Préparation IESO 2021

Défi 3 – Janvier

This challenge is a multiple-choice question on astronomy, and is written in English to help you practice.

There are 20 questions; a right answer gives you 1 point, and a wrong one gives you -0,4 point. There can be multiple answers to one question. For some questions, a letter is indicated at the end of each line. Find all the right answers and the letters will form a word that indicates the topic of the next challenge!

GENERALITIES

1. The amount of light that a telescope can collect is limited by the telescope's...
   A) chromatic aberration.
   B) focal point.
   C) aperture.
   D) eyepiece.

2. What is the correct term for the time taken for any object in the Solar System (such as the Moon) to return to the same position relative to the Sun as seen from Earth?
   A) year
   B) solar time
   C) sidereal period
   D) synodic period

3. The color of a star is mainly due to its ...
   A) surface temperature.
   B) composition.
   C) distance.
   D) twinkling.

4. The diagram on the next page shows the Hertzprung-Russell diagram (H-R diagram) with six positions (A – F) indicated. The y-axis is given in terms of Solar Luminosity ($L_\odot$) and x-axis gives effective surface temperature (T) of stars in Kelvin. In this diagram:

   A) C has the largest diameter, A and E have the same spectral class but different luminosities, and D is primarily burning Hydrogen.
   B) B has the largest diameter, D and F have the same spectral class but different luminosities, and A is primarily burning Hydrogen.
   C) D has the largest diameter, A and C have the same spectral class but different luminosities, and B is primarily burning Hydrogen.
   D) E has the largest diameter, B and F have the same spectral class but different luminosities, and C is primarily burning Hydrogen.

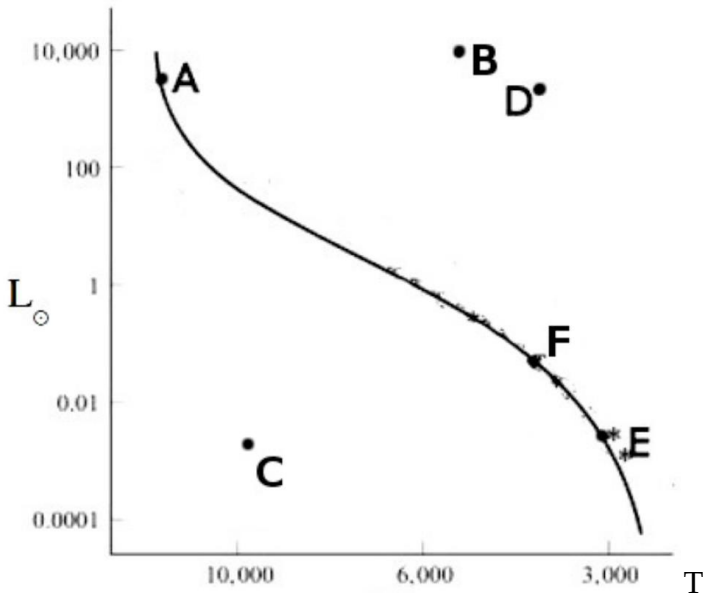

Figure Q4: Hertzprung-Russell diagram

5. On the following image, you can see the constellations…

A) Orion, Leo and Virgo. (c)
B) Andromeda, Delphinus and Lepus. (f)
C) Virgo, Lepus and Draco. (o)
D) Andromeda, Hydrus and Leo. (a)

