The Scientific Method	Il metodo scientifico
Metodology: Dictogloss (Communicative activities)	Metodologia: Dictogloss (attività basate sulla comunicazione)
Skills: Reading – listening - talking	Conoscenze/competenze: Lettura, ascolto ed espressione in lingua inglese
Subject contents/objective • Describe how the science works; • Describe and distinguish deductive and inductive reasoning.	Contenuti/obiettivi disciplinari • Descrivere il metodo di operare della scienza; • Descrivere e distinguere tra ragionamento deduttivo e ragionamento induttivo

A – Activity description – Descrizione dell'attività:

Il testo viene fotocopiato in tante copie quanti sono gli studenti. Lo stesso vale per le parole/frasi. Ciascuna copia del testo viene poi suddivisa in strisce. Gli studenti possono lavorare singolarmente o in gruppo. Gli studenti legegranno le strisce e tenteranno di riscostruire la corretta sequenza. Successivamente viene fatto ascoltare l'audio per consentire agli studenti di controllare se hanno individuato la sequenza corretta.

Vengono fatto ascoltare l'audio del testo completo per due volte. Gli studenti devono ricostruire l'esatta sequenza del testo mediante l'ascolto.

A questo punto gli studenti vengono suddivisi in coppie ed a ciascuna coppia vengono fornite le parole/frasi. Ogni studente farà pratica nello spiegare al partner quello che sa del metodo scientifico, usando le parole/frasi assegnate.

Ogni coppia redigerà una sua versione sintetica del testo. Essa verrà quindi confrontata dagli stessi studenti con il testo originario per effettuare eventuali correzioni.

Ogni coppia leggerà la propria versione ad alta voce al resto della classe.

B – Content vocabulary – Vocabolario della disciplina (può essere fornito agli studenti dopo lo svolgimento della attività di ricostruzione della sequenza)

(https://dictionary.cambridge.org/)

Knowledge: /ˈnɒl.ɪdʒ/ understanding of or information about a subject that you get by experience or study, either known by one person or by people generally
Evidence: /ˈev.ɪ.dᵊns/ one or more reasons for believing that something is or is not true
Hypothesis: /haɪˈpɒθ.ə.sɪs/ an idea or explanation for something that is based on known facts but has not yet been proved
Logic: /ˈlɒdʒ.ɪk/ a particular way of thinking, especially one that is reasonable and based on good judgment OR a formal scientific method of examining or thinking about ideas
Phenomenon (plur. Phenomena): /fəˈnɒm.ɪ.nən/ something that exists and can be seen, felt, tasted, etc., especially something unusual or interesting

Experiment: /ɪkˈsper.ɪ.mənt/ a test done in order to learn something or to discover if something works or is true
Paradigm: /ˈpær.ə.daɪm/ a model of something, or a very clear and typical example of something
Theory: /ˈθɪə.ri/ a formal statement of the rules on which a subject of study is based or of ideas that are suggested to explain a fact or event or, more generally, an opinion or explanation
Model: /ˈmɒd.ᵊl/ something that a copy can be based on because it is an extremely good example of its type
Examination: /ɪgˌzæm.ɪˈneɪ.ʃᵊn/ the act of looking at or considering something carefully in order to discover something
Assumption: /əˈsʌmp.ʃᵊn/ something that you accept as true without question or proof

C Scaffolding language – Vocabolario linguistico di supporto (può essere fornito agli studenti dopo lo svolgimento della attività di ricostruzione della sequenza)

Thought: /θɔːt/ pensiero, idea
Has brought: /əz/ /brɔːt/ : ha portato
Thinking: /ˈθɪŋ.kɪŋ/ attività del pensare
Although: /ɔːlˈðəʊ/ nonostante
Lifeless execution of step-by-step instructions: esecuzioni meccaniche, automatiche (“senza mita”) di istruzioni, passo dopo passo.
Community: /kəˈmjuː.nə.ti/ comunità
Peer: /pɪəʳ/ persona con pari caratteristiche riferite ad una qualche qualità
Review: /rɪˈvjuː/ revisione
Preconceived: /ˌpriː.kənˈsiːvd/ preconcetto
Grasp out: /grɑːsp/ /aʊt/ afferrare
Inquiry: /ɪnˈkwaɪə.ri/ processo di scoperta, investigazione
Widespread: /ˌwaɪdˈspred/ qualcosa di diffuso, esistente, o che accade in molti posti o tra molte persone
Acceptance: /əkˈsep.tᵊns/ accettazione
Scratch: /skrætʃ/ segno, graffio, incisione
Extremely efficient: /ɪkˈstriːm.li ɪˈfɪʃ.ᵊnt/ estremamente efficiente
Might be founded /maɪt biː ˈfaʊn.dɪd/ potrebbe essere basato su
Deeply valued: /ˈdiːp.li ˈvæl.juːd/ molto utile o importante
Attractive: /əˈtræk.tɪv/ attraente
Sun-centered universe: Universo centrato sul Sole
Took root: /tʊk ruːt/ mise radici, si affermò
Irreconcilable: /ˌɪr.ekˈ.ənˈsaɪ.lə.bəl/ inconciliabile
Increasingly difficult: /ɪnˈkriː.sɪŋ.li ˈdɪf.ɪ.kəlt/ sempre più difficile
Once it becomes apparent that: una volta che/quando diventa evidente che
To pursue: /tuː pəˈsjuː/ perseguire
Proven: /pruːv/ dimostrato, provato
To lead: /tuː liːd/ controllare, dirigere, condurre

D - Text – Testo completo - Materiale da fotocopiare, tagliare e distribuire agli studenti.

C	The results of scientific thought have played an important role in shaping the world into what it is today. This is true not only because of the influence technology has had in our lives, but also because of the change science has brought in the *way* we think. Scientific thinking has permeated all aspects of our lives, fundamentally changing the way we see the world. It is science's "way of thinking," the scientific method, that forms its heart.
G	The scientific method is fundamental to the investigation and acquisition of new knowledge based upon physical evidence. Scientists use observations, hypotheses, and logic to propose explanations for natural phenomena in the form of theories. Predictions from these theories that can be reproducibly tested by experiment are the basis for developing new technology.
N	Although scientific progress is often described as a linear scheme that allows a single scientist to proceed from a state of relative ignorance to a state of knowledge, the scientific method is really much more complicated than this. The scientific method is not a recipe.
P	It requires intelligence and imagination. Science is not the lifeless execution of step-by-step instructions, but a creative and inspired process. Over the past half-century, philosophers, historians, and sociologists of science have established a more complete model describing the ways science is actually practiced.
D	The modern description of scientific progress gives much more importance to the role of the scientific community. It is impossible for a single person working in isolation to engage in science. This is because of the central role of peer review as a means of correcting error, bias, and self interest.
O	Human nature prevents even a well intentioned scientist from doing anything other than confirming preconceived ideas when working in isolation. In a new area of scientific exploration, scientific progress is slow at first. Investigators grasp out in search of a basic description of how their area of inquiry works.
R	As the new field advances, an underlying set of principles begins to take hold and gain widespread acceptance. These principles become the common ground of scientists in the new field, the basis of a paradigm. With a paradigm in place, researchers no longer need to start from scratch when interpreting the results of new experiments.
S	Instead, they address a specialized audience that works under a common paradigm, and they describe their work in the context of that paradigm. They are no longer unguided in the direction of the work — the paradigm dictates which experiments might be useful in further exploring the questions of their field.

F	An established paradigm is therefore an extremely valuable asset in the pursuit of science. New theories are born. The theories discern previously unseen details in the paradigm and in nature, and guide the method of new observations. For the normal course of scientific progress, these methods are extremely efficient.
A	In some cases, however, a scientific discipline might be founded on a paradigm that is fundamentally incorrect. This presents a problem, since the paradigm underlying a discipline is deeply valued by the practitioners in the discipline. Such was the case in astronomy during the scientific revolution of the Renaissance.
E	From the times of Aristotle, it had been thought that the Earth was at the center of the Universe, with everything else moving around it in circles. Eventually, observations of the positions of the planets made Aristotle's model inconsistent with reality. As time passed, it became increasingly difficult to modify Aristotle's paradigm to agree with observations. The prospect of a new and completely different paradigm became ever more attractive, and the new idea of a Sun-centered universe took root.
I	Only once it becomes apparent that the ideas tied to the paradigm are irreconcilable with observations does it begin to appear sensible to pursue completely new explanations. The central goal of science is to produce theories that are consistent with reality. If scientists find that a theory's predictions are incorrect, the theory is falsified.
H	*A central property of scientific theories is that they can never be proven, but they can eventually be disproved.* This fact makes it essential that a theory make specific, useful predictions before it can be examined scientifically. A requirement of scientific theories is that they be as simple as possible while still accurately describing nature.
B	When creating theories or distinguishing between competing theories, scientists rely on two distinct types of reasoning: inductive reasoning and deductive reasoning. Scientists use both inductive and deductive reasoning to learn about nature. In inductive reasoning, one uses observations and the results of experiments to make generalizations about how nature works. These generalizations lead to new theories or new elaborations on a theory.
M	Notice that it is possible, though unlikely, for inductive reasoning to discredit a correct theory or support an incorrect theory. Although it is a powerful and essential tool in science, inductive reasoning must be treated with skepticism when based on a very limited sample of observations.
Q	In deductive reasoning, existing theories are subjected to rational consideration to produce logical consequences of the theory. These consequences may lead to new theories and predictions that can be tested through experiment. deductive reasoning is perfectly reliable if you have made correct assumptions and applied correct logic.

L	Because deductive reasoning is absolutely reliable when used with good assumptions and proper method, it is easy to place undue trust in claims made on the basis of deductive reasoning. It is important to remember that these claims also require careful examination to check that the assumptions are good and the reasoning is valid. In reality, deductive reasoning is as much subject to error as inductive reasoning. Only the sources of error differ.

