

Test: 2021 National Science Bee (B)

Question 1 of 50

The rough endoplasmic reticulum is characterized by the presence of what organelle?

- A) Ribosome
- B) Mitochondrion
- C) Lysosome
- D) Vesicle

Question 2 of 50

Gaussian elimination is used to put what mathematical items in reduced row echelon form?

- A) Matrices
- B) Sequences
- C) Sets
- D) Polyhedra

Question 3 of 50

Taking what operation of position yields acceleration?

- A) First derivative with respect to position
- B) Second derivative with respect to position
- C) First derivative with respect to time
- D) Second derivative with respect to time

Question 4 of 50

Which philosopher developed an early form of the scientific method in his book *Novum Organum*?

- A) Francis Bacon
- B) Aristotle
- C) Galileo Galilei
- D) Isaac Newton

Question 5 of 50

Which of the following is not a characteristic of all aromatic molecules?

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- A) Planar structure
 - B) Contains only carbon atoms
 - C) Cyclic structure
 - D) Contains delocalized electrons

Question 6 of 50

Cisplatin is a compound with what molecular geometry that includes two lone pairs and four bonds?

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- A) Trigonal planar
 - B) Tetrahedral
 - C) Seesaw
 - D) Square planar

Question 7 of 50

Tribologists study what force, which is described in Amonton's laws?

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- A) Centrifugal
 - B) Centripetal
 - C) Friction
 - D) Gravity

Question 8 of 50

Dipalmitoylphosphatidylcholine (DPPC) is used in what organ as a surfactant?

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- A) Lung
 - B) Skin
 - C) Small intestine
 - D) Large intestine

Question 9 of 50

Fleischmann and Pons tried (and failed) to perform the "cold" form of what process which also occurs in toroidal reactors called tokamaks?

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- A) Nuclear fusion
 - B) Quantum containment
 - C) Alpha decay
 - D) Rare earth element synthesis

Question 10 of 50

DMF (Dimethylformamide) and THF (Tetrahydrofuran) are used as what kind of substances in chemistry?

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- A) Acid
 - B) Solute
 - C) Solvent
 - D) Volatile

Question 11 of 50

Which scientist improved on Thomas Newcomen's design of a steam engine?

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- A) James Watt
 - B) William Murdoch
 - C) Alessandro Volta
 - D) John Roebuck

Question 12 of 50

The Bessemer process is used to produce what material?

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- A) Steel
 - B) Glass
 - C) Amorphous
 - D) Paper

Question 13 of 50

In what Guido van Rossum designed programming language does whitespace indentation matter for syntax?

- A) Java
- B) Python
- C) OCaml
- D) Pascal

Question 14 of 50

The maximum potential mass of a white dwarf is a "limit" named for which scientist?

- A) Chandrasekhar
- B) Van Allen
- C) Hertzsprung
- D) Halley

Question 15 of 50

What lab technique, which often requires ethidium bromide, uses an electric field to separate out substances?

- A) Cell culturing
- B) Chromatography
- C) Gel electrophoresis
- D) Centrifugation

Question 16 of 50

The ocean floor mainly consists of what type of rock?

- A) Flint
- B) Obsidian
- C) Gabbro
- D) Basalt

Question 17 of 50

What ancient fossils contain sediment that precipitated over layers of cyanobacteria and algae to form "microbial mats"?

- A) Stromatolites
- B) Trilobites
- C) Coprolites
- D) Perminerals

Question 18 of 50

Which term best describes the fraction of an administered medication that reaches the blood stream?

- A) Absorption
- B) Bioavailability
- C) Bioequivalence
- D) Adsorption

Question 19 of 50

In what technique are chemicals purified by dissolving a substance and then precipitating out the pure chemical?

- A) Recrystallization
- B) NMR extraction
- C) Laser melting
- D) Filtration

Question 20 of 50

What type of rock is the extrusive equivalent of granite?

- A) Andesite
- B) Rhyolite
- C) Diorite
- D) Marble

Question 21 of 50

A lichen consists of algae and fungi engaging in what type of symbiotic relationship?

- A) Mutualism
- B) Commensalism
- C) Parasitism
- D) Amensalism

Question 22 of 50

The iron-containing "sandwich compound" ferrocene has 2 rings each with how many carbon atoms?

- A) 3
- B) 5
- C) 6
- D) 8

Question 23 of 50

What device, whose namesake quantity is measured in henrys, stores energy in coils of metal?

- A) Inductor
- B) Capacitor
- C) Resistor
- D) Thermistor

Question 24 of 50

Stellar light appears as a bright ring called Bailey's Beads during what type of event?

- A) Meteor shower
- B) Type I Supernova
- C) Solar eclipse
- D) Solar Flare

Question 25 of 50

White pulp and red pulp are regions of what organ that filters blood?

