

namazu contest

Episode 3 – Questions issued on 21/01/22 ; answers due on or before the 27/03/2022 to namazu@geoazur.unice.fr

Part I – Questions to start the year off right!

During this part, we will dive into this year 2022 which begins...

Q1. To begin indeed this year, a film with Leonardo DiCaprio and Jennifer Lawrence has a great success (“Don’t look up”). In this film, a stellar object is heading straight for Earth. However, NASA is seriously working on this threat and in September 2022, the DART mission will aim to deflect an asteroid for the first time.



What method will it use?

- Cause a nuclear explosion that will fragment the object
- Cause a nuclear explosion near the object to make it change its course
- Divert the course of the object thanks to a gravitational force between it and a spacecraft.
- Launch a spacecraft against the asteroid to change its course.



Q2. What will be the date on which the Earth will be farthest from the Sun during the year 2022:

Date: _____

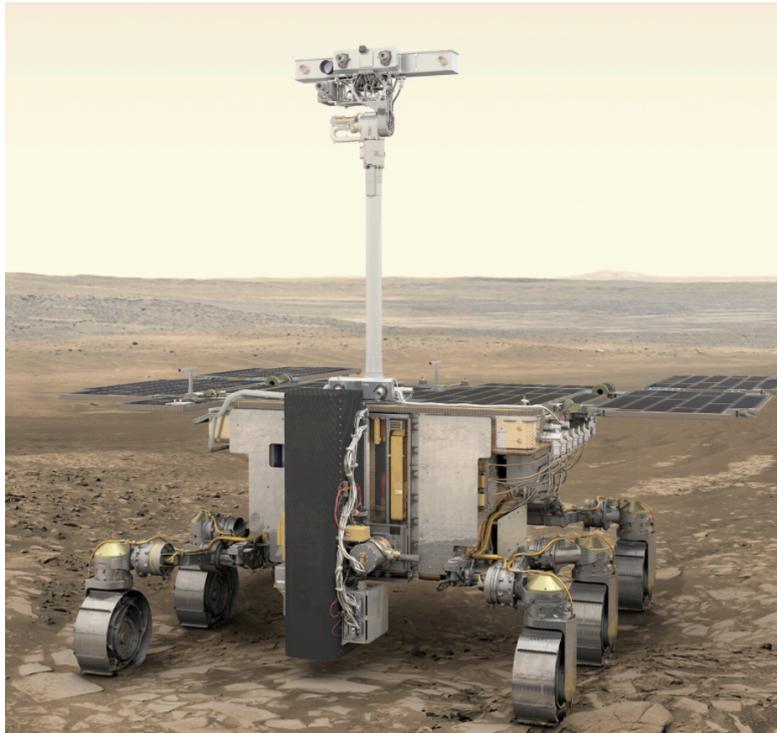


Q3. In August 2022, the Psyche mission should be launched and its purpose is to study a metallic asteroid from an ancient protoplanet. To which part of this ancient protoplanet does this asteroid correspond?

- The crust
- The coat
- The core
- We do not know



Q4. Another mission will take off in 2022 and the rover below will be the star. It's up to you to find out its name, and why it was so named.



Q5. In early January, InSight had to be put on hold for a few days. What is the cause ?

- A computer bug due to the passage in 2022
- Loss of communication due to strong solar wind
- Too much ground shaking
- A sandstorm reducing its energy production



Q6. In February 2022, the Artemis mission will begin. What is the objective ?

- Discover life on Mars
- Exploit the limits of the solar system
- Bring Man back to the Moon before aiming for Mars
- Communicate with aliens

