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PHYSICS

Waves

Waves are one of the ways in which energy may be transferred between stores. Waves can be described as oscillations or vibrations about a rest position, which are transmitted through space. For example:

- sound waves cause air particles to vibrate back and forth
- ripples cause water particles to vibrate up and down

The direction of these oscillations is the difference between longitudinal or transverse waves. In longitudinal waves, the vibrations are parallel to the direction of wave travel. In transverse waves, the vibrations are at right angles to the direction of wave travel.

Mechanical waves cause oscillations of particles in a solid, liquid or gas and must have a medium to travel through. **Electromagnetic waves** cause oscillations in electrical and magnetic fields. They can travel in a vacuum.

All waves transfer energy but they do not transfer matter.

Wave period and wave speed

The time period of a wave can be calculated using the equation:

$$Time\ period = \frac{1}{frequency}$$

$$T = \frac{1}{f}$$

This is when:

- the period (*T*) is measured in seconds (s)
- frequency (*f*) is measured in hertz (Hz)

Example

Calculate the time period of a wave with a frequency of 50 Hz.

$$T = \frac{1}{f}$$

$$T = 1 \div 50 \quad T = \frac{1}{50\ \text{Hz}}$$

$$T = 0.02\ s$$

Measuring the speed of sound in air and water

The air is made up of many tiny particles. When sound is created, the air particles vibrate and collide with each other, causing the vibrations to pass between air particles. The vibrating particles pass the sound through to a person's ear and vibrate the ear drum.

Light travels much faster than sound through air. For example, a person fires a starting pistol and raises their hand in the air at the same time. A distant observer stood 400 metres (m) away records the time between seeing the action (the light reaches the time keeper immediately) and hearing the sound (which takes more time to cover the same distance).

The speed of sound can be calculated using the equation:

$$speed = \frac{distance}{time}$$

$$v = \frac{d}{t}$$

This is when:

- speed (*v*) is measured in metres per second (m/s)
- distance (*s*) is measured in metres (m)
- time (*t*) is measured in seconds (s)

Adapted from: https://www.bbc.com/bitesize/guides/zqf97p3/revision/1

A) VOCABULARY

1) These words are underlined in the text. Match them with their definitions.

oscillations / medium / longitudinal wave / vibrations / transverse wave / matter

1. A wave that moves in the same direction as the direction in which the particles are vibrating.
2. Sub-atomic particles and anything made from them, such as atoms and molecules, are matter. Energy and forces are not matter.
3. A material through which a wave can be transmitted (propagate).
4. The repeated and regular fluctuations, above and below the same position, e.g. the pressure of a sound wave or the voltage of an alternating current.
5. A wave that moves in a direction at right angles to the way in which the particles are vibrating.
6. Repeated movements back and forth (about a fixed point).

2) Complete the diagram of a wave by writing the missing labels. Use the following parts of a wave:

- **rest position** - the undisturbed position of particles or fields when they are not vibrating
- **displacement** - the distance that a certain point in the medium has moved from its rest position
- **peak** - the highest point above the rest position
- **trough** - the lowest point below the rest position
- **amplitude** - the maximum displacement of a point of a wave from its rest position
- **wavelength** - distance covered by a full cycle of the wave, usually measured from peak to peak, or trough to trough
- **time period** - the time taken for a full cycle of the wave, usually measured from peak to peak, or trough to trough
- **frequency** - the number of waves passing a point each second

