CESAR Scientific Challenge

# Mission to the Moon

## Student Guide

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# Your Scientific challenge

# Mission to the Moon

*50 years after humans reached the Moon none is walking on it anymore. This is going to change quite soon with the ARTEMISA Program, in which the Space Agencies from Europe (ESA), North America (NASA), Japan (JAXA), Canada (CSA), Australia (ASA) and Bolivia (ABAE), are working together.*

**We want to go to the moon! Will you join us?**

*Figure 1: The Earth and The Moon (Credits: https://www.meteorologiaenred.com)*

With your help, we are going to prepare a mission to the Moon (design the trajectory and the dates, build the ship and finally land on the Moon). **Can we count on you?**

*Figure 2: The exploration of the Moon (Credits: https://estandardigital.com )*

# Phase 0

# Work as a team!

If you want to travel to the Moon, you must know that you can't handle this mission alone! Work in teams with 4-5 classmates, each one of you with a clear role. (Tip: The most different the team members think the more qualified the Team)


***Figure** 3: ESA/Kerbal Space misión team (Credits: Kerbal & ESA)*

| **Challenge ID** | | **Number of the Team** | |
|---|---|---|---|

Writer:_____

Responsible for the material: _____

Reader:_____

Spokesperson:_____

Designer: _____

# Paxi and the European Space Agency

## Who is Paxi?

*Hello! My name is Paxi and I come from another planet. I left my ship in orbit and parachuted to Earth to meet you*.

*Figure 4: Who is Paxi?? (Credits: ESA & ESERO)*

If you want to know more about who Paxi is and why he has come to help us, watch the following video: video Who is Paxi?

1. After watching the video, talk to your Team and write who do you think Paxi is.

Paxi represents the European Space Agency that explores the Space for getting knowledge about our Universe and for taking care of our spaceship, the planet Earth. This is the flag for ESA, and if you are from an European country, this is also your flag!!


***Figure 5:*** *ESA flag on the ESA astronaut's suit (Credits: ESA)*

¿How many countries do you think that work together (as a Team) in ESA? (Tip: Count the number of flags in Figure 5)

¿Do you recognize the flag of your country? And from where are the rest of the flags?

If you want to know some of the things ESA does, watch these videos:

- The amazing adventures of Rosetta and Philae
- The epic adventures of BepiColombo

# Phase 1

# Activity 1: Refresh concepts

*Figure 6: Paxi (Credits: ESA)*

| | |
|---|---|
| Paxi and the Solar System | video 1 |
| Paxi - Day, night, and the seasons | video 2 |
| Paxi and Our Moon: Phases and Eclipses | video 3 |
| Units of Time | video 4 |

# Activity 2: The Moon

## Activity 2.1: Basic info

What do you know about the Moon? (Tip: You can write all what you have learnt before)

## Activity 2.2: Distance

**Can you imagine how far (in meters) is the Moon from the Earth?** Write down the number of meters that you think are between the Earth and the Moon

Do you think that the Moon and Earth will always be at the same distance?

*Figure 7: Distance Moon-Earth (Credits: https://www.meteorologiaenred.com)*

## Activity 2.3: The phases of the Moon

Have you ever stare at the night sky and see that the Moon is round Moon, but in others nights it looks like a letter "C" or a "D"? However, other nights you do not see the Moon. **Do you know why?** (Tip: If you paid attention to the videos of Paxi before you know the answer for sure!)

