Biomolecules

1. [MYE 14] Explain how cellulose differs from starch in structure. [6]

Points of comparison	Cellulose	Starch (amylose and amylopectin)
Monomer	consists of β-glucose monomers	consists of α-glucose monomers
Bond between monomers	β-1,4-glycosidic bonds between monomers	α-1,4-glycosidic bonds between monomers α-1,6-glycosidic bonds at branch points in amylopectin
Orientation of monomer	alternate glucose units are inverted/rotated 180^o / each glucose unit rotated 180^0 with respect to each other;	all glucose units have the same orientation
Overall Structure / Structure of each molecule	long, parallel, straight chain (s)	long spiral / helical / coiled chains forming a compact structure
Bonds between molecules **(type and location of hydrogen bonds)**	OH groups projecting outwards in both directions for each chain, allow intermolecular/ interchain H-bonding (between OH group of a chain and –O from adjacent chain) → leading to microfibril formation + intra-chain hydrogen bonds between –OH and –O of adjacent b-glucose monomers	no interchain H-bonding, only intra-chain hydrogen bonds between adjacent a-glucose residues (-OH group of adjacent glucose residues)
Level of packing	microfibrils bundle to form macrofibrils	no higher levels of packing, only a mixture of amylose and amylopectin.
Branching **(only when comparing cellulose and amylopectin)**	no branching present	branching occurs at intervals of abour 20-30 glucose units for amylopectin

2. 07/2/8a Describe the main structural features of cellulose and collagen. [8]

1 Cellulose is a polysaccharide, consisting of many β-glucose residues linked by β-1,4-glycosidic bonds;

2 Straight chains of β-glucose run parallel to each other with numerous inter-chain hydrogen bonds between hydroxyl groups, binding the chains rigidly;

3 The cellulose chains associate in groups to form microfibrils and then macrofibrils, which are interwoven and are embedded in a gel-like matrix, thus having high tensile strength;

4 Collagen is a protein consisting of amino acid residues linked by peptide bonds;

5 Each polypeptide chain has a repeated triplet sequence of Gly-X-Y, with a high proportion of glycine, proline and hydroxyproline.

6 Every 3rd amino acid residue is a glycine and this allows each helical chain to makes a turn every 3 residues and intertwines around two other chains to form a compact triple helix, as only glycine is small enough to fit into the centre.

7 The 3 helical polypeptide chains are held together by interchain hydrogen bonds forming tropocollagen (rigid);

8 Many triple helices lie parallel in a staggered pattern to form fibrils, with covalent bonds between neighbouring triple helix chains. Fibrils unite to form fibres;

RI 2016/Prelim/Q8a Compare the structure of cellulose with that of collagen. [6]

Similarities:

1. Both are fibrous;
2. Both have hydrogen bonds between chains;
3. Both do not have a fixed number of monomers;

Differences – max 5m

Points of comparison	**Cellulose**	**Collagen**	
4 Monomer	Cellulose is made up of ***β-glucose**** monomers	Collagen is made up of ***amino acid**** monomers	1 1
5 No. of types of monomers	1 type of monomer	More than 1 type of monomer e.g. glycine, proline, hydroxyproline;	
6 Bond between monomers;	***β(1-4) glycosidic bond**** links monomers of cellulose	***peptide bond**** links monomers within a polypeptide; R: amide bond	1
7. Structure of each molecule	a. Each cellulose molecule is a single chain; b. Each chain is long, straight chain	a. Tropocollagen molecule consists of 3 polypeptides ; b. 3 loose helical polypeptides intertwined to form 1 tropocollagen molecule;	1
8. Groups involved in hydrogen bonding;	Hydrogen bonds form between ***OH groups**** projecting outwards in both directions between adjacent chains **Note: H bonds are intermolecular**	Hydrogen bonds between the CO group of proline and NH group of glycine of the tropocollagen **Note: H bonds are intramolecular**	1
9. Presence of covalent links;	No covalent links	***Covalent links**** between N & C terminal lysine residues of staggered tropocollagen molecules forming a collagen fibril;	

