**Q1) Which of the following is not an extensive property?**

a) Mass

b) Volume

c) Density

d) Temperature

Correct Answer: Option (d)

Explanation: Extensive properties depend on the size or amount of matter present, while intensive properties do not. Mass and volume are extensive properties, while density is an intensive property. Temperature is also an intensive property because it does not depend on the amount of matter present.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q2) Which of the following is an example of an exothermic process?**

a) Melting of ice

b) Boiling of water

c) Burning of coal

d) Photosynthesis

Correct Answer: Option (c)

Explanation: An exothermic process releases heat energy to the surroundings. The melting of ice and boiling of water are endothermic processes that absorb heat energy from the surroundings. Photosynthesis is also an endothermic process.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q3) Which of the following is a state function?**

a) Heat

b) Work

c) Internal energy

d) Enthalpy

Correct Answer: Option (c)

Explanation: A state function is a property that depends only on the current state of the system and not on the path taken to reach that state. Heat and work are not state functions because they depend on the path taken. Enthalpy is a state function, but internal energy is a better answer because it is a more fundamental property.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q4) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/14uCzzpGj91XIqZNz0RSWwceIW48huVbX/view?usp=share\_link**](https://drive.google.com/file/d/14uCzzpGj91XIqZNz0RSWwceIW48huVbX/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following statements is true regarding the second law of thermodynamics?**

a) It states that energy cannot be created or destroyed.

b) It states that the entropy of a system increases over time.

c) It states that all processes are reversible.

d) It states that the enthalpy change of a reaction is equal to the sum of the enthalpy changes of its individual steps.

Correct Answer: Option (b)

Explanation: It states that the entropy of a system increases over time. The second law of thermodynamics is concerned with the direction of spontaneous processes. It states that the entropy of a closed system will tend to increase over time, and that the total entropy of the universe will also increase. The first law of thermodynamics states that energy cannot be created or destroyed, while the third law of thermodynamics states that the entropy of a perfectly crystalline substance at absolute zero is zero.

Thus, the correct answer is option (b).

Difficulty Level- Easy

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**Q5) Answer the following question with reference to the audio**

[**https://drive.google.com/file/d/1hn\_wjbKD082dW-9nQClzoiptfuCGz\_YB/view?usp=share\_link**](https://drive.google.com/file/d/1hn_wjbKD082dW-9nQClzoiptfuCGz_YB/view?usp=share_link)

**TYPE: Audio**

**Which of the following is an example of a reversible process?**

a) A balloon popping

b) Water flowing downhill

c) A gas expanding against a piston

d) Ice melting at constant temperature and pressure

Correct Answer: Option (d)

Explanation: Ice melting at constant temperature and pressure. A reversible process is one that can be reversed by an infinitesimal change in the conditions. A balloon popping is a sudden and irreversible change in the volume of the gas inside it. Water flowing downhill is an irreversible process because it involves a decrease in the gravitational potential energy of the water. A gas expanding against a piston is irreversible if the piston is allowed to move freely, because it involves an increase in the volume of the gas and a decrease in its pressure.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q6) Answer the following question with reference to the audio**

[**https://drive.google.com/file/d/1lqqlt9K2h2Z7aHKe5E0I-7bm3Ec3h3M6/view?usp=share\_link**](https://drive.google.com/file/d/1lqqlt9K2h2Z7aHKe5E0I-7bm3Ec3h3M6/view?usp=share_link)

**TYPE: Audio**

**Which of the following is not an extensive property of a system?**

a) Density

b) Energy

c) Mass

d) Volume

Correct Answer: Option (a)

Answer: Density is an inensive property of a system, as it does not depends on the size or amount of the system. Extensive properties vary with the size or amount of the system, whereas intensive properties do not.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q7) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/18sbCXOFS7-hSbIzFCgZWwnsrge\_Felzu/view?usp=share\_link**](https://drive.google.com/file/d/18sbCXOFS7-hSbIzFCgZWwnsrge_Felzu/view?usp=share_link)**)**

**TYPE: Audio**

**The enthalpy change for a reaction is negative. What does this indicate?**

a) The reaction is endothermic

b) The reaction is exothermic

c) The reaction is spontaneous

d) The reaction is non-spontaneous

Correct Answer: Option (b)

Explanation: The enthalpy change for a reaction is negative when the reaction is exothermic. This means that the reaction releases heat energy to the surroundings, and the products are more stable than the reactants.

