1. Mention regulation of heme biosynthesis

Regulation of heme biosynthesis:

♣ The key regulatory enzyme is the mitochondrial δ-ALA synthase.

♣ It is inhibited by: - Excess heme formation: feedback mechanism. - Glucose.

♣ It is stimulated by: - Iron. - Phenobarbitol, rifampin and other drugs that induce production of cytochrome P450

2. Enumerate 4 enzymes in heme synthesis pathway

δ-aminolevulinate synthase (ALA synthase

ALA dehydratase

hydroxymethylbilane synthase (uroporphyrinogen I synthase)

uroporphyrinogen III synthase

uroporphyrinogen decarboxylase.

errochelatase enzyme (heme synthase)

3. Enumerate 3 compounds stimulating heme synthesis pathway

stimulated by: - Iron. - Phenobarbitol, rifampin

4. Enumerate enzymes that is sensitive to lead poisoining in heme synthesis pathway

ALA dehydratase and ferrochelatase enzymes are sensitive to inhibition by lead

5. Mention treatment of porphyria

orphyrias can be treated symptomatically by

avoiding drugs that induce production of cytochrome P450,

ingestion of large amounts of carbohydrate and administration of hematin. Patients exhibiting photosensitivity can benefit from sunscreens and possibly β-carotenes

6. Compare between hemoglobin & myoglobin

	Hemoglobin "Hemo" = blood	Myoglobin "Myo" = muscle
Site	RBCs	Mainly in muscle cells
Protein type	Oxygen transport protein	oxygen storage protein
Function	It takes O2 from the lungs to the tissues (including muscles)	It stores O2 in the muscle cells
Structure	-Heterotetramer -Quaternary structure -Four polypeptide chains	-Monomer -Tertiary structure -Single polypeptide chain
Oxygen binding	Four oxygen molecules	Single oxygen molecule
Affinity for oxygen	Lower	Higher

7. Enumerate 4 normal types of hemoglobin

Hemoglobin A1 (Hb A1 or Hb
Hemoglobin A2 (Hb A2)
Hemoglobin F (Hb F, fetal hemoglobin)
Hemoglobin A1c (HbA1c) or glycated Hb

8. Enumerate 3 abnormal types of hemoglobin

Carboxyhemoglobin
Methemoglobin
Sulfhemoglobin

9. Mention structure of the following hb

a. Hemoglobin A1 two α chains and two β protein
b. Hemoglobin A2 two α and two δ protein chains
c. Hemoglobin F two α and two γ protein chains

10. Define jaundice and enumerate its types

yellowish discoloration of the skin, sclera and mucous membranes due to increase the blood bilirubin level (hyperbilirubinemia) beyond the normal level.

There are 3 main types of jaundice:

1) Hemolytic (Prehepatic) jaundice.

2) Hepatocellular (Hepatic) jaundice.

3) Obstructive (Posthepatic) jaundice.

11. Compare between types of jaundice (hemolytic / hepatic / obstructive)

	Hemolytic (Prehepatic) jaundice	Hepatocellular (Hepatic) jaundice	Obstructive (Posthepatic) jaundice
Biochemical basis (mechanism)	↑↑ Production of bilirubin exceeding the capacity of hepatocytes for uptake, conjugation and excretion.	Hepatocyte dysfunction → impaired hepatic uptake, conjugation or secretion of bilirubin.	Obstruction in the passage of conjugated bilirubin from the liver to the intestine → regurgitation of bilirubin to blood.
Causes	• Sickle cell anemia. • Spherocytosis. • G-6-P-D deficiency. • Incompatible blood transfusion.	• Infection (viral hepatitis). • Liver cirrhosis. • Alcoholic liver disease.	• Bile stones (common bile duct gallstones is the most common cause of obstructive jaundice). • Tumor (cancer of pancreatic head).
Type of bilirubin increased	Unconjugated (indirect)	Both unconjugated & conjugated (direct & indirect)	Conjugated (direct)

12. Enumerate function of albumin

1. Responsible for 70 to 80% of osmotic pressure of human plasma.

2. Helps in the transport of several substances e.g. FFA, unconjugated bilirubin, Ca++ and steroid hormones.
3. Certain drugs also bind to albumin, e.g. sulphonamides, aspirin, penicillin and are transported to target tissue.
4. Preparations of human albumin have been widely used in treatment of hemorrhagic shock and burns.

13. Enumerate types of alpha 1 globulins and its fuction

1. α1-acid glycoprotein (orosomucoid): is a reliable indicator of acute inflammation.
2. α1-antitrypsin (α1-AT): is the principal protease inhibitor (PI) of human plasma. It inhibits trypsin, elastase, and other proteases by forming complexes with them. It is deficient in emphysema.

14. Mention function of haptoglobin

♣ Bind free Hb and minimizes urinary loss of Hb. ♣ After binding, Hp-Hb complex circulates in the blood, which cannot pass through glomerular filter and ultimately the complex is destroyed by RE cells

15. Enumerate types of beta globulin

1. β - Lipoproteins (LDL)
2. Transferrin: transport of iron (Fe) between intestine and site of synthesis of Hb and other Fe containing proteins.
3. C-reactive Protein

16. Enumerate function of CRP

- It precipitates with group C polysaccharide of pneumococci, in the presence of Ca, hence the name.
- It can bind to T-lymphocytes and can activate complement.

 Used as a marker of tissue injury & inflammation.

17. Enumerate function of different plasma proteins

1. They contribute amino acids for tissue protein synthesis.
2. Regulation of blood volume and tissue fluid formation: plasma proteins exert osmotic pressure across the capillary wall which tend to pull water into the blood.
3. Buffering action: The serum proteins, like other proteins, are amphoteric,
5. Role in blood coagulation and fibrinolysis.
6. Immunological function (Body defense): γ-globulins protect the body against microbial infections.
7. Enzymes: most enzymes are proteins in nature.
8. Carriage of Co2

Define acute phase reactants or proteins

Levels of certain proteins in plasma increase during acute inflammatory states or secondary to certain types of tissue damage. These proteins are called Acute phase proteins or reactants

18. Enumerate 4 acute phase reactants

1. C-reactive protein (CRP)
2. Haptoglobin (Hp)
3. α1 antitrypsin
4. α1 acid glycoprotein
5. fibrinogen

19. Enumerate causes of hypoalbuminemia

a. Loss from the body
1. Renal: Loss of albumin in urine in nephrotic syndrome.
2. GI Tract: Protein losing enteropathy.
3. Skin: Severe burns.
b. Decreased synthesis of albumin in severe liver diseases such as chronic hepatitis and liver cirrhosis.

c. Miscellaneous: Pregnancy and chronic illness.

20. Enumerate causes of hypogammaglobulinemia

(a) Protein loss: Same as above

(b) Decreased synthesis:

1. Primary: Genetic deficiency

2. Secondary: Certain toxins/and drugs: uremia, cytotoxic therapy, corticosteroid therapy, AIDS.

(c) Miscellaneous: Pregnancy

21. Enumerate 3 effects of hypoproteinemia

Effects of hypoproteinemia:

- Most important sign is L.L edema, swelling of face and of other parts of the body.
- Loss of muscle mass
- Infections
- Fatigue
- Dry brittle hair
- Lack of growth in children