Chemistry Questions with Solutions

Q1: What are Atoms?

Answer:

The proton, neutron, and electron make up an atom, the smallest recognised division of a chemical element. The central nucleus, which consists of protons and neutrons, holds 99% of the atom's mass. Negatively charged electrons whirl about the nucleus in a variety of orbital shells.

- The atomic number refers to the number of protons in a nucleus.
- Because the number of protons in an atom equals the number of electrons, atoms have no overall charge.
- An ion is created whenever an atom gains or loses electrons.

Q2: What do you understand by the Periodic Table?

Answer:

The Periodic Table is how researchers have arranged the 100+ elements that constitute all matter. Dmitri Mendeleev, a Russian chemist, proposed it in 1869.

Mendeleev arranged the elements in order of the mass of their electrons, unlike prior attempts to organise the elements by characteristics. He also left empty spaces for items that had yet to be identified. As a result, he could forecast what those yet-to-be-discovered elements would be like.

The elements are arranged in the Periodic Table in two ways:

Periods: these run from left to right across the table. The number of protons in the atom's nucleus rises by one as we proceed in this direction.

Groups: Each vertical column represents a group. Because they usually have the same amount of electrons in their outer shell, groups comprise elements with similar properties.

Q3: What are some of the essential branches in Chemistry?

Answer:

Chemistry is the study of atoms and molecules and their properties. Atoms and molecules are the building blocks of all matter. The following are the five major branches of chemistry:

- Organic chemistry
- Inorganic chemistry
- Physical chemistry
- Biochemistry
- Analytical chemistry

Q4: What is the significance of Organic Chemistry?

Answer:

The study of carbon compounds is what organic chemistry is about. Organic chemistry is significant since it deals with life studies and all chemical reactions that occur in life. Organic chemistry began with the investigation of chemicals derived from living beings.

There are around 7 million different organic compounds known to exist, but only 1.5 million different inorganic compounds exist. The special feature of carbon gives rise to such a large range of organic molecules.

Q5: The S.I unit of temperature is :
(a) Fahrenheit
(b) Celsius
(c) Kelvin
(d) Centigrade

Answer:

(c) Kelvin

Explanation: The kelvin is one of the seven SI base units and is used to measure thermodynamic temperature. We designate another temperature unit, the degree Celsius (°C), in the SI, which is unusual.

Q6: The atomic mass and metal-specific heat product are about 6.4. This information was provided by:
(a) Dalton's law
(b) Dulong Petit's law
(c) Newton's law
(d) Avogadro's law

Answer:

(b) Dulong Petit's law

Explanation: According to Dulong Petit's law, the product of an element's atomic mass and specific heat remains constant, equaling 6.4.

Q7: Among isomeric amines, tertiary amines have the lowest boiling points because:
(a) they have the highest molecular mass
(b) they are most basic in nature
(c) they are more polar in nature
(d) they do not form hydrogen bonds

Answer:

(d) they do not form hydrogen bonds

Explanation: Hydrogen bonds can be formed by primary and secondary amines, but not by tertiary amines. As a result, they have the lowest boiling points.

Q8: The most electronegative of the following elements is:
(a) sodium
(b) bromine
(c) oxygen
(d) fluorine

Answer: Option (d)

Q9: 1 mole of $K_4[Fe(CN)_6]$ contain carbon = 6g atoms. 0.5 mole of $K_4[Fe(CN)_6]$ contains carbon = 3g atoms. The mass of carbon present in 0.5 mole of $K_4[Fe(CN)_6]$ is:
(a) 36 g
(b) 18 g
(c) 3.6 g
(d) 1.8 g

Answer:

(a) 36g

Explanation: 1 mole of $K_4[Fe(CN)_6]$ contain carbon = 6g atoms

0.5 mole of $K_4[Fe(CN)_6]$ contain carbon = 3g atoms

Mass of carbon in grams = (12g) × [(3g atoms)/(1g atom)] = (12g) × [(3g)/(1g)] = **36g**

Q10: What are metallic/interstitial hydrides? How do they differ from molecular hydrides?

Answer:

A hydride is a binary chemical that contains an element and a hydrogen atom.

Metallic hydrides are also known as interstitial hydrides. Metallic/interstitial hydrides are compounds in which transition metals and hydrogen are bonded together. They are the source of many d-Block and f-Block elements. Heat and electricity conductors, these hydrides are.

Molecular hydrides are hydrides that have additional electronegative atoms linked to the H-atom. The electrical conductivity of metallic hydrides is strong, while that of molecular hydrides is low. Metallic hydrides are solid, whereas molecular hydrides are gaseous.

Interstitial or metallic hydrides are formed when hydrogen and transition metals bind instead of molecular hydrides, which contain bonding between an electronegative atom and hydrogen.

Q11: What are the sources of dissolved oxygen in water?

Answer:

The sources of dissolved oxygen in water are photosynthesis, natural aeration, and mechanical aeration. The bulk of oxygen in a pond comes from microscopic algae. Through a process known as photosynthesis, these organisms produce oxygen and release it into the pond water through a process known as photosynthesis.

