

Episode 3 – Questions issued on 11/01/21 ; answers due on or before the 17/03/2021 to namazu@geoazur.unice.fr

Part I - Mars, again and again.

Choose the correct response(s) or answer the short questions.



Q1. Mount Olympus rises to 21,229m on Mars, whilst Mount Everest rises to only 8849m on Earth. What is the cause or causes of this difference between the two?

- As erosion is very strong on Earth, Mount Everest cannot peak at an altitude comparable to that of Mount Olympus.
- With the absence of plate tectonics on Mars, Mt Olympus is much older than any terrestrial volcano and is built by much more magma.
- Less gravity on Mars allows magma to be expelled to greater heights than on Earth
- We do not know



Q2. On July 20, 1969, Mankind first set foot on the moon. In the pictures we can see the astronauts hopping around (https://www.youtube.com/watch?v=Ptx_c7g4Lsg). If we ever set foot on Mars, could we leap the same way?

- Yes, because the gravity on the Moon and on Mars is the same
- Yes, but a little less easily because the gravity of Mars is between that of the Moon and that of the Earth
- No, because the gravity of Mars is much greater than that of the Earth because of its atmosphere rich in CO₂.
- We don't know until we set foot on Mars



Q3. A little physics. If I take 100g of rock fragment to Mars, this rock fragment would then have:

- A mass of 100g and a weight of 0.37N
- A mass of 372g and a weight of 100N
- A mass of 100g and a weight of 100N
- A mass of 372g and a weight of 0.37N



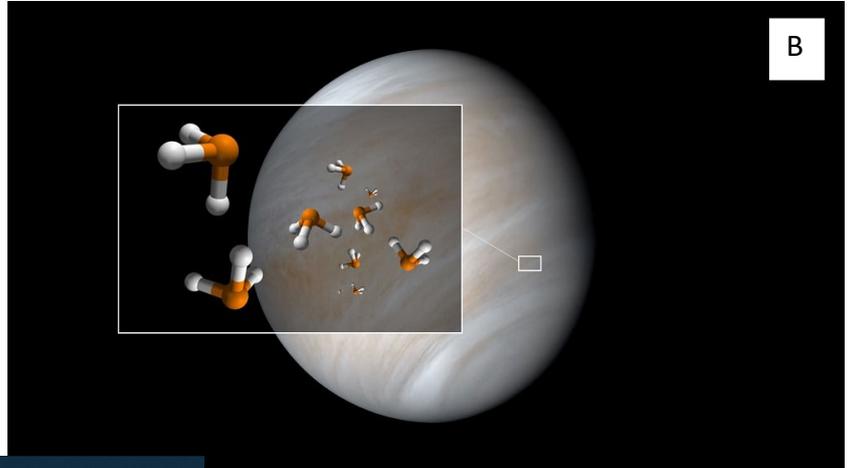
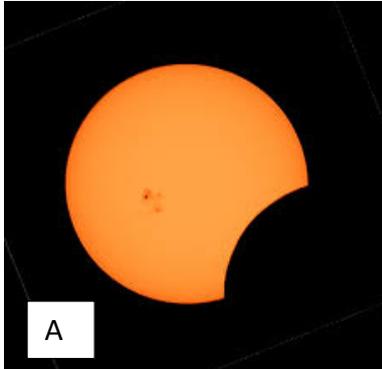
Q4. Suppose you were born on Mars and knowing that Mars takes 687 days to make its revolution around the Sun. What would your Martian age be ?

Your earth age: _____.

Your Martian age: _____



Q5. Let's go back to several major astronomical moments in 2020. For each of the photographs below, name the phenomenon related to it.



A :
 B:
 C :
 D:

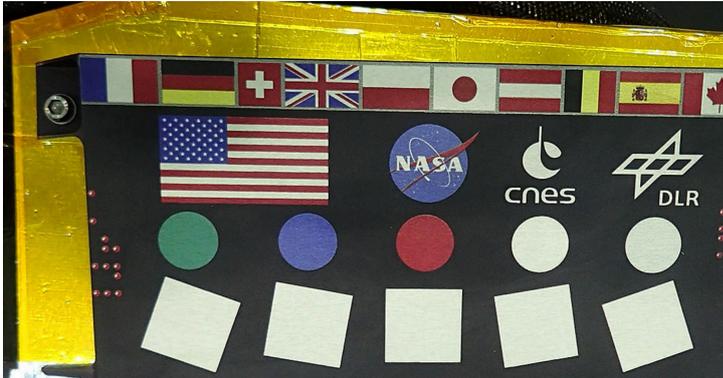


Q6. InSight has not recorded any marsquakes for a few months now. What may be the hypothesis?

