

Science & Technology

# SciTech Tryouts

# Q1. This question gets me up

- Angina Pectoris is a fancy name for chest pain-specifically spasms in the heart's coronary arteries.
- The pharmaceutical company Pfizer developed a pill named UK92480 to help constrict these arteries to relieve pain.
- The pill failed its primary purpose, but the secondary side effect was startling. The drug became known as \_\_\_\_\_ and I hope no one here needs to use it :)
- Pfizer sold \$288 million worth of the little blue pill in the first quarter of 2013.

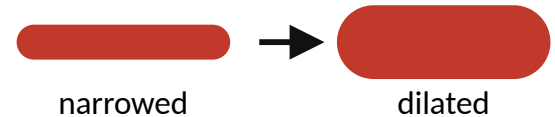
# Q1. Answer

## ■ Viagra (sildenafil)

- Pfizer's UK-92,480 was trialled for angina: it was meant to relax and widen the coronary arteries (not constrict them).
- It did little for angina, but trial volunteers reported a notable side effect: erections. It is a PDE5 inhibitor.
- It was approved for erectile dysfunction in 1998; the “little blue pill”, and the title's pun.



**Sildenafil • PDE5 inhibitor**



## Q2. Is OLED good for my usecase?

- “3d pipes”, a bouncing \_ \_ \_ logo and flying windows logos are all solutions to an age old (and sometimes very visible) problem that used to plague a certain computer peripheral in the 90s, that was somewhat made redundant with improvements in phosphor coatings.
- However the problem has made a resurgence in the modern era, with a particular (modern) class of the same peripheral having a similar issue, which is mitigated by using more “granular” techniques. What am I talking about?

## Q2. Answer

### ■ Screen burn-in

- CRT monitors burned static images into their phosphor, so screensavers (3D Pipes, the bouncing DVD logo, Flying Windows) kept the picture moving.
- OLED panels have brought burn-in back, because organic pixels age unevenly.
- The fix is now at pixel level: pixel shifting/orbiting and pixel refresh cycles.



**Ghost of a static image**

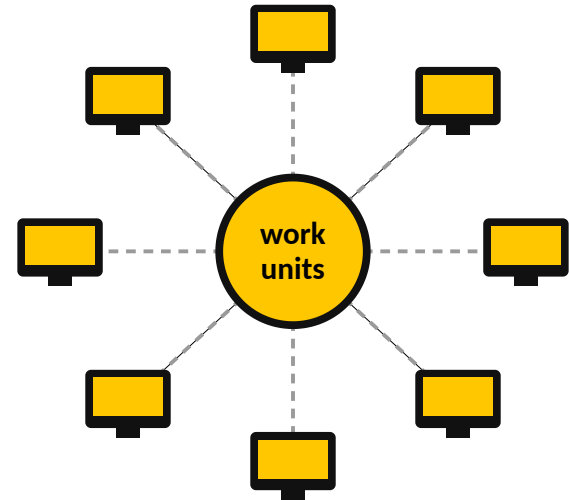
fix: screensavers → pixel shifting

## Q3. A thousand minds

- While all proteins can be described by sequences of just 22 amino acids, their 3d structure can be very unpredictable and is critical to their function. Folding@home is a mass project that simulates the folding of different protein structures, and has been instrumental in the treatment of Alzheimer's and Huntington's disease.
- Einstein@home is a similar project to analyse astronomical data to find a variety of rare celestial bodies
- Both these projects feature problems that are simple at a unitary scale, but feature an enormous number of these unitary problems
- Hence they use "resources" that are otherwise left unused for a large time. What are these systems based off of?

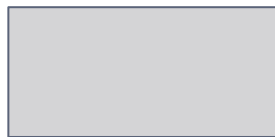
## Q3. Answer

- **Volunteer distributed computing (grid computing on idle CPU/GPU cycles)**
  - Volunteers' PCs crunch small work units while otherwise idle; Einstein@home runs on BOINC.
  - Huge numbers of simple, independent tasks are “embarrassingly parallel”, which is ideal for this.



Idle PCs, one shared problem

## Q4. Who's theorem is this?



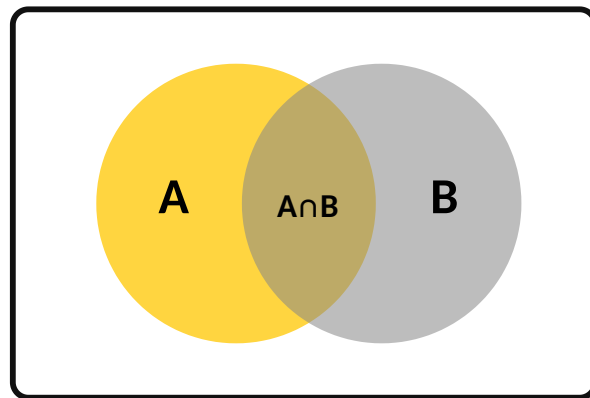
**THEOREM**

$$P(\text{she likes you} \mid \text{she likes your memes}) = \frac{P(\text{she likes your memes} \mid \text{she likes you})P(\text{she likes you})}{P(\text{she just likes memes in general})}$$

