

**Test:** 2021 National Science Bee (A)

### Question 1 of 50

In a fair-division procedure, the goal for each participant is to (I) receive an identical portion or (II) receive what is perceived as a fair portion?

- A) I only
- B) II only
- C) Both I and II
- D) neither I nor II

### Question 2 of 50

Which is NOT a type of interspecific interaction?

- A) Symbiosis
- B) Speciation
- C) Mutualism
- D) Predation

### Question 3 of 50

Determine the oxidation state of P in  $\text{PO}_3^{-3}$ .

- A) 6
- B) 3
- C) -3
- D) 0

**Question 4 of 50**

Which of these is a disease where multiple cysts and lesions formed from lymphatic vessels ?

- 
- A) Castleman's Disease
  - B) Lymphangiomatosis
  - C) Hamrick's Disorder
  - D) Hodgkin Lymphoma

**Question 5 of 50**

What is the net rate of increase in a population when the carrying capacity is equal to the population size?

- 
- A) less than 0
  - B) the intrinsic rate of growth
  - C) one
  - D) zero

**Question 6 of 50**

Water changing from seawater to vapor to precipitation and flowing back to the sea describes what phenomenon?

- 
- A) Watersheds
  - B) The Hydrologic Cycle
  - C) The Mineral Cycle
  - D) The Carbon Cycle

**Question 7 of 50**

The total amount of energy received by one square meter of Earth's surface is called

- 
- A) solar infiltration
  - B) solar intensity
  - C) photoinfiltration
  - D) insolation

**Question 8 of 50**

A disease when seen in females causes them to be missing some teeth and sweat glands missing from random areas is called

- A) Regressive Distribution
- B) Polytrophy
- C) X-Inactivation
- D) Epistasis

**Question 9 of 50**

What do cells use to accelerate the chemical reactions that enable the cell's metabolic machinery?

- A) Golgi Apparatus
- B) Lysosomes
- C) Centrosomes
- D) Enzymes

**Question 10 of 50**

Who among the following is considered to be the world's first computer programmer?

- A) Ada Lovelace
- B) Adam Osborne
- C) Adi Shamir
- D) Alain Glavieux

**Question 11 of 50**

When a particle is disturbed away from its fixed equilibrium position and experiences an acceleration that is proportional and opposite to its displacement, what is happening?

- A) simple harmonic motion
- B) thermal expansion
- C) degradation of energy
- D) damping

**Question 12 of 50**

Why is HIV called a retrovirus?

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- A) HIV originates from an ancient virus strain
- B) Genetic information is copied from RNA to DNA
- C) It destroys cells in the nervous system
- D) The HIV virus unlike most, replicates outside of a host cell

**Question 13 of 50**

In a typical nuclear fusion reaction deuterium fuses with what to form a helium nucleus, a neutron, and energy?

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- A) another deuterium atom
- B) tritium
- C) a free neutron
- D) a free proton

**Question 14 of 50**

What type of rock is formed from lava cooling underground?

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- A) Shoreline Sedimentary Rock
- B) Metamorphic Rock
- C) Extrusive Igneous Rock
- D) Intrusive Igneous Rock

**Question 15 of 50**

Who was the first to propose the idea of finitely divisible matter?

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- A) Aristotle
- B) Socrates
- C) Democritus
- D) Galileo

**Question 16 of 50**

When was the earliest evidence of number sense found to exist according to discoveries made in 1937?

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- A) 30,000 B.C.
- B) 17,500 B.C.
- C) 3000 B.C.
- D) 8000 B.C.

**Question 17 of 50**

Which among the following is the earliest functioning base of the computer?

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- A) Window
- B) P1 Processor
- C) Vacuum tubes
- D) Microprocessor

**Question 18 of 50**

In what culture is the earliest evidence of an equation similar to the quadratic formula?