- The Martian wind is responsible for too many vibrations, which obscures the marsquakes in the SEIS recordings
- Marsquakes are certainly due to collapses of the ice sheet which melted during the Martian summer
- InSight's batteries are too weakly charged by its solar panels to record
- The marsquakes seem to be created by meteor showers and they will only return in 3 months.



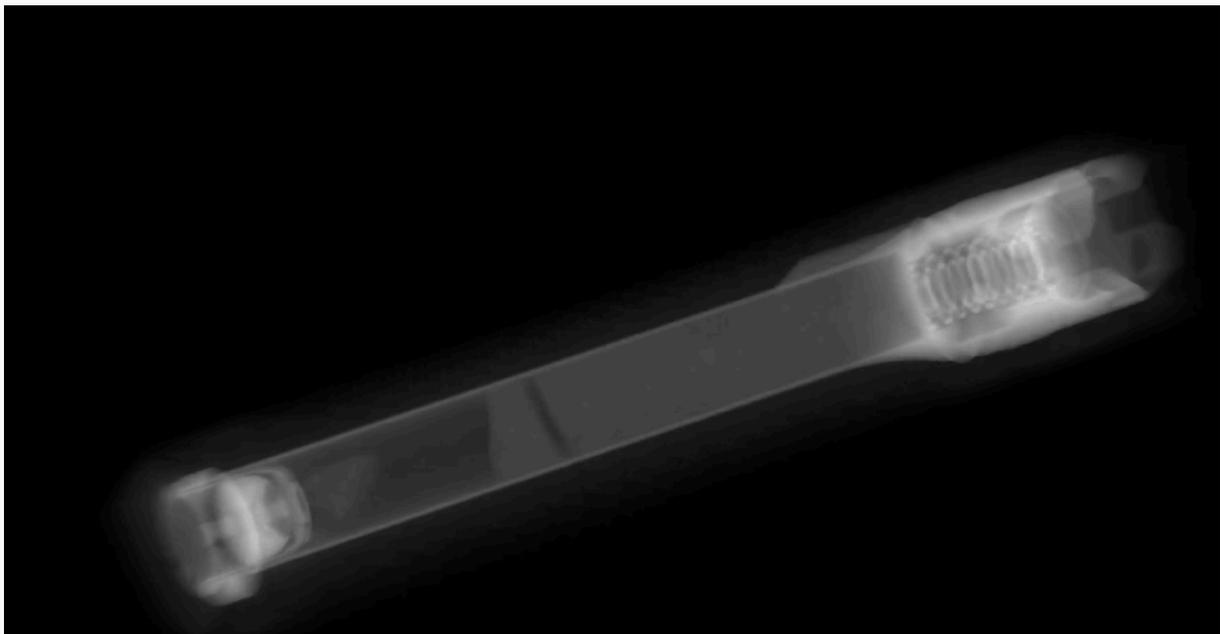
Q7. Here are two photographs of the plates on board the InSight and Mars2020 missions
What are the colored discs used for?



- They symbolize the continents and the unity of the world
- They are used to calibrate optical instruments
- They change color depending on the amount of oxygen present on Mars
- Nothing. They are a tradition.



Q8. What is the mystery item below?



- A shock absorber of a wheel from the Perseverance rover
- The mole of the InSight mission
- A tube from the Mars2020 mission used for storing rock samples
- The SuperCam optical tube from the Mars2020 mission



Q9. What instrument(s) will be attached to Perseverance?

- A weather station that will measure temperature, pressure and wind speed.
- A spectrometer capable of looking for organic compounds in rocks
- A device to produce oxygen
- An even more precise seismometer than that of InSight

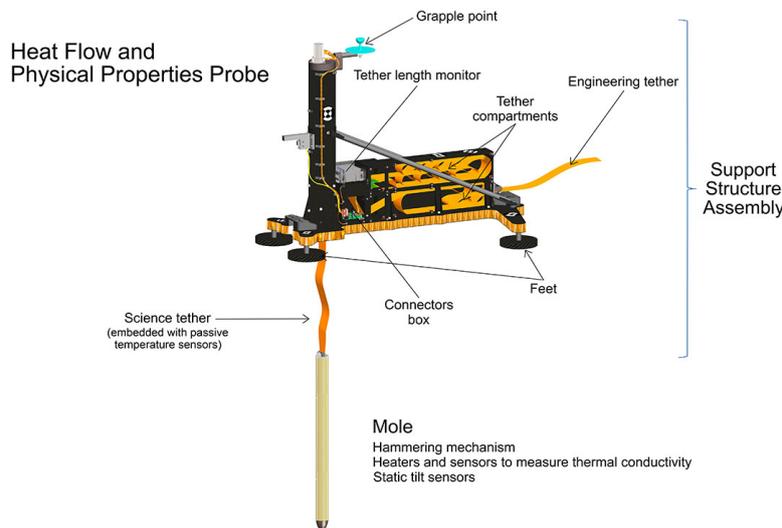


Q10. The Perseverance rover will land on February 18, 2021. When should it return to Earth?

