

**Subject: Bio503 (objective
subjective notes)**

CR: Muhammad Nouman

VU Medical Zone (biotechnologists)

**Admins: Hafiza Mubeen,
Muhammad Nouman, Tasha Khan, VU
Medical zone BIOtechnologists**

- 1) Biophysics is an interdisciplinary science that applies the approaches and methods of to study biological systems.

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- a) Physics
 - b) Chemistry
 - c) Mathematics
 - d) Biochemistry
- 2) Biophysical research shares significant overlap with _____
- a) biochemistry and physical chemistry
 - b) nanotechnology and bioengineering,
 - c) computational biology, biomechanics and systems biology
 - d) all of the above
- 3) Biophysics covers all scales of biological organization, from molecular to _____
- a) Organismic
 - b) populations
 - c) species
 - d) both a and b
- 4) Biophysics discovers how atoms are arranged to work in _____.
- a) DNA
 - b) Proteins
 - c) Amino acids
 - d) Both a and b
- 5) _____ are discovering how proteins work, they use these protein structures for discovering how biological machines work. in health and also in diseases.
- a) Biologists
 - b) Biophysicists
 - c) Biochemists
 - d) Biotechnologists
- 6) _____ study life at every level, from atoms and molecules to cells, organisms, and environments
- a) Biochemists
 - b) Biophysicists
 - c) Biotechnologists
 - d) Chemists
- 7) Understanding of by studying fundamental physical principles and mechanisms by which living organism's life to _____
- a) Survive
 - b) Adapt
 - c) Grow
 - d) All of the above
- 8) Fundamental experimental work in areas such as _____.
- a) molecular structure and dynamics
 - b) photosynthesis

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- c) cell membranes
 - d) all of the above
- 9) _____ is the crossroad where all the interesting sciences intersect.
- a) Biochemistry
 - b) Biophysics
 - c) Biotechnology
 - d) Bioinformatics

10) What is the **Uniqueness in Biophysics?**

- I. Biophysics is a growing enterprise world-wide, driven primarily by the widespread realization of the major contributions made to biological science by a combination of truly state-of-the-art physical measurements with modern molecular biology.
 - II. The field occupies a unique and central position at the intersection of the biological, chemical, physical, and computational sciences.
 - III. Development and advancement of new techniques and approaches.
 - IV. Biophysicists as a group most often develop the novel, sophisticated experimental methods that reveal molecular level details with unique clarity.
- 11) Biophysics is a molecular science that seeks to explain biological function in terms of the _____.
- a) molecular structures
 - b) properties of specific molecules
 - c) functions of molecules
 - d) both a and b
- 12) A technique known as _____, which revealed the physical patterns of DNA.
- a) Crystallography
 - b) Laser crystallography
 - c) X-ray crystallography
 - d) Microscopy
- 13) Experiments in the _____ showed that genes are made of a simple chemical DNA.
- a) 1930's
 - b) 1940's
 - c) 1950's
 - d) 1960's
- 14) Biophysicists discovered the DNA double helix in _____.
- a) 1951
 - b) 1952
 - c) 1953
 - d) 1954
- 15) During the _____, biophysical inventions decoded all the genes in a human being (Human genome project).

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- a) 1970's
b) 1980's
c) 1990's
d) 2000's
- 16) All the genes of nearly 200 different species, and some genes from more than _____ other species have been determined.
a) 1,000
b) 10,000
c) 100,000
d) 1,000,000
- 17) The term **biophysics** was originally introduced by Karl Pearson in _____.
a) 1829
b) 1882
c) 1892
d) 1992
- 18) _____ involves the movement and measurement of voltage and current coursing through the tissues through the ion channel proteins
a) Electrograph
b) Electrophysiology
c) Electrometer
d) Non
- 19) There are _____ kinds of forces, or attractions, that operate in a molecule.
a) Two
b) Three
c) Four
d) Five
- 20) The **American** Biophysical Society was founded in _____.
a) 1947
b) 1957
c) 1967
d) 1985
- 21) A series of conferences on Biophysics was organized in Genoa and in other cities in _____.
a) 1957
b) 1959
c) 1963
d) 1969
- 22) The first National Biophysics Congress was held from 3-5 June, 1963 in _____.
a) America
b) Kanada
c) Italy
d) Australia
- 23) Electrophysiology study is used Study abnormal _____.