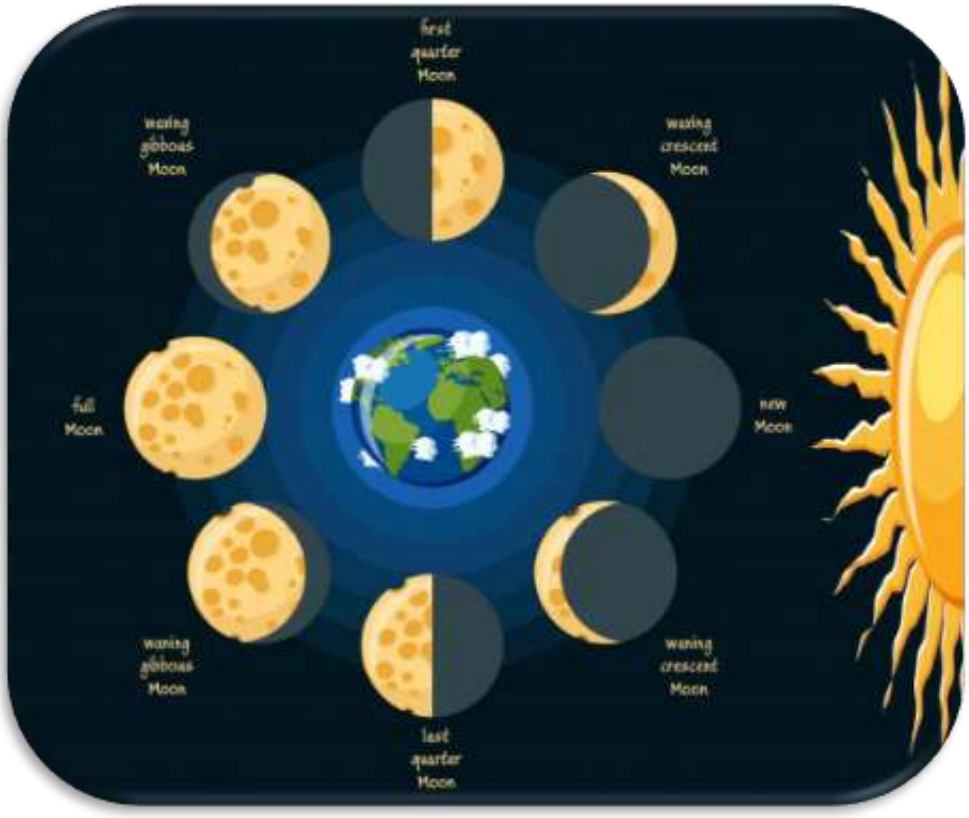



*Figure 8: Phases of the Moon (Credits: https://www.freepik.es )*

## Activity 2.4: The Story of the Moon

*Figure 9: The Moon (Credits: https://www.geoenciclopedia.com/luna/)*

How do you think that the Moon was born? How long do you think it has been spinning around the Earth? **Tell us a story about "how do you think" or "how would you like" the Moon would appeared:**

## Activity 2.5: Why is the Moon super important to the Earth?

# Activity 3: Exploring the Moon

## Activity 3.1: Paxi explores the moon

Watch this video and accompany Paxi to explore the moon. Video


*Figure 10: Paxi en el espacio (Credits: https://www.esa.int/kids/es/Quien_es/Paxi)*

What would you need to live on the Moon?

Why does the Moon have so many holes (we call it craters) on its face? How do you think that a crater is originated?

*Figure 11: (Credits: https://www.agenciasinc.es)*

## Activity 3.2: Humans explore the Moon

### *In the past…*

Do you know than humans have ever step on the Moon? If your answer is yes, when was it? (Tip: Ask your elder friends and family members (parents, grandparents, uncle/ant…) to get some information)

*Figure 12: The Earth from the Moon (Credits: https://www.pinterest.es/pin)*

## *Today…*

Do you know if there is any mission now on the Moon?

- Tip: You may ask your friends, family members and classmates

*Figure 13: Lunar Reconnaissance Orbiter (Credits: NASA/)*

## *The future. Artemis Program.*

The Artemis mission wants to re-explore the Moon and bring the first woman and man, in the year 2024.

Also with this mission, ESA, NASA and other Space Agencies together, will build a Moon base to study how humans behave. If all the mission is successful humans could be sent to Mars in 2030. **Would you like to be part of their space crew?**

*Figure14: The first Women in the Moon (Credits: NASA/)*

Think about how would be to live on the Moon? (Tip: You can watch again this video about Paxi explores the Moon)

Do you think that it could be like A or B?

| | |
|---|---|
|  | ☐ A |
|  | ☐ B |

## Activity 4: What do you know about the Moon?

To find out what you have learned so far answer this questionnaire

# Phase 2

*Figure 15: Apollo 11 (Credits: https://ecodiario.eleconomista.es/)*

# Phase 3

# Preparations and Moon Arrival.

At this stage you are already an expert on the Moon. Let's start then to prepare our mission to the Moon!

1. Take 2 minutes to imagine how this experience could be with this Trailer of the movie "Fly me to the Moon"
2. As in the European Space Agency, each group is going to solve one of the keys (Activities) for going to the Moon. Your teacher will support you in what is your task for succeed together in this Challenge!