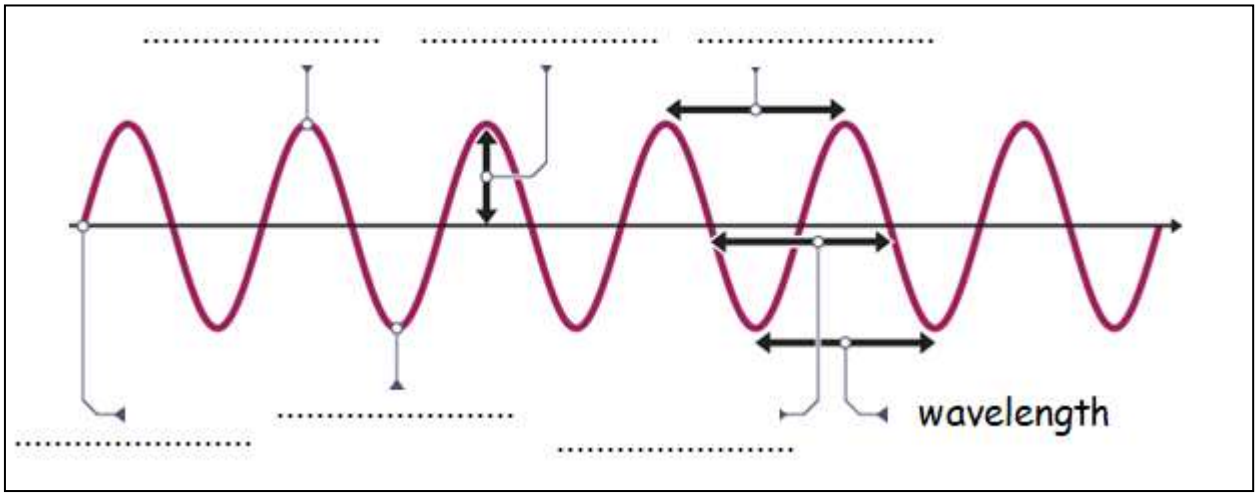


Diagram of a wave

B) READING COMPREHENSION

1) Choose the correct answer according to the information in the text.

1) What do waves transfer?

A) Energy but not matter
B) Energy and matter
C) Matter but not energy

2) What is the name of the distance from peak to peak of a wave?

A) Wavelength
B) Amplitude
C) Frequency

3) What is the general name for waves that require a medium to vibrate?

A) Electromagnetic
B) Mechanical
C) Transverse

4) What is the unit for time period?

A) Metres (m)
B) Hertz (Hz)
C) Seconds (s)

5) What is the time period of a 40 Hz wave?

A) 40 Hz
B) 0.025 s
C) 0.4 s

6) What is the frequency of a wave with a time period of 0.08 s?

A) 8 Hz
B) 1.25 Hz
C) 12.5 Hz

7) What is the wave speed of a 1,000 Hz wave with a wavelength of 0.04 m?

A) 40 m/s
B) 400 m/s
C) 0.00004 m/s

8) What is the speed of sound in air?

A) 300,000,000 m/s
B) 330 m/s
C) 1,500 m/s

9) How is wave speed calculated?

A) Wave speed = frequency ÷ wavelength
B) Wave speed = frequency × wavelength
C) Wave speed = wavelength ÷ frequency

10) What is the speed of a sound wave that takes 0.5 s to travel 750 m?
A) 3,000 m/s
B) 375 m/s
C) 1,500 m/s

C) GRAMMAR: Adjectives

Some adjectives are formed from nouns and others are formed from verbs. The word forms are from Latin, Greek and other languages. There is no simple rule for adding suffixes, but there are common patterns. Also, suffixes have specific meaning that may help us to understand the meaning of adjectives. For example:

-al	relating to
-ful	full of
-ic	having the nature of, caused by
-ical	having the nature of
-ing	causing effect
-less	without

1) In the text, find:

a) 2 adjectives ending in *–ic*

b) 3 adjectives ending in *–al*

c) 2 adjectives ending in *–ing*

2) Can you work out the meaning of these adjectives according to their suffixes?

3) Think about adjectives ending in *–ful/-less.* What do they mean according to these suffixes?

4) Use the suffixes in the box above to make adjectives from the following words:

Suffix			
-less	USE useless	FRIEND	CHILD
	RELAX	SURPRISE	EXCITE
	ACCIDENT	PERSON	UNIVERSE
	SUCCESS	DELIGHT	POWER
	MAGIC	LOGIC	HISTORY
	ATHLETE	SCIENCE	PHOTOGRAPH

INFORMATION TECHNOLOGY

Have you ever heard the term BLOCKCHAIN? If not, watch the following video to understand it.
https://www.youtube.com/watch?v=r43LhSUUGTQ

A Brief History of Blockchain: An Investor's Perspective

1-……

In 2008, Satoshi Nakamoto (the pseudonym for an unidentified individual) (a)……(**publish)** a report called Bitcoin: A Peer to Peer Electronic Cash System. In this paper, he (b)……(**argue)** that he (c)……(**solve)** the issue of double-spend for digital currency via a distributed database that combined cryptography, game theory, and computer science. Double spend is simply the idea that digital currency can be spent in two places. Satoshi's creation (d)……**(be)** a huge innovation because it (e)……(**enable)** one entity to confidently transact value directly with another entity without relying on a trusted third party to stand between them.