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- a) Heart rhythms
 - b) Plant rhythms
 - c) lungs rhythms
 - d) Non
- 24) The scientific study of the motion of fluids, especially non-compressible liquids, under the influence of internal and external forces is called
- a) **Hydrodynamics**
 - b) Hydroxylation
 - c) Hydrogenation
 - d) Dehydration
- 25) _____ scanners use strong magnetic fields, electric field gradients, and radio waves to generate images of the organs in the body.
- a) **MRI**
 - b) MRV
 - c) MRIV
 - d) MRB
- 26) Intermolecular forces are typically weaker than intermolecular forces, and account for the bulk properties of matter such that
- a) boiling point
 - b) melting poin
 - c) **both a and b**
 - d) Non
- 27) **Ionic bonding** is a type of chemical **bond** that involves the electrostatic attraction between charged **ions**.
- a) Positive
 - b) Negative
 - c) **Oppositely**
 - d) Non
- 28) **Metallic bondings** are the force of attraction between _____ electrons and the metal atoms.
- a) **Valence**
 - b) Tone
 - c) Paired
 - d) Single
- 29) Differentiate between Intra-molecular and Intermolecular forces of attraction?
Intramolecular forces are the forces that hold atoms together within a molecule
Intermolecular forces are forces that exist between molecules.
Intermolecular forces are also known as van der Waals forces, named after **Johannes van der Waals** who first postulated them.
Intermolecular forces are typically weaker than intramolecular forces, and account for the bulk properties of matter (e.g., boiling point, melting point, etc.)
- 30) Define induced dipole and explain"
The force of attraction between a non-polar molecule and an ion that may lie in its vicinity is called ion-induced dipole force.
In this, the ion may attract or repel the electron cloud present on the non-polar molecule and induce the non-polar molecule to become a temporary dipole.

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The strength of this induced dipole depends on how easily the electron cloud can be distorted, i.e., the bigger the molecule, the stronger is the dipole induced.

- 31) Since the hydrogen donor is strongly _____, it pulls the covalently bonded electron pair closer to its nucleus, and away from the hydrogen atom?

a) electronegative
b) electropositive
c) both a and b
d) non

- 32) What are Intramolecular hydrogen bonds?

Intramolecular hydrogen bonds are those which occur within one single molecule. This occurs when two functional groups of a molecule can form hydrogen bonds with each other. In order for this to happen, both a hydrogen donor and acceptor must be present within one molecule, and they must be within close proximity of each other in the molecule. For example, intramolecular hydrogen bonding occurs in ethylene glycol ($\text{C}_2\text{H}_4(\text{OH})_2$) between its two hydroxyl groups due to the molecular geometry.

- 33) What are Intermolecular hydrogen bonds?

Intermolecular hydrogen bonds occur between separate molecules in a substance. They can occur between any number of like or unlike molecules as long as hydrogen donors and acceptors are present and in positions in which they can interact. For example, intermolecular hydrogen bonds can occur between NH_3 molecules alone, between H_2O molecules alone, or between NH_3 and H_2O molecules.

- 34) In DNA base A and T are held together by _____ hydrogen bonds.

a) One
b) Two
c) Three
d) Four

- 35) In DNA bases G and C are bonded together by three hydrogen bonds

a) One
b) Two
c) Three
d) Four

- 36) Hydrogen bonding is present abundantly in the secondary structure of proteins, and also sparingly in _____ conformation.

a) Primary
b) Tertiary
c) Quaternary
d) Non

- 37) Give the Importance of Hydrogen Bonds?

Source of unique properties of water
Structure and function of proteins

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Structure and function of DNA

Structure and function of polysaccharides

Binding of a substrates to enzymes

Binding of hormones to receptors

38) The _____ dispersion force is the weakest intermolecular force

- a) London
- b) Dipole
- c) Electrostatic
- d) All

39) _____ force is sometimes called an induced dipole-induced dipole attraction.

- a) Electrostatic
- b) London
- c) Dipole
- d) Dipole-dipole

40) The LDF is named after the German-American physicist _____.

- a) Fritz London
- b) Jackson
- c) Kerosene
- d) Franklin

41) ICl and Br₂ have similar masses _____ and therefore experience similar London dispersion forces.

- a) 16 amu
- b) 106 amu
- c) 160 amu
- d) 1160 amu

42) Predict which will have the higher boiling point: N₂ or CO. Explain your reasoning.

CO and N₂ are both diatomic molecules with masses of about 28 amu, so they experience similar London dispersion forces. Because CO is a polar molecule, it experiences dipole-dipole attractions. Because N₂ is nonpolar, its molecules cannot exhibit dipole-dipole attractions. The dipole-dipole attractions between CO molecules are comparably stronger than the dispersion forces between nonpolar N₂ molecules. so CO is expected to have the higher boiling point.

43) Which type of attraction/bond has the least relative strength?

- a) Ionic bond
- b) Hydrogen bond
- c) Dipole-dipole
- d) London force

44) Stronger intermolecular forces _____ viscosity.

