Nobel Laureate in Chemistry 1961-1970

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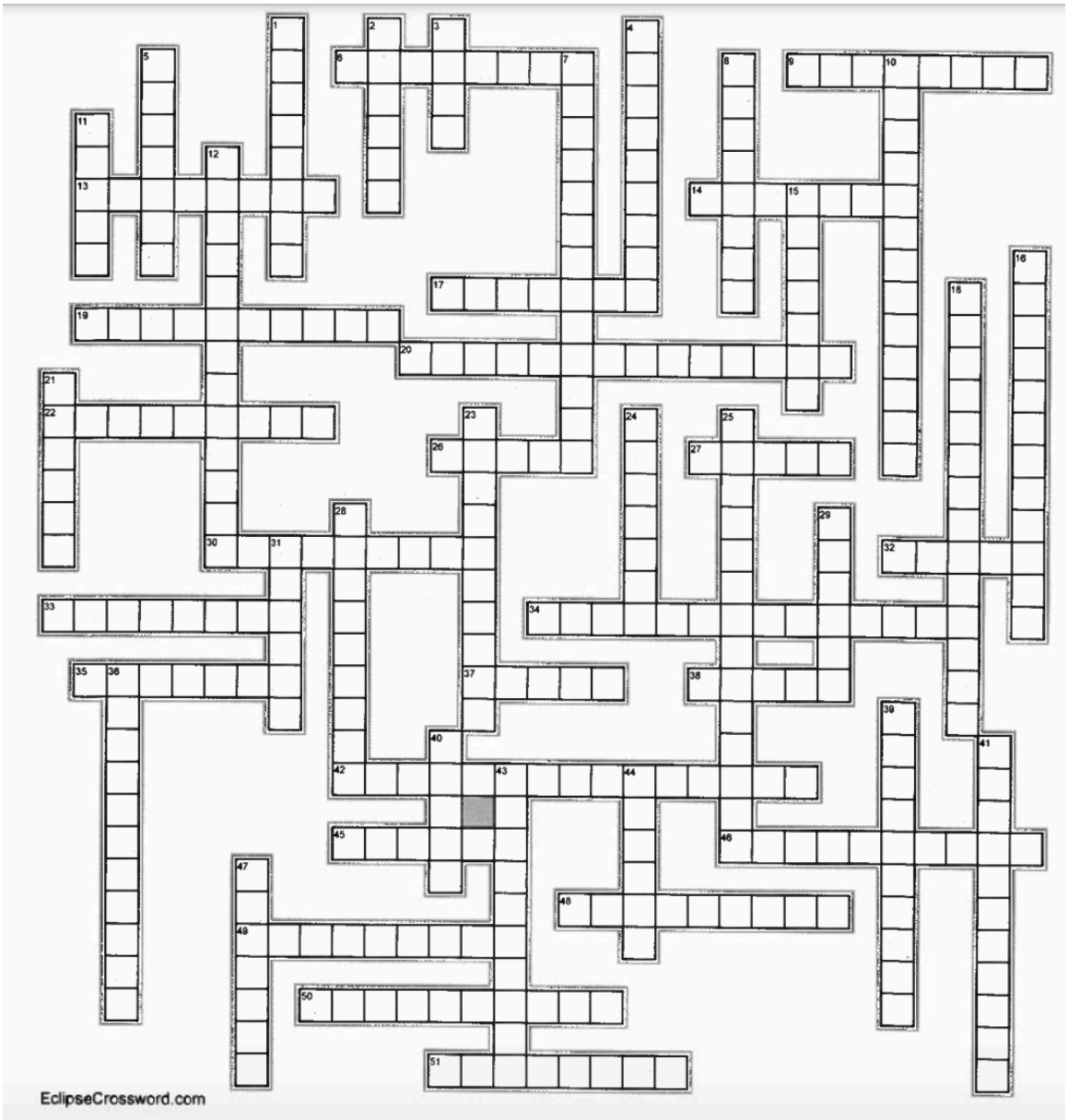

Across

6. Professor Ronald Norrish was one of three recipients of the 1967 Nobel Prize in chemistry. He used short pulses of energy (i.e. photons) to alter the equilibrium in chemical reactions. In many experiments the burst of light caused molecules to split into fragments and form _____.