Adattamento da testi reperibili qui:
https://en.wikibooks.org/wiki/General_Astronomy/The_Scientific_Method

Segue nella prossima pagina: verifiche

E – Review – Verifica

A)

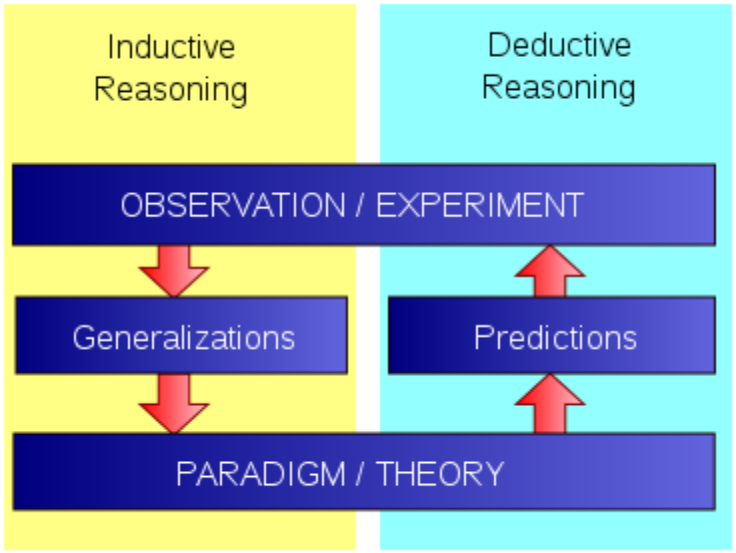
Underline the part of the test where you can find the information to answer the following questions:

1. What are the requirements to carry out an investigation by scientific method?
2. When does a theory become not credible?
3. What is the risk for a scientist to work in isolation?

B)

Choose the correct answer: Inductive or deductive?

1) You might observe the sunrise every day for a year, and you notice that this Sun rises more or less in the east every time. You might conclude that the Sun always rises in the East. [I] [D]
2) You may observe from the space the rotation motion of a planet, from its North pole. You can see that it rotates counterclockwise. You might conclude that the Sun always rises in the East. [I] [D]
3) You might observe that mammals, amphibia and reptiles paws have five fingers. You might conclude that they descend from a common ancestor that had five fingers in each paw. [I] [D]
4) You may observe that horse paws have only a finger instead of five, as it happens to the common ancestor, instead. You might conclude that the missing fingers have been reduced during evolution [I] [D]



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Adattamento da testi reperibili qui:

https://en.wikibooks.org/wiki/General_Astronomy/The_Scientific_Method

Earth's Rotation	La rotazione Terrestre
Metodology: Communicative dictation (Communicative activities)	Metodologia: Communicative dictation (attività basate sulla comunicazione)
Skills: Reading - listening	Conoscenze/competenze: Lettura e ascolto in lingua inglese
Subject contents/objective • Describe Earth's rotation on its axis; • Describe Earth's revolution around the Sun.	Contenuti/obiettivi disciplinari • Descrivere la rotazione terrestre sul proprio asse; • Descrivere la rivolzione terrestre intorno al Sole

A – Activity description – Descrizione dell'attività:

Il testo viene fotocopiato in tante copie quanti sono gli studenti. Ciascuna copia viene poi suddivisa in strisce. Gli studenti possono lavorare singolarmente o in gruppo. Viene fatto ascoltare l'audio del testo completo per due volte. Gli studenti devono ricostruire l'esatta sequenza del testo mediante l'ascolto.

B – Content vocabulary – Vocabolario della disciplina (può essere fornito agli studenti dopo lo svolgimento della attività di ricostruzione della sequenza)

Axis: An imaginary line that runs from the North Pole to South Pole, and includes the center Earth.
Ellipse: A shape that looks like a slightly squashed circle.
Hemisphere: One half of a sphere.
Revolution: The Earth's movement around the Sun in an orbital path.
Rotation: The motion of the Earth spinning on its axis.

C Scaffolding language – Vocabolario linguistico di supporto (può essere fornito agli studenti dopo lo svolgimento della attività di ricostruzione della sequenza)

Swung : fece oscillare / oscillato
Wire: cavo
Pulled: spinse
Back and forth: indietro e avanti
Motion: movimento
Underneath: sotto
Spin: rotazione
It takes: "prende", tempo necessario
Sun rise – Sun set: Alba – tramonto
It would make us dizzy: ci darebbe vertigini
Make dizzy: dare vertigini
To keep: mantenere
Roughly: approssimativamente
Path: sentiero, percorso
Farther away: più lontano
Closer: più vicino
Seasons: stagioni

D - Text – Testo completo - Materiale da fotocopiare, tagliare e distribuire agli studenti.

C	In 1851, a French scientist named Léon Foucault took an iron sphere and swung it from a wire. He pulled the sphere to one side and then released it, letting it swing back and forth in a straight line. A ball swinging back and forth on a string is called a pendulum. A pendulum set in motion, will not change its motion, so it will not change the direction of the swinging
G	However, Foucault observed that his pendulum did seem to change direction. He knew that the pendulum itself could not change its motion, so he concluded that the Earth, underneath the pendulum was moving.
J	It takes 23 hours, 59 minutes and 4 seconds for the Earth to make one complete rotation on its axis, if we watch Earth spin from out in space.
A	Because Earth is moving around the Sun at the same time that it is rotating, Earth has to turn just a little bit more to reach the same place relative to the Sun, so we experience each day on Earth as 24 hours. At the equator, the Earth rotates at a speed of about 1,700 kilometers per hour. Thankfully, we do not notice this movement, because it would certainly make us dizzy.
I	If you were to look at Earth from the North Pole, it would be spinning counterclockwise. As the Earth rotates, observers on Earth see the Sun moving across the sky from east to west with the beginning of each new day.
E	We often say that the Sun is "rising" or "setting", but actually it is the Earth's rotation that gives us the perception of the Sun rising up or setting over the horizon. When we look at the Moon or the stars at night, they also seem to rise in the east and set in the west.
H	Earth's rotation is also responsible for this. As Earth turns, the Moon and stars change position in our sky. Another effect of Earth's rotation is that we have a cycle of daylight and darkness approximately every 24 hours.

B	This is called a day. As Earth rotates, the side of Earth facing the Sun experiences daylight, and the opposite side (facing away from the Sun) experiences darkness or night time. Since the Earth completes one rotation in about 24 hours, this is the time it takes to complete one day-night cycle. As the Earth rotates, different places on Earth experience sunset and sunrise at a different time.
F	As you move towards the poles, summer and winter days have different amounts of daylight hours in a day. For example, in the Northern hemisphere, we begin summer on June 21. At this point, the Earth's North Pole is pointed directly toward the Sun. Therefore, areas north of the equator experience longer days and shorter nights because the northern half of the Earth is pointed toward the Sun.
D	Since the southern half of the Earth is pointed away from the Sun at that point, they have the opposite effect—longer nights and shorter days. For people in the Northern hemisphere, winter begins on December 21. At this point, it is Earth's South Pole that is tilted toward the Sun, and so there are shorter days and longer nights for those who are north of the equator.

E – Review – Verifica

Underline the part of the test where you can find the information to answer the following questions:

4. What is the force that keeps the Earth and other planets in their orbital paths?
5. The planet Jupiter is about 778,570,000 kilometers from the Sun; Earth is about 150,000,000 kilometers from the Sun. Does Jupiter take more or less time to make one revolution around the sun?
6. In its elliptical orbit around the Sun, the Earth is closest to the Sun in January. Even though Earth is closest to the Sun in January, people in the Northern hemisphere experience winter weather. Using your understanding of how the Earth is tilted on its axis, why do you think people in the Northern Hemisphere have winter in January?

Fonte dei testi: https://en.wikibooks.org/wiki/High_School_Earth_Science/Earth%27s_Motions

Phenomena on Earth caused by the movement of the Earth and the Moon	Fenomeni osservabili dalla sulla Terra determinati dai movimenti terrestri e lunari
Metodology: Pair work information exchange (Communication gap)	Metodologia: Attività di scambio informazioni tra studenti (Attività basate sulle lacune nelle informazioni ricevute)
Skills: Talking, interacting in target language, making and answering questions	Conoscenze/competenze: Espimersi e interagire in lingua inglese, fare e rispondere a domande
Subject contents/objective • Describe how Earth's movements affect seasons and cause day and night. • Explain solar and lunar eclipses. • Describe the phases of the Moon and explain why they occur. • Explain how movements of the Earth and Moon affect Earth's tides.	Contenuti/obiettivi disciplinari • Descrivere come i movimenti terrestri determinino le stagioni a causino l'alternanza del dì e della notte • Spiegare le eclissi • Descrivere le fasi lunari e spiegarne il maccanismo • Spiegare come i movimenti terrestri e lunari determinino le meree

A – Activity description – Descrizione dell'attività:

Gli studenti lavorano in coppia. Ciascuna coppia è formata dallo studente A e dallo studente B. Ciascuni di essi, nel foglio ricevuto, possiede solo una parte delle informazioni contenute nella tabella mentre le informazioni mancanti sono possedute dall'altro studente. Di conseguenza ciascuno di essi chiede, a turno, all'altro, le informazioni necessarie per completare la tabella (esercizio A). Successivamente essi collaborano per completare la/le figura/figure inserendo i termini che identificano le parte indicate.

N.B. Il testo proposto è ricco di contenuti disciplinari e linguistici, essendo pensato per studenti liceali. A scelta del docente alcune parti possono essere eliminate se egli ritenesse di sostituirle con lezioni/attività in lingua italiana. Ad esempio si può omettere di far compilare agli studenti la sezione "Further information" in tabella.

B – Content vocabulary – Vocabolario della disciplina (può essere fornito agli studenti dopo lo svolgimento dell' attività di compilazione della tabella)

Crescent: Phase of the moon when it is less than half full but still slightly lit.
Gibbous: Phase of the moon when it is more than half lit but not completely full.
Lunar eclipse: An eclipse that occurs when the Moon moves through the shadow of the Earth and is blocked from view.
Neap tide: Type of tide event when the Sun and Earth are in line and the Moon is perpendicular to the Earth.
Penumbra: Outer part of shadow that remains partially lit during an eclipse.
Solar eclipse: The obscuring of the light of the sun
Spring tide: An extreme tide event that happens when the Earth, Moon, and the Sun are aligned; happens at full and new moon phases.
Tide: The regular rising and falling of Earth's surface waters twice a tidal day as a result of the Moon's and Sun's gravitational attraction.
Umbra: Inner cone shaped part of a shadow when all light is blocked during an eclipse.