- A) Liver
- B) Pancreas
- C) Bladder
- D) Spleen

Question 26 of 50

Dedekind cuts are used to construct what set of numbers which are also represented by infinite continued fractions?

- A) Complex numbers
- B) Irrational numbers
- C) Integers
- D) Algebraic numbers

Question 27 of 50

Which quantity is a fluid's resistance to flow?

- A) Viscosity
- B) Reynold's number
- C) Feynman factor
- D) Flux

Question 28 of 50

What fibers in the heart conduct action potentials from the bundle of His?

- A) Pacemaker fibers
- B) Purkinje fibers
- C) Synchronization fibers
- D) Septae

Question 29 of 50

What type of series represents periodic functions with trigonometric sums?

- A) Taylor
- B) Maclaurin
- C) Mercator
- D) Fourier

Question 30 of 50

Actin and myosin are proteins found in what tissue?

- A) Bone
- B) Skin
- C) Muscle
- D) Nervous

Question 31 of 50

Storms nicknamed the Scooter, the Great Dark Spot, and the Wizard's Eye are features on what planet?

- A) Jupiter
- B) Saturn
- C) Uranus
- D) Neptune

Question 32 of 50

Which of the following is the statement of the ideal gas law?

- A) $PV=nRT$
- B) $PT=nRV$
- C) $PR=nVT$
- D) $P/R=nVT$

Question 33 of 50

Ceva's theorem describes what shape?

- A) Circle
- B) Triangle
- C) Cyclic quadrilateral
- D) Hexagon

Question 34 of 50

The thyroid gland requires what element, the lack of which can lead to goiter?

- A) Chlorine
- B) Iodine
- C) Nickel
- D) Boron

Question 35 of 50

Dijkstra's algorithm is used to find the shortest path between nodes in what type of structure?

- A) Database
- B) Tree
- C) Graph
- D) Linked list

Question 36 of 50

Bell's paradox describes two accelerating spaceships connected by a string that undergo what relativistic phenomenon?

- A) Time dilation
- B) Quantum entanglement
- C) Length contraction
- D) Quantum tunneling

Question 37 of 50

What quantity measures the potential capability of an organism to produce offspring?

- A) Fecundity
- B) Fertility
- C) Survivor rate
- D) Heritability

Question 38 of 50

A frequent joke repeated in what field of mathematics claims that a coffee mug is essentially equivalent to a donut?

- A) Field theory
- B) Combinatorics
- C) Topology
- D) Discrete geometry

Question 39 of 50

What constant describes the expansion of the universe?

- A) Gravitational wave
- B) Hubble
- C) Cassini
- D) Huygens

Question 40 of 50

Eutrophication can be caused by the addition of what element?

- A) Carbon
- B) Zinc
- C) Argon
- D) Phosphorus

Question 41 of 50

The square root of the variance is what quantity that describes how far statistical values are from the mean?

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- A) Chebyshev coefficient
 - B) Uniformity
 - C) Standard deviation
 - D) P-value

Question 42 of 50

By Graham's Law, a gas's rate of effusion is inversely proportional to the square root of what quantity for the gas?

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- A) Molecular weight
 - B) Atomic number
 - C) Vapor pressure
 - D) Specific density

Question 43 of 50

Han dynasty scientist Zhang Heng created an early version of what type of device using a bronze urn with cast dragon heads?

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- A) Printing press
 - B) Seismoscope
 - C) Refrigerator
 - D) Water pump

Question 44 of 50

What type of cloud is indicative of thunderstorms?

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- A) Cirrus
 - B) Cirrostratus
 - C) Cumulonimbus
 - D) Nacreous

Question 45 of 50

The Abel–Ruffini theorem states that polynomials of what degree or higher cannot be solved algebraically?

- A) Two
- B) Three
- C) Four
- D) Five

Question 46 of 50

What theorem states that a^p is congruent to a mod p ?

- A) Fermat's little theorem
- B) Goldbach theorem
- C) Lagrange's theorem on powers
- D) Carmichael number theorem

Question 47 of 50

What type of bond occurs between nucleotide base pairs in DNA?

- A) Covalent
- B) Triple
- C) Dative
- D) Hydrogen

Question 48 of 50

Which of the following organelles has cisternae to assist with transport?

- A) Peroxisome
- B) Golgi apparatus
- C) Nucleus
- D) Cytoskeleton

Question 49 of 50

What glacial feature has types like "medial" and "lateral"?

- A) Moraine
- B) Arete
- C) Cirque
- D) Kame

Question 50 of 50

Insulators have a large value for what quantity, the energy range where electrons cannot exist in a solid?

- A) Lattice energy
- B) Dielectric constant
- C) Thermoplasticity
- D) Band Gap