10 Further arrangement	**Molecules** form microfibrils which further forms macrofibrils	3 loose helices coil to form tropocollagen. Tropocollagen molecules form collagen fibrils which further forms fibres.	1 1
11. Orientation of monomer;	***Alternate glucose**** units are ***rotated* 180º*** with respect to each other	All ***amino acid residues*** in the chain are not ***rotated* 180º*** with respect to each other;	1

3. [9286/08/2/9b] Describe the structural differences between collagen and cellulose. [7] (Refer to Q2 ans)

Feature	**Collagen**	**Cellulose**
Type of monomer	Amino acid	β-glucose
Bonds between monomers	Peptide bonds	β-1,4-glycosidic bonds
Location of hydrogen bonds / Types of bonds between chains	Interchain hydrogen bonds between N-H of peptide bond of a glycine residue of one pp chain with C=O of peptide bond of a.a. residues in adjacent pp chain help hold the three chains together. ➔ Forming a rigid structure	Interchain H-bonds between OH groups projecting outwards in both directions for each chain / between OH group of a chain and –O from adjacent chain ➔ Forming a rigid structure + intra-chain hydrogen bonds between –OH and –O of adjacent b-glucose monomers
Macromolecule structure	Many triple helices lie parallel in a staggered pattern to form fibrils, with covalent bonds between neighbouring collagen molecules (between lysine / hydroxylysine). Fibrils unite to form fibres ➔ allowing collagen to have high tensile strength;	Cellulose chains associate in bundles to form microfibrils, which then arrange in larger bundles to form macrofibrils. Macrofibrils of successive layers are interwoven and are embedded in a gel-like matrix. ➔ High tensile strength.
Structure of each chain	Helical pp chain, makes a turn every 3 a.a residues	Straight chain with adjacent glucose monomer rotated 180° with respect to each other

4. 07/2/8b Explain how glucagon differs from glycogen. [8]

(b) Differences

	Features	**Glucagon**	**Glycogen**
1	Biomolecule ;	Globular protein	Polysaccharide

2	Monomers;	Amino acids	α glucose
3	Bonds between monomers;	Peptide bonds	α-1,4-glycosidic bond α-1,6-glycosidic bond result in branching
4	Solubility ;;	Soluble Hydrophilic amino acids found at exterior of the protein and hydrophobic amino acids found in the interior of the protein	Insoluble Large size and Hydroxyl groups all involved in hydrogen bonds between each other and not exposed
5	Bonds supporting the entire structure	Hydrogen bonds, disulfide bonds, ionic bonds and hydrophobic interactions between R groups;	Hydrogen bonds between hydroxyl groups;
6	Functions	Protein hormone that regulates blood glucose.	Energy storage in muscle and liver
7	Site of formation	Produced by alpha cells in the pancreas in islets of Langerhans	Produced by condensation of glucose in liver and muscle cells

5. 07/2/8c Suggest why plant cells mainly store carbohydrates and animal cells mainly store lipids. [4]

Both carbohydrates and lipids are able to function as energy reserves ;

Lipids have other functions beside energy reserves that are more useful to animals than plants

Buoyancy – for aquatic animals ;

Thermal/heat insulation – animals can use lipids in blubber ;