C Scaffolding language – Vocabolario linguistico di supporto (può essere fornito agli studenti dopo lo svolgimento dell' attività di compilazione della tabella)

Across: attraverso
East: Est
West: Ovest
Light: luce
Side: lato
Facing: rivolto
Opposite: opposto
To move towards: spostare verso
Summer: estate
Winter: inverno
Amount: quantità
Misconception: idea sbagliatamantenere
Closer: più vicino
Farther: più lontano sentiero, percorso
Farther away: più lontano
Seasons: stagioni
Tilt: inclinazione
Degree: gradi
Warm: caldo
Vice versa: viceversa
To occur: verificarsi
To cast: lanciare
Shadow: ombra
Cooler: più fresco
Outside: all'esterno, all'aperto
Bird: uccello
To sing: cantare
Through: attraverso
Between: in mezzo a due cose, persone, punti ecc.
To be lined: essere allineati, in linea
To reflect: riflettere
To illuminate: illuminare
Week: settimana
Upward: verso l'alto
Height: altezza
Nothing to do: niente a che fare, niente a che vedere
Higher than: maggiore di, più elevato di
Less: meno

D - Text – Tabella completa

Phenomenon	Definition	How does it happen? / Description

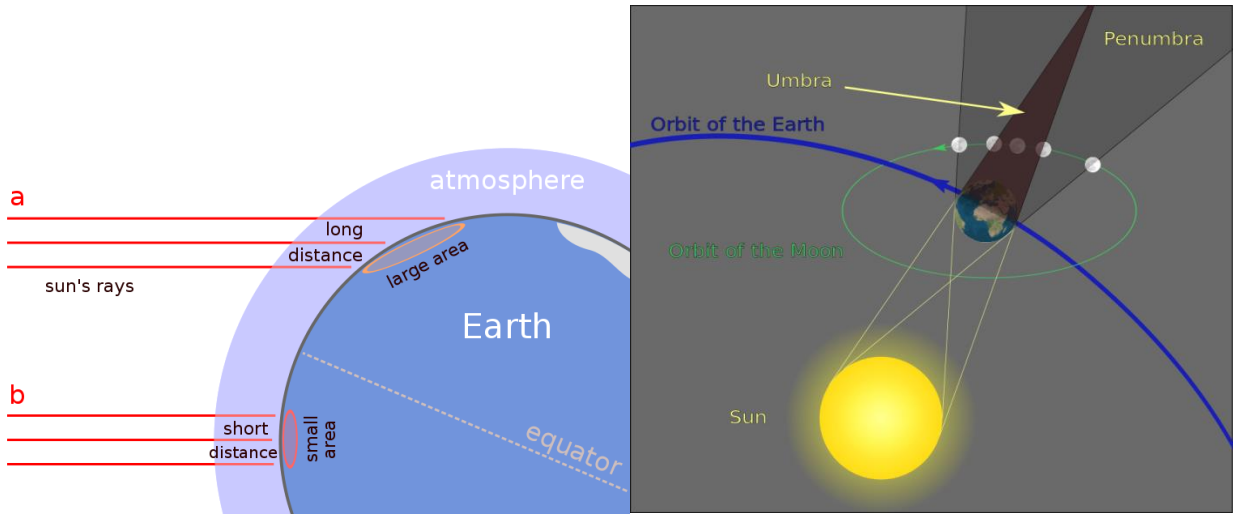
Earth’s rotation	The motion of the Earth spinning on its axis	The Earth rotates once on its axis about every 24 hours. If you were to look at Earth from the North Pole, it would be spinning counterclockwise. Further information: As the Earth rotates, observers on Earth see the Sun moving across the sky from east to west with the beginning of each new day.
Earth's Day and Night	Cycle of daylight and darkness approximately every 24 hours.	As Earth rotates, the side of Earth facing the Sun experiences daylight, and the opposite side (facing away from the Sun) experiences darkness or night time. Further information: Since the Earth completes one rotation in about 24 hours, this is the time it takes to complete one day-night cycle. As the Earth rotates, different places on Earth experience sunset and sunrise at a different time. As you move towards the poles, summer and winter days have different amounts of daylight hours in a day. For example, in the Northern hemisphere, we begin summer on June 21. At this point, the Earth's North Pole is pointed directly toward the Sun. Therefore, areas north of the equator experience longer days and shorter nights because the northern half of the Earth is pointed toward the Sun. Since the southern half of the Earth is pointed away from the Sun at that point, they have the opposite effect—longer nights and shorter days. For people in the Northern hemisphere, winter begins on December 21. At this point, it is Earth's South Pole that is tilted toward the Sun, and so there are shorter days and longer nights for those who are north of the equator
Earth's Seasons	Four natural divisions of the year, spring, summer, fall, and winter, in the North and South Temperate zones. Each season, beginning astronomically at an equinox or solstice, is characterized by specific meteorological or climatic	Seasons are caused by the 23.5 degree tilt of Earth's axis of rotation and Earth's yearly revolution around the Sun. This results in one part of the Earth being more directly exposed to rays from the Sun than the other part. The part tilted away from the Sun experiences a cool season, while the part tilted toward the Sun experiences a warm season. Further information: Seasons change as the Earth continues its revolution, causing the hemisphere tilted away from or towards the Sun to change accordingly. When it is winter in the Northern hemisphere, it is summer in the Southern hemisphere, and vice versa. It is a common misconception that summer is warm and winter is cold because the Sun is closer to Earth in the summer and farther away from it during the winter.

	conditions.	
Solar Eclipses	The obscuring of the light of the sun	A **solar eclipse** occurs when the new moon passes directly between the Earth and the Sun. This casts a shadow on the Earth and blocks our view of the Sun. Further information: A total solar eclipse occurs when the Moon's shadow completely blocks the Sun. When only a portion of the Sun is out of view, it is called a partial solar eclipse. Solar eclipses are rare events that usually only last a few minutes. That is because the Moon's shadow only covers a very small area on Earth and Earth is turning very rapidly. As the Sun is covered by the moon's shadow, it will actually get cooler outside. Birds may begin to sing, and stars will become visible in the sky. During a solar eclipse, the corona and solar prominences can be seen.
Lunar Eclipse	The obscuring of the light of the moon	A **lunar eclipse** occurs when the full moon moves through the shadow of the Earth. Further information: This can only happen when the Earth is between the Moon and the Sun and all three are lined up in the same plane, called the ecliptic. The ecliptic is the plane of Earth's orbit around the Sun. The Earth's shadow has two distinct parts: the umbra and the penumbra. The **umbra** is the inner, cone shaped part of the shadow, in which all of the light has been blocked. The outer part of Earth's shadow is the **penumbra** where only part of the light is blocked. In the penumbra, the light is dimmed but not totally absent. A total lunar eclipse occurs when the Moon travels completely in Earth's umbra. During a partial lunar eclipse, only a portion of the Moon enters Earth’s umbra. A penumbral eclipse happens when the Moon passes through Earth’s penumbra. The Earth's shadow is quite large, so a lunar eclipse lasts for hours and can be seen by anyone with a view of the Moon at the time of the eclipse. Partial lunar eclipses occur at least twice a year, but total lunar eclipses are less common . The moon glows with a dull red coloring during a total lunar eclipse.
The Phases of the Moon	Regular changes of the shape of the Moon as they can be seen from the Earth	The Moon does not produce any light of its own—it only reflects light from the Sun. As the Moon moves around the Earth, we see different parts of the near side of the Moon illuminated by the Sun. This causes the changes in the shape of the Moon that we notice on a regular basis, called the phases of the Moon. As the Moon revolves around Earth, the illuminated portion of the near side of the Moon will change from fully lit to completely dark and back again.

		Further information: A full moon is the lunar phase seen when the whole of the Moon's lit side is facing Earth. This phase happens when Earth is between the Moon and the Sun. About one week later, the Moon enters the quarter-moon phase. At this point, the Moon appears as a half-circle, since only half of the Moon's lit surface is visible from Earth. When the Moon moves between Earth and the Sun, the side facing Earth is completely dark. This is called the new moon phase, and we do not usually see the Moon at this point. Sometimes you can just barely make out the outline of the new moon in the sky. This is because some sunlight reflects off the Earth and hits the moon. Before and after the quarter-moon phases are the **gibbous** and **crescent** phases. During the gibbous moon phase, the moon is more than half lit but not full. During the crescent moon phase, the moon is less than half lit and is seen as only a sliver or crescent shape. It takes about 29.5 days for the Moon to revolve around Earth and go through all the phases
The Tides	the regular rising and falling of Earth's surface water i	**Tides** are the regular rising and falling of Earth's surface water in response to gravitational attraction from the Moon and Sun. The Moon's gravity causes the oceans to bulge out in the direction of the Moon. In other words, the Moon's gravity is pulling upwards on Earth's water, producing a high tide. On the other side of the Earth, there is another high tide area, produced where the Moon's pull is weakest. As the Earth rotates on its axis, the areas directly in line with the Moon will experience high tides. Each place on Earth experiences changes in the height of the water throughout the day as it changes from high tide to low tide. There are two high tides and two low tides each tidal day. Further information: Two particular cases are called spring tide and neap tide. Confusingly, spring tide has nothing to do with the season "Spring", but means that the tide waters seem to spring forth. During a spring tide, the Sun and Moon are in line. This happens at both the new moon and the full moon. The Sun's gravity pulls on Earth's water, while the Moon’s gravity pulls on the water in the same places. The high tide produced by Sun adds to the high tide produced by the Moon. So spring tides have higher than normal high tides. The places where the water is being pulled out experience high tides, while the areas perpendicular to them experience low tides. Since the Earth is rotating on its axis, the high-low tide cycle moves around the globe in a 24-

		hour period. A neap tide occurs when the Earth and Sun are in line but the Moon is perpendicular to the Earth. This happens when the moon is at first or last quarter moon phase. In this case, the pull of gravity from the Sun partially cancels out the pull of gravity from the Moon, and the tides are less pronounced. Neap tides produce less extreme tides than the normal tides. This is because the high tide produced by the Sun adds to the low tide area of the Moon and vice versa. So high tide is not as high and low tide is not as low as it usually might be.

Figure complete



E – Review – Verifica

Underline the part of the test where you can find the information to answer the following questions:

1. Explain how Earth's tilt on its axis accounts for seasons on Earth.
2. Explain how the positions of the Earth, Moon, and Sun vary during a solar eclipse and a lunar eclipse.
3. Draw a picture that shows how the Earth, Moon, and Sun are lined up during the new moon phase.
4. Why are neap tides less extreme than spring tides?

