

Molecular Biology test - Maximum mark = 40

Multiple choice questions

1. Carbon is the basis of biological polymers because

I It can form chains by bonding to other carbon atoms

II It is found in carbohydrates

III It can form four covalent bonds

A I only

B I and II only

C I and III only

D I, II and III

2. When Wohler synthesised urea, it falsified which theory?

A Creationism

B Vitalism

C Spontaneous generation

D None of the above

3. Hydrogen bonding between water molecules is important in living systems because

I It makes water cohesive

II It gives water a high specific heat capacity

III It makes water transparent

IV It helps water to be a good solvent for polar molecules

A I and III only

B II and IV only

C I and II only

D I, II and IV only

4. Which row of the table shows a correct description of the different types of fatty acid?

	Saturated fatty acid	Mono-unsaturated fatty acid	Poly unsaturated fatty acid
A	Many double bonds between carbon atoms	One double bond between the carbon atoms	All the carbon atoms are linked by single bonds
B	One double bond between the carbon atoms	Many double bonds between carbon atoms	Many single bonds between carbon atoms
C	All the carbon atoms are linked by single bonds	One double bond between the carbon atoms	Many double bonds between carbon atoms
D	All the carbon atoms are joined by double bonds	One single bond between carbon atoms	Many double bonds between carbon atoms

5. Proteins are polymers with a large range of structures and functions because

A Each individual has a unique proteome

B They can be folded into different three dimensional shapes

C They are made of amino acids which are amphoteric

D They contain the element nitrogen

6. When a dipeptide is formed from two amino acids which type of reaction takes place?

A Denaturing of amino acids

B Condensation reaction

C Hydrolysis reaction

D A reaction which is catabolism

7. Which of the following are proteins?

I Collagen

II Glycogen

III Insulin

IV Immunoglobulins

A I and III only

B I, III and IV only

C I and II only

D All of the above

8. Crick and Watson elucidated the structure of DNA using which of the following?

A Model making

B Gel Electrophoresis

C X-ray crystallography

D Condensation reactions

9. Taq DNA polymerase could be used to

A Identify the DNA of a person at a crime scene

B Remove a portion of a DNA sample for testing

C Initiate transcription in a cell

D Produce multiple copies of a segment of DNA in laboratory conditions

10. The only N-containing nutrient available to a group of bacteria is heavy (^{15}N) nitrogen, All the bacteria divide just once and the new DNA in these new cells is examined (after DNA replication). What type of nitrogen would you find in that DNA?

A Only heavy nitrogen (^{15}N) strands in the DNA molecules

B Some heavy (^{15}N) and some light nitrogen strands in the DNA molecules

C One heavy (^{15}N) and one light strand in each DNA molecule

D Variable nitrogen in the DNA molecules

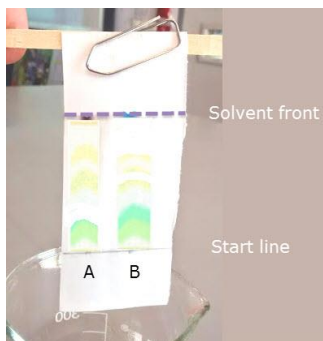
Structured answer questions

11. Two chromatograms have been run to compare the pigments present in two angiosperm leaves, one which is green in colour and another which has a dark red appearance.

Describe how you could use the chromatogram to compare the pigments present in the two types of leaves including any measurements and calculations that you would make.

(4 marks)

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Visually compare the position and colour of the pigments (obtain qualitative data);

Measure the R_f values of the pigments;

Marking the position of the solvent front **and** marking the top of the position of each pigment on the chromatogram;

R_f (R value) is calculated by Distance moved by pigment divided by the distance moved by the solvent front;

The same R_f value indicates that the pigments are the same or identical/different values mean that the pigments are not identical (or an explanation WTTE);

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12. Why is the proteome of an individual cell of a multicellular organism different from the proteome of the whole organism? (3 marks)

The proteome is all the protein molecules in a cell or organism;

The proteome of a cell depends on the genes which are activated/transcribed/expressed;

Differentiation will cause different genes to be expressed/switched off;

Different proteins are manufactured in different tissue types;

The proteome of a tissue is less than that of the entire organism/the same proteins are not manufactured in all cells

13. Describe how hydrogen bonding is important in water and in the structures of nucleic acids.

(4 marks)

Max 3 if only one molecule is referred to.

H-bonds are weak attractions between polar groups/molecules

In DNA -

Hydrogen bonds hold the two DNA strands together;
Complementary bases are joined together;

A pairs with T and C with G;

In Water -

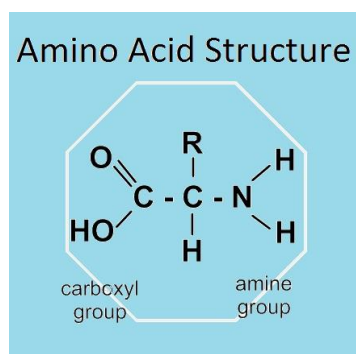
Water molecules are polar;
+ pole of water is bonded to - pole by hydrogen bonding;

Water molecules are more tightly bonded together;

This causes higher mp/bp/cohesion/adhesion/surface tension/ etc.;

14. Draw a generalised diagram of an amino acid molecule and label the chemical groups which make up the molecule

(4 marks)



carboxyl group correctly drawn and labelled;
amine groups shown correctly with label;
a central carbon atom correctly drawn;
radical and hydrogen also shown bonded correctly to middle carbon;

(Beware of new nomenclature in IB chemistry. In option B Chemistry students call this bond an amide link)

15. Lactose-free milk can be produced by the use of immobilised lactase. Explain why lactase is a hydrolysing enzyme and the importance of immobilising the enzyme in this process.

(5 marks)

Lactase is a hydrolysing enzyme because it the bond between glucose and galactose/disaccharide/lactose to form monosaccharides/glucose/galactose;

This process is called hydrolysis,

Water is added to the disaccharide/used to break the bond;

Immobilisation is attaching the enzyme to an unreactive/porous solid/gel beads (or example);

The beads/enzyme can be removed from the reaction mixture/leaving a pure product;

The (immobilised) enzyme can be reused;

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16. Describe the role of yeast in the brewing and the baking industry. (5 marks)

Yeast carries out anaerobic respiration;

Which produces ethanol **and** carbon dioxide;

From the breakdown of sugars/monosaccharides/carbohydrates (in the dough/grape juice);

In wine fermentation, ethanol is the essential product making the juice into wine;

Ethanol concentration rises in the ferment causing the process to stop/death of yeast;

In bread making, carbon dioxide causes the dough/bread to rise;

The ethanol evaporates during baking/heating/cooking;

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17. Discuss the reasons why lipids are important as long-term energy storage in animals. (3 marks)

Twice as much/more ATP/energy is produced from respiration of lipids compared to carbohydrate

(For the same amount of energy stored) glycogen is heavier than lipid ;

It is more energy efficient to carry stored energy as fat (important for animals who move)

Example of an animal where low storage mass is important e.g. birds

Lipids also have other uses /Energy stored as fat can also provide heat insulation/ Lipids also provide buoyancy;

Example of an animal who also uses fat for heat insulation/buoyancy eg. Seals/Penguin;

18. Human insulin can now be produced in industry by bacteria.
Explain why this fact demonstrates the universality of the genetic code. (2 marks)

Human DNA is inserted into a bacterium

Insulin produced by (GM) bacteria containing human/non-prokaryote/non-self DNA

Insulin produced by the bacterium is identical to human DNA

Therefore the genetic code is universal/codes for the same amino acids in bacteria as in humans