



# QUADSPARKS



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## ANSWER KEY AND RUBRIC

ONLINE PRELIMS, 22<sup>ND</sup> JULY 2023

The updated rubric encompasses comments after evaluating the responses.

- The highest score was 16/20.
- The cutoff for selection into the interview round was 14/20 (a total of nine teams)
- Average score: 7.27, SD: 4.26.
- There was no negative marking.
- Time penalty was calculated with no marks cut until 7:05:59 PM (time of submission) and 0.5 marks for every further minute.

Selected candidates have been intimated via email.

## Section 1

1. According to sacred texts, Vaidoorya is the gemstone of Ketu. This gem is uniquely known as the " \_ \_ \_ \_ \_ \_ " because one can see a band of reflected light across the middle of the gemstone when light is shone on its rounded surface. This optical reflectance effect arises from the fibrous inclusions or cavities within the stone. This effect is termed as chatoyancy, which translates to "shining like a \_ \_ \_ \_ \_ \_". Fill in the blanks. (Blanks are indicative)



*Cat's eye*

2. Referring to people with X syndrome as Y dates back to 1866, when Dr. John Langdon X published a paper “Observations on an Ethnic Classification of Idiots”, in which he asserts that it is possible to classify different types of conditions by ethnic characteristics. He picked this up while working for the Royal Earlswood Asylum for Idiots with people having learning disabilities. He noticed a big group of people he was treating shared common appearance traits of round cheeks, flattened faces and oddly shaped eyes, and concluded that they are of Y ethnicity. From that time on, Y was the “clinical” term used for this syndrome.

In 1959, the true nature of this syndrome was understood, and a joint letter was written to The Lancet (a prominent medical journal) to change the name Y as it is “racially insensitive”. In 1965, the country of Y joined the WHO and pleaded for the same. From then on it was changed to X syndrome.

Name X and Y.

(2)

*X – Down (1)*

*Y- Mongoloid/Mongolism/Mongolia*

Points were NOT awarded for:

- *Chinese*: The then-accepted name of the racial group must have been mentioned.
- *Trisomy/Trisomy 21*: Down was the doctor’s surname after which the syndrome was named. Down’s syndrome is a trisomy of the 21<sup>st</sup> chromosome, but it does not match here.

3. The following are the characteristics of the planet Vulcan:  
it was estimated to have an orbital inclination of between  $5.3^\circ$  and  $7.3^\circ$ , a longitudinal node of about  $183^\circ$ , an "enormous" eccentricity, and a transit time across the solar disk of 4 hours, 30 minutes.

Its orbit was described as follows by astronomer Lescarbault as follows:

- a period of 19 days, 7 hours;
- a mean distance from Sun of 0.1427 AU;
- an inclination of  $12^\circ 10'$ ; and,
- an ascending node at  $12^\circ 59'$ .

The diameter is considerably smaller than Mercury's and its mass is estimated at one-seventeenth of Mercury's mass.

What is special about Vulcan?

(1)

*Vulcan is a hypothetical planet. It doesn't exist. (1)*

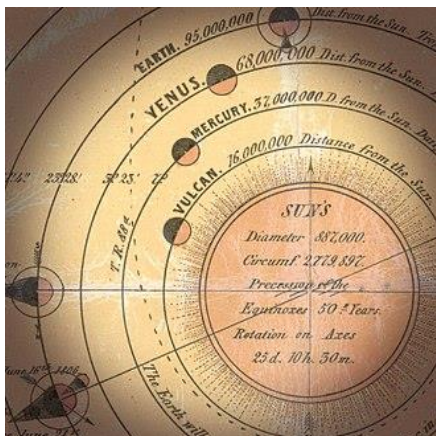
*It was believed to be a planet that existed closer to the Sun than mercury.*

Points were NOT awarded for:

- *Fictional Planet:* Most of the entries in this category referenced Star Wars or Star Trek. We are confident in saying that Lescarbault was not a fan of either, most likely due to him existing in 19<sup>th</sup> Century France.
- *Dwarf Planet:* One of the major requirements to be a dwarf planet is existence.
- *Engulfed by the Sun:* Again, a planet that doesn't exist cannot be engulfed by anything, let alone the Sun.
- *Roman God of Fire:* Almost all planets in the solar system are named after Roman deities. As such, being named after a Roman deity does not make Vulcan special.

Partial Credit was awarded for:

- *Planet between Mercury and Sun:* Not mentioning that the planet is hypothetical would give partial credit.



4. MIT meteorologist Edward Lorenz tried to create a mathematical model to quantify the behavior of atmospheric convection currents. Solving this system, he showed that at certain parameters, even a minuscule change in initial conditions could lead to a very different solution. To account for this large uncertainty, a technique was developed to make useful predictions.

What is the common name of the effect that calls into need this technique?