Fonte dei testi e delle immagini:
https://en.wikibooks.org/wiki/High_School_Earth_Science/The_Sun_and_the_Earth-Moon_System

F – Materiale da fotocopiare e distribuire agli studenti:

STUDENT A

Pronunciation: practise saying the words below (https://dictionary.cambridge.org/)

Crescent /ˈkres.ənt/ Gibbous: /ˈgɪb.əs/ Lunar eclipse: /ˈluːnər ɪˈklɪps/ Tide: /taɪd/ Neap tide: /ˈniːp ˌtaɪd/ Spring tide: /ˌsprɪŋ ˈtaɪd/ Penumbra: /pɪˈnʌm.brə/ Umbra: /ˈʌm.brə/

Exercise 1:

Ask your partner questions to complete the table below. Do not look at your partner's sheet

Phenomenon	Definition	How does it happen? / Description
Earth's rotation	The motion of the Earth spinning on its axis	Further information:
Earth's Day and Night		As Earth rotates, the side of Earth facing the Sun experiences daylight, and the opposite side (facing away from the Sun) experiences darkness or night time. Further information: Since the Earth completes one rotation in about 24 hours, this is the time it takes to complete one day-night cycle. As the Earth rotates, different places on Earth experience sunset and sunrise at a different time. As you move towards the poles, summer and winter days have different amounts of daylight hours in a day. For example, in the Northern hemisphere, we begin summer on June 21. At this point, the Earth's North Pole is pointed directly toward the Sun. Therefore, areas north of the equator experience longer days and shorter nights because the northern half of the Earth is pointed toward the Sun. Since the southern half of the Earth is pointed away from the Sun at that point, they have the opposite effect—longer nights and

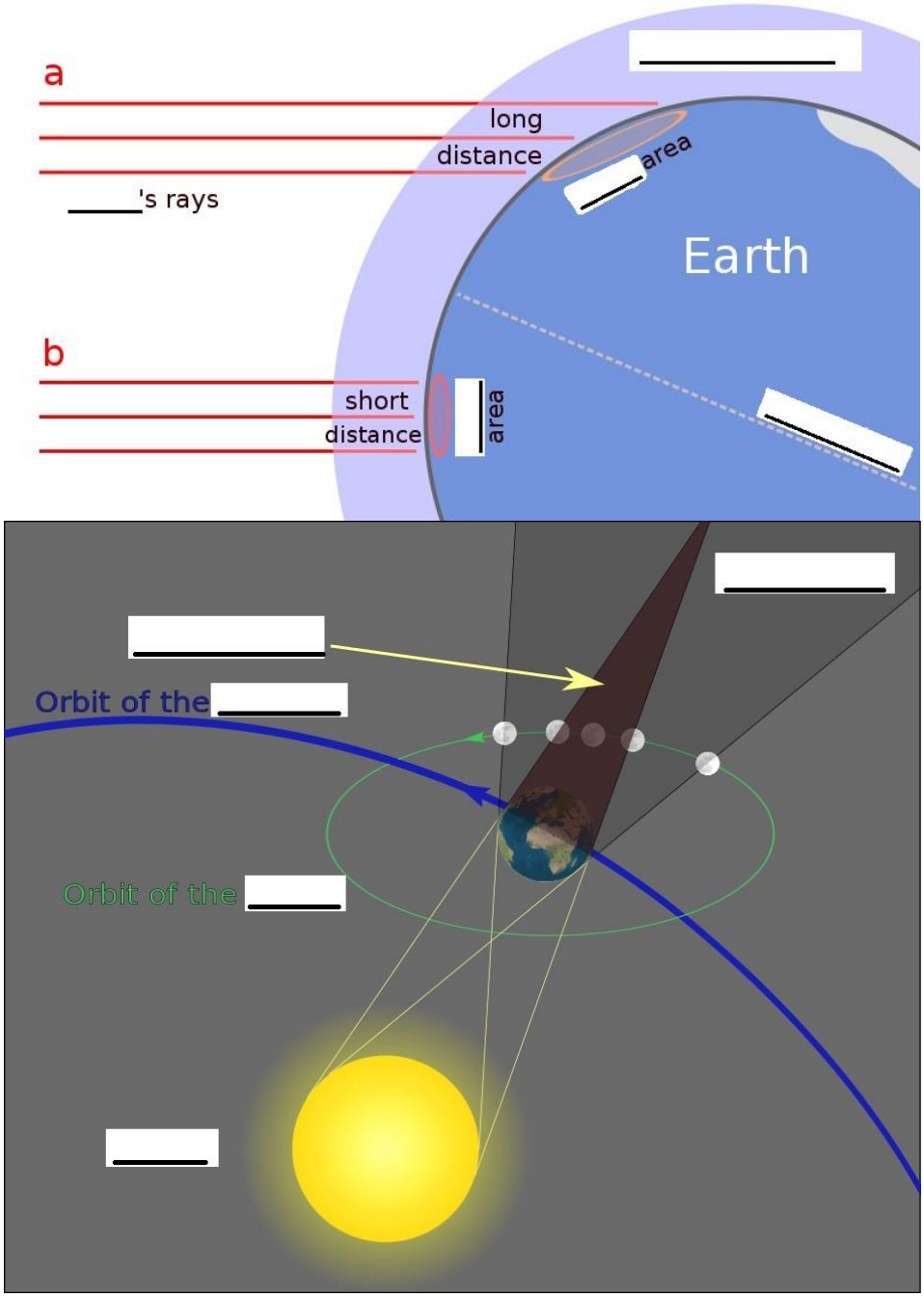
		shorter days. For people in the Northern hemisphere, winter begins on December 21. At this point, it is Earth's South Pole that is tilted toward the Sun, and so there are shorter days and longer nights for those who are north of the equator
Earth's Seasons	Four natural divisions of the year, spring, summer, fall, and winter, in the North and South Temperate zones. Each season, beginning astronomically at an equinox or solstice, is characterized by specific meteorological or climatic conditions.	Further information:
Solar Eclipses		A **solar eclipse** occurs when the new moon passes directly between the Earth and the Sun. This casts a shadow on the Earth and blocks our view of the Sun. Further information: A total solar eclipse occurs when the Moon's shadow completely blocks the Sun. When only a portion of the Sun is out of view, it is called a partial solar eclipse. Solar eclipses are rare events that usually only last a few minutes. That is because the Moon's shadow only covers a very small area on Earth and Earth is turning very rapidly. As the Sun is covered by the moon's shadow, it will actually get cooler outside. Birds may begin to sing, and stars will become visible in the sky. During a solar eclipse, the corona and solar prominences can be seen.
Lunar Eclipse	The obscuring of the light of the moon	Further information:

The Phases of the Moon		The Moon does not produce any light of its own—it only reflects light from the Sun. As the Moon moves around the Earth, we see different parts of the near side of the Moon illuminated by the Sun. This causes the changes in the shape of the Moon that we notice on a regular basis, called the phases of the Moon. As the Moon revolves around Earth, the illuminated portion of the near side of the Moon will change from fully lit to completely dark and back again. Further information: A full moon is the lunar phase seen when the whole of the Moon's lit side is facing Earth. This phase happens when Earth is between the Moon and the Sun. About one week later, the Moon enters the quarter-moon phase. At this point, the Moon appears as a half-circle, since only half of the Moon's lit surface is visible from Earth. When the Moon moves between Earth and the Sun, the side facing Earth is completely dark. This is called the new moon phase, and we do not usually see the Moon at this point. Sometimes you can just barely make out the outline of the new moon in the sky. This is because some sunlight reflects off the Earth and hits the moon. Before and after the quarter-moon phases are the **gibbous** and **crescent** phases. During the gibbous moon phase, the moon is more than half lit but not full. During the crescent moon phase, the moon is less than half lit and is seen as only a sliver or crescent shape. It takes about 29.5 days for the Moon to revolve around Earth and go through all the phases
The Tides	the regular rising and falling of Earth's surface water i	

		Further information:

Exercise 2:

Work with your partner to label the diagrams below



Fonte dei testi: https://en.wikibooks.org/wiki/High_School_Earth_Science/The_Sun_and_the_Earth-Moon_System

STUDENT B

Pronunciation: practise saying the words below (https://dictionary.cambridge.org/)

Crescent /ˈkres.ənt/ Gibbous: /ˈgɪb.əs/ Lunar eclipse: /ˈluːnər ɪˈklɪps/ Tide: /taɪd/ Neap tide: /ˈniːp ˌtaɪd/ Spring tide: /ˌsprɪŋ ˈtaɪd/ Penumbra: /pɪˈnʌm.brə/ Umbra: /ˈʌm.brə/

Exercise 1:

Ask your partner questions to complete the table below. Do not look at your partner's sheet

Phenomenon	Definition	How does it happen? / Description
Earth's rotation		The Earth rotates once on its axis about every 24 hours. If you were to look at Earth from the North Pole, it would be spinning counterclockwise. Further information: As the Earth rotates, observers on Earth see the Sun moving across the sky from east to west with the beginning of each new day.
Earth's Day and Night	Cycle of daylight and darkness approximately every 24 hours.	Further information:

Earth's Seasons		Seasons are caused by the 23.5 degree tilt of Earth's axis of rotation and Earth's yearly revolution around the Sun. This results in one part of the Earth being more directly exposed to rays from the Sun than the other part. The part tilted away from the Sun experiences a cool season, while the part tilted toward the Sun experiences a warm season. Further information: Seasons change as the Earth continues its revolution, causing the hemisphere tilted away from or towards the Sun to change accordingly. When it is winter in the Northern hemisphere, it is summer in the Southern hemisphere, and vice versa. It is a common misconception that summer is warm and winter is cold because the Sun is closer to Earth in the summer and farther away from it during the winter.
Solar Eclipses	The obscuring of the light of the sun	Further information:
Lunar Eclipse		A **lunar eclipse** occurs when the full moon moves through the shadow of the Earth. Further information: This can only happen when the Earth is between the Moon and the Sun and all three are lined up in the same plane, called the ecliptic. The ecliptic is the plane of Earth's orbit around the Sun. The Earth's shadow has two distinct parts: the umbra and the penumbra. The **umbra** is the inner, cone shaped part of the shadow, in which all of the light has

		been blocked. The outer part of Earth's shadow is the **penumbra** where only part of the light is blocked. In the penumbra, the light is dimmed but not totally absent. A total lunar eclipse occurs when the Moon travels completely in Earth's umbra. During a partial lunar eclipse, only a portion of the Moon enters Earth's umbra. A penumbral eclipse happens when the Moon passes through Earth's penumbra. The Earth's shadow is quite large, so a lunar eclipse lasts for hours and can be seen by anyone with a view of the Moon at the time of the eclipse. Partial lunar eclipses occur at least twice a year, but total lunar eclipses are less common . The moon glows with a dull red coloring during a total lunar eclipse.
The Phases of the Moon	Regular changes of the shape of the Moon as they can be seen from the Earth	Further information:
The Tides		**Tides** are the regular rising and falling of Earth's surface water in response to gravitational attraction from the Moon and Sun. The Moon's gravity causes the oceans to bulge out in the direction of the Moon. In other words, the Moon's gravity is pulling upwards on Earth's water, producing a high tide. On the other side of the Earth, there

		is another high tide area, produced where the Moon's pull is weakest. As the Earth rotates on its axis, the areas directly in line with the Moon will experience high tides. Each place on Earth experiences changes in the height of the water throughout the day as it changes from high tide to low tide. There are two high tides and two low tides each tidal day. Further information: Two particular cases are called spring tide and neap tide. Confusingly, spring tide has nothing to do with the season "Spring", but means that the tide waters seem to spring forth. During a spring tide, the Sun and Moon are in line. This happens at both the new moon and the full moon. The Sun's gravity pulls on Earth's water, while the Moon's gravity pulls on the water in the same places. The high tide produced by Sun adds to the high tide produced by the Moon. So spring tides have higher than normal high tides. The places where the water is being pulled out experience high tides, while the areas perpendicular to them experience low tides. Since the Earth is rotating on its axis, the high-low tide cycle moves around the globe in a 24-hour period. A neap tide occurs when the Earth and Sun are in line but the Moon is perpendicular to the Earth. This happens when the moon is at first or last quarter moon phase. In this case, the pull of gravity from the Sun partially cancels out the pull of gravity from the Moon, and the tides are less pronounced. Neap tides produce less extreme tides than the normal tides. This is because the high tide produced by the Sun adds to the low tide area of the Moon and vice versa. So high tide is not as high and low tide is not as low as it usually might be.