Thus, the correct answer is option (b).

Difficulty Level- Easy

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**Q8) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1ilcEDmUTjdfGxDn68mUl2-Jdj\_xo\_\_wt/view?usp=share\_link**](https://drive.google.com/file/d/1ilcEDmUTjdfGxDn68mUl2-Jdj_xo__wt/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following statements is true for an adiabatic process?**

a) There is no change in entropy

b) There is no change in temperature

c) There is no heat exchange with the surroundings

d) There is no work done by the system

Correct Answer: Option (c)

Explanation: In an adiabatic process, there is no heat exchange with the surroundings. This means that the system is thermally insulated, and there is no transfer of heat energy between the system and the surroundings.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q9) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1xowg7dBK3uVZRLgY5ZT1fBX2zTtrE6Jq/view?usp=share\_link**](https://drive.google.com/file/d/1xowg7dBK3uVZRLgY5ZT1fBX2zTtrE6Jq/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following processes is irreversible?**

a) Melting of ice

b) Vaporization of water

c) Combustion of methane

d) Expansion of a gas against a vacuum

Correct Answer: Option (c)

Explanation: Combustion of methane is an irreversible process, as it involves a chemical reaction that produces some new substances. Irreversible processes are those that cannot be reversed by any practical means.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q10) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1TlBPM7bwDHZzGBc\_o5wITbFmf40xAUwE/view?usp=share\_link**](https://drive.google.com/file/d/1TlBPM7bwDHZzGBc_o5wITbFmf40xAUwE/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following thermodynamic functions is a state function?**

a) Heat capacity

b) Work

c) Enthalpy

d) Heat

Correct Answer: Option (c)

Explanation: Enthalpy is a state function, as it depends only on the initial and final states of the system, and not on the path taken to reach the final state. State functions are independent of the process or path by which the system reaches the final state.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q11) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1AQIkF0octOSIBIbvVFOX0pJ2OHwuI6xa/view?usp=share\_link**](https://drive.google.com/file/d/1AQIkF0octOSIBIbvVFOX0pJ2OHwuI6xa/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following statements is true about internal energy (U) of a system?**

a) U is a state function and depends only on the initial and final states of the system.

b) U is not a state function and depends on the path taken to reach the final state.

c) U is the sum of kinetic and potential energies of the system.

d) U is always constant and does not change during a process.

Correct Answer: Option (a)

Explanation: Internal energy (U) is a state function, which means that its value depends only on the initial and final states of the system and not on the path taken to reach the final state.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q12) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1KobS\_XzUyS-43Rve8MBAs1wdZHUcpMnw/view?usp=share\_link**](https://drive.google.com/file/d/1KobS_XzUyS-43Rve8MBAs1wdZHUcpMnw/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following is an extensive property?**

a) Temperature (T)

b) Pressure (P)

c) Volume (V)

d) Density (ρ)

Correct Answer: Option (c)

Explanation: An extensive property is a property that depends on the amount of substance present in the system. Volume is an example of an extensive property because it depends on the amount of substance present in the system.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q13) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1h\_qecG1sGxg3TA80jCGO7vpl3945008q/view?usp=share\_link**](https://drive.google.com/file/d/1h_qecG1sGxg3TA80jCGO7vpl3945008q/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following processes is exothermic?**

a) Ice melting at 0°C

b) Water evaporating at 100°C

c) Solid carbon dioxide subliming at -78.5°C

d) A balloon expanding against an external pressure

Correct Answer: Option (a)