## Q4. Answer

- **Bayes' theorem**

- $P(A | B) = P(B | A) \cdot P(A) / P(B)$
- Named after Rev. Thomas Bayes (published posthumously, 1763).



$$\frac{P(A|B) = P(B|A) \cdot P(A)}{P(B)}$$

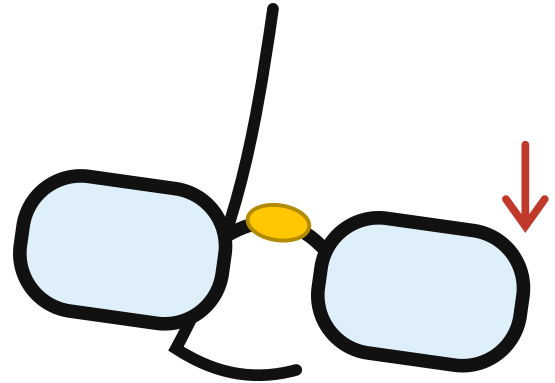
## Q5. You stupid four-eyes, you



- Hejny, an audio engineer from Nashville, Tenn., was inspired to create the wax four years ago when he was at a concert in Texas and saw a musician he was working with, constantly have to do something.
- Out of sympathy, he wanted to walk on stage and hold something in place so the drummer could focus on the music. This led to him creating Nerd Wax.
- What is NerdWax?

## Q5. Answer

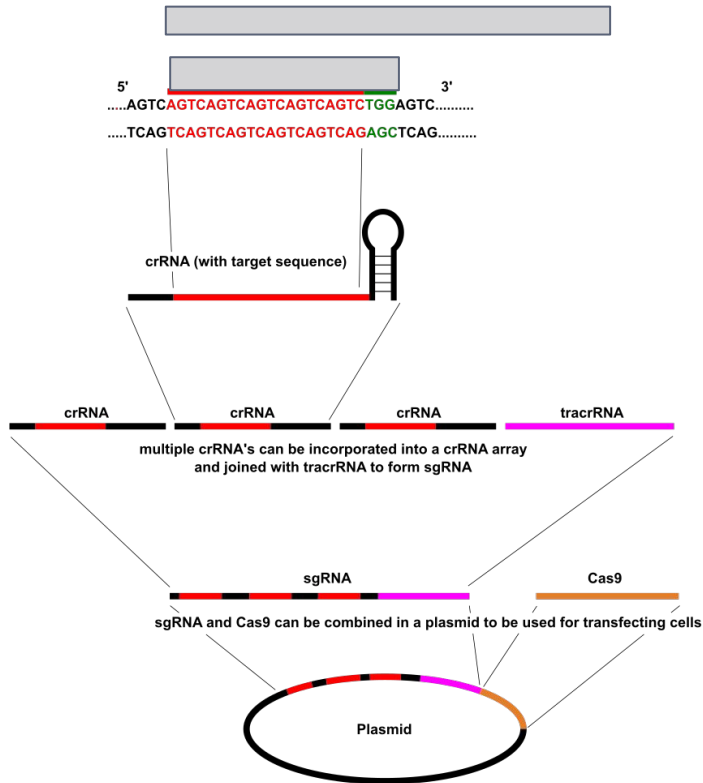
- A wax for glasses that stops them slipping down your nose
  - Rubbed on the nose pads/bridge of spectacles; it's what the drummer needed held in place.
  - Hence “four-eyes”, and the nerd in Nerdwax.



**Wax on the nose pads**

→ glasses stay put

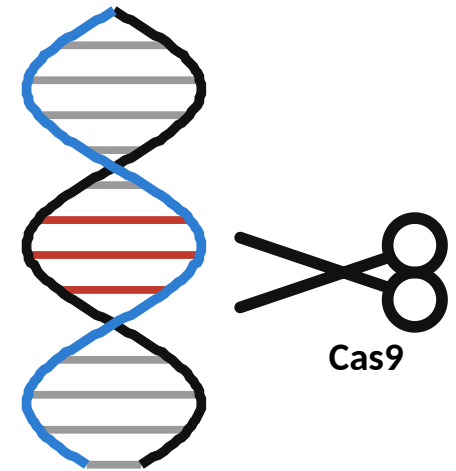
## Q6. It's not chips! - some brit, probably



- The existence of anomalous **repeating sequences** of DNA in certain single celled organisms was first noticed in E.Coli.
- It was later observed in yogurt bacteria repeatedly infected by viruses that these sequences were actually being taken from the virus
- Along with a protein named Cas9, this setup allowed the cell to **target specific DNA** in the attacker the next time around
- What are these sequences called OR what did their discovery allow humanity to do for the first time?