What is the name of the forecasting technique in question?

(2)



*Butterfly effect (1)*

*Ensemble forecasting (1)*

Points were NOT awarded for:

- *Chaos Theory*: Chaos Theory is the name of the entire field of study. It is neither the name of the effect nor the forecasting technique.
- *Lorenz System*: Same reasoning as the above. It is the name of a system of differential equations.
- *Weather Forecasting*: While that is an application of the butterfly effect, weather forecasting existed before Edward Lorenz.

5. arXiv is a worldwide repository of electronic preprints and postprints of scientific literature, which are posted online for free access. The platform, owned and hosted by Cornell University, was one of the pioneers of the scientific open-access movement. Why is the name spelled this way?

*X refers to the Greek letter chi (X). Hence, arXiv -> archive  
(full credits for mentioning chi. Half for mentioning archive)*

6. **Pando is a male aspen clonal colony found in Fishlake National Park in Utah. The tree was identified in 1976 by Jerry Kemperman and Burton Barnes. Genetic marker analysis has led to a certain categorization of the organism. Why does it figure on this quiz?**

*It is the world's largest/densest/heaviest organism (either sufficient)*

Points were NOT awarded for:

- *Massive interconnected root system:* Many trees have a large and interconnected root system. That does not make it special.
- *Identical genetic markers:* Doesn't contribute fully to the answer. The tree was identified to be the same organism as a result of identical markers across a large area.

Partial credit was awarded for:

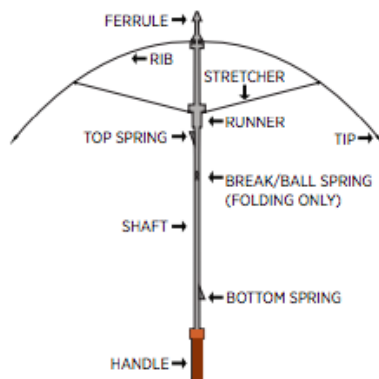
- *Single organism/clonal organism*

7. This commonly used item has several parts – a certain few essential ones are bottom and top springs, shaft, runner, ferrule and ribs. Ribs are connected via stretchers to runners on the shaft for its intended movement.

The entity is commonly available in two varieties – telescopic and non-telescopic. Telescopic ones have a central spring along the shaft.

What are we talking about?

### *Umbrella*





8. Kamala Sohoni was the first Indian woman to receive a PhD in a scientific discipline. However, this was achieved after major controversy.

When Kamala applied to the Indian Institute of Science for a research fellowship, her application was rejected by the then-Director solely on the grounds of her being a woman, and the director believing that women were not competent enough to pursue research.

This led to Kamala holding a Satyagraha outside the director's office. Further, she was granted admission, albeit with some insulting limitations (such as a year of probation and not being granted regular student status). She joined the institute in 1933, and the director eventually allowed female students into the institute with no stipulations in 1936.

Identify this director, who conducted some early scientific work into the acoustics of Indian musical instruments.

*Sir CV Raman*

9. The science-fiction movie 2012 dealt with an apocalyptic plot that dramatizes the end of the world. The historical backing was provided by the popular prediction in the Mayan calendar.

The makers also attempted to explain the rash of natural disasters by adding in ignorant scientific “quips”. In the storyline, an astrophysicist in India discovers that a huge solar flare is causing the temperature of the earth’s core to spike. With a horrified look on his face, he says that the \_\_\_\_\_ have mutated.

The blank indicates a class of subatomic particles, belonging to the larger group of fermions, which are now thought to be responsible for weak nuclear forces. The rest mass of the particle is much smaller than that of the other known elementary particles, leading to a popular, albeit erroneous, description in pop-science arenas.

Fill in the blank.

*Neutrinos*

Points were NOT awarded for:

- *Bosons*: While they are a class of subatomic particles, they do not include Neutrinos. Neutrinos are fermions.
- *Neutrons*: Not the same as Neutrinos, despite similar names.

10. Charles ("Pete") Conrad Jr. was a Princeton University alumnus, having spent his undergraduate years there before getting selected for training. As the Commander of a certain mission, Pete decided to honour his alma mater by carrying the university Coat of Arms with him. The successful completion of the event meant that the Princeton University flag holds the distinction of having been at a specific place.

Which place?

What is Pete Conrad's claim to fame?

(2)

*The moon (1)*

*Conrad was third man on the moon – aboard the Apollo 12 mission, after Armstrong and Aldrin (1) (either third man, or Apollo 12)*

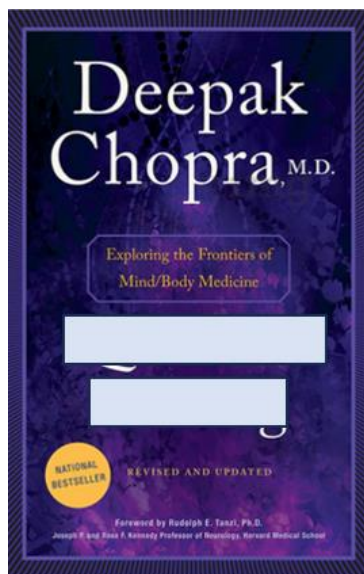
11. The following is a book by Deepak Chopra, a prominent Indian-American author and mystic, who is a leading figure in the New Age spiritual movement.