Explanation: In an exothermic process, heat is released by the system to the surroundings. In other words, it is a process that produces heat as a byproduct and the energy of the system decreases during the reaction. Examples of exothermic processes include combustion reactions, such as burning wood or gasoline, and neutralization reactions, such as the reaction between an acid and a base. Exothermic reactions are often accompanied by an increase in temperature, which is why they are sometimes called "heat-releasing" reactions.When ice melts at 0°C, heat is released to the surroundings, making it an exothermic process.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q14) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1pWUdaCKP6mnOqkZ8AL2J6p5FORB4Ocr1/view?usp=share\_link**](https://drive.google.com/file/d/1pWUdaCKP6mnOqkZ8AL2J6p5FORB4Ocr1/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following statements is true about the first law of thermodynamics?**

a) It states that energy can be created or destroyed.

b) It states that the total energy of the universe is constant.

c) It only applies to reversible processes.

d) It only applies to closed systems.

Correct Answer: Option (a)

Explanation: It states that the total energy of the universe is constant. The first law of thermodynamics is also known as the law of conservation of energy. It states that energy can neither be created nor destroyed, but can only be converted from one form to another. The total energy of the universe remains constant.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q15) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/15PurehAp4hAqSx4HtoNedf9p7gB\_fnwE/view?usp=share\_link**](https://drive.google.com/file/d/15PurehAp4hAqSx4HtoNedf9p7gB_fnwE/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following is true about entropy (S)?**

a) It is a state function and depends only on the initial and final states of the system.

b) It is a measure of the disorder or randomness of a system.

c) It is always negative for spontaneous processes.

d) It decreases thespontaneous process.

Correct Answer: Option (b)

Explanation: Entropy (S) is a thermodynamic property that is a measure of the disorder or randomness of a system. It is a state function and depends only on the initial and final states of the system. Entropy always increases for spontaneous processes, and decreases for non-spontaneous processes.

Thus, the correct answer is option (b).

Difficulty Level- Easy

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**Q16) Answer the following question with reference to the audio**

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**TYPE: Audio**

**Which of the following statements is true about the first law of thermodynamics in daily life?**

a) It explains when food is cooked

b) It explains why a car engine converts fuel into mechanical work.

c) It explains why ice cubes float in water.

d) It explains why metals expand when heated.

Correct Answer: Option (a)

Explanation: The first law of thermodynamics states that energy cannot be created or destroyed, but can only be converted from one form to another. When we turn on the burner, electrical energy is converted into thermal energy, which is then transferred to the pot and the food inside it. This is an example of the first law of thermodynamics in action.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q17) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1hxtNXzAHaqRaBL4UzNxbYEE-vAqxNng4/view?usp=share\_link**](https://drive.google.com/file/d/1hxtNXzAHaqRaBL4UzNxbYEE-vAqxNng4/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following processes is an example of an endothermic reaction in daily life?**

a) Cooking an egg on a hot pan.

b) Burning wood in a fire.

c) Melting ice with salt.

d) Evaporating sweat from the skin.

Correct Answer: Option (c)

Explanation: When ice is melted with salt, the salt absorbs heat from the surroundings to dissolve in the water, causing the temperature to decrease. This is an example of an endothermic reaction, where heat energy is absorbed by the system from the surroundings.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q18) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1XWHyLzA00m-nx1B1HFCExpo93igkEDu_/view?usp=share_link>

**TYPE: Audio**

**Which of the following is not an example of a closed system in daily life?**

a) A car engine.

b) A pot of boiling water.

c) A human body.

d) A campfire.

Correct Answer: Option (c)

Explanation: A closed system is a system that does not exchange matter with its surroundings, but can exchange energy in the form of heat or work. As the human body exchanges heat with the surroundings to maintain its internal temperature it is an open system.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q19) Which of the following processes is an example of a reversible process in daily life?**

a) Melting of an ice cube.

b) Boiling of water in a kettle.

c) Burning of a matchstick.

d) Rusting of iron.

