

3

## CONSOLIDATION

## Human nutrition

1. Explain why carbohydrates, fats and proteins are important for our bodies.
2. Why is the respiratory system involved in the function of nutrition?
3. Identify the terms that relate to the following definitions:
  - a) A large gland located on the upper part of the abdomen.
  - b) This organ produces trypsin.
  - c) A substance located in the trachea that captures unwanted particles.
  - d) A section of the intestine that is before the rectum.
  - e) A secretion that helps the passage of bolus.
  - f) This enzyme is produced in the stomach.
  - g) Inspired air goes through this organ as it warms up.
  - h) This organ is part of the respiratory and digestive systems.

## The digestive system

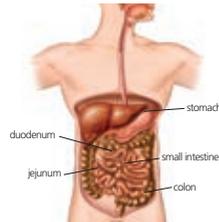
4. What are accessory glands of the digestive system?
5. What separates the chest cavity from the abdominal cavity? What part of the digestive tract is in the thoracic cavity?
6. Why do you think the stomach has three layers of muscle, while the rest of the digestive system only has two?
7. Explain how the digestive system prepares foods so it can be absorbed by all body cells.
8. The liver, as well being involved in the digestion process, performs other functions. What are they?

## Digestion

9. Describe the function of the following components of saliva: water, mucus and amylase.
10. Which of the following processes are essential for the complete digestion of oil?
  - a) Production of pepsin
  - b) Secretion of bile
  - c) Chewing
  - d) Swallowing
  - e) Production of lipase
11. Athletes consume glucose when they're performing intense exercises. What are the advantages of consuming glucose instead of certain foods like bread and potatoes?
12. Match each organ found in the diagram to the following functions:
  - a) Glucose absorption

- b) Chyme formation
- c) Sodium bicarbonate secretion
- d) Water absorption
- e) Formation of chyle

13. The following table displays the quantities of nutrients (g) found in a meal as well as the quantity of the same nutrients found in faeces. Can you make any conclusions after studying the data?



	Nutrients in food	Nutrients in faeces
Carbohydrates	300 g	cellulose (18 g); otherwise insignificant quantities.
Lipids	50 g	1 g
Proteins	80 g	insignificant quantities
Water	1200 g	80 g
Minerals	9 g	0.5 g
Vitamins	0.01 mg	0

14. Name the enzymes involved in protein digestion and explain where they come from.

15. Copy and complete the following table:

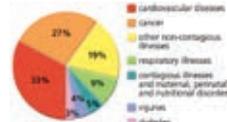
Enzyme	Organ	Function
trypsin	...	...
lipase	...	...
...	...	starts the digestion of proteins
...	...	digests sucrose
...	salivary glands	...

## The respiratory system

16. What are the pleura?
17. Why do you think the group of the bronchi with the bronchioles formed from them is called the bronchial tree?
18. Why is the trachea reinforced with cartilage rings?
19. What special characteristics do alveoli have in order to facilitate the passage of respiratory gases through them?
20. When the work of cilia and tracheal mucus is not enough, the body uses two other mechanisms to eject particles found in the airways. What are they?

## Healthy habits: illnesses of the digestive and respiratory systems

21. Look at the following pie chart. Does it support the view that smoking is one of the greatest threats to our health?



22. Why do we sometimes suffer from heartburn?
23. What is the function of the pharynx when our body tries to protect itself from infection?
24. Why does air reach our lungs clean, humid and warm?

## READ AND UNDERSTAND SCIENCE

## Microbiota composition

The human intestine hosts an enormous quantity of microorganisms, approximately 100 trillion (ten times more than the total number of cells found in the body). Microorganisms found in the intestine are mostly bacteria (belonging to over 1000 species). Every individual has a different microbiota composition that varies, although all people host a range of microorganisms that they have in common.

The human microbiota is created in the early stages of life, as we are exposed to microorganisms. However, it may vary depending on our age, diet, geographical location, intake of food supplements or drugs, as well as other environmental factors.

Intestinal microorganisms perform an essential role. They ensure our intestines are healthy as well as influencing our immunological system. Changes in the intestinal microbiota of an individual can potentially increase the risk of contracting infections.

