1. **Which of the following is not degraded by colonic flora?**

a) >Pectin

b) >Lignin

c) >Starch

d) >Glucose

Correct Answer - B
Lignin *Ref: Advanced Human nutrition 1/e p89; Medical Biochemistry by N V Bhagvan 3/e p154*

- Lignin is a dietary fibre that can neither be digested by gastrointestinal enzymes nor fermented by colonic microorganisms.
- Cellulose, Hemicellulose and Pectins are plant components that cannot be digested by gastrointestinal enzymes, but can be fermented by colonic microorganisms.

2. CAP in LAC operon is

a) >Positive regulator

b) >Negative regulator

c) >Attenuation

d) >Constitutive expression

Correct Answer - A

Ans. A. >Positive regulator

Positive regulator *Ref Lippincott's biochemistry 4/e chapter 32 (3/e p418-420)*

What is an Operon?

* In prokaryotes, the genes coding for proteins involved in a particular metabolic pathway are often sequentially arranged together on the chromosome along with a single promoter or regulatory region. This entire cluster is termed as an operon, for eg, the *lac operon* (coding proteins for metabolism of lactose) or *trp operon* (coding proteins needed for the synthesis of tryptophan).
* An operon is regulated by the single promoter or regulatory region. All the genes of an Operon are transcribed together as a unit. The transcription product of operon is a single polycistronic messenger RNA (mRNA). Thus all the genes of an operon are controlled together, that is, they all are turned on or off as a unit.

When both glucose and lactose are available:

* In this case, transcription of the lac operon does not take place, even if lactose is present at a high concentration.
* Presence of glucose deactivates Adenylyl cyclase—so no cAMP–CAP complex forms and the CAP-binding site remains empty. RNA polymerase is, therefore, unable to effectively initiate transcription, even though the repressor may not be bound to the operator region.

Consequently, the three structural genes are not expressed.
* (Lac Operon regulation is very beautifully depicted in a figure of Lippincott biochemistry; Fig. 32.4 of 4/e and Fig. 30.11 of 3/e)

3. Following modification occurs in Gs subunit which leads to watery diarrhea in cholera

a) >ADP ribosylation

b) >ATP-ADP transfer

c) >Phosphorylation

d) >Dephosphorylation

Correct Answer - A

Ans. A. >ADP ribosylation

ADP ribosylation [Ref. Harper 28/e p620; Robbins Pathology (big), 8/e p797 (7/e p835)]

- Cholera toxin (CT) is a potent protein enterotoxin, chiefly responsible for the virulence of V. cholera.
- It is elaborated by the organism following its colonization of the small intestine [Note that V. cholera never invades the intestinal epithelium but remain within the lumen and secretes the cholera toxin].
- Effect of cholera toxin leads to watery diarrhoea, the charactersitic feature of cholera.

Mechanism of Cholera Toxin Action

- Cholera toxin consists of 2 subunits
  - a monomeric enzymatic moiety (A subunit)
  - a pentameric binding moiety (B subunit)
- The B-subunit, serves as a 'landing pad and hinds to GM1 ganglioside, a glycolipid on the surface of epithelial cells of the small intestine. This facilitates the entry of A-subunit into the epithelial cells.
- The entry of A-subunit into the cells leads to activation of its

A_1 fragment.

- Activated A_i interacts with cytosolic proteins called ADP-ribosylation factors (ARF)
- The ARF-A_1 complexes catalyze ADP-ribosylation of a G-protein called GSa.
- The ADP-ribasylated Gsa in turn binds to and stimulates adenylate cyclase. [The ADP-ribosylated GSa is in a permanently active state, resulting in continued activation of adenylate cyclase]
- Activated adenylate cyclase generates high levels of intracellular cyclic AMP (cAMP) from ATP.
- cAMP inhibits the absorptive sodium transport system (decreases sodium & chloride reabsorption) and activates the secretory chloride transport system (increases chloride and bicarbonate secretion)
- This leads to accumulation of sodium choride in the intestinal lumen.
- Accumulated sodium chloride draws water into the lumen due to increased osmolality leading to watery diarrhoea.

4. Among the following all are hydrophilic hormones that act on cytosolic receptors except one which is a lipophilic hormone that acts on nuclear receptor:

a) >Thyroxine

b) >Epinephrine

c) >GH

d) >ACTH

Correct Answer - A

Thyroxine *[Ref: Harper 28/e p427,428; KDT 6/e p232]*

Classification of Hormones by Mechanism of Action

I. Hormones that bind to intracellular receptors (lipophilic, readily penetrate the cell membrane)

At cytoplasmic receptors	At nuclear receptors
(hormone penetrates cell membrane-combines with its cytoplasmic receptor-passes through nuclear membrane and binds to specific genes-DNA mediated mRNA synthesis-synthesis of functional proteins)	*(hormone penetrates nuclear membrane? combines with its receptor-DNA mediated mRNA synthesis-synthesis of functional proteins)*
Androgens	Thyroid hormones (T_3 and T4)
Calcitriol (1,25[0H1$_2$-D3)	
Estrogens	
Glucocorticoids	

Mineralocorticoids
Progestins
Retinoic acid
II. Hormones that bind to cell surface receptors (hydrophilic)
A. The second messenger is cAMP
a_2-Adrenergic catecholamines
P-Adrenergic catecholamines
Adrenocorticotropic hormone (ACTH)
Antidiuretic hormone
Calcitonin
Chorionic gonadotropin, human (CG)
Corticotropin-releasing hormone
Follicle-stimulating hormone (FSH)
Glucagon
Lipotropin (LPH)
Luteinizing hormone (LH)
Melanocyte-stimulating hormone (MSH)
Parathyroid hormone (PTH)
Somatostatin
Thyroid-stimulating hormone (TSH)
B. The second messenger is cGMP
Atrial natriuretic factor
Nitric oxide
C. The second messenger is calcium or phosphatidylinositols (or both)
Acetylcholine (muscarinic)
a_l-Adrenergic catecholamines
Angiotensin II
Antidiuretic hormone (vasopressin)
Cholecystokinin
Gastrin
Gonadotropin-releasing hormone
Oxytocin
Platelet-derived growth factor (PDGF)
Substance P

Substance P
Thyrotropin-releasing hormone (TRH)
D. The second messenger is a kinase or phosphatase cascade
Adiponectin
Chorionic somatomammotropin Epidermal growth factor
Erythropoietin
Fibroblast growth factor (FGF) Growth hormone (GH)
Insulin
Insulin-like growth factors I and II Leptin
Nerve growth factor (NGF)
Platelet-derived growth factor Prolactin

5. Gene duplication plays an important role in the evolution of -

a) >m Rna

b) >r Rna

c) >t Rna

d) >hn Rna

Correct Answer - A
mRNA (most likely) *[Ref: various internet sites]*

- Gene duplications are important forces of genome evolution which change genome size and lead to the evolution of new gene functions.
- Gene duplication (or chromosomal duplication or gene amplification) is any duplication of a region of DNA that contains a gene; it may occur as an error inhomologous recombination, a retrotransposition event, or duplication of an entire chromosome. The second copy of the gene is often free from selective pressure— that is, mutations of it have no deleterious effects to its host organism. Thus it accumulates mutations faster than a functional single-copy gene, over generations of organisms.
- This freedom from consequences allows for the mutation of novel genes that could potentially increase the fitness of the organism or code for a new function.
- The two genes that exist after a gene duplication event are called paralogs and usually code for proteins with a similar function and/or structure. By contrast, orthologous genes are ones which code for proteins with similar functions but exist in different species

6. Movement of protein from nucleus to cytoplasm can be seen by

a) >FISH

b) >FRAP

c) >Confocal microscopy,

d) >Electron microscopy

Correct Answer - B
FRAP *[Ref: Lehninger Biochemistry 4/e p.382; Article -Use of fluorescence photobleaching techniques to measure the kinetics of intracellular transport R.G. Davies, D.A. Jans and K.M. Wagstaff on website http://www„formatex.info/microscopy4/756-763.pdf]*
Fluorescence Recovery After Photobleaching (FRAP)
Principle:

- All fluorescent dyes emit light of one wave length (e.g. green) after they have absorbed light of another wave length (e.g. blue). However, if a very high intensity blue light is delivered to the dye, the dye will "photobleach" meaning that the high intensity light has rendered the dye unable to fluoresce.
- FRAP is based on the principal of observing the rate of recovery of fluorescence in a photobleached area of cell, due to the movement of a fluorescent marker into the area.
- The method is to tag a specific cell component (i.e. protein, lipid, carbohydrate) with a fluorescent molecule, image that cell, photobleach a small portion of the cell, then image the recovery of fluorescence over time.
- The recovery of fluorescence in the photobleached portion occurs because of diffusion or active movement of fluorophore tagged molecules within the cell replacing the bleached fluorophore with

unbleached molecules. Use:

- FRAP is used to investigate the diffusion and motion of biological macromolecules. including movement into and out of the nucleus, and lateral movement within membranes.
- FRAP has been used to assess the structure of artificial and biological membranes._FRAP was used to help define the fluid mosaic model of cell membranes.

7. Histone acetylation causes?

a) >Increased Heterochromatin formation

b) >Increased Euchromatin formation

c) >Methylation of cystine

d) >DNA replication

Correct Answer - B
Increased Euchromatin formation [Ref: Lippincott's Biochemistery 3/e p406, 420; Harper biochemistry 28/e p.315]
Histone acetylation promotes Euchromatin formation (transcriptionally active DNA).
Deacetylation and methylation promotes Heterochromatin formation (transcriptionally inactive DNA).

- There are five classes of histones, designated HI, H2A, H2B, H3, and H4. These small proteins are positively charged at physiologic pH as a result of their high content of lysine and arginine. Because of their positive charge, they form ionic bonds with negatively charged DNA. Histones help in condensation of DNA into chromosomes.
- Two molecules each of H2A, H2B, H3, and H4 form the structural core of the individual nucleosome "beads." Around which a segment of the DNA double helix is wound nearly twice. (Histone HI, is not found in the nucleosome core, but instead binds to the linker DNA chain between the nucleosome beads.). Nucleosomes are further arranged into increasingly more complex structures that organize and condense the long DNA molecules into chromosomes.
- These histone proteins can undergo reversible modifications at their N-terminal end (like acetylation, methylation or phosphorylation). These modifications help in regulation of gene expression.

- Acetylation of the lysine residues at the N terminus of histone proteins removes positive charge on the lysine and thereby decreases the interaction of the histone with the negatively charged DNA. As a result, the condensed chromatin is transformed into a more relaxed structure allowing transcription factors to access specific regions on the DNA. Deacetylation restores the positive charge, causing stronger interactions between histones and DNA.
- *Thus histone acetylation enhances transcription while histone deacetylation represses transcription.*
- Relaxed, transcriptionally active DNA is referred to as euchromatin. More condensed, inactive DNA is referred to as heterochromatin.
- Histone acetylation is catalyzed by histone acetyltransferases (HATS) and histone deacetylation is catalyzed by histone deacetylases (denoted by HDs or HDACs).
- Another difference noted between transcriptionally active and inactive chromatin is the extent of methylation of cytosine bases in CG-rich regions (CG islands) of many genes. It has been observed that transcriptionally active genes are less methylated (hypomethylated) than their inactive counterparts.
- *Thus formation of euchromatin is promoted by acetylationand formation of heterochromatin is promoted by deacetylation and methylation. The action of methylation is indirect and has no effect upon charge.*

8. Triplex DNA is due to

a) >Hoogsteen pairing

b) >Palindromic sequences

c) >Large no. of guanosine repeats

d) Polypyramidine tracts

Correct Answer - A
Hoogsteen pairing *[Ref: Lehninger principles of biochemistety 4/e p286J "Hoogsteen pairing allows the formation of triplex DNAs."- Lehninger*
Normal duplex DNAs contain Watson-Crick base pairing; according to which Adenine pairs with Thymine by 2 hydrogen bonds and Guanine pairs with Cytosine by 3 hydrogen bonds.
Hoogsteen pairing *(named after its discoverer Karst Hoogsteen)* is an alternate base pairing pattern, more commonly seen in RNA. Here the pairing is the same as in Watson-Crick i.e. A to T and G to C. The difference described in simple terms is that
of geometry. *(hydrogen bonds are formed between the same base pairs, but in a different way which involve the N7 atom of the purine ring*
rather than the NI atom). It is because of this different geometry that a third strand could be formed in the double-stranded DNA to give rise to Triplex DNA.

9. Acetyl coA can be directly converted to all except

a) Glucose

b) Fatty acids

c) Cholesterol

d) Ketone bodies

Correct Answer - A
Glucose *[Ref: Harper 28/e p132,133]Repeat from May 10*
Acetyl CoA has a special central role. It's a common product of Carbohydrates. Fats and Protein. Acetyl CoA thus formed can then undergo multiple fates:

- Oxidized to produce energy via Citric acid cycle (TCA cycle)
- Synthesized into
- Fatty acids
- Cholesterol and other steroids
- Ketone bodies

Acetyl CoA cannot be converted into Glucose. It is not a substrate of gluconeogenesis. Substrates for Gluconeogenesis

- Glucogenic amino acids
- Lactate
- Glycerol
- Propionate

10. True about Sickle cell disease are all, Except:

a) Single nucleotide change results in change of Glutamine to Valine

b) Sticky patch is generated as a result of replacement of a non polar residue with a polar residue

c) HbS confers resistance against malaria in heterozygotes

d) RFLP results from a single base change

Correct Answer - B

Sticky patch is generated as a result of replacement of a non polar residue with a polar residue *[Ref: Harper 28/ e p49 (26/e p46)]*
Repeat from May 11
Sticky patch in sickle cell disease results from replacement of a polar residue (Glutamate) with a non polar residue
Glutamate is ----Polar *(Mnemonic: GP i.e. General Practioner)*
Valine is Non Polar
(Valine) at the 6th position of the beta chain.

11. Respiratory quotient of carbohydrate is:

a) 0.5

b) 0.8

c) 0.75

d) 1

Correct Answer - D
Ans: D. 1

- The **respiratory quotient** (or **RQ** or **respiratory coefficient**), is a dimensionless number used in calculations of basal metabolic rate (BMR) when estimated from carbon dioxide production. It is calculated from the ratio of carbon dioxide produced by the body to oxygen consumed by the body. Such measurements, like measurements of oxygen uptake, are forms of indirect calorimetry. It is measured using a respirometer.
- The respiratory quotient (**RQ**) is the ratio:
  RQ = $CO_{2\ \text{eliminated}}$ / $O_{2\ \text{consumed}}$

12. **Most common determinant of energy expenditure in a resting state is:**

a) Lean Body Mass

b) Adipose tissue

c) Resting Heart Rate

d) Exercise

Correct Answer - A

Energy expended in the resting state depends primarily on the lean body mass and the metabolic cost for processing ingested nutrients.

Ref: New Developments in Obesity Research By Lawrence F. Ditmier, Page 131; Handbook of Obesity: Etiology and Pathophysiology By George A. Bray, Page 705

13. **Which one of the following coenzyme is associated with glycogen phosphorylase?**

a) Thiamine pyrophosphate

b) Tetrahydrofolate

c) Flavin mononuleotide

d) Pyridoxal phosphate

Correct Answer - D

Glycogen phosphorylase has a pyridoxal phosphate (PLP, derived from Vitamin B_6) at each catalytic site.
Pyridoxal phosphate links with basic residues and covalently forms a Schiff base.
Once the Schiff base linkage is formed, holding the PLP molecule in the active site, the phosphate group on the PLP readily donates a proton to an inorganic phosphate molecule, allowing the inorganic phosphate to in turn be deprotonated by the oxygen forming the α-1,4 glycosidic linkage.

14. **Which of the following is seen in association with membrane raft?**

a) Mannose binding protein

b) GTP associated receptor

c) GPI anchored protein

d) None of the above

Correct Answer - C

The **membrane rafts** are microdomains of the biological membranes and they consist of,

- Saturated phospholipids
- Cholesterol
- Sphingomyelin
- *Various sugars in a glycosphingolipid with long, saturated fatty acyl chains (particularly ceramics and gangliosides) or GPI linked protein*

Membrane proteins can also contain carbohydrates resulting in membrane glycoproteins important in membrane signaling and functions. *Upto 50% of the plasma membrane may consist of rafts.*

Ref: Janson L.W., Tischler M.E. (2012). Chapter 8. Membranes. In L.W. Janson, M.E. Tischler (Eds), The Big Picture: Medical Biochemistry.