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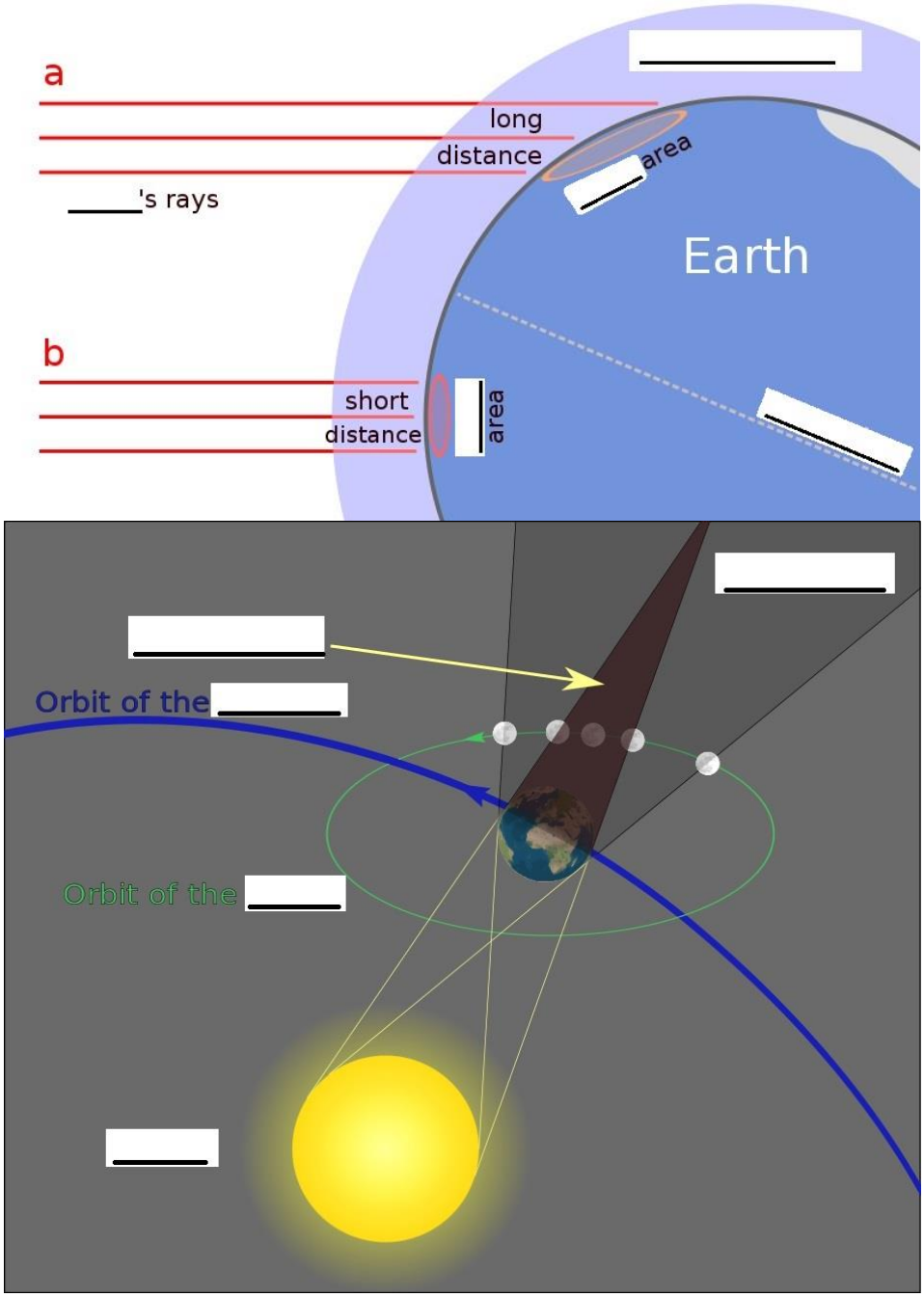


Fonte dei testi: https://en.wikibooks.org/wiki/High_School_Earth_Science/The_Sun_and_the_Earth-Moon_System

Kepler's laws	Le leggi di Keplero
Metodology: Krossword puzzle (Communicative activities)	Metodologia: Parole crociate (attività basate sulla comunicazione)
Skills: Talking, interacting in target language, making and answering questions	Conoscenze/competenze: Espimersi e interagire in lingua inglese, fare e rispondere a domande
Subject contents/objective • Describe the shape of the ellipse and how to drow it; • Describe the Kepler's laws.	Contenuti/obiettivi disciplinari • Descrivere la forma e la costruzione di una ellisse; • Descrivere le leggi di Keplero

A – Activity description – Descrizione dell'attività:

Gli studenti vengono divisi in coppie (Studente A e studente B). Il testo viene fotocopiato in tante copie quanti sono gli studenti e distribuito a ciascuno di essi. Viene distribuito anche lo schema delle parole crociate, che è incompleto. Ciascuno studente di ogni coppia possiede metà dello schema e chiederà all'altro le informazioni necessarie per identificare le parole che gli mancano.

Successivamente, come compito per casa, gli studenti dovranno disegnare una ellissi seguendo le istruzioni nel testo e procurandosi il materiale richiesto. Sarà richiesto di tracciarne anche gli assi.

B – Content vocabulary – Vocabolario della disciplina (può essere fornito agli studenti dopo lo svolgimento dell'attività)

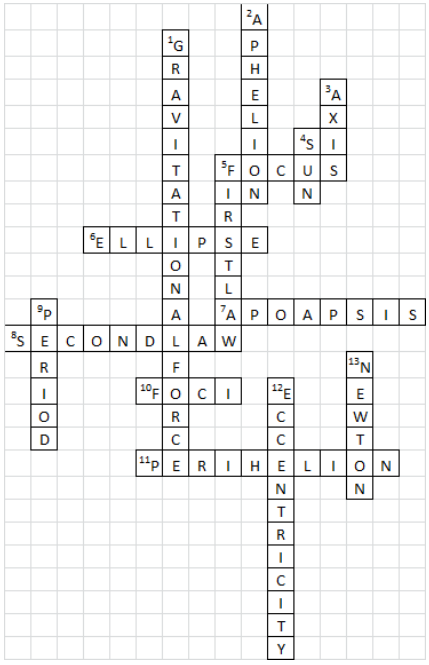
Axis: Line that divides an ellipse or a flat geometriche figure in two syummetrical parts.
Ellipse: A shape that looks like a slightly squashed circle.
Mechanics: part of physics that studies motion
Inverse-square: "quadrato inverso"
Orbit: the path of the planets around the Sun
To orbit: to move around something
To speed up: to increase the velocity
To slow down: to decrease the velocity
Gravitational: referred to gravity, the force between two different objects due to the two masses
Ratio: mathematical division between two numbers
Focus: internal point of the ellipse used to drow it
Periapsis: point of the ellipse closest to the focus
Apoapsis: point of the ellipse farther to the focus
Perihelion: point of the orbit closest to the Sun (plural perihelia)
Aphelion: point of the orbit farther to the Sun (pliral aphelia)

C Scaffolding language – Vocabolario linguistico di supporto (può essere fornito agli studenti dopo lo svolgimento dell'attività)

Path : percorso
Around: intorno
Closest: più vicino
Farther: più lontano

Motion: movimento
Painstaking: accurato
Attempt: tentativo
To summarize: riepilogare
Findings: scoperte
To develop: sviluppare
Shape: forma
Loop: anello
It takes: “prende”, tempo necessario
Sunrise – Sunset: Alba – tramonto
It would make us dizzy: ci darebbe vertigini
Make dizzy: dare vertigini
To keep: mantenere
Roughly: approssimativamente
Path: sentiero, percorso
Farther away: più lontano
Closer: più vicino
Seasons: stagioni

D – Schema completo



1 Vert.	GRAVITATIONALFORCE
2 Vert.	APHELION
3 Vert.	AXIS
4 Vert.	SUN
5 Vert.	FIRSTLAW
5 Orizz.	FOCUS
6 Orizz.	ELLIPSE
7 Orizz.	APOAPSIS
8 Orizz.	SECONDLAW
9 Vert.	PERIOD
10 Oriz	FOCI
11 Oriz	PERIHELION
12 Vert	ECCENTRICITY
13 Vert	NEWTON

E – Review – Verifica

Underline the part of the test where you can find the information to answer the following questions:

-What is the force that keeps the Earth and other planets in their orbital paths?

-The planet Jupiter is about 778,570,000 kilometers from the Sun; Earth is about 150,000,000 kilometers from the Sun. Does Jupiter take more or less time to make one revolution around the sun?

-In its elliptical orbit around the Sun, the Earth is closest to the Sun in January. Even though Earth is closest to the Sun in January, people in the Northern hemisphere experience winter weather. Using your understanding of how the Earth is tilted on its axis, why do you think people in the Northern Hemisphere have winter in January?