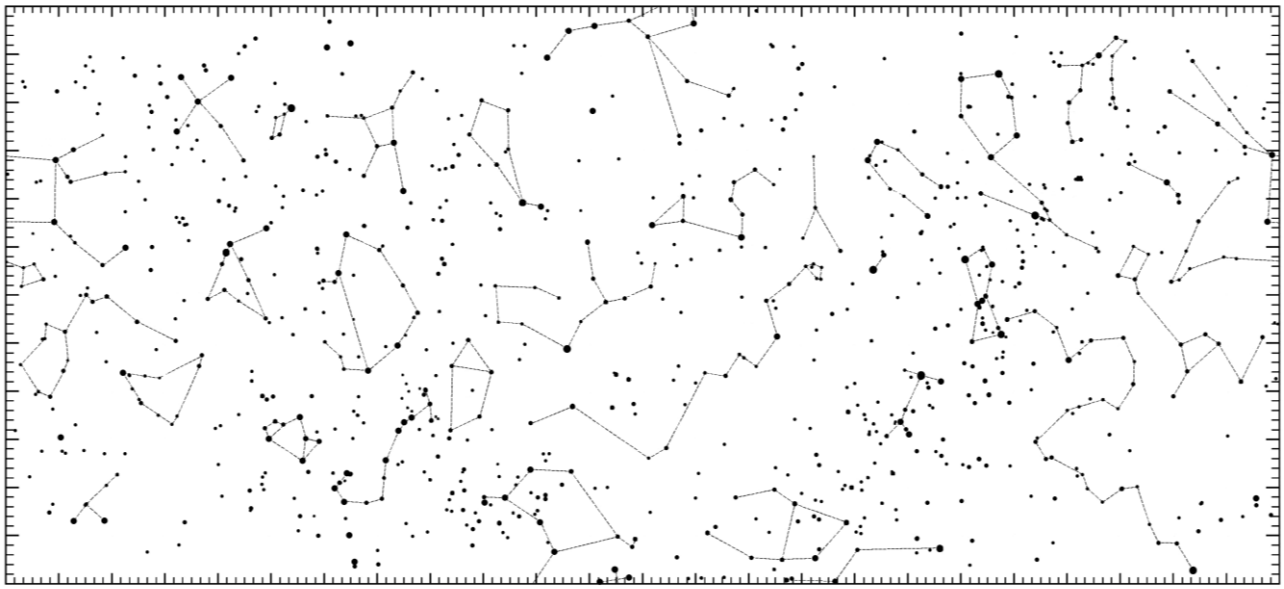

Figure Q5: a map of constellations

6. A superior planet can be seen to retrograde when it is near...
   A) conjunction.
   B) quadrature.
   C) opposition.
   D) the Moon.

7. The star Alpha Centauri is approximately 4.0×10^{13} km away from Earth. If Alpha Centauri moves closer like the Moon (about 4.0×10^{5} km away), about how much brighter is Alpha Centauri than before?
   A) 10^{8} times (f)
   B) 10^{12} times (h)
   C) 10^{16} times (y)
   D) 10^{24} times (e)

PLANETS

MARS

8. Mars, like the Earth, has different seasons during the year (summer, autumn, winter and spring). Which ones of the following parameters could explain the existence of seasons on Mars?
   A) Ellipticity
   B) Distance to the Sun
   C) Angle of rotation axis
   D) Precession angle
   E) Tides
   F) Existence of 2 moons
   G) Magnetic field
   H) Solar storms

9. The photography below is an image of sand dunes at the surface of Mars. Which one(s) of these propositions is/are a good interpretation of the photography?
NB: the width of the photography is approximately 4 km.

   A) The wind was coming from the right side of the photography.
   B) The wind was coming from the left side of the photography.
   C) Wind erosion processes are active on the surface of Mars.
   D) Water erosion processes are active on the surface of Mars.
   E) Wind deposition processes are active on the surface of Mars.
   F) Mars used to have an atmosphere.
   G) Water deposition processes are active on the surface of Mars.
   H) Mars currently has an atmosphere.

I) Mars currently has a hydrosphere.
J) Mars used to have an atmosphere.
K) Meteoritic erosion processes are active on the surface of Mars.
L) Interactions hydrosphere-geosphere used to take place on the surface of Mars.
M) Interactions atmosphere-geosphere used to take place on the surface of Mars.

Figure Q9: sand dunes at the surface of Mars

THE MOON

10. The drawings below were drawn by Galileo Galilei. Notice the light spots in the darker zones (white arrow) and the dark spots in the lighter zones (black arrow). Galileo observed the lighter spots grow during the month and concluded that they are mountains. He also concluded that darker spots are shadows in a lower topography.
Which one of the following phenomena contributes to the phases of the Moon?

A) The Earth hides the light from the Sun and projects its shadow on the Moon. (b)
B) The rotation of the Moon around its axis. (a)
C) The rotation of the Moon around the Earth. (c)
D) The rotation of the Earth around the Sun. (h)