To illustrate the issue of double-spend, consider that you (f)……(**want)** to purchase a book from Amazon with a credit card. You were searching Amazon when you found the one that you wanted. You (g)……(**use)** digital cash to purchase that book. Since digital cash consists of a digital file (like a PDF), it can be duplicated. For this reason, an institution (often a bank) needs to verify these transactions. Bitcoin (h)……**(be)** the first native digital medium for the exchange of value. Remember, money is not just coins or banknotes, it's basically trust. Anything can be used as money, if there is mutual trust.

2-……

Investor Opportunity: Bitcoin was the first killer app of the blockchain, as email was to the web. Bitcoin has had a rapid change since 2008, experiencing a massive multi-year crash and recovery. In countries such as Argentina and Venezuela where inflation is astronomical, Bitcoin is used to pay for some goods. Bitcoin may become a de facto store of value similar to Gold and can be

viewed as protection against financial risk like instability and inflation. According to Satoshi's protocol, Bitcoin is issued every 10 minutes.

3-…….

Around 2014, technologists and investors (i)……**(shift)** their focus from Bitcoin to blockchain. Though Bitcoin and blockchain are often used interchangeably, that's incorrect.

Bitcoin is built on a version of a blockchain. A blockchain is an open, decentralized ledger that can record transactions between two parties efficiently and in a verifiable and permanent way without the need for a central authority. The key qualities of this distributed ledger are that it is time-stamped (mark with time, date), transparent (anyone can see the ledger of transactions), and decentralized (the ledger exists on multiple computers).

Many (j)……(welcome)blockchain technology as revolutionary and claimed it (k)……(have) the potential to dramatically lower the cost of transactions, just as the protocols of the Internet lowered the cost of connection. Take, for instance, a typical stock transaction. The transaction can be executed in microseconds but the settlement — the ownership transfer of the stock – usually takes a week. This is because the parties have no access to each other ledgers and therefore can't automatically verify that the assets are in fact owned and can be transferred. A number of intermediaries (i.e. banks, credit card companies) act as guarantors of assets as the transaction is verified and the ledgers individually updated.

A digital ledger that keeps a record of all transactions taking place on a peer-to-peer network

Adapted from https://medium.com/hummingbird-ventures/a-brief-history-of-blockchain-an-investors-perspective-387c440ad11c

A) READING COMPREHENSION

1) Complete the article with the missing subheadings. There are two extra subheadings.

a) It's Blockchain That We Love!
b) Bitcoin
c) Use Bitcoin not Blockchain

d) The Bitcoin Mining Process
e) Double-spend**2) True and false. Correct the false ones.**
a) Satoshi Nakamoto figured out how a digital currency can be spent in two places.

b) Most people disliked blockchain technology and did not find it useful.

c) Satoshi's creation disregarded a third party's role in a transaction.

d) Blockchain was created before bitcoin.

e) Satoshi Nakamoto is the real name of the person who wrote "Bitcoin: A Peer to Peer Electronic Cash System".

3) Answer these questions.

a) Why is Bitcoin useful in countries such as Argentina and Venezuela?

b) When did investors change their attention from one technology to the other one? Why?

c) What did many people think about Blockchain?

B) GRAMMAR: Past Simple

1) Complete the text with the missing verbs in the correct form of Past Simple.

2) In the fourth paragraph, the author mentions one action that was interrupted by another one. Find the sentence and transcribe it here.

……

……

3) Let's analyze the sentence and complete the rule with *past simple* or *past continuous*.

The action in <u>progress</u> is in the ……, while the <u>action</u> that interrupts it is in the ……..

4) Complete the sentences using the correct form of the Past Simple and Past Continuous.

Mark Zuckerberg a) ……. (help) his friends Tyler and Cameron in the creation of a social networking site for Harvard when he b) ……. (create) Facebook. My best friends c) …… (buy) a new game online when the lights d) ……. (go) off and their computer e)……. (turn) off. There f) ……. (be) a blackout in their neighborhood.

When Evan Spiegele g) ……. (design) Sanpchat, h)……. (do) his final project at the Univerity of Standford. The name of the app i) ……. (be not) Snapchat, it j) ……. (be) Picaboo.

C) VOCABULARY

1) Read the following headlines from newspapers around the world and complete them with the correct adjective from the box to form the collocation.