F - Materiale da fotocopiare, tagliare e distribuire agli studenti:

STUDENT A

Pronunciation: practise saying the words below (https://dictionary.cambridge.org/)

Axis: : /ˈæk.sɪs/
Ellipse: /iˈlɪps/
Mechanics: /məˈkæn·ɪks/ (American English)
Inverse-square: /ɪnˈvɜːs skweəʳ/
Orbit: /ˈɔː.bɪt/
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To speed up: /-tə. ˈspiːd.ʌp/
To slow down: /-tə. sləʊ. daʊn/
Gravitational: /ˌgræv·ɪˈteɪ·ʃə·nəl/ (American English)
Ratio: /ˈreɪ.ʃi.əʊ/
Focus: /ˈfəʊ.kəs/
Perihelion: /ˌper.ɪˈhiː.li.ən/
Aphelion: /æfˈiː.li.ən/
Path : /pɑːθ/
Around: /əˈraʊnd/
Closest: /kləʊz/
Farther: /ˈfɑː.ðəʳ/
Motion: /ˈməʊ.ʃən/
Painstaking: /ˈpeɪnzˌteɪ.kɪŋ/
Attempt: /əˈtempt/
To summarize: /-tə. ˈsʌm.ər.aɪz/
Findings: /ˈfaɪn.dɪŋ/
To develop: /-tə. dɪˈvel.əp/
Shape: /ʃeɪp/
Loop: /luːp/
It takes: /ɪt . teɪk/
Sunrise – Sunset: /ˈsʌn.raɪz/ /ˈsʌn.set/
It would make us dizzy: /ɪt . wʊd . meɪk . ʌs . ˈdɪz.i/
To keep: /-tə. kiːp/
Roughly: /ˈrʌf.li/
Farther away: /ˈfɑː.ðər . əˈweɪ/
Close: /kləʊz/
Seasons: /ˈsiː.zən/

Exercise 1:

Read carefully the following text and then ask your partner questions to complete the crossword puzzle below. Do not look at your partner's sheet

General Astronomy/Kepler's Laws

Johannes Kepler was a mathematician who attempted to derive a set of fundamental principles which would explain the motions of the planets. He believed in the heliocentric view of the solar

system proposed by Copernicus, and he also possessed a rich set of observations of the planets made by Tycho Brahe.

After twenty years of painstaking attempts and various discarded ideas based on geometry, he finally arrived at a mathematical model of orbital motions based on the ellipse. Kepler summarized his findings in the form of three laws of planetary motion, frequently referred to as Kepler's First, Second and Third Laws, respectively:

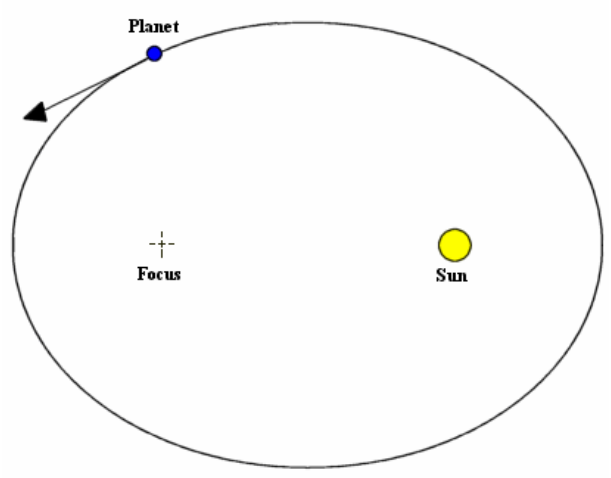
- **Kepler's First Law**, also known as **The Law of Ellipses** — The orbits of the planets are ellipses, with the sun at one focus.
- **Kepler's Second Law**, or **The Law of Equal Areas in Equal Time** — The line between a planet and the sun sweeps out equal areas in the plane of the planet's orbit over equal times.
- **Kepler's Third Law**, or **The Law of Harmony** — The time required for a planet to orbit the sun, called its period, is proportional to half the long axis of the ellipse raised to the 3/2 power. The constant of proportionality is the same for all the planets. It is often called the Law of Harmony because it shows a harmonic relation between distances and periods.

At that time he developed these laws, there was not yet a developed theory of gravity capable of explaining why the planets moved as they were observed to. Later, Isaac Newton, using his universal inverse-square law theory of gravity, was able to show how Kepler's Laws fit into a scientific theory of celestial mechanics.

An ellipse is a shape formed by taking a diagonal slice through a cone. It is essentially the shape of a circle viewed at an angle.

An ellipse can be drawn by taking a piece of paper, two push-pins, a loop of string, and a pencil. The two pins are pushed through the paper into a suitable surface, providing the two foci for the ellipse. They should be closer together than the loop is long. The loop of string is placed around the base of these pins, leaving some slack. The pencil is now placed so that the pins and the loop form a triangle with a slight tension on the string.

If you want, you can try to draw a shape by moving the pencil about the pins while keeping the string taunt. The result should be an ellipse. The shape of the ellipse can be varied either by moving the pins closer together or further apart. This shape, according to Kepler, defines the path that a planet takes when it orbits the Sun.



Kepler's First Law - A planet orbits the Sun on an ellipse with the Sun at one focus.

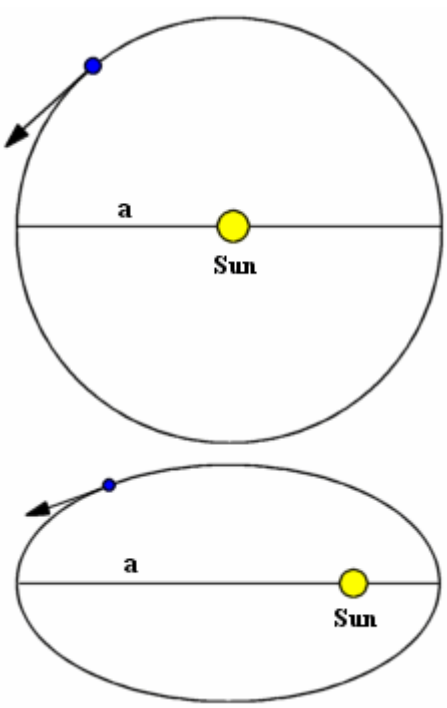
A line that divides an ellipse in half and passes through the widest part of the ellipse is called the major axis. A line perpendicular to this axis and dividing the ellipse in half is called the minor axis. Half the length of the major axis is called the semi-major axis, and is represented by a. The period required for a planet to complete one full orbit is represented by *P*. The relationship between the period *P* and the length of the semimajor axis is known as Kepler's Third Law, and can be represented as follows: $P^2 \propto a^3$

where the symbol $\propto$ means "proportional to", and implies that there is a direct mathematical relationship between the period squared and the length of the semi-major axis cubed.

The Second and Third Laws provide a basis for calculating the period of any planet orbiting the Sun, as well as determining where the planet will be located along the orbital path.

The ratio of the distance of a focus from the center of an ellipse to the semi-major axis is called the *eccentricity* of the orbit. When the two foci of the ellipse are on top of each other, the eccentricity is exactly 0.0 and the shape is a circle. As the eccentricity increases, the orbiting planet moves much further away than at the closest approach. The orbital eccentricities for planets in our Solar system vary from as much as 0.21 for Mercury down to 0.0068 for Venus.

The scientific name for the point of closest approach is the **periapsis**, while the most distance separation is the **apoapsis**. In the case of planets orbiting the Sun, these are called the **perihelion** and **aphelion**, respectively. (The *-helion* suffix comes from the Greek name for the Sun deity, Helios. This word is also the source of the name for the element Helium.)

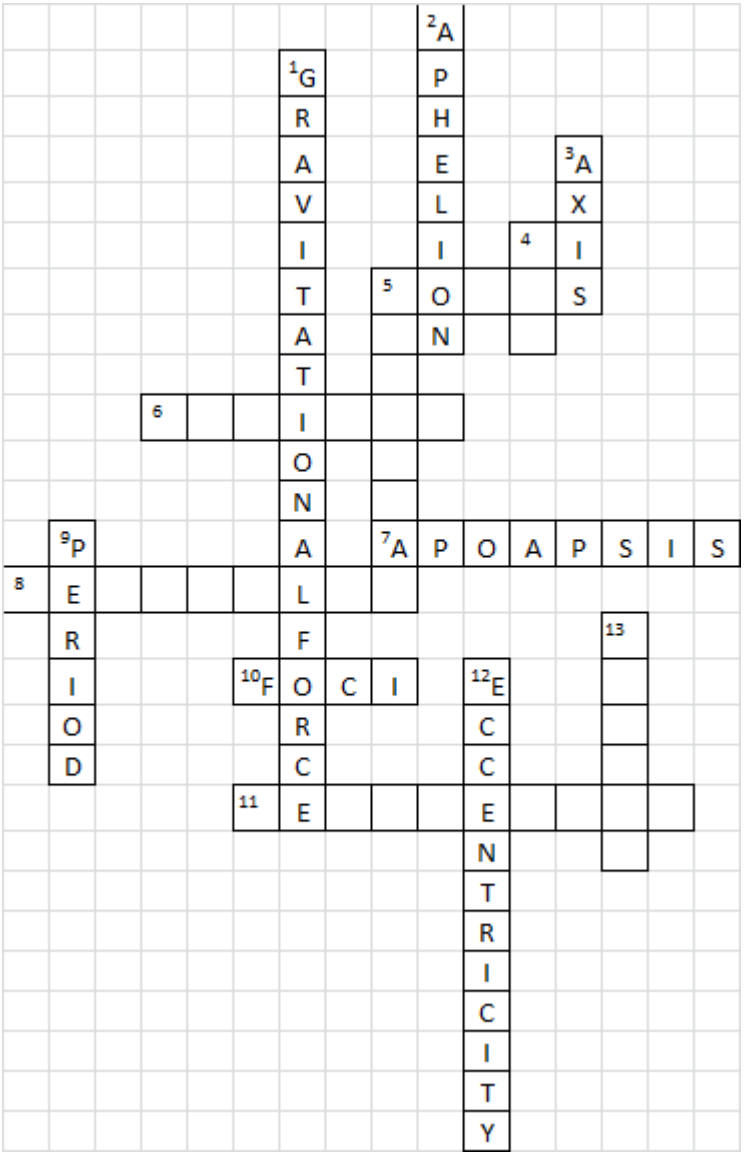


Two elliptical orbits with the same major axis but different eccentricity

Perhaps the most counter-intuitive aspect of the Third Law is that for any two identical bodies orbiting the Sun with the same semi-major axis, the orbital period is the same. This is true even if one is orbiting in a perfect circle and the other has an orbit that is highly elliptical (has a relatively

high eccentricity). The elliptical shape will fit entirely within the circle except at two points (the ends of the major axis, at which the two curves will be tangent), so it is actually a shorter orbital path. However the aphelion of the ellipse will be located further from the Sun, so the planet will spend more time traversing the distant section of the orbit. The shorter orbit and the slower traverse of the aphelion compensate for each other, resulting in an identical period with the circular orbit.

