



INGLESE

PERCORSI PER STUDENTI NON ITALOFONI

tratti da *Intorno a te - Capire e vedere la Scienza* di Stefano Zanoli

PERCORSI PER STUDENTI
NON ITALOFONI

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CLASSE PRIMA



The Earth's soil

Il suolo

1 What is soil and where does it come from?

Soil is the uppermost layer of the Earth's crust. It derives from the alterations of the rocks due to air, water and living organisms.

2 What is soil made of?

Soil is made of three components: solid mineral and organic particles; water containing dissolved minerals; and air.

3 What are mineral particles made of?

Mineral particles make up the backbone of the soil. They consist of the following elements from smallest to largest: clay, silt, sand, gravel and boulders.

4 Where do the organic particles of the soil come from?

This part, known as humus, originates from the remains of dead organisms.

5 What is soil porosity?

Pores are those small empty spaces that keep the soil particles separate from each other. Porosity is the set of such spaces.

6 What is soil permeability?

The permeability of a soil is the capacity of the soil to have water flow through it.

7 What is pedogenesis and how does it occur?

The process of soil formation is known as pedogenesis. Rock crumbles through the mechanical action of atmospheric agents and the chemical action of certain substances contained in water. The rock fragments are colonised by pioneer organisms, then by grass, shrubs, bushes and trees. The remains of this vegetation turn into humus via decomposition. By seeping into the soil, water drags down tiny mineral substances.

8 What is the difference between the different soil layers?

A mature soil encloses different layers known as horizons, which differ by composition, colour and compactness. From the top down, they are: the organic layer, humus, subsoil and bedrock.

9 What are the main kinds of soil?

Gravel soil, with a high degree of porosity; sandy soil, which is porous and highly water-permeable; loamy soil, made up of extremely fine particles that are quite water-permeable; clay soil, which is impermeable and very compact; and topsoil, which is rich in humus and permeable.

10 Why is soil crucial for life?

Soil represents a fundamental resource: it allows vegetation to grow, filters polluting substances found in waters and keeps mountain and hill sides more stable.





The animal kingdom

Il regno degli animali

1 What does the animal kingdom include?

Eukaryotic, multicellular and heterotrophic organisms.

2 What forms can an animal's symmetry and body covering take?

The body can have a bilateral or radial symmetry; it can either be covered in hairs, scales or feathers, or bare.

3 What is the difference between nutrition and respiration in animals?

Nutrition is the vital function which provides matter and energy for the body via feeding and digestion. Respiration brings oxygen into the body for the "combustion" of food, which produces energy and eliminates carbon dioxide. Gas exchanges can occur through the surface of the body or through organs such as the trachea, gills or lungs.

4 What is circulation and how does it occur in different animals?

Circulation is the transportation of nutrients obtained from the digestion of food and oxygen. It can occur either directly between cells or within vessels that are part of the circulatory system.

5 What is excretion and how does it occur in animals?

Excretion is the elimination of waste. It can occur through the surface of the body, the Malpighian tubule system or an excretory apparatus.

6 How do animals reproduce?

Most animal species reproduce sexually. Fecundation can be either external, when the two gametes meet outside the female body; or internal, when it occurs within the female body, via mating.

7 What is the difference between oviparous, viviparous and ovoviviparous animals?

Oviparous animals lay the eggs in which embryos develop outside the body; ovoviviparous animals keep the eggs in the female parent's body until the birth of the offspring; among viviparous animals, the embryo develops inside the body of the female parent, which nourishes it until birth.

8 What is metamorphosis?

It is a process of development after birth through a series of changes in the body. For example, tadpoles turn into adult frogs, larvae into adult insects.

9 What are the differences between the various support systems found in animals?

The hydroskeleton is formed by inner liquids (as in earthworms); the dermoskeleton is found under the skin and muscle tissue (as in starfish); the exoskeleton is an external skeleton, which acts like armour (as in insects and crustaceans); the endoskeleton is internal, as in the human body.

Vertebrates have an endoskeleton with a flexible spine that runs the whole length of the animal's back. Invertebrates don't.





CLASSE SECONDA





Nutrients

Sostanze nutritive

1 What are nutrients?

Nutrients are substances, deriving from food, which are essential for the growth and correct functioning of the body. These include both organic and inorganic substances.

2 What functions do nutrients have?

Nutrients may have an energy function, a building-rebuilding-repairing function, and a bioregulatory function.