- In about 9 months
- In about 2 years when Mars will be closer to Earth again
- It will leave as soon as it finds organic traces in a sample
- Never

Part II - How to make the mole work?

Below you may perhaps recognize the "mole" or HP3 of the InSight mission.



Video showing describing how the mole works :
<https://www.youtube.com/watch?v=KAxiHK6dYvE>

It is a heat flow sensor which aims to measure the heat given off by the Martian subsoil. The mole had to sink to a depth of 5 meters in order to take measurements without being disturbed by daily and seasonal variations in surface temperature.

As you may know the mole had trouble sinking in and only managed to reach a few inches.

Experiment : For this part, you will have to model the "mole".

Material:

- A transparent and empty 500mL bottle
- An ordinary pen about 15 centimeters long
- About 500g of rice

Protocol:

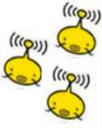
- Cut off the top of the bottle
- Fill the bottle with the rice



- Pack the rice well by tapping the underside of the bottle and filling with as much as possible

- Place the bottle vertically on a table
- Push the pen with the top into the bottle

Your mission is to press the pen so that it touches the bottom of the bottle. You can do this however you want. Today you are the engineers of the InSight mission. Be efficient and imaginative.



Your experiment should be filmed and be accompanied by an explanation of the technique used.

Will HP3 sink in the same way?

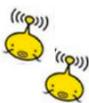
If you do not manage to touch bottom, measure the maximum depth reached.

Part III. Landing of Mars2020!

On February 18, 2021, the Mars2020 mission will land on Martian soil. For this occasion, you will be able to experience this special moment via various websites such as the one of NASA or the one of CNES.



Trailer : https://youtu.be/tITni_HY1Bk



Q1. In order to immortalize this moment, you will need to take a selfie with a photo taken by Rover Perseverance behind you. It's selfie time!

Q2. Once again this year, the Martian landing will be synonymous with "egg" for you. In this experimental part, you will complete the "Egg Drop" challenge ... but this year and you will have to be in contact with another school.

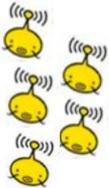
All previous missions have shown that it is not easy to land on Mars. In fact, such a thin atmosphere is of little help in braking the undercarriage before it hits the ground. A smooth arrival is therefore a key step in the success of each mission.

The goal is to drop a raw egg from the first floor and have it land safely a few meters below, and as close as possible to a 20cm x 20cm target!

Your lander must be limited to a dimension of 30 cm x 30 cm x 30 cm maximum. We will have to limit ourselves to recovery equipment. Before the final throw, teams are strongly advised to test their lander (without the egg) several times in order to improve it.

Each lander will be weighed before the throw, timed during the throw, and the distance from the landing site to the target will be measured.

Preparations: For this, each group of students is provided with an egg, a freezer bag in which to insert the egg (to avoid egg projections in case of failure) and a little recovery equipment (plastic bags, cardboard, cereal boxes, sponges, newspaper, bubble wrap, etc.). The device may include a parachute.



In connection with the school with which you will be twinned (you will have to send me an email to obtain their contact details), you will have to imagine a device as identical as possible. It will therefore be necessary to communicate with each other, as scientists from different countries do.

For this question, you will have to film your throw and transmit the data of your device (weight, distance from the target) ... and accompany your answer with a technical sheet of the assembly of the imagined and tested lander. The video must be placed on a file transfer site for which you provide the link.

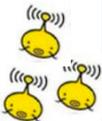
Consult the special sheet for this activity>

<https://insight.oca.eu/fr/hands-on-pratiques/topic-journey/377-egg-drop-ou-comment-atterrir-sans-casse-sur-mars-teens>

Q3. To celebrate the landing, you will also need to make a model of the Perseverance rover. It can be made in Lego; with recycled materials; in plasticine... the supports are free. or even through software such as Solidworks or Minecraft or other. The choice is yours.

A maximum of 3 projects are authorized for each school.

Expert level: At least one of your rovers must ride programmed.



Each model must be presented in a video of 10 seconds maximum.

All the feedback will be put on the internet and a public vote will decide which model is the most successful. Internet users will be invited to judge according to realism, technicality and creativity.

BONUS point:

1st prize: 3

2nd prize:

3rd prize: