

Metabolism

4.4.2.3 · Bioenergetics · revision notes

Metabolism is the sum of all the reactions in a cell or the body. You need the examples of metabolic reactions in the specification and the small molecules that carbohydrates, proteins and lipids are built from and broken down into. Expect short recall and explain questions, often linked to enzymes, digestion or photosynthesis.

Key facts

- Metabolism = the sum of all the reactions in a cell or the body
- Energy for building new molecules comes from respiration
- Lipid = 1 glycerol + 3 fatty acids
- Excess proteins → urea → excreted
- Metabolic reactions are controlled by enzymes
- Glucose → starch (plant store), glycogen (animal store), cellulose (plant cell walls)
- Glucose + nitrate ions → amino acids → proteins
- Carbohydrates ← sugars; proteins ← amino acids; lipids ← fatty acids and glycerol

Notes

What metabolism is

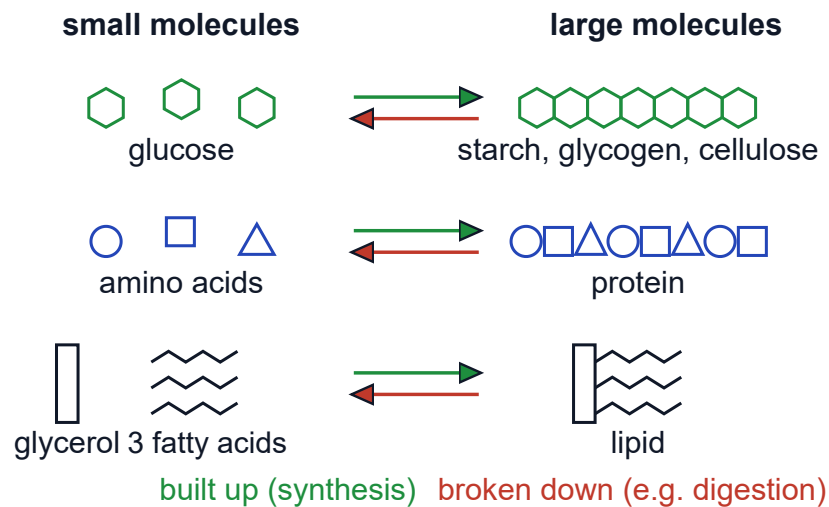
- Metabolism** is the sum of all the reactions in a cell or the body.
- Metabolic reactions are controlled by **enzymes**.
- The energy transferred by **respiration** is used for the metabolic reactions that build (synthesise) new molecules.
- Some metabolic reactions build large molecules from small ones; others break large molecules down.

Examples you need to know

- Glucose is converted into **starch** (storage in plants), **glycogen** (storage in animals) and **cellulose** (plant cell walls).
- A **lipid** molecule is formed from one molecule of **glycerol** and three molecules of **fatty acids**.
- Glucose and nitrate ions are used to make **amino acids**, which are then used to make **proteins**.
- Respiration** is itself a metabolic reaction.
- Excess proteins are broken down to form **urea**, which is excreted in urine.

Building blocks: made from and broken down into

- Carbohydrates (starch, glycogen, cellulose) are built from sugars such as glucose.
- Proteins are built from amino acids.
- Lipids are built from fatty acids and glycerol.



Building up needs energy from respiration; digestion breaks large molecules back down.

How to answer each type of question

Define metabolism and give examples

1 to 3 marks

Grade 3

1. Learn the definition exactly: the sum of all the reactions in a cell or the body.
2. For examples, choose from the specification list and make sure they fit the organism in the question (starch and cellulose in plants, glycogen in animals).

Example. (a) What is meant by metabolism?

(b) Give **two** examples of metabolic reactions that take place in plant cells.

Model answer. (a) The sum of all the reactions in a cell or the body (1)

(b) Any two from: respiration; converting glucose into starch; converting glucose into cellulose; making amino acids / proteins; making lipids (1 each)

Complete sentences on building blocks

3 marks

Grade 5

1. Match each large molecule to its small units: proteins to amino acids, lipids to glycerol and fatty acids, carbohydrates to sugars.
2. Remember the numbers for a lipid: one glycerol, three fatty acids.

Example. Complete the sentences.

Proteins are made from molecules of

A lipid molecule is made from one molecule of and three molecules of

Model answer. amino acids (1); glycerol (1); fatty acids (1)

Don't lose marks

- ✗ Defining metabolism as 'digestion' or 'how fast you use food'. It is the sum of all the reactions in a cell or the body.
- ✗ Saying lipids are made of glucose and fatty acids. They are made of glycerol and fatty acids (one glycerol and three fatty acids).
- ✗ Saying plants store glycogen or animals store starch. Plants store starch; animals store glycogen.
- ✗ Saying urea comes from the breakdown of glucose or fat. It comes from the breakdown of excess proteins.
- ✗ Forgetting that respiration is itself one of the metabolic reactions.

More tips

Memory tricks

- Metabolism = every reaction: all the building up and all the breaking down.
- Three carbohydrates from glucose: starch stores (plants), glycogen stores (animals), cellulose supports (cell walls).
- Lipid 1 + 3: picture one glycerol backbone with three fatty acid tails, like a capital E.
- Pair each large molecule with its units and its enzyme: carbohydrate—sugars—carbohydrase, protein—amino acids—protease, lipid—fatty acids and glycerol—lipase.

Exam technique

- Learn the specification's examples of metabolic reactions; they are often asked as 'give two examples'.
- When a question asks about the importance of sugars, amino acids, fatty acids and glycerol, say they are the units large molecules are built from and broken down into.
- Use the words 'synthesise' (build) and 'break down' accurately, and mention enzymes and energy from respiration where they fit.
- Expect links to other topics: digestive enzymes, photosynthesis (glucose) and blood glucose control (glycogen).

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3**Define metabolism**

Metabolism is the sum of all the reactions in a cell or the body.

Grade 4**Give examples of metabolic reactions**

For example respiration, making starch, glycogen or cellulose from glucose, making lipids and proteins, and making urea.

Grade 5**Name the building blocks of large molecules**

Carbohydrates are made from sugars, proteins from amino acids, and lipids from glycerol and fatty acids.

Grade 5**State how a lipid molecule forms**

One molecule of glycerol joins with three molecules of fatty acids.

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