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Chemistry Grade 9 — Complete MCQs

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Chapters 1–8 MCQs extracted from chapter tests

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Chemistry Grade 9 — Chapter 1

Nature of Science in Chemistry

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Practice MCQs extracted from the supplied Class 9 Chemistry chapter tests (Section A). Total: 30 questions.

A. Important / Main Topics

1. Chemistry is defined as the science that investigates:

(A) The materials of the universe and the changes they undergo
(B) Only the reactions that occur in laboratories
(C) Only the elements present in the periodic table
(D) The motion of planets and stars

Correct Answer: A

Explanation: The chapter defines chemistry as the science that investigates the materials of the universe and the changes that these materials undergo.

2. Which of the following is NOT studied under the scope of chemistry?

(A) Composition of a substance
(B) Gravitational pull between two masses
(C) Structure of an atom
(D) Changes in properties of matter

Correct Answer: B

Explanation: Gravitational pull is studied in physics, not chemistry; chemistry deals with matter, its composition, structure, properties, and changes.

3. The branch of chemistry that deals with substances containing carbon (except carbonates, bicarbonates, oxides, and carbides) is:

(A) Inorganic chemistry
(B) Physical chemistry
(C) Organic chemistry
(D) Analytical chemistry

Correct Answer: C

Explanation: Organic chemistry deals with substances containing carbon, with the four specified exceptions (carbonates, bicarbonates, oxides, and carbides).

4. Forensic chemistry is an application of:

(A) Organic chemistry
(B) Geochemistry
(C) Nuclear chemistry
(D) Analytical chemistry

Correct Answer: D

Explanation: Forensic chemistry is the application of analytical chemistry; it involves examining physical traces to identify unknown compounds.

5. Which branch of chemistry studies chemical processes occurring in stars, planets, and interstellar space?

(A) Astrochemistry
(B) Geochemistry
(C) Nuclear chemistry
(D) Biochemistry

Correct Answer: A

Explanation: Astrochemistry deals with chemical processes and reactions in astronomical environments such as stars, planets, comets, and interstellar space.

6. The main purpose of green chemistry is to:

(A) Increase the use of hazardous substances
(B) Reduce the use of hazardous substances
(C) Study only laboratory reactions
(D) Replace chemistry with physics

Correct Answer: B

Explanation: Green chemistry is the model of chemical products and processes that reduce the use of hazardous substances.

7. Which of the following is a correct sequence of the relationship between science, technology, and engineering?

(A) Engineering → Science → Technology
(B) Technology → Science → Engineering
(C) Science → Technology → Engineering
(D) Science → Engineering → Technology

Correct Answer: C

Explanation: Science → Technology → Engineering — this correctly answers the question.

8. In the example of solar energy, the role of the technologist is to:

(A) Discover how photovoltaic cells work
(B) Design the wiring of a solar power plant
(C) Study the chemistry of silicon
(D) Develop solar panels from scientific principles

Correct Answer: D

Explanation: In the example of solar energy, the role of the technologist is to Develop solar panels from scientific principles.

9. The essential questions listed for each branch of chemistry are best described as:

(A) Guiding questions for exploration and understanding
(B) Exam questions that must be memorized
(C) Questions that have simple yes/no answers
(D) Questions unrelated to the branch

Correct Answer: A

Explanation: These questions are open-ended guiding questions for learning, not exam questions.

10. Which of the following is a real-life application of inorganic chemistry?

(A) Synthesizing new medicines
(B) Lithium-ion batteries
(C) Forensic examination of drugs
(D) Water purification using filtration

Correct Answer: B

Explanation: Lithium-ion batteries are a direct application of inorganic chemistry (metals and salts).

11. Which statement best explains why chemistry interacts with other sciences?

(A) It is only concerned with laboratory experiments
(B) It replaces biology and physics
(C) It studies how matter and energy change together
(D) It ignores the composition of matter

Correct Answer: C

Explanation: Chemistry interacts with other sciences by studying how matter and energy change together, linking physics, biology, geology, medicine, and engineering.

12. Which pair correctly matches a branch of chemistry with its focus?

(A) Physical chemistry — pollution and its effects
(B) Polymer chemistry — changes in atomic nuclei

(C) Nuclear chemistry — study of polymers
(D) Industrial chemistry — large-scale production of chemical substances

Correct Answer: D

Explanation: Industrial chemistry deals with the large-scale production of chemical substances, turning lab chemistry into factory-scale production.

13. A chemist working on designing a new drug for cancer treatment is most likely a specialist in:

(A) Medicinal chemistry
(B) Geochemistry
(C) Astrochemistry
(D) Nuclear chemistry

Correct Answer: A

Explanation: Medicinal chemistry deals with the study of drug–biological target interaction and the development of new medicinal agents.

14. Which of the following best describes the relationship between chemistry and energy?

(A) Chemistry only studies matter, not energy
(B) Every change in matter involves a change in energy
(C) Energy changes only occur in physical changes
(D) Energy is not involved in chemical reactions

Correct Answer: B

Explanation: Chemistry deals with matter and energy together because every change in matter involves a change in energy (absorbed or released).

15. A geochemist would most likely study:

(A) Chemical processes in stars
(B) Design of new medicines
(C) Distribution of elements in the Earth's crust
(D) Atomic nuclei changes

Correct Answer: C

Explanation: Geochemistry deals with the chemical composition, distribution, and transformation of elements and compounds in the Earth's crust.

B. Less Important / Secondary Topics

16. In the example of designing a water filtration system, which engineers are involved?

(A) Chemical engineers and mechanical engineers
(B) Only electrical engineers
(C) Only civil engineers
(D) Only software engineers

Correct Answer: A

Explanation: Chemical engineers and mechanical engineers — this correctly answers the question.

17. Which of the following is NOT a characteristic of analytical chemistry?

(A) Determines what is in a substance
(B) Studies pollution and its effects on humans
(C) Determines how much of a substance is present
(D) Uses instruments and methods to identify substances

Correct Answer: B

Explanation: Studying pollution and its effects is the focus of environmental chemistry, not analytical chemistry.

18. Which of the following best explains why chemistry is essential to medicine?

(A) Chemistry explains only the structure of the human body
(B) Chemistry cannot be applied to medicine
(C) Medicines are made of organic compounds designed by chemists
(D) Medicines are unrelated to chemistry

Correct Answer: C

Explanation: Organic chemists synthesize new medicines that interact with specific targets like proteins or enzymes in the body.

19. In the example of making French fries, what is the role of the chemical engineer?

(A) Studying the chemistry of carbohydrates
(B) Extracting oil from seeds
(C) Frying the potatoes
(D) Designing oil production equipment and processes

Correct Answer: D

Explanation: Chemical engineers design oil production equipment and processes so that oil is produced efficiently and safely for cooking.

20. Which of the following is a correct pairing of a branch of chemistry with its application?

(A) Analytical chemistry — forensic chemistry
(B) Organic chemistry — water purification
(C) Inorganic chemistry — forensic chemistry
(D) Physical chemistry — medicines synthesis

Correct Answer: A

Explanation: Forensic chemistry is the application of analytical chemistry, involving the examination of physical traces to identify unknown compounds.

21. A scientist is studying a newly discovered substance found in a deep-sea vent. She wants to determine its exact chemical composition and the relative amounts of each element present. Which branch of chemistry is most directly suited for this task?

(A) Organic chemistry
(B) Analytical chemistry
(C) Astrochemistry
(D) Nuclear chemistry

Correct Answer: B

Explanation: Analytical chemistry deals with the methods and instruments for determining the composition and properties of matter, answering "what is in this substance, and how much?".

22. A new industrial process is being designed to produce a fertilizer on a massive scale while minimizing the use of hazardous chemicals. Which two branches of chemistry are most directly involved in this process?

(A) Geochemistry and astrochemistry
(B) Nuclear chemistry and polymer chemistry
(C) Industrial chemistry and green chemistry
(D) Analytical chemistry and biochemistry

Correct Answer: C

Explanation: Industrial chemistry and green chemistry — this correctly answers the question.

23. A physics student asks a chemistry student, "Why does a compressed gas cylinder explode if heated?" The chemistry student explains the relationship between temperature, pressure, and particle behavior. This scenario best illustrates:

(A) Chemistry is the same as physics
(B) Chemistry is only useful in laboratories
(C) Chemistry is a branch of engineering
(D) Chemistry interacts with other sciences by studying matter and energy changes

Correct Answer: D

Explanation: Chemistry links with physics by studying how matter (the gas) and energy (heat) interact, explaining the pressure increase.

24. A pharmaceutical company develops a new drug. Which sequence of chemical branches is most logically followed from discovery to patient use?

(A) Medicinal chemistry → Analytical chemistry → Industrial chemistry → Biochemistry
(B) Biochemistry → Analytical chemistry → Industrial chemistry → Medicinal chemistry
(C) Organic chemistry → Geochemistry → Nuclear chemistry → Analytical chemistry
(D) Analytical chemistry → Astrochemistry → Physical chemistry → Industrial chemistry

Correct Answer: A

Explanation: Medicinal chemistry → Analytical chemistry → Industrial chemistry → Biochemistry — this correctly answers the question.

25. An engineer is designing a solar power plant. She uses the photovoltaic principle discovered by scientists, uses panels built by technologists, and designs the electrical grid. Which statement about this process is correct?

(A) Science is more important than engineering
(B) Science, technology, and engineering are interconnected and depend on each other
(C) Engineering and technology are identical
(D) Technology is the first step in the process

Correct Answer: B

Explanation: The chapter emphasizes that science discovers principles, technology turns them into tools, and engineering implements them at scale — all three depend on each other.

26. A forensic chemist is called to a crime scene to analyze an unknown white powder. Which **essential question from the analytical chemistry branch best guides her work?**

(A) Why is carbon the backbone of organic compounds?
(B) What is the structure of an atom?
(C) How are analytical methods used to identify and quantify chemical substances?
(D) How do nuclear reactions differ from chemical reactions?

Correct Answer: C

Explanation: The essential questions for analytical chemistry focus on methods used to identify and quantify substances.

27. A student claims that "chemistry only studies reactions that happen in test tubes." Which of the following provides the strongest counterexample?

(A) Mixing two chemicals in a beaker
(B) Heating a substance in a test tube
(C) Using a Bunsen burner
(D) Rusting of iron on a car

Correct Answer: D

Explanation: Rusting happens naturally in the environment, outside the laboratory, showing that chemistry studies all matter and its changes in the real world.

28. A geochemist and an astrochemist both study the distribution of elements. Which statement best explains how their fields differ?