CROSSWORD PUZZLE



Instructions

You have half of a crossoword. Find out the missing words, e.g. ask your partner:

“What’s 6 across?”

Your partner will explain the world. When you know the word, you must say:

“Oh, I see!”

Do not say the word out loud. If you do not know what the word is, say your partner:

“How do you spell it?”

Exercise 2 (homework):

Drow an ellipse how described in the text.

Fonte dei testi: https://en.wikibooks.org/wiki/General_Astronomy/Kepler%27s_Laws

Altro link utile: http://www.physicsclassroom.com/class/circles/Lesson-4/Kepler-s-Three-Laws

STUDENT B

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To speed up: /-tə. ˈspiːd.ʌp/
To slow down: /-tə. sləʊ. daʊn/
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Focus: /ˈfəʊ.kəs/
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Closest: /kləʊz/
Farther: /ˈfɑː.ðəʳ/
Motion: /ˈməʊ.ʃən/
Painstaking: /ˈpeɪnzˌteɪ.kɪŋ/
Attempt: /əˈtempt/
To summarize: /-tə. ˈsʌm.ər.aɪz/
Findings: /ˈfaɪn.dɪŋ/
To develop: /-tə. dɪˈvel.əp/
Shape: /ʃeɪp/
Loop: /luːp/
It takes: /ɪt . teɪk/
Sunrise – Sunset: /ˈsʌn.raɪz/ /ˈsʌn.set/
It would make us dizzy: /ɪt . wʊd . meɪk . ʌs . ˈdɪz.i/
To keep: /-tə. kiːp/
Roughly: /ˈrʌf.li/
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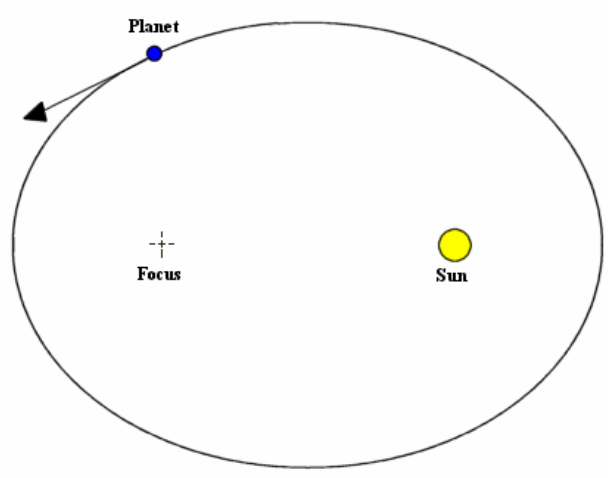
At that time he developed these laws, there was not yet a developed theory of gravity capable of explaining why the planets moved as they were observed to. Later, Isaac Newton, using his universal inverse-square law theory of gravity, was able to show how Kepler's Laws fit into a scientific theory of celestial mechanics.

An ellipse is a shape formed by taking a diagonal slice through a cone. It is essentially the shape of a circle viewed at an angle.

An ellipse can be drawn by taking a piece of paper, two push-pins, a loop of string, and a pencil. The two pins are pushed through the paper into a suitable surface, providing the two foci for the ellipse. They should be closer together than the loop is long. The loop of string is placed around the base of these pins, leaving some slack. The pencil is now placed so that the pins and the loop form a triangle with a slight tension on the string.

If you want, you can try to draw a shape by moving the pencil about the pins while keeping the string taunt. The result should be an ellipse. The shape of the ellipse can be varied either by moving the pins closer together or further apart. This shape, according to Kepler, defines the path that a planet takes when it orbits the Sun.



Kepler's First Law - A planet orbits the Sun on an ellipse with the Sun at one focus.

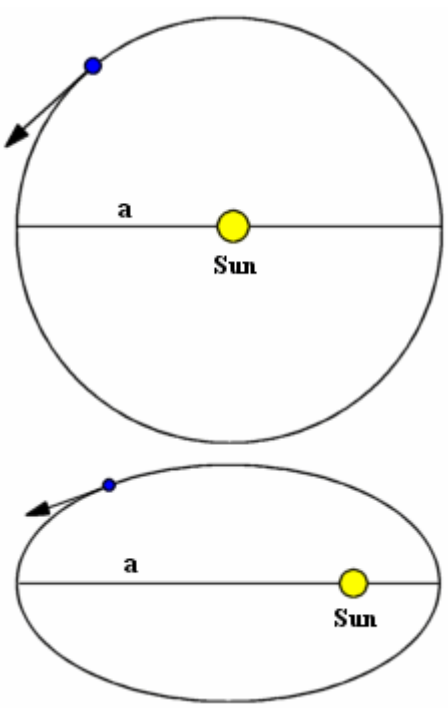
A line that divides an ellipse in half and passes through the widest part of the ellipse is called the major axis. A line perpendicular to this axis and dividing the ellipse in half is called the minor axis. Half the length of the major axis is called the semi-major axis, and is represented by a. The period required for a planet to complete one full orbit is represented by *P*. The relationship between the period *P* and the length of the semimajor axis is known as Kepler's Third Law, and can be represented as follows: $P^2 \propto a^3$

where the symbol $\propto$ means "proportional to", and implies that there is a direct mathematical relationship between the period squared and the length of the semi-major axis cubed.

The Second and Third Laws provide a basis for calculating the period of any planet orbiting the Sun, as well as determining where the planet will be located along the orbital path.

The ratio of the distance of a focus from the center of an ellipse to the semi-major axis is called the *eccentricity* of the orbit. When the two foci of the ellipse are on top of each other, the eccentricity is exactly 0.0 and the shape is a circle. As the eccentricity increases, the orbiting planet moves much further away than at the closest approach. The orbital eccentricities for planets in our Solar system vary from as much as 0.21 for Mercury down to 0.0068 for Venus.

The scientific name for the point of closest approach is the **periapsis**, while the most distance separation is the **apoapsis**. In the case of planets orbiting the Sun, these are called the **perihelion** and **aphelion**, respectively. (The *-helion* suffix comes from the Greek name for the Sun deity, Helios. This word is also the source of the name for the element Helium.)

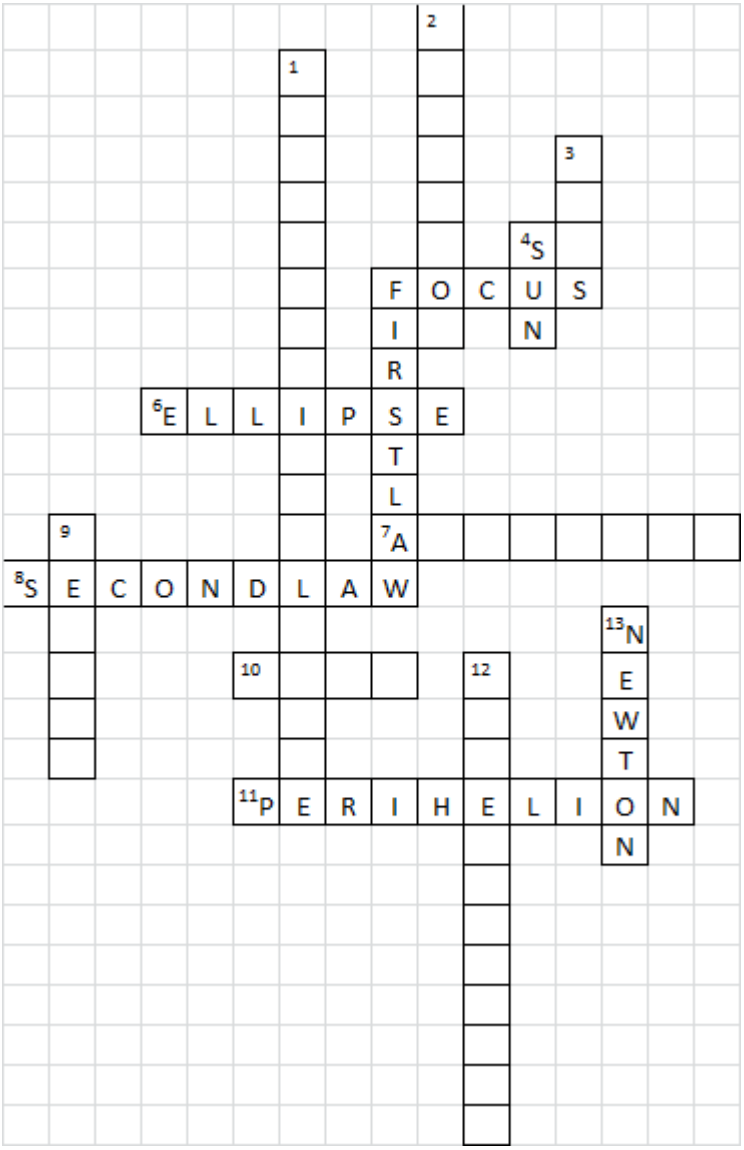


Two elliptical orbits with the same major axis but different eccentricity

Perhaps the most counter-intuitive aspect of the Third Law is that for any two identical bodies orbiting the Sun with the same semi-major axis, the orbital period is the same. This is true even if one is orbiting in a perfect circle and the other has an orbit that is highly elliptical (has a relatively

high eccentricity). The elliptical shape will fit entirely within the circle except at two points (the ends of the major axis, at which the two curves will be tangent), so it is actually a shorter orbital path. However the aphelion of the ellipse will be located further from the Sun, so the planet will spend more time traversing the distant section of the orbit. The shorter orbit and the slower traverse of the aphelion compensate for each other, resulting in an identical period with the circular orbit.

CROSSWORD PUZZLE



Instructions

You have half of a crossoword. Find out the missing words, e.g. ask your partner:

"What's 1 down?"

Your partner will explain the world. When you know the word, you must say:

"Oh, I see!"

Do not say the word out loud. If you do not know what the word is, say your partner:

"How do you spell it?"

Exercise 2 (homework):

Drow an ellipse how described in the text.