15. **If more than one codon codes for same amino acid, this phenomenon is known as?**

a) Degeneracy

b) Frameshift mutation

c) Transcription

d) Mutation

Correct Answer - A

3 out of 64 codons do not code for any amino acid. These have been termed nonsense codons.
These nonsense codons are utilized in the cell as termination signals; they specify where the polymerization of amino acids into a protein molecule is to stop.
The remaining 61 codons code for 20 amino acids.
Thus, there must be *degeneracy in the genetic code, ie; multiple codons must decode the same amino acid.*

Some amino acids are encoded by several codons; for example six different codons, UCU, UCC, UCA, UCG, AGU, and AGC all specify serine. Other amino acids, such as methionine and tryptophan, have a single codon. In general, the third nucleotide in a codon is less important than the first two in determining the specific amino acid to be incorporated, and this accounts for most of the degeneracy of the code.

However, for any specific codon, only a single amino acid is indicated; with rare exceptions, the genetic code is **unambiguous**—that is, given a specific codon, only a single amino acid is indicated. **The distinction between ambiguity and degeneracy is an important concept.**

Ref: Weil P. (2011). Chapter 37. Protein Synthesis & the Genetic Code. In D.A. Bender, K.M. Botham, P.A. Weil, P.J. Kennelly, R.K. Murray, V.W. Rodwell (Eds), Harper's Illustrated Biochemistry, 29e.

16. **Subtelomeric rearrangement of genes is frequently associated with mental retardation. All of the following techniques can be used to diagnose them, EXCEPT:**

a) FISH

b) MAPH

c) CGHarray

d) MALDI

Correct Answer - D

MALDI: It is a technique used to assess the molecule, based on their mass only.
Most commonly employed methods for dispersing peptides, proteins, and other large biomolecules into the vapor phase for mass spectrometric analysis are electrospray ionization and matrix-assisted laser desorption and ionization, aka MALDI.

In electrospray ionization, the molecules to be analyzed are dissolved in a volatile solvent and introduced into the sample chamber in a minute stream through a capillary .
As the droplet of liquid emerges into the sample chamber, the solvent rapidly disperses leaving the macromolecule suspended in the gaseous phase. The charged probe serves to ionize the sample.
Electrospray ionization is frequently used to analyze peptides and proteins as they elute from an HPLC or other chromatography column already dissolved in a volatile solvent.

In MALDI, the sample is mixed with a liquid matrix containing a light-absorbing dye and a source of protons.
In the sample chamber, the mixture is excited using a laser, causing the surrounding matrix to disperse into the vapor phase so rapidly as to avoid heating embedded peptides or proteins.

Ref: Kennelly P.J., Rodwell V.W. (2011). Chapter 4. Proteins: Determination of Primary Structure. In D.A. Bender, K.M. Botham, P.A. Weil, P.J. Kennelly, R.K. Murray, V.W. Rodwell (Eds), Harper's Illustrated Biochemistry, 29e.

17. After digestion by restriction endonucleases DNA strands can be joined again by which of the following enzymes?

a) DNA polymerase

b) DNA ligase

c) DNA topoisomerase

d) DNA gyrase

Correct Answer - B

DNA is cleaved into fragments by restriction endonucleases. After the fragments of DNA have base paired, the ends are covalently joined by the action of **DNA ligase**. Restriction enzymes in conjunction with DNA ligase can produce vector containing recombinant or hybrid or chimeric DNA.

Ref: Essentials of Biochemistry By Naik, 2012, Page 335.

18. **Which of the following test is used to differentiate the chromosome of normal and cancer cells?**

a) PCR

b) Comparative genomic hybridization

c) Western Blotting

d) Southern Blotting

Correct Answer - B
Comparative genomic hybridization (CGH) is a method that can be used only when DNA is available from a specimen of interest. This technology has been used to study cryptic chromosomal imbalances in patients with mental retardation and multiple congenital anomalies, as well as in prenatal diagnosis.

It has also been used to detect microdeletions and microduplications in cancer and in previously unidentified genomic disorders.

Ref: Schwartz S., Hassold T. (2012). Chapter 62. Chromosome Disorders. In D.L. Longo, A.S. Fauci, D.L. Kasper, S.L. Hauser, J.L. Jameson, J. Loscalzo (Eds), Harrison's Principles of Internal Medicine, 18e

19. Irreversible step (s) in glycolysis is/are:

a) Hexokinase

b) Phosphofructokinase

c) Pyruvate kinase

d) All of the above

Correct Answer - D
All of the above

20. Increased levels of alanine in serum after fasting suggest:

a) Increased release of alanine from muscle

b) Reduced amino acid utilization for gluconeogenesis

c) Break in continuity of plasma membrane resulting in leakage of amino acids

d) Decreased uptake of alanine by liver

Correct Answer - A
A i.e. Increased release of alanine from muscle:*lanong 24/e p2 I*
** except for the first few hours of starvation, the major effects are progressive depletion of tissue fat and protein.*
** Fat depletion is steady and continues unabated until most of the fat stores in the body are gone.*
** Proteins undergo three phases of depletion-rapid depletion of mobilizable proteins at first, then greatly slowed depletion (during this time increased fat breakdown leads to a state of ketosis).*
** this finally, rapid depletion again shortly before death. The major aim of protein catabolism during a state of starvation is to provide the glucogenic amino acids (especially alanine and glutamine) that serve as substrates for gluconeogenesis in the liver."*

21. During prolonged starvation, the rate of gluconeogenesis depends on

a) Increased alanine levels in liver

b) Decreased cGMP in liver

c) ADP in liver

d) Decreased essential fatty acids in liver

Correct Answer - A
A i.e. Increased alanine level in muscle

22. All the statements regarding LDL receptors are true except:

a) Present only in the extra-hepatic tissues

b) Clathrin-coated pits contain the receptor on cell membrane

c) It is taken into the cells by endocytosis

d) Increased cellular cholesterol down-regulates the synthesis of LDL receptors

Correct Answer - A
A i.e. Present only in the extra-hepatic tissues:

23. A young male patient presents with LDL 600mg/dl, triglycerides 140 mg/dl. What would be the most likely finding on physical examination

a) Tendon xanthoma

b) Planar xanthoma

c) Lipemia retinalis

d) Tuberoeruptive xanthoma

Correct Answer - A
A i.e. Tendon Xanthoma

- Tendon xanthomas are associated with type II hyperlipidemia, chronic biliary tract obstruction, and primary biliary cirrhosis. Palmar xanthomata and tuberoeruptive xanthomata (over knees and elbows) occur in type III hyperlipidemia.
- The lipid profile and the lipoprotein electrophoresis reveales elevated levels of low-density lipoprotein (LDL) cholesterol, and total cholesterol.
- Biopsy from the nodule reveales infiltration of the dermis with admixture of foam cells, histiocytes and lymphocytes, The lipid profile of the parents shows a rise in the LDL cholesterol
-

24. In a well fed state, the activity of CPT-I in outer mitochondrial membrane is inhibited by:

a) Glucose

b) Pyruvate

c) Acetyl CoA

d) Malonyl CoA

Correct Answer - D
D i.e. Malonyl CoA
In well *fed state, the activity of CPTI (carnitine palmitoyl transferase I) in outer mitochondrial membrane is inhibited by melonyl CoAQ.*

25. Poly(A) tail translates into (i.e. on translation give rise to):

a) Polyproline

b) Polylysine

c) Polyalanine

d) Polyglycine

Correct Answer - B
B i.e. Polylysine

Codon	AAA	GGG	CCC	TTT/ UUU
Translation product	*LysinQ*	Glycine	Proline	Phenylalanine

26. APO B48 & APO B100 is synthesized from the same rnRNA; the difference between them is due to:

a) RNA splicing

b) Allelic exclusion

c) Deamination of cytidine to uridine

d) Upstream repression

Correct Answer - C

C i.e. Deamination of cytidine to uridine IRef: Vasudevan

- **Least post translational modification** occurs in **prokaryotic mRNA,** which is generally identical to its primary transcript. Post translational modification of t-RNA includes removal of introns from anticodon loop, trimming of 5' & 3' **ends, methylation /** reduction / deamination / alkylation / rearranging glycolsidic bond to produced modified bases like methylated bases, dihydrouracil (D) & pseudo uracil (W) bases in nucleus, whereas cleavage and attachment of CCA tailing occur in cytoplasmQ.
- In RNA, gene during processing undergoes nucleoside modifications, nucleoside cleavage and terminal addition but not chemical hydrolysisQ.
- Post translational modification of mRNA involves 5' capping , 3' polyadenylation (addition of poly 'A' tail at 3' end), splicing (removal of non coding intervening or intron sequences and ligation / joining of coding exons) by Sn RNA/ Sn RNPs / Snurps or self splicing d/t ribozyme activity of self splicing introns with formation of lariat intermediates, RNA editing and secondary methylationQ.
- Apo B-48 and Apo B-100 are synthesized from same Apo B gene

and same ApoB- m-RNA. Apo B 100 is a 100 kDa protein synthesized in liver by full length translation of corresponding mRNA of Apo B gene. Apo - B-100 forms part of LDL, IDL and VLDL. Apo B-48 is a 48 KDa protein (48% shorter form of Apo B-100) synthesized in intestine by partial translation of same mRNA of Apo B gene. Apo B 48 forms part of chylomicron & chylomicron remnant. This difference between the sizes of Apo B100 and Apo B48 occurs because post transcriptional processing (editing) of Apo B mRNA , deaminates the cytidine (C) to uracil (U) in intestine at 2153 position. After cyti dine deamination the CAA codon (which codes glutamine in liver) becomes UAA (nonsense or stop codon) in intestine. This results in shorter apo B-48 protein being made in intestine (and incorporated into chylomicron) than is made in the liver full length Apo B-100, incorporated in to VLDL.

27. Which of the following is not required for protein synthesis of eukaryotes:

a) RNA polymerase

b) Ribosomes

c) Peptidyl transferase

d) Amino acyl tRNA synthetase

Correct Answer - A
Ans. a. RNA polymerase *(Ref Harper 28/e p362) RNA polymerase enzyme is involved in transcription process, not in translation.*
The a-amino group of the new aminoacyl-tRNA in the A site carries out a nucleophilic attach on the esterified carboxyl group of the peptidyl-tRNA occupying the P site (peptidyl or polypeptide site).
Peptidyl transferase: Catalyses two reactions, peptide bond formation between amino acids and together with *release factor, peptide release.*

28. Technique (s) used to detect Gene Mutation is/are

a) RT-PCR

b) Denaturing gradient gel electrophoresis

c) DNA sequencing and Restriction fragment polymorphism (RFLP) both

d) All

Correct Answer - D
ALL i.e. (RT-PCR, Denaturing gradient gel electrophoresis, DNA sequencing, Restriction fragment polymorphism (RFLP), Single-strand conformational polymorphism

29. The 40 nm gap in between the tropocollagen molecule in collagen which serve as the site of bone formation is occupied by which of the following-

a) Carbohydrate

b) Ligand moiety

c) Calcium

d) All

Correct Answer - C
C i.e. Calcium
40 *nm gap between the typrocollagen molecues serve as nucleation site for deposition of hydroxyapatite* $_{|}$ *ca5(p04)3(19H),1 with some phosphate] crystals in boneQ.*

30. In noncompetitive antagonism, the true statement is:

a) Km value decrease;.v_{max}decreases

b) no change in v_{max};K_m value decrease

c) V max decreased; Km value normal

d) Km value increased; V max increased

Correct Answer - C
Answer is c. v_{max} decreases, km unchanged

Ref: Harper's Illustrated Biochemistry 30th edn; Page no. 82

Noncompetitive inhibitors bind to the enzyme or the enzyme-substrate complex at a site different from the active site, decreasing the activity of the enzyme. Thus, V_{max} is decreased.

Competitive inhibition	Noncompetitive inhibition
It is reversed by increasing substrate concentration.	Irreversible
Excess substrate abolishes inhibition.	Excess substrate does not abolish the inhibition.
v_{max} remains the same, but the apparent Km is increased.	K_m remains the same, but the apparent v_{max} is decreased.
	Inhibitors have no structural

Inhibitor will be structural analogue of substrate.	resemblance to substrate.

31. True about isoenzymes is:

a) Same quaternary structure

b) Same distribution in different organs

c) Same enzyme classification with same umbers

d) Catalyze the same reaction

Correct Answer - D
Ans: D
* Isoenzymes are the multiple forms of the same enzyme in a single species that *catalyze the same chemical reaction* or reactions, but differ from each other structurally, electrophoretically and immunologically.
* Though the same chemical reaction is catalyzed, the different isoenzymes may catalyze the same reaction *at different rates.*
* Isoenzymes have *different pH optimes, Km and V max values.*
* Isoenzymes may differ in their *amino acid sequence* and their *quarternary structures.*
* The isoenzymes may have *different properties* also for e.g. LDH-4 and LDH-5 are easily destroyed by heat, whereas LDH-1 and LDH-2 are not, if heated upto 60°C. (Heat resistant).
* Individual isoenzymes (isozymes) are distinguished and *numbered on the basis of electrophoretic mobility,* with the number 1 being assigned to that form having the highest mobility toward the anode, for e.g. LDH-1 has the highest mobility towards the anode and LDH-5 is the slowest.
* Isoenzymes have *different tissue distributions.* Therefore the pattern of isoenzymes found in the plasma may serve as a means of identifying the site of tissue damage. Example of the diagnostic use of isoenzymes are the study of Lactate Dehydrogenase and

Creatine Kinase.

32. All of the following enzymes are involved in oxidation reduction reactions, Except

a) Dehydrogenases

b) Hydrolases

c) Oxygenases

d) Peroxidases

Correct Answer - B

Enzymes involved in *oxidation (removal of e-)* and *reduction (gain of electrons)* are called oxido - reductase and are classified into 4 groups: *oxidase, oxygenase, dehydrogenase, hydroperoxidase (peroxidase and catalase).*
Hydrolase is another class of enzyme that catalyzes hydrolysis i.e. cleavage of bonds by addition of water.

33. All of the following are true regarding oxygenases except :

a) Incorporate 2 atoms of oxygen

b) Incorporate 1 atom of oxygen

c) Required for hydroxylation of steroids

d) Required for carboxylation of drugs

Correct Answer - D

Ans. d. Required for carboxylation reaction *(Ref Harper 2R/e p9R-102: Lehninger 5/e p8l 6).*

Oxygenase (which belongs to oxido-reductase class) cause incorporation of 2 atoms of 0, (dioxygenase) or 1 atom of 02 (monoxygenase or hydroxylase). Carboxylase enzyme, which belongs to ligase class is required for carboxylation.

Cytochromes P_{450} are (heme containing) monoxygenases° which take part in **hydroxylase cycle°** (NADH, NADPH and Fe_2 **S_2** required), **detoxify drugs in liver microsomes° (with cytochrome b_5, Fe_2 S_2 not required).**

34. Thiamine deficiency decreases cellular metabolism because:

a) Thiamine is a coenzyme for pyruvate dehydrogenase and alfa-ketoglutarate dehydrogenases

b) Activity of transketolase is inhibited

c) It is required for the process of transamination

d) It is a cofactor in oxidative reduction

Correct Answer - A
Thiamine deficiency results in decreased energy production because TPP interferes with its coenzyme for pyruvate
and alphaketoglutarate dehydrogenase.
Chronic peripheral Neuritis, Beriberi & Wemicke Encephalopathy with Korsakoff's Psychosis.
Thiamin requirements increase in excess intake of carbohydrates and its deficiency leads to decreased energy production

35. DNA double helix is maintained by:

a) Hydrogen bond

b) Vanderwaal forces

c) Disulfide linkage

d) Covalent bond

Correct Answer - A
Ans. A. Hydrogen bond
In a DNA double helix, two polynucleotide strands come together through complementary pairing of the bases, which occurs by hydrogen bonding.
Each base forms hydrogen bonds readily to only one other — A to T and C to G — so that the identity of the base on one strand dictates what base must face it on the opposing strand.
Thus the entire nucleotide sequence of each strand is complementary to that of the other, and when separated, each may act as a template with which to replicate the other.

36. Most common metabolite of progesterone excreted in urine is _____

a) Pregnanelone

b) Pregnanetriol

c) 17-hydroxy pregnanolone

d) Pregnanediol

Correct Answer - D
Pregnanediol is an inactive metabolic product of progesterone. A test can be done to measure the amount of pregnanediol in urine, which offers an indirect way to measure progesterone levels in the body.
The principal pathway of the metabolism of progesterone is believed to be progesterone → pregnanedione → pregnanolone → pregnanediol, although small amounts of the corresponding allopregnane compounds are formed.

37. Which of the following is known as suicidal enzyme?

a) Lipoxygenase

b) Cyclooxygenase

c) Thromboxane synthatase

d) 5' nucleotidase

Correct Answer - B
Suicidal enzyme is one, which undergoes self-destruction in order to terminate its own acitivity, e.g. Cyclooxygenase.
Suicidal Inhibition is conversion of a substrate by the enzyme into a metabolite, which is a potent inhibitor of the enzyme; example: Xanthine oxidase converts allopurinol to alloxanthine (oxypurinol), which is a more potent inhibitor of allopurinol.
Cycloorygenase is known as suicide enzyme because it catalyzes its own destruction.

38. Exact location of a genetic loci is identified by:

a) Fluorescent in-situ hybridization

b) Polymerase chain reaction

c) Chromosome painting

d) Comparative genomic hybridization

Correct Answer - A

Exact location of a genetic loci is identified by Fluorescent in-situ hybridization (FISH).

Fluorescent in-situ hybridization:

- FISH, which utilizes fluorescent rather than radioactively labeled probes, is a very sensitive technique for exact location of a genetic loci[Q].
- This often places the gene at a location on a given band or region of the chromosome[Q].

Polymerase chain reaction:

- PCR is a cell free, test tube method used for amplifying a target sequence of DNA[Q].
- Much faster and more sensitive than cell based cloning[Q] PCR is used to amplify specific regions of DNA strand[Q] (target DNA)

Chromosome painting:

- A technique for visualizing CHROMOSOME ABERRATIONS using fluorescently labeled DNA probes, which are hybridized to chromosomal DNA.
- Multiple fluorochromes may be attached to the probes.
- Upon hybridization, this produces a multicolored, or painted, effect with a unique color at each site of hybridization[Q].

- This technique may also be used to identify cross-species homology by labeling probes from one species for hybridization with chromosomes from another species.

Comparative genomic hybridization:

- Comparative genomic hybridization differentiate the chromosome of normal and cancer cells[Q].
- Comparative genomic hybridization is used to study cryptic chromosomal imbalances in patients with mental retardation and multiple congenital anomalies, as well as in prenatal diagnosis and to detect microdeletions and microduplications in cancer and in previously unidentified genomic disorders[Q].

39. True about RIBOZYME:

a) Peptidyl transferase activity

b) Cut DNA at specific site

c) Participate in DNA synthesis

d) GTPase activity

Correct Answer - A
Ribozymes are RNA molecule with catalytic activity. Ribozymes play a central role in peptide bond formation (peptidyl transferase activity).

Ribozyme

- Ribozymes are RNA molecule with catalytic activity.
- These generally involve transesterification reactions, and most are concerned with RNA metabolism (splicing and endoribonuclease).
- Recently, a ribosomal RNA component was noted to hydrolyze an aminoacyl ester and thus play a central role in peptide bond formation (peptidyl transferase).

40. Which enzyme's activity is increased in low insulin/glucagon level?

a) Hexokinase

b) Glucokinase

c) Glucose-6-phosphatase

d) Pyruvate kinase

Correct Answer - C
Insulin suppresses glucose-6-phosphatase gene.
Glucose-6-phosphatase activity is increased in low insulin/glucagon level.
Glucocorticoids, glucagon, epinephrine are inducers of glucose-6-phosphatase whereas insulin is repressor.
Insulin upregulates the transcription of glucokinase, phosphofructokinase, and pyruvate kinase, while glucagon downregulates their transcription.
Glucose-6-phosphatase plays an important role in the regulation of hepatic glucose production, and insulin suppresses glucose-6-phosphatase gene.

41. Which of the following is false about NADPH?

a) Produces ATP in RBCs

b) Glucose-6-phosphate dehydrogenase causes decreased synthesis of NADPH

c) Required for reductive biosynthesis

d) Stabilizes the membrane of RBCs

Correct Answer - A
NADPH does not produce ATP in RBCs.
NADPH
Sources of NADPH:
HMP shunt enzymes:
- Glucose-6-phosphate dehydrogenase
– 6-phospho gluconate dehydrogenase
- Cytoplasmic isocitrate dehydrogenases
- Malic enzyme (decarboxylating malate dehydrogenase)

NADPH is required for:
- Reductive biosynthesis of all lipids including fatty acid synthesis, cholesterol synthesis, bile acid synthesis as coenzyme.
- Regenerating reduced glutathione in RBCs and stabilizing the membrane or protects the membrane from oxidative stress

42. Which of the following enzyme is not a component of fatty acid synthase complex?

a) Acetyl Co-A carboxylase

b) Ketoacyl synthase

c) Enoyl reductase

d) Acetoacetyl

Correct Answer - A

The Fatty Acid Synthase Complex Is a Homodimer of Two Polypeptide Chains Containing Six Enzyme Activities and the Acyl Carrier Protein.

The 6 enzymes are-

- *Ketoacyl synthase*
- *Ketoacyl reductase*
- *Malonyl transacylase*
- *Dehydratase*
- *Enoyl reductase*
- *Thioesterase*

Acetyl Co-A carboxylase is the rate-limiting enzyme of fatty acid synthesis and is an enzyme, which is not a component of fatty acid synthase complex.

43. Platelet adhesion to collagen occurs via:

a) Factor VIII

b) Factor IX

c) von Willebrand factor

d) Fibronectin

Correct Answer - C
Platelet adhesion to collagen occurs via von-Willebrand factor) Endothelial injury allows platelets to contact the underlying extracellular matrix; subsequent adhesion occurs through interactions with *von Willebrand factor (vWF),* which is a product of normal endothelial cells and an essential cofactor for platelet binding to matrix elements.

44. Markers of acute kidney injury inculde all of the following except:

a) Micro RNA-122

b) Cystatin C

c) N-gal

d) Kim-1

Correct Answer - A

Acute Kidney Injury	
Biomarker types	Biomarkers
Functional markers	SCr and plasma/serum **Cystatin C**
Up-regulated proteins	**NGAL, KIM-1,** L-FABP and IL-18
Low-molecular weight proteins	Urine **Cystatin C**
Enzymes	NAG, α-GST, π-GST, GGT and AP

45. Indoor air pollution does not lead to:

a) Chronic lung disease

b) Impaired neurological development

c) Adverse pregnancy outcome

d) Pneumonia in child

Correct Answer - B

Indoor air pollution can lead to chronic lung disease, adverse pregnancy outcome and pneumonia in child.

Indoor Air Pollution

The commonest pollutant is tobacco smoke, but additional offenders are CO, nitrogen dioxide, and asbestos. Volatile substances containing polycyclic aromatic hydrocarbons generated by cooking oils and coal burning are important indoor pollutants in some regions of China.

Wood smoke, containing various oxides of nitrogen and carbon particulates, may not only be an irritant but also predisposes to lung infections and may contain the far more dangerous carcinogenic polycyclic hydrocarbons. Bioaerosols range from microbiologic agents capable of causing infectious diseases such as Legionnaires' disease, viral pneumonia, and the common cold, to less threatening but nonetheless distressing allergens derived from pet dander, dust mites, and fungi and molds responsible for rhinitis, eye irritation, and asthma.

Radon, a radioactive gas derived from uranium widely present in soil and in homes, can cause lung cancer in uranium miners.

Exposure to formaldehyde *causes breathing difficulties and a burning sensation in the eyes and throat, and can trigger asthma attacks.*

46. Chromosomes are visualized through light microscope with resolution of:

a) 5 kb

b) 50 mb

c) 5 mb

d) 500 kb

Correct Answer - C
Chromosomes are visualized through light microscope with resolution of 5 mb.
Karyotype analysis:
Organize all chromosomes by homology, size and shape.
Provide an overview of the whole genome.
Detect both numerical and structural chromosomal aberrations (overall resolution is 5 Mega bases (Mb); breakpoint resolution is 5 to 15 Mb).

47. Tensile strength of wound after laparoscopic cholecystectomy in a 30 years old woman depends upon:

a) Replacement of type 3 collagen

b) Extensive crosslinking of tropocollagen

c) Macrophage activity/invasion

d) Granulation tissue

Correct Answer - B

The recovery of tensile strength results from the excess of collagen synthesis over collagen degradation during the first 2 months of healing, and, at later times, from structural modifications of collagen fibers (cross-linking, increased fiber size) after collagen synthesis ceases.

48. In a 70 years old man, who was working in asbestos factory for 10-15 years, a mass was seen in right apical region of the lung on a routine X-ray,. Biopsy was taken from the mass. Which of the following is seen on electron microscopic examination?

a) Numerous long, slender microvilli

b) Melanosomes

c) Desmosomes

d) Neurosecretary granules in the cytoplasm

Correct Answer - A
Most likely diagnosis on the basis of description is malignant mesothelioma. Numerous long, slender microvilli will be seen on electron microscopy in malignant mesothelioma.
Diagnosis depends on a constellation of findings, including history of asbestos exposure, clinical signs and symptoms, radiographic findings, histopathological features, and immunohistochemical and ultrastructural studies.
On electron microscopy, *the* presence of long microvilli and abundant tonofilaments *but* absent microvillous rootlets and lamella bodies favors the diagnosis of malignant mesothelioma.
Mesothelioma cells *are characterized by a* profusion of markedly elongated surface microvilli in the absence of secretory cytoplasmic granules. - *Robbin's 8/e*

49. Which of the following induces apoptosis in a cell?

a) Oleic acid

b) Glucocorticoids

c) Isoprenoids

d) Myristic acid

Correct Answer - B
Glucocorticoid hormones are therapeutically useful agents for the treatment of a variety of inflammatory and immune diseases. Their anti-inflammatory and immunomodulatory actions are explained in part by the inhibition of NF-κB and its subsequent actions.
3 Mechanisms for the inhibition of NF-κB by glucocorticoids has been described:
(1) glucocorticoids increase IκB mRNA, which leads to an increase of IκB protein and more efficient sequestration of NF-κB in the cytoplasm.
(2) The glucocorticoid receptor competes with NF-κB for binding to coactivators.
(3) The glucocorticoid receptor directly binds to the p65 subunit of NF-κB and inhibits its activation.

50. A 45 years old female patient presented painless supraclavicular lymphadenopathy. Biopsy revealed binucleated acidophilic owl eye appearance with floating lymphocytes in empty space, which was CD 15, CD 30 positive. What is the most probable diagnosis?

a) Lymphocytic predominant Hodgkin's lymphoma

b) Nodular sclerosis Hodgkin lymphoma

c) Mixed cellularity Hodgkin lymphoma

d) Lymphocytic depleted lymphoma

Correct Answer - B

In a 45 years old female patient, who presented with painless supraclavicular lymph node enlargement. Biopsy revealed binucleated acidophilic owl eye appearance with floating lymphocytes in empty space, which was CD 15, CD 30 positive. The most probable diagnosis is Hodgkin's lymphoma. Nodular sclerosis, mixed cellularity and lymphocyte-depleted variants are positive for CD 15 and CD30. But Nodular sclerosis variant is most common type and more common in females. So, in the above-mentioned clinical situation, most probable diagnosis is nodular sclerosis variant of Hodgkin's lymphoma.

Reed-Sternberg cells are large and are either multinucleated or have a bibbed nucleus (thus resembling an 'owl's eye' appearance) with prominent eosinophilic inclusion-like nucleoli. Reed-Sternberg cells

are CD30 and CDI5 positive, usually negative for CD20 and CD45. The presence of these cells is necessary in the diagnosis of Hodgkin's lymphoma - the absence of Reed-Sternberg cells has very high negative predictive value.

Nodular sclerosis:

- Nodular sclerosis is MC type all over the world[Q]
- Nodular sclerosis is MC in females
- It has propensity to involve the cervical, supraclavicular and mediastinal lymph nodes of adults and adolescents
- Lacunar cells of Reed Sternberg cells variant is seen

51. Northern blot is used to detect ?

a) Protein

b) Immunoglobulin

c) RNA

d) DNA

Correct Answer - C
Visualization of a specific DNA or RNA fragment among the many thousand of contaminating molecules requires the convergence of the number of techniques collectively termed as the blot transfer.
Southern blot -4 → Detects DNA
Northern blot → Detects RNA
Western blot → Detects proteins (proteins are separated by electrophoresis, renatured and analyzed for interaction by hybridization with a specific labeled DNA probe).

52. Thiamine deficiency is best diagnosed by?

a) Thiamine level in blood.

b) Transketolase level in blood.

c) Aldolase level in blood.

d) Thiamine level in urine.

Correct Answer - B

Ans: B. Transketolase level in blood

THIAMINE (VITAMIN B1)

Thiamine has a central role in energy-yielding metabolism, and especially the metabolism of carbohydrates. Thiamine diphosphate is the coenzyme for three multienzyme complexes that catalyze oxidative decarboxylation reactions: pyruvate dehydrogenase in carbohydrate metabolism; α-ketoglutarate dehydrogenase in the citric acid cycle; and the branched-chain keto acid dehydrogenase involved in the metabolism of leucine, isoleucine, and valine. Thiamine deficiency can result in peripheral neuritis, beriberi, lactic acidosis and Wernicke encephalopathy with korsakoff psychosis. The activation of apotransketolase (the enzyme protein) in erythrocyte lysate by thiamine diphosphate added in vitro has become the accepted index of thiamine nutritional status.

53. Hepatic enzyme undergoes phosphorylation from dephosphorvlated state. Which of the following is true

a) Affected by level of Catecholamines

b) Occurs in starvation rather than well fed state

c) Always activated by c-AMP dependent protein kinase

d) Always activates the enzyme

Correct Answer - C
Ans. c. Always activated by c-AMP dependent protein kinase

- Epinephrine and norepinephrine (in muscle during activity) or glucagon (in liver when blood glucose level is too low) increase concentration of c-AMP, which inturn activates c-AMP dependent protein kinase (protein kinase a or PICA).

Allosteric Control of Phosphorylase occurs through

- In Muscle
- Activation: Ca2+°c-AMP°
- 5'-AMP Inhibition: - ATP°
- Glucose-6-phosphate

In Liver

- Activation: - c-AMP°
- Inhibition:
- ATP°
- Glucose-6-phosphate Free glucose°

54. Gluconeogenesis in fasting state is stimulated by

a) Pyruvate kinase stimulated by citrate

b) Activation of pyruvate carboxylase by acetyl Co-A

c) Activation of pyruvate kinase by fructose 1, 6-bisphosphate

d) Stimulation of phosphofructokinase-1 by fructose 2, 6-bisphosphate

Correct Answer - B
Ans. b. Activation of pyruvate carboxylase by acetyl Co-A
(Ref: Harper 29/e p190, 28/e pl65; Lippincott 5/e pl171
Allosteric activatlon by acetyl Co-A: Acetyl Co-A derived from fatty acid oxidation inhibits pyruvate dehydrogenase (PDH) enzyme and simultaneously stimulates pyruvate carboxylase, thus shunting pyruvate to
gluconeogenesis

55. In humans, the genetic code is represented by code of three nucleotides. If one amino acid is coded 1)' more than one triplet, then this is known as

a) Degeneracy

b) Frame-shift mutation

c) Ambiguity

d) Mutation

Correct Answer - A

Ans. a. Degeneracy

Degeneracy

- Degeneracy is the redundancy of the genetic code[Q]
- The genetic code has redundancy but no ambiguity[Q]
- The codons encoding one amino acid may differ in any of their three positions[Q]

Degeneracy

- There are three amino acids encoded by six different codons: serine, leucine and arginine[Q]
- Only two amino acids are specified by a single codon[Q]
- One of these is the amino-acid methionine, specified by the codon AUG, which also specifies the start of translation; the other is tryptophan, specified by the codon UGG[Q]
- The degeneracy of the genetic code accounts for the existence of synonymous mutations[Q]
- Degeneracy results because there are more codons than encodable amino acids[Q]

Codon

- Initiation codon is AUG (Methionine)[Q]
- Termination codons: UAA (Ochre), UAG (Ambre), UGA (Opal)[Q]

56. Which of the following is true regarding Fluorescence

a) Spontaneous illumination in dark

b) Release of longer wavelength light on absorbing light of shorter wavelength

c) Release of shorter wavelength light on absorbing light of longer wavelength

d) Continuous emission of lights of different wavelength

Correct Answer - B

Ans. b. Release of longer wavelength light on absorbing light of shorter wavelength

- In Fluorescence, there is release of longer wavelength of light on absorbing light of shorter wavelength is seen.

Fluorescence

- It is the emission of light by a substance that has absorbed light or other electromagnetic radiation[Q]
- It is a form of luminescence[Q]
- In most cases, the emitted lights have a longer wavelength and lower energy than the absorbed radiation[Q]

57. DNA estimation can be done by

a) Spirometer

b) Spectrophotometer

c) pH meter

d) Sphygmomanometer

Correct Answer - B
Ans. b. Spectrophotometer
Biomolecules absorb light at characteristic wavelengths, just as tryptophan, tyrosine and to a much lesser extent phenylalanine absorb ultraviotet light near a wavelength of 280 nmo

58. In porphyrias, which of the following enzyme defects does not lead to photosensitivity

a) Uroporphyrinogen synthase

b) Uroporphyrinogen decarboxylase

c) Protoporphyrinogen oxidase

d) Coproporphyrinogen oxidase

Correct Answer - A
Ans.a. Uroporphyrinogen synthase
(Ref Harper 29/e p3l2-314, 27/e p277)
In porphyrias, uroporphyrinogen synthase enqlme defects lead to Acute Intemittent Porphyria, which shows purely
ne urological manifestation witho ut photosensitivity.