3 What are macronutrients and micronutrients?

Macronutrients are those nutrients that our body requires in large amounts (tens or hundreds of grams per day): proteins, fats and carbohydrates; micronutrients are those nutrients required in tiny amounts (milligrams or micrograms per day): minerals and vitamins.

4 What characteristics do proteins have?

Proteins are made of composites known as amino acids. Their main function is to build, rebuild and repair, and they can be found in meat, eggs, milk and legumes.

5 What are fats for and where can they be found?

Fats principally serve as an energy backup system. Large quantities of fats can be found in butter and oils. Phospholipids can be found in the cell membrane.

6 What characteristics do carbohydrates have?

Carbohydrates can be monosaccharides, disaccharides or polysaccharides. They represent the main source of energy for living beings. Some carbohydrate-rich foods are bread, rice and potatoes.

7 What are vitamins and what is their function?

Vitamins are organic substances mostly found in fruit and vegetables; many are involved in cellular chemical reactions, others are necessary for growth, and others still contribute to the body's defence.

8 What are minerals for?

The main functions of minerals are: the regulatory function, since they control the distribution of water; and the repairing and protective function, since some minerals are involved in the growth of the body.

9 What is metabolism?

Metabolism consists of the sum of chemical reactions in the human body through which the energy required for its functioning is obtained from food.

10 How do we calculate the amount of energy we need on a daily basis?

The energy found in foods is expressed using a special unit of measurement: the calorie (kcal). Each day we need a certain amount of energy, known as our daily energy requirement.





Nutrition and the digestive system

La nutrizione e l'apparato digerente

1 What are the various nutrition phases and where do they take place?

Nutrition is composed of four phases: ingestion, digestion, absorption and waste elimination. The digestive system is subdivided into different compartments, each serving specific functions.

2 What is the purpose of digestion?

Digestion enables our body to break down and transform food into simpler molecules to be used by the cells of the organism. Digestive enzymes are substances which help in the breakdown process.

3 What happens to the food in our mouth?

When food enters our mouth, it is broken down into smaller pieces and mixed thanks to the chewing motion of the teeth and mouth. Food is transformed into bolus and pushed towards the oesophagus. The chemical breakdown of carbohydrates starts in the mouth.

4 What happens to the food in our stomach?

When the bolus enters our stomach, it is transformed into chymus. This is where the chemical breakdown of proteins and fats begins and where the carbohydrate breakdown continues. The chemical environment of the stomach is very acidic, due to the chloride acid produced by the gastric glands.

5 What is the structure of the intestine?

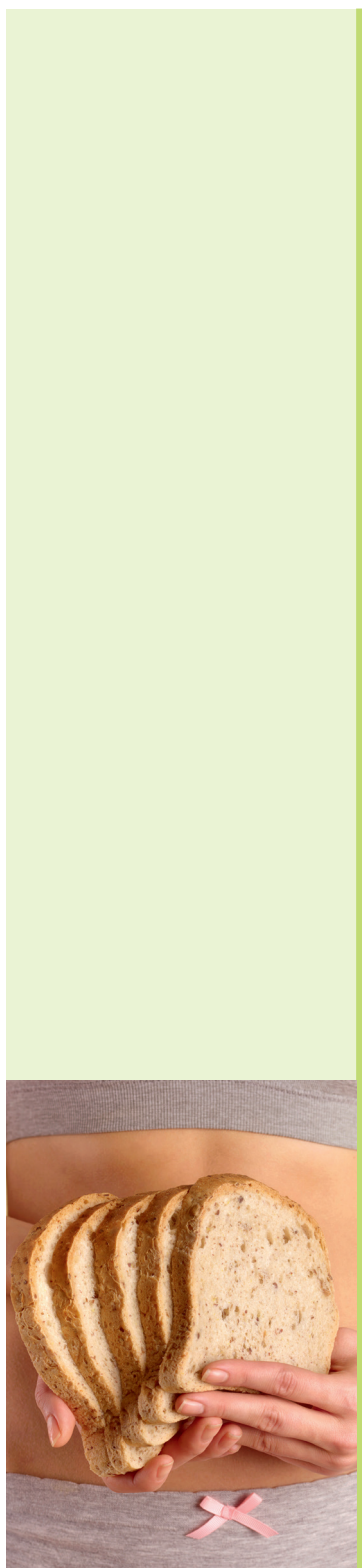
The intestine is a long tube divided into two sections: the small intestine and the large intestine.

6 What is the function of the intestine?

As the chymus is conveyed down this tube, it is transformed into chyle where the nutrient digestive process continues. The small intestine receives the digestive juices from the liver and pancreas. Once digestion is complete, the intestine absorbs the final products through small, finger-like structures known as intestinal villi.

