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Storage Gain

After the Centre relaxed the Fair and Average Quality norms for wheat procurement this season, Punjab's state procurement agencies (SPAs) are now seeking a waiver of 'storage gain'

- Wheat tends to gain some weight during storage. This is known as 'storage gain' and it mostly happens due to absorption of moisture.
- The weight gain/losses depended upon the moisture content at which stacking was done whereas the change in environmental conditions plays a limited role.
- The moisture is mostly absorbed by the endosperm, one of the three parts of a grain.

  The three parts of the grain are bran (outer layer rich in fibre), germ (inner layer rich in nutrients) and endosperm (bulk of the kernel which contains minerals and vitamins).

- **Compensation** - The State procurement agencies purchase and store wheat at their facilities.
- They are required to give one kg wheat extra per quintal to the Food Corporation of India (FCI), the Centre's nodal agency for grain procurement, to compensate for storage gain.
- The 20% of wheat, procured by the FCI and the SPAs, is moved immediately after procurement.
- But, it is usually on the remaining 80%, which is moved out after July 1 every year, that storage gain has to be accounted for due to longer storage duration.

Reference

1. https://indianexpress.com/article/explained/explained-storage-gain-wheat-why-punjab-procurement-agencies-dont-shell-it-out-7930486/
2. http://hwc.org.in/wdir/uploads/page_pdf/Pdf-1614339252-image_file.pdf

W Boson

The researchers from Collider Detector at Fermilab (CDF) Collaboration have made a precise measurement of the mass of the W boson.

This precise value did not match with what was expected from estimates using the standard model of particle physics.

- Discovered in 1983 at CERN, the W boson is a fundamental particle.
- Together with the Z boson, it is responsible for the weak force.
- [Weak force is one of four fundamental forces - electromagnetic, weak nuclear, strong nuclear and gravitational interactions - that govern the behaviour of matter in our universe.
- Particles of matter interact by exchanging these bosons, but only over short distances.]

- The W boson, which is **electrically charged**, changes the very make up of particles.
- It **switches protons into neutrons**, and **vice versa**, through the weak force, triggering nuclear fusion and letting stars burn.
- This burning also creates heavier elements and, when a star dies, those elements are tossed into space as the building blocks for planets and even people.

Standard Model of Elementary Particle Physics

- This model is a theoretical construct in physics that **describes particles of matter and their interaction**.
- It views the elementary particles of the world as being connected by mathematical symmetries, just as an object and its mirror image are connected by bilateral (left–right) symmetry.
- These are mathematical groups generated by continuous transformations from, say, one particle to another.
- This model says that there are a finite number of fundamental particles which are represented by the characteristic "eigen" states of these groups.
- The particles predicted by the model, such as the Z boson, have been seen in experiments and the last to be discovered, in 2012, was the Higgs boson which gives mass to the heavy particles.
- This is an **incomplete model** as it gives a unified picture of only three of the four fundamental forces of nature, it totally omits gravity.
- The other gap in the standard model is that it does not include a description of dark matter particles. So far, these have been detected only through their gravitational pull on surrounding matter.

Reference

1. https://www.thehindu.com/sci-tech/the-standard-model-of-particle-physics-gets-a-jolt/article65398162.ece#:~:text=The%20standard%20model%20is%20thought,interactions%20%E2%80%94%20it%20totally%20omits%20gravity
2. https://home.cern/science/physics/w-boson-sunshine-and-stardust

Endosulfan

The Supreme Court order has pulled up the Kerala government for delaying the compensation to the Endosulfan pesticide exposure victims.

- Endosulfan is a cyclic sulfite ester. It is an organochlorine biocide.
- It is a cream- to brown-colored solid that may appear in the form of crystals or flakes with a pungent odor.
- It is denser than water and nearly insoluble in water.
- It does not occur naturally in the environment.
- **Uses** - It is used as a pesticide, fungicide or herbicide. It is used to control insects on food and non-food crops and as a wood preservative.
- It is sprayed on cotton, cashew, fruits, tea, paddy, and tobacco etc.
- It is used for controlling pests and mites by generating neurotoxic effects.
- **Problems** - It is toxic by inhalation, skin absorption, or ingestion.
- Upon application, receiving soils act as a primary reservoir of endosulfan in the environment.
- Because of its hydrophobic properties, endosulfan has shown high mobility across environmental compartments.