59. A 2-year old male child presents with pellagra like lesions with passage of amino acids in urine. In the family, out of 4 siblings, two are having similar symptoms with two normal siblings and parents are not affected. Most likely diagnosis is:

a) Phenylketonuria

b) Alkaptonuria

c) Maple syrup urine disease

d) Hartnup disease

Correct Answer - D

Ans. 'D' Hartnup disease.

Hartnup Disease

Genetic Defect: A rare autosomal recessive disorder that results in the mutation of a sodium-dependent transport channel of neutral amino acids (ie, tryptophan).

Pathophysiology: The neutral amino acid transport channel is present in both the proximal tubule of the nephron and the brush border of the small intestine. If this transport channel is defective, neutral amino acids cannot be absorbed in the intestine or reabsorbed by the kidney after filtration, thereby resulting in a relative deficiency of the neutral amino acids, such as tryptophan. If the body is deficient in tryptophan (a precursor for niacin), symptoms can arise that mimic niacin deficiency (ie, pellagra).

Clinical Manifestations

Symptoms include photosensitive dermatitis that affects the face, neck and extensor surfaces of limbs and neurologic signs

neck and extensor surfaces of limbs and neurologic signs (headaches; personality disturbances; photophobia; mental retardation; cerebellar ataxia).
Lab findings: Renal aminoaciduria; indoles in the urine.
Treatment: Nicotinic acid supplements.

60. All of the following are the components of collagen except:

a) Glycine

b) Lysine

c) Proline

d) Desmosine

Correct Answer - D
Ans. d. Desmosine
'A striking characteristic of collagen is the occurrence of glycine residues at every third position of the triple helical
portion of the alpha chain. This is necessary because glycine is the only amino acid small enough to be accommodated in
the timited space available down the central core of the triple helix. This repeating structure, represented as (Gly-X-Y)n
an absolute requirement for the formation of the triple helix.

61. Which of the following changes is commonly seen in cancers?

a) Methylation of tumor suppressor genes

b) Hypomethylation of oncogenes

c) Loss of heterozygosity

d) Mutation in Introns

Correct Answer - A
Ans. a. Methylation of tumor suppressor genes
Hypermethylation of promoter regions is a common mechsnism by which tumor-suppressor loci are epigenetically silenced
in cancer cells.

62. Epigenetic deals with genetic modifications that do not alter the sequence of DNA. All of the following can detect epigenetic modification except:

a) HPLC

b) Methylation specific PCR

c) Bisulphite method

d) ChIP on Chip

Correct Answer - A
Ans. a. HPLC
'Epigenetics is defined as the stady of heritable chemical modification of DNA or chromatin that does not alter the DNA sequence itself, Examples of such modification include the methylation of DNA, and the methylation ancl acetylation of histones. Since traditional Sangersequencing alone cannot detect DNA methylation, ctther techniques have been developed to uncover these chemical modifications.

63. A 10-month old male child was having vomiting upon eating fruits, but is of normal weight. He has been exclusively breast fed till now. The doctor suggests fructose intolerance. Which of the following enzyme would be deficient in this child?

a) Aldolase B

b) Hexokinase

c) Fructokinase

d) Glucose-6-phosphatase

Correct Answer - A
Ans. a. Aldolase B

64. All of the following are true about changes in brain metabolism after traumatic brain injury, except:

a) Shut down of pyruvate dehydrogenase activity

b) Accumulation of lactate in brain

c) Increased lactate uptake from circulation

d) Increased CSF lactate is associated with good prognosis

Correct Answer - D
Ans. d. Increased CSF lactate is associated with good prognosis
After damage to the brain parenchyma, pyruvate dehydrogenase activity decreases (specifically E-1 subunit) and pyruvate carboxylase activity increases leading to accumulation of lactate in the brain and CSF, as well as increased uptake from the circulation. During the course of the illness, earlier the fall in CSF lactate, better is the prognosis.'
'Dysregulated brain glucose metabolism and lactate accumulation are seen folio wing traumatic **brain** injury **(T131).** The underlying molecular mechanism is poorly understood. Pyruvate dehydrogenase **(PDH),** the rate-limiting enzyme coupling cytosolic glycolysis to mitochondria[citric acid cycle, plays a critical role in maintaining homeostasis of brain glucose metabolism.' Traumatic brain injury-induced phosphorylation of p^{y}ruvate dehydrogenase: a mechanism of dysregulated
'Study demonstrates that TBI causes a significant reduction in PDH enzyme, disrupt-acid-base balance and increase oxidative stress in blood Also, lower PDH enzyme in blood is related to the increased gliosis and loss of its PDH El-infinity subunit PDH in brain tissue, and these effects of TBI were prevented by pyruvate treatment. '-

and these effects of TBI were prevented by pyruvate treatment.
Role of pyruvate dehydrogenase complex in traumatic brain injury. J Emerg Trauma Shock
(http://www.ncbi.nlm.nih.gov/pubmed/19561963)
'Brain-tissue acidosis inferred by cerebrospinal fluid (CSF) lactic acidosis is considered to play an important role in the clinical course of severe head injury. Patients with a poor outcome had significantly higher ventricular CSF lactate levels than did those with moderate disabilities or a good outcome. Patients showing favorable outcome had a significant decrease in ventricular CSF lactate levels 48 hours after injury. This decrease was not observed in patients with a poor outcome. Increased ventricular CSF lactate concentration was also reliably associated with increased intracranial pressure (ICP). Ventricular CSF lactate levels did not correlate with the magnitude of intraventricular bleeding. Arterial and jugular venous blood lactate levels, although high after head injury, were usually lower than the levels in the ventricular CSF and reached a normal range by the 3rd day following head trauma. Ventricular CSF pH did not generally correlate with the ventricular CSF lactate concentration in patients under controlled ventilation. '- Prognostic signcance of ventricular CSF lactic acidosis in severe head injury. J. Neurosurg
(http://www.ncbinlm.nih.gov/pubmed/3772448)

65. Study of molecular structure is done

a) Electron microscopy

b) Ion exchange chromatography

c) X-ray crystallography

d) Agarose gel electrophoresis

Correct Answer - C
Ans. c. X-ray crystallography
X-ray Crystallography
X-ray crystallography revealed the structures of thousands of proteins and of many viruses.
For solution of its structure by X-ray crystallography, a protein is first precipitated under conditions that form large, well ordered crystals.
The results from the phasing and Fourier summations I provide an electron density profile or three-dimensional map of how the atoms are connected or related to one another.
NMR Spectroscopy
NMR spectroscopy, a powerful complement to X-ray crystallography, measures the absorbance of radio frequency electromagnetic energy by certain atomic nuclei.
Two-dimensional NMR spectroscopy permits a three-dimensional representation of a protein to be constructed by determining the proximity of these nuclei to one another.
NMR spectroscopy analyzes proteins in aqueous solution

66. Not an intermediate product of citric acid cycle is:

a) Acyl Co-A

b) Succinyl Co-A

c) Citrate

d) Alpha-ketoglutarate

Correct Answer - A
Ans. 'A' Acyl Co-A
Acyl CoA is a starting molecule, not an intermediate product of the citric acid cycle.

67. Methylation of cytosine leads to:

a) Increased expression of gene

b) Decreased expression of gene

c) No effect on gene expression

d) Mutation

Correct Answer - B
Ans. b. Decreased expression of gene

- "There is evidence that the methylation of deoxycytidine residues, 5MeC, (in the sequence 5'-meCpG-3) in DNA may effect changes in chromatin so as to preclude its active transcription.
- Acute demethylation of 5MeC residues in specific regions of steroid hormone-inducible genes have been associated with an increased rate of transcription of the gene. - Harper 's 29/e p421
- "DNA methylation at the 5 position of cytosine has the specific effect of reducing gene expression and has been found in every vertebrate examined

Methylation of Cytosine

- There is evidence that the methylation of deoxycytidine residues, 5MeC, (in the sequence 5'-meCpG-3') in DNA may effect changes in chromatin so as to preclude its active transcription.
- Acute demethylation of 5MeC residues in specific regions of steroid hormone-inducible genes has been associated with an increased rate of transcription of the gene.
- However, it is not yet possible to generalize that methylated DNA is transcriptionally inactive, that all inactive chromatin is methylated, or that active DNA is not methylated.

68. The last to receive electrons in electron transport system is:

a) Coenzyme-Q

b) FADH2

c) 0_2

d) Cytochrome-C

Correct Answer - C
Ans. c. 0_2

69. Enzyme replacement therapy is available for ?

a) Gauchers disease

b) Galactosemia

c) Fructosuria

d) None

Correct Answer - A
Ans. is 'a' i.e., Gauchers disease

- Enzyme replacement therapy refers to the replacement of missing enzyme, artificially
- Gaucher's disease was the first one in which successful enzyme replacement therapy was tried.
- Enzyme replacement therapy is currently available for some lysosomal storage diseases :-
- Gaucher's disease
- Mucopolysaccharidosis I (Hurler)
- Fabry disease
- Mucopolysaccharidosis II (Hunter)
- Glycogen storage disease type II
- Mucopolysaccharidosis VI

70. Ketone body formation without glycosuria is seen in ?

a) Diabetes mellitus

b) Diabetes insipidus

c) Starvation

d) Obesity

Correct Answer - C
Ans. is 'c' i.e., Starvation
Amongst the given options, DM and starvation are the causes of ketosis

Diabetes :- Ketosis with hyperglycemia and glycosuria

Prolonged starvation :- Ketosis with low or normal glucose and without glycosuria.

- In diabetic Ketoacidosis:- (i) Positive Rothera's test (due to ketone bodies) (ii) Positive Benedict's test (due to presence of reducing sugar in urine)
- In Starvation ketosis:- (i) Postive Rothera's test (due to ketone bodies), (ii) Negative Benedict's test (no sugar in urine)

71. Ketone bodies are not used by ?

a) Muscle

b) Brain

c) RBC

d) Renal cortex

Correct Answer - C
Ans. is 'c' i.e., RBC

- Only glucose is the sole fuel for RBCs.
- As RBCs have no mitochondria, they oxidize glucose anaerobically to lactate.
- Liver also cannot use ketone bodies because of lack of succinyl-CoA-acetoacetate-CoA transferase, which is required for activation of ketone bodies.

72. What is the enzymatic defect which causes Hunter's Disease?

a) L- Iduronidase

b) Iduronate sulphatase

c) Beta Galactosidase

d) All of the above

Correct Answer - B

Ans: B. Iduronate sulphatase

- Inheritance- X-linked Recessive
- Defective enzyme- Iduronate Sulphatase

Clinical Features-

- slower progression of somatic and central nervous system (CNS) deterioration
- large tongue
- prominent forehead
- joint stiffness
- short stature
- skeletal dysplasia
- obstructive airways
- Valvular heart disease
- Mental retardation

73. All are true regarding mitochondrial DNA, EXCEPT ?

a) Double stranded

b) Inherited from mother

c) High mutation rate

d) All respiratory proteins are synthesized within mitochondria itself

Correct Answer - D
Answer. D. All respiratory proteins are synthesized within mitochondria itself

- Mt DNA is organized as a circular, covalently closed, double-stranded DNA.
- In sexual reproduction, mitochondria are normally inherited exclusively from the mother; the mitochondria in mammalian sperm are usually destroyed by the egg cell after fertilization.
- Mutations of mitochondrial DNA can lead to a number of illnesses including exercise intolerance and Kearns–Sayre syndrome(KSS), which causes a person to lose full function of heart, eye, and muscle movements.

74. True about type 1 diabetes mellitus

a) Decreased protein catabolism

b) Decreased hepatic Glucose output

c) Increased lipolysis

d) Increase glucose uptake

Correct Answer - C
Answer: C. Increased lipolysis
Uncontrolled insulin-dependent diabetes mellitus (type I diabetes) involves decreased glucose utilization, with hyperglycemia, and increased fatty acid oxidation.
Increased fatty acid oxidation leads to excessive production of acetoacetic and 3-hydroxybutyric acids and of acetone, which are known as ketone bodies.
2. Acetoacetic and 3-hydroxybutyric acids dissociate at body pH and release H leading to a metabolic acidosis.
LCAT is the enzyme that esterifies the free cholesterol on HDL to cholesterol ester and allows the maturation of HDL.
LCAT deficiency does not allow for HDL maturation resulting in its rapid catabolism of circulating apoA-1 and apoA-2. The remaining form of HDL resembles nascent HDL.

75. A 3- year old child has hepatosplenomegaly. On examination of the bone marrow, large cells are seen with crumpled paper appearance. Which of the following must have accumulated in these cells?

a) Spingomyelins

b) Gulcocerebrosides

c) Ceramides

d) Sulphatides

Correct Answer - B
Ans. b. Glucocerebroside (Ref. Robbins 9/ p153, 8/e p153)

- A child who presents with hepatosplenomegaly and pancytopenia, on bone marrow biopsy, large cells with crumpled tissue paper appearance is seen. The clinical picture is suggestive of Gaucher's disease, caused by deposition of Glucocerebroside.

76. A patient presents with Von-Gierk's disease and ketosis was detected on investigation. All of the following would he associated findings except:

a) There is hypoglycemia

b) Have low blood sugar levels

c) Oxaloacetate is required for gluconeogenesis

d) Low fat mobilization

Correct Answer - D

Ans. d. Low fat mobilization *(Ref Harper 's 27/e p/66)*

- Excessive fatty acid mobilization (not the Low fat mobilization) from adipose tissues leads to ketosis in Von-Gierke's disease. Von Gierke's Disease:
- Type I glycogen storage disorder, inherited as autosomal recessive[Q], due to the deficiency of glucose-6 phosphatase
- Deficiency of glucose-6 phosphatase leads to low blood sugar and hypogl[Y]cemic attacks.
- Gluconeogenesis is enhanced, that's why Oxaloacetate is required for gluconeogenesis
- Excessive fatty acid mobilization from adipose tissues leads to ketosis

77. If a 4 nucleotides sequence code for an amino acid instead of 3, then theoretically how many unique amino acids could be coded by such a system?

a) 16

b) 64

c) 128

d) 256

Correct Answer - D

Ans. d. 256 Ref· Harper 28/e p353

Number of Nucleotides in Codon	**Number of Coded Amino Acids**
2	**42=16**
3	**43= 64**
4	**44=256**

Three is the minimum number of nucleotides per codon needed to encode 20 amino acids.

a. 20 amino acids are encoded by combinations of 4 nucleotides

b. If a codon were two nucleotides, the set of all combinations could encode only

4x4 = 16 amino acids.

c. With three nucleotides, the set of all combinations can encode **4x4x4 = 64 amino acids** (i.e. 64 different combinations of four nucleotides taken three at a time).

d. With three nucleotides,

4x4x4x4 = 256 amino acids

78. Which of the following is not used in polymerase chain reaction?

a) DNA Polymerase

b) Taq polymerase

c) Dideoxyribonucleotides

d) DNA template

Correct Answer - C
PCR is an in vitro DNA amplification procedure in which millions of copies of a particular sequence of DNA can be produced within a few hours.
The reaction cycle has the following steps:
Step 1: Separation (Denaturation): DNA strands are separated (melted) by heating at 95°C for 15 seconds to 2 minutes.
Step 2: Priming (Annealing): The primers are annealed by cooling to 50°C for 0.5 to 2 minutes. The primers hybridize with their complementary single-stranded DNA produced in the first step.
Step 3: Polymerization: New DNA strands are synthesized by Taq polymerase. This enzyme is derived from bacteria Thermus aquaticus that are found in hot springs.
The steps of 1,2 and 3 are repeated. In each cycle, the DNA strands are doubled. Thus, 20 cycles provide for 1 million times amplifications. These cycles are generally repeated by automated instrument, called Tempcycler.
5. After the amplification procedure, DNA hybridization technique or Southern blot analysis with a suitable probe shows the presence of the DNA in the sample tissue.
Dideoxyribonucleotides are not **used in the polymerase chain reaction.**