## Activity 6: What would you take to the Moon?

### Material to be used:

- Pencils, paper, rubber.
- Scissors
- Glue
- Cut-out
- Color pencils

### Procedure

**Step 1**. As the Moon is very different from our Planet, we need first to find the main differences among these two world. Let's try it!

| Ideas | Earth | Moon |
|---|---|---|
| **Can I breath there?** | | |
| **Can I drink there? (potable water)** | | |
| **Can I walk there?** | | |
| **How do I dress there? (clothes)** | | |

**Step 2.** Imagine that you are one of the astronauts that will go to the Moon. What things, objects. .. Would we carry in your spaceship?

**Written version:**

Write a list of important things you would take on your trip. Then round off with a green circle the things you think are necessary:

**Step 3. Congratulations!** We have already a luggage list!

- Choose from your list (here your list) what would take to the Moon?
- Paste or draw it in the table ONLY 6 of the cutouts
- Order your list in by importance, being 1 the most important item and 6 the least important one to bring to the Moon

(Tip: You know that in the spaceships you can only carry with what is necessary, it does not fit and it is heavy)

| | | | |
|---|---|---|---|
| 1 | | 2 | |
| 3 | | 4 | |
| 5 | | 6 | |

# Activity 7: Book your flight tickets to the Moon!

## Required material:

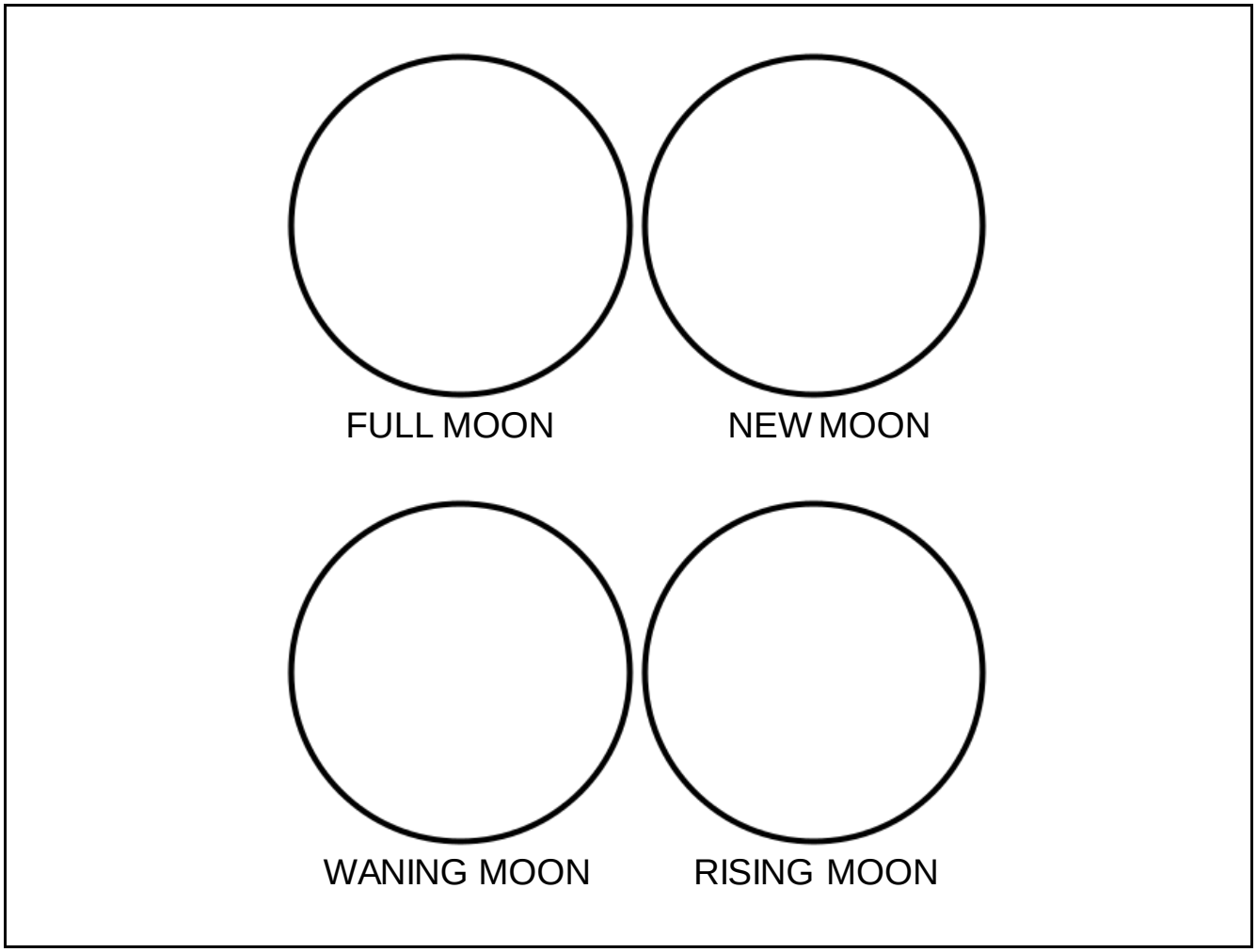
- Pencils, paper, rubber.
- Color pencils