7 What is the last phase of nutrition?

The intestine contains a large number of microorganisms, known as the bacterial flora. Any digestive waste is pushed out of the body through the anus in the form of faeces.





The respiratory system

La respirazione

1 What is respiration?

Respiration is the process by which organisms take oxygen from the environment and combine it with substances in their cells in order to produce energy.

2 What is the function of the respiratory system?

The organs in the respiratory system are used to take oxygen from the air and expel the carbon dioxide produced during cellular respiration.

3 What makes up the respiratory system?

The respiratory system consists of the respiratory tract: nose, pharynx, larynx, trachea, bronchi, bronchioles and lungs.

4 How do the nasal cavities filter air?

The air that passes through the nasal cavities is partially filtered by nasal hairs, which are lash-like tissues and cells that produce mucus.

5 How are lungs structured?

Lungs are made up of two spongy and elastic masses: they contain millions of small “sacs” called pulmonary alveoli.

6 What are the different phases of respiration?

Respiration consists of four phases:

- 1) the passage of air from the upper airways to the lungs (ventilation);
- 2) the passage of oxygen from the alveoli to the blood (diffusion);
- 3) the transportation of oxygen to the cells through the blood;
- 4) the chemical reaction of glucose and oxygen within the cell (cellular respiration).

7 What movements occur when you breathe and what do breaths depend on?

Each breath consists of two movements: inhalation and exhalation. Breaths depend on the action of certain muscles, such as the diaphragm, which also divides the thorax from the abdomen.

8 What gases pass through the alveoli and blood capillaries?

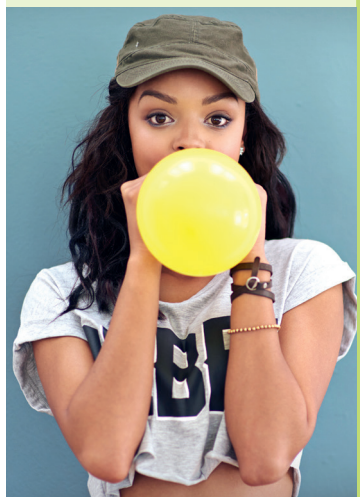
There is a continuous exchange of oxygen and carbon dioxide between the alveoli and the blood capillaries.

9 How is gas exchanged between the alveoli and the blood?

Oxygen moves spontaneously from the alveoli, where the concentration is the highest, to the blood, where the concentration is lower. Carbon dioxide moves through the capillaries, at its highest concentration, to the alveoli, where it is less concentrated.

10 What is cellular respiration?

Cellular respiration is the chemical process by which energy is produced through the oxidation (combustion) of glucose in cells.





Reactions and compounds

Reazioni e composti

1 What is the difference between an element and a compound?

An element is any substance formed by atoms of the same kind, which is to say with the same atomic number. A compound is any substance deriving from the combination of two or more elements.

2 What is a molecule?

A molecule is an aggregate of atoms, either of the same kind or of different kinds; it is the smallest unit of a substance to preserve its properties.

3 What are chemical formulas and what forms do they take?

A chemical formula is the representation of a molecule through the symbols of its elements. The empirical formula only shows which and how many atoms make up the molecule (H_2O); the structural formula also shows which and how many chemical bonds are established.

4 What is a chemical reaction?

The transformation of one or more substances, called reactants, into different substances, called products.

5 What does Lavoisier's law of conservation of mass state?

It states that in a chemical reaction the overall mass of the reactants is equal to the overall mass of the products.

6 Into what groups are inorganic compounds divided? And how are these groups formed?

Basic oxides are formed when a metal reacts with oxygen; acidic oxides are formed when a non-metal reacts with oxygen. Hydroxides are formed when basic oxides react with water. Acids include: oxyacids, formed when acidic oxides react with water, and hydric acids, formed when a non-metal reacts with hydrogen. When an acid reacts with an hydroxide, salts are formed, along with water as a by-product.

7 When is a solution acidic? When is it basic?

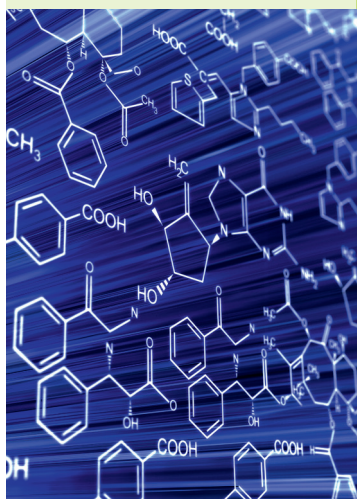
A solution is acidic when the number of H^+ ions is higher than that of OH^- ions; it is basic when the number of OH^- ions is higher than that of H^+ ions; it is neutral when the number of H^+ ions is equal to that of OH^- ions.

