



NATIONAL Science Bee

National Science Bee – 2021-22 A Set Qualifying Exam

Name _____

School _____

Grade _____

Email address _____

Instructions - Circle the correct answer or leave it blank. Correct answers are worth 2 points. Incorrect answers are worth -1 point. Questions left blank are worth 0 points.

- In a scattering experiment, alpha particle 1 deflected at 120° , alpha 2 at 60° , and alpha 3 at 3° . Which was deflected by electrons of atoms in the foil?
 - Alpha 1 only
 - Alpha 1 and 2 only
 - Alpha 2 and 3 only
 - Alpha 3 only
- Which of the following is NOT a programming language?
 - Pascal
 - Mozilla
 - C++
 - Ada
- Which of the following would not be found in a standard hydrogen electrode?
 - 1 M HCl solution with hydrogen gas
 - Zinc electrode
 - 1 atmosphere
 - Inert platinum electrode
- The Almagest was written by which of the following?
 - Aristotle
 - Pythagoras
 - Ptolemy
 - Hipparchus
- Which theory states that there exists no set larger than the set of integers and smaller than that of real numbers?
 - Continuum hypothesis
 - Cantor's theorem
 - Non-denumerability of the continuum
 - Axiom of infinity
- Identify the substances which contain a high concentration of a specific mineral.
 - Slag
 - Minerals
 - Ores
 - Gangue
- Thales of Miletus accurately predicted a solar eclipse for the first time in recorded history in which year?
 - 1530 BC
 - 584 BC
 - 1276 AD
 - 2201 AD
- A steel ball is dropped from rest and falls for several seconds. Approximately how fast is the ball moving at the end of 3 seconds?
 - 30 m/s
 - 60 m/s
 - 10 m/s
 - 20 m/s
- A triangle where no two sides are equal is classified as which of the following?
 - Scalene
 - Isosceles
 - Acute
 - Obtuse
- Phosphorus reactions in soil are dependent on which of the following?
 - Porosity
 - Type of soil
 - Solubility
 - pH
- Which of the following is an amino acid, not a polymer?
 - Glycine
 - Bakelite
 - Polyethylene
 - Propanic acid

12. Most hypoxic zones, often caused by runoff of excess nutrients, can be found in which parts of the world?
- Along the coasts of countries
 - In the hadalpelagic zones
 - In the abyssopelagic zones
 - Open ocean surface waters
13. Diurnal motions are caused by
- The rapid rotations of heavenly bodies
 - The motion of the moon about the Earth
 - The motion of the Sun about the Earth
 - The rotation of the Earth around its axis
14. Medieval scientists and doctors believed in the existence of four key liquids of the body that they called humours. Among the four humours, which was believed to be the cause of ill-tempered moods?
- Black bile
 - Phlegm
 - Yellow bile
 - Blood
15. Which accurately describes the role of the light-independent reactions?
- Transforming light energy into chemical energy
 - Transferring chemical energy into high-energy sugars
 - Returning chemical energy to light energy
 - Transferring light energy among different compounds
16. What process in the biogeochemical cycle of nitrogen converts organic compounds from decomposing organisms to inorganic ammonium?
- Fixation
 - Ammonification
 - Nitrification
 - Denitrification
17. Which is a cause of the rapid movement of a Venus flytrap's leaf?
- Auxin
 - Electrical Signals
 - Ethylene gas
 - Abscisic acid
18. Which of the following is a rational number?
- $\sqrt{2}$
 - $\sqrt{\pi}$
 - $\sqrt{7}$
 - $\sqrt{49/64}$
19. Which of the following is TRUE?
- An effective buffer has a $[\text{base}]/[\text{acid}]$ ratio in the range of 10 – 100.
 - An effective buffer has very small absolute concentrations of acid and conjugate base.
 - A buffer is most resistant to pH change when $[\text{acid}] = [\text{conjugate base}]$
 - A buffer cannot be destroyed by adding too much strong base. It can only be destroyed by adding too much strong acid.
20. If a planet's rotation on its axis is perpendicular to its orbital plane, its seasons would be ____.
- Constant
 - Shorter than those on Earth
 - Longer than those on Earth
 - The same as those on Earth
21. All prime numbers greater than 2 are odd, but a prime greater than 10 can never end in which digit?
- 1
 - 7
 - 3
 - 5
22. The two strands of a DNA molecule are held together by which type of bond?
- Covalent
 - Peptide
 - Ionic
 - Hydrogen
23. Which astronomer created a trade wind theory when studying regional wind systems, though is better known for identifying his namesake comet?
- Edwin Holmes
 - Robert H. McNaught
 - Edmund Halley
 - Alan Hale
24. Which element is so radioactive that it glows visibly and emits heat?
- Radium
 - Xenon
 - Curium
 - Radon
25. What is the probability that an integer chosen randomly from numbers 100 through 999 will have 0 as at least one of the digits?
- 19/900
 - 171/900
 - 81/900
 - 90/900