9. In 1964, the Verrazano Narrows Bridge in New York City, linked _____ and Staten Island and set a standard for span bridges.

13. The 1962 Nobel Prize in Chemistry was awarded to Dr. Max Perutz and Dr. John Kendrew for their work determining the structures of _____ proteins.

14. Dr. Dorothy _____ developed x-ray techniques and complex calculations to determine the structure of penicillin and vitamin B12.

17. A _____is a string like structure that has a repeating structure.

19. Vitamin B12 is the most complex structure of the vitamins. X-rays (high energy photons) were _____ through their structure in order to determine the positions of the atoms.

20. _____, Plants transform light (electromagnetic radiation) into chemical energy. In green plants, light converts water, carbon dioxide, and some minerals into O_2 (oxygen) and organic compounds such as sugars (i.e. glucose).

22. Neil _____ and Buzz Aldrin were inside the Apollo Lunar Module Eagle when they landed on the moon on July 20, 1969, _____'s famous quote when first putting his foot on the moon was "One small step for man, one giant leap for mankind."

26. Dr. _____ developed the dating technique that utilized the carbon-14 isotope to measure age of carbon containing objects (aka radiocarbon dating). Dr. Willard _____ of UC Berkley.

27. A protein's tertiary structure is its _____-dimensional shape.

30. MASER stands for _____amplification by stimulated emission of radiation.

32. The measles vaccine, the _____ vaccine and the rubella vaccine were all developed in the 1960's.

33. Robert S. _____ won the Nobel "for his fundamental work concerning chemical bonds and the electronic structure of molecules by the molecular orbital method".

34. Globular proteins are spherical structures that are water-soluble and shaped like a sphere. They naturally fold into the shape of a sphere (aka as _____).

35. Polystyrene is a synthetic polymer made from monomers (single units) of _____.

37. The _____ is a brand of spacecraft developed in the USSR (Soviet Union) in the 1960's and made over 120 flights.

38. Dr. Charles Townes was a co-recipient of the 1964 Nobel Prize in Physics. He invented the _____.

42. Liquid helium is used to cool _____magnets used in instruments such as NMR (nuclear magnetic resonance).

45. Lev Landau won the 1962 Nobel Prize in physics for his work in condensed matter, specifically for his work with liquid ____ (BP = 4.2 Kelvin / -269 °C).

46. Laser stands for Light amplification by _____ emission of radiation

48. The 1962 Nobel Prize in Literature was awarded to John _____.for his novels, such as the *Grapes of Wrath*, *Cannery Row*, and *Of Mice and Men*. Some of his stories focused on the struggles of the oppressed working class.

49. Scuba stands for Self Contained Underwater Breathing _____

50. Dr. Lars Onsager won the 1968 Nobel Prize in chemistry for his work describing reactions that, thermodynamically were not _____.

51. Quinine is a natural product that was extracted from the bark of the _____ tree, Quinine is a well-known natural product that was used by native populations in South America to kill the parasite that caused malaria. While an effective source for small groups of people, this source could not meet the world's requirement.

Down

1. Dr. Robert _____ was a ground breaking synthetic organic chemist. He developed unique chemical reactions to convert small molecules into larger organic molecules that were of great use to humanity. He was the sole recipient of the chemistry prize in 1965.

2. The 1961 Nobel Prize in Chemistry was awarded to Dr. Melvin ____ for tracing the path of carbon through the photosynthesis process (used carbon dioxide).

3. The 1964 Nobel Peace Prize was awarded to Dr. Martin Luther ___ Jr. for his peaceful approach to seeking civil rights for African Americans.

4. Dr. Dorothy Hodgkin won the Nobel Prize in Chemistry (1964). Her work was focused on biology at the _____ level.

5. The 1965 Nobel Prize in Physics was awarded to Sin-Itiro Tomonaga, Julian Schwinger and Richard P. Feynman developing quantum electrodynamics. Dr. Feynman would later publish a very popular book, read by laymen around the world, called "Surely You're Joking, Mr. Feynman!": Adventures of a _____Character." (hint, its a good read).