Correct Answer: Option (a)

Explanation: A reversible process is a process that can be reversed by an infinitesimal change in the conditions. Melting of an ice cube is an example of a reversible process, as it can be reversed by cooling the water to freeze the ice again.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q20) Which of the following statements is true about the second law of thermodynamics in daily life?**

a) It explains why a refrigerator cools down its contents.

b) It explains why a hot cup of coffee cools down when left on the table.

c) It explains why a car engine can never be 100% efficient.

d) It explains why a metal spoon becomes hot when left in a cup of hot tea.

Correct Answer: Option (c)

Explanation: The second law of thermodynamics states that the total entropy of the universe always increases for a spontaneous process. This means that it is impossible to convert all of the energy in a system into work, and some of it will always be lost as waste heat. This is why a car engine can never be 100% efficient.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q21) Which of the following statements about enthalpy change is true?**

a) Enthalpy change is always positive for an endothermic reaction.

b) Enthalpy change is always negative for an exothermic reaction.

c) Enthalpy change is the same for all reactions.

d) Enthalpy change can be either positive or negative depending on the reaction.

Correct Answer: Option (d)

Explanation: Enthalpy change is a measure of the heat energy absorbed or released during a chemical reaction. Enthalpy change can be positive (endothermic) or negative (exothermic) depending on whether the reaction absorbs or releases heat energy.

Thus, the correct answer is option (d).

Difficulty Level- Medium

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**Q22) Which of the following factors affect the spontaneity of a reaction?**

a) Enthalpy change only

b) Entropy change only

c) Both enthalpy change and entropy change

d) Neither enthalpy change nor entropy change

Correct Answer: Option (c)

Explanation: Spontaneity of a reaction is affected by both enthalpy change (heat energy released or absorbed) and entropy change (the degree of disorder or randomness of the system). The spontaneity of a reaction refers to its tendency to occur naturally without any external input of energy. Several factors affect the spontaneity of a reaction, including: Change in free energy (), Temperature, Pressure, Concentration, Catalysts.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q23) What is the difference between heat and temperature?**

a) Heat is a measure of the total energy in a system, while temperature is a measure of the average kinetic energy of the particles in a system.

b) Heat is a measure of the average kinetic energy of the particles in a system, while temperature is a measure of the total energy in a system.

c) Heat and temperature are the same thing.

d) Heat and temperature are not related to each other.

Correct Answer: Option (a)

Explanation: Heat refers to the transfer of thermal energy between two objects due to a temperature difference. It is a form of energy that flows from hotter to cooler objects until they reach thermal equilibrium. Heat is measured in joules (J) or calories (cal). Temperature, on the other hand, is a measure of the average kinetic energy of the particles in a substance. It is a scalar quantity that is measured in units such as Celsius (°C) or Fahrenheit (°F) on a thermometer.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q24) Which of the following statements about the first law of thermodynamics is true?**

a) Energy cannot be created or destroyed, only converted from one form to another.

b) The total entropy of a system and its surroundings always increases for a spontaneous process.

c) The enthalpy change of a reaction is equal to the heat absorbed or released at constant pressure.

d) The second law of thermodynamics states that the entropy of the universe is always increasing.

Correct Answer: Option (a)

Explanation: The first law of thermodynamics is the law of conservation of energy, which states that energy cannot be created or destroyed, only converted from one form to another. This law has important implications in thermodynamics, which is the study of energy and its transformations. It means that any energy that enters or leaves a system must be accounted for in terms of changes in the internal energy of the system. The internal energy of a system is the sum of its kinetic and potential energies, and it can be increased by adding heat or doing work on the system. Mathematically, the first law of thermodynamics can be expressed as: where is the change in internal energy of the system, Q is the heat added to the system, and W is the work done.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q25) Which of the following statements about Gibbs free energy is true?**

a) A negative Gibbs free energy indicates a spontaneous reaction.

b) A positive Gibbs free energy indicates a spontaneous reaction.

c) Gibbs free energy is the same for all reactions.

d) Gibbs free energy is not related to spontaneity.