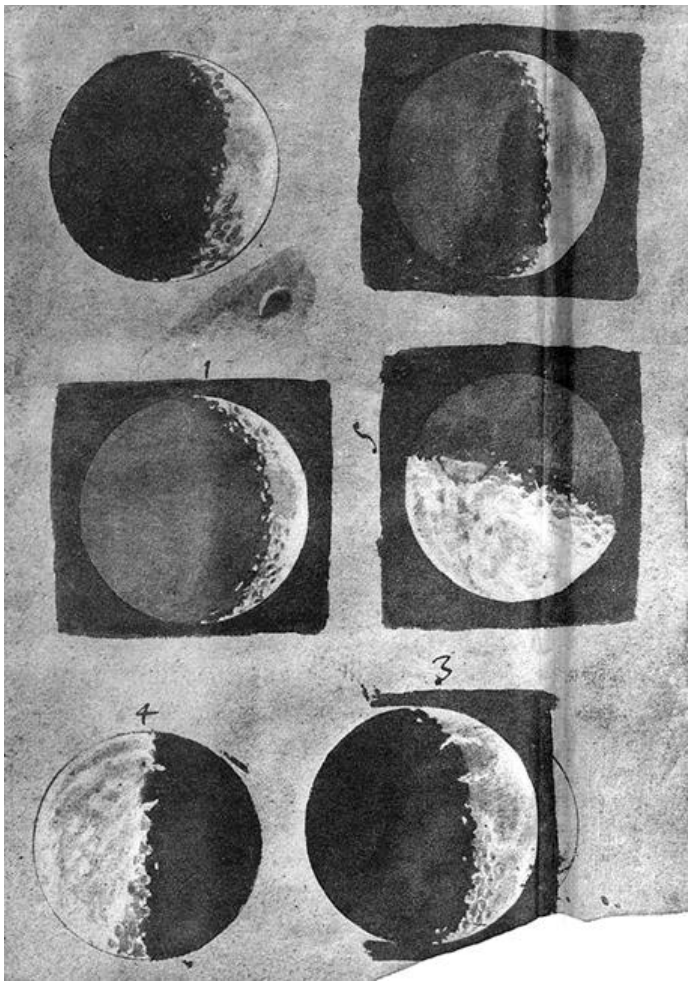

Figure Q10: drawings of the Moon by Galileo Galilei

11. Which one of these propositions explains why only one side of the Moon is visible from Earth ?

A) The Moon rotates around the Earth at the same speed that the rotates around its axis.
B) The hidden side of the Moon is made of rocks with a low albedo.
C) Only one side of the Moon faces the Sun.
D) Density and gravity of the Moon influence its rotation and its orbit.

12. Which one of the following affirmations can explain the high amount of impact craters on the Moon compared with the Earth?

A) There is no atmosphere on the Moon.
B) The dense magnetic field of the Earth protects it from meteoritic impacts.
C) The low density of the Moon attracts space objects.
D) The orbit of the Moon crosses paths with more asteroid-rich regions than Earth.

VENUS

13. Based on the two following images, which one(s) of the following affirmations can explain the low amount of impact craters on Venus compared with the Moon?

A) The atmosphere of Venus is thick and impacts its surface. (f)
B) The orbit of Venus does not cross paths with asteroid-rich regions. (e)
C) The surface of Venus has been eroded. (i)
D) Magmatic activity covered traces of ancient craters. (l)
E) The magnetosphere and the atmosphere of Venus interact with one another. (c)

Figure Q13a: shiny shades indicate high altitudes and darker shades indicate low altitudes. This image shows the scarcity of impact craters on Venus compared with the Moon.

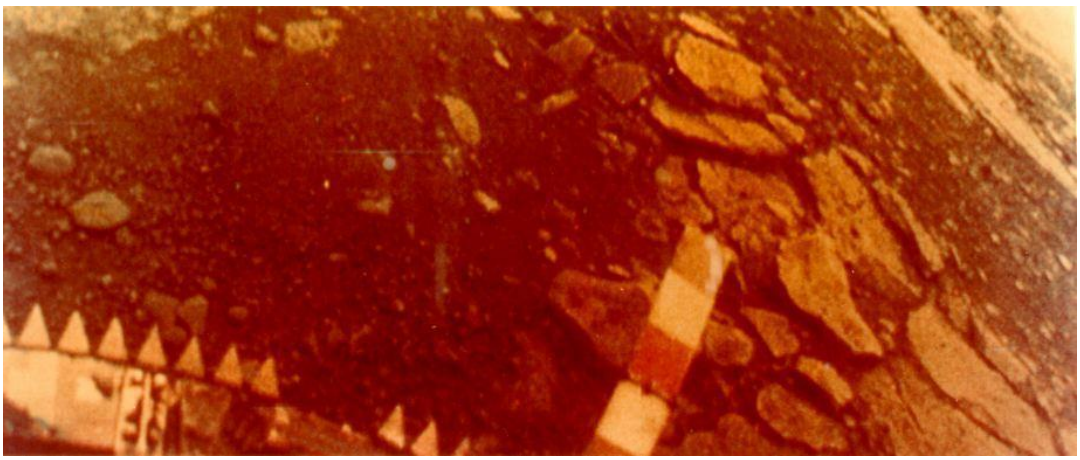

Figure Q13b: this photography has been shot by the probe Venera-13 and shows the basaltic surface of Venus.