EFUIC (European Food Information Council)  
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- a) How can the intestine host such a high number of microorganisms?
- b) Why is intestinal microbiota often compared with a fingerprint?
- c) How can food or antibiotics affect intestinal microbiota?
- d) Sometimes we can see adverts for products that are rich in probiotic substances. Find out what probiotics are and how they relate to intestinal microbiota.

## STUDY SKILLS

1. Create your own summary of the unit using the Key concepts. Add other important information.
2. Copy the following diagram and add the missing information to create a concept map of the unit.



3. Create your own scientific glossary. Include the following words: alveoli, asthma, bile, bolus, cardia, duodenum, egestion, epiglottis, larynx, microvilli, nutrition, parotid, pylorus, pleura, chyle, chyme, saliva, ulcers, intestinal villi, pulmonary ventilation, gallbladder. You can add any other scientific words you consider interesting or important.

You can record your summary and listen to it as many times as you like to revise.

## Human nutrition

1. Explain why carbohydrates, fats and proteins are important for our bodies.

Carbohydrates are primarily energy substances; lipids can be energetic, have structural or regulatory functions; Proteins are the major structural molecules.

2. Why is the respiratory system involved in the function of nutrition?

The respiratory system is responsible for the addition of oxygen to the lungs, which is then distributed to the cells. The cells use oxygen to obtain energy from nutrients.

3. Identify the terms that relate to the following definitions:

- a) A large gland located on the upper part of the abdomen.

Liver

- b) This organ produces trypsin.

Pancreas

- c) A substance located in the trachea that captures unwanted particles.

Mucus

- d) A section of the intestine that is before the rectum.

Colon

- e) A secretion that helps the passage of bolus.

Saliva

- f) This enzyme is produced in the stomach.

Pepsin

- g) Inspired air goes through this organ as it warms up.

Nose

- h) This organ is part of the respiratory and digestive systems.

Pharynx

## Digestive system

4. What are the annexed glands of the digestive system?

Saliva glands, liver and pancreas

5. What separates the chest cavity from the abdominal cavity? What part of the digestive tract is in the thoracic cavity?

The diaphragm. The esophagus is in the thoracic cavity.

6. Why do you think the stomach has three layers of muscle, while the rest of the digestive system only has two?

The stomach has three layers of muscle (longitudinal, circular and oblique) because its mechanical digestive action is much more intense than other organs in the digestive system. In addition, the stomach makes more complex movements than the esophagus and small intestine.

7. Explain how the digestive system prepares foods so it can be absorbed by all body cells.

Food consists of large molecules that cannot cross the cell membrane. The function of the digestive system is to break these molecules into smaller ones that can be carried by the

circulatory system to the various tissues. Then they can be absorbed by cells and used during cell metabolism.

- 8.** The liver, as well being involved in the digestion process, performs other functions. What are they?

The liver stores glycogen as a reserve substance, synthesises certain proteins and participates in the excretion process, eliminating substances from the blood that could be harmful to the body.

## Digestion

- 9.** Describe the function of the following components of saliva: water, mucus and amylase.

Water: helps food to dissolve.

Mucus: lubricates and makes swallowing easier.

Amylase: breaks down starch

- 10.** What cell has more mitochondria, one found in muscle tissue or one found bone tissue? Why?

- Production of pepsin
- Secretion of bile
- Chewing
- Swallowing
- Production of lipase

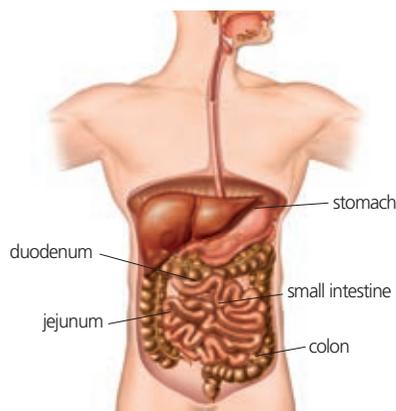
In order to digest oil we have to swallow, secrete bile and produce lipase for the digestion process.

- 11.** Athletes consume glucose when they're performing intense exercises. What are the advantages of consuming glucose instead of certain foods like bread and potatoes?

It refers to the connective tissue that binds other tissues when organs are formed and which forms the outer boundary of the organs.

- 12.** What type of tissue is predominant in the following organs?

- Glucose absorption. Small intestine
- Chyme formation. Stomach
- Sodium bicarbonate secretion. Duodenum
- Water absorption. Colon
- Formation of the chyle. Duodenum and first part of the jejunum



- 13.** The following table displays the quantities of nutrients (g) found in a meal as well as the quantity of the same nutrients found in faeces. Can you make any conclusions after studying the data?

	Nutrients in food	Nutrients in faeces
Carbohydrates	300 g	Cellulose (18 g); otherwise insignificant quantities.
Lipids	50 g	1 g
Proteins	80 g	Insignificant quantities
Water	1200 g	80 g
Minerals	9 g	0.5 g
Vitamins	0.01 mg	0

The conclusions are obvious:

- There are nutrients, which are incorporated into the body completely and will not appear in faeces. This is the case of vitamins and proteins.
- Some nutrients are absorbed in large quantities, but not completely (lipids, water and mineral salts).
- Carbohydrates are a special case because cellulose (dietary fibre constituent) is not absorbed and is found in faeces; the rest is incorporated into the body almost entirely.

- 14.** Name the enzymes involved in protein digestion and explain where they come from.

First pepsin, found in gastric juices, breaks down protein molecules into smaller fragments. Trypsin, from pancreatic juice, breaks the fragments into smaller pieces and then erepsin, found in intestinal juices, breaks them down into amino acids.

- 15.** Copy and complete the following table:

Enzyme	Organ	Function
Trypsin	Pancreas	Digests sucrose
Lipase	Pancreas, small intestine	Digests fats
Pepsin	Stomach	<b>Starts the digestion of proteins</b>
Sucrase	Small intestine	<b>Digests sucrose</b>
Amylase	<b>Salivary glands</b>	Digests starch

## The respiratory system

- 16.** What are the pleura?

It's a film that surrounds the lungs. It consists of two membranes; in between them there is a liquid that allows them to stay together and glide smoothly.

- 17.** Why do you think the group of each bronchus with the bronchioles formed from it is called bronchial tree?

Because it branches out like a tree.

**18. Why is the trachea reinforced with cartilage rings?**

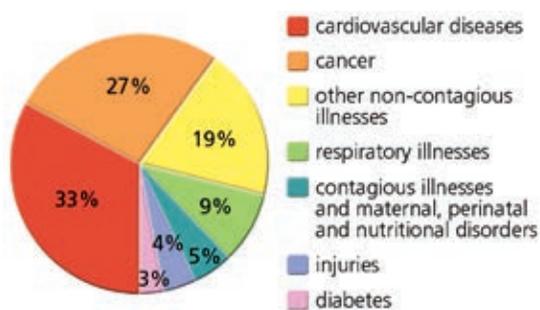
To stop it from collapsing when we bend our necks or receive pressure in the area.

**19. What special characteristics do alveoli have in order to facilitate the passage of respiratory gases through them?**

The alveoli are surrounded by a single layer of flattened cells (endothelium) that are covered by a rich network of capillaries. The capillaries facilitate the exchange of gases between air and blood.

**20. When the work of cilia and tracheal mucus is not enough, the body uses two other mechanisms to eject particles found in the airways. What are they?**

Coughing and sneezing.

**Healthy habits: illnesses of the respiratory and circulatory systems****21. Look at the following pie chart. Does it support the view that smoking is one of the greatest threats to our health?**

Yes, because smoking is the most common cause of respiratory illnesses, cancer or cardiovascular disease.

**22. Why do we sometimes suffer from heartburn?**

Because there is an excess hydrochloric acid, usually as a result of ingestion of certain foods.

**23. What is the function of the pharynx when our body tries to protect itself from infection?**

Tonsils, located in the side walls of the pharynx, produce white blood cells that defend our body from organisms causing infections.

**24. Why does air reach our lungs clean, humid and warm?**

As you breathe in through your nose air passes through mucus that is highly irrigated by blood vessels and moisturises and heats the air. In addition, the nose hairs and mucus trap harmful particles that may be in the air.