Q12: What is the normality of a 1M solution of H_3PO_4?
(a) 0.5 N
(b) 3.0 N
(c) 2.0 N
(d) 1.0 N

Answer:

(b) 3.0 N

Explanation: H_3PO_4 is tribasic.

So, N = 3M, i.e., 3 × 1 = 3.0N

Q13: What is the Ozone Layer?

Answer:

The ozone layer is a vast shield surrounding the Earth and extends 50 kilometres above the planet's surface. Ozone is a unique oxygen molecule with the formula O_3. It can be up to 20 kilometres thick, with most of the gas located in the stratosphere.

Ozone gases provide our protection from UVB rays. The Sun emits this harmful radiation, which is exceedingly deadly.

The ozone hole spans between 21 and 24 million square kilometres and is mostly over Antarctica, is between 21 and 24 million square kilometres in size. Ozone reacts with CFCs, which are pollutants used in refrigeration, causing enormous breaches in this protection layer.

Q14: Differentiate between disinfectants and antiseptics.

Answer:

Antiseptics	**Disinfectants**
1. They are chemical agents that prevent microorganisms from growing and might kill them.	1. They are harmful chemicals that kill microorganisms.
2. They are suitable for use on live tissues.	2. They are not suitable for use on live tissues.
3. They're typically used to treat wounds, cuts, ulcers, and unhealthy skin. Furacin, soframycin, Dettol, and savlon, 0.2% phenol solution.	3. They kill microorganisms in drains, toilets, and floors, among other places. Phenol (>1% solution) and chlorine are two examples (0.2 to 0.4 ppm).

Q15: (a) Why do transition elements show variable oxidation states?

1. Name the elements showing a maximum number of oxidation states among the first series of transition metals from Sc (Z = 21) to Zn (Z=30)
2. Name the element which shows only +3 oxidation state

(b) What is lanthanide contraction? Name an important alloy that contains some of the lanthanoid metals

Answer:

(a) Elements with partially filled d orbitals are known as transition elements (also known as transition metals). The IUPAC defines transition elements as those that have a partially filled d subshell or can form stable cations with an incompletely filled d orbital. The electrical configuration of the transition element is $(n-1)d^5\ ns^1$ or $(n-1)d^{10}\ ns^1$.

These elements have varying oxidation states because their valence electrons are in two different sets of orbitals, (n-1)d and ns. Both energy levels can be used to build bonds since the energy difference between them is minimal. As a result, the oxidation states of transition elements vary.

1. The d-subshell of Mn(Z-25) has the most unpaired electrons; thus, it has a high oxidation state(+7).
2. Scandium (Sc) is the sole element in this series with a +3 oxidation state.

(b) Lanthanoid contraction is the constant decrease in atomic and ionic radii (with the same charge) with rising atomic numbers as we progress from lanthanum to lutetium. Mischmetal is a lanthanide metal alloy that comprises 95% lanthanide metal and 5% Fe, along with traces of S, C, Ca, and Al. In Mg-based alloys, it's utilised to create bullets, shells, and lighter flint.

Practise Questions on Chemistry

Q1: Define ‘Amorphous’ and give a few examples of Amorphous Solids.

Answer:

Amorphous solids are solids with irregularly shaped constituent particles and a small range of order. These substances are isotropic, meaning they melt at different temperatures. As a result, amorphous solids are often known as phantom solids or super cooled liquids. They don't have a distinct fusion heat. When sliced with a sharp-edged instrument, they split into two pieces with uneven surfaces. Glass, rubber, and plastic are examples of amorphous solids.

Q2: Using IUPAC norms, write the formula for the following:

(a) Sodium dicyanidoaurate(I)

(b) Tetraamminechloridonitrito-N-platinum(IV) sulphate

Answer:

(a) $Na[Au(CN)_2]$
(b) $[Pt(NH_3)_4Cl(NO_2)]SO_4$

Q3: (a) Write the colligative property that is used to identify the molecular mass of macromolecules.

(b) In a non-ideal solution, what type of deviation confirm the overview of minimum boiling azeotropes?

Answer:

(a) The colligative feature of osmotic pressure is utilised to determine the molecular mass of macromolecules.

(b) Positive deviation indicates the production of minimum boiling azeotropes in a non-ideal solution.

Q4: What distinguishes a glass from a solid-like quartz? Under which circumstances could quartz be transformed into glass?

Answer:

Glass differs from quartz due to the arrangement of the powder elements. The constituent particles in glass have a short-range order, but the constituent particles in quartz have both long and short-range orders. Quartz can be turned into glass by rapidly heating and cooling it.

Q5: When $NiCl_2.6H_2O$ is combined with $AgNO_3$, two moles of AgCl are precipitated per mole of the coordination molecule. Write the complex's structural formula and IUPAC name.

Answer:

The structural formula of the complex compound is- $[Cr(H_2O)5Cl]Cl_2.H_2O$. The IUPAC name of the complex is Pentaaquachlorochromium(III)dichloride monohydrate.