## Procedure (Instructions/steps to follow)

**Step1. Look at the Moon**

As we studied in Activity 2.3, the Moon can have different shapes (amount of illuminated area) when we observe it from the Earth.

1. Draw with the pencil, in dark, the following circles to indicate the various phases of the Moon



2. Join the left and right sentences

| | |
|---|---|
| • When I see full moon, the Sun<br>• When I see wining moon,<br>• When I see a rising moon<br>• When I see a new moon (don't see it) | • The face of the moon that I see is completely illuminated<br>• The face of the moon that I see is only partly illuminated<br>• The face of the Moon that I see is not illuminated |

**Step 2**. Where should I land my spaceship on the Moon?
We should think about whether we want to get to the Moon when it's there by day (full Moon), by night (new Moon), or something in between (waning or rising). Think of the batteries as being charged by sunlight and also giving us the warmth of the day.

| |
|---|
| |

**Step 3.** How long will the trip from Earth to the Moon last?

We have calculated that the trip will take 5 days. So we have to look at the following lunar calendar to know what day we are going to leave the Earth and what day we will arrive, taking into account the Moon that we have just colored.

- Let's have a look at the following lunar calendar to know
  - **What day we are going to leave the Earth**?
  - What day we will arrive?
  - Note: take into account the Moon phase when you want to land that we have just colored.