- a) Lower

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- b) Very low
c) Higher
d) Middle
- 45) Surface tension is a measure of the toughness of the surface of a liquid. Stronger intermolecular forces _____ surface tension
a) Lower
b) Very low
c) Higher
d) Middle
- 46) _____ is defined as the pressure exerted by a vapor in thermodynamic equilibrium with its condensed phases (solid or liquid) at a given temperature in a closed system.
a) Vapor pressure
b) equilibrium vapor pressure
c) liquid pressure
d) Both Vapor pressure or equilibrium vapor pressure
- 47) Stronger intermolecular forces _____ vapor pressure
a) Lower
b) Very low
c) Higher
d) Middle
- 48) _____ are molecules that allow organisms to transfer genetic information from one generation to the next.
a) Nucleic acids
b) Proteins
c) Chromosome
d) Non
- 49) _____ bears the hereditary information that's passed on from parents to children
a) RNA
b) DNA
c) cDNA
d) nucleotides
- 50) In the nucleic acid if the sugar is a simple ribose, the polymer is _____
a) RNA
b) DNA
c) Both
d) Non
- 51) In the nucleic acid if the sugar is derived from ribose as deoxyribose, the polymer is _____ which of the following
a) RNA

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- b) DNA
- c) Both
- d) Non

52) The five-carbon sugar in DNA is called _____.

- a) Ribose
- b) Oxyribose
- c) Deoxyribose
- d) Trioxiribose

53) The second carbon of ribose bears a _____ group.

- a) Hydrogen
- b) Hydroxyl
- c) Carboxyl
- d) Phosphate

54) The second carbon of deoxyribose has a _____ instead.

- a) Hydrogen
- b) Hydroxyl
- c) Carboxyl
- d) Phosphate

55) Nucleic acids are found in abundance in all living things, where they function _____ information in the nucleus of every living cell of every life-form organism on Earth.

- a) to create
- b) encode
- c) store
- d) all of the above

56) Adenine and guanine are purines, meaning that their structures contain _____

- a) a single carbon-nitrogen ring
- b) Two fused carbon-nitrogen rings.
- c) Both a and b
- d) Non

57) Well-studied biological nucleic acid molecules range in size from 21 nucleotides (small interfering RNA) to large chromosomes (human chromosome 1 is a single molecule that contains _____ million base pairs).

- a) 225
- b) 237
- c) 247
- d) 257

58) Nuclein were discovered by Friedrich Miescher in _____.

- a) 1837
- b) 1869

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- c) 1886
d) 1896
- 59) In _____ Richard Altmann discovered that nuclein has acidic properties, and it became called nucleic acid.
a) 1869
b) 1879
c) 1889
d) 1899
- 60) In 1938 _____ published the first X-ray diffraction pattern of DNA.
a) Astbury and Bell
b) Watson and Crick
c) Friedrich Miescher
d) Richard Altmann
- 61) In _____ Watson and Crick determined the structure of DNA.
A) 1869
B) 1889
C) 1938
D) 1953
- 62) In eukaryotes, such as plants and animals, DNA is found in the nucleus, as well as in certain other types of organelles such as _____.
a) mitochondria
b) chloroplasts
c) both a and b
d) none of these
- 63) In prokaryotes, such as bacteria, the DNA is not enclosed in a membranous envelope, although it's located in a specialized cell region called the _____.
a) Nucleoli
b) Nucleoside
c) Nucleoid
d) Nucleonic
- 64) In eukaryotes, DNA is typically broken up into a number of very long, linear pieces called _____.
a) Chromosomes
b) Genes
c) Nucleotides
d) Non
- 65) In prokaryotes such as bacteria, chromosomes are much smaller and often _____.
a) Linear
b) Broad
c) Circular

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d) Long

66) A always pairs with T through two _____ bonds.

a) **Hydrogen**

b) Hydroxide

c) Covalent

d) All of the above

67) The sugars and phosphates lie on the _____ of the helix, forming the backbone of the DNA; this portion of the molecule is sometimes called the sugar-phosphate backbone.

a) Inside

b) **Outside**

c) Both a and b

d) None of these

68) Write and define types of RNA?

There are several different types of RNA.

Messenger RNA (mRNA) is the RNA transcript or RNA copy of the DNA message produced during DNA transcription. Messenger RNA is translated to form proteins.

Transfer RNA (tRNA) has a three dimensional shape and is necessary for the translation of mRNA in protein synthesis.

Ribosomal RNA (rRNA) is a component of ribosomes and is also involved in protein synthesis. MicroRNAs (miRNAs) are small RNAs that help to regulate gene expression.