79. Which of the following enzyme dysfunction leads to lactic acidosis in thiamine deficiency?

a) Pyruvate carboxylase

b) Phosphofructokinase

c) Phosphoenol pyruvate carboxykinase

d) Pyruvate dehydrogenase

Correct Answer - D
Ans: D. Pyruvate dehydrogenase
Thiamin diphosphate (TDP)/Thiamin pyrophosphate (TPP):
* Biologically active & storage form of vitamin B 1.
* Formed by transfer of pyrophosphate group from ATP.
Functions:
As coenzyme catalyze oxidative decarboxylation reactions:
* Branched-chain ketoacid dehydrogenase - Metabolism of leucine, isoleucine & valine
* Alpha-ketoglutarate dehydrogenase - In citric acid cycle.
* Pyruvate dehydrogenase - In carbohydrate metabolism
Effects of thiamine deficiency:
* Pyruvate cannot be converted to acetyl Co-A.
* Thiamine pyrophosphate-
  - Coenzyme for pyruvate dehydrogenase.
  - Catalyzes pyruvate to acetyl Co-A conversion.
  - Hence, excess pyruvate metabolized to lactate by lactate dehydrogenase.
* This **results in lactic acidosis.**
(Ref Harper 30/e p172, 198, 555, 556; 28/e p321,473)

80. Find out the value of LDL, if total cholesterol level is 300 mg/dL, HDL level is 25 mg/dL and triglycerides level is 150 mg/dL:

a) 55

b) 95

c) 125

d) 245

Correct Answer - D
Ans: D. 245
* Calculated by **Friedewald Equation.**
* LDL-cholesterol is most commonly estimated from quantitative measurements of total and HDL-cholesterol and plasma triglycerides using the empirical relationship of Friedewald et al.
*** Total cholesterol = (LDL + HDL + Total cholesterol) / 5.**
- 300 = LDL + 25 +150/5.
- LDL = 300 - (25 + 30) = 245 mg/dl.
* LDL-C = total cholesterol - (TG/5) - HDL-C (The VLDL cholesterol content is estimated by dividing the plasma TG by 5, reflecting the ratio of TG to cholesterol in VLDL particles.) This formula (the Friedewald formula) is reasonably accurate if test results are obtained on fasting plasma **and if the TG** level does not exceed -200 Ing/dL; by convention it cannot he used if the TG level is >400 mg/dL."-Ilarrison I9/e p2446.
Limitations of Friedewald Equation
* Friedewald Equation should not be used under the following circumstances: - When chylomicrons are present

* When plasma triglyceride concentration exceeds 400 mg/dL
* In patients with dysbeta-lipoproteinemia (type III hyperlipoprteinemia)

81. On laboratory investigations in a patient, LDL was highly elevated but the level of LDL receptors was normal. Which of the following is most probable cause?

a) Phosphorylation of LDL receptors

b) Lipoprotein lipase deficiency

c) Apo B-100 mutation

d) Cholesterol Acyl Co-A transferase deficiency

Correct Answer - C

Ans: C. Apo B-100 mutation

In Type IIa Familial hypercholesterolemia:

- Highly elevated levels of LDL with normal level of LDL receptors.
- Characterized mutation **in ligand region of apoB-100**.

Differential diagnosis:

- "Familial Defective apoB-100 (FDB)"/"Autosomal dominant hypercholesterolemia (ADH) type 2":
- Dominantly inherited disorder.
- Clinically resembles heterozygous familial hypercholesterolemia (FH) with elevated LDL-C levels and normal TGs.
- FDB - Caused by mutations in gene encoding apoB-100, specifically in LDL receptor–binding domain of apoB-100.
- Ref (Harrison 19/e p2438-2447, 18/e p3148)

82. RNAi causes the following in a gene:

a) Knock in

b) Knock out

c) Knock down

d) Knock up

Correct Answer - C

Ans. C. Knock down *(Ref Robbins 9/e p5) RNAi causes Knock down in a gene.*

"Small interfering RNAs (siRNAs): Another species of gene-silencing RNA, called small interfering RNAs (siRNAs), works in a manner quite similar to that of miRNA. siRNAs are becoming powerful tools for studying gene function and may in the future be used therapeutically to silence specific genes, such as oncogenes, whose products are involved in neoplastic transformation."-Robbins 9/e p5.

Knock out	Targeted gene is completely removed from the DNA sequence by replacing it with an artificial piece of DNA°
Knock down	Gene is not completely removed but its expression is suppressed by using RNA interference technology°
Knock in	Segment of a gene is inserted into a

DNA sequence°

83. Which of the following is used by RBCs in the fasting state?

a) Glucose

b) Alanine

c) Ketone body

d) Fatty acid

Correct Answer - A
Ans: A. Glucose
Glucose is used by RBCs in fasting state.

Organ	Fed	Fasting	Starvation
Brain	Glucose	Glucose	Ketone bodies
Heart	Fatty	Fatty acids	Ketone bodies
Liver	Glucose	Fatty acids	Amino acids
Muscles	Glucose	Fatty acids	Fatty acids & ketone
Adipose tissue	Glucose	Fatty acids	Fatty acids & ketone
RBCs	Glucose	Glucose	

(Ref Harper 30/e p146, 150, 28/e p141).

84. A 48-year old lady presented with bony pain and hepatosplenomegaly. On examination of biopsy speci¬men from spleen, crumpled tissue paper appearance is seen. Which of the following product is likely to have accumulated?

a) Ganglioside

b) Sulfatide

c) Sphingomyelin

d) Glucocerebroside

Correct Answer - D
Ans: D. Glucocerebroside
Gaucher's disease:
* MC lysosomal storage disorder, autosomal recessive in inheritance.
* Caused by deficiency of tissue enzyme glucocerebrocidase.
Glucocerebrocidase:
* Splits glucose from glucosyl ceramide. Hence, accumulates glucocerebroside.
* Glucosyl ceramide - Cerebrocide accumulates in cell of reticuloendothelial system.
Clinical history:
* Hepatosplenomegaly with crumpled tissue paper appearance on biopsy - Highly suggestive of Gaucher's disease.
* Pancytopenia & thrombocytopenia secondary to hypersplenism.
* Widened marrow cavity - Due to Gaucher's cells deposition.

- Expansion of bone is prominent - Especially at lower end of femur & humerus.
- Causes pathologic fracture & bone pain.

Treatment:

* Enzyme replacement therapy done with natural or recombinant glucocerebrocidase.

(Ref Harrison 19/e p432-e5; Robbins 9/e p151-154, 8/e p153; Nelson 20/e p708, 19/e p487, 488, 500)

85. Which of the following enzyme is common between glycogenesis and glycogenolysis?

a) Glycogen synthase

b) Glycogen phosphorylase

c) Glucan transferase

d) Phosphoglucomutase

Correct Answer - D

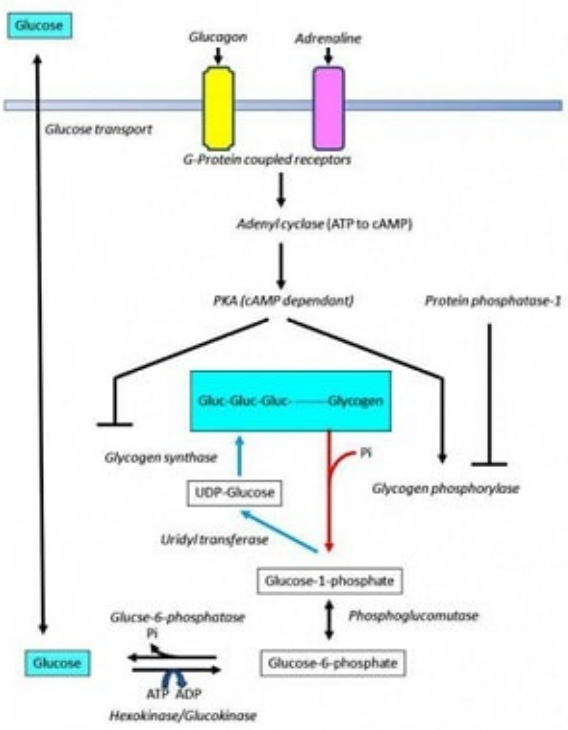
Ans: D.Phosphoglucomutase

Phosphoglucomutase enzyme is common between glycogenesis & glycogenolysis.

Reaction catalyzed by phosphoglucomutase is reversible.

Hence, glucose 6-phosphate can be formed from glucose I-phosphate.

In liver & kidney, (not in muscle) glucose 6-phosphatase hydrolyzes glucose 6-phosphate à glucose à Increases blood glucose concentration.



(Ref Harper's 29/e p180; Harper 30/e p176, 177, 28/e p158, 333).

86. What does forward scatter in flow cytometry used to assess?

a) Cell death

b) Cell size

c) Cell granules

d) Cell fluorescence

Correct Answer - B

Ans: B. Cell size

Flow cytometry:

- Technique for counting, examining & sorting microscopic particles suspended in a stream of fluid.
- Allows simultaneous multi-parametric analysis of physical and/or chemical characteristics of single cells flowing through an optical and/or electronic detection apparatus.
- Measures optical & fluorescence characteristics of single cells.

Direction of light & interpretation:

Direction of light scattered in forward Scatter (FS):

- For cell size.
- Liver cells will have more forward scatter (FS) than dead and apoptotic cells

Direction of light scattered in side scatter (SS):

- For density of cells (granularity, vacuoles & membrane size).
- Granulocytes/monocytes have more granularity or vacuoles à more side scattering (SS).
- (Ref Hematology: Clinical Principles and Applications/p456).

87. Which of the following types of collagen is present in basement membrane?

a) Type I

b) Type III

c) Type IV

d) Type V

Correct Answer - C

Ans: C. Type IV

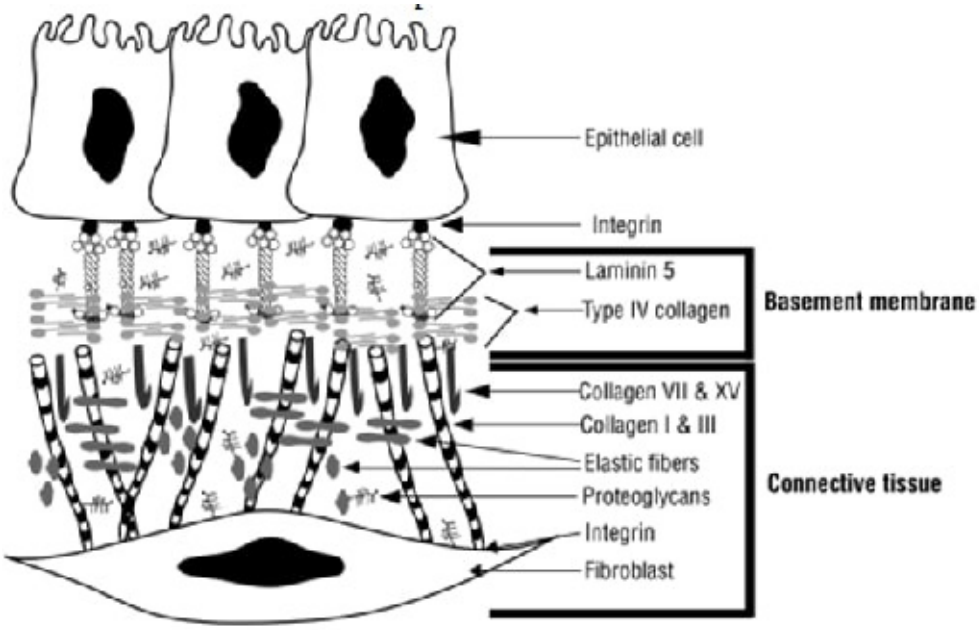
Type IV collagens are the main components of the basement membrane, together with lamina.

Major constituents:

- Amorphous nonfibrillar type IV collagen & laminin.

Type IV collagens:

- Long, interrupted triple-helical domains forming sheets instead of fibrils.
- Main components of basement membrane, together with laminin.



- (Ref Robbins 9/e p20-23, 8/e p9.5)

88. A child was brought to the hospital was found to have hypoglycemia, hepatomegaly and accumulation of highly branched glycogen called limit dextrins. He is likely to be suffering from:

a) McArdle's disease

b) Anderson's disease

c) von Gierke's disease

d) Cori's disease

Correct Answer - D

Ans. 'D' Cori's disease

- Cori’s disease is also called Limit dextrinosis. It is a Type IIa glycogen storage disorder.
- It occurs due to the deficiency of the enzyme liver and muscle debranching enzyme.
- The clinical features are fasting hypoglycemia, hepatomegaly in infancy, accumulation of characteristic branched polysaccharide (limit dextrin) and muscle weakness.

89. A 7-year old boy presented with severe abdominal pain. On examination, he had xanthoma. Blood sample was taken for work-up blood sample had milky appearance of plasma. Which of the following lipoprotein is increased?

a) LDL

b) HDL

c) Chylomicron

d) Chylomicron remnants

Correct Answer - C
Ans: C. Chylomicron
Type I or V hyperlipoproteinemia:
Features:

- Severe abdominal pain, xanthomas & milky appearance of plasma.
- Elevated levels of chylomicrons.

(Ref. Harrison 19/e p2438-2447, 18/e p3148).

90. A 10-year old boy presented with muscle weakness and fatigue with increased lead in the blood. Which of the following enzyme production in the liver is increased?

a) ALA synthase

b) Heme oxygenase

c) Ferrochelatase

d) Porphobilinogen deaminase

Correct Answer - A
Ans: A. ALA synthase
Lead poisoning:

- High levels of lead affects heme metabolism by combining with SH groups in enzymes such as Ferrochelatase & ALA dehydratase (zinc containing enzyme).
- Affects porphyrin metabolism.
- Elevated protoporphyrin levels in RBC's.
- Elevated levels of ALA & Coproporphyrin found in urine.
- Appears that heme, probably acting via an aporepressor molecule –
- Acts as a negative regulator of synthesis of ALA synthase.
- Thus, the rate of synthesis of ALA synthase increases greatly in the absence of heme and is diminished in its presence.
- (Ref: Harper 30/e p325-328, 28/e p272, 278, p563).

91. Which of the following is not a technique for protein precipitation?

a) Trichloroacetic acid

b) Heat precipitation

c) Isoelectric point method

d) Titration with reducing sugar

Correct Answer - D
Ans: D. Titration with reducing sugar
(Ref Harper 30/e p26)

- Titration with reducing sugar is not used for protein precipitation.

Protein precipitation:

- Widely used to concentrate proteins & purify them from various contaminants.
- Used for isolating specific protein in quantities sufficient for analysis.
- Requires multiple successive purification techniques.

Classic approaches:

Based on,

- Isoelectric precipitation - Differences in relative solubility of individual proteins as pH function.
- Precipitation with ethanol or acetone – Polarity.
- Salting out with ammonium sulfate.
- Paper chromatography including TLCD.

92. Which of the following conversions does not require Biotin as a cofactor?

a) Gamma carboxylation of glutamate

b) Acetyl Co-A to Malonyl Co-A

c) Propionyl Co-A to methyl malonyl Co-A

d) Pyruvate to oxaloacetate

Correct Answer - A
Ans: A. Gamma carboxylation of glutamate
(Ref: Harrison 19/e p96e-5; Harper 30/e p550, 561)
Gamma carboxylation of glutamate:

- Carried out by Gamma-glutamyl carboxylase.

Gamma-glutamyl carboxylase:

- Vitamin-K dependent enzyme.
- Catalyzes post-translational modification of vitamin K-dependent proteins.

Biotin:

- Transfers carbon dioxide in reactions like acetyl-CoA carboxylase, pyruvate carboxylase, propionyl-CoA carboxylase & methylcrotonyl-CoA carboxylase.

Biotin functions to transfer carbon dioxide in reactions

Pyruvate carboxylase	**Pyruvate** (3C) **to oxaloacetate** (4C) **in gluconeogenesis°**
Acetyl-CoA carboxylase	Acetyl-CoA (2C) to **malonyl-CoA (3C) in lipid** synthesis.
Propionyl-CoA carboxylase	Propionyl-Co A **(3C) to methylmalonyl-CoA (4C) in**
Methylmalonyl	Propionic acid synthesis in bacteria

CoA carboxyl	
Methylcrotonyl-CoA carboxylase	Leucine catabolism

93. All of these substrates are glucogenic except:

a) Acetyl CoA

b) Pyruvate

c) Glycerol

d) Lactate

Correct Answer - A
Ans: A. Acetyl CoA
(Ref: Harper 30/e p185. 29/e p187)

Acetyl CoA:

- Not substrate for gluconeogenesis.
- Cannot be converted back to glucose.
- Since acetyl CoA cannot be converted back to pyruvate as carbon backbone is lost during citric acid cycle as CO_2.

Substrates for Gluconeogenesis

- Glucogenic amino acids (all except Leucine & lysine which are purely ketogenic): Most important is alanine
- Lactate
- Pyruvate
- Propionate
- Glycerol
- Fumarate

94. What is the codon for selenocysteine?

a) UAG

b) UGA

c) UAA

d) GUA

Correct Answer - B
Ans: B. UGA
(Ref Harper 30/e p18, 286)
Selenocysteine:

- Commonly termed "21st amino acid".
- Present in biological proteins.
- Not coded directly in genetic code.
- Instead encoded by a UGA codon.
- UGA codon - Normally a stop codon.
- This mechanism called as|”translational recoding”.