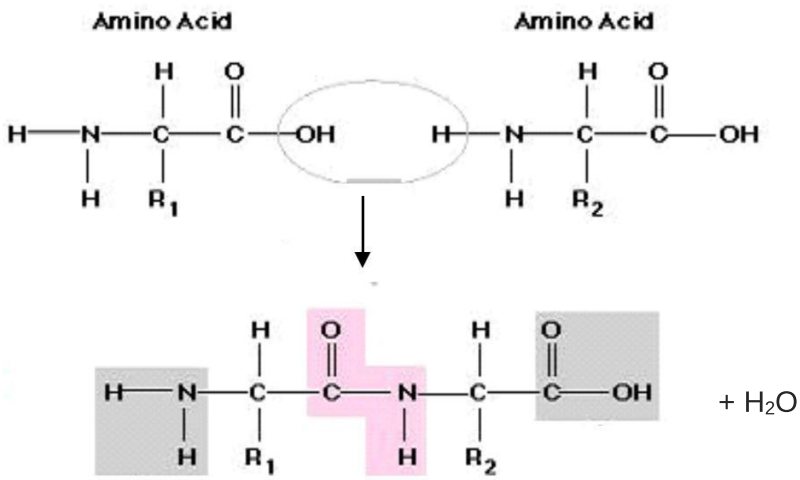
More metabolic water – lipids produce more metabolic water ;

Contain more energy **per unit mass** – plants are stationary while animals need to mov ;

Protection of internal organs – plants have no internal organs while animals have internal organs;

6. 10/2/9a Describe the structure of an amino acid and how a peptide bond is formed with another amino acid. [6]

1. Amino acids comprise a central carbon atom bonded to amino group ($-NH_2$), carboxyl group ($-COOH$) and a R group ;
2. There are **20** different amino acids due to the different R groups;
3. R groups are classified by their chemical properties; **polar and non-polar** ;
4. Peptide bond is formed between two amino acids by removal of a one molecule of water by condensation reaction;
5. Peptidyl transferase is the enzyme that catalyses the formation of peptide bond;
6. 2 aminoacyl-tRNA are brought close to each other in a ribosome on the peptidyl site and aminoacyl site;



Peptide bond

7. 04/2/7 Outline the differences in structure between amino acids and nucleotides. [6]
8. [10/2/9b] Explain what is meant by primary, secondary, tertiary and quaternary structure of a named protein. [8]
   1. Haemoglobin is a quaternary globular protein made up of 4 polypeptide chains;
   2. The polypeptide chains are held together by hydrogen bonds, ionic bonds, and hydrophobic interactions between side chains of each amino acid; Reject disulfide bonds
   3. Primary structure refers to the specific number and sequence of amino acids;
   4. Haemoglobin has 2 identical α-chains of 141 amino acids each and 2 identical β-chains of 146 amino acids.
   5. Different amino acids possess side chains of different chemical and physical properties and are held by peptide bonds;
   6. In haemoglobin, the secondary structure is repeated coiling of a polypeptide chain into α-helix
   7. Secondary structure is maintained by hydrogen bonds between peptide bonds;
   8. Tertiary structure refers to the unique three-dimensional conformation / shape / structure as a result of further coiling and folding of secondary structures of one of the polypeptide chain;
   9. The tertiary structure is held together by hydrogen bonds, ionic bonds, and hydrophobic interactions between side chains of each amino acid; Reject disulfide bonds

Focus of the question: *Primary, secondary, tertiary and quaternary structure*. Only Hb can gain the full credit as Hb has tertiary structure, but not collagen.

9. [Tutorial 04/2/7] Explain, with examples, the structural differences between fibrous and globular proteins. [8]

[6]