69) Organic compounds including fats, phospholipids, steroids, and waxes are called _____.

a) Proteins

b) **Lipids**

c) Carbohydrates

d) Amino acids

70) _____ percent of the human body is made up of protein.

a) 10

b) **20**

c) 25

d) 30

71) What are Group II or Polar, uncharged amino acids?

Group II amino acids are serine, cysteine, threonine, tyrosine, asparagine, and glutamine.

The side chains in this group possess a spectrum of functional groups. However, most have at least one atom (nitrogen, oxygen, or sulfur) with electron pairs available for hydrogen bonding to water and other molecules.

72) Which type of protein contains prosthetic group?

a) **Conjugated**

b) Simple

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- c) Globular
d) Fibrous
- 73) The most common types of secondary structures is/are
a) The α helix
b) The β pleated sheet
c) Both a and b
d) Non
- 74) The stress exerted on a body of rock by surrounding rock. is a pressure in Earth's crust somewhat analogous to hydrostatic pressure in fluids is called
a) Liquid pressure
b) Hydrostatic pressure
c) Lithostatic pressure
d) Non
- 75) Enthalpy H is the energy transferred between a system and the surroundings under constant_____
a) Volume
b) Pressure
c) Temperature
d) Non
- 76) The _____ structure is held together by covalent bonds such as peptide bonds.
a) Primary
b) Secondary
c) tertiary
d) Quaternary
- 77) Thermodynamics is the field of physics that deals with the relationship between heat and other properties such as _____ in a substance
a) Pressure
b) Density
c) Temperature
d) All
- 78) The heat of a material is understood as a representation of the energy contained within the particles of that material. This is known as the _____ theory of gases.
a) Kinetic
b) Potential
c) Heat
d) Non
- 79) When a low-conducting material is used to prevent heat transfer. This is called_____
a) Insulation
b) Convection

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- c) Conduction
- d) Radiation

80) Define the any five terms form the Thermal Contact, Thermal Equilibrium, Thermal Expansion, Conduction, Convection, Radiation and Insulation?

Thermal Contact is when two substances can affect each other's temperature.

Thermal Equilibrium is when two substances in thermal contact no longer transfer heat

Thermal Expansion takes place when a substance expands in volume as it gains heat.

Conduction is when heat flows through a heated solid.

Convection is when heated particles transfer heat to another substance, such as cooking something in boiling water.

Radiation is when heat is transferred through electromagnetic waves, such as from the sun.

Insulation is when a low-conducting material is used to prevent heat transfer.

81) _____ are those that are independent of the size of a system.

- a) Intensive properties
- b) Extensive properties
- c) Dynamic properties
- d) Non

82) Define Extensive properties and give two examples of it?

Extensive properties are those whose values depend on the size-or extent-of the system. Examples are Mass m, Volume V, Total energy E, Weight, Length.

83) _____ system is a system that freely exchanges energy and matter with its surroundings.

- a) Open
- b) Closed
- c) Submerged
- d) Isolated System

84) _____ system is a system that exchanges only energy with its surroundings, not matter

- a) Open
- b) Closed
- c) Submerged
- d) Isolated System

85) Define Processes and cycle?

Any change that a system undergoes from one equilibrium state to another is called a process.

The series of states through which a system passes during a process is called the path of the process.

86) A process during which the pressure remains constant is called_____.

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- a) Isochoric
 - b) Isobaric**
 - c) Isothermal
 - d) Adiabatic
- 87) The IUPAC recommendation for pressure is a _____
- a) lower-case p**
 - b) upper-case P
 - c) both
 - d) non
- 88) Atmospheric pressure is close to _____ pascals.
- a) 1000
 - b) 10,000
 - c) 100,000**
 - d) 1,000,000
- 89) _____, the stress exerted on a body of rock by surrounding rock, is a pressure in Earth's crust somewhat analogous to hydrostatic pressure in fluids.
- a) Hydrostatic pressure
 - b) Lithostatic pressure**
 - c) Atmospheric Pressure
 - d) Non
- 90) A device that measures pressure using a column of liquid is called a _____.
- a) Manometer**
 - b) Pressure meter
 - c) Svanometer
 - d) Pascal meter
- 91) The rolling rock has _____.
- a) Kinetic energy**
 - b) Potential energy
 - c) Activation energy
 - d) Non
- 92) The rock that could roll has _____.
- a) Kinetic energy
 - b) Potential energy**
 - c) Activation energy
 - d) Non
- 93) The total energy of a system consists of the kinetic, potential, and internal energies:
Expressed as E
- a) $KE + PE$
 - b) $U = KE$
 - c) $U = KE + PE$**

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d) Non

94) Enthalpy H is the energy transferred between a system and the surroundings under constant _____.

a) Pressure

b) Volume

c) Temperature

d) Non

95) The unit of measurement for enthalpy in the International System of Units (SI) is the _____.

a) Joule

b) Kelvin

c) Celery

d) Celsius

96) Enthalpy of a reaction or energy change of a reaction ΔH_r is the amount of energy or heat absorbed in a reaction. If the energy is released, ΔH_r is _____.

a) Positive

b) Negative

c) Both

d) Non

97) Differentiate standard-State Enthalpy of Reaction (ΔH_r°) and Enthalpy of formation (ΔH_f°)?