26. What is the surface area of a cube whose volume is 27 cubic inches?
- 27 cubic inches
 - 27 square inches
 - 54 square inches
 - 54 cubic inches
27. Anthropoids include monkeys and which of the following?
- Lemurs
 - Humans
 - Tarsiers
 - Lorises
28. Which of the following procedures would double the pressure of a gas in a container?
- Double the volume
 - Double the temperature
 - Decrease the pressure
 - Increase the size of the container
29. What is the oxidation number of chlorine in NaCl?
- 2
 - 1
 - 0
 - +1
30. Which of the following describes a salt bridge?
- A pathway composed of salt water that ions pass through.
 - A pathway in which no ions flow.
 - A pathway between the cathode and anode in which ions are oxidized.
 - A pathway by which counterions can flow between the half-cells without the solutions in the half-cell totally mixing.
31. Which civilization is regarded as the first to have a functional theory of the planets?
- Chinese
 - Babylonian
 - Egyptian
 - Cro-Magnon
32. Which of the following was the first to apply for a patent for a refracting telescope?
- Galileo Galilei
 - Hans Lipperhey
 - Johannes Kepler
 - Hypatia
33. Which of the following is a real operating system?
- Cold Fusion
 - Perl
 - Solaris
 - Boomerang
34. If a photographic film is sensitive to blue light but not green light, would you predict it would be sensitive to red light?
- No, because red photons are less energetic than green photons.
 - Yes, because red photons are more energetic than green photons.
 - Yes, if the intensity is high enough.
 - Yes, if the exposure is long enough.
35. On an ideal coil spring, pulses:
- keep their size
 - Keep their shape
 - add displacements
- I and II only
 - I, II, and III
 - I only
 - II only
36. If the calculated cell potential is _____, the reaction is spontaneous.
- Positive
 - Negative
 - Neutral
 - Balanced
37. The most dangerous consequence of earthquake damage to structures is caused by
- Soil Liquefaction
 - Foundation tremors
 - Rolling Surfaces
 - Tsunamis
38. Identify the ion that is responsible for the red color of rubies.
- Cr⁶⁺
 - Cr⁵⁺
 - Cr⁴⁺
 - Cr³⁺
39. Identify the isomers that have ligands with different spatial arrangements about the metal ions.
- Linkage isomers
 - Geometric isomers
 - Coordination isomers
 - Optical isomers
40. Which statement below describes chewing cud?
- Ruminants regurgitate food from the rumen, chew and swallow it again
 - Non-ruminants use specialized bacteria to help digest proteins
 - Ruminants use specialized bacteria to digest cellulose
 - Non-ruminants regurgitate food that is indigestible

41. A plant near a window will start to bend toward the window. Which of the following explains this phenomenon?
- Abscisic acid inhibits cell division on the sunny side of stems.
 - Cytokinin stimulates cell division on the sunny side of the plant's roots.
 - Gibberella fujikuroi stimulates the plant to grow unusually tall.
 - Auxin concentrates on the shaded side of stems and stimulates cell elongation.
42. A battery that uses a reversible redox reaction is called a _____ storage battery.
- Primary
 - Secondary
 - Tertiary
 - Quaternary
43. Which of the following features of the photoelectric effect are incompatible with the wave model of light?
- The photocurrent is proportional to the intensity of light.
 - There is no systematic delay between the time light hits cathode of photocell and ejection of photoelectrons.
 - The wavelength of the light is inversely proportional to its frequency.
 - Ejection of photo electrons is not dependent on the frequency of light.
44. The problem with replicating the lagging strand, 3' to 5' direction, is solved through use of which of the following?
- Base Pairing
 - Enzyme Helicase
 - Okazaki Fragments
 - Replication Forks
45. The ancestors of many modern animal phyla first appeared during the
- Burgess Period
 - Ediacaran Period
 - Precambrian Period
 - Cambrian Period
46. Which of the following changes would double the period of a pendulum?
- Double the mass of the bob
 - Double the length of the string
 - Quadruple the mass of the bob
 - Quadruple the length of the string
47. What is the smallest number greater than 64 that is both a perfect square and a perfect cube?
- 256
 - 729
 - 4096
 - 149
48. Most crops are grown from which of the following?
- Dicotyledons
 - Monocotyledons
 - Epiphytes
 - Eudicots
49. An uncharged glass rod is rubbed with silk. The rod is suspended and when the silk comes near the rod, it turns toward it. What does this tell you about electric charges?
- A negative charge was transferred from rod to silk.
 - A positive charge was transferred from the silk.
 - Charges can be separated by rubbing glass with silk.
 - No conclusion can be drawn.
50. Who is credited with the invention of the electric battery?
- Dmitri Mendeleev
 - Alessandro Volta
 - James Clerk Maxwell
 - Michael Faraday