(A) Geochemistry studies Earth's crust; astrochemistry studies stars and planets
(B) Geochemistry studies space; astrochemistry studies Earth
(C) Both study only laboratory reactions
(D) Astrochemistry is a branch of geochemistry

Correct Answer: A

Explanation: Geochemistry is the chemistry of the Earth's crust, while astrochemistry deals with chemical processes in astronomical environments like stars and planets.

29. A new material is discovered that can absorb harmful pollutants from air. Which combination of branches would best study its effectiveness and its environmental impact?

(A) Organic chemistry and astrochemistry
(B) Analytical chemistry and environmental chemistry
(C) Nuclear chemistry and medicinal chemistry
(D) Polymer chemistry and geochemistry

Correct Answer: B

Explanation: Analytical chemistry would measure the material's effectiveness (composition/quantification), while environmental chemistry would study its impact on the environment.

30. Which of the following **best shows the relationship between science, technology, and engineering in the creation of a new medicine?**

(A) Science designs the tablet; technology creates the factory; engineering discovers the molecule

(B) Engineering discovers the molecule; science designs the factory; technology tests the drug

(C) Science discovers the active molecule; technology develops a way to produce it; engineering designs the factory for mass production

(D) Technology discovers the molecule; engineering tests the drug; science designs the factory

Correct Answer: C

Explanation: Science discovers the active molecule; technology develops a way to produce it; engineering designs the factory for mass production — this correctly answers the question.

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Chemistry Grade 9 — Chapter 2

Matter

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Practice MCQs extracted from the supplied Class 9 Chemistry chapter tests (Section A). Total: 30 questions.

A. Important / Main Topics

1. Which of the following is a **plasma state of matter?**

(A) Lightning
(B) Steam
(C) Ice
(D) Brine

Correct Answer: A

Explanation: Plasma is formed at very high temperatures or under a strong electric field where gas atoms are ionized; lightning is a common example.

2. The state of matter in which particles are far apart, move freely, and have very weak forces of attraction is called:

(A) Solid
(B) Gas
(C) Liquid
(D) Plasma

Correct Answer: B

Explanation: Gas particles are far apart, move freely, and have very weak intermolecular forces of attraction.

3. The property of an element to exist in different physical forms is called:

(A) Isomerism
(B) Catenation
(C) Allotropy
(D) Crystallization

Correct Answer: C

Explanation: Allotropy is the property of an element to exist in different physical forms (allotropes), such as diamond and graphite for carbon.

4. Which of the following is **not a pure substance?**

(A) Oxygen
(B) Water
(C) Sodium chloride
(D) Air

Correct Answer: D

Explanation: Air is a mixture of nitrogen, oxygen, carbon dioxide, and other gases, so it is not a pure substance.

5. In a saturated solution, the undissolved solute is in equilibrium with the dissolved solute. This is called:

(A) Dynamic equilibrium
(B) Static equilibrium
(C) Chemical equilibrium
(D) Thermal equilibrium

Correct Answer: A

Explanation: In a saturated solution, the undissolved solute is in equilibrium with the dissolved solute. This is called Dynamic equilibrium.

6. The particle size in a **colloid ranges between:**

(A) Less than 1 nm
(B) 1 to 1000 nm
(C) Greater than 1000 nm
(D) Exactly 1000 nm

Correct Answer: B

Explanation: Colloidal particles range from 1 to 1000 nm in diameter, larger than solution particles but not visible to the naked eye.

7. Which of the following will **increase the solubility of a gas in a liquid?**

(A) Increasing temperature
(B) Decreasing pressure
(C) Increasing pressure
(D) Adding more solvent

Correct Answer: C

Explanation: For gases, increasing pressure increases solubility (e.g., carbonated drinks are bottled under high pressure).

8. In a **supersaturated solution, the amount of solute is:**

(A) Less than the maximum at a given temperature
(B) Exactly the maximum at a given temperature
(C) Always zero
(D) More than the maximum at a given temperature

Correct Answer: D

Explanation: A supersaturated solution contains more solute than a saturated solution at the same temperature and is uns.

9. Which of the following is an example of a **solid solution?**

(A) Brass
(B) Air
(C) Brine
(D) Fog

Correct Answer: A

Explanation: Brass is a solid solution (alloy) of copper and zinc, where the solvent is solid.

10. The Tyndall effect is used to distinguish:

(A) Solutions from suspensions
(B) Colloids from solutions
(C) Elements from compounds
(D) Mixtures from compounds

Correct Answer: B

Explanation: The Tyndall effect is the scattering of light by colloidal particles, which distinguishes colloids from true solutions.

11. Which of the following explains why a gas completely fills its container?

(A) Gas particles are held in fixed positions
(B) Gas particles have strong forces of attraction
(C) Gas particles are far apart and move freely
(D) Gas particles are tightly packed

Correct Answer: C

Explanation: In a gas, particles are far apart, have very weak forces of attraction, and move freely, which allows them to spread out and fill the entire container.

12. Why does graphite conduct electricity while diamond does not?

(A) Graphite has ionic bonds, diamond has covalent bonds
(B) Diamond has delocalized electrons, graphite has no free electrons
(C) Both have free electrons, but diamond's are less mobile

(D) Graphite has delocalized electrons, diamond has no free electrons

Correct Answer: D

Explanation: In graphite, the fourth valence electron of each carbon atom is delocalized and free to move. In diamond, all four valence electrons are used in covalent bonds, so no free electrons are present.

13. A solution in which no more solute can dissolve at a given temperature is called:

(A) Saturated
(B) Unsaturated
(C) Dilute
(D) Supersaturated

Correct Answer: A

Explanation: A saturated solution contains the maximum amount of solute that can dissolve at a given temperature; any extra solute remains undissolved.

14. Which of the following is an example of a **gaseous solution where a gas is the solvent?**

(A) Brine
(B) Air
(C) Brass
(D) Sugar syrup

Correct Answer: B

Explanation: In air, nitrogen gas is the solvent, and oxygen, carbon dioxide, and trace gases are solutes—this makes it a gaseous solution.

15. When a saturated solution of a solid is heated, it becomes:

(A) Supersaturated
(B) More saturated
(C) Unsaturated
(D) Unstable

Correct Answer: C

Explanation: Heating increases the solubility of most solids, so the solution can dissolve more solute and becomes unsaturated.

B. Less Important / Secondary Topics

16. Which property of colloids is used to distinguish them from true solutions?

(A) Their particles scatter a beam of light
(B) Their particles settle down on standing
(C) Their particles are visible to the naked eye
(D) Their particles cannot pass through filter paper

Correct Answer: A

Explanation: Colloidal particles are large enough to scatter light (Tyndall effect), which distinguishes them from true solutions whose particles are too small to scatter light.

17. In the context of solutions, what is the main difference between a concentrated and a dilute solution?

(A) Concentrated solutions are always saturated
(B) Dilute solutions contain a relatively small amount of solute
(C) Dilute solutions cannot dissolve more solute
(D) Concentrated solutions are always unsaturated

Correct Answer: B

Explanation: Dilute solutions contain a relatively small amount of solute — this correctly answers the question.

18. Which of the following correctly describes a **suspension?**

(A) Homogeneous mixture with particles less than 1 nm
(B) Heterogeneous mixture with particles between 1 and 1000 nm that scatter light
(C) Heterogeneous mixture with particles greater than 1000 nm that settle on standing

(D) Homogeneous mixture that cannot be separated by filtration

Correct Answer: C

Explanation: A suspension is a heterogeneous mixture with large particles (greater than 1000 nm) that are visible to the naked eye and settle down when left standing.

19. Which factor affects the solubility of a gas in a liquid?

(A) Pressure only
(B) Temperature only
(C) Neither temperature nor pressure
(D) Both temperature and pressure

Correct Answer: D

Explanation: The solubility of a gas in a liquid depends on both temperature (solubility decreases as temperature increases) and pressure (solubility increases as pressure increases).

20. Which of the following is a **heterogeneous mixture?**

(A) Milk
(B) Salt solution
(C) Air
(D) Brass

Correct Answer: A

Explanation: Milk is a colloid (a type of heterogeneous mixture) with particles that scatter light and remain dispersed. Salt solution, air, and brass are homogeneous.

21. A sealed container holds a mixture of two gases. The container is cooled to a very low temperature until the gases condense into a liquid. Which statement best explains this change of state?

(A) The kinetic energy of the gas particles increased, allowing them to settle
(B) The forces of attraction between particles became stronger than their kinetic energy
(C) The particles of the gas chemically reacted to form a new liquid compound
(D) The pressure inside the container increased, forcing the particles together

Correct Answer: B

Explanation: The forces of attraction between particles became stronger than their kinetic energy — this correctly answers the question.

22. Two samples of carbon are tested. Sample X is extremely hard and does not conduct electricity. Sample Y is soft, slippery, and conducts electricity. Which statement correctly identifies the samples and explains the difference?

(A) X is graphite and Y is diamond; graphite has free electrons
(B) X is diamond and Y is graphite; diamond has free electrons
(C) X is diamond and Y is graphite; graphite has delocalized electrons
(D) X is graphite and Y is diamond; diamond conducts electricity

Correct Answer: C

Explanation: Diamond is hard and non-conductive because each C is bonded to 4 others with no free electrons. Graphite is soft and conductive because each C is bonded to 3 others, leaving delocalized electrons.

23. A solution is prepared by dissolving 50 g of a solute in 100 g of water at 20 °C. At this temperature, the solubility of the solute is 40 g per 100 g of water. Which statement about the solution is correct?

(A) It is an unsaturated solution
(B) It is a saturated solution with no undissolved solute
(C) It is a supersaturated solution
(D) It is a saturated solution with 10 g of undissolved solute

Correct Answer: D

Explanation: Since the solubility is 40 g per 100 g of water, 40 g dissolves and 10 g remains undissolved, making it a saturated solution.

24. Which of the following observations would **most reliably identify a liquid as a colloid rather than a true solution?**

(A) A beam of light passing through it is visible from the side
(B) The liquid is clear and transparent
(C) The liquid conducts electricity
(D) The liquid has a colour

Correct Answer: A

Explanation: The Tyndall effect (visible path of light) is the defining test for colloids; true solutions do not scatter light because their particles are less than 1 nm.

25. A student heats a saturated solution of potassium nitrate from 20 °C to 60 °C. What happens to the solution and why?

(A) It becomes supersaturated because solubility decreases
(B) It becomes unsaturated because solubility increases
(C) It remains saturated because temperature does not affect solubility
(D) It becomes a suspension because the solute precipitates

Correct Answer: B

Explanation: The solubility of most solids increases with temperature, so the heated solution can dissolve more solute and becomes unsaturated.