## Q6. Answer

- **CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats)**
- **It allowed precise, programmable editing of genes (CRISPR-Cas9 genome editing)**
  - The repeats were first seen in *E. coli* (Ishino, 1987); in 2007 work on yogurt bacteria (*S. thermophilus*) at Danisco showed they store viral DNA as an immune memory.
  - Doudna and Charpentier won the 2020 Nobel in Chemistry. The title: crisps, not chips.



Guide RNA finds it • Cas9 cuts

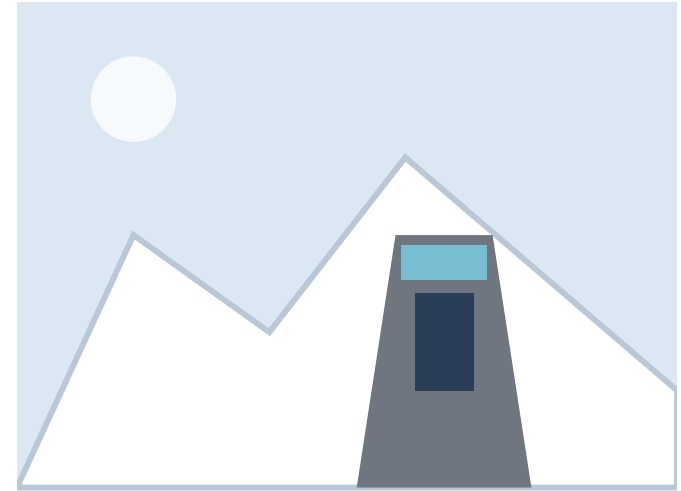
## Q7. Would be slightly weird if it were human

- The Svalbard Global \_\_\_\_\_ vault is a secure backup facility in order to maintain diversity of a certain item.
- Svalbard is a Norwegian archipelago that lies at the convergence of the Arctic Ocean with the Atlantic Ocean, and hence is a perfect location for the same.
- It has over a million samples of said item, ensuring humanity's future even if things go against us.
- FITB/Put funda

## Q7. Answer

- **Seed: the Svalbard Global Seed Vault**

- Nicknamed the “Doomsday Vault”, opened 2008, dug into a mountain on Spitsbergen.
- Permafrost keeps the seeds cold even if power fails; it holds duplicate crop seeds from gene banks worldwide.
- First withdrawal: ICARDA in 2015, to rebuild seed stocks lost to the Syrian war.



**-18 °C • 1.3 M+ seed samples**

Permafrost backup if power fails

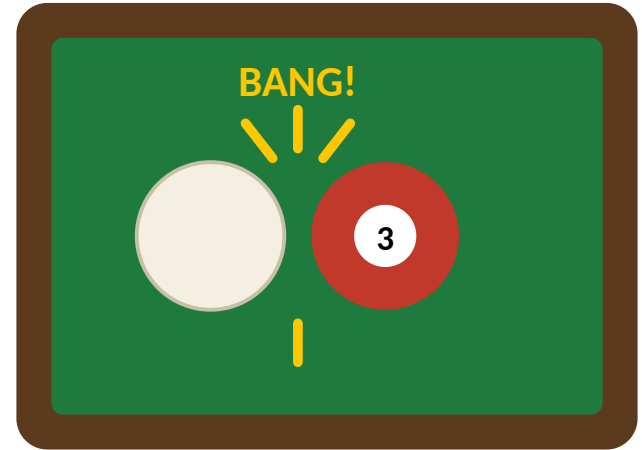
## Q8. Mr Wilson if he had health insurance

- These items initially used to be made of ivory, because it had certain physical properties, such as a particular density, and the ability to rebound properly.
- A shortage in ivory during the late nineteenth century meant that celluloid was used instead.
- However, celluloid was unstable, and exploded when 2 such items bumped together, which was not ideal for its use-case.
- What items, whose explosions would cause a scorching of the “green”?

## Q8. Answer

### ■ Billiard / pool balls

- Ivory balls were costly, which led to a prize for a substitute; John Wesley Hyatt tried celluloid.
- Celluloid balls could crack loudly on impact, like a gunshot. Legend says players in saloons drew their guns.
- The “green” is the baize table cloth.