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- A) Ancient Greeks
- B) Babylonians
- C) Egyptians
- D) Chinese

**Question 19 of 50**

Identify the radiotracer used to study the thyroid.

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- A) iodine-131
- B) iron-59
- C) phosphorus-32
- D) thallium-201

**Question 20 of 50**

In 1993, when comet Shoemaker-Levy 9 broke up, many of the pieces smashed into which planet?

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

**Question 21 of 50**

In genetic engineering, a vector is used to

- A) Accept proteins into target cells
- B) To direct DNA replication of target cells
- C) Transfer genetic material into a host organism
- D) Direct translation of RNA into proteins needed by the cell

**Question 22 of 50**

What data should be plotted to show that experimental concentration data fits a first-order reaction?

- A)  $1/[\text{reactant}]$  vs. time
- B)  $[\text{reactant}]$  vs. time
- C)  $\ln[\text{reactant}]$  vs. time
- D)  $\ln(k)$  vs.  $1/T$

**Question 23 of 50**

What was the first real evidence of what the early universe looked like?

- A) Discovery of quarks
- B) Discovery of Bosons
- C) Galaxies discovered by Hubble
- D) Cosmic Background Radiation

**Question 24 of 50**

Sometimes when two tectonic plates collide, one plate is forced under another. This interaction happens where?

- A) A Strike-Slip Fault
- B) A Divergent Zone
- C) A Subduction Zone
- D) An Uplift Zone

**Question 25 of 50**

What are some of the elements HIPPCO represents?

- A) Climate Change
- B) Overfishing
- C) Habitat Loss
- D) Population Decline

**Question 26 of 50**

What theory is generally accepted to explain the origin of our Solar System?

- A) Nebular Hypothesis
- B) Big Bang Theory
- C) Composite Formation Hypothesis
- D) Hybrid Fusion Theory

**Question 27 of 50**

Which of the following statements is TRUE?

- A) State functions do not depend on the path taken to arrive at a particular state.
- B)  $\Delta E_{\text{rxn}}$  can be determined using constant volume calorimetry.
- C)  $\Delta H_{\text{rxn}}$  can be determined using constant pressure calorimetry.
- D) All statements are true

**Question 28 of 50**

Which of the following is an example of the law of multiple proportions?

- A) Two different compounds formed from carbon and oxygen have the following mass ratios: 1.33 g O: 1 g C and 2.66 g O: 1 g C.
- B) A sample of chlorine is found to contain three times as much Cl-35 as Cl-37.
- C) Two different samples of table salt are found to have the same ratio of sodium to chlorine.
- D) Nitrogen dioxide always has a mass ratio of 2.28 g O: 1 g N.

**Question 29 of 50**

A molecule, that is  $sp^3d^2$  hybridized and has a molecular geometry of square pyramidal, has \_\_\_\_\_ bonding groups and \_\_\_\_\_ lone pairs around its central atom.

- A) 4, 2
- B) 5, 1
- C) 3, 2
- D) 4, 1

**Question 30 of 50**

Specialized cells called podocytes are found where in the body?

- A) Bowman's capsule in nephrons
- B) Papilla of Vater
- C) Biliary Tree
- D) Duodenum

**Question 31 of 50**

How does the photoelectric effect differ from a photovoltaic cell when both produce electric current?

- A) photoelectric effect electrons absorb a photon of the right energy
- B) current produced by photoelectric effect depends on semiconductors
- C) in photoelectric effect, electrons are actually ejected from the metal
- D) In photoelectric effect electrons make a transition from valence band energy levels

**Question 32 of 50**

What kind of method, which can be applied consistently, deals with rounding a set of fractions so that their sum is maintained at its original value?

- A) The Hamilton method
- B) The Jefferson method
- C) The Webster method
- D) The Apportionment Method

**Question 33 of 50**

Who is credited as the father of Atomic Theory?

- A) J.J. Thompson
- B) John Dalton
- C) Ernest Rutherford
- D) Erwin Schrodiner

**Question 34 of 50**

Which one of the following is NOT an empirical formula?