*Figure 16: Moon phases (Credits: ESA)*

**Step 4.** Agree with your colleagues on dates and fill in this info

**Date of departure from Earth:** _____

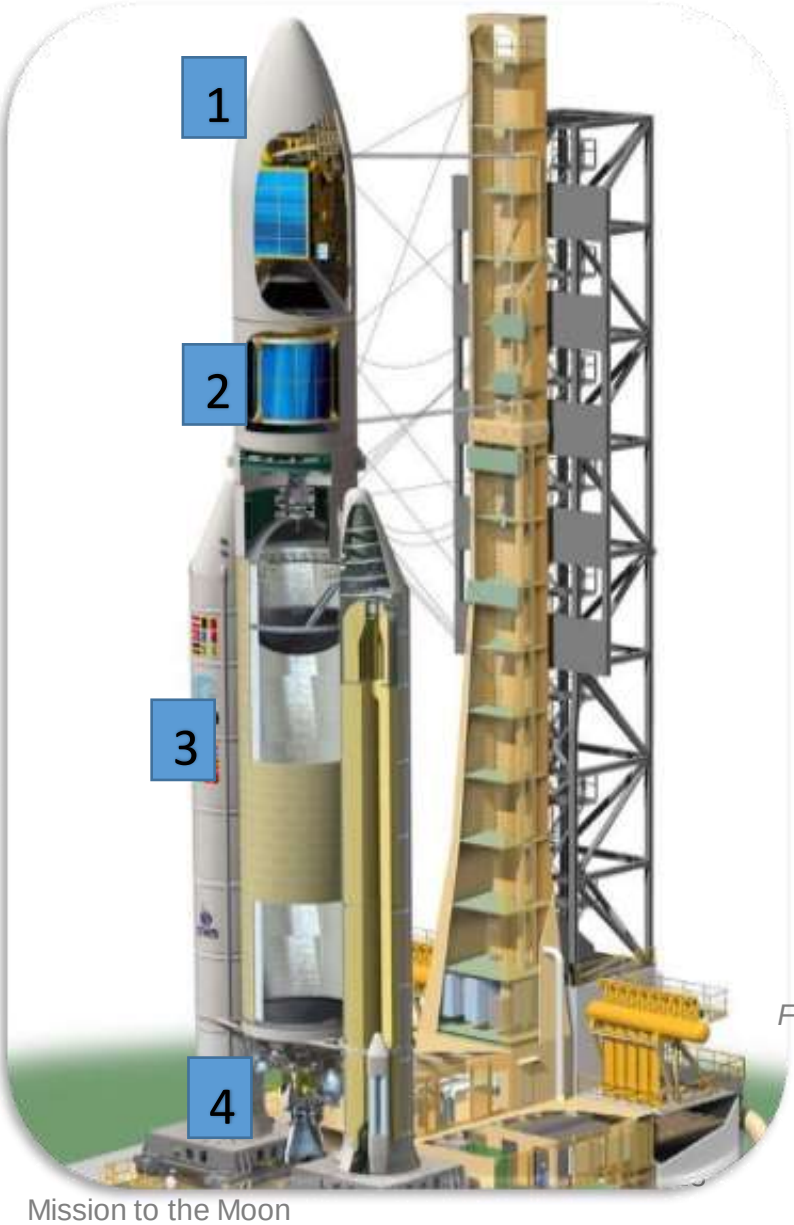
**Date of arrival to the Moon:** _____

## Activity 8: Choose your spaceship fleet!

Rocket and spaceships are not exactly the same. **Do you know why?**

| |
|---|
| |

What shape should the rocket have to take the astronauts to the Moon? Watch this video, it will explain the parts of a rocket and relate the 4 main parts of a rocket learned to the ones you see in this image. Video




| | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |

*Figura 17: Cohete Ariane5 Créditos:* ESA)

Now you know what parts a rocket has. Do you know how many times of rockets are? Look at Figure 18 to see some