95. Sites of heme synthesis are all of these except:

a) RBC

b) Hepatocytes

c) Osteocytes

d) Bone marrow

Correct Answer - A
Ans: A. RBC
(Ref: Harper 30/e p325)
Heme biosynthesis:

- Occurs in most mammalian cells except mature erythrocytes.
- Due to lacking mitochondria.
- 85% - In erythroid precursor cells in bone marrow.
- 15% heme synthesis - In hepatocytes.

96. In lead poisoning, there is an inhibition of some of the enzymes of the heme biosynthetic pathway. This is reflected by the accumulation of what substance in blood?

a) Uroporphyrinogen III

b) Ferrochelatase

c) Porphob I inogen

d) Delta amino levulinic acid

Correct Answer - D
Ans: D. Delta amino levulinic acid
(Ref: Harper 30/e n329)
Lead poisoning:

- Affect heme metabolism by combining with SH groups in ferrochelatase & ALA (delta-amino levulinic acid) dehydratase enzymes.
- Elevated protoporphyrin levels - Found in RBC's.
- Elevated ALA & coproporphyrin levels - Found in urine.

97. Glycogen synthesis and breakdown takes place in the same cell, having enzymes necessary for both the pathways. Why the glucose-6-phosphate, freshly synthesized during glycogenesis in cytoplasm of hepatocytes, is not immediately degraded by the enzyme glucose¬6-phosphatase?

a) The thermodynamics does not favor such a reaction to occur

b) Glucose-6-phosphatase is present in the endoplasmic reticulum and cannot act on glycogen formed in the cytoplasm

c) Glycogenesis and glycogenolysis are tightly regulated such that enzymes of only one of those is present at a time.

d) Steric hindrance due to albumin

Correct Answer - B
Ans: B. Glucose-6-phosphatase is present in the endoplasmic reticulum and cannot act on glycogen formed in the cytoplasm (Ref Harper 30/e p178)

Glucose-6-phosphate:

- Formed in cytoplasm of hepatocytes.

Glucose-6-phosphatase:

- Present in lumen of smooth endoplasmic reticulum of cell.
- Reaction does not take place until gluconeogenesis is favored.
- Glucose-6-phosphatase catalyzes hydrolysis of glucose-6-phosphate in liver → Exports glucose à increases blood glucose concentration

98. The cofactor vitamin B12 is required for the following conversion:

a) Dopamine to Norepinephrine

b) Propionyl CoA to methyl malonyl CoA

c) Methyl malonyl CoA to succinyl CoA

d) Cysteine to homocysteine

Correct Answer - C
Ans: C. Methyl malonyl CoA to succinyl CoA
(Ref: Harper 30/e p550, 558, 28ie p346)
Vitamin B12 as Cofactor for:

- Methylmalonyl CoA mutase - Isomerization of methylmalonyl co-A to succinyl co-A.
- Methionine synthase - Methylation of pyrimidine ring to form thymine.
- Homocysteine methyl transferase - Methylation of homocysteine to methionine
- Metabolism of diol.
- In bacteria for interconversion of glutamate & beta-methyl aspartate°

99. Thiamine is a cofactor for all of the following enzymes except:

a) Alpha ketoglutarate dehydrogenase

b) Branched-chain keto-acid dehydrogenase

c) Succinate dehydrogenase

d) Pyruvate dehydrogenase.

Correct Answer - C
Ans: C. Succinate dehydrogenase
Thiamin as coenzyme:

- Catalyzes oxidative decarboxylation reactions.
- 3 multi-enzyme complexes catalyzing oxidative decarboxylation reactions:
  - Branched-chain ketoacid dehydrogenase - Involved in metabolism of leucine, isoleucine & valine
  - Alpha-ketoglutarate dehydrogenase – In citric acid cycle
  - Pyruvate dehydrogenase - In carbohydrate metabolism
  - Transketolase reaction – In pentose phosphate pathway.

Succinate dehydrogenase:

- Involved in redox reaction catalyzed by FMN & FAD.

100. After a point mutation, glutamic acid is replaced by valine, which leads to formation of sickle cell hemoglobin. The mobility of HbS as compared with normal hemoglobin on gel electrophoresis will be:

a) Decreased

b) Increased

c) Dependent on HbS concentration

d) Unchanged.

Correct Answer - A

HbS mobility on gel electrophoresis:

- Decreased mobility - Compared to normal hemoglobin.

Electrophoresis of hemoglobin:

- Obtained from lysed red blood cells.
- Used in sickle cell trait & disease diagnosis.

Sequence of Movement: HbA2 < HbC < HhS < HbF < HbA

101. Which of these is not a cofactor for glycogen phosphorylase, an important enzyme of the glycogenolysis pathway?

a) Calmodulin

b) c-AMP

c) Protein Kinase A

d) Glycogenin

Correct Answer - D
Ans: D. Glycogenin
(Ref Harper 30/c p 181)
Glycogenin:

- An enzyme involved in glucose conversion to glycogen.
- Acts as a primer - By polymerizing first few glucose molecules à enzymes take over.
- Involved in glycogen synthesis pathway rather than glycogenolysis.

102. All of the following are the reasons responsible for ketosis in a patient of Von Gierke’s disease?

a) They have hypoglycemia

b) Have low blood sugar levels

c) Oxaloacetate is required for gluconeogenesis

d) Low fat mobilization

Correct Answer - D

Answer- D. Low fat mobilization

- Excessive fatty acid mobilization (not the Low fat mobilization) from adipose tissues leads to ketosis in Von-Gierke's disease.
- Type I glycogen storage disorder, inherited as autosomal recessive, due to the deficiency of glucose-6 phosphatase.
- Excessive fatty acid mobilization from adipose tissues leads to ketosis.
- Deficiency of glucose-6 phosphatase leads to low blood sugar and hypoglycemic attacks.

103. 2, 3-BPG binds to sites of haemoglobin and the affinity for oxygen

a) 4, decreases

b) 1, decreases

c) 4, increases

d) 1, increases

Correct Answer - B
Answer- B. 1, decreases

- 2,3-BPG binds to 1 site of haemoglobin and decreases the affinity for oxygen.
- 2, 3 Bisphosphoglycerate (2,3- BPG) or 2,3 Diphosphoglycerate 2,3-DPG)
- It is most abundant organic phosphate in RBC.

104. During exercise, the most rapid way to synthesize ATP is:

a) Glycogenolysis

b) Glycolysis

c) TCA cycle

d) Creatine phosphate

Correct Answer - D
Ans. d. Creatine phosphate.
The high group transfer potential of ATP enables it to act as a donor of high-energy phosphate compounds.
There are three major sources of high phosphate compounds taking part in energy conservation i.e. oxidative phosphorylation, glycolysis, and citric acid cycle.
Phosphagens act as storage forms of group transfer potential and include creatine phosphate, which occurs in vertebrate skeletal muscle, heart, spermatozoa, and brain, and arginine phosphate, which occurs in the invertebrate muscle.

105. In a child with cerebrohepatorenal syndrome and with hypotonia and hepatomegaly, the probable biochemical defect is accumulation of:

a) Pyruvate

b) Short-chain fatty acid

c) Very long-chain fatty acid

d) Acetyl CoA

Correct Answer - C

Ans. c. Very long-chain fatty acid

Ref: Harper's Illustrated Biochemistry 30th edn; Page no. 241

- Elevated levels of very long-chain polyenoic acids found in Zellweger (cerebrohepatorenal) syndrome.
- It is an X-linked disorder that affects the transport of very long-chain fatty acids into the peroxisomes for initial oxidation events.
- The loss of this activity leads to the accumulation of very long-chain fatty acids.
- Accumulate of C_{26}-C_{38} polyenoic acids in brain tissue.
- The result, adrenal glands and the myelin sheath for destruction, through
- incorporation into the membrane lipids surrounding those structures.

106. Which of the following amino acids does not include post-translational modification?

a) Selenocysteine

b) Triiodothyronine

c) Hydroxyproline

d) Hydroxylysine

Correct Answer - A

Ans. A. Selenocysteine

Peptidyl selenocysteine is not the product of a posttranslational modification, but is inserted directly into a growing polypeptide during translation. Selenocysteine is commonly termed as the “21st amino acid.” However, incorporation of selenocysteine is specified by a large and complex genetic element for the unusual tRNA called $tRNA^{Sec}$ which utilizes the UGA anticodon that normally signals STOP.

107. Dried blood drop of an infant can be used to know:

a) Blood sugar

b) Inborn errors of metabolism

c) Hepatitis

d) Cataract

Correct Answer - B

Ans. b. Inborn errors of metabolism

Complex peptide mixtures can be analyzed, without prior purification, by Tandem Mass Spectrometry, which employs the equivalent of two mass spectrometers linked in series. For this reason, analysis by tandem instruments is often referred to as MS–MS, or MS^2. Tandem mass spectrometry can be used to screen blood samples from newborns for the presence and concentrations of amino acids, fatty acids, and other metabolites. Abnormalities in metabolite levels can serve as diagnostic indicators for a variety of genetic disorders, such as phenylketonuria, ethylmalonic encephalopathy, and glutaric acidemia type 1.

108. CG islands in our DNA are important for:

a) Methylation

b) Acetylation

c) t-RNA synthesis

d) DNA replication

Correct Answer - A

Ans: A. Methylation

(Ref Harper 30/e p438, 439; Harrison 19/e p102e-7)

CG islands:

- Also referred as “CpG islands”.
- Plays vital role in gene expression regulation.
- Cytosine (C) residues in CG rich islands undergo methylation by DNA methyl transferase.
- The DNA methyltransferase can methylate only the CG sequence paired with methylated CG. The CG sequence not paired with methylated CG will not be methylated.
- Methylation of deoxycytidine residues (in sequence 5'-in CpG-3’) in DNA may effect gross changes in chromatin so as to preclude its active transcription.

109. A patient has normal blood glucose level as estimated by glucose-oxidase peroxidase method, shows positive Benedicts test in urine. Which of the following is the most likely cause?

a) Fructosemia

b) Denaturation of glucose

c) Galactosemia

d) False positive

Correct Answer - C

Ans: C. Galactosemia

(Ref Harper 30, e p205,- Actsan 20,c p726,- Harrison I9/e p433e-5)

Galactosemia:

- Apart from glucose, both fructose & galactose gives positive Benedict's test.

Classic galactosemia:

- Caused by galactose 1-phosphate uridyl transferase (GALT) deficiency.

Diagnosis:

- Urine of patient shows reducing sugar (galactose) - Detected by Benedict's reagent.
- Negative glucose oxidase test - Specific for glucose.
- Presence of reducing sugar (galactose) in urine.

110. Ammonia from brain is removed as:

a) Urea

b) Alanine

c) Glutamate

d) Glutamine

Correct Answer - D

Ans: D. Glutamine

(Ref. Harper 30/e p292).

- Ammonia from brain is removed as glutamine.

Ammonia disposal:

- Ammonia from all over body reaches liver, detoxified to urea by liver cells & excreted through kidney.
- Ammonia formed in most tissues including brain is trapped by glutamate to form glutamine (primary ammonia trapping).

111. At physiological pH, which of these amino acids has a positive charge?

a) Valine

b) Aspartic acid

c) Arginine

d) Isoleucine

Correct Answer - C

Ans: C. Arginine

- At physiological pH, arginine has a positive charge.
- Negative Charged (Acidic Side Chains) - Aspartic acid & glutamic acid.
- Positive Charged (Basic Side Chains) - Histidine, arginine & lysine.

112. Which of the following is maximum in HDL as compared to other lipoproteins?

a) Cholesterol

b) Apoproteins

c) Triglycerides

d) Fatty acids

Correct Answer - B

Ans: B. Apoproteins

(Ref Harper 30/e p2541).

HDL:

- Highest apoproteins proportion.
- Has highest density & migrates the least during electrophoresis.
- Also contains maximum phospholipids.

Apolipoprotein or apoprotein:

- Protein moiety of lipoprotein.
- Constituting nearly 70% of HDL & 1% chylomicrons.

113. HCO3/H2CO3 is the best buffer because it is:

a) pKa near physiological pH

b) Its components can be increased or decreased in the body as needed

c) Good acceptor and donor of H+ ions

d) Combination of a weak acid and weak base

Correct Answer - B

<u>Ans: B. Its components can be increased or decreased in the body as needed</u>

(Ref:Harper 30/e p11; Gaizung 25/e p6).

HCO/H2CO3:

- Best buffer.
- As components can be increased or decreased in body as needed.

Bicarbonate buffer system:

- Most powerful extracellular buffer in body.
- Since both elements of buffer system (HCO 3- & CO).
- Regulated respectively by kidneys & lungs.
- pH of extracellular fluid precisely controlled by HCO removal & addition by kidneys & CO 2 removal by lungs.

114. All of the following processes take place in mitochondria except:

a) Beta-oxidation of fatty acids

b) DNA synthesis

c) Fatty acid synthesis

d) Protein synthesis

Correct Answer - C

Ans: C. Fatty acid synthesis

Metabolic Pathways (Cycle or Reactions)	Site
• **Beta oxidation.** • **Ketone body utilization.** • **Pyruvate dehydrogenase.** • **Electron transport chain.** • **TCA** cycle **(BK PET),**	**Mitochondria**

115. Which of the following is most effective for gluconeogenesis in starvation?

a) Acetyl Co-A stimulation of pyruvate carboxylase

b) Fructose-1, 6-biphosphate stimulation of phosphofructokinase-1

c) Citrate stimulation of acetyl carboxylase

d) Fructose-2, 6-biphosphate stimulation of phosphofructokinase-2

Correct Answer - A
Ans: A
(Ref: Harper 30/c 1)1880)

- Acetyl Co-A stimulation of pyruvate carboxylase is most effective for gluconeogenesis.
- In Gluconeogenesis, pyruvate carboxylase catalyzes oxaloacetate synthesis from pyruvate.

116. Which of the following vitamin is synthesized in vivo, in the body by humans?

a) Niacin

b) Pantothenic acid

c) Cyanocobalamin

d) Folic acid

Correct Answer - A
Ans: A. Niacin
(Ref: Harper 30/e p547, 556)
Niacin:

- Not strictly a vitamin.
- Can be synthesized in body from essential amino acid tryptophan.
- Two compounds, nicotinic acid & nicotinamide - Similar biologic activity of niacin.
- Metabolic function is as the nicotinamide ring of coenzymes NAD & NADP in oxidation-reduction reactions.

117. Which of the following is not glucogenic?

a) Pyruvate

b) Oxaloacetate

c) Acetyl-CoA

d) Lactate

Correct Answer - C
Ans: C. Acetyl-CoA
(Ref. Harper 30/e p185, 29/e p187)

- Acetyl CoA is not a substrate for gluconeogenesis (not glucogenic) and cannot be converted back to glucose.
- "Acetyl CoA is not a substrate for gluconeogenesis and cannot be converted back to glucosee. This is because acetyl CoA cannot be converted back to pyruvateQ since its carbon backbone is lost in citric acid cycle as CO2."

118. Which of these amino acids does not enter the Krebs cycle by forming Acetyl-CoA via pyruvate?

a) Glycine

b) Tyrosine

c) Hydroxyprolinc

d) Alanine

Correct Answer - B
Ans: B. Tyrosine
(Ref: Harper 30Ie p165)

- Tyrosine enters Krebs cycle via fumarate, while all others form pyruvate to enter the Krebs cycle.

119. A child to emergency with accidental ingestion of cyanide. It blocks citric acid cycle by blocking:

a) Aconitase

b) Acetyl-CoA production

c) NAO

d) Citrate

Correct Answer - C
Ans: C. NAO
Ref: Harper 30Ie p132)

- Cyanide blocks citric acid cycle by blocking NAD+

120. Which of the following types of lipase is controlled by glucagon?

a) Lipoprotein lipase

b) Hormone-sensitive lipase

c) Gastric lipase

d) Pancreatic lipase

Correct Answer - B
Ans: B. Hormone-sensitive lipase
Ref: Harper 30/e p262)

- Hormone sensitive lipase is controlled by glucagon.
- "Hormone-sensitive lipase is activated by ACTH, TSH, glucagon, epinephrine, norepinephrine, and vasopressin and inhibited by insulin, prostaglandin E1, and nicotinic acid.

121. Second messenger for smooth muscle relaxation mediated by NO is:

a) Ca'

b) cAMP

c) cGMP

d) Magnesium

Correct Answer - C
Ans: C. cGMP
Ref.: Harper 30/e p290, 437)

- Second messenger for smooth muscle relaxation mediated by NO is cGMP.
- "GTP serves as an allosteric regulator and as an energy source for protein synthesis, and cGMP serves as a second messenger in response to nitric oxide (NO) during relaxation of smooth muscle.