7. _____ utilizes ultrasound to accelerate or change the type of reaction taking place. It uses ultrasound radiation in the 20 kHz to 20 MHz range.

8. Three common examples of globular proteins are antibodies, enzymes and _____.

10. Jacques Cousteau, the French _____, was working on 3 underwater villages called Precontinent I, Precontinent II and Precontinent III in the 1960's. They were at different depths for underwater workers.

11. Dr. Manfred ____ won the 1967 Nobel Prize in chemistry. He was one of three recipients that year. He used sound waves to stimulate some chemical reactions to go faster. One example was dissolving salts in a specific solvent

12. The element Rf or _____ is a man made radioactive element that has chemical and physical properties similar to hafnium and zirconium.

15. Yuri _____ (USSR) was the first human in space. He circled the planet at 27,000 km/hour. It lasted less than 2 hours..

16. Mycobacterium tuberculosis is the bacterium responsible for ____ (Tb). Up until the early 1960s, Tb patients were treated for up to 24 months, with time spent in the hospital. New antibiotics in the 1960's, many are still in use today, helped reduce the time needed to treat Tb down to 3 to 6 months. Tb is one of the deadliest diseases in the history of humanity, and drug resistant Tb is now a problem. One sneeze from an infected person can infect up to two dozen people in close quarters (i.e. crowded room).

18. _____is the study of ultrafast chemical reactions that can studied by pulses of light that take place on the order of 10^{-15} seconds (a femto-second).

21. The _____-14 isotope has a half-life of 5730 years. As a rule of thumb, it cannot measure the age of an object that is more than 60,000 years old.

23. The 1964 _____Act, the U.S. Congress started a formal process of setting aside wilderness areas for the long term benefit of Americans.

24. The total synthesis of _____ was published in 1944 by by Dr. Robert Woodward and William Doering. _____ was a critical anti-malaria drug needed by the military fighting in the South Pacific (WW2).

25. Polyethylene (PE), Polystyrene (PS), Polypropylene, Polyvinyl chloride (PVC), Polyester, Nylon, Acetals are example of _____

28. Dr. Mulliken outlined how a Linear Combination of Atomic Orbitals (LCAO) could be used to construct a set Molecular Orbitals (MO). MO's are the paths that electrons travel in covalent bonds, bonding atoms together to form _____.

29. Dr. George _____ shared the 1967 Nobel Prize for his studies of extremely fast chemical reactions using very short pulses of light. He worked with Dr. Norrish.

31. Dr. Peyton Rous was awarded the Nobel Prize in Medicine for demonstrating that cancer can be spread from one organism (i.e. chicken) to another by transferring _____ cells.

36. "For example, we used seeds and plant material from _____'s tomb, which is very precisely dated. We also used seeds from a room underneath the Saqqara step pyramid dated to a specific year of the reign of King Djoser," from: https://www.bbc.com/news/10345875

39. _____ inversion exists in a laser. It is when there are more electrons in the excited state than in the ground state.

40. The 1962 Nobel Prize in Physiology or Medicine was awarded to Francis Crick, James Watson and Maurice Wilkins for uncovering the Double _____ structure of DNA.

41. A simple polymer is _____, which is composed of -CH_2- units,

43. An example of a non-reversible chemical reaction is the _____ process in a flame, where air (oxygen, nitrogen) and hydrocarbons react to form a product.

44. The 1965 Nobel Peace Prize was awarded to United Nations Children's Fund : _____ for their efforts to bring economic equality for those in poor nations.

47. Helium is unique as a (elemental) liquid. The liquid form that follows the laws of physics is called Helium I; it exists from the BP at 4.2 Kelvin down to 2.18 Kelvin. The second form of liquid Helium 2, exists below 2.18 K, and follows some unique and interesting laws of _____ quantum physics. Absolute zero (O K) has never been achieved. https://www.youtube.com/watch?v=YVMuI_shItE A classic video (1963) showing the superfluid (He(II)) - which has zero entropy.