Fonte dei testi: https://en.wikibooks.org/wiki/General_Astronomy/Kepler%27s_Laws

Altro link utile: http://www.physicsclassroom.com/class/circles/Lesson-4/Kepler-s-Three-Laws

Mendel's laws	Le leggi di Mendel
Metodology: Jigsaw reading activity (Communicative activities)	Metodologia: Attività di lettura a puzzle da ricomporre (attività basate sulla comunicazione)
Skills: Reading - listening	Conoscenze/competenze: Lettura e ascolto in lingua inglese
Subject contents/objective • Distinguish between characteristics and traits • Identify the terms used to describe the three generations in Mendel's studies • Identify the traits that appeared in Mendel's F_2 generation • Identify the actions of dominant alleles and recessive alleles for a trait. • Outline the Law of Segregation • Outline the Law of Independent Assortment • Distinguish between genotype and phenotype.	Contenuti/obiettivi disciplinari • Distinguere tra caratteri e tratti; • Identificare i termini usati per descrivere le tre generazioni osservate da Mendel nei suoi lavori • Identificare i tratti che appaiono nella generazione F_2 • Identificare le azioni degli alleli dominanti e di quelli recessivi nella manifestazione dei tratti • Delineare la legge della segregazione • Delineare la legge dell'assortimento indipendente • Distinguere tra genotipo e fenotipo.

A – Activity description – Descrizione dell'attività:

La classe viene divisa i tre gruppi, Gruppo A, Gruppo B e Gruppo C. A ciascun gruppo viene assegnato un testo che verrà consegnato più avanti. Cercare di adeguare ogni gruppo al livello di difficoltà del rispettivo testo. Prima di consegnare i testi, chiedere a ciascun gruppo di discutere quanto già di loro conoscenza:

What do you know about the following:

Gruppo A: Mendel and Dominance law

Gruppo B: Mendel and Random Segregation of Alleles law

Gruppo C: Mendel and Independent Assortment low

Dare agli studenti tempo per condividere informazioni e idee. Se ritenuto utile, fornire agli studenti dizionari di biologia o accesso al WEB

Successivamente CONSEGNARE l'introduzione generale ed i testi assegnati a ciascun gruppo.

Chiedere a ciascun gruppo di leggere il testo assegnato e di provare a pronunciare e a spiegare il significato dei termini sottolineati. Ogni gruppo deve avere a disposizione un dizionario di biologia e/o accesso al WEB.

Chiedere a ciascun gruppo di fare pratica nel riformulare con parole proprie i concetti del testo, in coppie o gruppetti da tre. Gli studenti possono aiutarsi con le parole/frasi sottolineate.

Creare tre sottogruppi in ciascun gruppo, assegnando a ciascuno studente un numero (da 1 a 3). Di conseguenza ognuno di loro sarà identificato dal gruppo di appartenenza (A, B o C) e dal numero (1, 2 o 3).

Chiedere agli studenti di riorganizzare i gruppi in base al numero assegnato: gruppi studenti A1+B1+C1, gruppi studenti A2+B2+C2 e gruppi studenti A3+B3+C3. A questo punto ciascuno studente riferirà con parole proprie la sua parte del testo al resto del nuovo gruppo di cui fa parte. Ciascun gruppo ricostruirà così l'intero testo.

In classi numerose raccomandare di parlare a bassa voce.

ATTIVITA' DI VERIFICA SUCCESSIVA (di oltre)

Quesiti vero/falso in cui a ciascun gruppo originario (A, B e C) vengono posti quesiti sulle parti di testo date agli altri gruppi.

B – Content vocabulary – Vocabolario della disciplina (può essere fornito agli studenti in qualsiasi momento, a discrezione del docente)

Per la pronuncia: https://dictionary.cambridge.org/dictionary/english/

Genetics /dʒəˈnet.ɪks/: the study of how, in all living things, the characteristics and qualities of parents are given to their children by their genes
Inheritance /ɪnˈher.ɪ.tᵊns/: money or objects that someone gives you when they die
Traits /treɪt/: a particular characteristic that can produce a particular type of behaviour
Fertilization /ˌfɜr·tᵊl·əˈzeɪ·ʃən/ : the process of joining male and female sexual cells to produce young
Blend /blend/ : a mixture of different things or styles
Pattern /ˈpæt.ən/ : a particular way in which something is done, is organized, or happens
Gene /dʒiːn/ : a part of the DNA in a cell that controls the physical development, behaviour, etc. of an individual plant or animal and is passed on from its parents
Allele /əˈliːl/ : a gene that is found in one of two or more different forms in the same position in a chromosome, and so produces a particular characteristic that can be different for different people, such as eye colour
Offspring /ˈɒf.sprɪŋ/ : the young of an animal
Dominant /ˈdɒm.ɪ.nənt/ : A dominant gene is one that always produces a particular characteristic in a person, plant, or animal
Recessive /rɪˈses.ɪv/ : **(**of genes and the physical qualities they control) only appearing in a child if both parents supply the controlling gene
Male /meɪl/: having characteristics that are traditionally thought to be typical of or suitable for men
Female /ˈfiː.meɪl/: having characteristics that are traditionally thought to be typical of or suitable for a woman
Gamete /ˈgæm.iːt/ : a cell connected with sexual reproduction, either a male sperm or a female egg
Random /ˈræn.dəm/ : happening, done, or chosen by chance rather than according to a plan:
Meiosis /maɪˈəʊ.sɪs/ : the type of cell division that happens as part of reproduction (= the process of producing young animals or plants), in which one cell divides into four gametes (= reproductive cells), each with a different mixture of chromosomes and half the number contained in the original cell
Zygote /ˈzaɪ.gəʊt/ : the cell that is formed when a female reproductive cell and a male reproductive cell join
Homologous /həˈmɒl.ə.gəs/: having a similar position, structure, value, or purpose
Chromosome /ˈkrəʊ.mə.səʊm/ : any of the rod-like structures found in all living cells, containing the chemical patterns that control what an animal or plant is like

C Scaffolding language – Vocabolario linguistico di supporto (può essere fornito agli studenti in qualsiasi momento, a discrezione del docente)

Pea plant: Piante di pisello
To carry out: eseguire
Pollen: polline
Seed: seme
To grow: crescere, coltivare
Earlier generation: prima generazione
To find out: scoprire
Predictable: prevedibile
Therefore: perciò
For instance: per esempio

Each: ogni
Parent: genitore
To separate: separare
To fuse: fondere
To state: affermare, dichiarare, stabilire
Segregation: in biologia, separazione
Either: o; entrambi, nessuno
To cross: in biologia, incrociare
Characteristic: caratteristica
Shape: forma
To affect: influenzare
Located far apart: situato lontano
Linked: unito
Discovered by: scoperto da

D – Text – Testi - Materiale da fotocopiare, tagliare e distribuire agli studenti.

Introduction

Gregor Johann Mendel (1822-1884) was an Augustinian monk, a teacher, and a scientist. He is often called the ”father of modern genetics” for his study of the inheritance of traits in pea plants. Mendel showed that the inheritance of traits follows particular laws, which were later named after him.

To carry out his scientific researches, he made artificial fertilization on plants many times. Artificial fertilization is the process of transferring pollen from the male part of the flower to the female part of another flower, in another plant. Artificial fertilization is done in order to have seeds that will grow into plants that have a desired trait, such as yellow flowers.

During Mendel’s time, the popular blending inheritance hypothesis stated that offspring were a ”mix” of their parents. For example, if a pea plant had one short parent and one tall parent, that pea plant would be of medium height.

Mendel noted that plants in the monastery gardens sometimes gave rise to plants that were not exactly like the parent plants, nor were they a “mix” of the parents. He also noted that certain traits reappeared after“disappearing” in an earlier generation.

Mendel was interested in finding out if there was a predictable pattern to the inheritance of traits, so between 1856 and 1863 he grew and tested about 29,000 pea plants in the monastery garden.

There are different versions of genes. These different versions account for variations in characteristics. Different versions of a gene are called alleles. For example, there is a “yellow-pod” allele and a “green pod” allele. The blending inheritance hypothesis was discredited by Mendel’s allele hypothesis.

Mendel understood that every individual has two copies of each gene. Note that at that time the modern concept of gene was not yet present. Mendel therefore spoke of "factors".

Group A - Dominance law

When two different alleles are inherited together, one may be expressed, while the effect of the other may be “silenced.” In the case of pod color, the allele for green pods is always expressed and is dominant. The allele for yellow pods, which is not expressed, is recessive . For instance, if a plant inherits a “yellow-pod” gene and a “green pod” gene, it will have only green pods. For each characteristic, an organism inherits two alleles, one from each parent . Mendel noted that offspring could inherit their traits from either parent. In the case of the expressed trait, it did not matter whether it was the male gamete or female gamete that supplied the gene.

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Group B - Random Segregation of Alleles law

When gametes are formed, the two alleles of each gene are separated. During meiosis, each male or female gamete receives one allele for a trait. When the male and female gametes are fused at fertilization, the resulting zygote contains two alleles of each gene. The Law of Segregation states that a pair of alleles is separated, or segregated, during the formation of gametes. During meiosis, homologous chromosomes are randomly separated. Each resulting gamete has an equal probability or chance of receiving either of the two alleles.

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Group C - Independent Assortment low

Mendel also crossed pea plants that differed in two characteristics, such as seed color and shape. Mendel wanted to see if the inheritance of characteristics were dependent. He concluded that characteristics were inherited independently of each other. The Law of Independent Assortment states that the inheritance of one trait will not affect the inheritance of another. In modern terms, alleles of each gene separate independently during gamete formation.

We now know that the only alleles that are inherited independently are ones that are located far apart on a chromosome or that are on different chromosomes. There are many genes that are close together on a chromosome, and are packaged into the gametes together. Genes that are inherited in this way are called linked genes. Linked genes tend to be inherited together. Genetic linkage was first discovered by the British geneticists William Bateson and Reginald Punnett shortly after Mendel’s laws were rediscovered.

E – Follow-up activity, test

Student: _____

Question for groups B and C

The expressed allele is called dominant V F

In living beings, normally there is one allele for each characteristcs V F

The behaviour of alleles depends on the parent where each one of them comes from V F

Question for groups A and C

The alleles separate during fertilization V F

Female gametes normally get recessive alleles V F

Each gamete contains two alleles V F

Querstion for groups A and B

Despite two genes can be unlinked, normally they are inherited togheter V F

Despite two genes can be linked, thay can be inherited independently of each other V F

When two are unlinked, they are inherited independently of each other V F

Fonte dei testi: https://upload.wikimedia.org/wikipedia/commons/c/ce/High_School_Biology_1-13.pdf