122. Precipitation of proteins is done by all of these except:

a) Adding trichloroacetic acid.

b) Adding acetyl alcohol and acetone.

c) Adjusting pH to other than the isoelectric point.

d) Salts of heavy metals.

Correct Answer - C

Ans: C. Adjusting pH to other than the isoelectric point

- Protein precipitation is widely used to concentrate proteins and purify them from various contaminants.
- Protein precipitation occurs at the isoelectric point of the protein and not at any other pH.
- Selective precipitation exploits differences in relative solubility of individual proteins as a function of pH (isoelectric precipitation), polarity (precipitation with ethanol or acetone), or salt concentration (salting out with ammonium sulfate).

123. In the mammalian genome, maximum number of genes code for the receptors of:

a) Immunoglobulin receptors

b) Interleukins

c) Growth factors

d) Odorants

Correct Answer - D

Ans: D. Odorants

- In the mammalian genome, maximum number of genes code for the receptors of odorants.
- "The olfactory receptor (OR) genes constitute the largest gene family in mammalian genomes.
- Humans have >1,000 OR genes, of which only –40% have an intact coding region and are therefore putatively functional.
- Odorant receptor genes form the largest gene family in the genome of many animals: for example, the mouse genome contains approximately 1200 of these genes.

124. A lady presented with fatigue and tingling sensation in both hands and legs. On examination, she is found to have a fissured red tongue, lesions at angle of mouth and peripheral neuropathy with a decreased RBC glutathione reductase activity. What is the likely deficient vitamin?

a) Riboflavin

b) Vitamin B12

c) Thiamine

d) Vitamin B6

Correct Answer - A
Answer- A. Riboflavin
Clinical Manifestations of Riboflavin deficiency:

- Cheilosis, glossitis, lingual desquamation seborrheic dermatitis
- Keratitis, conjunctivitis, corneal vascularisation

125. Maximum thermic effect of food is seen with

a) Carbohydrates

b) Protein

c) Fat

d) Not dependent on macronutrients

Correct Answer - B
Answer- B. Protein

- Maximum thermic effect off is seen with proteins (20-30%) >carbohydrates (5-6%) > fat (2.5-4%).

126. Which of these is an example of anaplerotic reaction?

a) Pyruvate to oxaloacetate

b) Pyruvate to Acetyl CoA

c) Pyruvate to lactic acid

d) Pyruvate to acetaldehyde

Correct Answer - A
Answer- A. Pyruvate to oxaloacetate

- Carboxylation of pyruvate to oxuloacetate is an example of anaplerotic reactions.
- "Anaplerotic reactions are chemical reactions that form intermediates of a metabolic pathway. Examples of such are found
- in the citric acid cycle (TCA cycle).
- Examples of Anaplerotic Reactions
- Carboxylation of pyruvate to oxaloacetate
- Transamination of aspartate to oxaloacetate by aspartate amino transferasea
- Hydration of glutamate to alpha-ketoglutarate by glutamate-dehydrogenase
- Beta-oxidation of fatty acids to succinyl-CoA
- In purine synthesis & purine nucleotide cycle: Adenylosuccinate to fumarate catalyzed by adenylosuccinate lyase.

127. A girl complaints of acute abdominal pain on and off with tingling sensation of limbs. She had a history of eating paint from the wall of newly built house. Which of the following enzyme deficiency will be the cause of her condition?

a) ALA dehydratase

b) ALA synthase

c) Coproporphyrinogen synthase

d) Heme synthase

Correct Answer - A
Answer- A. ALA dehydratase

- ALA dehydratase is a zinc-containing enzyme and is sensitive to inhibition by lead (present in the paints). High levels of lead can affect heme metabolism by combining with SH groups in enzymes such as ferrochelatase and ALA dehydratase.
- The most common presentation of lead poisoning is an encephalopathy.
- Laboratory investigation can reveal a microcytic hypochromic anemia with basophilic stippling of erythrocytes, an elevated serum lead level, and an elevated serum coproporplryrin level. A 24-h urine collection demonstrates elevated levels of lead excretion.
- The neuropathy is characterized by an insidious and progressive onset of weakness usually beginning in the arms, in particular involving the wrist and finger extensors.

128. In uncontrolled diabetes mellitus, elevated triglyceride and VLDL levels are seen due to:

a) Increased activity of lipoprotein lipase and decreased activity of hormone sensitive lipase

b) Increased activity of hormone sensitive lipase and decreased activity of lipoprotein lipase

c) Increase in peripheral LDL receptors

d) Increased activity of hepatic lipase

Correct Answer - B
Answer- B. Increased activity of hormone sensitive lipase and decreased activity of lipoprotein lipase

- In uncontrolled diabetes mellitus, elevated triglyceride and VLDL levels sre seen due to increased activity of hormone sensitive lipase (which insulin inhibits) and decreased activity of lipoprotein lipase (which insulin stimalates).

129. Anaerobic glycolysis of which of these produces 3 ATPs per unit glucose consumed?

a) Amino acid

b) Fructose

c) Galactose

d) Glycogen

Correct Answer - D
Answer- D. Glycogen

- Anaerobic glycolysis of glycogen produces 3 ATPs per unit glucose consumed.
- Consumption of ATP at the level of hexokinase is not required when we start from glycogen as a substrate. As there is no glucose-6-phosphatase in muscle, glucose-6-phosphate directly enters into glycolysis. Hence, net ATPs are 4-1 = 3 ATPs.

130. Restriction Fragment Length Polymorphism (RFLP) was used in order to identify the five different species of Staphylococci in a surgical ICU. Which of the following site does the restriction enzymes act?

a) TAGATA/ATCTAT

b) ATGGAC/TACG rG

c) A ATATA/TATAAT

d) GATTAC/CATTAG

Correct Answer - D
Restriction endonucleases are enzymes that cut DNA at specific DNA sequences within the molecule - called the palindromic regions. A palindromic sequence is a sequence made up of nucleic acids within the double helix of DNA/RNA that is the same when reading from 5' to 3' end on either, i.e. complementary strands. In the given options, only GATTAC/ CATTAG (option d) is a Palindrome.

131. Low insulin to glucagon ratio is seen in all of these except:

a) Glycogen synthesis

b) Glycogen breakdown

c) Gluconeogenesis

d) Ketogenesis

Correct Answer - A
Answer- A. Glycogen synthesis

- Low insulin to glucagon ratio implies a catabolic state, i.e. usage of body stores to form energy, typically seen in fasting state ancl diabetes mellitus. Hence, this state will promote glycogen breakdown, gluconeogenesis as well as ketone body formation, while at the same time inhibiting glycogen synthesis and storage.

132. Phenylbutyrate is used in management of urea cycle disorders. What is its role?

a) Activates enzymes of urea cycle

b) Excretion of products of urea cycle

c) Maintains energy production

d) Scavenges nitrogen

Correct Answer - D
Answer- D. Scavenges nitrogen

- Phenylbutyrate is used to treat urea cycle disorders, because its metabolites offer an alternative pathway to the urea cycle to allow excretion of excess nitrogen. Urea cycle disorders result in the accumulation of precursors of urea, principally ammonia and glutamine. Phenylbutyrate provides an alternate means of detoxfication of glutamine via acetylation, which bypasses the urea cycle.

133. Vitamin C cannot be produced in humans due to lack of:

a) L-gluconolactone oxidase

b) Xylitol reductase

c) Pyruvate dehydrogenase

d) UDP glucose dehydrogenase

Correct Answer - A
Ans: A. L-gluconolactone oxidase

- In the liver, the uronic acid pathway catalyzes the conversion of glucose to glucuronic acid, ascorbic acid (except in human beings and other species for which ascorbate is a vitamin, vitamin C), and pentoses.
- In human beings and other primates, as well as guinea pigs, bats, and some birds and fishes, ascorbic acid cannot be synthesized because of the absence of l-gluconolactone oxidase'

134. Klenow fragment lacks the activity of?

a) 3'-5' exonuclease

b) 5'-3' exonuclease

c) 5'-3' DNA polymerase

d) 3'-5' DNA polymerase

Correct Answer - B
Ans: B. 5'-3' exonuclease

- DNA polymerase I is not the primary enzyme of replication; instead, it performs a host of clean-up functions during replication, recombination, and repair.
- When the 5'-3' exonuclease domain is removed, the remaining fragment (Mr 68,000), the large fragment or Klenow fragment, retains the polymerization and proofreading activities.
- Klenow fragment is a large protein fragment produced when DNA polymerase I from E. coli is enzymatically cleaved by the protease subtilisin.

135. Which of the following techniques is based on RNA?

a) RT PCR

b) Sanger's technique

c) Next generation sequencing

d) Western blot

Correct Answer - A
Ans: A. RT PCR
Reverse transcription-polymerase chain reaction (**RT**-**PCR**)

- It is a laboratory technique combining **reverse transcription** of RNA into DNA (in this context called complementary DNA or cDNA) and amplification of specific DNA targets using **polymerase chain reaction** (**PCR**).
- It is primarily used to measure the amount of a specific RNA. This is achieved by monitoring the amplification reaction using fluorescence, a technique called real-time PCR or quantitative PCR (qPCR).
- Combined RT-PCR and qPCR are routinely used for the analysis of gene expression and quantification of viral RNA in research and clinical settings.
- A method used to quantitate mRNA levels that rely upon the first step of cDNA copying of mRNAs catalyzed by reverse transcriptase before PCR amplification and quantitation.

Sanger **sequencing**,

- Also known as the **chain termination method**, is a technique for DNA sequencing-based upon the **selective** incorporation of chain-terminating dideoxynucleotides (ddNTPs) by DNA polymerase during in vitro DNA replication.

Next-generation sequencing:

- Modified methods of genome sequencing. It has significantly reduced the cost and time taken for whole-genome sequencing.
- It is a technique similar to Sanger sequencing, done on DNA

136. Which of the following does not require 5'capping?

a) tRNA of alanine

b) mRNA for histone

c) U6 snRNA

d) siRNA

Correct Answer - A
Ans: A. tRNA of alanine

- Small nuclear RNAs contain a unique 5'-caps. Sm-class snRNAs are found with 5'-trimethylguanosine caps, while Lsm-class snRNAs are found with S'-monomethyl phosphate caps.
- mRNAs do have a 7-methylguanylate cap, abbreviated m7G.
- **tRNAs and rRNAs don't require 5' capping. They have other modifications.**

137. Which of the following does not favor permissive euchromatin due to changes occurring at cytosine residues at CpG islands in DNA?

a) Methylation

b) Alkylation

c) Phosphorylation

d) Sumoylation

Correct Answer - A
Ans: A. Methylation
ref: Harper's illustrated biochemistry, 30th editon., pg. 560.

- Methylation of cpG sites in the promoter of a gene may inhibit gene expression.
- There is also evidence that low folate status results in impaired methylation of cpG islands in DNA, which is a factor in the development of colorectal and other cancers.

138. In a reaction substrate is available in a concentration that is l000times the Km value of the enzyme. After 9 minutes of reaction, l7o substrate is converted to product (12 microgram/ml). If the concentration of the enzyme is changed to 1/3 and concentration of substrate is doubled. What is the time taken to convert the substrate into the same amount of product, i.e. I 2microgram/ml?

a) 9 minutes

b) 4.5 minutes

c) 27 minutes

d) 13.5 minutes

Correct Answer - C
Ans: C. 27 minutes
Ref: Lehninger principles of biochemistry, 6t' ed., pg. 204

- During derivation of Michaelis-Menten equation,
- If total enzyme concentration is reduced by 1/3 and [S] is very high then Vmax also become l/3.
- So in this question same amount of product will be fbrmed in 27 rninutes (3 x 9min)

139. A Middle aged woman presents with fissures in mouth, tingling sensation and peripheral neuropathy. Investigations showed reduced glutathione reductase activity. which vitamin deficiency is the likely cause of this?

a) Vitamin B1

b) Vitamin 82

c) Vitamin 86

d) Vitamin B l2

Correct Answer - B
Ans: B. Vitamin 82
Ref: Harper's illustrated biochemistry, 3Oh ed., pg. 556

- Deficiency of riboflavin (vitamin B2) is characterized by cheilosis, desquamation and inflammation of the tongue, and a seborrheic dermatitis.

140. Fe absorption increases by which vitamin?

a) VitaminA

b) Vitamin C

c) Thiamine

d) Riboflavin

Correct Answer - B
Ans: B. Vitamin C
Ref: Harper's illustrated biochemistry, 3Ah ed., pg. 541

- Inorganic iron is absorbed in the Fe2+ (reduced) state, and hence, the presence of reducing agents enhances absorption.
- **The most effective compound is vitamin C,** and while intakes of 40 to 80 mg of vitamin C per day are more than adequate to meet requirements, an intake of 25 to 50 mg per meal enhances iron absorption, especially when iron salts are used to treat iron deficiency anemia.

141. Which of the following enzyme activity decreases in fasting?

a) Hormone sensitive lipase

b) Glycogen phosphorylase

c) Acetyl CoA Carboxylase

d) Phosphofructokinase I

Correct Answer - D
Ans: D. Phosphofructokinase I
Ans: D. Phosphofructokinase I

- Phosphofructokinase 1 (PFK1) provides the first enzymatic step at which a glucose molecule becomes committed to glycolysis and therefore is subject to regulation (Nelson & Cox, 2008). **PFK1 activity depends on the concentrations of AMP, ADP, and ATP with allosteric activation by AMP and ADP and allosteric inhibition by ATP.**
- In the fasting state, glucagon causes the liver to mobilize glucose from glycogen (glycogenolysis) and to synthesize glucose from oxaloacetate and glycerol (gluconeogenesis).
- Glucagon stimulates an increase in cAMP, leading to an increase in phosphorylation by protein kinase A.
- The wave of phosphorylation that spreads through the liver cell activates enzymes such as glycogen phosphorylase that are involved in glycogen degradation while simultaneously inhibiting glycogen synthesis.
- Inhibition of glycogen synthase prevents futile resynthesis of glycogen from glucose 1-phosphate (G1P) via UDP-Glc. Glucose-6-phosphatase (G6Pase), a gluconeogenic enzyme that is present in the liver but not in muscle, then converts G6P to glucose for release

into the blood.
Ref: Harper's illustrated biochemistry,3a,ed., pg. I88 and Lippincott's illustratet! reviewsr 6't' ed., pg. 107

142. An adolescent male patient came with pain in calf muscles on exercise. On biopsy excessive amount of glycogen present was found to be present in the muscle. What is the most likely enzyme deficiency?

a) Muscle debranching enzyme

b) Phosphoftuctokinase I

c) Glucose-6 phosphatase

d) Phosphorylase enzyme

Correct Answer - D
Ans: D. Phosphorylase enzyme
Ref: Harper's illustrated biochemistry, 3A" ed., pg. 178

- It is Mc Ardle disease.
- Deficiency of muscle glycogen phosphorylase enzyme.
- So the first step of glycogen breakdown will not occur.
- Thus intact glycogen is seen in muscle biopsy.

143. Fluoride released from fluoroacetate inhibits which metabolic pathway?

a) TCA cycle

b) Glycolytic pathway

c) Oxidative phosphorylation

d) ETC

Correct Answer - A
Ans: A. TCA cycle
Ref Harper's illustrated biochemistry, 3A" ed, pg. 162, I7l'133

- Read the question carefully, it says fluoride from fluoroacetate and not sodium fluoride.
- The poison fluoroacetate is found in some of plants, and their consumption can be fatal to grazing animals.
- Some fluorinated compounds used as anticancer agents and industrial chemicals (including pesticides) are metabolized to fluoroacetate.
- It is toxic because fluoroacetyl-CoA condenses with oxaloacetate to form fluorocitrate, which inhibits aconitase, causing citrate to accumulate.

144. Vitamin K in its coenzyme form is regenerated by which enzyme?

a) Glutathione reductase

b) Pyruvate Carboxylase

c) Dihydrofolate reductase

d) Epoxide reductase

Correct Answer - D
Ans: D. Epoxide reductase
Ref: Harper's illustrated biochemistry, 3Ah ed., pg. 555.

- Vitamin K is the cofactor for the carboxylation of glutamate residues in the postsynthetic modification of proteins to form the unusual amino acid y-carboxyglutamate (Gla).
- Vitamin K epoxide is reduced to the quinine by a warfarin-sensitive reductase, and the uinone is reduced to the active hydroquinone by either the same warfarin-sensitive reductase or a warfarin-insensitive quinone reductase.

