November 7, 2017

Q.1) Consider the following statements about 'Proxima Centauri'

1. It is the closest star to the Sun
2. It is orbited by the Earth-sized temperate world Proxima b, discovered in 2016 and the closest exoplanet to the solar system

Select the correct statements

a) 1 Only
b) 2 Only
c) Both 1 and 2
d) Neither 1 nor 2

Q.1) Solution (c)

Proxima Centauri or Alpha Centauri C, is a red dwarf, a small low-mass star, about 4.25 light-years (1.30 pc) from the Sun in the constellation of Centaurus.

It was discovered in 1915 by the Scottish astronomer Robert Innes, the Director of the Union Observatory in South Africa, and is the nearest-known star to the Sun.

With an apparent magnitude of 11.05, it is too faint to be seen with the naked eye. Proxima Centauri forms a third component of the Alpha Centauri binary star system, currently with a separation of about 12,950 AU (1.94 trillion km) and an orbital period of 550,000 years.

Because of Proxima Centauri's proximity to Earth, its angular diameter can be measured directly. The star is about one-seventh the actual diameter of the Sun. It has a mass about an eighth of the Sun's mass ($M_\odot$), and its average density is about 40 times that of the Sun. Although it has a very low average luminosity, Proxima is a flare star that undergoes random dramatic increases in brightness because of magnetic activity. The star's magnetic field is created by convection throughout the stellar body, and the resulting flare activity generates a total X-ray emission similar to that produced by the Sun. The mixing of the fuel at Proxima Centauri's core through convection and its relatively low energy-production rate mean that it will be a main-sequence star for another four trillion years,or nearly 300 times the current age of the universe.

In 2016, the European Southern Observatory announced the discovery of Proxima b, a planet orbiting the star at a distance of roughly 0.05 AU (7.5 million km) with an orbital period of approximately 11.2 Earth days. Its estimated mass is at least 1.3 times that of the Earth. The equilibrium temperature of Proxima b is estimated to be within the range of where water could exist as liquid on its surface, thus placing it within the habitable zone of Proxima Centauri, although because Proxima Centauri is a red dwarf and a flare star,

whether it could support life is disputed. Previous searches for orbiting companions had ruled out the presence of brown dwarfs and supermassive planets.

Source: http://www.thehindu.com/sci-tech/science/proxima-centauri-may-host-planetary-system/article19993333.ece

Q.2) Consider the following statements about 'Tholpavakoothu'

1. It is a form of shadow puppetry practiced in Karnataka
2. The puppets used are made of leather

Select the correct statements

a) 1 Only
b) 2 Only
c) Both 1 and 2
d) Neither 1 nor 2

Q.2) Solution (b)

Tholpavakoothu a form of shadow puppetry that is practiced in Kerala, India. It is performed using leather puppets as a ritual dedicated to Bhadrakali and is performed in Devi temples in specially built theatres called koothumadams. This art form is especially popular in the Palakkad, Thrissur and Malappuram districts of Kerala.

The puppets used in Tholpavakoothu used to be made out of deerskin but are now typically made from goatskin. The puppets are painted in vegetable dyes, as these dyes last long. Some puppets can be as tall as four feet. The puppets are controlled using two sticks; the puppeteer holds the puppet in one hand while its limbs are manipulated using a thinner stick held in the puppeteer's other hand.

Source: http://www.thehindu.com/news/national/kerala/strings-attached/article19982142.ece

Q.3) 'Blackbuck' is found in which of the following countries?

1. India
2. Nepal
3. Sri Lanka

Select the correct statements

a) 1 and 2
b) 2 and 3
c) 1 and 3
d) All of the above

Q.3) Solution (a)

The Blackbuck formerly occurred across almost the whole of the Indian subcontinent south of the Himalaya. Their range decreased during the 20th century and they are now extinct in Bangladesh and Pakistan. Blackbucks are still present in the terai zone of Nepal (Bashistha et al. 2012). The species has been introduced to the United States of America (Texas) and Argentina.

It is also known as Indian Antelope.

Native: India; Nepal

Regionally extinct: Bangladesh; Pakistan

Introduced: Argentina; United States

News: Uttar Pradesh Cabinet approves Blackbuck Conservation Reserve in the Trans-Yamuna region of Allahabad. The State Cabinet has approved a Blackbuck Conservation Reserve in the Meja Forest Division, in the Trans-Yamuna region of Allahabad near the Madhya Pradesh border, known for its rocky, undulating and arid terrain.

Source: http://www.thehindu.com/news/national/other-states/ias-officer-throws-his-weight-behind-blackbuck/article19987987.ece

Q.4) Parambikulam Tiger Reserve is located in which state?

a) Karnataka
b) Kerala
c) Telangana
d) Tamil Nadu

Q.4) Solution (b)

Parambikulam Tiger Reserve, which also includes the erstwhile Parambikulam Wildlife Sanctuary, is a 391 square kilometres (151.0 sq mi) protected area in Chittur taluk in Palakkad district of Kerala state, South India. The wildlife sanctuary, which had an area of 285 square kilometres (110 sq mi) was established in 1973. It is in the Sungam range of hills between the Anaimalai Hills and Nelliampathy Hills.

Source: http://www.thehindu.com/news/national/kerala/fluttering-about-gaily-in-tiger-reserve/article19884200.ece

Q.5) Which of the following statements is/are correct?

1. The lotus leaf is a hydrophilic material
2. Hydrophobic surfaces are ones with a low surface energy that therefore do not attract water to them

Select the correct statements

a) 1 Only
b) 2 Only
c) Both 1 and 2
d) Neither 1 nor 2

Q.5) Solution (b)

In the case of a liquid resting on a solid surface in a gaseous environment, the contact angle can be defined as the angle formed by the liquid at the gas, liquid, solid boundary. Due to the high surface tension of water, it tends to form spherical droplets on surfaces, so as to reduce its area and thus energy. The contact angle is therefore generally large, although this depends on the surface material. Due to its high surface tension, water has a high capacity for bonding if the surface is right. Hydrophobic surfaces are ones with a low surface energy that therefore do not attract water to them. For these materials the contact angle is greater than 90°. Hydrophilic surfaces, such as glass, have a high surface energy and water spreads out over them. For these materials the contact angle is less than 90°.

Two excellent examples of natural superhydrophobic materials are the lotus leaf and the gecko foot. In fact, the superhydrophobic property is sometimes referred to as the lotus effect. The leaves of the lotus consist of micro- and nano-scale papillae that are coated in a hydrophobic wax. This double structure makes the leaves superhydrophobic and water makes a contact angle of up to 170°. The resulting selfcleaning effect means that lotus leaves are free from dirt and bacteria, despite growing in dirty ponds. Similarly, the way

geckos can walk quickly while upside down fascinates lay people and scientists alike. The pads of a gecko's feet are covered with tiny fibres made of the protein keratin. These enable the gecko to adhere strongly to a surface but at the same time allow it to lift its feet quickly so that it can walk along a surface at speed without falling off. If these fibres become dirty, the function would be lost. In recent years, it has been discovered that the gecko secretes an oil that imparts superhydrophobic functionality to keep the toe fibres clean and therefore in good working order.

News: Superhydrophobic medical cotton has been developed by a team of researchers at IIT Guwahati. It removed up to 95% of oil-spill of different densities i.e both light and heavy oils repetitively at least 100 times.

Source: http://www.thehindu.com/sci-tech/science/iit-guwahati-uses-superhydrophobic-cotton-to-remove-oil-spill/article19981565.ece