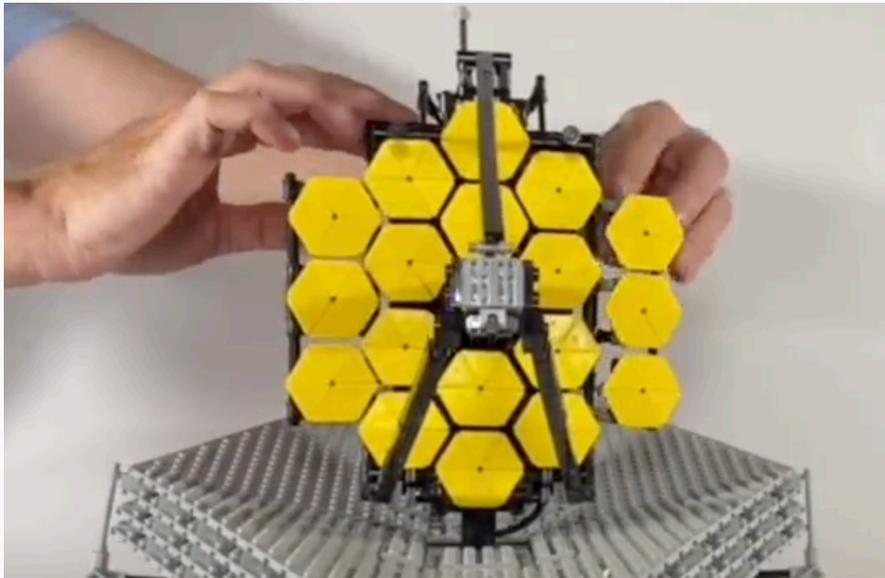


Q7. Will there be a solar eclipse visible from France in 2022?

- Yes, an eclipse that will be total
- Yes, an eclipse that will be partial
- No
- We can't know yet



Q8. A brick and space fan made the build below. What is it like ?



- At the James-Webb Space Telescope
- At the InSight solar panels
- Has an Apollo Saturn V reactor
- At the Mars 2020 SuperCam



Q9. How many total lunar eclipses will take place in mainland France in 2022 and when will they take place?

Number of total eclipses: _____

Date(s): _____

Part II – Pi in space

Collecting samples from an asteroid, calculating the speed of a seismic wave on Mars, understanding the formation of Martian craters... These are problems that scientists are trying to answer using the number pi.

And Monday, March 14, is the day of the number pi!

Exercise 1

NASA's OSIRIS-Rex mission was designed to travel to an asteroid called Bennu and bring a small sample back to Earth for further study. To accomplish its mission, the spacecraft had to come into contact with 26 cm² of the surface of the asteroid Bennu and collect particles of millimeter size using its "contact samplers". They are circular pads of 1.5 cm in diameter in Velcro type stainless steel. There are 24 pads on the mechanism designed to collect samples.



How many pads are needed to come into contact with the surface of Bennu in order to meet the requirements of the mission?



If all 24 pads were in contact with Bennu, what asteroid surface would the contact pads sample?

Exercise 2.

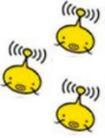
During a seismic event on Mars, or a "Marsquake", a type of seismic wave called surface waves propagate from the epicenter, across the planet in all directions. Scientists expect these surface waves to arrive at the InSight lander, designed to study marsquakes, at three different times:

R1, when the first wave arrives, having traveled the shortest distance from the epicenter to the lander;

R2, when the second wave arrives, after having traveled Mars in the other direction;

and R3, when the first wave arrives at the lander again, having circled Mars.

Imagine that InSight records the vibrations of a Marsquake at the Earth times shown in the diagram.



What is the velocity (U) in rad/s of the surface wave, the distance in radians on the InSight sphere to the epicenter (Δ), and the time the marsquake occurred (t_0) ?

$$U = \frac{2\pi}{(R_3 - R_1)}$$
$$\Delta = \pi - \frac{U(R_2 - R_1)}{2}$$
$$t_0 = R_1 - \frac{\Delta}{U}$$



Exercise 3.