**25. Why do we have to cover our mouths when we cough or sneeze?**

Coughing and sneezing expel droplets of saliva that may contain pathogens. We cover our mouths to avoid infecting others.

**READ AND UNDERSTAND SCIENCE****a) How can the intestine host such a high number of microorganisms?**

Due to its length as well as the small size of bacteria: about 100 times smaller than our cells.

**b) Why is intestinal microbiota often compared with a fingerprint?**

Because the composition of the microbiota is different in each person as it depends on many factors: the first microorganisms to which we are exposed in the early stages of life, our age, diet, geographic area, medicines we take, etc.

**c) How can food or antibiotics affect intestinal microbiota?**

Food in the early years of life affects the intestinal microbiota. As our diet changes throughout our life we will have bacteria that has a preference for the type of nutrient we are digesting.

Antibiotics alter the composition of the microbiota, because they destroy symbiotic bacteria as well as pathogens.

**d) Sometimes we can see adverts for products that are rich in probiotic substances. Find out what probiotics are and how they relate to intestinal microbiota.**

Probiotics are foods that have had non-pathogenic live microorganisms added to them that contribute to the balance of the intestinal microbiota and strengthen the immune system.

**Study skills**

Open answer

**EXTRA RESOURCES**

PDF:

CONCEPT MAP

EXTENSION WORKSHEET

INTERACTIVE ACTIVITIES

PRESENTATION



3



## WORK AND EXPERIMENTATION TECHNIQUES

## Starch digestion



It is possible to observe how starch (a complex carbohydrate comprised of glucose molecules), begins to be digested as it mixes with the amylase present in our saliva, as you shall see. In addition, you will do a science experiment to see how temperature affects digestive action.

## Materials

3 test tubes	funnel	beaker
rack	filter	wooden tweezers
mortar	Lugol's solution	bread

## Procedure

- Number the test tubes 1, 2 and 3.
- Place some breadcrumbs in water and use the mortar to mash them up. You should obtain a whitish liquid. Filter the liquid and then pour it into three different test tubes.
- Pour some of your saliva through the funnel into test tubes 2 and 3.
- Pour 300 ml of water into the beaker. Place test tubes 1 and 2 in the beaker and warm them up gently, do not boil the water.
- Remove the test tubes using the wooden tweezers and place them on the rack to cool.
- Perform the Lugol test in all test tubes. Do so, by adding a drop of Lugol solution to each test tube. Lugol solution is a substance that will react by changing colour when it is in the presence of starch and sugar.
- Finally, perform the Biuret test. This process will help you find existing proteins.
- Collect data in the following table. If the reaction was very strong, use the symbols ++, if the reaction is moderate, use the symbol +. Finally, use the symbol – if the reaction did not occur.



	Test tube 1	Test tube 2	Test tube 3
Reaction	...	...	...

- Create a laboratory report that includes photographic evidence of your science experiment. Make sure that your report answers the following questions:
  - What is the objective of the science experiment?
  - What are the different variables and what is your hypothesis?
  - What is the function of test tube 1 and why did we only warm up test tubes 1 and 2?
  - What conclusions can you make from your science experiment? Do the results obtained corroborate your hypothesis?
  - Look at your conclusions and describe the activity of amylase.

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## FINAL TASK

## Anti-smoking campaign



The objective of this research task is to identify some of the harmful effects of tobacco, as well as the relationship between smoking and certain illnesses. After completing the research stage, you will create a poster that displays tobacco's negative effects.

## 1. Research

- Why is smoking addictive?
- What types of substances are found in cigarettes?
- What are some of the adverse effects smoking produces?
- Which illnesses are related to smoking?
- What are the benefits of giving up smoking?
- How many people die as a result of smoking every year?

## 2. Presentation

In order to present your results, you will create a poster.

- Make sure the poster is attention grabbing and easy to read.
- Remember that the aim of the campaign is to make an impact; your poster should not have too much information, but instead it should have a clear message.
- Emphasise the benefits of giving up smoking.