Enthalpy of reaction:

Enthalpy of reaction, defined as the enthalpy change observed in a constituent of a thermodynamic system when one mole of substance reacts completely.

Standard enthalpy of formation

The standard enthalpy of formation is a measure of the energy released or consumed when one mole of a substance is created under standard conditions from its pure elements. The symbol of the standard enthalpy of formation is ΔH_f° .

98) The enthalpy change which occurs when one mole of the compound is burned completely in oxygen under standard conditions, and with everything in its standard state, this is called _____.

a) Enthalpy of a reaction

b) Enthalpy of reaction

c) The enthalpy combustion

d) Enthalpy of neutralization

99) The enthalpy change of combustion will always have a _____ value.

a) Negative

b) Positive

c) Neutral

d) non

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100) Enthalpy of denaturation of lysozyme

kcal/mole.

a) $63 + 6$

b) $63 - 6$

c) 63×6

d) 36×6

101) Enthalpy of _____, defined as the enthalpy change observed when one mole of gaseous ions are completely dissolved in water forming one mole of aqueous ions.

a) Hydration

b) Denaturation

c) Vaporization

d) Sublimation

102) Enthalpy of _____, defined as the heat that is absorbed when melting occurs at constant pressure.

a) Hydration

b) Fusion

c) Vaporization

d) Sublimation

103) Enthalpy of _____, defined as the enthalpy change required to completely change the state of one mole of substance between liquid and gaseous states

a) Hydration

b) Denaturation

c) Vaporization

d) Sublimation

104) Enthalpy of _____, defined as the enthalpy change required to completely change the state of one mole of substance between solid and gaseous states.

a) Hydration

b) Denaturation

c) Vaporization

d) Sublimation

105) For sodium chloride, the solid is more stable than the gaseous ions by _____ kJ mol^{-1}

a) 767

b) 778

c) 787

d) 797

106) Define Lattice enthalpy?

Lattice enthalpy, defined as the energy required to separate one mole of an ionic compound into separated gaseous ions to an infinite distance apart (meaning no force of attraction). Lattice enthalpy is a measure of the strength of the forces between the ions in an ionic solid. The greater the lattice enthalpy, the stronger the forces.

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107) A _____ reaction is one that is able to proceed without needing an outside source of energy.

- a) Spontaneous
- b) Non-spontaneous
- c) Reversible
- d) Non

108) Ice melting at -10°C is an example of _____.

- a) Spontaneous
- b) Non-spontaneous
- c) Both a and b
- d) Non

109) Define ENTROPY and write its units?

Measure of degree of Disorder or randomness in a molecular system is called

ENTROPY Units: $\text{J/K}\cdot\text{mol}$ (Joules per Kelvin per mole)

110) The Cell membranes are involved in a variety of cellular processes such as

- a) Cell adhesion
- b) Ion conductivity
- c) Cell signaling
- d) All of the above

111) _____ is the process in which cells absorb molecules by engulfing them

- a) Endocytosis
- b) Phagocytosis
- c) Pinocytosis
- d) Non

112) The plasma membrane creates a small deformation inward, called an _____ in which the substance to be transported is captured.

- a) Inversion
- b) Invagination
- c) Hole
- d) channel

113) When the dissolved materials enter the cell. It is called _____

- a) Endocytosis
- b) Phagocytosis
- c) Pinocytosis
- d) Non

114) The thermal decomposition of copper carbonate is a _____ reaction.

- a) non-spontaneous
- b) spontaneous
- c) non

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115) The higher up an organism is on the food chain, the _____ available energy it receives/requires from its food sources.

- a) High
- b) Moderate
- c) Less
- d) Non

116) Define the First Law of Thermodynamics?

"The First Law of Thermodynamics, also known as the law of conservation of energy, states that energy can neither be created nor destroyed. It may change from one form to another, but the energy in a closed system remains constant"

117) Define and explain the Second Law of Thermodynamics?

"The Second Law of Thermodynamics states that when energy is transferred, there will be less energy available at the end of the transfer process than at the beginning." Due to entropy, which is the measure of disorder in a closed system, all of the available energy will not be useful to the organism. Entropy increases as energy is transferred.