Correct Answer: Option (a)

Explanation: Gibbs free energy is a measure of the maximum amount of work that can be obtained from a system at constant temperature and pressure. A negative Gibbs free energy indicates a spontaneous reaction.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q26) The enthalpy change for the reaction is . If 4 moles of hydrogen gas react with 2 moles of oxygen gas, the amount of heat released or absorbed will be:**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The enthalpy change for the reaction is for 2 moles of hydrogen gas reacting with 1 mole of oxygen gas.

Therefore, the enthalpy change for the reaction with 4 moles of hydrogen gas and 2 moles of oxygen gas would be .

Since the enthalpy change is negative, the reaction releases heat.

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q27) The standard enthalpy of formation of methane is . If moles of methane is burned completely in excess oxygen, how much heat is released?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The balanced chemical equation for the combustion of methane is .

From this equation, we can see that for every 1 mole of methane combusted, of heat is released. Therefore, for 0.5 moles of methane, the heat released is

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Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q28) The enthalpy change for the reaction is -1299 kJ. If 4 moles of and 10 moles of react, how much heat is released?**

a) -207.84 kJ

b) -6495 kJ

c) 6495 kJ

d) 207.84 kJ

Correct Answer: Option (a)

Explanation: The balanced chemical equation shows that for every 1 mole of combusted with 2.5 moles of , 1299 kJ of heat is released.

Therefore, for 4 moles of and 10 moles of , the heat released is:

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Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q29) The molar heat capacity of a gas at constant pressure is . If moles of the gas is heated from to at a constant pressure of , how much heat is required?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The heat required to raise the temperature of a substance is given by the equation , where n is the number of moles, Cp is the molar heat capacity at constant pressure, and is the temperature change.

Since the temperature change is in Celsius, we need to add 273.15 to convert to Kelvin.

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Therefore, the heat required is:

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q30) The heat of combustion of benzene () is. If moles of benzene are burned in excess oxygen, how much heat is released?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The balanced chemical equation for the combustion of benzene is:

From this equation, we can see that for every mole of benzene combusted, of heat is released. Therefore, for moles of benzene, the heat released is:

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q31) The standard enthalpy of combustion of methane gas is -890.4 kJ/mol. What is the enthalpy change when 0.8 moles of methane gas are burned completely in excess oxygen?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The balanced chemical equation for the combustion of methane is:

From this equation, we can see that for every 1 mole of methane combusted, of heat is released. Therefore, for 0.8 moles of methane, the heat released is:

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q32) The standard enthalpy of formation of is . Calculate the enthalpy change when 1 mole of liquid water is formed from its elements under standard conditions.**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The balanced chemical equation for the formation of water from its elements is:

From this equation, we can see that for every 2 moles of hydrogen gas and mole of oxygen gas, of heat is released. Therefore, for the formation of mole of liquid water, the heat released is:

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q33) The standard enthalpy of formation of ethanol is . Calculate the enthalpy change when moles of ethanol is burned completely in excess oxygen to produce carbon dioxide and water vapor.**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The balanced chemical equation for the combustion of ethanol is:

From this equation, we can see that for every mole of ethanol combusted, of heat is released. Therefore, for moles of ethanol, the heat released is:

Since the heat released is negative, we need to change the sign to get the enthalpy change, which is . However, we need to subtract the standard enthalpy of formation of the products (2 moles of and 3 moles of O) to get the actual enthalpy change. The enthalpy change is therefore,

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q34) The enthalpy change for the reaction is. How much heat is released when moles of ammonia is formed?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: From the balanced chemical equation, we can see that for every mole of ammonia formed, of heat is released. Therefore, for moles of ammonia formed, the heat released is .