**Ivory → celluloid**

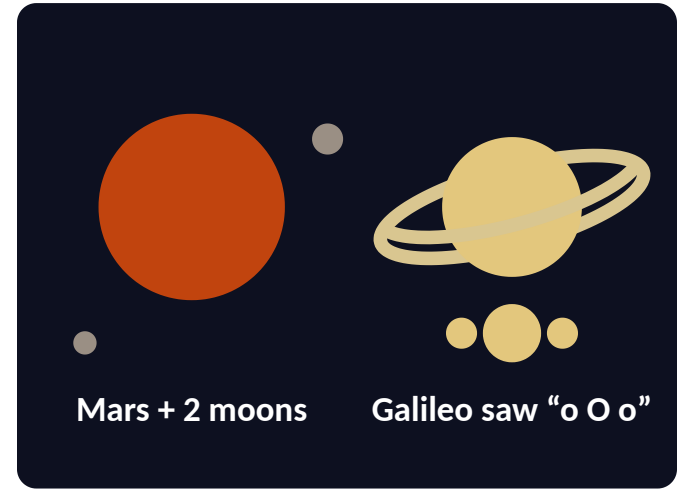
The green = baize

## Q9. Choosiest iqs solution - unscramble this for bonus

- In 1610, Galileo sent out an anagram SMAISMIRMILMPOETALEUMIBUNENUGTTAUIRAS in order to announce a new discovery.
- This was re-assembled by Kepler as “Salve, umbistineum germinatum Martia proles.” However, what Galileo actually wanted to communicate was “Altissimum planetam tergeminum obseravi”.
- Miraculously, both these interpretations were astronomical fact - though the prior one was only established to be true in 1877.
- What discoveries, respectively about Mars and Saturn?

## Q9. Answer

- **Mars:** it has two moons (Phobos and Deimos)
- **Saturn:** it appeared triple (Galileo was seeing its rings)
  - Kepler's reading: "Hail, twin companionship, children of Mars." Asaph Hall discovered the two moons in 1877.
  - Galileo's meaning: "I have observed the highest planet tri-form"; his telescope couldn't resolve the rings, so they looked like two side bodies.



**Phobos & Deimos (1877)**

Saturn's rings, unresolved in 1610

## Q10. If you can't chuck the logs,...

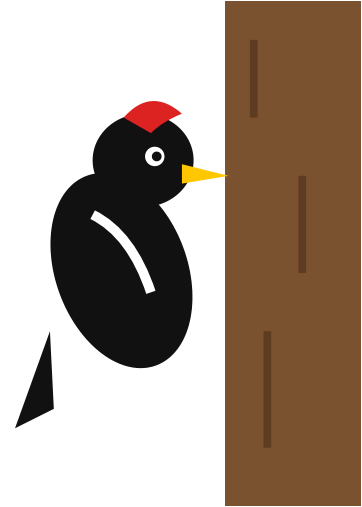
- This particular species should be a prime candidate for CTE (Concussions) due to their working conditions being similar to NFL players. (even worse, considering they do it year-round)
- However, the 2006 IgNobel prize was awarded for showing that the species is built to avoid any kind of head injury.
- This is due to having their brains packed more tightly into their skulls, smoother brain surface to maximise impact area, and by having minimal lateral motion, which avoids shear forces
- What animal?

# Q10. Answer

## ■ Woodpecker

- 2006 Ig Nobel Prize in Ornithology: Ivan Schwab and Philip May, for explaining why woodpeckers don't get headaches.
- Title: "How much wood would a woodchuck chuck..."

tok!



**~20 pecks/sec, no concussion**

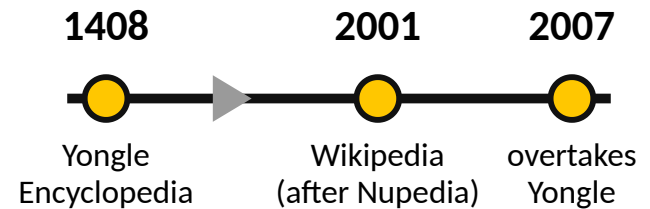
Tight skull • smooth brain • straight strikes

# Q11. Just google it man

- January 15, 2001 is probably the single most notable day in 2001 (sadly).
- \_\_\_\_\_ was launched on this date as a single language Edition. Its integral policy of "neutral point of view" arose within its first year.
- Otherwise, there were initially relatively few rules, and it operated independently of Nu\_\_\_\_\_, its precursor.
- In 2007, it surpassed the Yongle Encyclopedia made in China during the Ming dynasty in 1408, which had held the record for almost 600 years, as the largest of its kind.
- WAITA?

# Q11. Answer

- **Wikipedia**
- **Precursor: Nupedia**
  - Launched 15 January 2001 by Jimmy Wales and Larry Sanger, initially in English only.
  - In 2007 it overtook the Yongle Encyclopedia as the largest encyclopedia ever compiled.