ENCELADE

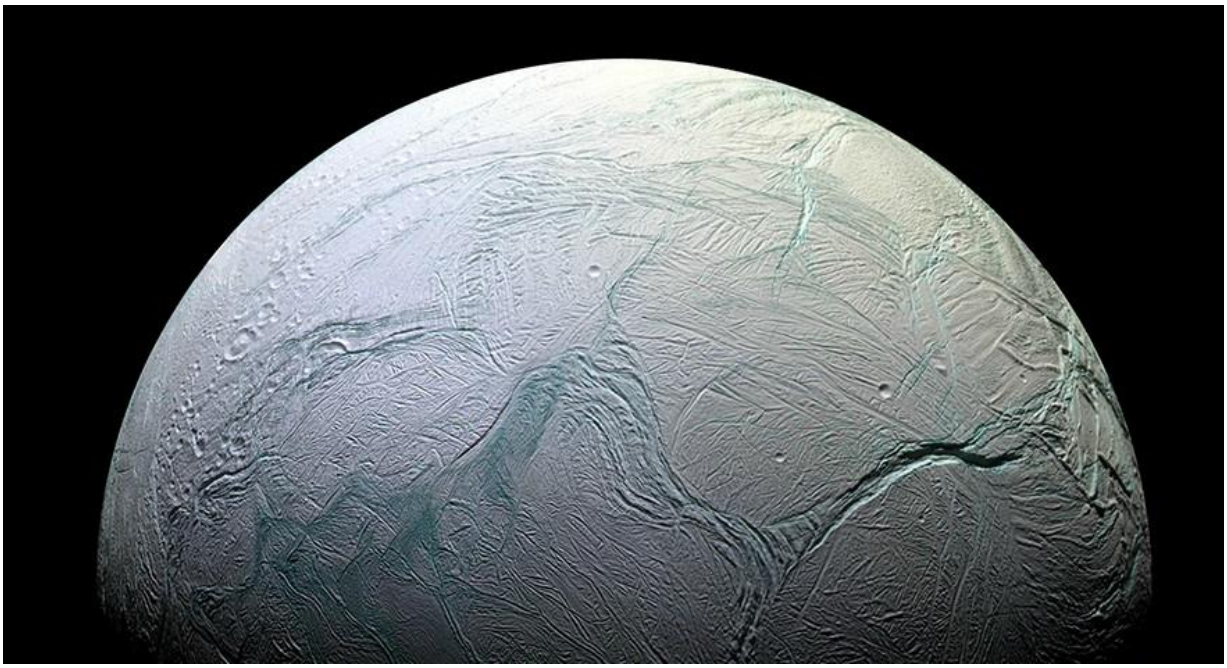

Figure Q14: the dimensions of Encelade are 513,2 km x 502,8 km x 496,6 km

14. What can be learned from the observation of surface structures on Encelade?

A) The crust is active.
B) The crust is static.
C) There are plates boundaries on Encelade.
D) There were recent meteoritic impacts on Encelade.
E) There is no proof of recent meteoritic impacts on Encelade.
F) There is a hydrosphere on Encelade.

15. What could explain local temperature differences on the surface of Encelade?

A) The intensity variation of solar radiations depending on the latitude. (e)
B) The entrapment of thermal energy by the atmosphere of Encelade. (t)
C) The release of heat from the depths by processes of crust formation in some regions. (d)
D) Subduction zones being colder than expansion ones. (h)

EARTH

16. When vascular plants evolved, during the upper Paleozoic (350 Ma), the continents began to cover in forests. Before 350 Ma, they were covered in sand. A direct result of vegetation on continents is the change of albedo (reflexion at the surface of the Earth, for example an albedo of 0.4 means that 40% of the solar energy is reflected towards space): the albedo of a sand desert is 0.4 and that of a forest is 0.15. Which one of these affirmations is correct?

A) Earth assimilates more solar radiations since 350 Ma. (s)
B) Earth assimilates less solar radiations since 350 Ma. (r)
C) The whole system will collapse because of temperatures too high. (z)
D) The whole system will collapse because of temperatures too low. (b)

17. Based on the indications given in the previous question, suppose that oceans cover 70 % of Earth's surface with an albedo of 0.1, and continents cover the remaining 30 %. After 350 Ma, which one of these proposals is correct?

A) Solar radiation absorbed by Earth's surface will rise by 7 %.
B) Solar radiation absorbed by Earth's surface will decrease by 7 %.
C) Solar radiation absorbed by Earth's surface will rise by 30 %.
D) Solar radiation absorbed by Earth's surface will decrease by 30 %.

18. The duration of spring and summer in the southern hemisphere of Earth is 178.7 days, whilst the duration of autumn and winter is 186.5 days (the opposite is valid for the northern hemisphere). This apparently strange fact is related to:

A) The magnetic field of the Sun that affects the velocity of the Earth when it approaches the perihelion.
B) The fact that the Earth changes its velocity in accordance with Kepler's Second Law.
C) The precession of the Earth.
D) The Earth is in its perihelion in July.

19. If you were at the North Pole, Polaris would be...

A) at your zenith.
B) at your northern horizon.
C) below the horizon.
D) it depends on the time of day.

20. If your latitude is 30, what is the most southerly declination of a star to be circumpolar?

A) +90
B) +60
C) +30
D) -30

Theme of the next challenge: ……..

Time taken to complete the challenge: ……