Thus, the correct answer is option (a).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q35) The standard enthalpy of formation of glucose () is. How much heat is released when of glucose is burned completely in excess oxygen?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: The balanced chemical equation for the combustion of glucose is

From this equation, we can see that for every 1 mole of glucose combusted, of heat is released. To find the amount of heat released for of glucose, we first need to convert the mass to moles by dividing the mass by molar mass (). Therefore, of glucose is equivalent to . The heat released for of glucose is :

Thus, the correct answer is option (d).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q36) The standard enthalpy of formation of carbon dioxide gas is l. What is the enthalpy change when moles of carbon dioxide gas is formed from carbon and oxygen gas at constant pressure?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The balanced chemical equation for the formation of carbon dioxide is:

From this equation, we can see that for every 1 mole of carbon dioxide formed, 393.5 kJ of heat is released. Therefore, for 2 moles of carbon dioxide, the heat released is:

Thus, the correct answer is option (a).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q37) The molar heat capacity of water at constant pressure is . How much heat is required to raise the temperature of of water from ?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The heat required to raise the temperature of a substance is given by the equation , where n is the number of moles, is the molar heat capacity at constant pressure, and is the temperature change. We can convert of water to moles using the molar mass of water. Therefore, the number of moles of water is:

Therefore, the heat required is:

Thus, the correct answer is option (a).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q38) A gaseous mixture of hydrogen and nitrogen is present in a container at a total pressure of 10 atm. The partial pressure of hydrogen is 6 atm. What is the mole fraction of nitrogen in the mixture?**

a) 0.4

b) 0.6

c) 0.2

d) 0.8

Correct Answer: Option (a)

Explanation: The total pressure of the mixture is the sum of the partial pressures of the two gases.

Therefore, the partial pressure of nitrogen is .

The mole fraction of nitrogen in the mixture is given by the equation

We can use Dalton's law of partial pressures to calculate the moles of nitrogen and hydrogen. The moles of nitrogen is

,

where V is the volume of the container and R is the gas constant.

The moles of hydrogen is

.

Therefore, the mole fraction of nitrogen is :

Thus, the correct answer is option (a).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q39) The enthalpy change of vaporization of water at its boiling point is. How much heat is required to completely vaporize of water at ?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The heat required to vaporize a substance is given by the equation , where n is the number of moles and is the enthalpy change of vaporization. We can convert of water to moles using the molar mass of water .

Therefore, the number of moles of water is

.

Therefore, the heat required to vaporize the water is

.

The positive sign indicates that heat is absorbed during the vaporization process (endothermic). The value of , which is the closest to the calculated value of when rounded to the nearest tenth.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q40) A gas is compressed adiabatically from a volume of . The initial temperature of the gas is and its initial pressure is . The gas is then** **allowed to expand isothermally to its original volume of Finally, the gas is allowed to expand adiabatically back to its original pressure of What is the final temperature of the gas after the adiabatic expansion?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: This problem involves several steps and requires the use of various thermodynamic equations.

Step 1: Adiabatic Compression

During the adiabatic compression, the gas is compressed without any heat exchange with the surroundings. Therefore, . We can use the equation , where is the ratio of specific heats, to find the final pressure of the gas.

Since the compression is adiabatic, we have

Therefore, .

Using the ideal gas law, we can find the final temperature of the gas as

.

Step 2: Isothermal Expansion

During the isothermal expansion, the temperature of the gas remains constant at . Therefore, we can use the ideal gas law to find the final pressure of the gas as

Step 3: Adiabatic Expansion

During the adiabatic expansion, the gas expands without any heat exchange with the surroundings. Therefore, . Using the equation , we can find the final volume of the gas as . Using the ideal gas law, we can find the final temperature of the gas as .

Therefore, the final temperature of the gas after the adiabatic expansion is 120 K.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q41) A gas mixture contains of helium, of neon, and of argon. The gas mixture is placed in a cylinder with a piston, and the temperature is kept constant at. The cylinder is then compressed isothermally from a volume of. What is the work done by the gas during the compression process?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: To find the work done by the gas during an isothermal compression process, we can use the equation,

where n is the number of moles, R is the gas constant, T is the temperature, is the initial volume, and is the final volume.

In this case, the temperature is kept constant at or .

First, we need to calculate the final pressure of the gas mixture.

According to Dalton's law of partial pressures, the total pressure of the gas mixture is the sum of the partial pressures of each gas. The partial pressure of each gas can be calculated using the ideal gas law,

The partial pressure of helium is, .

The partial pressure of neon is, .

The partial pressure of argon is, .

Therefore, the total pressure of the gas mixture is,

.