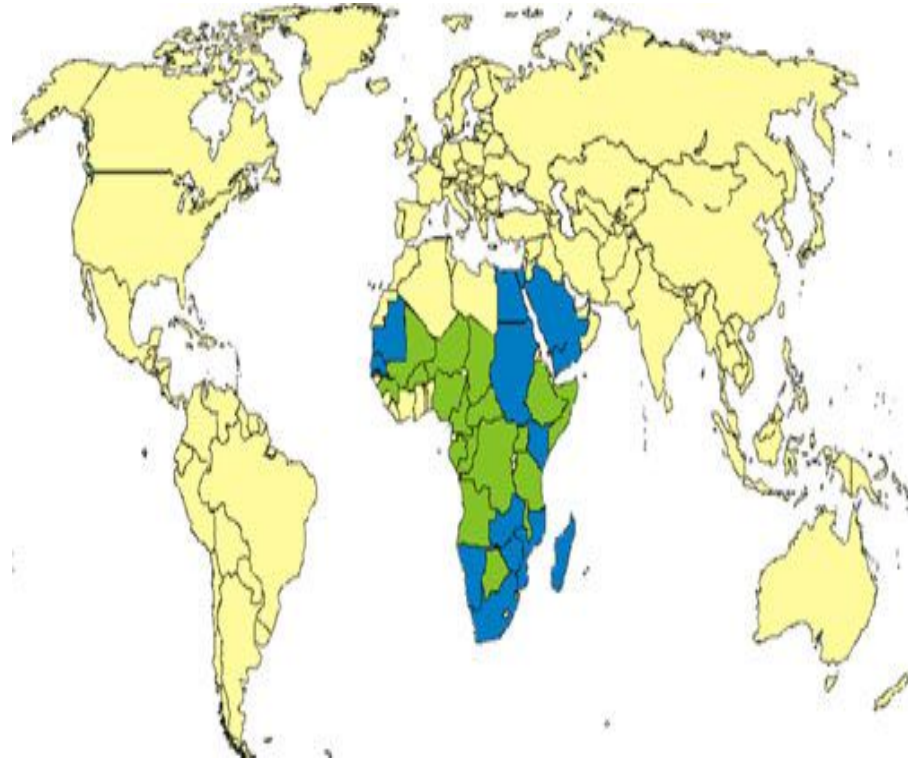


**~600-year record broken**

15 Jan 2001: Wikipedia Day

## Q12. Might cause arguments

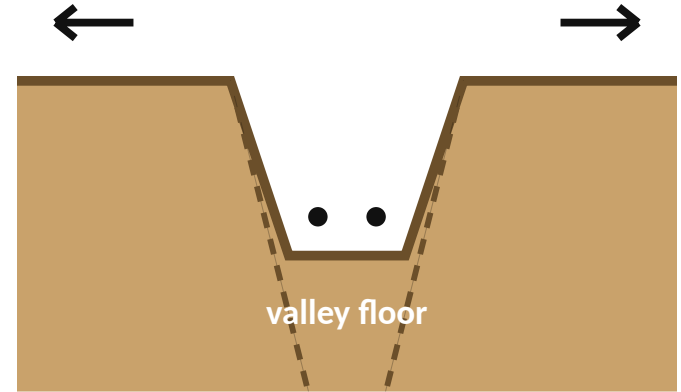
- \_\_\_\_\_ fever is a viral disease of humans and livestock that can cause loss of sight, infections of the brain, and liver problems.
- It was first discovered in livestock in the \_\_\_\_\_ in Kenya, and was named thus, after the famous natural feature.
- FITB



## Q12. Answer

### ■ Rift Valley fever

- Named after the Great Rift Valley in Kenya, where it was identified in sheep in the 1930s.
- Spread by mosquitoes and contact with infected animals. A rift “might cause arguments”.



**Great Rift Valley, Kenya**

Plates pulling apart: a “rift”

# Q13. Rise. Rise!

- The album Reise, Reise was dedicated to one of the worst disasters in a particular field, claiming 520 lives after a thirty minute struggle to regain control
- The album cover art also references this horrific incident, in particular the unique and standardised color of the item that fills the frame
- What is the item present in the the cover?



Audio A(full track):



Audio B: WARNING



## Q13. Answer

- A flight recorder: the “black box”, which is actually orange
  - Rammstein's Reise, Reise (2004) references Japan Airlines Flight 123 (1985): 520 deaths after about 30 minutes of struggle; the deadliest single-aircraft accident.
  - The cover is styled as a flight recorder, painted the standard high-visibility orange so it can be found in wreckage.