Features	Fibrous proteins	Globular proteins
Example;	Collagen	Haemoglobin
Variety of amino acids used;	Mainly 3 amino acids. Each polypeptide chain has a high proportion of glycine, proline and hydroxyproline.	Large variety of amino acids is used
No. of polypeptide chains;	3 polypeptide chains	4 polypeptide chains
Overall Structure; (can be broken into 2 points 1. Quaternary structure 2. Overall structure)	3 helical chains wound around each other to form triple helix / tropocollagen Many triple helices lie parallel to form fibrils and fibrils unite to form fibres	4 polypeptide chains, each polypeptide chain is repeatedly coiled to form α-helix. Further folding of secondary structures (α-helices) to form compact spherical shape. 4 subunits, each containing one haem group, makes up one haemoglobin molecule.
Tertiary structure;	No tertiary structure. Unfolded, parallel (helical) polypeptide chains secondary structure	Further coiling and folding of secondary structure (α-helices) to form compact spherical shape
Bonds involved in quaternary structure;	The quaternary structure of collagen is held by hydrogen bonds	The quaternary structure of haemoglobin is held by hydrogen bonds, ionic bonds and hydrophobic interaction
Solubility;;	Insoluble Hydrophobic amino acids are found at the exterior surface of collagen	Soluble The hydrophobic amino acids in the interior of the protein and hydrophilic amino acids found at the exterior surface
Function / Role;	Structural and supportive function in skin, bone	Involved in metabolic reaction i.e. Transport oxygen in blood

10. 10/2/9c Outline how the structure of a named globular protein is related to its specific function. [6]

Haemoglobin (a globular protein involved in the transport of oxygen in blood)	Hydrophobic amino acids in the interior of the protein and hydrophilic amino acids found at the exterior of the protein;	Soluble protein: take part in chemical reactions;
	Haem group, a porphyrin ring with an iron ion (Fe^{2+}) centre, held in the hydrophobic pocket of the	Haemoglobin to bind reversibly to oxygen and transport

	polypeptide chain; Four polypeptide subunits are associated by weak bonding – hydrophobic interactions, hydrogen bonds and ionic bonds;	oxygen; Cooperative binding of oxygen to haemoglobin: Binding of an O_2 molecule to one subunit results in a conformation change in the adjacent subunits in the haemoglobin making it easier for another O_2 molecule to bind;
	Haemoglobin is folded into a spherical shape;	Allow the protein to be compact and many haemoglobin molecules to be dissolved in the cytoplasm of a red blood cell;

11. [Tutorial] Explain how the structure of collagen and haemoglobin are related to their function. [8]

Max 4 for each protein

Collagen is a fibrous protein involved in structural and supportive function;
Each polypeptide chain has a repeated triplet sequence of Gly-X-Y, with a high proportion of glycine, proline and hydroxyproline, with glycine being small enough to fit into the centre, allowing it to form a compact triple helix;
The 3 helical polypeptide chains are held together by interchain hydrogen bonds forming tropocollagen, which is relatively rigid; Presence of Proline and Hydroxyproline also contributes to the rigidity of the polypeptide chains;
Hydrophobic amino acids are found at the exterior surface of collagen, allowing it to be insoluble in water, metabolically inactive, and thus, resistant to chemical changes. ;
Many triple helices lie parallel in a staggered pattern to form fibrils, with covalent bonds between neighbouring chains. Fibrils unite to form fibres allowing collagen to have high tensile strength;
Haemoglobin is a globular protein involved in the transport of oxygen in blood ;
The hydrophobic amino acids in the interior of the protein and hydrophilic amino acids found at the exterior surface of the protein allows the haemoglobin to be soluble to take part in chemical reactions;
The haem group, a porphyrin ring with an iron ion (Fe^{2+}) centre, is held in the hydrophobic pocket of the polypeptide chain, allowing haemoglobin to bind reversibly to oxygen;
The quaternary structure, of four subunits, are held by weak bonds such as hydrophobic interactions, ionic bonds and hydrogen bonds, allowing cooperative binding of oxygen to haemoglobin;
Haemoglobin is folded into a spherical shape, allowing the protein to be compact and many haemoglobin molecules to be dissolved in the cytoplasm of a red blood cell;

9286/08/2/9a Explain how the molecular structure of haemoglobin is related to its function. [7]

12. [Tutorial] Explain how the molecular structure of triglyceride and phospholipid is related to their function. [6]

12/2/8a Outline the molecular structure of phospholipids in relation to their function in cell membranes. [7]