26. Which statement correctly explains why ice floats on water?

(A) Ice has a higher density than liquid water
(B) Ice has a higher kinetic energy than liquid water
(C) Ice has a lower density than liquid water because of its hydrogen-bonded lattice
(D) Ice has a stronger intermolecular force than liquid water

Correct Answer: C

Explanation: In ice, hydrogen bonding forms a hexagonal lattice with more empty space, making solid water less dense than liquid water, so it floats.

27. A saturated solution of sodium thiosulphate is prepared at 60 °C and then cooled slowly to room temperature. No crystallization occurs immediately. What type of solution is this, and what happens when a small crystal of sodium thiosulphate is added?

(A) Unsaturated; the crystal dissolves
(B) Saturated; nothing happens
(C) Colloidal; the crystal scatters light
(D) Supersaturated; crystallization begins immediately

Correct Answer: D

Explanation: Supersaturated; crystallization begins immediately — this correctly answers the question.

28. A homogeneous mixture is separated into its components by distillation. Which type of mixture was it?

(A) A solution
(B) A compound
(C) A suspension
(D) A colloid

Correct Answer: A

Explanation: A solution is a homogeneous mixture whose components can be separated by physical means such as distillation (based on differences in boiling point).

29. Which of the following statements about plasma is correct?

(A) Plasma is formed when a solid is heated to its melting point
(B) Plasma consists of ionized gas particles with free electrons
(C) Plasma is a state of matter found only in laboratories
(D) Plasma is the most common state of matter on Earth's surface

Correct Answer: B

Explanation: Plasma forms at very high temperatures or in strong electric fields, where gas atoms are ionized and free electrons and ions are present.

30. Which observation shows that a solution is **supersaturated rather than merely saturated?**

(A) The solution is clear and transparent

(B) The solution contains some undissolved solute at the bottom

(C) Adding a seed crystal causes rapid crystallization

(D) The solution conducts electricity

Correct Answer: C

Explanation: Adding a seed crystal causes rapid crystallization — this correctly answers the question.

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Chemistry Grade 9 — Chapter 3

Atomic Structure

by Public Library

Practice MCQs extracted from the supplied Class 9 Chemistry chapter tests (Section A). Total: 30 questions.

A. Important / Main Topics

1. Who proposed the first scientific theory that atoms are indivisible particles?

(A) Dalton
(B) Rutherford
(C) Bohr
(D) Heisenberg

Correct Answer: A

Explanation: In 1803, John Dalton presented his atomic theory, stating that all elements are composed of tiny indivisible particles called atoms.

2. Which subatomic particle has a relative charge of -1 and a mass of approximately 1/1836 amu?

(A) Proton
(B) Electron
(C) Neutron
(D) Nucleon

Correct Answer: B

Explanation: Electron — this correctly answers the question.

3. The total number of protons and neutrons in an atom is known as its:

(A) Atomic number
(B) Valence number
(C) Mass number
(D) Isotopic number

Correct Answer: C

Explanation: The mass number (or nucleon number) is the total number of protons and neutrons in the nucleus.

4. What is the maximum number of electrons that can be accommodated in the **p sub-shell?**

(A) 2
(B) 10
(C) 14
(D) 6

Correct Answer: D

Explanation: The p sub-shell can accommodate a maximum of 6 electrons.

5. According to Bohr's atomic theory, the angular momentum of an electron is an integral multiple of:

(A) $h/2\pi$
(B) h
(C) $2\pi h$
(D) $h/4\pi$

Correct Answer: A

Explanation: Bohr postulated that the electron revolves only in those orbits where the angular momentum is an integral multiple of $h/2\pi$.

6. Which isotope is commonly used in the treatment of cancer by irradiating cancer cells?

(A) Iodine-131
(B) Cobalt-60
(C) Carbon-14

(D) Sodium-24

Correct Answer: B

Explanation: Cobalt-60 is commonly used to irradiate cancer cells in the hope of killing or shrinking the tumors.

7. The principal quantum number (n) for the M shell is:

(A) 1
(B) 2
(C) 3
(D) 4

Correct Answer: C

Explanation: The principal quantum number (n) for the M shell is 3.

8. Which of the following is the correct electronic configuration for a neutral sodium (Na) atom (Atomic No. 11)?

(A) \(1s^2 2s^2 2p^6\)
(B) \(1s^2 2s^2 2p^5 3s^2\)
(C) \(1s^2 2s^2 2p^3 3s^2 3p^3\)
(D) \(1s^2 2s^2 2p^6 3s^1\)

Correct Answer: D

Explanation: \(1s^2 2s^2 2p^6 3s^1\) — this correctly answers the question.

9. The isotopes of hydrogen are:

(A) Protium, Deuterium, Tritium
(B) Carbon-12, Carbon-13, Carbon-14
(C) Chlorine-35, Chlorine-37
(D) Uranium-234, Uranium-235, Uranium-238

Correct Answer: A

Explanation: The isotopes of hydrogen are Protium, Deuterium, Tritium.

10. Which principle states that it is impossible to simultaneously determine the exact location and future trajectory of an electron?

(A) Aufbau Principle
(B) Heisenberg Uncertainty Principle
(C) Pauli Exclusion Principle
(D) Hund's Rule

Correct Answer: B

Explanation: Formulated by Werner Heisenberg in 1927, this principle states that it is impossible to simultaneously determine the exact location and future trajectory of an electron.

11. Which observation from Rutherford's gold foil experiment led to the conclusion that the atom is mostly empty space?

(A) A few α-particles were deflected at small angles
(B) One in a million α-particles bounced back
(C) Most α-particles passed straight through the foil
(D) Some α-particles were absorbed by the gold foil

Correct Answer: C

Explanation: The fact that most α-particles passed through undeflected proved that most of the atom's volume is empty space.

12. Why did Rutherford's model fail to explain the stability of an atom?

(A) It did not include neutrons in the nucleus
(B) It could not explain the existence of isotopes
(C) It treated electrons as waves instead of particles
(D) It predicted that orbiting electrons would continuously emit energy and spiral into the nucleus

Correct Answer: D

Explanation: According to classical physics, a charged particle moving in a circular path emits energy continuously, which would cause the electron to lose energy and collapse into the nucleus.

13. According to Bohr's model, what happens when an electron jumps from a higher energy orbit to a lower energy orbit?

(A) It emits energy in the form of light
(B) It absorbs energy in the form of light
(C) It becomes a neutron
(D) It stops moving

Correct Answer: A

Explanation: Bohr postulated that light is emitted when an electron falls from a higher energy orbit to a lower energy orbit, with energy equal to the difference between the orbits.

14. Which of the following is the correct order of increasing energy of sub-shells?

(A) 1s < 2p < 2s < 3s < 3p
(B) 1s < 2s < 2p < 3s < 3p
(C) 2s < 1s < 2p < 3s < 3p
(D) 1s < 2s < 3s < 2p < 3p

Correct Answer: B

Explanation: The Aufbau principle states that electrons fill the lowest energy sub-shell first. The correct order is 1s < 2s < 2p < 3s < 3p.

15. The isotope Carbon-14 is used in carbon dating. Why is Carbon-14 suitable for this purpose?

(A) It is the most abundant isotope of carbon
(B) It is stable and does not decay
(C) It is radioactive and decays at a known rate
(D) It is produced only in living organisms

Correct Answer: C

Explanation: Carbon-14 is a radioactive isotope with a known half-life, making it useful for estimating the age of once-living things by measuring how much C-14 remains.

B. Less Important / Secondary Topics

16. Which of the following correctly represents the electronic configuration of a chloride ion (Cl□)? (Atomic number of Cl = 17)

(A) \(1s^2 2s^2 2p^6 3s^2 3p^6\)
(B) \(1s^2 2s^2 2p^6 3s^2 3p^4\)
(C) \(1s^2 2s^2 2p^6 3s^2 3p^5\)
(D) \(1s^2 2s^2 2p^6 3s^2 3p^6 4s^1\)

Correct Answer: A

Explanation: A neutral chlorine atom has 17 electrons. When it gains one electron to form Cl□, it has 18 electrons, giving the configuration \(1s^2 2s^2 2p^6 3s^2 3p^6\) (the same as argon).

17. Which subatomic particle is not found in the nucleus of an atom?

(A) Proton
(B) Electron
(C) Neutron
(D) Nucleon

Correct Answer: B

Explanation: Electrons orbit the nucleus in energy levels or shells. Protons and neutrons are found in the nucleus and are collectively called nucleons.

18. The symbol \(^{35}_{17}\text{Cl}\) represents a chlorine atom. How many neutrons are present in its nucleus?

(A) 17
(B) 35

(C) 18
(D) 52

Correct Answer: C

Explanation: The mass number (35) is the sum of protons and neutrons. Number of neutrons = mass number - atomic number = 35 - 17 = 18.

19. Why is the relative atomic mass of chlorine (35.5 amu) not a whole number?

(A) Chlorine atoms have half a proton
(B) It is the mass of the most abundant isotope
(C) Chlorine atoms lose mass during reactions
(D) It is the weighted average of the masses of its isotopes (Cl-35 and Cl-37)

Correct Answer: D

Explanation: Relative atomic mass is a weighted average of the isotopic masses based on their natural abundances. Chlorine is about 75% Cl-35 and 25% Cl-37, giving an average of 35.5 amu.

20. Which of the following is the correct number of neutrons for the isotope \(^{14}_{6}\text{C}\)?

(A) 8
(B) 6
(C) 14
(D) 20

Correct Answer: A

Explanation: 8 — this correctly answers the question.

21. An atom has an atomic number of 19 and a mass number of 39. Which of the following correctly describes its subatomic particles?

(A) 19 protons, 19 neutrons, 19 electrons
(B) 19 protons, 20 neutrons, 19 electrons
(C) 20 protons, 19 neutrons, 20 electrons
(D) 19 protons, 39 neutrons, 19 electrons

Correct Answer: B

Explanation: Atomic number = protons = 19. Mass number = protons + neutrons, so neutrons = 39 − 19 = 20. A neutral atom has electrons = protons = 19.

22. Which of the following electronic configurations represents an **excited state of a magnesium atom (Z = 12)?**

(A) \(1s^2 2s^2 2p^6 3s^2\)
(B) \(1s^2 2s^2 2p^6 3s^1\)
(C) \(1s^2 2s^2 2p^6 3p^2\)
(D) \(1s^2 2s^2 2p^5 3s^2\)

Correct Answer: C

Explanation: The ground state of Mg ends in \(3s^2\). An excited state has an electron promoted to a higher sub-shell (here, from 3s to 3p), while the total number of electrons remains 12.

