, differential and integrated rate laws of chemical reactions, and activation energy. This type of studies is usually called
- a) chemical kinetics**
 - b) chemical energy
 - c) chemical reactions
- 166) In a spontaneous reaction the mixture of reactants has ---energy than that of the products.
- a) Less
 - b) More**
 - c) very less
- 167) The difference between the potential energies is called the ----of reaction.
- a) Entropy
 - b) Enthalpy**
 - c) Both
- 168) If the repeating elementary steps do not lead to the formation of new product, they are called.
- a) chain inhibition reactions**
 - b) chain branching reaction
 - c) chain termination reaction

- 169) When chain carriers react with one another forming stable product, the elementary steps are called.
- a) **chain termination reactions**
 - b) chain inhibition reaction
 - c) chain branching reaction
- 170) The chain reaction mechanism is involved in nuclear reactors; in this case the chain carriers are ---?
- a) **Neutrons**
 - b) Electrons
 - c) Protons
- 171) Chain carriers are
- a) Stable
 - b) Non stable
 - c) Radicals
 - d) **Both b and c**
- 172) Elementary steps in which the number of free radicals consumed is equal to the number of free radicals generated are called
- a) Initiation step
 - b) **Chain propagation steps**
 - c) Chain branching steps
 - d) Chain inhibition steps
- 173) Elementary steps that generate more free radicals than they consume which result in an explosion.
- a) Initiation step
 - b) Chain propagation steps
 - c) **Chain branching steps**
 - d) Chain inhibition steps
- 174) The steps not leading to the formation of products are called
- a) Initiation step
 - b) Chain propagation steps
 - c) Chain branching steps
 - d) **Chain inhibition steps**
- 175) Elementary steps that consume radicals
- a) Initiation step
 - b) Chain propagation steps
 - c) Chain branching steps
 - d) **Chain termination steps**
- 176) The equation in an elementary step represents the reaction
- a) **at the molecular level**
 - b) overall reaction
 - c) both
- 177) The fact that a mechanism explains the experimental results is not a proof that the mechanism is correct. This statement is

- a) **True**
 - b) False
- 178) When a molecule or ion decomposes by itself, such an elementary step is called
- a) Bimolecular step
 - b) **Unimolecular step**
 - c) Trimolecular step
- 179) Slowest step in a mechanism determines the
- a) Concentration of reactants
 - b) **Rate of a reaction**
 - c) both
 - d) none
- 180) The number of particles involved in an elementary step is called
- a) **Molecularity**
 - b) Order of reaction
 - c) Concentration of reactants
 - d) None
- 181) The quantitative relationship of temperature effect on chemical reaction rates is discussed in form of
- a) Kinetic energy
 - b) Chemical kinetics
 - c) **Activation energy**
 - d) Chemical equilibrium
- 182) Rates of chemical reactions depend on
- a) the nature of the reactants
 - b) the temperature
 - c) the presence of a catalyst
 - d) concentration.
 - e) **All of above**
- 183) Rate measured between long time interval
- a) **Average rate**
 - b) Instantaneous rate
 - c) Initial rate
 - d) Rate
- 184) Rate of a reaction is a function of the
- a) concentrations of reactants
 - b) concentration of solution
 - c) concentration of solute
 - d) all of above
- 185) Order are ----from the stoichiometry of the reaction equation.
- a) Determined
 - b) **Not determined**
 - c) Sometimes determined
- 186) For a second order reaction, the plot is a

- a) Straight line
 - b) Horizontal line
 - c) Branch of parabola
- 187) As a chemical change takes place, the quantities of reactants and products change in a way that leads to a more ----free energy.
- a) Positive
 - b) **Negative**
 - c) Neutral
- 188) When the free energy reaches its ----possible value, there is no more net change and the system is said to be in equilibrium.
- a) **Minimum**
 - b) Maximum
 - c) Highest
 - d) Lowest
- 189) The beauty of thermodynamics is that it enables us to unfailingly predict the without conducting the experiment
- a) net direction of a reaction
 - b) the composition of the equilibrium state
 - c) **both of above**
- 190) The stoichiometric equation for the reaction says nothing about its mechanism. This is
- a) False
 - b) **True**
- 191) Whether you use the differential rate laws or the integrated laws, you have to evaluate the----- first.
- a) Rate constant
 - b) **Order**
 - c) Initial concentration
 - d) All together
- 192) Values for k calculated using the integrated rate laws are more accurate than differential laws. This statement is
- a) **True**
 - b) False
- 193) Plot of $\frac{1}{[A]}$ vs. t should yield a straight line, and the slope is
- a) **k**
 - b) $\ln(A)$
 - c) Both
- 194) The steady state approximation is a method used to
- a) **Derive a rate law**
 - b) Find the order
 - c) Rate of reaction
 - d) All of above
- 195) The use of light to decompose a molecule into simpler units, often ions or free radicals
- a) **Photolysis**

- b) Thermolysis
 - c) Both
 - d) None
- 196) In ----Ronald Norrish of Cambridge University and his graduate student George Porter conceived the idea of using a short-duration flash lamp to generate gas-phase CH₂ radicals.
- a) **1945**
 - b) 1946
 - c) 1995
 - d) 1975
- 197) Norrish and Porter shared the ----Nobel Prize in Chemistry for this work.
- a) 1998
 - b) **1967**
 - c) 1976
 - d) 1985
- 198) The relaxation time t^* is defined as the ----for the return to equilibrium, that is, as the time required for x_0 to decrease by $\Delta x/e = \Delta x/2.718$.
- a) Full time
 - b) 3/4th time
 - c) **Half time**
 - d) Approximate time
- 199) Manfred Eigen (Germany) pioneered when, in the early 1960's, he measured the rate constant of what was then the---- reaction ever observed.
- a) Slowest
 - b) **Fastest**
 - c) Unknown
- 200) An enzyme catalyzed reaction can be stopped by adding an ----solution that denatures (destroys the activity of) the protein enzyme
- a) Acid
 - b) Base
 - c) Salt
 - d) **All of above**