1. Consist of 2 fatty acids/ hydrocarbon chains / tails, 1 phosphate group and 1 glycerol molecule ;
2. basic structure of cell membranes by forming a phospholipid bilayer;
3. polar phosphate head faces towards the aqueous medium of the extracellular and intracellular environment;
4. hydrophobic hydrocarbon tails faces each other, forming the hydrophobic core of the lipid bilayer;
5. Hydrogen bonds form between the polar phosphate heads and water molecules;
6. hydrophobic interactions between hydrocarbon tails stabilise the membrane structure;
7. hydrophobic core of the bilayer only allows non-polar substances (O_2 and CO_2) to move across the bilayer through simple diffusion;
8. polar and charged substances are repelled by the hydrophobic core;
9. weak hydrophobic interactions between the phospholipid molecules allows the membrane to be fluid;

10. thus allowing changes to the conformation of membrane transport proteins as they transport substances across the membrane/ enable bulk transport to occur because vesicles can pinch off the membranous organelles like the ER and GA;

02/3/9 Explain how the molecular structure of triglycerides is related to their functions. [6]

Molecular Structure ←(Property)→ Function

1. Triglycerides formed from 3 fatty acids molecules and 1 glycerol molecule, by condensation reaction, with the formation of three ester linkages;

Large number of hydrogen and carbon atoms, very few oxygen atoms:

2. + Triglycerides release twice as much metabolic water as compared to carbohydrates when oxidised in respiration;

3. Lipids like triglycerides have a higher calorific value than other respiratory substrates releasing a higher amount of metabolic energy per unit mass as there are more C-H bonds to release more adenosine triphosphate (ATP) upon oxidation/ OR (5);

Presence of hydrocarbon chains / Length of the hydrocarbon chain →

4. Large molecule + C-H bonds in the hydrocarbon chains of fatty acids are relatively non-polar, triglycerides are hydrophobic / insoluble in water, therefore can be stored in large amounts without exerting any osmotic effect on cells;
(Note: The longer the hydrocarbon chain, the more insoluble it is in water.)

5. Triglycerides have long hydrocarbon chains that can be oxidised during respiration to produce energy in the form of ATP;

6. Triglycerides are compact and unhydrated, making them less dense than water and carbohydrates. Therefore, they are able to provide buoyancy for large aquatic animals OR serves as an alternative energy source and storage in animals for locomotion (OR energy storage in the seeds of fruits that are dispersed by wind)

7. Therefore the main function of triglycerides is energy storage/ serves as a respiratory substrate;

13. 06/2/8 Explain the differences in molecular structure between triglycerides and phospholipids. [6]

Features	Triglycerides	Phospholipids
Components;;	Consist of 3 fatty acids and 1 glycerol molecule (no phosphate group present)	Made up of 2 fatty acids, 1 glycerol molecule, 1 phosphate group (derived from phosphoric acid)
Presence of base;;	Absence of nitrogen-containing base choline	Presence of nitrogen-containing base choline
Bonds;;	Three ester linkages are formed by condensation reaction	Two ester linkages and one phosphoester bond are formed by condensation reaction

14. 06/2/8 Describe the functions of triglycerides and phospholipids in living organisms. [8]