HUGE	DE FACTO	DIGITAL (X2)	ASTRONOMICAL	DECENTRALIZED

..... INNOVATION IN THE BUDAPEST ZOO

Five predictions for..... currencies in 2018 — including stomach-churning drops, bitcoin-related IPO

China's 'Protectionist' Blockchain Policy in a ..... Ledger Space

Bitcoin is the ..... store of value in the crypto currency market and is the world's oldest blockchain network

THE..... INFLATION IN KIEV BECAUSE OF THE CHAMPIONS LEAGUE

Bitcoin: Much more than ..... cash

2) Complete the chart with information from the previous exercise.

	currency
	innovation
	cash
	inflation
	store
	ledger

BIOLOGY

Genetics

Alleles

The genes that occupy corresponding positions on homologous chromosomes and control the same characteristic are called allelomorphic genes, or alleles. The word 'allelomorph' means 'alternative form'. For example, there are two alternative forms of a gene for eye colour. One allele produces brown eyes and one allele produces blue eyes.

Patterns of inheritance

A knowledge of mitosis and meiosis allows us to explain, at least to some extent, how heredity works. The allele in a mother's body cells that causes her to have brown eyes may be present on one of the chromosomes in each ovum she produces. If the father's sperm cell contains an allele for brown eyes on the corresponding chromosome, the zygote will receive an allele for brown eyes from each parent. These alleles will be reproduced by mitosis in all the embryo's body cells and when the embryo's eyes develop, the alleles will make the cells of the iris produce brown pigment (melanin) and the child will have brown eyes.

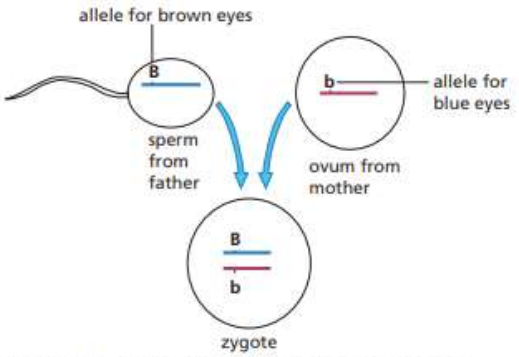
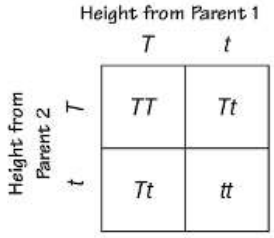


Figure 17.21 Combination of alleles in the zygote (only one chromosome is shown). The zygote has both alleles for eye colour; the child will have brown eyes.

Single-factor inheritance

Because it is impossible to follow the inheritance of the thousands of characteristics controlled by genes, it is usual to start with the study of a single gene that controls one characteristic. We have used eye colour as an example so far. Probably more than one allele pair is involved, but the simplified example will serve our purpose. It has already been explained how an allele for brown eyes from each parent results in the child having brown eyes. However, if the mother has blue eyes and the father brown eyes, the child will receive an allele for blue eyes from its mother and an allele for brown eyes from its father. If this happens, the child will, in fact, have brown eyes. The allele for brown eyes is said to be dominant to the allele for blue eyes.

Although the allele for blue eyes is present in all the child's cells, it is not expressed. It is said to be recessive to brown. Eye colour is a useful 'model' for explaining inheritance but it is not wholly reliable because 'blue' eyes vary in colour and sometimes contain small amounts of brown pigment.



Punnett Square

A Punnett square is a diagram that illustrates all of the possible genetic combinations that can occur during sexual reproduction. Let's say that "T" stands for dominate gene for tallness and that "t" stands for a recessive trait for shortness. The Punnett square below shows the possible outcomes. This pattern is called the dominant-recessive pattern.

The dominant–recessive pattern is not the only way that genes and their traits can work in an organism. Say, for instance, that both parents of an organism have two recessive traits for a gene. In that case, the genes would have dominance. Sometimes when the parents of organisms have two recessive copies of a gene, the traits that are produced are a kind of blend of both. For example, pink flowers are often produced by the reproduction of a white and red flower.

Adapted from
Cambridge IGCSE, Biology Third Edition
Differentiated Lessons and Assessments: Science: Science

A) READING COMPREHENSION

1) What is the text about? In your own words, summarize the main idea of the text. Share your summary in class.

2) Underline key words in the text and make a glossary of the vocabulary. Some words have been included for you. Then, find their Spanish translation.

a) Alleles ……

b) Homologous chromosomes ……

c) Zygote ……

d) Dominant allele ……

e) Punnett square ……

f) Recessive trait ……

g) Possible outcomes ……

h) Dominant-recessive pattern ……

3) Read the text and state if the following sentences are TRUE or FALSE. Correct the false ones.

a) An allele is a variant form of a given gene.

b) Recessive alleles control the characteristics of chromosomes.

c) Alleles are reproduced by a process of cell duplication, or reproduction.

d) Recessive alleles are not present in a person's cells.

e) A Punnett square is a diagram that illustrates only human genetic combinations.