23. An ion \(X^{2+}\) has the electronic configuration \(1s^2 2s^2 2p^6\). What is the atomic number of element X?

(A) 8
(B) 10
(C) 14
(D) 12

Correct Answer: D

Explanation: \(X^{2+}\) has 10 electrons. Since it lost 2 electrons, the neutral atom has 10 + 2 = 12 electrons, so its atomic number is 12 (magnesium).

24. The isotope \(^{14}_{6}\text{C}\) decays by emitting a beta particle. Which of the following best describes the change in the nucleus?

(A) The number of protons increases by 1 and the mass number stays the same

(B) The number of protons decreases by 1 and the mass number stays the same
(C) The number of protons decreases by 2 and the mass number decreases by 4
(D) The number of neutrons increases by 1 and the mass number increases by 1

Correct Answer: A

Explanation: In beta decay, a neutron changes into a proton, so the atomic number increases by 1 while the mass number remains constant. Carbon-14 becomes nitrogen-14.

25. An element has two isotopes with masses 63 amu and 65 amu. If the relative atomic mass is 63.5 amu, what is the approximate relative abundance of the heavier isotope?

(A) 50%
(B) 25%
(C) 63.5%
(D) 75%

Correct Answer: B

Explanation: 25% — this correctly answers the question.

26. Which of the following pairs of particles would be deflected in **opposite directions by an electric field?**

(A) Proton and neutron
(B) Electron and neutron
(C) Proton and electron
(D) Two neutrons

Correct Answer: C

Explanation: Protons are positive and are deflected toward the negative plate; electrons are negative and are deflected toward the positive plate. Neutrons are undeflected.

27. Which observation from the hydrogen emission spectrum **most directly supports the idea that energy levels in an atom are quantized?**

(A) The spectrum is continuous
(B) The spectrum appears white
(C) The spectrum changes with temperature
(D) The spectrum consists of discrete lines

Correct Answer: D

Explanation: The spectrum consists of discrete lines — this correctly answers the question.

28. An element's electronic configuration ends in \(3s^2 3p^4\). Which of the following is true about this element?

(A) It is a non-metal and will gain 2 electrons to form a 2− anion
(B) It is a metal and will lose electrons to form a cation
(C) It is a noble gas and will not react
(D) It is a metalloid with variable behaviour

Correct Answer: A

Explanation: Ending in \(3s^2 3p^4\) indicates Group 16, Period 3 — sulfur, a non-metal that gains 2 electrons to complete its octet and form S^{2}□.

29. A neutral atom has 17 protons. Which subatomic particles are present in the nucleus, and how many?

(A) 17 protons, 17 neutrons
(B) 17 protons, 18 neutrons (if mass number is 35)
(C) 17 electrons, 18 neutrons
(D) 17 protons, 17 electrons

Correct Answer: B

Explanation: Chlorine (Z = 17) has 17 protons. For chlorine-35, mass number = 35, so neutrons = 35 − 17 = 18. Electrons are not in the nucleus.

30. Which statement best explains why chlorine has a relative atomic mass of 35.5 amu, which is not a whole number?

(A) Chlorine atoms have half a proton
(B) It is the mass of the most common isotope
(C) It is a weighted average of the isotopes Cl-35 (≈75%) and Cl-37 (≈25%)
(D) Chlorine atoms lose mass during chemical reactions

Correct Answer: C

Explanation: Relative atomic mass = weighted average of isotopic masses; for Cl, about 75% Cl-35 and 25% Cl-37 gives ≈35.5 amu.

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Chemistry Grade 9 — Chapter 4

Periodic Table and Periodicity of Properties

by Public Library

Practice MCQs extracted from the supplied Class 9 Chemistry chapter tests (Section A). Total: 30 questions.

A. Important / Main Topics

1. The periodic table is arranged in order of increasing:

(A) Atomic number
(B) Atomic mass
(C) Number of neutrons
(D) Density

Correct Answer: A

Explanation: The periodic table is arranged based on increasing atomic number (number of protons), following Moseley's 1913 discovery.

2. The horizontal rows in the periodic table are called:

(A) Groups
(B) Periods
(C) Blocks
(D) Families

Correct Answer: B

Explanation: The horizontal rows in the periodic table are called Periods.

3. Which of the following elements belongs to the s-block?

(A) Carbon (C)
(B) Chlorine (Cl)
(C) Sodium (Na)
(D) Neon (Ne)

Correct Answer: C

Explanation: Sodium (Z = 11) has the configuration \(1s^2 2s^2 2p^6 3s^1\). Its valence electron is in the s sub-shell, so it is an s-block element.

4. The general electronic configuration of Group VIIIA (noble gases) is:

(A) \(ns^1\)
(B) \(ns^2 np^5\)
(C) \(ns^2 np^3\)
(D) \(ns^2 np^6\)

Correct Answer: D

Explanation: Noble gases (except He) have a complete octet with the configuration \(ns^2 np^6\).

5. Which of the following is the correct trend for atomic radius across a period (left to right)?

(A) Decreases
(B) Increases
(C) Remains constant
(D) Increases then decreases

Correct Answer: A

Explanation: Decreases — this correctly answers the question.

6. Which factor is primarily responsible for the shielding effect?

(A) Electrons in the valence shell
(B) Electrons in the inner shells
(C) Protons in the nucleus

(D) Neutrons in the nucleus

Correct Answer: B

Explanation: Shielding effect is the reduction in attraction between the nucleus and valence electrons caused by electrons in the inner shells.

7. Which of the following elements has the **highest electronegativity?**

(A) Chlorine (Cl)
(B) Oxygen (O)
(C) Fluorine (F)
(D) Nitrogen (N)

Correct Answer: C

Explanation: Fluorine (F) — this correctly answers the question.

8. Which of the following is **not a characteristic of transition elements?**

(A) High density
(B) Variable oxidation states
(C) Coloured compounds
(D) Very low melting points

Correct Answer: D

*Explanation: Transition elements generally have **high** melting points due to strong metallic bonding from partially filled d sub-shells.*

9. The correct order of **decreasing oxidizing power for halogens is:**

(A) \(F_2 > Cl_2 > Br_2 > I_2\)
(B) \(I_2 > Br_2 > Cl_2 > F_2\)
(C) \(Cl_2 > F_2 > Br_2 > I_2\)
(D) \(Br_2 > Cl_2 > F_2 > I_2\)

Correct Answer: A

Explanation: Fluorine is the strongest oxidizing agent and iodine is the weakest; the order is \(F_2 > Cl_2 > Br_2 > I_2\).

10. Which of the following statements about **metals and **non-metals** is correct?**

(A) Non-metals are good conductors of electricity
(B) Metals are malleable and ductile
(C) Metals are brittle and non-malleable
(D) Non-metals have high melting points

Correct Answer: B

Explanation: Metals are malleable (can be hammered into sheets) and ductile (can be drawn into wires), while non-metals are generally brittle.

11. Why does the shielding effect increase down a group in the periodic table?

(A) The number of valence electrons increases
(B) The nuclear charge decreases
(C) The number of inner electron shells increases
(D) The atomic radius decreases

Correct Answer: C

Explanation: Down a group, additional electron shells are added. The electrons in these inner shells shield the valence electrons from the nucleus, increasing the shielding effect.

12. Which of the following explains why atomic radius decreases across a period from left to right?

(A) The number of shells increases
(B) The shielding effect increases
(C) The number of protons decreases
(D) The effective nuclear charge increases

Correct Answer: D

Explanation: The effective nuclear charge increases — this correctly answers the question.

13. A neutral atom has the electronic configuration \(1s^2 2s^2 2p^6 3s^2 3p^5\). Which block, group, and period does this element belong to?

(A) p-block, Group 17, Period 3
(B) s-block, Group 1, Period 3
(C) p-block, Group 7, Period 3
(D) d-block, Group 17, Period 3

Correct Answer: A

Explanation: The valence electron is in the 3p sub-shell → p-block. Highest n = 3 → Period 3. Valence electrons = 2 + 5 = 7; for p-block, group = 7 + 10 = 17.

14. Which of the following statements correctly describes the trend in ionization energy across a period?

(A) It decreases because atomic size increases
(B) It increases because nuclear charge increases while shielding remains constant
(C) It decreases because shielding increases
(D) It remains constant across the period

Correct Answer: B

Explanation: Across a period, the nucleus becomes more positive while inner shielding stays the same; valence electrons are more tightly held, so ionization energy increases.

15. Which of the following elements would have the **lowest ionization energy?**

(A) Fluorine (F)
(B) Oxygen (O)
(C) Lithium (Li)
(D) Neon (Ne)

Correct Answer: C

Explanation: Lithium is the furthest left in Period 2 and has the largest radius and lowest effective nuclear charge among these; its single valence electron is easiest to remove, giving the lowest ionization energy.

B. Less Important / Secondary Topics

16. Which pair of elements would you expect to have the **most similar chemical properties?**

(A) Na and K
(B) Na and Mg
(C) Na and Cl
(D) Na and Ne

Correct Answer: A

Explanation: Na and K are both in Group 1 (alkali metals). They have the same valence electron configuration (\(ns^1\)) and therefore similar chemical properties.

17. The oxidation state of chromium in potassium dichromate, K□Cr□O□, is:

(A) +3
(B) +6
(C) +7
(D) +2

Correct Answer: B

Explanation: K = +1 (×2 = +2); O = −2 (×7 = −14). Sum must be zero: +2 + 2x − 14 = 0 → 2x = 12 → x = +6.

18. Which of the following is **not a correct comparison between metals and non-metals?**

(A) Metals are malleable; non-metals are brittle
(B) Metals conduct electricity; non-metals (except graphite) do not
(C) Metals have low melting points; non-metals have high melting points
(D) Metals have free electrons; non-metals generally lack free electrons

Correct Answer: C

*Explanation: This is the reverse of the actual trend. Metals generally have **high** melting points; non-metals generally have **low** melting points.*

19. Bromine is a liquid at room temperature, whereas fluorine and chlorine are gases. What does this indicate about the trend in the halogens?

(A) Intermolecular forces become weaker down the group
(B) Atomic size decreases down the group
(C) Electronegativity increases down the group
(D) Intermolecular forces become stronger down the group

Correct Answer: D

Explanation: As the size and mass of halogen molecules increase down the group, van der Waals forces between molecules strengthen; hence Br□ is a liquid and I□ is a solid while F□ and Cl□ are gases.

20. What is the main reason why transition elements exhibit variable oxidation states?

(A) Their d sub-shell electrons can participate in bonding along with s electrons
(B) They have only one valence electron
(C) They are all radioactive
(D) They have very small atomic radii

Correct Answer: A

Explanation: Because the energies of the 4s and 3d (or corresponding) sub-shells are close, both can lose electrons to different extents, giving multiple oxidation states.