His books, including the one pictures, attempt to draw direct connections between an element of modern science and mind-body healing, a theory that has been widely characterized by physicists as “flapdoodle” that invigorates misinformation among the public, and as hijacking of the scientific discipline.

Earlier books of a similar genre include *The Tao of Physics: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism*, written by physicist Fritjof Capra in 1975.

Fill in the blank on Chopra’s book title.

(1)



*Quantum Healing (half credits for mentioning “quantum”)*

12. While the irrationality of  $\pi$  was only proved in 17th century Europe by Johann Lambert, it is believed that a 6th century Indian mathematician might have implied the same in his book. Paraphrased, the book says that by doing some calculations (which compute to 62832), one can approach the circumference of a circle with diameter 20000. This gives the value of  $\pi$  as 3.1416. It is speculated that the use of the word “approached” implies that the mathematician knew that the value was incommensurable due to it being irrational. The book was translated into Arabic and the same approximation is mentioned in Al-Khwazirimi's book on Algebra. Who is the Indian mathematician being talked about here?

(1)

*Aryabhata*

## Section 2

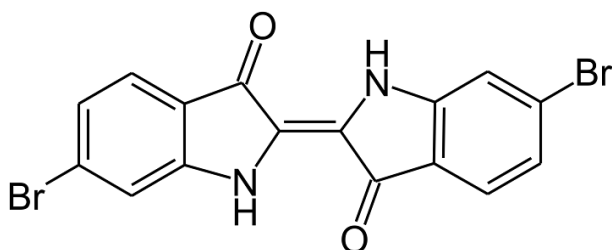
13. The following is the chemical compound 6,6'-Dibromoindigo, commonly known as Tyrian \_\_\_\_.

This dye, extracted from desiccated hypobranchial glands of sea snails from the *Murex* species, which were further dyed and boiled. Fabrics once dyed retained the remarkable stench of the snail secretions.

The blanks indicate the rich colour provided by the dye. Worn by the rulers of the Byzantine empire, the Holy Roman Empire, and in more recent times, by Roman Catholic Bishops, this colour is most often associated with royalty, rarity, luxury and magic.

However, this colour does not appear on Newton's colour wheel. What is the closest colour to it that appears?

(1)



*Violet*

*The dye is Tyrian purple (half credits for purple)*

Points were NOT awarded for:

- *Indigo*: Purple is closer in colour to the red side of the spectrum than the blue side. Hence, it is closer to violet than it is to indigo.
- *Red*: While Tyrian purple is indeed closer to red than it is to violet, the question was asking about purple (which would be the word that fit in the blank and is the colour associated with all the mentioned things). As such, the correct answer would be violet.

14. A study in 2017, investigating the prevalence of different kinds of hyper excitability during migraine, found that hypersensitivity to a certain general sensory cue gave rise to an aversion/fear of such stimuli in 84% of migraine patients with aura.

What sensory cue are we talking about?

(1)

*Odour/stench (half credit for smell)*

Points were also awarded for:

- *Osmophobia*

Points were NOT awarded for:

- *Light*: Aversion to light occurred in “upto 80%” of cases. The studies in question are linked below.

Partial credit was awarded for for:

- *Olfactory*

The study mentioned in the question: [Link](#)

A study about photophobia: [Link](#)

15. The common name of this mineral originates from the Latin word for "flow". The mineral is used as flux in iron smelting to reduce the viscosity of the by-product. Samples of this mineral obtained from certain locations emitted light (due to the presence of impurities), and the word for a certain kind of luminescence is derived from it.

Which mineral?

(1)

*Fluorite/Fluorspar (Half credit for  $\text{CaF}_2$ )*

Partial credit was awarded for:

- *Fluorine*



16. What etymological theme connects the answers to the above questions?  
(2)

*The etymologies of halogens (full credit)*

*Fluorine <- Fluorite; Bromine <- stench (bromos); Iodine <- violet colour (iodos)*

Points were NOT awarded for:

- *Latin*: A very large number of words have Latin origins. As such, Latin is too general of an answer to avoid points for.
- *Chemistry*: Also too general of a theme. And incorrect because Q'14 is more related to biology.
- *Various definitions of Etymology*: That wasn't what we were looking for.
- *Pravega*: That would be a connecting theme for anything appearing on this quiz. As such, too general.
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