1	The main function of triglycerides is energy storage;
2	Triglycerides are a respiratory substrate, having long hydrocarbon chains that can be hydrolysed and oxidized during respiration to produce energy in the form of ATP;
3	Lipids have a higher calorific value than other respiratory substrates, releasing higher amount of metabolic energy per unit mass. In triglycerides, there are more C-H bonds to release more ATP upon oxidation;
4	Triglycerides release twice as much metabolic water as compared to carbohydrates when oxidised in respiration;
5	Lipids can be stored in large amounts without exerting any osmotic effect on cells as it is insoluble, therefore lipids will be unable to diffuse out of cells and will not alter osmotic pressure of the cell (does not affect the movement of water in or out of cell);
6	Triglycerides, stored in adipose tissues, serves as a heat insulator as it is a poor conductor of heat;
7	Adipose tissues around vital internal organs protect from shock and physical impact. The cushioning of internal organs also prevents abrasion with adjacent organs;
8	Lipids are less dense than water and thus large aquatic animals living in cold environments make use of their thick layer of blubber for buoyancy.
9	Phospholipids form the basic structure of cell surface membrane and internal membranes of cells. This is called the phospholipid bilayer;
10	The phospholipid bilayer acts as a boundary that separates the cell contents from the external environment;
11	The internal cell membranes compartmentalise the cell preventing indiscriminate mixing and allows for specialisation of cell function;
12	Phospholipid bilayer also serves as a partially permeable barrier, whereby the hydrophobic tails repel charged ions (e.g. Na^+) and polar substances (glucose). It allows non-polar molecules (e.g. O_2) and small polar molecules (H_2O) to pass through via diffusion.
13	Can associate with hydrophilic oligosaccharides, which are short polysaccharides, to form glycolipids which help in cell-cell recognition and cell-cell adhesion;
14	Phospholipids are necessary for the formation of acetylcholine (a neurotransmitter);
15	Phospholipids can form micelles help in the transport of fats from the gut to the liver;

15. [MYE 14] Describe the structure of the cell membrane and relate it to its functions. [8]

1. Fluid – phospholipids and proteins can move freely;
2. Mosaic – protein molecules are scattered and embedded within phospholipid molecules;

Components of membrane	**Function**
Phospholipids	Structure: Forms **phospholipid bilayer** where 3 **Hydrophilic phosphate head** faces the aqueous medium (exterior and interior of cell); 4 The **hydrophobic fatty acid tails** facing each other in the middle of the bilayer (hydrophobic core); Function:

	5 **Partially permeable** barrier allows transport of certain molecules (small & lipid-soluble/uncharged/hydrophobic) / Barrier / boundary that separates the cell from the **external environment** / **Compartmentalize** the cell, preventing indiscriminate mixing and specialization of cell function;
Cholesterol	Structure: 6 **Interspersed among bilayer** hindering the close packing of the phospholipids; Function: 7 **Regulate fluidity** of cell membrane;
Glycolipids and Glycoproteins	Structure: 8 addition of **short carbohydrate chains** to lipids or proteins; Function: 9 **Cell-to-cell recognition** as they act as receptor sites for signal molecules OR **Cell adhesion** for other cells to bind;
Proteins	Structure and Function: Two major groups of membrane proteins: Intrinsic / integral proteins and extrinsic / peripheral proteins. 10 **Intrinsic** proteins are **embedded in the hydrophobic core** of the phospholipid bilayer; 11 and can be **transmembrane or unilateral**; 12 **Extrinsic** proteins are **loosely attached** to membrane on **either sides of the bilayer;** 13 either to **fibers of extracellular matrix (external extrinsic proteins) or cytoskeleton (internal extrinsic proteins);** 14 **Carrier proteins** have **specific binding sites** for specific solutes and transport them across the cell membrane **down their concentration gradient** or against their concentration gradient **using ATP**; 15 **Channel proteins** have **hydrophilic pore** which allows movement of large or hydrophilic molecules;

16. [Tutorial] Suggest why plant cells mainly store carbohydrates and animal cells mainly store lipids. [4]

(c) Suggest why plant cells mainly store carbohydrates and animal cells mainly store lipids. [4]