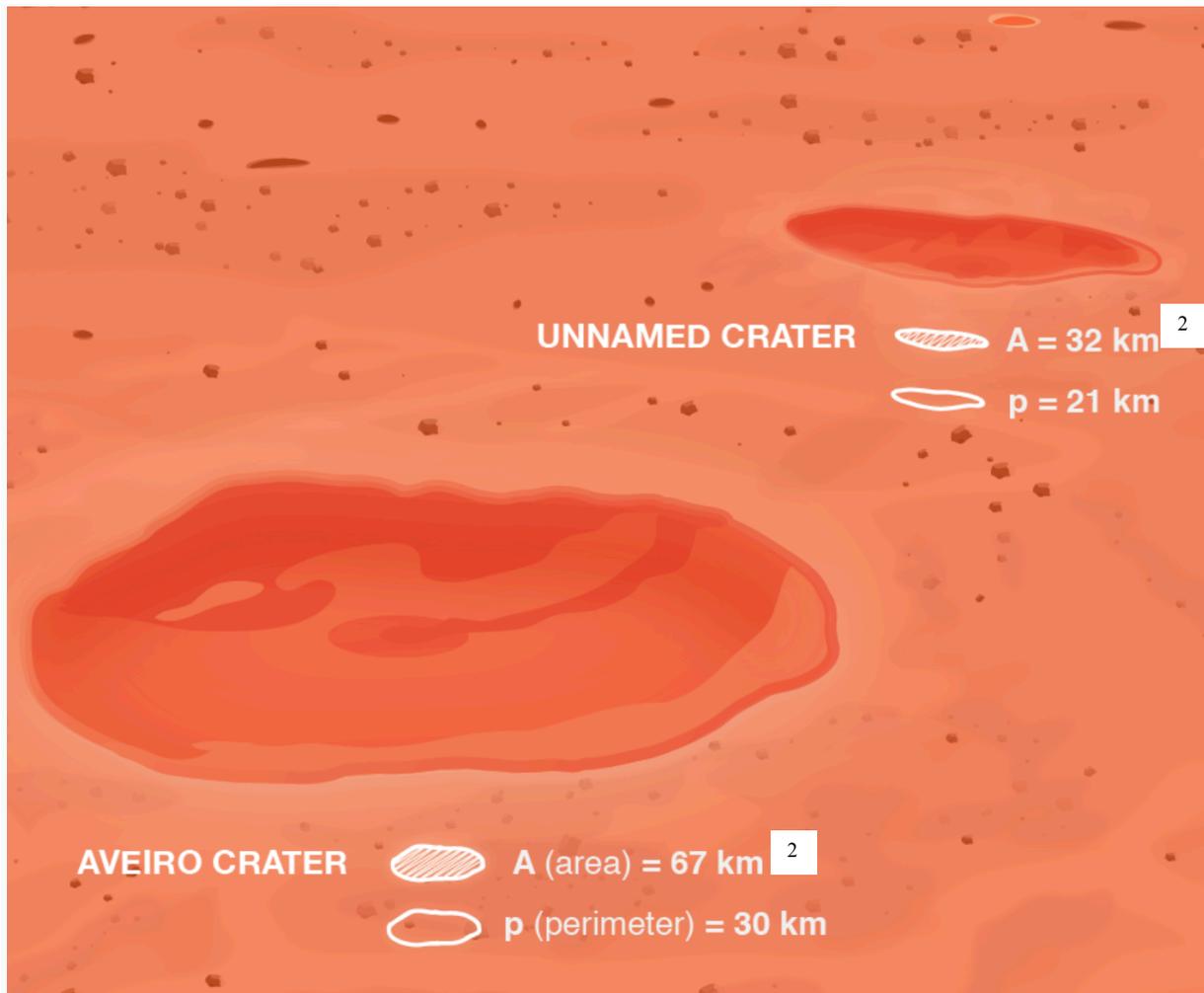
Craters form when an object hits the surface of a planet or other body. The impact creates a round impression surrounded by material, called ejecta, that gets blasted out of the crater. Scientists study ejecta because it contains clues about what's below a planet's surface. When an object hits Mars at an angle under 20 degrees, the crater is less circular and the ejecta settles in a butterfly shape. Some areas around the crater contain no blast material. Finding craters that formed this way can help scientist understand how meteor impacts change the surface of a planet. To do this, they measure a crater's circularity ratio. If the ratio is less than 0,925, it suggests that an object impacted at an angle under 20 degrees and created a butterfly ejecta pattern.



Using the circularity ratio formula, determine which of the craters shown here would have the butterfly ejecta pattern

Circularity ratio formula:

$$\frac{4\pi A}{P^2}$$



Part III – The weather at the Insight and Curiosity sites

Curiosity is the name of the rover that is part of the Mars Science Laboratory (MSL) space exploration mission developed by the Jet Propulsion Laboratory (JPL) associated with NASA. It landed on Mars on August 6, 2012 with 75 km of scientific equipment on board. As for InSight, the number of days passed since its landing is counted in sols. The initial duration of the mission was planned for 669 sols, or 2 Earth years, but Curiosity enjoys exceptional longevity since the rover is now at more than 3360 sols, or more than 9 Earth years of activity! And the mission is still not over!

In this part, we suggest that you locate the Curiosity rover on Marsview, learn about the characteristics of its mission, then compare two atmospheric parameters on the InSight and Curiosity sites.