21. Element X has the electronic configuration \(1s^2 2s^2 2p^6 3s^2 3p^6 4s^2\). Which of the following statements correctly identifies its position in the periodic table?

(A) p-block, Group 12, Period 4
(B) s-block, Group 2, Period 4
(C) s-block, Group 12, Period 4
(D) d-block, Group 2, Period 4

Correct Answer: B

Explanation: The last electron enters the 4s sub-shell → s-block. The highest n is 4 → Period 4. Valence electrons = 2 (in 4s), so group = 2.

22. Which of the following elements would have the **largest atomic radius?**

(A) Li
(B) Na
(C) Rb
(D) K

Correct Answer: C

Explanation: Atomic radius increases down a group. Rb is the lowest element among the options in Group 1, so it has the largest radius.

23. An element is placed in Group 17 and Period 3. Which of the following is its correct identity and electronic configuration?

(A) Fluorine, \(1s^2 2s^2 2p^5\)
(B) Bromine, \(1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5\)
(C) Sulfur, \(1s^2 2s^2 2p^6 3s^2 3p^4\)
(D) Chlorine, \(1s^2 2s^2 2p^6 3s^2 3p^5\)

Correct Answer: D

Explanation: Group 17 means 7 valence electrons, Period 3 means highest n = 3. Chlorine has 17 electrons, ending in \(3s^2 3p^5\).

24. Which of the following explains why the first ionization energy of sodium is lower than that of magnesium?

(A) Sodium has a larger atomic radius and lower effective nuclear charge
(B) Magnesium has more inner shells
(C) Sodium has a full outer shell

(D) Magnesium has a lower nuclear charge

Correct Answer: A

Explanation: Na and Mg are in the same period. Na is to the left, with a larger radius and lower effective nuclear charge; its valence electron is easier to remove.

25. A transition element is used as a catalyst in the Haber process for the synthesis of ammonia. Which element is this, and why is it effective?

(A) Platinum, because it is very dense
(B) Iron, because it provides a surface for the reaction and has variable oxidation states
(C) Nickel, because it is malleable
(D) Copper, because it is a good conductor

Correct Answer: B

Explanation: The Haber process uses iron (Fe) as a catalyst. Transition metals are effective catalysts due to their partially filled d sub-shells and variable oxidation states.

26. Which of the following correctly describes the trend in metallic character across a period and down a group?

(A) Increases across a period; decreases down a group
(B) Remains constant across a period; increases down a group
(C) Decreases across a period; increases down a group
(D) Increases both across a period and down a group

Correct Answer: C

Explanation: Metallic character decreases from left to right across a period (harder to lose electrons) and increases down a group (easier to lose electrons).

27. The isotope \(^{37}_{17}\text{Cl}\) has a different atomic mass from \(^{35}_{17}\text{Cl}\). Which of the following correctly describes the difference between these two isotopes?

(A) They have a different number of protons
(B) They have a different number of electrons in a neutral atom
(C) They belong to different groups of the periodic table
(D) They have a different number of neutrons

Correct Answer: D

Explanation: They have a different number of neutrons — this correctly answers the question.

28. Which of the following combinations would produce an **ionic compound?**

(A) A metal from Group 1 and a non-metal from Group 17
(B) Two non-metals from Group 16
(C) Two metals from Group 2
(D) Two non-metals from Group 17

Correct Answer: A

Explanation: A metal from Group 1 and a non-metal from Group 17 — this correctly answers the question.

29. Which statement correctly explains why **noble gases are unreactive?**

(A) They have one valence electron and lose it easily
(B) They have a complete valence shell and do not tend to gain or lose electrons
(C) They are the most electronegative elements
(D) They are the largest atoms in their periods

Correct Answer: B

Explanation: Noble gases have a stable octet configuration (\(ns^2np^6\)), so they have no tendency to lose or gain electrons, making them chemically inert.

30. A student predicts that a halogen X will displace another halogen Y from its salt solution. Which condition must be true for this displacement to occur?

(A) X must be less reactive than Y
(B) X and Y must be in different groups
(C) X must be more reactive than Y

(D) X must be a metal

Correct Answer: C

Explanation: In halogen displacement reactions, a more reactive halogen displaces a less reactive one from its salt solution. For example, Cl□ displaces Br□ from bromide solutions.

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Chemistry Grade 9 — Chapter 5

Chemical Bonding

by Public Library

Practice MCQs extracted from the supplied Class 9 Chemistry chapter tests (Section A). Total: 30 questions.

A. Important / Main Topics

1. According to the octet rule, an atom is most stable when its valence shell contains:

(A) 8 electrons
(B) 2 electrons
(C) 18 electrons
(D) 32 electrons

Correct Answer: A

Explanation: The octet rule states that an atom is most s.

2. Which of the following elements is chemically inert due to a complete valence shell?

(A) Sodium (Na)
(B) Neon (Ne)
(C) Chlorine (Cl)
(D) Oxygen (O)

Correct Answer: B

Explanation: Neon is a noble gas (Group 18) with a complete octet (\(1s^2 2s^2 2p^6\)), making it chemically inert.

3. In an ionic bond, electrons are:

(A) Shared equally between atoms
(B) Shared unequally between atoms
(C) Transferred from one atom to another
(D) Lost by both atoms

Correct Answer: C

Explanation: An ionic bond forms when one atom (usually a metal) transfers electrons to another atom (usually a non-metal).

4. Which type of bond is formed when two non-metal atoms share a pair of electrons?

(A) Ionic bond
(B) Metallic bond
(C) Coordinate covalent bond
(D) Covalent bond

Correct Answer: D

Explanation: Covalent bonds form when two non-metal atoms share one or more pairs of electrons to achieve a s.

5. In a non-polar covalent bond, the shared electrons are:

(A) Pulled equally by both atoms
(B) Pulled more by one atom
(C) Completely transferred to one atom
(D) Lost to the surroundings

Correct Answer: A

Explanation: Non-polar covalent bonds form between identical atoms (e.g., H–H, Cl–Cl), so both atoms exert the same force on the shared electrons.

6. The bond in HCl is best described as:

(A) Non-polar covalent
(B) Polar covalent
(C) Ionic

(D) Metallic

Correct Answer: B

Explanation: HCl has a polar covalent bond because chlorine is more electronegative than hydrogen, pulling the shared electrons toward itself.

7. In a coordinate covalent bond, the shared electron pair comes from:

(A) Both atoms equally
(B) The nucleus
(C) A single atom (the donor)
(D) A third atom

Correct Answer: C

Explanation: In a coordinate covalent bond, one atom (the donor) provides both electrons for the shared pair.

8. Which of the following is a property of metals due to metallic bonding?

(A) They are brittle
(B) They are poor conductors of electricity
(C) They have low melting points
(D) They are malleable and ductile

Correct Answer: D

Explanation: In metallic bonding, layers of metal ions can slide over each other, making metals malleable and ductile.

9. Which of the following compounds contains an ionic bond?

(A) NaCl
(B) H□O
(C) Cl□
(D) CH□

Correct Answer: A

Explanation: NaCl is an ionic compound formed from a metal (Na) and a non-metal (Cl), involving the transfer of electrons.

10. The intermolecular force that is strongest among the following is:

(A) Dipole–dipole forces
(B) Hydrogen bonding
(C) London dispersion forces
(D) Ion–dipole forces

Correct Answer: B

Explanation: Hydrogen bonding is the strongest of the intermolecular forces discussed in the chapter, occurring when H is bonded to N, O, or F.

11. Why do noble gases not participate in ordinary chemical reactions?

(A) They have one valence electron
(B) They have high electronegativity
(C) They have a complete valence shell with a stable octet
(D) They are highly reactive metals

Correct Answer: C

Explanation: Noble gases (Group 18) have a completely filled valence shell (\(ns^2 np^6\), except He with \(1s^2\)), so they do not need to gain, lose, or share electrons.

12. Which of the following best explains why metals are electropositive?

(A) They have a strong tendency to gain electrons
(B) They have a complete octet
(C) They form covalent bonds with non-metals
(D) They have low ionization energy and low electronegativity, so they lose electrons easily

Correct Answer: D

Explanation: Metals are electropositive because they have low ionization energy and low electronegativity, allowing them to lose electrons and form positive ions.

13. In the formation of Mg^{2}□ from a neutral magnesium atom, what happens?

(A) Magnesium loses two electrons
(B) Magnesium gains two electrons
(C) Magnesium shares two electrons
(D) Magnesium gains two protons

Correct Answer: A

Explanation: Magnesium loses two electrons — this correctly answers the question.

14. Which of the following molecules contains a **double covalent bond?**

(A) H□
(B) O□
(C) Cl□
(D) HCl

Correct Answer: B

Explanation: O□ — this correctly answers the question.

15. In a coordinate covalent bond, the atom that donates both electrons is called the:

(A) Acceptor
(B) Cation
(C) Donor
(D) Anion

Correct Answer: C

Explanation: In a coordinate covalent bond, the donor atom provides both electrons for the shared pair, while the acceptor receives them.

B. Less Important / Secondary Topics

16. Which of the following statements about hydrogen bonding is correct?

(A) It occurs when hydrogen is bonded to N, O, or F
(B) It occurs between any two hydrogen atoms
(C) It is weaker than dipole–dipole forces
(D) It only occurs in non-polar molecules

Correct Answer: A

Explanation: Hydrogen bonding occurs when a hydrogen atom covalently bonded to a highly electronegative atom (N, O, or F) is attracted to a lone pair on a nearby N, O, or F atom.

17. Why does diamond have a very high melting point?

(A) It has weak intermolecular forces
(B) It has a giant covalent network of strong bonds throughout
(C) It contains free electrons
(D) It is an ionic compound

Correct Answer: B

Explanation: Diamond is a giant covalent structure; each carbon atom is bonded to four others by strong covalent bonds, so a lot of energy is needed to break the structure.

18. Why does graphite conduct electricity while diamond does not?

(A) Diamond has delocalized electrons; graphite has no free electrons
(B) Both have free electrons, but diamond's are less mobile
(C) Graphite has delocalized electrons; diamond has no free electrons
(D) Graphite is ionic; diamond is covalent

Correct Answer: C

Explanation: In graphite, the fourth valence electron of each carbon atom is delocalized and can move, allowing conductivity. In diamond, all valence electrons are used in covalent bonds, so no free electrons exist.