118) The higher up an organism is on the food chain, the _____ available energy it receives from its food sources

- a) High
- b) Very high
- c) Less
- d) Non

119) In all spontaneous processes, the total entropy always increases and the process is _____.

- a) Irreversible
- b) Reversible

120) Its first formulation is credited to the French scientist Sadi Carnot, who in _____ showed that there is an upper limit to the efficiency of conversion of heat to work, in a heat engine

- a) 1824
- b) 1828
- c) 1834
- d) 1844

121) The _____ is concerned with the direction of natural processes. It asserts that a natural process runs only in one sense, and is not reversible.

- a) Zeroth law
- b) First law
- c) second law
- d) third law

122) The _____ also predicts the end of the universe.

- a) Zeroth law

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b) First law

c) **second law**

d) third law

123) _____ of thermodynamics was developed by the German chemist Walther Nernst during the years 1906-12.

a) Zeroth law

b) First law

c) second law

d) **third law**

124) The third law of thermodynamics is often referred to as

a) Nernst's theorem

b) Nernst's postulate

c) **Both a and b**

d) Non

125) An alternative version of the third law of thermodynamics as stated by _____ in 1923.

a) Gilbert N Lewis

b) Merle Randall

c) Walther Nernst

d) **Both a and b**

126) Define Nernst Heat Theorem?

It is impossible for any process, no matter how idealized, to reduce the entropy of a system to its absolute-zero value in a finite number of operations.

127) The third law of thermodynamics states that the entropy of a system approaches a constant value as the temperature approaches _____

a) **absolute zero**

b) extreme value

c) 37 degree

d) 100 degree

128) The entropy of a system at absolute zero is typically _____, and in all cases is determined only by the number of different ground states it has.

a) Minimum

b) Maximum

c) **Zero**

d) Non

129) It says that when we are considering a totally perfect (100% pure) crystalline structure, at absolute zero (0 Kelvin), it will have _____.

a) Low entropy

b) **no entropy**

c) high entropy

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d) non

130) Define Zeroth Law of Thermodynamics?

"If two bodies are each in thermal equilibrium with some third body, then they are also in equilibrium with each other"

131) What do you know about Fahrenheit, Celsius or Centigrade, Kelvin or Absolute?

Fahrenheit:

This is one of the oldest scales, and is based on the coldest temperature that could be achieved with a mix of ice and alcohol. In it the freezing point of water is at 32 °F, the boiling point of water is at 212 °F.

Celsius or Centigrade:

This is a very sane system, where the freezing point of water is at 0 °C and the boiling point is at 100 °C. The degree size is thus as big as the Fahrenheit degree.

Kelvin or Absolute:

0 K is the lowest possible temperature, where the internal energy of a system is at its absolute minimum. The degree size is the same as that of the Centigrade or Celsius scale. This makes the freezing point of water at atmospheric pressure 273.16 K, the boiling point at 373.16 K.

132) Reactions that have a negative ΔG release free energy and are called _____ reactions.

- a) Exergonic
- b) Endergonic
- c) non-spontaneous
- d) non

133) Reactions with a positive ΔG ($\Delta G > 0$), on the other hand, require an input of energy and are called _____ reactions.

- a) Exergonic
- b) Endergonic
- c) spontaneous
- d) non

134) Living systems do not violate the _____ law of thermodynamics, which states that entropy increases over time.

- a) Zeroth
- b) First
- c) Second
- d) Third

135) Define metabolic pathway?

A sequence of chemical reactions, where the product of one reaction serves as a substrate for the next, is called a metabolic pathway or biochemical pathway. Most metabolic pathways take place in specific regions of the cell.

136) **Difference Between Passive and Active Transport?**

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The main difference is the fact that passive transport does not require any energy, whereas active transport requires energy for movement.

Passive transport is basically along the concentration gradient and is mostly dependent on the permeability of the cell membrane structure.

Active transport requires energy for its execution because the movement of substances is usually against the concentration gradient, due to which, it has to make an extra effort to pass through.

This type of transport is usually needed in cases where the cell requires higher amount or concentration of a substance within the cell for its proper functioning, like ions, glucose and certain kinds of amino acids.

137) What are the **Movement Across Membrane**?

The necessity for movement of substances across the plasma membrane

All movement of substances go through the cell membrane, which is also known as the plasma membrane.

The necessity for the movement of substances across a plasma membrane are

- a) Cells need nutrients and oxygen
- b) Cells produce waste product which exit through the plasma membrane.
- c) The plasma membrane control the types and the amounts of substances needed by the cell at any one time.

138) Depending on the membrane's location and role in the body, lipids can make up anywhere from _____ percent of the membrane, with the remainder being proteins.