145. Best investigation for Metabolic disorders is?

a) Western blot

b) Tandem mass spectrometry

c) PCR

d) Gel electrophoresis

Correct Answer - B

Diagnosis of patients with inborn errors of metabolism:

- Relies on specific tests such as ion-exchange chromatography and liquid chromatography with tandem mass spectrometry (LC-MS/MS) for amino acid analysis, gas chromatography/mass spectrometry (GC/MS) for organic acid analysis, tandem mass spectrometry (MS/MS) with (LC-MS/MS) or without liquid chromatographic separation for acylcarnitine profiles, and LC-MS/MS or GC/MS for acyl glycine profiles

146. An infant presented to the OPD with a history of vomiting and malnutrition. On investigation, the Guthrie test was found to be positive.
All are true regarding this disease except?

a) Due to Phenylalanine hydroxylase enzyme defect

b) White patch of hair due to tryptophan deficiency

c) Phenyl acetate positive in urine

d) Mental retardation is present

Correct Answer - B
Ans: B. White patch of hair due to tryptophan deficiency
The deficiency of phenylalanine hydroxylase is the cause of this disease.

- The genetic mutation may be such that either the enzyme is not synthesized, or a non-functional enzyme is synthesized.
- The classical Phenylketonuria child is mentally retarded with an IQ of 50.
- Guthrie test is a rapid screening test.

Ferric chloride test:

- The urine of the patient contains phenyl ketones about 500-3000 mg/day.
- This could be detected by adding a drop of ferric chloride to the urine.
- A transient blue-green colour is a positive test.

147. Best method to neasure HbA1c?

a) lsoelectric focusing

b) Affinity chromatography

c) Ion exchange chromatography

d) Electrophoresis

Correct Answer - C
Ans: C. Ion exchange chromatography
*Ref: Tietz T*tbook of clinical chemistry and molecular biologt, lh ed^, pg. 1443-1444*

- Techniques based on charge differences (ion-exchange chromatography, HPLC, electrophoresis, and isoelectric focusing), structural differences (affinity chromatography and immunoassay), or chemical analysis (photometry and spechophotometry).

148. intermediate of kreb cycle used in heme synthesis;

a) succinyl-CoA

b) Alpha ketoglutarate

c) Citrate

d) Aspartate

Correct Answer - A

Answer (A) succinyl-CoA

- All the carbon and nitrogen atoms of the porphyrin molecule are provided by glycine
- (a nonessential amino acid) and succinyl coenzyme A (an intermediate in the citric acid cycle) that condense to form ALA in a reaction catalyzed by ALA synthase(ALAS)
- Heme synthesis also requires a functional tricarboxylic acid cycle and an oxygen supply.
- Heme synthesis starts in mitochondria with the condensation of succinyl-CoA with the amino acid glycine, activated by pyridoxal phosphate.
- ALA synthase is the rate-limiting enzyme of heme synthesis. ALA molecules enter the cytoplasm, where their union in the presence of ALA dehydratase yields porphobilinogen(PBG) and water molecules.

149. Mother to children's transmission is a key feature of which pattern of inheritance?

a) Codominance

b) Autosomal dominant inheritance

c) Recessive inheritance

d) Mitochondrial inheritance

Correct Answer - D

Ans-d-Mitocondrial inheritance , it is the only non-chromosomal DNA in human cells.

- Mitochondria! DNA, is always maternally inherited.
- Mitochondrial and nuclear DNA are located in different places in the cell. During fertilization, the sperm and egg cell nuclei fuse to form an embryo.
- The egg cell is very large compared to the sperm, so although the cells nuclei fuse, the rest of the cell mass in the embryo comes from the egg only.
- Nuclear DNA is therefore co-inherited but the mitochondrial DNA, which is located outside of the nucleus, is always maternally inherited because all mitochondria in a foetus and later adult are derived from the mitochondria in the mother 's egg.
- So, in diseases showing mitochondria! inheritance all children from affected mother will inherit the disease but it will not be transmitted from an affected father to his children.

150. A young man was on high protein diet and raw eggs. After 3 days he developed weakness. Blood investigation revealed hypoglycemia. Hypoglycemia is due to inhibition of which of the following enzymes

a) Glucose 6 phosphatase

b) Glycogen phosphorylase

c) Pyruvate Carboxylase

d) Glucokinase

Correct Answer - C
Ans- c- Pyruvate Carboxylase.

When gluconeogenesis is elevated due to low blood glucose levels, the activation by acetyl-CoA of pyruvate carboxylase, which catalyzes the conversion of pyruvate to oxaloacetate, partially alleviates this problem, but in conditions such as starvation and untreated diabetes mellitus, ketone bodies are overproduced and cause ketosis.

151. Sickle cell anemia is a -

a) Gene deletion

b) Gene modification

c) Point mutation

d) Frame shift mutation

Correct Answer - C

Answer- c- point mutation.

- Sickle-cell anemia is caused by a point mutation in the β-globin chain of hemoglobin, causing the hydrophilic amino acid glutamic acid to be replaced with the hydrophobic amino acid valine at the sixth position.
- It is caused by a point mutation (Base substitution mutation) at the sixth position of the β-globin chain leading to subsitution of a valine residue for a glutamic acid residue resulting in sickle hemoglobin (HbS).
- Sickle cell anemia is an autosomal recessive disorder.

152. what does not occur in 5'→ 3'direction?

a) DNA repair

b) DNA replication

c) RNA editing

d) Transcription

Correct Answer - C
Ans -C- RNA editing

- **In rna editing editosome can edit only in 3→ 5 direction, along with primary rna transcript.**
- DNA replication goes in the **5' to 3' direction** because DNA polymerase acts on the 3'-OH of the existing strand for adding free nucleotides.
- In transcription the complementary RNA is created in the opposite direction, in the 5' → 3' direction, matching the sequence of the sense strand with the exception of switching uracil for thymine.
- When the strand containing the mis-match is identified, an endonuclease nicks the strand and the mis-matched nucleotide(s) is/are removed by an exonuclease.

153. Hepcidin decreases iron absorption by inhibition of -

a) Hephaestin

b) Ferroportin

c) Divalent metal ion transporter

d) Transferrin

Correct Answer - B

Ans - b). Ferroportin

Iron leaves the mucosal cell via a transport protein ferroportin, but only if there is free transferrin in plasma to bind to. Once transferrin is saturated with iron, any that has accumulated in the mucosal cells is lost when the cells are shed. Expression of the ferroportin gene is downregulated by hepcidin, a peptide secreted by the liver when body iron reserves are adequate. In response to hypoxia, anemia, or hemorrhage, the synthesis of hepcidin is reduced, leading to increased synthesis of ferroportin and increased iron absorption. As a result of this mucosal barrier, only ~10% of dietary iron is absorbed, and only 1 to 5% from many plant foods.

154. Kcat/km is a measure of -

a) Enzyme efficiency

b) Speed of enzymatic reaction

c) Concentration of substrate

d) Enzyme turn over

Correct Answer - D

Answer-D. Enzyme efficiency

- **"**The Km of an enzyme is the concentration of the substrate that enables the enzyme to
- Function at half maximum activity and is therefore a measure of the specificity of a substrate for the enzyme" .
- Actually enzyme specificity is not measured by alone.
- It is measured by the ratio Kcat /Km which is a second order rate constant for the reaction between substrate and free enzyme.
- This ratio is important, for it provides a direct measure of enzyme eficiency and specificity.

Note: Km, is turnover number and measures tJre rate of the catalytic process

155. Enzyme involved in gluconeogenesis are all except:

a) Pyruvate carboxylase

b) PEP carboxykinase

c) Pyruvate kinase

d) Glucose-6-phosphatase

Correct Answer - C

Answer-c- Pyruvate kinase

- Mitochondrial pyruvate carboxylase catalyzes the carboxylation of Pyruvate to Oxaloacetate, It is an ATP-requiring reaction, Biotin is the coenzyme.
- Phosphoenolpyruvate Carboxykinase: Catalyzes the decarboxylation and phosphorylation of oxaloacetate to phosphoenolpyruvate(PEPCK) (Cytosol) using GTP as the phosphate donor.
- The conversion of glucose-6-phosphate to glucose is catalyzed by glucose 6-phosphatase

156. Which of the following leads to an increase in enzyme activity -

a) Increase in temperature

b) Decrease in activation energy

c) Extremes of pH value

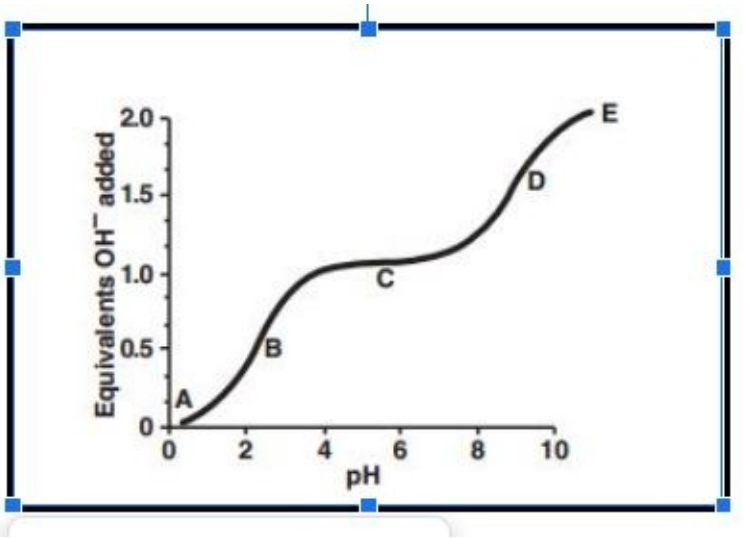
d) Low substrate concentration

Correct Answer - B

Answer-B. -Decrease in activation energy

- The enzymes speed up chemical reactions by lowering the magnitude of the activation energy banier, i.e.,free energy of Activation

157. The letters A through E designate certain regions on the titration curve for glycine (shown below). Which one of the following statements concerning this curve is correct?



a) Point A Represents the region where glycine is deprotonated

b) Point B represents a region of minimal buffering

c) Point C represents the region where the net charge on glycine is zero

d) Point D represents the pK of glycine's carboxyl group

Correct Answer - C

Answer-C. Point C represents the region where the net charge on glycine is zero

- C represents the isoelectric point or pI, and as such is midway between pK1 and pK2 for this monoamine monocarboxylic acid.

- Glycine is fully protonated at Point A. Point B represents a region of maximum buffering, as does Point D.
- Point E represents the region where glycine is fully deprotonated.

158. Assertion: Central dogma is the flow of information from DNA to mRNA and then decoding the information present in mRNA in the form of protein.
Reason: In retroviruses, the reverse of central dogma occurs.

a) Both the assertion and the reason are true and the reason is a correct explanation of the assertion

b) Both assertion and reason are true but the reason is not the correct explanation of the assertion

c) The assertion is true but the reason is false

d) The assertion and reason are false

Correct Answer - B

Answer: B Both assertion and reason are true but the reason is not the correct explanation of the assertion

The flow of information from DNA to RNA to protein is termed the "central dogma" of molecular biology, and is descriptive of all organisms, with the exception of some viruses that have RNA as the repository of their genetic information.

(i) One way flow of information (central dogma)

DNA(transcription) → RNA (translation) → proteins

(i) Reverse flow of transcription information

DNA(transcription) ↔RNA(translation) → proteins

159. All are true about CRISPR cas 9 Except

a) gRNA ensures that the Cas9 enzyme cuts at the right point in the genome

b) NHEJ repair & HDR pathway

c) C9 enzyme is used in CRISPR gene editing

d) All of these

Correct Answer - D
Answer-D. All of these
CRISPR-Cas9 was adapted from a naturally occurring genome editing system that can generate double standard Breaks (DSBs). Cas9 is the enzyme that is used most often, other enzymes (for example Cpf1) can also be used→ these enzymes can can repair by homologus repair system or by non-homologous end joining in the absence of DNA template.
Two general repair pathways:
The efficient but error-prone **non-homologous end joining (NHEJ) pathway**
The less efficient but high-fidelity **homology directed repair (HDR) pathway**

160. Restriction endonuclease cuts at

a) AAGGAA

b) AAGAAG

c) AAGTTC

d) AAGCTT

Correct Answer - D
Answer-D. AAGCTT
* AAGCTT is the only palindrome among the choices. Because the sequence of only one DNA strand is given, one must determine the base sequence of the complementary strand. To be a palindrome, both strands must have the
* The vast majority of restriction endonucleases recognize palindromes, and
same sequence when read in the 5'→3' direction. Thus, the complement of 5'-AAGCTT-3' is also 5'-AAGCTT-3'.

161. Which of the following statements about tRNA molecules is false?

a) The enzyme that attaches an amino acid to a tRNA is aminoacyl-tRNA synthetase

b) Although composed of a single strand of RNA, each molecule contains several short, double-helical regions

c) The amino acid attachment is always to 3' end of the molecule.

d) There is at least one tRNA for each of the 2 amino acids

Correct Answer - D

Answer-D. There is at least one tRNA for each of the 2 amino acids

* There is at least one tRNA for each of the 2 amino acids RNA which transfer amino acid from the cytoplasm to the ribosomal protein synthesizing machinery
* Clover leaf shape in the secondary structure.
* L-shaped tertiary structure, Single tRNA contains 74-95 nucleotides.
* Cytoplasmic translation system Possess 31 tRNA species
* Mitochondrial system Possess 22 tRNAs'

Contain significant proportion of nucleosides with unusual bases.

* Dihydro uridine (contain Dihydrouracil)
* Pseudouridine
* Inosine (contain Hypoxanthine)
* Ribothymidine

162. Which of the following statements regarding proteoglycans is true?

a) consist of a core protein with GAG chains attached.

b) GAG contain oxidized acid sugars

c) negative charges cause to radiate out from the protein

d) All of these

Correct Answer - D

Ans-D. All of these

* Proteoglycans contain many long unbranched polysaccharide chains attached to a core protein.
* The polysaccharide chains, called glycosaminoglycans, are composed of repeating disaccharide units containing oxidized acid sugars (such as glucuronic acid), sulfated sugars, and N-acetylated amino sugars.
* The large number of negative charges causes the glycosaminoglycan chains to radiate out from the protein so that the overall structure resembles a bottlebrush.

The proteoglycans are essential parts of the extracellular matrix, the aqueous humor of the eye, secretions of mucus-producing cells, and cartilage.

163. Which of the following is having Maximum buffering capacity

a) Histidine

b) Cysteine

c) Tyrosine

d) Arginine

Correct Answer - A
Answer-A- Histidine
Maximum buffering capacity occurs at a pH equal to the pKa,
So amino acid which has pKa range near physiologic pH can act as an effective buffer
* lmidazole group of histidine - 6.5- 7.4 pKa range
* SH group of cysteine→ 8.5-9.0 pKa range
* OH group of tyrosine → 9.5-10.5 pKa range
* Arginine → > 12

164. Replacing amino acid will not change its functions

a) Glutamine to Asparagine

b) Aspartate and Glutamate

c) Alanine to tryptophan

d) None of these

Correct Answer - A
Answer- A. Glutamine to Asparagine
* Glutamine and Asparagine are Amide group containing amino acids.
* These belongs to same category (hydrophilic /Homophilic) so no alteration in function

165. Genes involved in X-Linked SCID-

a) EGFR

b) CD23

c) IL6

d) IL2RG

Correct Answer - D
Answer-D. IL2RG
* X-linked severe combined immunodeficiency (SCID) is an inherited disorder of the immune system that occurs almost exclusively in males.
* Mutations in the *IL2RG* gene cause X-linked SCID.
The *IL2RG* gene provides instructions for making a protein that is critical for normal immune system function.
* Mutations in the *IL2RG* gene prevent these cells from developing and functioning normally. Without functional lymphocytes, the body is unable to fight off infections.

166. Binding of Eukaryotic mRNA to Ribosomes is facilitated by

a) Capping

b) Poly-A tail

c) tRNA

d) Shine-Dalgarno sequence

Correct Answer - A
Answer- A. Capping
* In E. coli mRNA, a leader sequence upstream of the first AUG codon, called the Shine-Dalgarno sequence (also known as the ribosomal binding site AGGAGG), interacts through complementary base pairing with the rRNA molecules that compose the ribosome.
* In eukaryotic initiation complex recognizes the 5′ cap of the eukaryotic mRNA, then tracks along the mRNA in the 5′ to 3′ direction until the AUG start codon is recognized. At this point, the 60S subunit binds to the complex of Met-tRNAi, mRNA, and the 40S subunit.

167. Glycoprotein which is Lubricant & Protective

a) Mucin

b) Immunoglobulin

c) Ovalbumin

d) None of these

Correct Answer - A
Answer- A. Mucin
* glycoproteins found in the body is mucins, which are secreted in the mucus of the respiratory and digestive tracts. The sugars when attached to mucins give them considerable water-holding capacity and also make them resistant to proteolysis by digestive enzymes.
* O-Linked Glycans: • Mucins, which are found extensively in salivary secretions, contain many short O-linked glycans. • Increase the viscosity of the fluids