## Required material:

- Pencils, paper, rubber.
- Color pencils

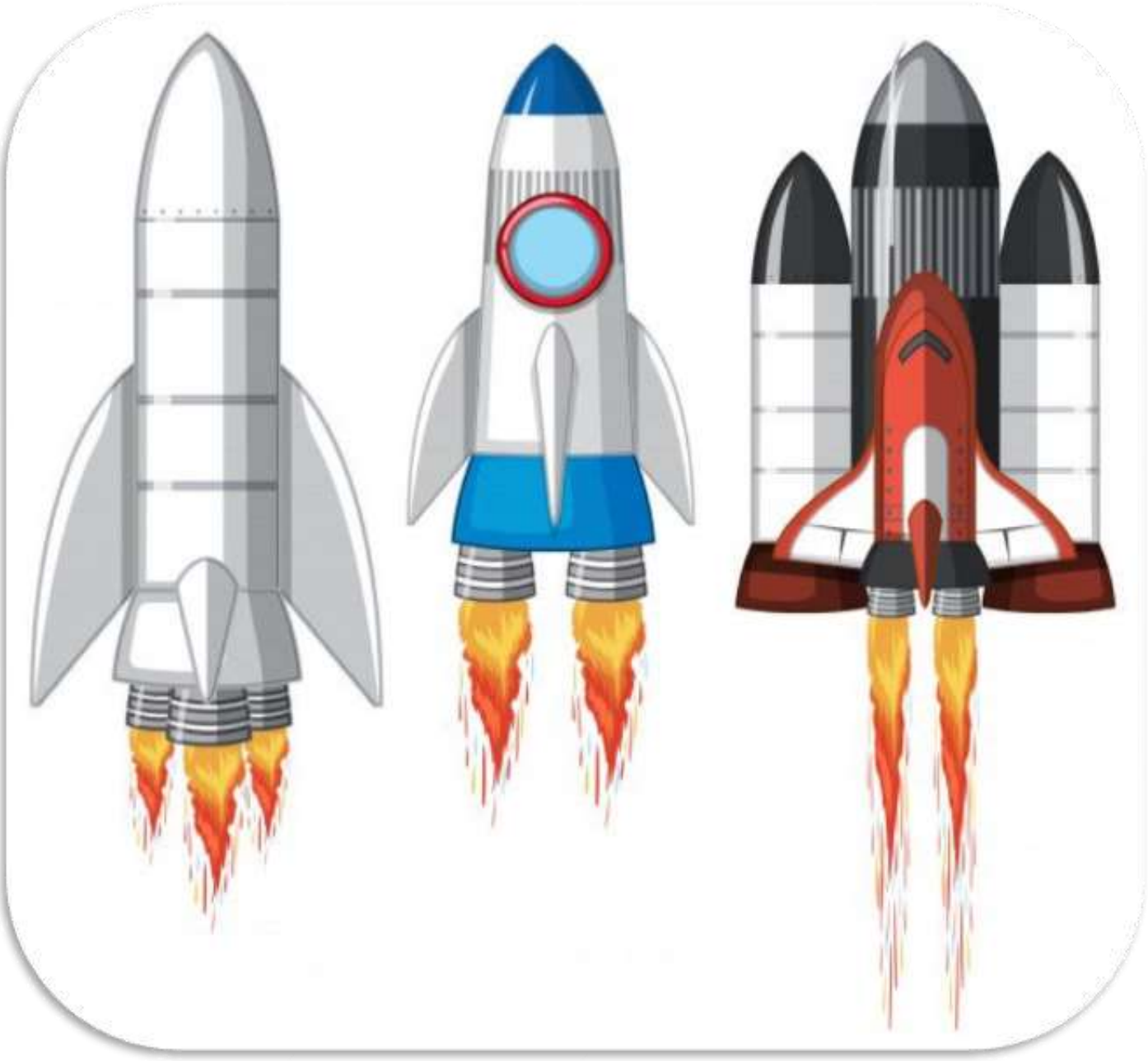


*Figure 18. Types of rockets (Credits: https://www.google.com/imgres*

Look at the examples, use your imagination and **design an incredible rocket** on the outside (before drawing here, you can do dirty drawings on other sheets)

When the rocket is launched several pieces are being detached in different phases (stages) as Figure 19 shows.

*Figura 19. Separación etapas (Créditos: spacex)*

The spaceship (where the astronauts and /or the scientific instruments are located) is in the upper compartment of the rocket (yellow part in Figure 19). With this "small" ship the astronauts must complete their journey and land on the Moon.

How do you imagine it could be **the internal part of your spaceship?? Draw it**!

## Activity 9: Take off

*Figure 20. Ariadne 5 launch (Credits:* ESA*)*

What do you think the launch of a rocket looks like?

Get an idea with this launch simulator here

Watch this video of what the trip in the spacecraft would be like since it was launched from the Earth to the Moon. Video 1

Video 2: Mission Kerbal Space

**Do you know from where in the world ESA launches are made?**

*Figura 21: Lanzamiento Ariadne 5 (Créditos:*https://www.youtube. *)*

# Activity10: Arrival. Where to land and why

Not all places on the Moon are the same, and it is important to decide where it is best to land.

## Required material:

- Pencils, paper, rubber.
- Color pencils

## Procedure

**Step 1.** Look at the map and think about which conditions you think are important to choose where to land, and which will be the best area. You can help yourself from this video


- http://cesar.esa.int/upload/201902/mapaluna.pdf

**Step 2.** Look at the map and mark three places that seem very different to you. Then, let's write down what we think we might find there:

**Step 3.** Now it is time to decide among yourselves which of the places is the best to land on the moon. Explain why you have chosen that place for the moon landing**:**

## Activity 11: Moon landing in 3, 2, 1...

**Can you imagine what the Apollo 11 moon landing looked like? Video Apollo 11**

Play with this simulator, try to land on the moon without destroying your ship!
Game


*Figure 23: Game (Credits https://phet.colorado.edu/sims/lunar-lander/lunar-lander_en.html )*

## Activity 12: Build a base on the Moon

Imagine that we have finally arrived with our space rocket.

**Step 1.** What do you imagine the Moon will look like? What would you like to find there? Let's draw it!

**Step 2.** Build a Colony on the Moon

Draw what your Moon Colony would look like, create a Base with everything you need to live

- If you need inspiration, check out this video
- EXAMPLES ESA ‘’Moon Camp’’
- Play with this interactive presentation of what your house on the moon would look like GAME

## Activity 13: Safe trip back

Think about this … would it be more difficult to leave the Moon than the Earth with a rocket? If so, could it be easier or not to go from the Moon to other planets like Mars?