8 What is pH?

It is scale used to specify the acidity of a solution. Its values range from 0 to 14 on the pH scale. A neutral solution has a pH of 7; solutions with a pH above 7 are basic; ones with a pH under 7 are acidic.

9 What compounds can carbon form?

Inorganic compounds such as carbon dioxide (CO_2), carbon monoxide (CO), carbonates and bicarbonates, diamond and graphite; organic compounds such as hydrocarbons and biomolecules (carbohydrates, lipids, proteins, nucleic acids).





Motion and forces

Il movimento e le forze

1 What elements do you need to describe a body's motion?

The frame of reference, the trajectory, the space travelled, and the time it takes to travel it.

2 What is velocity?

Velocity is the ratio of distance travelled and the time it took to travel it. Velocity is a vector quantity.

3 What is uniform rectilinear motion and what is its motion law?

The motion of a body moving in a straight line at a constant velocity is called uniform rectilinear motion. The law of uniform rectilinear motion is $s = v \times t$.

4 What is acceleration?

Acceleration is the rapidity with which a velocity changes. A body that is moving in a straight line and changing its velocity with constant acceleration, is moving with uniformly accelerated motion.

5 What happens to a body in free fall?

A body in free fall moves downwards in a uniformly accelerated motion. Air resistance decreases the velocity of free fall.

6 Why does a body fall downwards?

A body falls downwards because the force of gravity operates on it. This force acts as though the force were concentrated and applied to its centre of gravity.

7 What is force and how is it measured?

Force is something that causes the acceleration of a body or its deformation. The unit of its measurement is called newton (symbol used N), but often kilogram-force is used.

8 What does the principle of inertia state?

The principle of inertia states that a body tends to constantly maintain its state of rest or motion as long as no force is acting on it.

9 How many types of friction are there?

There are three fundamental types of friction: sliding, rolling and viscous.

10 If we apply force on a body, how will the acceleration be?

The acceleration produced by a force applied to a body is directly proportional to the force applied and inversely proportional to the mass of the body.

11 What does the principle of action and reaction assert?

The principle of action and reaction states that for every action (force) by a body on another body there is always an equal and opposite reaction.





CLASSE TERZA



Waves and sound

Onde e suoni

1 What are waves?

Waves are oscillations by which energy is transmitted.

2 What are the characteristics of waves?

When we represent a wave as a sinusoid, we call the highest point of the wave crest, and the lowest point trough; the horizontal distance between two successive crests or troughs is the wavelength; the vertical distance between a crest and the horizontal axis is the amplitude.

3 What is the difference between the period and the frequency of a wave?

The period is the duration of a complete oscillation (T); the frequency is the number of complete oscillations which the wave makes in a given time.

4 What are mechanical and electromagnetic waves and how do they travel?

Mechanical (or elastic) waves need a medium to travel, which is to say a material which oscillates when they pass through it. One example is sound waves.

Electromagnetic waves do not need any medium to travel.

5 What is the difference between transversal and longitudinal waves?

A transversal wave travels horizontally and the particles involved move perpendicularly to the wave's direction of travel.

A longitudinal wave travels through compression and rarefaction; the particles involved move in the direction in which the wave travels.

6 What is sound and why are there so many different sounds?

Sound is a mechanical wave produced by the oscillations of a vibrating body. Sounds differ in pitch, timbre, and intensity. The pitch of a sound depends on the frequency of the wave; its timbre on the pattern of the oscillation of the wave; intensity on the amplitude of the wave.

7 How does the speed of sound vary?

Sound speed varies depending on the characteristics of the medium across which it travels; it increases with temperature and is greater in solids.

8 What are the main acoustic phenomena?

Reflection is the bouncing of waves off a large obstacle; reflected waves produce echoes and reverberations.

Resonance occurs when the vibrations emitted by a sound source reach another body, which begins to vibrate with the same frequency.

Interference occurs when several sound waves with the same frequency become superimposed while travelling along the same medium.

The Doppler effect is the perception by a fixed observer of a change in the pitch of a sound coming from a moving source.