19. Which of the following is **not a property of ionic compounds?**

(A) High melting points
(B) Conduct electricity when molten or dissolved
(C) Often soluble in water
(D) Conduct electricity in the solid state

Correct Answer: D

*Explanation: Ionic compounds do **not** conduct electricity in the solid state because their ions are fixed in the lattice. They conduct only when molten or dissolved.*

20. Metals are malleable and ductile because:

(A) Their layers of ions can slide over one another while being held by the electron sea
(B) They have weak ionic bonds
(C) They have strong covalent bonds
(D) They contain free protons

Correct Answer: A

Explanation: In metallic bonding, the delocalized electron sea holds the layers of metal ions together even when the layers slide, so metals can be shaped without breaking.

21. An element \(X\) has the electronic configuration \(1s^2 2s^2 2p^5\). It reacts with an element \(Y\) that has the configuration \(1s^2 2s^2 2p^6 3s^1\). Which type of bond will most likely form between X and Y?

(A) Non-polar covalent bond
(B) Ionic bond
(C) Polar covalent bond
(D) Coordinate covalent bond

Correct Answer: B

Explanation: X is a non-metal (fluorine, 7 valence electrons) and Y is a metal (sodium, 1 valence electron). The metal transfers its electron to the non-metal, forming an ionic bond (NaF).

22. A molecule \(XY\) is formed between two elements, X and Y. If the electronegativity of X is 2.1 and that of Y is 3.5, which of the following is the most likely type of bond?

(A) Non-polar covalent
(B) Ionic
(C) Polar covalent
(D) Metallic

Correct Answer: C

Explanation: The electronegativity difference is \(3.5 - 2.1 = 1.4\), which is moderate. This difference indicates a polar covalent bond (like O–H in water).

23. Which of the following molecules contains a **coordinate covalent bond?**

(A) CH□
(B) NH□
(C) H□O
(D) H□O□

Correct Answer: D

Explanation: In the hydronium ion (H□O□), water donates a lone pair to H□. Both electrons in the new O–H bond come from oxygen, making it a coordinate covalent bond.

24. Graphite is a good conductor of electricity, but diamond is not. Which statement best explains this difference?

(A) Graphite has delocalized electrons between its layers, while diamond's electrons are all localized in covalent bonds
(B) Graphite has a 3D network, while diamond has a 2D layered structure
(C) Diamond has free ions, while graphite does not
(D) Graphite is ionic, while diamond is covalent

Correct Answer: A

Explanation: In graphite, the fourth valence electron of each carbon atom is delocalized and can move freely, allowing conductivity. In diamond, all valence electrons are used in covalent bonds, so no free electrons exist.

25. Why is the melting point of NaCl much higher than that of ice (H□O)?

(A) NaCl has a giant covalent network; ice has a simple molecular structure

(B) NaCl has strong ionic bonds throughout a giant lattice; ice has weak intermolecular forces between molecules

(C) NaCl is a metal; ice is a non-metal

(D) NaCl has delocalized electrons; ice does not

Correct Answer: B

Explanation: Ionic bonds in NaCl are much stronger than the intermolecular forces in ice. Melting NaCl requires breaking strong ionic bonds; melting ice requires breaking weak intermolecular forces.

26. What is the strongest intermolecular force among the following?

(A) London dispersion forces

(B) Dipole–dipole forces

(C) Hydrogen bonding

(D) Van der Waals forces

Correct Answer: C

Explanation: Hydrogen bonding is the strongest of the intermolecular forces discussed in the chapter, occurring when H is bonded to N, O, or F.

27. Which of the following combinations of elements would most likely form a **non-polar covalent bond?**

(A) Na and Cl

(B) H and Cl

(C) Mg and O

(D) H and H

Correct Answer: D

Explanation: H and H — this correctly answers the question.

28. Which of the following would you expect to have the **highest melting point?**

(A) Diamond

(B) H□O

(C) NaCl

(D) CO□

Correct Answer: A

Explanation: Diamond has a giant covalent structure with strong covalent bonds throughout a 3D network. A lot of energy is needed to break these bonds, so its melting point is very high (~3550 °C).

29. A metal such as copper is malleable and ductile. Which feature of its structure allows this?

(A) Strong ionic bonds

(B) Layers of atoms that can slide over each other, held together by a sea of delocalized electrons

(C) Giant covalent network

(D) Weak intermolecular forces

Correct Answer: B

Explanation: In metallic bonding, the layers of metal ions can slide without breaking the metallic bond because the delocalized electrons hold them together.

30. In the formation of an ionic compound, which of the following is true?

(A) The metal gains electrons, and the non-metal loses electrons

(B) Both atoms share electrons equally

(C) The metal loses electrons, and the non-metal gains electrons

(D) Both atoms lose electrons

Correct Answer: C

Explanation: The metal loses electrons, and the non-metal gains electrons — this correctly answers the question.

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Chemistry Grade 9 — Chapter 6

Stoichiometry

by Public Library

Practice MCQs extracted from the supplied Class 9 Chemistry chapter tests (Section A). Total: 30 questions.

A. Important / Main Topics

1. The chemical formula that gives the simplest whole-number ratio of atoms in a compound is called the:

(A) Empirical formula
(B) Molecular formula
(C) Structural formula
(D) Formula unit

Correct Answer: A

Explanation: The chemical formula that gives the simplest whole-number ratio of atoms in a compound is called the Empirical formula.

2. A mole of any substance contains:

(A) \(3.011 \times 10^{23}\) particles
(B) \(6.022 \times 10^{23}\) particles
(C) \(6.022 \times 10^{22}\) particles
(D) \(1.0 \times 10^{23}\) particles

Correct Answer: B

Explanation: A mole of any substance contains \(6.022 \times 10^{23}\) particles.

3. What is the molecular mass of glucose, C□H□□O□? (Atomic masses: C=12, H=1, O=16)

(A) 180 g
(B) 180 kg
(C) 180 amu
(D) 180 mg

Correct Answer: C

Explanation: "180 amu" is correct: it matches the idea asked in the question ("What is the molecular mass of glucose, C□H□□O□? (Atomic masses: C=12, H=1, O=16)"), while the other choices do not.

4. The mass of one mole of a substance is called its:

(A) Atomic mass
(B) Molecular mass
(C) Formula mass
(D) Molar mass

Correct Answer: D

Explanation: The mass of one mole of a substance (in g/mol) is called its molar mass.

5. How many moles of water are present in 36 g of H□O? (Molar mass of H□O = 18 g/mol)

(A) 2 moles
(B) 1 mole
(C) 3 moles
(D) 4 moles

Correct Answer: A

Explanation: "2 moles" is correct: it matches the idea asked in the question ("How many moles of water are present in 36 g of H□O? (Molar mass of H□O = 18 g/mol)"), while the other choices do not.

6. In the balanced chemical equation \(2H_2 + O_2 \rightarrow 2H_2O\), what is the coefficient of \(O_2\)?

(A) 2
(B) 1
(C) 3
(D) 4

Correct Answer: B

Explanation: In the balanced equation, the coefficient of \(O_2\) is 1 (understood, not written).

7. The empirical formula of hydrogen peroxide (H□O□) is:

(A) H□O
(B) HO□
(C) HO
(D) H□O□

Correct Answer: C

Explanation: The simplest ratio of H to O in H□O□ is 1:1, so the empirical formula is HO.

8. According to the law of conservation of mass, in a chemical reaction:

(A) Mass can be created
(B) Mass can be destroyed
(C) Mass changes into energy
(D) Total mass remains constant

Correct Answer: D

Explanation: The law of conservation of mass states that matter cannot be created or destroyed; the total mass of reactants equals the total mass of products.

9. Which of the following is the correct formula mass of NaCl? (Atomic masses: Na=23, Cl=35.5)

(A) 58.5 amu
(B) 58.5 g
(C) 23 amu
(D) 35.5 amu

Correct Answer: A

Explanation: "58.5 amu" is correct: it matches the idea asked in the question ("Which of the following is the correct formula mass of NaCl? (Atomic masses: Na=23, Cl=35.5)"), while the other choices do not.

10. The number of moles in \(3.011 \times 10^{23}\) atoms of carbon is:

(A) 1 mole
(B) 0.5 mole
(C) 2 moles
(D) 0.25 mole

Correct Answer: B

Explanation: The number of moles in \(3.011 \times 10^{23}\) atoms of carbon is 0.5 mole.

11. A compound has the empirical formula CH□O and a molar mass of 180 g/mol. What is its molecular formula?

(A) CH□O
(B) C□H□O□
(C) C□H□□O□
(D) C□H□O□

Correct Answer: C

Explanation: C□H□□O□ — this correctly answers the question.

12. Which of the following contains the **largest number of molecules?**

(A) 1 mole of H□O
(B) 1 mole of CO□
(C) 1 mole of CH□
(D) All contain the same number of molecules

Correct Answer: D

Explanation: All contain the same number of molecules — this correctly answers the question.

13. The mass of 3.011×10^{23} molecules of CO_2 (molar mass = 44 g/mol) is:

(A) 22 g
(B) 44 g
(C) 11 g
(D) 88 g

Correct Answer: A

Explanation: The mass of 3.011×10^{23} molecules of CO_2 (molar mass = 44 g/mol) is 22 g.

14. In the reaction $2H_2 + O_2 \rightarrow 2H_2O$, how many moles of water are produced from 4 moles of H_2?

(A) 2 moles
(B) 4 moles
(C) 8 moles
(D) 1 mole

Correct Answer: B

Explanation: 4 moles — this correctly answers the question.

15. Which of the following is the correct formula for the ionic compound formed between Al^{3+} and SO_4^{2-}?

(A) $AlSO_4$
(B) $Al(SO_4)_2$
(C) $Al_2(SO_4)_3$
(D) $Al_3(SO_4)_2$

Correct Answer: C

Explanation: The charges must balance: 2 Al^{3+} ions (total +6) and 3 SO_4^{2-} ions (total −6) give a neutral compound, $Al_2(SO_4)_3$.

B. Less Important / Secondary Topics

16. When the equation $Fe + O_2 \rightarrow Fe_2O_3$ is balanced, the coefficients are:

(A) 4, 3 → 2
(B) 2, 3 → 1
(C) 3, 2 → 1
(D) 1, 1 → 1

Correct Answer: A

Explanation: When the equation $Fe + O_2 \rightarrow Fe_2O_3$ is balanced, the coefficients are 4, 3 → 2.

17. The number of moles of NaCl in 117 g of NaCl (molar mass = 58.5 g/mol) is:

(A) 1 mole
(B) 2 moles
(C) 3 moles
(D) 0.5 mole

Correct Answer: B

Explanation: The number of moles of NaCl in 117 g of NaCl (molar mass = 58.5 g/mol) is 2 moles.

18. Which of the following has a mass of 1 amu?

(A) One hydrogen atom
(B) One carbon-12 atom
(C) 1/12 of a carbon-12 atom
(D) One electron

Correct Answer: C

Explanation: 1 amu is defined as exactly 1/12 the mass of one carbon-12 atom.

