



PLANET  
CHANGE

# Space Hazards: Space debris

Answer sheet  
ECF level 2



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**Planet change** is the short name of an EU Erasmus+ project aimed at VET teachers and their students. With small activities, the idea is to create awareness about sustainability and acquire 21st century skills. All this is done in a technical context, mostly from space technology.

[www.planetchange.eu](https://www.planetchange.eu)



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# 1. Space pollution exploration

1. What colors do the objects have? Name the four colors in the table below.
2. What category does each color correspond to? Add the categories in the table below.

<i>Color</i>	<i>Category</i>
<i>Red</i>	<i>Satellite</i>
<i>Blue</i>	<i>Rocket body</i>
<i>Grey</i>	<i>Grey</i>
<i>Yellow</i>	<i>Unknown</i>

3. Do you think the objects in the category 'rocket body' are also space debris? Why?
  - a. No, because the rocket bodies that are discarded during space missions always fall back to Earth
  - b. No, because the rocket bodies are from active rockets
  - c. Yes, because the rocket bodies are defunct satellites
  - d. Yes, because the rocket bodies are discarded during space missions in space and stay in orbit until they can fall back to Earth**

Hover over 'Groups' in the upper-left corner of the screen and click on 'GPS'.

4. What do the blue lines represent?
  - a. The number of satellites in the same orbit
  - b. The trajectory of the satellite**
  - c. The altitude of the satellite

Click on the black background to see all objects again. Zoom in on the country you live in.

5. Over the next 30 seconds, count the objects that fly through the airspace directly above the country. How many objects have been there?

Any number.

6. Click on one of the objects. Fill in the table below.

Example:

<i><b>Name of object</b></i>	<i>SL-8 DEB</i>
<i><b>Type of object</b></i>	<i>Debris</i>
<i><b>Speed</b></i>	<i>7.06 km/s</i>
<i><b>Altitude</b></i>	<i>1631.50 km</i>



Right now, there are around 36,500 pieces of space debris larger than 10 cm in orbit around the Earth. This number will increase over the years.

7. Why will this number increase over time?
  - a. Humanity will keep sending stuff into space
  - b. During space missions, parts of the systems may be lost intentionally or by accident
  - c. Objects in space may collide with each other and shatter
  - d. **All of the above**





## 2. Collisions in space

Investigate the 2009 collision between two satellites, Iridium 33 and Kosmos 2251.

You can search the internet to find answers to the questions below.

*During this assignment, the students may find various answers. The answers below are an indication originating from a variety of sources.*

1. How many pieces of debris larger than 10 cm were produced by the collision?
  - a. 700
  - b. 1000
  - c. **2000**

*Ten days after the collision, NASA estimated the collision created 1000 pieces of debris larger than 10 cm. In reality this would be more, as pieces smaller than 10 cm were more difficult to detect.*

*In July 2010, the U.S. Space Surveillance Network (SNN) reported that almost 2000 pieces of debris larger than 10 cm were produced by the collision.*

*Over time some pieces fell back to Earth. However, at least 1000 pieces of debris remain in space as of 2023 according to the U.S. Space Surveillance Network (SNN).*

Satellites carry a lot of equipment and can get quite heavy. Iridium 33 was 689 kg when it crashed with the 900 kg heavy Kosmos 2251. But mass is not the only factor that has an impact on a collision.

2. Circle all factors that also have an impact on collision:
  - a. **Velocity**
  - b. Electric current
  - c. Temperature
  - d. **Size of the objects**

3. What do you think happens if a large piece of debris from this collision hits another satellite?

Hint: Look at the speed of one of the pieces on <https://sky.rogue.space>

- a. **The collision will shatter the satellite, because of the high speed of both objects.**
- b. The piece of debris will bounce off the satellite, because the satellite is made from strong material.
- c. The piece of debris will make a small dent in the satellite but does no further harm.

*If two large pieces of debris hit each other at the indicated speed, the objects will shatter upon impact. This results in more debris.*



### 3. Space junk near Earth

Watch the following video: [Journey back to Earth / Aeolus' historic reentry](#)

Answer the questions below.

**What method mentioned in the video would you like to use? Why?**

In orbit refueling, \_\_\_\_\_

\_\_\_\_\_

Controlled reentry, \_\_\_\_\_

\_\_\_\_\_

**Which two methods of the following would you NOT use?**

Use a satellite to catch debris and deorbit the satellite and debris

Blow up the satellite into smaller chunks with lasers

Make the material of the satellite stronger to prevent breakage

Use powerful magnets to catch space debris

**Which method would you like to introduce?**

Make satellite disposal a mandatory part of production

Get rid of unstable fuel in the satellite to prevent explosions

Employ more sensors to monitor space debris traffic