The Universe and the Solar System

L'Universo e il Sistema Solare

1 How are distances measured in the Universe?

The Astronomical Unit (AU) corresponds to the mean distance between the Sun and the Earth, about 150 million km. The light year corresponds to the distance light travels in space in one year, that is about 9,500 billion km.

2 What are stars made of and what is their temperature?

Stars are mainly composed of hydrogen and helium, which burn at very high temperatures in the nuclear fusion process. The temperature of the stars diminishes from the core to the outermost part. The surface temperature determines the colour of the star. The hottest are blue, the coolest are red.

3 Why are stars bright?

The brightness of a star is how much light it emits; it depends on its size and distance from Earth.

4 What is the life cycle of a star?

Stars are born as protostars in a mass of gas and dust (nebula). When they begin to emit light, they become real stars. They die when all the nuclear fuel is consumed.

5 What are galaxies?

Galaxies are clusters of billions of stars. Depending on their shape, we speak of elliptic, spiral, barred spiral or irregular galaxies. The Sun belongs to the Milky Way galaxy.

6 What makes up the Solar System?

The Solar System consists of a number of celestial bodies which rotate around the Sun: 8 planets, a star (the Sun), and hundreds of satellites and asteroids.

7 What is the Sun composed of?

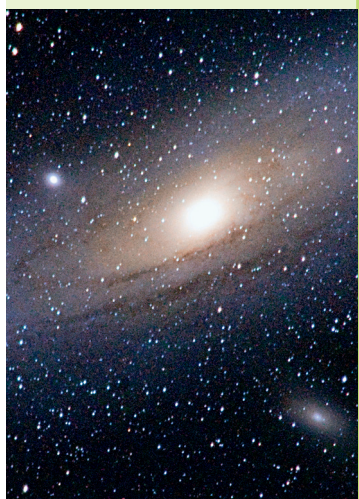
The Sun consists of hydrogen (74%) and helium (25%) and has a concentric shell structure: core, radiative zone, convective zone, photosphere, atmosphere.

8 What is the difference between inner and outer planets in the Solar System?

Inner planets, closer to the Sun, are principally rock-based: Mercury, Venus, Earth and Mars. External planets, further away from the Sun, are principally gaseous and include Jupiter, Saturn, Uranus and Neptune. These planets often have satellites.

9 What do Kepler's Laws state?

1. All planets move in elliptical orbits with the sun at one focus. 2. During their revolution, the imaginary line connecting the centre of the Sun to the centre of each planet sweeps equal areas of space during equal time intervals. 3. The squares of the orbital periods of the planets are directly proportional to the cube of their mean distances from the Sun.





Reproduction and development

La riproduzione e lo sviluppo

1 What are the characteristics of human reproduction?

The human species has a sexual reproduction with internal fertilisation. The union of a sperm cell and an egg cell leads to the formation of a zygote.

2 What are the male reproductive organs?

The male reproductive system has external organs, such as the testicles and the penis, and internal ones, such as the vas deferens, the seminal vesicles, the prostate and the urethra.

3 What is the route taken by sperm cells?

Sperm cells are produced inside the seminiferous tubules and then transferred into a folded canal, called the epididymis. During ejaculation, millions of sperm cells are expelled in the sperm, which also contains the seminal liquid formed by seminal vesicles and the prostate.

4 What are the female reproductive organs?

The organs of the female reproductive system are: the ovaries, connected to the uterus through the fallopian tube; the uterus, a hollow organ shaped like an inverted pear and formed by three layers (the innermost layer is the endometrium); the vagina, a canal that connects the uterus to the external environment; and the vulva, an external organ.

5 What happens and which hormones are active during the ovarian cycle?

During an ovarian cycle, ovaries normally produce only one egg cell, which matures inside a structure called a follicle. The follicle stimulating hormone regulates the maturation of the egg cell, which is then released into the fallopian tube. This is the ovulation phase. The follicle transforms into a bleb called the corpus luteum, which produces a hormone called progesterone.

6 What happens if the egg cell encounters a sperm cell?

Fertilisation may happen in the fallopian tube.

7 What happens after fertilization?

Fertilization interrupts the menstrual cycle and the pregnancy cycle begins. Through the process of mitosis the zygote multiplies rapidly and in the first week it becomes a morula and then a blastula.

8 What happens during pregnancy?

The blastula attaches itself to the endometrium. The embryo, enclosed in two membranes (the amnion and the corium), develops from the interior of the blastula. Part of the corium and the mucus of the endometrium form the placenta, which allows the exchange of substances between the mother and the embryo. After about two months the embryo is called a fetus.