- a) 2 to 20
- b) 20 to 40
- c) 20 to 60
- d) 20 to 80

139) The element _____ is a one-atom molecule.

- a) Hydrogen
- b) Helium
- c) Oxygen
- d) Neon

140) The process of _____, a substance tends to move from an area of high concentration to an area of low concentration until its concentration becomes equal throughout a space.

- a) Diffusion
- b) Effusion
- c) Active transport
- d) None

141) Kinetic Energy can be increased by increasing the _____

- a) Pressure
- b) Temperature

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c) Length

d) Width

142) In _____ oxygen and carbon dioxide are not exchanged by diffusion in the lungs.

a) Mammals

b) Birds

c) reptiles and amphibia

d) All of the above

143) _____ is the passive movement of molecules across the cell membrane via the aid of a membrane protein.

a) Diffusion

b) Effusion

c) Facilitated diffusion

d) Active transport

144) Define Carrier Proteins and their mechanism in the cell membrane?

Integral glycoproteins which bind a solute and undergo a conformational change to translocate the solute across the membrane.

Carrier proteins will only bind a specific molecule via an attachment similar to an enzyme-substrate interaction. Carrier proteins may move molecules against concentration gradients in the presence of ATP (i.e. are used in active transport). Carrier proteins have a much slower rate of transport than channel proteins (by an order of ~1,000 molecules per second).

145) Define Channel Proteins and give their mechanism in the cell membrane?

Integral lipoproteins which contain a pore via which ions may cross from one side of the membrane to the other.

Channel proteins are ion-selective and may be gated to regulate the passage of ions in response to certain stimuli. Channel proteins only move molecules along a concentration gradient (i.e. are not used in active transport). Channel proteins have a much faster rate of transport than carrier proteins.

146) Define isotropic diffusion and anisotropic diffusion?

Free diffusion (no obstacles) occurs equally in all directions. This is called **isotropic diffusion**.

Bundles of axons provide a barrier to perpendicular diffusion and a path for parallel diffusion along the orientation of the fibres. This is termed **anisotropic diffusion**.

147) How many types of membranes are possible?

a) Two

b) Three

c) Four

d) Five

148) Write a note on types of membranes?

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Diffusion takes place also through membranes. Three types of membranes are possible:

1. Permeable membranes
2. Impermeable membranes
3. Semipermeable membranes

Permeable membranes:

- Permeable membranes are those which allow diffusion of both solvent and solute molecules and ions through them.
- Ordinary cellulose cell walls of young non-vacuolated cells are examples of completely permeable membranes.
- Lignified cell walls are also quite freely permeable to water and when wet, to solute ions and molecules as well.

Impermeable membranes:

- Impermeable membranes are those which prohibit the entry of both solvent and solute particles.
- Suberized or heavily cutinized cell walls in plants are practically impermeable as regards the passage of water and dissolved substances.

Semipermeable membranes:

- Semipermeable or differentially permeable membranes are those which allow the diffusion only of the solvent particles through them while restricting the entrance of the solute particles. i.e., the membrane is permeable to one substance but impermeable to the other.

149) At rest, the inside of the neuron's membrane is _____ charged, while the outside is _____ charged.

- a) Negatively, positively
- b) Positively, Negatively
- c) Positively, neutral
- d) Neutral, negative

150) Define **Osmosis**?

Osmosis is a type of diffusion that involves the random movement of water molecules. It is the movement of water across a partially-permeable membrane, from an area of high water concentration to an area of low water concentration.

151) If the **water concentration** of the cells cytoplasm is **lower** than that of the medium (i.e. the medium is a _____ solution).

- a) **hypotonic**
- b) isotonic
- c) hypertonic
- d) non

152) What are the **Effects of osmosis in animal cells**.

Animal cells do not have cell walls.

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In hypotonic solutions, animal cells swell up and explode as they cannot become turgid because there is no cell wall to prevent the cell from bursting.

When the cell is in danger of bursting, organelles called contractile vacuoles will pump water out of the cell to prevent this.

In hypertonic solutions, water diffuses out of the cell due to osmosis and the cell shrinks. Thus, the animal cell has always to be surrounded by an isotonic solution.

In the human body, the kidneys provide the necessary regulatory mechanism for the blood plasma and the concentration of water and salt removed from the blood by the kidneys is controlled by a part of the brain called the hypothalamus.

The process of regulating the concentration of water and mineral salts in the blood is called **osmoregulation**.

Animals which live on dry land must conserve water and so must animals which live in the salty sea water, but animals which live in freshwater have the opposite problem, they must get rid of excess water as fast as it gets into their bodies by osmosis.

153) How do bacteria undergo random walks?