## Procedure

In order to complete your research, follow these steps:

## Search for information

- Find out which tobacco components are the most harmful.
- Research illnesses that are related to smoking and how they affect an individual's health.
- Find out the annual percentage of deaths caused directly or indirectly by smoking.
- Create a list of reasons to stop smoking.

## Organise the information

- Create an attention-grabbing title.
- Select relevant images and information.
- Use graphs to represent numerical data.

## Draw conclusions and check your research

- Always verify your findings
- Make sure that your images and graphs convey the message you are trying to deliver clearly.

## SELF-ASSESSMENT

After completing the task, answer the following questions:

- Have you referred to a variety of sources? How reliable are they?
- Have you created your own original design?
- Have you found enough information to answer the questions in the *Research* section?
- Rate your poster on a scale of 1 to 5.

3. Nutrition: The digestive and respiratory systems 21

## Starch digestion

At the beginning of this activity pupils will have to place saliva in test tubes. Sometimes pupils might say that they do not produce enough saliva. In this case ask them to hold a small drink of water in their mouths and leave it there for a small period of time.

If students have no previous training they might need help identifying the variables as well as the control test tube. Discuss the problems of having slight inaccuracies when controlling variables as well as the objective of the experiment, which is to find out if temperature affects the digestive action of amylase. Before completing the experiment get students to formulate their own hypothesis.

By doing this science experiment students will achieve the following key competences:

- Mathematical competence and basic competences in science and technology (MCST)
- Learning to learn (LL)
- Sense of initiative and entrepreneurship (SIE)

## Answer key

- Create a scientific report that includes photographic evidence of your scientific experiment. Make sure that your report answers the following questions:

- What is the objective of the scientific experiment?

To find out if temperature affects the digestive action of amylase.

- What are the different variables and what is your hypothesis?

The independent variable is the temperature. The dependent variable is the action of amylase, as measured by the amount of starch remaining after operation.

- What is the function of test tube 1 and why did we only warm up test tubes 1 and 2?

Test tube 1 is the control test tube. Test tube 2 was heated up to see if there were differences with the one that was not warmed up. Test tube 1 was heated up to check that the differences are not due to something that happened to the bread, and verify that it is the action of amylase.

- What conclusions can you make from your scientific experiment? Do the results obtained corroborate your hypothesis?

Amylase acts better at body temperature and even at slightly higher temperatures, provided it is not too high as to destroy the enzyme. The hypothesis corroboration would depend on the students' hypothesis, so it is an open answer.

- Look at your conclusions and describe the activity of amylase.

Amylase starts the digestion of starch molecules, which are present in many foods (bread, potatoes, rice, and so on) and transforms them into simpler sugars. In order to do this, amylase breaks down the most complex sugars into simpler ones. The temperature of the body ensures amylase can perform its function adequately.

## Anti-smoking campaign

The final task of this unit aims to help students become aware of the dangers of smoking. They will research this harmful addiction and how it affects the body in order to then create an anti-smoking campaign that will convince people to never touch a cigarette.

In addition it might be useful to look again at the weblink *ANTISMOKING CAMPAIGN HIGHLIGHTS HOW CIGARETTES 'ROT THE BODY FROM THE INSIDE'*. This will inspire students to create attention grabbing anti-smoking campaigns.

Make sure the students understand that they have to create a poster.

On page 16 we introduce the final task to the students.

On page 21 we explain how to do the investigation and the poster.

- In the section **Research** there are questions aimed at sparking students' ideas as well as shape their investigation and anti-smoking campaign.
- The **Presentation** section will give students guidance on how to create their posters.
- The **Procedure** section indicates the steps needed to complete the research, organise the information collected and how to draw conclusions and confirm research.
- The **Self Assessment** section at the end allows students to reflect about their work.

The learning outcome that will be reinforced during this task is:

### 4.1. Recognises healthy nutritional habits

An example of how to assess the final task is shown here:

0 = not handed in      1 = very basic      2 = well done      3 = excellent

	0	1	2	3
<b>POSTER</b>				
The poster's format and organisation are suitable.				
The main ideas of the poster are suitable.				
The balance between the amount of images and text is adequate.				
It uses correct terminology; the message is clear.				
It presents the data in an attention grabbing way and is well organised.				
The student can answer the questions the teacher and other students ask				