Activity on Marsview:



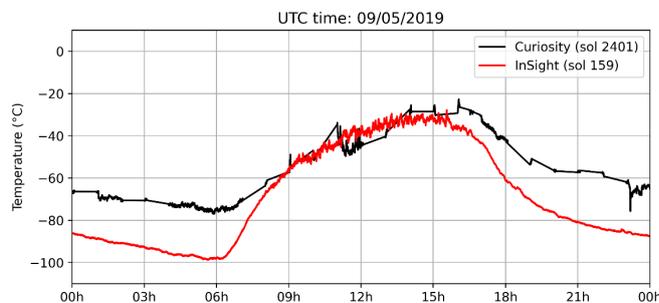
Q1. Find the Curiosity rover on Marsview (<http://namazu.unice.fr/marsview/>) by checking the “other landers” box in the left menu. With the circle, estimate the distance between InSight and Curiosity in km and give the name of the landing site.

Distance InSight-Curiosity: _____
Landing site name: _____

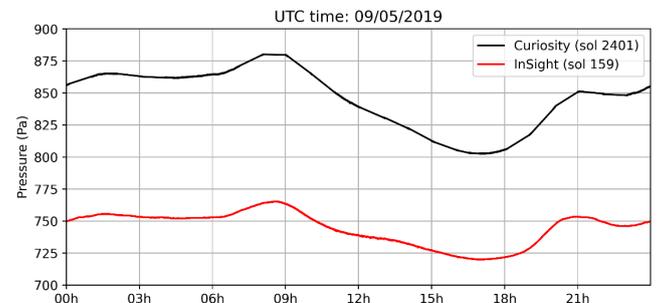


Q2. On Marsview, by clicking on the icons of the rover and certain places, you can access information about them. What were the objectives of the Curiosity rover? Why was this landing site chosen?

Comparison of atmospheric parameters:



Comparaison de la température.



Comparaison de la pression.

Above you can see two graphs comparing the temperature and pressure at the InSight and Curiosity sites during a Martian day over 24 hours (LMST time). This data was recorded by the weather sensors installed on board the landers during sol 159 for InSight, which corresponds to sol 2401 of the Curiosity mission. The temperature unit is the degree Celsius noted °C and that of the pressure is the Pascal noted Pa.



Q3. In which season was the planet Mars during sol 159 of the InSight mission? You can use the interactive diagram offered on the InSight Education website in the “Data” tab (<https://insight.oca.eu/fr/data-insight>).

Season: _____

Temperature :



Q4. During InSight sol 159, what was the approximate temperature difference between the InSight and Curiosity sites at 3am? at 3 p.m.?

3am: _____

3 p.m.: _____



Q5. Are temperature variations between day and night more important for InSight or for Curiosity?

- InSight
- Curiosity



Q6. What is the approximate temperature difference between 6 a.m. and 3 p.m. at the two sites?

InSight: _____

Curiosity: _____



Q7. Why are the temperature variations between day and night so important at these two sites? (only one answer possible)

- During the day, warm winds coming from the poles sweep the places where the landers are located
- The very thin atmosphere of Mars is not enough to keep the heat during the night
- At night, snowfall cools the atmosphere
- During the day, pressurized fluids pierce the ground like geysers and heat the atmosphere

Pressure :



Q8. What is the approximate average pressure difference between the InSight and Curiosity sites in Pascal (Pa)?



Q9. Where is the pressure the highest?

- InSight site
- Curiosity site



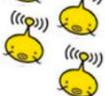
Q10. Bonus question:

Based on these two graphs, what can be said about the relationship between pressure and temperature?

PART IV – Mystery Video.



As with every Namazu challenge, here is a video in which a question is asked.



This time, it's Raphael Garcia, ISAE-SUPAERO, working on the InSight mission who asks you.

Video link: <https://youtu.be/FxrMbKzihOA>

PART V – We are on Mars!

You probably know that some people think that humans will one day be able to live on Mars. Your challenge will be to visualize this objective and to make a model of a Martian base.

The goal is big and requires knowledge, reasoning and imagination.

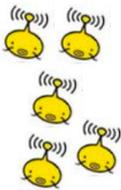
You will have two support options:

- A "real" model which must be limited to a space of 50 cm on each side

Or

- A virtual model via Minecraft or via another digital medium of your choice.

You will also produce and send a video showing your production, and in which you will justify the choices you have made in the realization of your Martian base.



The models will then be posted on social media and those that receive the most votes will earn bonus points.

1st model 

2nd model 

3rd model 