Reference

1. https://www.thehindu.com/news/national/kerala/endosulfan-victims-and-their-families-relieved-after-supreme-court-verdict/article65442032.ece
2. https://pubchem.ncbi.nlm.nih.gov/compound/Endosulfan
3. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/endosulfan

Europa

A team of researchers have said that on one of Jupiter's moons Europa, a prime candidate for life in the solar system, there might be an abundance of water pockets beneath formations called double ridges.

- Europa or Jupiter II is the smallest of the four Galilean moons orbiting Jupiter.
- Europa is slightly smaller than Earth's moon and its diameter is about one-quarter that of the Earth.
- Even though Europa has a very thin oxygen atmosphere, it is considered one of the most promising places in the solar system to find present-day environments that are suitable for life beyond the Earth.
- It is also believed that underneath Europa's icy surface the amount of water is twice that on Earth.
- **Double ridges** are the formations which are most common on Europa's surface and are similar to those seen on Earth's Greenland ice sheet.
- The new study says that double ridges are formed over shallow pockets of water.
- It found that the "M" shaped crest in Greenland that is known as the double-ridge could be a miniature version of the most prominent feature found on the ice sheets of Europa.

  NASA is expected to launch its Europa Clipper in 2024. The module will orbit Jupiter and conduct multiple close flybys to Europa to gather data on the moon's atmosphere, surface and its interior.

- **Implications of the recent findings -** As per the new study, the ice shell is believed to be less of a barrier and more of a dynamic system.
- This means that the ice shell does not behave like an inert block of ice, but rather undergoes a variety of geological and hydrological processes.
- Because the double ridges' closer to the surface, there's a possibility that life has a shot if there are pockets of water in the shell.

Reference

1. https://indianexpress.com/article/explained/explained-jupiter-moon-europa-research-7880787/
2. https://www.independent.co.uk/space/alien-life-europa-jupiter-ridges-ice-nasa-b2060860.html

Icy Lava Flows in Pluto

There is a report that, in Pluto, icy lava flows have recently covered substantial tracts of its surface.

- In this context, "recently" means probably no more than a billion years ago.
- Also, there is no suggestion that volcanoes are still active - but it's only a quarter the age of the Solar System and no one knows how Pluto brewed up the heat needed to power these

eruptions.

- The news is coming nearly seven years after NASA's New Horizons probe made its spectacular flyby of Pluto in 2015, after a recent analysis.
- The analysis was done on to a mountainous feature named Wright Mons, which rises 4-5km above its surroundings.
- It is about 150km across its base and has a central depression 40-50km wide, with a floor at least as low as the surrounding terrain.
- The **Wright Mons is a volcano**, and the lack of impact craters shows that it is not likely to be older than 1-2 billion years.
- **Hummocks** - The Wright Mons and much of its surroundings are seen to be crowded with hummocks.
- The hummocks were likely created by some sort of ice volcanism, known by the term "cryovolcanism" - erupting icy water rather than molten rock.
- Pluto's bulk density shows that it must have rock in its interior, but its outer regions are a mixture of ices in the same way that the crust of the Earth and other rocky planets is a mixture of several silicate minerals.
- These mixtures of ices have water, methane, nitrogen and probably ammonia and carbon monoxide, too, all of which are less than a third as dense as rock.

Melting of the ice

- Ice, of course, melts at much lower temperatures than rock.
- And when there is a mixture of two ices, melting can begin at a lower temperature than for either of the pure ices (the same principle applies in silicate rock made of different minerals).
- This makes melting even easier.
- Despite this, it is a surprise to find evidence of relatively young water-rich cryovolcanic eruptions on Pluto, because there is no known heat source to power them.
- There is only very limited scope for Pluto's interior to be heated by tidal forces, which warm the interiors of some of the moons of Jupiter and Saturn.
- [Tidal force is the gravitational effect between orbiting bodies, such as a moon and a planet.]
- Also, the amount of rock inside Pluto is not enough to produce much heat from radioactivity.
- The reason may be the Pluto having a deep internal liquid water ocean.

Reference

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2. https://scroll.in/article/1020718/volcanoes-on-pluto-baffle-scientists-how-can-such-a-cold-body-power-eruptions