- A) CHO
- B) CH<sub>2</sub>O
- C) C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>
- D) C<sub>3</sub>H<sub>8</sub>O

**Question 35 of 50**

The double helical nature of DNA was discovered by whom?

- A) Rosalind Franklin
- B) Maurice Wilkins
- C) Ray Gosling
- D) Jim Watson

**Question 36 of 50**

After the disaster of Apollo 1, the Soviet Union also experienced a disaster with the crash-landing of which spacecraft?

- 
- A) Voskhod 1
  - B) Soyuz 1
  - C) Soyuz 2
  - D) Komarov 1

**Question 37 of 50**

How long did it take the Perserverance rover to travel to Mars?

- 
- A) 12 months
  - B) 7 months
  - C) 5 months
  - D) 15 months

**Question 38 of 50**

Benjamin Franklin discovered that in static electricity, the charge that is deposited on a conductor always stays on the outside surface. The net charge inside of the conductor is

- 
- A) negative one
  - B) zero
  - C) positive one
  - D) negative two

**Question 39 of 50**

The Laschamps Excursion (LE) was believed to cause mass extinction events 41,000 years ago. What was the LE?

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- A) Reversal of Earth's magnetic poles
  - B) A meteor storm
  - C) A drastic decrease in atmospheric oxygen
  - D) A drastic increase in atmospheric carbon dioxide

**Question 40 of 50**

The process in which a stimulus produces a response that opposes the original stimulus is called

- A) Feedback Inhibition
- B) Positive Feedback
- C) Reabsorption
- D) Endocrine Resistance

**Question 41 of 50**

Which of the following is an exponential function?

- A) Inverse Square Law
- B) Slope- Intercept
- C) Determin which job offers better pay
- D) Daily Energy Consumption

**Question 42 of 50**

Energy that is associated with the relative positions of electrons and nuclei in atoms and molecules is called

- A) Chemical Energy
- B) Kinetic Energy
- C) Thermal Energy
- D) Atomic Energy

**Question 43 of 50**

The largest mass a neutron star can have is about 2-3 solar masses. There is uncertainty due to the equation of state of matter inside a neutron star is not precise. This statement describes

- A) Oppenheimer-Volkoff limit
- B) Olbers paradox
- C) Bragg scattering
- D) Nyquist's Theorem

**Question 44 of 50**

A mixed strategy uses randomization which is

- A) to select a pure strategy for the game
- B) to choose among several pure strategies each time a round of the game is played
- C) to anticipate the opponent's next move
- D) to defer until the opponent has chosen a strategy

**Question 45 of 50**

The oldest known treatise on rocks and minerals was called De lapidibus, which means what?

- A) On Stones
- B) The Earth
- C) The Way of Rocks
- D) Of The Earth

**Question 46 of 50**

The energy transferred as heat during a phase change is equal to the mass multiplied by

- A) the potential energy between particles
- B) specific heat capacity
- C) vapor energy
- D) latent heat

**Question 47 of 50**

Two or more substances in variable proportions, where the composition is constant throughout are?

- A) A compound
- B) An element
- C) A crystalline solid
- D) A homogeneous mixture.

**Question 48 of 50**

The Law of Conservation of Energy is stated more precisely as

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- A) Law of Thirds
- B) 2nd Law of thermodynamics
- C) 1st Law of Thermodynamics
- D) Stefan-Boltzmann Law

**Question 49 of 50**

Which of the following situations is best modeled by a digraph?

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- A) A system of walking trails
- B) An electrical wiring plan for a home
- C) a bus route map
- D) A straight line route from Florida to California

**Question 50 of 50**

What is the TATA box?

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- A) A promoter region for mRNA transcriptions
- B) A stop codon region for elongation
- C) An RNA splicing exon
- D) A termination point for RNA polymerase