Six terms, three questions

Some terms describe the number of sugar units. Others describe how molecules are built or how large they are. These labels can overlap.

MONOSACCHARIDE One sugar unit	A simple carbohydrate that cannot be hydrolysed into smaller carbohydrates. Examples: glucose, fructose and galactose.
DISACCHARIDE Two sugar units	A carbohydrate containing two monosaccharide residues joined by a glycosidic bond. Examples: maltose, sucrose and lactose.
POLYSACCHARIDE Many sugar units	A carbohydrate polymer containing many linked monosaccharide residues. Examples: starch, glycogen and cellulose.
MONOMER A building-block molecule	A small molecule that can join with others to form a polymer. Glucose acts as a monomer when carbohydrate polymers are made.
POLYMER Many linked subunits	A large molecule built from many repeating units derived from monomers. A cellulose chain is a polymer of glucose residues.
MACROMOLECULE Very large molecular size	A very large molecule containing many atoms. Polysaccharide molecules are macromolecules; a single glucose molecule is not.

Ask in order: How many sugar units? Is it a building block or a chain? Is it a very large molecule? One correct label does not exclude another.

Scope: Cambridge Biology 9700 syllabus, section 2.2, outcome 2, p. 17.

One, two or many sugar units

Count joined sugar residues within one molecule, not the number of separate molecules in a beaker. The symbols below show subunits, not ring structures or individual atoms.

1. MONOSACCHARIDE

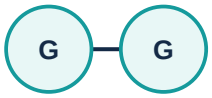


G = glucose molecule

Glucose

One complete sugar molecule. It can act as a monomer.

2. DISACCHARIDE

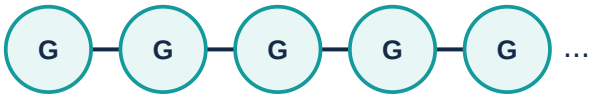


G = glucose-derived residue

Maltose

Two glucose residues joined in one molecule. Complete hydrolysis gives two glucose molecules.

3. POLYSACCHARIDE



G = residue; chain continues

A cellulose chain

Many glucose residues linked together. Complete hydrolysis gives many glucose molecules.

A RESIDUE IS THE PART INCORPORATED INTO THE CHAIN

Joining sugars by condensation removes the elements of water. The linked units are therefore called residues. Hydrolysis uses water to release the complete monosaccharides again.

Supporting reading: OpenStax Biology 2e, 3.2 Carbohydrates.

Use all the labels that fit

A molecule can belong to several categories at once. Name the molecule, give the precise carbohydrate class, and then add broader labels when they apply.

EXAMPLE	CARBOHYDRATE CLASS	OTHER USEFUL LABELS
Glucose	Monosaccharide	Carbohydrate monomer
Maltose	Disaccharide	Two glucose residues
Sucrose	Disaccharide	Glucose + fructose residues
Glycogen	Polysaccharide	Polymer; macromolecule
Cellulose	Polysaccharide	Polymer; macromolecule

1. MONOSACCHARIDE AND MONOMER ARE NOT SYNONYMS

Monosaccharide names a type of carbohydrate; monomer describes a molecule's role as a building block. Glucose can be both. Beyond carbohydrates, amino acids can be monomers of polypeptides, but they are not monosaccharides.

2. TWO LINKED UNITS DO NOT MAKE A POLYSACCHARIDE

Maltose is a disaccharide, not a polysaccharide. A mixture of many separate glucose molecules is still not a polymer: its molecules have not been covalently joined into long chains.

3. Size and identity are different: a glucose ring is not a macromolecule just because it contains several atoms. Likewise, being a carbohydrate does not automatically make a molecule a polymer.

Scope: Cambridge Biology 9700 syllabus, section 2.2, outcome 2, p. 17.