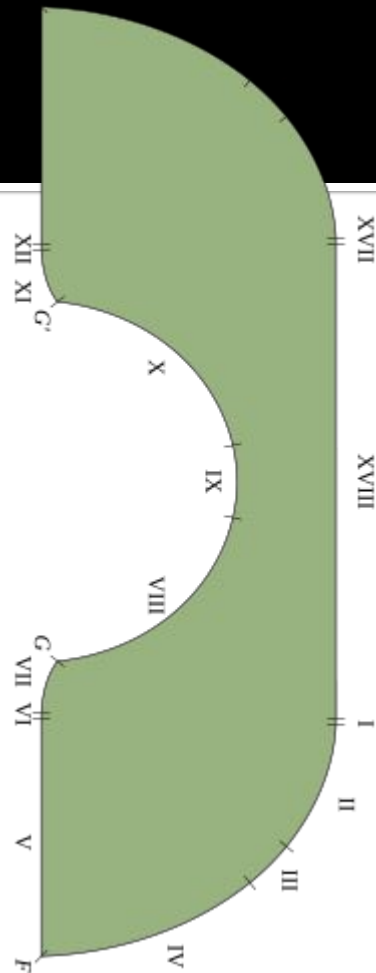


**“Black box” = high-vis orange**

JAL 123 • 12 Aug 1985 • 520 lost

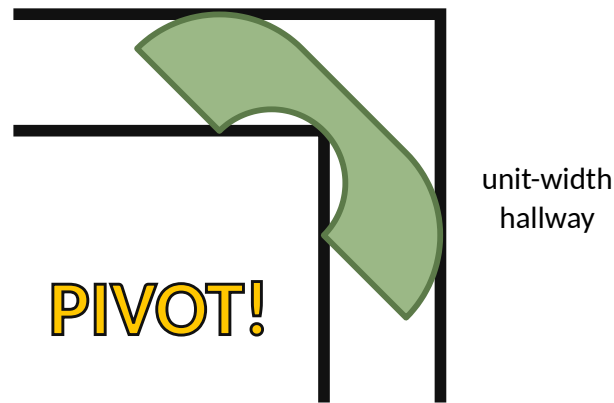
# Q14. You spin me right round

- What is this a proposed solution to?
- You might have seen it horizontally oriented, then in its current state
- There is also a very famous episode of Friends, with the episode *revolving* around a related issue



# Q14. Answer

- **The moving sofa problem**
  - What is the largest-area shape that can be turned around a right-angled corner in a hallway of unit width? (Leo Moser, 1966)
  - Hammersley's sofa is the horizontal “telephone” shape; shown here is Gerver's sofa (area  $\approx 2.2195$ ), proved optimal by Jineon Baek in 2024.
  - Friends, “The One with the Cop”: Ross yells “PIVOT!” while carrying his couch up the stairs.



**Max area  $\approx 2.2195$  (Gerver)**

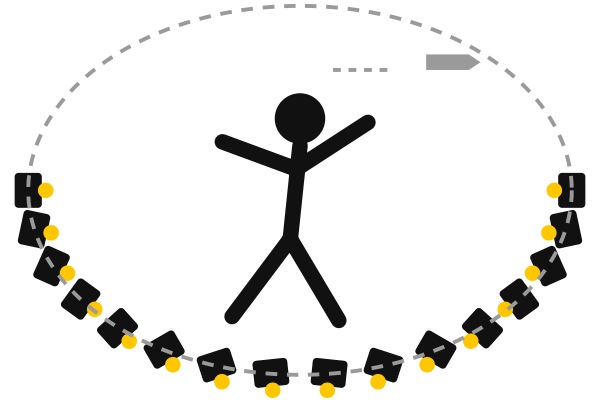
Proved optimal: Baek, 2024

# 15. zeroes and Ones

- This filmmaking technique uses an array of array of cameras around a fast moving object, and takes photos of it from multiple angles and high FPS.
- These photos are then stitched together and played in sequence (as in any normal movie) at normal speed to create a sense of fast camera movement in what is otherwise a single slow motion moment. CGI is sometimes use to smooth out the action.
- What is this technique called, named after its most common subject? OR Where can you find this technique first used in cinema?

# 15. Answer

- **Bullet time**
- **First used in cinema (and popularised by): The Matrix (1999)**
  - A ring of still cameras fires in sequence around the subject; the frames play as a camera move around a frozen moment.
  - Title: “zeroes and ones”, i.e. the Matrix's digital world.



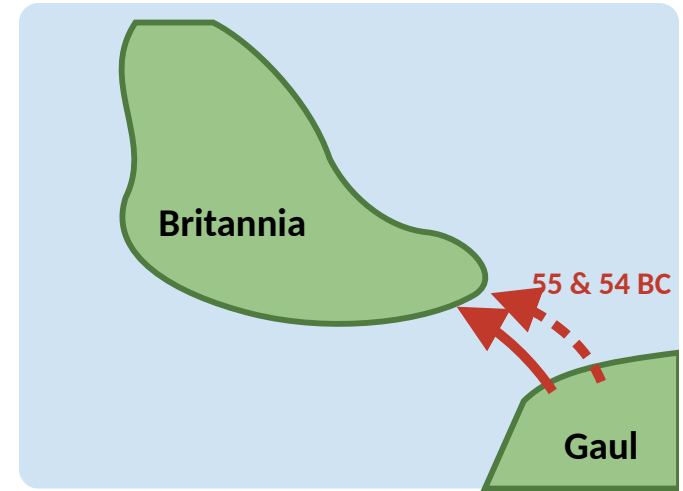
**Frozen moment, moving camera**  
The Matrix (1999)

## Q16. You as well, Johan?

- In 1963, he was the first of the only 8 people to be made an honorary citizen of the USA.
- He was also named the G.O.A.T of his nation in a 2002 poll by the national television, with 2nd in the list being a construction engineer, 3rd a women, 4th a biologist, 5th a poet and 6th a physicist. Who?
- About whose invasions to his country, twice in the history in 55 BC and 54 BC, was the theme of the first of his 4-volume book, titled 'A History of the \_\_\_\_\_ Speaking Peoples'?