Using the ideal gas law again, we can calculate the initial pressure of the gas mixture. At an initial volume of , the total pressure of the gas mixture is:

Substituting these values into the equation for work, we get:

.

Since the work is done on the gas (compression), the negative sign indicates that the work is done by the gas.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q42) Which of the following is a correct statement about alkanes?**

a) They have a double bond between two carbon atoms

b) They have a triple bond between two carbon atoms

c) They contain only single bonds between two carbon atoms

d) They contain only single bonds between carbon atoms

Correct Answer: Option (c)

Explanation: Alkanes are hydrocarbons that contain only single bonds between the carbon atoms. The double bond and a triple bond between carbon atoms are the characteristic of alkenes and alkynes, respectively.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q43) What is the general formula for alkenes?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The general formula for alkenes is , where n is the number of carbon atoms in the molecule. This formula reflects the presence of one double bond between two adjacent carbon atoms.

Thus, the correct answer is option (a).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q44) Which of the following is an example of an aromatic hydrocarbon?**

a) Ethyne

b) Benzene

c) Propane

d) Butyne

Correct Answer: Option (b)

Explanation: Benzene is an example of an aromatic hydrocarbon, which is a type of cyclic compound that contains a planar arrangement of six carbon atoms with alternating single and double bonds. Aromatic hydrocarbons are characterized by their distinctive aroma and high stability.

Thus, the correct answer is option (b).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q45) What is the IUPAC name of the compound with the molecular formula ?**

a) Butane

b)Pentene

c) Butyne

d) Butene

Correct Answer: Option (d)

Explanation: To determine the IUPAC name of the compound, we need to identify the functional groups present in it. The molecular formula is consistent with the alkene family with 4 carbon atoms, which has the general formula . This means that the compound contains a carbon-carbon double bond.

Thus, the correct answer is option (d).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q46) Which of the following is an example of an unsaturated hydrocarbon?**

a) Ethene

b) Ethane

c) Methane

d) Propane

Correct Answer: Option (a)

Explanation: Unsaturated hydrocarbons have double or triple bonds between carbon atoms, while saturated hydrocarbons have only single bonds. Ethene has a double bond between two carbon atoms, making it an unsaturated hydrocarbon.

Thus, the correct answer is option (a).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q47) Which of the following is a straight-chain alkane?**

a) Isobutane

b) Butene

c) Propane

d) Pentene

Correct Answer: Option (c)

Explanation: Straight-chain alkanes have a continuous chain of carbon atoms with single bonds. Isobutane has a branched structure, while butene and pentene are unsaturated hydrocarbons. Propane is a straight-chain alkane with three carbon atoms.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q48) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/18x4cPXiepQOMe1rml9f5uW434GrrTL6v/view?usp=share\_link**](https://drive.google.com/file/d/18x4cPXiepQOMe1rml9f5uW434GrrTL6v/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following is an example of an aromatic hydrocarbon used in drugs and dye industries?**

a) Ethyne

b) Benzene

c) Methane

d) Ethane

Correct Answer: Option (b)

Explanation: Benzene is a common example of an aromatic hydrocarbon. An aromatic compound is a type of organic compound that contains a cyclic structure of atoms with alternating double bonds. This cyclic structure is called an "aromatic ring" or "arene". Aromatic compounds are characterized by their unique chemical and physical properties, which are a consequence of their aromaticity.

Thus, the correct answer is option (b).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q49) Which of the following is not a product of complete combustion of a hydrocarbon?**

a) Carbon dioxide

b) Water

c) Carbon monoxide

d) Nitrogen dioxide

Correct Answer: Option (c)

Explanation: Complete combustion of a hydrocarbon produces carbon dioxide and water as the main products. Carbon monoxide is an incomplete combustion product and harmful to the environment. Combustion is a chemical reaction between a fuel and an oxidant that produces heat, light, and usually, some type of exhaust gas. The fuel can be a hydrocarbon such as methane, propane, or gasoline, and the oxidant is usually oxygen from the air.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q50) Which of the following is a common use of alkanes?**

a) Solvents

b) Dyes

c) Food preservatives

d) Plasticizers

Correct Answer: Option (a)

Explanation: Alkanes are commonly used as solvents, since they are nonpolar and can dissolve other nonpolar substances. They are also used as fuel and as a source of energy. Dyes, food preservatives, and plasticizers are typically made from other types of chemicals.