19. In the ionic equation for the reaction between HCl and NaOH, the spectator ions are:

(A) H□ and OH□
(B) H□ and Na□
(C) OH□ and Cl□
(D) Na□ and Cl□

Correct Answer: D

Explanation: In the reaction \(H^+ + Cl^- + Na^+ + OH^- \rightarrow Na^+ + Cl^- + H_2O\), Na□ and Cl□ appear on both sides unchanged, so they are spectator ions.

20. The empirical formula of a compound is CH□. If its molecular mass is 42 amu, the molecular formula is:

(A) C□H□
(B) CH□
(C) C□H□
(D) C□H□

Correct Answer: A

Explanation: The empirical formula of a compound is CH□. If its molecular mass is 42 amu, the molecular formula is C□H□.

21. A compound has the empirical formula CH and a molar mass of 78 g/mol. What is its molecular formula?

(A) C□H□
(B) C□H□
(C) C□H□
(D) C□H□

Correct Answer: B

Explanation: C□H□ — this correctly answers the question.

22. In the reaction \(N_2 + 3H_2 \rightarrow 2NH_3\), how many moles of \(NH_3\) are produced from 6 moles of \(H_2\)?

(A) 2 moles
(B) 3 moles
(C) 4 moles
(D) 6 moles

Correct Answer: C

Explanation: The balanced equation shows 3 moles of \(H_2\) produce 2 moles of \(NH_3\). So, 6 moles of \(H_2\) produce \((6/3) \times 2 = 4\) moles of \(NH_3\).

23. A sample contains \(1.2044 \times 10^{24}\) atoms of sodium. What is the mass of this sample? (Molar mass of Na = 23 g/mol)

(A) 23 g
(B) 11.5 g
(C) 92 g
(D) 46 g

Correct Answer: D

Explanation: "46 g" is correct: it matches the idea asked in the question ("A sample contains \(1.2044 \times 10^{24}\) atoms of sodium. What is the mass of this sample? (Molar mass of Na = 23 g/mol)"), while the other choices do not.

24. Which of the following is the correct net ionic equation for the reaction between silver nitrate (AgNO□) and sodium chloride (NaCl)?

(A) \(Ag^+ + Cl^- \rightarrow AgCl\)
(B) \(AgNO_3 + NaCl \rightarrow AgCl + NaNO_3\)
(C) \(Na^+ + NO_3^- \rightarrow NaNO_3\)
(D) \(Ag^+ + Na^+ \rightarrow AgNa\)

Correct Answer: A

Explanation: The spectator ions (Na□ and NO□□) are removed, leaving the net ionic equation \(Ag^+_{(aq)} + Cl^-_{(aq)} \rightarrow AgCl_{(s)}\).

25. What is the mass of 0.25 moles of calcium carbonate (CaCO□)? (Atomic masses: Ca=40, C=12, O=16)

(A) 50 g
(B) 25 g
(C) 100 g
(D) 125 g

Correct Answer: B

Explanation: "25 g" is correct: it matches the idea asked in the question ("What is the mass of 0.25 moles of calcium carbonate (CaCO□)? (Atomic masses: Ca=40, C=12, O=16)"), while the other choices do not.

26. The relative atomic mass of an element is 24 amu. What is the mass of \(1.5\) moles of this element?

(A) 24 g
(B) 48 g
(C) 36 g
(D) 12 g

Correct Answer: C

Explanation: 36 g — this correctly answers the question.

27. Which of the following is **not a valid molecular formula if the empirical formula is CH□O and the molar mass is 60 g/mol?**

(A) C□H□O□
(B) C□H□O□
(C) CH□O
(D) C□H□O□

Correct Answer: D

Explanation: The empirical formula mass is 30 g/mol. For a molar mass of 60 g/mol, \(n = 60/30 = 2\), so the molecular formula is C□H□O□. C□H□O□ would have a molar mass of 120 g/mol, not 60.

28. How many molecules are there in 44 g of carbon dioxide (CO□)? (Molar mass of CO□ = 44 g/mol)

(A) \(6.022 \times 10^{23}\)
(B) \(1.2044 \times 10^{24}\)
(C) \(3.011 \times 10^{23}\)
(D) \(1.0 \times 10^{23}\)

Correct Answer: A

Explanation: "\(6.022 \times 10^{23}\)" is correct: it matches the idea asked in the question ("How many molecules are there in 44 g of carbon dioxide (CO□)? (Molar mass of CO□ = 44 g/mol)"), while the other choices do not.

29. A hydrocarbon contains 92.3% carbon and 7.7% hydrogen by mass. Its empirical formula is:

(A) CH□
(B) CH
(C) CH□
(D) C□H□

Correct Answer: B

Explanation: A hydrocarbon contains 92.3% carbon and 7.7% hydrogen by mass. Its empirical formula is CH.

30. In the reaction \(2KClO_3 \rightarrow 2KCl + 3O_2\), how many moles of oxygen gas are produced from 4 moles of KClO□?

(A) 2 moles
(B) 4 moles
(C) 6 moles
(D) 8 moles

Correct Answer: C

Explanation: The balanced equation shows 2 moles of KClO□ produce 3 moles of O□. So, 4 moles of KClO□ produce \((4/2) \times 3 = 6\) moles of O□.

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Chemistry Grade 9 — Chapter 7

Electrochemistry

by Public Library

Practice MCQs extracted from the supplied Class 9 Chemistry chapter tests (Section A). Total: 30 questions.

A. Important / Main Topics

1. In the reaction \(2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}\), magnesium is:

(A) Oxidized
(B) Reduced
(C) Neither oxidized nor reduced
(D) Acting as an oxidizing agent

Correct Answer: A

Explanation: Magnesium gains oxygen to form MgO, so it is oxidized. Oxidation can be defined as the gain of oxygen.

2. Which of the following is the correct definition of reduction in terms of electrons?

(A) Loss of electrons
(B) Gain of electrons
(C) Gain of oxygen
(D) Loss of hydrogen

Correct Answer: B

Explanation: Reduction is the gain of electrons. This is remembered by the mnemonic "OIL RIG" (Oxidation Is Loss, Reduction Is Gain).

3. What is the oxidation state of sulfur in \(\text{H}_2\text{SO}_4\)?

(A) +2
(B) +4
(C) +6
(D) -2

Correct Answer: C

Explanation: H is +1 (×2 = +2), O is −2 (×4 = −8). Sum must be zero: +2 + x − 8 = 0 → x = +6.

4. Which of the following is a common **oxidizing agent?**

(A) Hydrogen gas (H□)
(B) Carbon monoxide (CO)
(C) Zinc (Zn)
(D) Potassium permanganate (KMnO□)

Correct Answer: D

Explanation: KMnO□ is a strong oxidizing agent (electron acceptor). H□, CO, and Zn are common reducing agents.

5. In a redox reaction, the substance that is oxidized:

(A) Loses electrons and is the reducing agent
(B) Gains electrons and is the reducing agent
(C) Loses electrons and is the oxidizing agent
(D) Gains electrons and is the oxidizing agent

Correct Answer: A

Explanation: The substance that is oxidized loses electrons. It causes the other substance to be reduced, so it is the reducing agent.

6. The oxidation state of any uncombined (free) element is always:

(A) +1
(B) 0

(C) -1
(D) +2

Correct Answer: B

Explanation: Rule 1 for assigning oxidation states: the oxidation state of any free element (e.g., Zn, Na, H□, O□) is zero.

7. Which of the following is the correct formula for the ionic compound formed between \(\text{Al}^{3+}\) and \(\text{O}^{2-}\)?

(A) AlO
(B) Al□O□
(C) Al□O□
(D) AlO□

Correct Answer: C

Explanation: To balance the charges (+3 and −2), use 2 Al^{3}□ ions (+6) and 3 O^{2}□ ions (−6). The formula is Al□O□.

8. Corrosion of iron is an example of a:

(A) Physical change
(B) Neutralization reaction
(C) Precipitation reaction
(D) Redox reaction

Correct Answer: D

Explanation: Corrosion involves oxidation of iron (Fe → Fe^{2}□ + 2e□) and reduction of oxygen (O□ + 2H□O + 4e□ → 4OH□). It is an electrochemical redox process.

9. Which method of corrosion prevention involves connecting iron to a more active metal like magnesium?

(A) Cathodic protection
(B) Galvanizing
(C) Tinning
(D) Electroplating

Correct Answer: A

Explanation: Cathodic protection (sacrificial protection) makes the iron the cathode and connects it to a more active metal (Mg or Al) that acts as the anode and corrodes instead.

10. In the reaction \(2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}\), which substance is the oxidizing agent?

(A) Na
(B) Cl□
(C) NaCl
(D) Both Na and Cl□

Correct Answer: B

Explanation: Cl□ is reduced (gains electrons to form Cl□), so it is the oxidizing agent. Na is oxidized (loses electrons) and is the reducing agent.

11. In the reaction \(\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}\), which species is oxidized?

(A) Cu^{2}□
(B) SO^{2}□□
(C) Zn
(D) Cu

Correct Answer: C

Explanation: Zinc goes from oxidation state 0 to +2, losing electrons. Thus, Zn is oxidized (and acts as the reducing agent).

12. Which of the following is the correct oxidation state of nitrogen in \(\text{HNO}_3\)?

(A) +1

(B) +3
(C) −3
(D) +5

Correct Answer: D

Explanation: H is +1, O is −2 (×3 = −6). Sum must be zero: \(+1 + x - 6 = 0 \Rightarrow x = +5\).

13. In the reaction \(2\text{FeCl}_2 + \text{Cl}_2 \rightarrow 2\text{FeCl}_3\), chlorine gas (\(\text{Cl}_2\)) acts as:

(A) An oxidizing agent
(B) A reducing agent
(C) A spectator
(D) A catalyst

Correct Answer: A

Explanation: \(\text{Cl}_2\) is reduced (from 0 to −1) and causes Fe^{2}□ to oxidize to Fe^{3}□. It is the oxidizing agent.

14. Which of the following changes represents **reduction?**

(A) \(\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + e^-\)
(B) \(\text{Cl}_2 + 2e^- \rightarrow 2\text{Cl}^-\)
(C) \(\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^-\)
(D) \(\text{Cu} \rightarrow \text{Cu}^{2+} + 2e^-\)

Correct Answer: B

Explanation: Reduction is the gain of electrons. \(\text{Cl}_2\) gains electrons to form \(\text{Cl}^-\), so it is reduced.

15. What is the oxidation number of Mn in \(\text{KMnO}_4\)?

(A) +2
(B) +4
(C) +7
(D) +6

Correct Answer: C

Explanation: +7 — this correctly answers the question.