1 Plant cells photosynthesis to produce glucose which are stored as starch grains in chloroplasts for energy storage whereas lipids such as triglycerides are constructed from glycerol and fatty acids, stored in adipose cells and they have other functions beside energy reserves that are more useful to animals than plants;
2 Lipids have a higher calorific value than other respiratory substrates, releasing higher amount of metabolic energy per unit mass needed for animals to move / locomotion whereas plants are stationary, therefore require relatively lesser energy for movement;
3 Lipids release twice as much metabolic water as compared to carbohydrates when oxidised in respiration, which is useful for animals living in places with shortage of water i.e. desert to store this metabolic water;
4 Lipids, stored in adipose tissues, serves as a heat insulator as it is a poor conductor of heat;
5 Adipose tissues around vital internal organs protect from shock and physical impact. The cushioning of internal organs also prevents abrasion with adjacent organs required for animals with internal organs;
6 Lipids are less dense than water and thus large aquatic animals living in cold environments make use of their thick layer of blubber for buoyancy OR; Due to demands of locomotion in animals, lipid is a compact, less-dense form of energy storage compared to carbohydrates, while in plants they can function with bulky energy storage since they are stationary;

17. [BT 15] Describe the ways in which a globular protein differs from DNA. [8]

Features	Globular protein	DNA
Structure ;	Globular proteins consists linear polypeptide chains folded into compact spherical shape.	DNA consists of a 2 polynucleotide chains spiralled into a double helix.
Monomers ;	Proteins are made up of amino acids.	DNA are made up of deoxyribonucleotides. ® nucleotides (Be specific)
Types of monomers ;;	There are 20 different amino acids present in proteins due to different R-groups. 2M for number and reason for different types (All or none)	There are four different nucleotides due to different nitrogenous bases; adenine, thymine, cytosine and guanine.
Bonds between monomers;	Amino acids are held by peptide bonds by condensation reaction to form protein	Nucleotides are held by phosphodiester linkages.
Bonds involved in	The globular structure of protein is maintained by	The double helix structure of DNA is maintained by

holding structure;;	hydrogen bonds, ionic bonds, disulfide bonds, and/or hydrophobic interactions between R- groups. 2M for types of bonds and their locations in globular protein & DNA (All or none)	hydrogen bonds between complementary nitrogenous bases and hydrophobic interaction between stacked bases. 1M awarded if students mentioned only 1 of the bonds and its location stated above for DNA
Location of synthesis;	Globular proteins are synthesised by ribosomes attached to rER / free ribosomes in cytoplasm. ® cytoplasm	DNA is replicated in the nucleus of a cell during synthesis phase of interphase. Accept if no mention of S phase
Elements present;	Globular proteins contain element sulphur in some amino acids (e.g. cysteine).	DNA contains element phosphorus in phosphate group of the nucleotide.
Function;	Proteins are involved in metabolic functions. Accept enzymes.	DNA is the genetic material that organisms inherit from their parents. / Genes on DNA codes for synthesis of proteins.

Marker's comments:

A handful of students are unable to integrate and apply concepts from different topics.

A handful of students are unable to describe the structure of globular protein as spherical shape.

A handful of students did not mention about the locations of the bonds involved in holding the structure.

Deduct 1m for students who wrote their answers in point forms (incomplete sentences) in table form. This might hinder the marker's understanding what the student was writing.

A few students look specifically at haemoglobin, instead of globular protein in general. Hence some did not mention disulphide bonds in the bonds holding the structure of globular protein (award 0).

A: Globular protein is found in cytoplasm of eukaryotes whereas DNA is found in nucleus, mitochondria and chloroplast of eukaryotes.

® the following weak comparison points or negative answering:

1. Presence / absence of primary, secondary & tertiary structures
2. Presence/ absence of complementary base-pairing
3. Presence/ absence of storing of genetic information (already mentioned in comparison of functions)
4. Presence / absence of haem group or nitrogenous bases
5. Compare processes of synthesis of DNA & globular protein
6. Compare sizes
7. Compare solubility in water / charged

8. Compare number of strands or polypeptide chains in globular proteins vs polynucleotide chains in DNA
9. Compare components of monomers (irrelevant to DNA & globular protein which are polymers)

Teaching point for students to learn to prioritise their points. “MAIN ways” in qns

Teaching point for students to show point-to-point comparison (PTPC) for comparison questions.