B) AUDIOVISUAL COMPREHENSION

1) Watch the video on Punnett squares for better understanding.
While watching the video choose the correct answers below.
https://www.getavideos.xyz/watch?v=Roo6YbjosgQ

1. The professor explains "alleles" with a metaphor: "Alleles are going to be like different flavours of.....
   a) ice-cream b) genes c) food

2. So, go to the ice-cream shop. There's 31 flavours of ice-cream. Even there are different flavours, they're still .....
   a) ice-cream b) genes c) flavours

3. Some of these alleles are going to be dominant, and some are going to be .....
   a) dominant b) recessive c) dominated

4. In each of the crosses there is one allele from the .....and one allele from the .....
   a) mother-father b) father-mother c) mother-son

5. We have four individual squares. Each of the squares is going to be a probability, and each of the squares is ..... or 25 percent.
   a) one fourth b) two fourth c) three fourth

6. Generally, people put the father or .....on top.
   a) female allele b) male allele c) allele

7. In any relationship for a Punnett square, a capital letter is going to be for the .....
   a) dominant b) recessive c) allele

8. The little or .....case letter is for the recessive.
   a) big b) upper c) lower

9. *Heterozygous* means that you have .....for that trait (dominant and recessive).
   a) two different alleles b) one allele c) two equal alleles

10. *Homozygous* means that you have two alleles that are ..... (both dominant or both recessive).
   a) different b) the same c) opposite

C) GRAMMAR: First Conditional

1) Find and underline 3 examples of First Conditional sentences in the text.

2) Now, let's complete the rule and provide examples.

We use first conditional to talk about……

IF + Subject+ ……., Subject + WILL / WON'T + …….

Example:

……

Subject + WILL / WON'T + …….. + if + Subject + ……

Example:

……

3) Put the verbs in the correct form of the First Conditional.

1. If an organism……(have) two copies of the same dominant or recessive gene, it ……(be) pure bred.
2. If traits ……(be) dominant, they ……(be) in the offspring.
3. If parents …… (have) a dominant gene for brown hair and a recessive gene for blond hair, the baby …… probably ……(not - have) blond hair.
4. We …… (see) the possible outcomes of traits if we…… (draw) a Punnett square.
5. If Sam …… (not possess) a dominant gene for dimples, he …… (not –have) them.
6. If an organism …… (have) one dominant gene and one recessive gene for a trait, it …… (be) a hybrid.
7. If the curly hair of a parent …… (be) a dominant trait, the offspring ……(have) curly hair.

4) Read the text on 'Mendel's Laws of Inheritance' below. You will notice that there are some words missing. Complete the blanks with the help of the references below.

Mendel was a Czech monk who carried out controlled breeding experiments with mice and pea plants to find out about (1) **i……..** He published his ideas on inheritance in 1865 but they were not very well received because (2) **b……..** of the time were not really interested in the mathematical treatment of scientific results or keen on the idea that there was a '(3) **h……..** unit'. It was not until 1903 that Mendel's Laws of Inheritance were accepted by scientists. Mendel's

(4) **L……..** are:

1. That a heritable unit called a (5) **g……..** is passed on from one generation to the next.
2. That genes can exist in different forms that are called (6) **a……..**..
3. That each individual must have two alleles per feature.
4. That the sex (7) **c……..** can only have one allele per feature.
5. One allele can be (8) **d……..** over the other.

1. **Noun**	The reception of genetic qualities by transmission from parent to offspring.
2. **Noun**	Experts in the branch of science concerning living organisms.
3. **Adj.**	Transmissible from parent to offspring.
4. **Noun**	Statements of facts, deduced from observation, to the effect that a particular natural or scientific phenomenon always occurs if certain conditions are present.
5. **Noun**	A unit of heredity which is transferred from a parent to offspring and is held to determine some characteristic of the offspring.
6. **Noun**	The genes that occupy corresponding positions on homologous chromosomes and control the same characteristic.
7. **Noun**	The smallest structural and functional units of an organism, which are typically microscopic and consist of cytoplasm and a nucleus enclosed in a membrane.
8. **Adj.**	Relating to or denoting heritable characteristics which are controlled by genes that are expressed in offspring even when inherited from only one parent.