B. Less Important / Secondary Topics

16. Which of the following is **not a reducing agent?**

(A) \(\text{KMnO}_4\)
(B) \(\text{H}_2\)
(C) \(\text{CO}\)
(D) \(\text{Zn}\)

Correct Answer: A

Explanation: \(\text{KMnO}_4\) is a strong oxidizing agent. \(\text{H}_2\), CO, and Zn are common reducing agents.

17. In the reaction \(2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}\), sodium acts as:

(A) An oxidizing agent
(B) A reducing agent
(C) A catalyst
(D) A spectator ion

Correct Answer: B

Explanation: Sodium loses electrons (is oxidized), so it causes chlorine to be reduced. Therefore, Na is the reducing agent.

18. Which of the following processes involves a **decrease in oxidation state?**

(A) \(\text{Fe} \rightarrow \text{Fe}^{2+} + 2e^-\)
(B) \(\text{H}_2 \rightarrow 2\text{H}^+ + 2e^-\)
(C) \(\text{Cl}_2 + 2e^- \rightarrow 2\text{Cl}^-\)
(D) \(\text{S} \rightarrow \text{S}^{2-} \text{ (as in oxidation)}\) *(Note: Option D is structurally incorrect as written; better to frame as a species gaining electrons.)*

Correct Answer: C

Explanation: Reduction involves a decrease in oxidation state. Chlorine goes from 0 in Cl_2 to −1 in Cl^-, a decrease.

19. The formula of the ionic compound formed from Ca^{2+} and PO_4^{3-} is:

(A) CaPO_4
(B) $\text{Ca}_2(\text{PO}_4)_3$
(C) $\text{Ca}(\text{PO}_4)_2$
(D) $\text{Ca}_3(\text{PO}_4)_2$

Correct Answer: D

Explanation: The formula of the ionic compound formed from Ca^{2+} and PO_4^{3-} is $\text{Ca}_3(\text{PO}_4)_2$.

20. Galvanizing protects iron from rusting by:

(A) Coating iron with zinc (which is more active and corrodes first)
(B) Making iron the anode
(C) Removing oxygen from the environment
(D) Forming an alloy with iron

Correct Answer: A

Explanation: Galvanizing coats iron with zinc. Zinc is more active than iron and oxidizes preferentially, protecting the iron.

21. In the reaction $\text{MnO}_4^- + 8\text{H}^+ + 5\text{Fe}^{2+} \rightarrow \text{Mn}^{2+} + 5\text{Fe}^{3+} + 4\text{H}_2\text{O}$, which statement is correct?

(A) MnO_4^- is oxidized and Fe^{2+} is reduced
(B) MnO_4^- is reduced and Fe^{2+} is oxidized
(C) MnO_4^- acts as a reducing agent
(D) Fe^{2+} acts as an oxidizing agent

Correct Answer: B

Explanation: Mn in MnO_4^- goes from +7 to +2 (reduced). Fe goes from +2 to +3 (oxidized). MnO_4^- is the oxidizing agent, and Fe^{2+} is the reducing agent.

22. In the reaction $\text{Cl}_2 + 2\text{KI} \rightarrow 2\text{KCl} + \text{I}_2$, which statement is correct?

(A) Cl_2 is oxidized and acts as a reducing agent
(B) I^- is reduced and acts as an oxidizing agent
(C) Cl_2 is reduced and acts as an oxidizing agent
(D) I^- is oxidized and acts as an oxidizing agent

Correct Answer: C

Explanation: Cl_2 (0) gains electrons to form Cl^- (−1), so it is reduced and is the oxidizing agent. I^- (−1) loses electrons to form I_2 (0), so it is oxidized and is the reducing agent.

23. The oxidation state of nitrogen in NH_4^+ is:

(A) +1
(B) +5
(C) −1
(D) −3

Correct Answer: D

Explanation: H is +1 (×4 = +4). The sum must equal the ion's charge (+1): $x + 4 = +1 \Rightarrow x = -3$.

24. Consider the reaction $\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu(NO}_3)_2 + 2\text{Ag}$. Which species is the reducing agent?

(A) Cu
(B) Ag^+
(C) NO_3^-
(D) Ag

Correct Answer: A

Explanation: Cu (0) loses electrons to form Cu^{2+}, so it is oxidized. The species that is oxidized is the reducing agent. Therefore, Cu is the reducing agent.

25. In the reaction $\text{H}_2\text{O}_2 + 2\text{KI} + \text{H}_2\text{SO}_4 \rightarrow \text{I}_2 + \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O}$, hydrogen peroxide ($\text{H}_2\text{O}_2$) acts as:

(A) A reducing agent
(B) An oxidizing agent
(C) A catalyst
(D) A spectator

Correct Answer: B

Explanation: I□ (−1) is oxidized to I_2 (0). H_2O_2 is reduced (oxygen changes from −1 in peroxide to −2 in water). Since it is reduced and causes I□ to oxidize, it is the oxidizing agent.

26. Which of the following changes represents a **reduction in terms of oxidation state?**

(A) $\text{Cr}^{3+} \rightarrow \text{Cr}_2\text{O}_7^{2-}$
(B) $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$
(C) $\text{MnO}_4^- \rightarrow \text{Mn}^{2+}$
(D) $\text{NO}_3^- \rightarrow \text{NO}$

Correct Answer: C

Explanation: In MnO_4^-, Mn is +7; in Mn^{2+}, Mn is +2. The oxidation state decreases, so it is a reduction. The other options involve increases (oxidation).

27. A compound contains chromium with an oxidation state of +6. Which of the following could be the formula?

(A) CrCl_3
(B) Cr_2O_3
(C) CrO
(D) CrO_3

Correct Answer: D

Explanation: In CrO_3, O is −2 (×3 = −6), so Cr must be +6 for the compound to be neutral. In the other options, Cr is +3 or +2.

28. In the reaction $2\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$ (thermite reaction), which statement is correct?

(A) Al is oxidized and Fe_2O_3 is reduced
(B) Al is reduced and Fe_2O_3 is oxidized
(C) Al is the oxidizing agent
(D) Fe_2O_3 is the reducing agent

Correct Answer: A

Explanation: Al (0) → Al^{3+} (+3) is oxidized. Fe (+3 in Fe_2O_3) → Fe (0) is reduced. Al is the reducing agent; Fe_2O_3 is the oxidizing agent.

29. Galvanized iron is protected from rusting because:

(A) Zinc is less reactive than iron
(B) Zinc is more reactive than iron and corrodes first
(C) Zinc prevents oxygen from reaching the iron
(D) Zinc reacts with iron to form an alloy

Correct Answer: B

Explanation: Zinc is more active than iron. It acts as the anode and oxidizes preferentially (sacrificial protection), protecting the iron (cathode) from corrosion.

30. A solution of sodium chloride conducts electricity, but solid sodium chloride does not. This is because:

(A) In the solid state, there are no ions; in solution, ions form
(B) In the solid state, sodium chloride is covalent; in solution, it is ionic

(C) In the solid state, the ions are fixed in the lattice; in solution, the ions are free to move

(D) In the solid state, electrons are free; in solution, they are not

Correct Answer: C

Explanation: In solid NaCl, ions are locked in a rigid lattice and cannot move, so it does not conduct. When dissolved in water, the ions become free to move and carry electric current.

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Chemistry Grade 9 — Chapter 8

Energetics

by Public Library

Practice MCQs extracted from the supplied Class 9 Chemistry chapter tests (Section A). Total: 10 questions.

A. Important / Main Topics

1. The study of energy changes in chemical reactions is called:

(A) Thermochemistry
(B) Electrochemistry
(C) Stoichiometry
(D) Chemical kinetics

Correct Answer: A

Explanation: The branch of chemistry that deals with heat or thermal energy changes in chemical reactions is called thermochemistry (or chemical energetics).

2. Which of the following processes **releases energy?**

(A) Breaking a chemical bond
(B) Forming a chemical bond
(C) Melting ice
(D) Boiling water

Correct Answer: B

Explanation: Forming a chemical bond — this correctly answers the question.

3. A reaction in which heat is absorbed from the surroundings is called:

(A) Exothermic
(B) Neutralization
(C) Endothermic
(D) Combustion

Correct Answer: C

Explanation: An endothermic reaction absorbs heat from the surroundings, causing the surroundings to cool.

4. In an exothermic reaction, the sign of \(\Delta H\) is:

(A) Positive (+)
(B) Zero
(C) Cannot be determined
(D) Negative (−)

Correct Answer: D

Explanation: In an exothermic reaction, heat is released, so the enthalpy change \(\Delta H\) is negative.

5. The minimum energy required to remove the outermost electron from an isolated gaseous atom is called:

(A) Ionization energy
(B) Activation energy
(C) Bond energy
(D) Enthalpy change

Correct Answer: A

Explanation: Ionization energy is the minimum energy required to remove the outermost electron from an isolated gaseous atom.

B. Less Important / Secondary Topics

6. A catalyst increases the rate of a chemical reaction by:

(A) Lowering the activation energy
(B) Increasing the activation energy
(C) Changing the enthalpy of the reaction
(D) Increasing the temperature

Correct Answer: A

Explanation: A catalyst provides an alternative pathway with lower activation energy, increasing the reaction rate. It does not change \(\Delta H\).

7. Which of the following is an **exothermic process?**

(A) Photosynthesis
(B) Respiration
(C) Melting of ice
(D) Decomposition of limestone

Correct Answer: B

Explanation: Respiration is a biochemical process that releases energy (exothermic). Photosynthesis, melting ice, and decomposition of limestone are endothermic.

8. In a thermochemical equation, the physical states of reactants and products are important because:

(A) They affect the color of the reaction
(B) They determine the reaction rate
(C) They affect the enthalpy change of the reaction
(D) They determine the activation energy

Correct Answer: C

Explanation: Different physical states have different energy contents, so the enthalpy change depends on the states of the substances involved.

9. The amount of energy released when neutral atoms form one mole of a bond is called:

(A) Bond dissociation energy
(B) Activation energy
(C) Lattice energy
(D) Bond energy

Correct Answer: D

Explanation: Bond energy is the energy released when neutral atoms form one mole of a bond. Bond dissociation energy is the energy required to break a bond.

10. Which of the following is **not true about a catalyst?**

(A) It changes the enthalpy change (\(\Delta H\)) of the reaction
(B) It speeds up a reaction
(C) It remains chemically unchanged at the end
(D) It provides an alternative reaction pathway

Correct Answer: A

Explanation: It changes the enthalpy change (\(\Delta H\)) of the reaction — this correctly answers the question.