# Q16. Answer

- **Winston Churchill**
- **Invader: Julius Caesar; book: A History of the English-Speaking Peoples**
  - First honorary US citizen (1963). Winner of the BBC's 100 Greatest Britons (2002), ahead of Brunel, Princess Diana, Darwin, Shakespeare and Newton.
  - Volume 1, The Birth of Britain, opens with Caesar's invasions of 55 and 54 BC. Title: "Et tu, Brute?"
  - He won the 1953 Nobel Prize in Literature, partly for his historical writings.



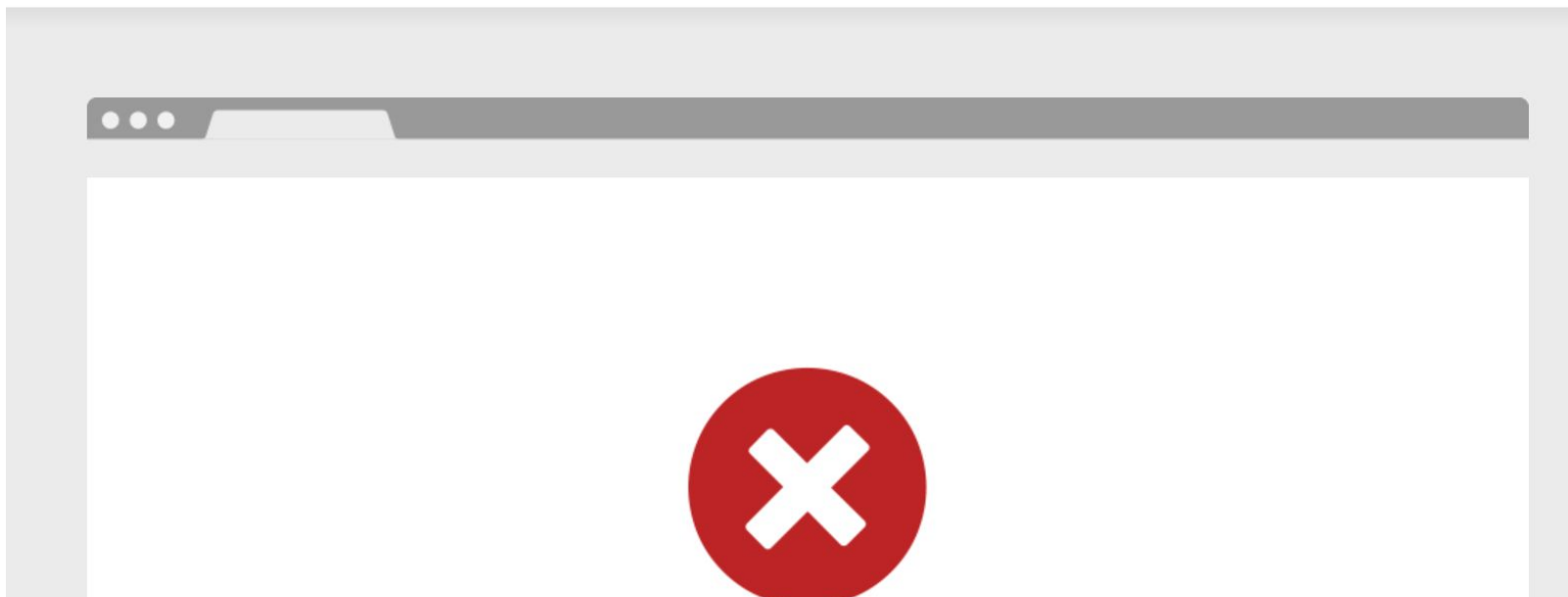
**Caesar crosses the Channel**

"Et tu, Brute?" → Johan

# Then why should I live?

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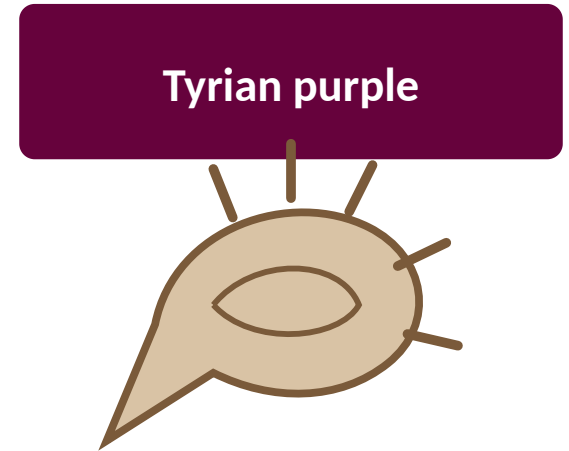
## 17.

- Before the advent of modern organic chemistry, bright, deep color was a time consuming process of extracting and processing gemstones, bugs and the like.
- The rarest of the lot was \_ \_ \_ \_ \_ , which could only be reliably extracted from the mucus of the Tyrian sea snail, or murex.
- As a result it became a color almost entirely missing from national and state flags over history, as these flags would need to be mass produced.
- Which color am I talking about?