One common mechanism for bacteria to undergo random walks is the so-called "run and tumble" method.

This method is used by bacteria that have several flagella (little whip-like propellers that help them swim).

When rotating in one direction, the flagella all work together to propel the bacterium, creating a straight swim.

Because of the way that the flagella are shaped, they don't propel the bacterium when rotating in the opposite direction, but rather cause the bacterium to "tumble" so that when it starts swimming again, it is moving in a random direction.

By alternating "runs" and "tumbles," a bacterium can undergo a random walk. The "runs" are the steps in a random walk and the "tumbles" are the random changes in direction.
e.g. *E. Coli*

154) Define Brownian Motion?

In 1827, Robert Brown was looking through a microscope at pollen grains in water. He observed that the smallest particles were in constant motion, jiggling around in a seemingly random way. This came to be known as Brownian motion.

155) Friction can be reduced by _____ to the rubbing surface.

- a) Increasing weight
- b) applying lubricants (like oil or grease)
- c) increasing speed
- d) non

156) Gel filtration chromatography is a separation based on _____.

- a) Culture
- b) Size
- c) Oder

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d) Non

157) Gel filtration chromatography also called _____.

a) Size-exclusion chromatography (SEC)

b) molecular sieve chromatography

c) both a and b

d) non

158) The Gel filtration chromatography technique was invented by _____.

working at **Queen Charlotte's Hospital, London.**

a) Grant Henry Lathe

b) Colin R Ruthven

c) Both a and b

d) Janssen Robert

159) Write down the **Principle of Gel Filtration Chromatography?**

SEC works by trapping smaller molecules in the pores of the adsorbent materials adsorption ("stationary phases")

This process is usually performed with a column, which consists of a hollow tube tightly packed with extremely small porous polymer beads designed to have pores of different sizes. These pores may be depressions on the surface or channels through the bead. As the solution travels down the column some particles enter into the pores. Larger particles cannot enter into as many pores.

The larger the particles, the faster the elution. The larger molecules simply pass by the pores because those molecules are too large to enter the pores.

Larger molecules therefore flow through the column more quickly than smaller molecules, that is, the smaller the molecule, the longer the retention time.

160) Thorslore Svedberg invented the analytical ultracentrifuge in _____, and won the Nobel Prize in Chemistry in 1926 for his research on colloids and proteins using the ultracentrifuge.

a) 1903

b) 1913

c) 1921

d) 1923

161) Write a note on X-ray Crystallography?

X-ray crystallography is a technique used for determining the atomic and molecular structure of a crystal, in which the crystalline atoms cause a beam of incident X-rays to diffract into many specific directions.

By measuring the angles and intensities of these diffracted beams, a crystallographer can produce a three-dimensional picture of the density of electrons within the crystal.

From this electron density, the mean positions of the atoms in the crystal can be determined, as well as their chemical bonds, their disorder, and various other information.

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Since many materials can form crystals – such as salts, metals, minerals, semiconductors, as well as various inorganic, organic, and biological molecules – X-ray crystallography has been fundamental in the development of many scientific fields.

The method also revealed the structure and function of many biological molecules, including vitamins, drugs, proteins and nucleic acids such as DNA.

X-ray crystallography is still the chief method for characterizing the atomic structure of new materials.

162) The European X-ray free-electron laser (European XFEL) is an X-ray research laser facility commissioned during May

- a) 2007
- b) 2011
- c) 2013
- d) 2017

163) Resolution of single-particle reconstruction of β -galactosidase is _____.

- a) 2.2 micrometer
- b) 2.2 nanometer
- c) 2.2 Å anstrong
- d) 2.2 Pico meter

164) Define **Nuclear magnetic resonance spectroscopy (NMR spectroscopy)?**

Nuclear magnetic resonance spectroscopy, most commonly known as **NMR spectroscopy**, is a research technique that exploits the magnetic properties of certain atomic nuclei.

This type of spectroscopy determines the physical and chemical properties of atoms or the molecules in which they are contained. It relies on the phenomenon of nuclear magnetic resonance and can provide detailed information about the structure, dynamics, reaction state, and chemical environment of molecules.

165) **Edward Mills Purcell** and **Felix Bloch** shared the _____ Nobel Prize in Physics for their discoveries.

- a) 1932
- b) 1942
- c) 1952
- d) 1962

166) Define **High-performance liquid chromatography (HPLC)?**

High-performance liquid chromatography (HPLC) formerly referred to as high-pressure liquid chromatography is a technique in analytical chemistry used to separate, identify, and quantify each component in a mixture. High performance liquid chromatography is powerful tool in analysis, it yields high performance and high speed compared to traditional columns chromatography because of the forcibly pumped mobile phase.