Answer Key Explanation

1. In the Solvay process, which two chemicals are dissolved in water to form ammoniacal brine?

A) NH_3 + CaO
B) NH_3 + HCl
C) NH_3 + CO_2
D) NH_3 + NaCl

Why is D correct?

- In the Solvay process, NH_3 and NaCl are dissolved in water to form ammoniacal brine, which is essential for producing sodium carbonate (Na_2CO_3).
- NaCl (salt) provides chloride ions, while NH_3 (ammonia) increases solubility and helps in the reaction with CO_2.

Why are other options incorrect?

A) (NH_3 + CaO): Calcium oxide is not used in ammoniacal brine formation.
B) (NH_3 + HCl): Forms ammonium chloride, which is unrelated to the Solvay process.
C) (NH_3 + CO_2): Forms ammonium bicarbonate but does not create ammoniacal brine.

2. Which of the following can behave as a Bronsted acid and Bronsted base?

A) OH^-
B) CH_3COO^-
C) H_2O
D) H_3PO_4

Why is C correct?

- H_2O acts as an acid by donating a proton (H^+), forming OH^-.
- H_2O also acts as a base by accepting a proton, forming H_3O^+.

Why are other options incorrect?

A) (OH^-): Only acts as a base, accepting H^+ to form H_2O.
B) (CH_3COO^-): Only acts as a base, accepting H^+ to form CH_3COOH.
D)(H_3PO_4): Only acts as an acid by donating H^+ ions.

3. The correct equilibrium constant expression for the given reaction 2A + B ⇌ C is:

A) $[C]^3 / ([A]^2 [B])$
B) [2A][B] / [3C]
C) [3C] / [2A][B]
D) $[A]^2 [B] / [C]$

Why is A correct?

- The equilibrium constant K = [products] / [reactants].
- Since the reaction is 2A + B ⇌ C, the correct expression is $K = [C]^3 / ([A]^2 [B])$ based on the coefficients.

Why are other options incorrect?

B & C) Incorrect exponent placement and incorrect fractions.
D) Incorrectly inverts the expression.

4. Which gas is widely used for welding and cutting metals?

A) Acetylene

B) Methane

C) Ethane

D) Ethylene

Why is A correct?

- Acetylene (C_2H_2) burns with oxygen to produce a high-temperature flame used in welding.
- It can reach temperatures up to 3300°C, making it ideal for cutting metals.

Why are other options incorrect?

B (Methane), C (Ethane), and D (Ethylene): These gases do not produce the high temperatures required for welding.

5. Identify the Arrhenius base.

A) NaF

B) NH_3

C) NaOH

D) H_2O

Why is C correct?

- Arrhenius base is a substance that increases OH^- ions in solution, and NaOH dissociates into Na^+ and OH^-.
- It strongly ionizes in water, making it a strong base.

Why are other options incorrect?

A (NaF): A salt, not a base.

B (NH_3): A weak base but not Arrhenius; it's a Bronsted-Lowry base.

D (H_2O): Neutral, not a base.

6. Halogenation of methane in diffused sunlight does NOT produce:

A) Chloromethane (CH_3Cl)

B) Carbon tetrachloride (CCl_4)

C) Chloroform ($CHCl_3$)

D) Carbon black (C)

Why is D correct?

- Halogenation replaces hydrogen atoms in CH_4 with chlorine, but it does not produce solid carbon.
- Carbon black is formed by incomplete combustion, not halogenation.

Why are other options incorrect?

A, B, C: These are all produced in different halogenation steps.

7. Proteins are essential for the formation of:

A) Cellulose

B) Protoplasm

C) Cholesterol

D) Dextrin

Why is B correct?

- Protoplasm (living content of a cell) contains proteins as structural and enzymatic components.
- Proteins are essential for cell function and repair.

Why are other options incorrect?

A (Cellulose): Made of carbohydrates.
C (Cholesterol): Made of lipids.
D (Dextrin): A polysaccharide, not protein-based.

8. Concentration of reactants and products in mol/dm³ in a dilute solution is called:

A) Active mass
B) Molecular mass
C) Molar mass
D) Atomic mass

Why is A correct?

- Active mass refers to the concentration of substances in mol/dm³.
- It affects reaction rates according to the law of mass action.

Why are other options incorrect?

B, C, and D: Deal with mass, not concentration.

9. The envelope of gases surrounding the planet Earth is called:

A) Mesosphere
B) Atmosphere
C) Troposphere
D) Stratosphere

Why is B correct?

- Atmosphere is the overall gaseous layer surrounding Earth.
- It includes the troposphere, stratosphere, mesosphere, and thermosphere.

Why are other options incorrect?

A, C, D: These are just parts of the atmosphere.

10. Which of the following is an air pollutant?

A) NO_2
B) Ne
C) O_2
D) N_2

Why is A correct?

- NO_2 (Nitrogen dioxide) is a major pollutant from vehicles and industries.
- It contributes to acid rain and respiratory diseases.

Why are other options incorrect?

B (Ne), C (O_2), and D (N_2): These are naturally present and not pollutants.

11. Which statement about water is correct?

A) Boils at 100°C

B) Low heat of vaporization
C) Low heat of fusion
D) Contracts when freezes

Why is this answer correct?

- Water has a boiling point of 100°C at standard atmospheric pressure (1 atm). This means that under normal conditions, water transitions from liquid to gas at this temperature.
- This property is important in various scientific and industrial processes, including distillation and steam generation.

Why are the other options incorrect?

B) Low heat of vaporization: Incorrect because water has a high heat of vaporization (40.7 kJ/mol), meaning it requires a lot of energy to convert from liquid to gas.
C) Low heat of fusion: Incorrect because water has a relatively high heat of fusion (6.01 kJ/mol), which helps maintain Earth's climate.
D) Contracts when freezes: Incorrect because water expands when it freezes due to hydrogen bonding, making ice less dense than liquid water.

12.Separation of minerals from gangue by some physical method is called:

A) Distillation
B) Bessemerization
C) Concentration
D) Extraction

Why is this answer correct?

- Concentration is the process used in metallurgy to separate valuable minerals from gangue (unwanted materials) through physical methods like gravity separation, froth flotation, or magnetic separation.
- It is a purely physical method, meaning it does not involve any chemical changes in the ore.

Why are the other options incorrect?

A) Distillation: Incorrect because distillation is a method used to separate liquids based on boiling points, not solid minerals from gangue.
B) Bessemerization: Incorrect because it is a chemical process used in steel production to remove impurities, not for mineral separation.
D) Extraction: Incorrect because extraction usually refers to chemical methods like leaching, rather than purely physical separation.