What would you bring back home, if anything, to be analyzed?

What experiments do you think you should do on the Earth before going again? Would you like to go often to the Moon as a 2nd house?

# Phase 4

# Congratulations!
# You have completed your Science Challenge!
# Tell us your story!

Stop to think about the Experience with your Team and teacher and complete these Activities.

## Activity14: Congratulations! You have achieved your goal

- **Teams:** Fill in this questionnaire so that you can check what you have learned in the Challenge.
- **With your teacher:** Give us your feedback

## Activity 15: Present your results

Students will have to create a final product (an A0 poster in pdf format, using power point, for example) showing what they have learned in the different phases of the Scientific Challenge.

This poster is the ticket to participate in the CESAR international adventure competition.

# Links

## Phase 0:

- **VIDEOS:**

- https://www.youtube.com/watch?v=fYa-hmNzlAQ&list=PLbyvawxScNbucdsnNdB9p89RmePmGv5cM&index=14
- https://www.youtube.com/watch?v=HD2zrF3I_II
- https://www.youtube.com/watch?v=MKEcanjC0eM

- **WEBS:**
- **http://esero.es/**
- **https://www.esa.int/**
    - **https://www.esa.int/kids/es/Home**

## Phase 1:

- **VIDEOS:**

- https://www.youtube.com/watch?v=mibxJwpennU&list=PLbyvawxScNbucdsnNdB9p89RmePmGv5cM&index=12
- https://www.youtube.com/watch?v=TagG32gwiBo&list=PLbyvawxScNbucdsnNdB9p89RmePmGv5cM&index=7
- https://www.youtube.com/watch?v=w4U_cuF-_hI&list=PLbyvawxScNbucdsnNdB9p89RmePmGv5cM&index=4
- https://www.youtube.com/watch?v=zjz_rcia79Y
- https://www.youtube.com/watch?v=PxqltnER8E4
- https://www.youtube.com/watch?v=w4U_cuF-_hI&list=PLbyvawxScNbucdsnNdB9p89RmePmGv5cM&index=4

- **APP/JUEGO/CUESTIONARIO:**

- **https://create.kahoot.it/share/ee9504a3-0243-41d2-aa2f-7c95f4b28092**

- **WEBS:**

- https://www.meteorologiaenred.com/distancia-de-la-tierra-y-la-luna.html
- https://www.freepik.es/vector-premium/diagrama-fases-luna-basica_3785117.htm
- https://spaceplace.nasa.gov/seasons/sp/
- https://www.nasa.gov/

## Phase 2

## Phase 3

- **VIDEOS:**
- https://www.youtube.com/watch?v=a1smyXGnZao

- https://www.youtube.com/watch?v=lPmaBlf94lc
- https://www.youtube.com/watch?v=L_0QxcDNuM0
- https://www.youtube.com/watch?v=EjOgdBm1dqc&feature=youtu.be
- https://www.youtube.com/watch?v=tpLrp0SW8yg
- https://www.youtube.com/watch?v=h5X3CTfShyE&feature=youtu.be

- **APP/JUEGO/CUESTIONARIO:**
- https://www.menti.com/45i9qv5roc
- http://cesar.esa.int/upload/201902/recortables_mision_a_la_luna.pdf
- https://www.sciencelearn.org.nz/embeds/132-rocket-launch-challenge
- https://create.kahoot.it/share/4fb4146d-32a7-4f37-8ff4-f5633e8ad704
- https://phet.colorado.edu/sims/lunar-lander/lunar-lander_en.html
- https://www.airbus.com/company/sustainability/airbus-foundation/discovery-space/kids/mission-to-the-moon.html
- **WEBS:**
- http://cesar.esa.int/upload/201902/mapaluna.pdf
- https://mooncampchallenge.org/moon-camp-discovery/
- http://esero.es/eventos/moon-camp/

Phase 4:

- **APP/JUEGO/CUESTIONARIO:**
  - Cuestionario: http://cesar.esa.int/form.php?Id=14&k=qw9AN7nVmx&ChangeLang=en

# Credits:

Material prepared to be executed on-line, based on previous activities developed by the ESASky Team in collaboration with CESAR and Planeta Ciencias in collaboration with CESAR, under the initiative and coordination of the European Space Agency within the framework of the CESAR programme.

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