# 17. Answer

## ■ Purple (Tyrian purple)

- Thousands of murex snails were needed for a single gram of dye, so it became the colour of emperors and royalty.
- Only two national flags include purple: Dominica (the Sisserou parrot) and Nicaragua (the rainbow in its coat of arms).
- William Perkin's synthetic mauveine (1856) finally made purple cheap.



**~10,000 murex ≈ 1 g of dye**

Flags with purple: Dominica, Nicaragua

# 18.Colorful

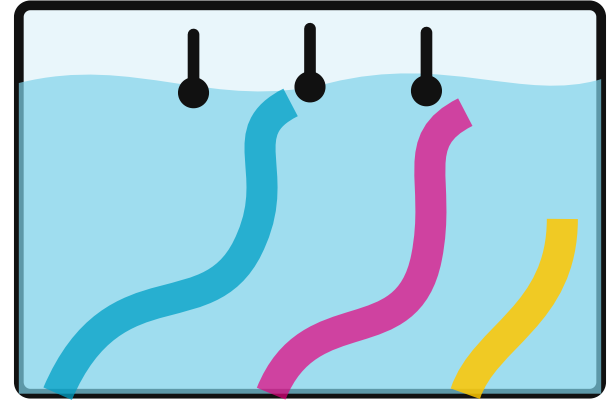
- X once collaborated with Triflare, a sportswear company for a marketing campaign where US synchronized swim team members performed in a 17,000-gallon tank broadcasted live on giant LED screens.
- This Swimming event featured X's new product with two years' worth of \_\_\_\_\_. The event also helped in promotion of Triflare special swimsuits printed with X's dye-sublimation technology.
- ID X.



# 18. Answer

## ■ Epson

- “Swimming in Ink”, Times Square, September 2015: USA Synchro swimmers performed in a 17,000-gallon tank.
- The launch was for the EcoTank printers, sold with two years' worth of ink.
- Triflare's swimsuits were printed with Epson's SureColor dye-sublimation printers.



**“Swimming in Ink” • 2015**

EcoTank: two years of ink

## 19. Maybe this quiz has too many color questions

- This dark blue pigment produced by oxidation of ferrous ferrocyanide salts, is named after a historic region in the central Europe. ID this compound that you might have come across during your JEE days. (5)
- Thanks to it binding to Cs-137 in the gastrointestinal tract of humans and animals, preventing it from being absorbed into the body and promoting its excretion through feces, the pigment was used extensively in Eastern Europe in the late 20th century. Put the funda. (5)
- What from the world of pop-culture is named after Cs-137 isotope? (5)

# 19. Answer

- a) Prussian blue (ferric ferrocyanide)
- b) An antidote for radioactive caesium after the Chernobyl disaster (1986)
  - It binds caesium in the gut and stops it being reabsorbed. It was given to people and added to livestock feed, and today is sold as Radiogardase.
- c) Cesium 137, an American futurepop/synthpop band

## Prussian blue



## Cs-137

trapped in gut  
→ excreted

Chernobyl, 1986 • Radiogardase

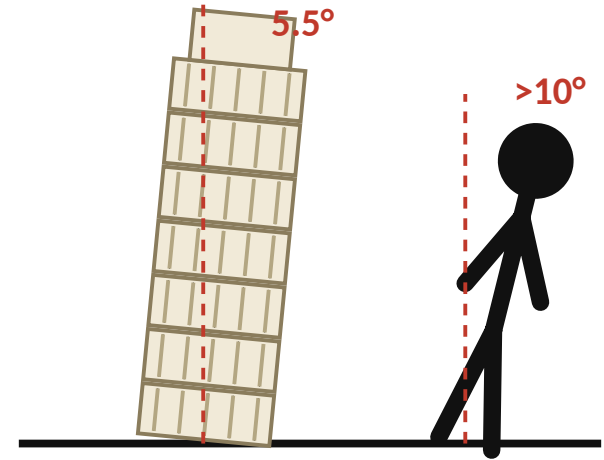
## 20. Za

- This is a condition in which there is sustained involuntary flexion of the body and head to one side and slight rotation of the trunk, so the person appears to have a 'lean'. Even though the common name owes its inspiration to something for its unintended  $5.5^\circ$  tilt, this syndrome is clinically defined as a lateral flexion of more than  $10^\circ$  in the standing position.
- How do we better know this medical condition?



## 20. Answer

- **Pisa syndrome (pleurothotonus)**
  - Named after the Leaning Tower of Pisa, which tilted about  $5.5^\circ$  before it was stabilised (about  $4^\circ$  now).
  - Often a side effect of antipsychotic drugs; also seen in Parkinson's disease. Title: “Za”, as in Piz-za.



**Leaning like the tower**

Lateral flexion of the trunk