Thus, the correct answer is option (a).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q51) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/10c7akSSIXwry7W-RwZNnaBLzDgb-lyK-/view?usp=share\_link**](https://drive.google.com/file/d/10c7akSSIXwry7W-RwZNnaBLzDgb-lyK-/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following is a characteristic feature of alkanes?**

a) They are highly reactive.

b) They have low boiling points.

c) They are soluble in water.

d) They contain a double bond.

Correct Answer: Option (b)

Explanation: Alkanes are nonpolar molecules and have only single bonds between carbon atoms. Due to their nonpolar nature, they exhibit weak intermolecular forces, resulting in low boiling points. Alkanes are saturated hydrocarbons with single bonds between carbon atoms. They have low reactivity and are relatively unreactive towards most chemical reactions.

Thus, the correct answer is option (b).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q52) Which of the following statements is true about alkenes?**

a) They contain a triple bond between carbon atoms

b) They contain a double bond between carbon atoms

c) They contain a single bond between carbon atoms

d) They do not contain any carbon-carbon bonds

Correct Answer: Option (b)

Explanation: Alkenes are unsaturated hydrocarbons that contain at least one carbon-carbon double bond in their structure. The double bond consists of one sigma bond and one pi bond. The pi bond is weaker than the sigma bond and is responsible for the reactivity of alkenes.

Thus, the correct answer is option (b).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q53) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1t19qxlWnZZl30\_HDGBrara\_fN50n0jOC/view?usp=share\_link**](https://drive.google.com/file/d/1t19qxlWnZZl30_HDGBrara_fN50n0jOC/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following is a structural isomer of pentane?**

a) Hexane

b) Butane

c) Isopentane

d) Propane

Correct Answer: Option (c)

Explanation: Structural isomers have the same molecular formula but different arrangements of atoms. They can have different physical and chemical properties, and include chain isomers, position isomers, and functional group isomers.Pentane has a linear chain of five carbon atoms, while isopentane has a branched structure.

Thus, the correct answer is option (c).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q54) Which of the following is the general formula for alkenes?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: Alkenes are unsaturated hydrocarbons that contain one or more double bonds between carbon atoms. They have at least one carbon-carbon double bond. They are more reactive than alkanes and can undergo addition reactions to form new compounds.The general formula for alkenes is.

Thus, the correct answer is option (c).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q55) Which of the following statements is true for conformers?**

a) Conformers have different shapes due to different spatial arrangements of atoms

b) Conformers have the same shape and energy due to identical spatial arrangements of atoms

c) Conformers have different shapes but identical energy due to different spatial arrangements of atoms

d) Conformers have the same shape but different energy due to different spatial arrangements of atoms

Correct Answer: Option (d)

Explanation: Conformers refer to different spatial arrangements of atoms in a molecule that can be achieved by rotating around single bonds. These different spatial arrangements may result in different shapes of the molecule, and hence, different conformers. However, the energy of different conformers may be different due to differences in the interactions between atoms.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q56) Answer the following question with reference to the audio:**

<https://drive.google.com/file/d/1MGiAv9ofSWMGSdpknE404iDLzptLadDv/view?usp=share_link>

**TYPE: Audio**

**Which of the following is a characteristic feature of aromatic hydrocarbons?**

a) They contain at least one triple bond.

b) They are highly reactive.

c) They have a ring structure with alternating double bonds.

d) They contain only single bonds.

Correct Answer: Option (c)

Explanation: They have a ring structure with alternating double bonds. Aromatic hydrocarbons contain a ring of carbon atoms with alternating double bonds, called an aromatic ring. They are relatively stable and less reactive compared to alkenes and alkynes.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q57) Which of the following is the structural formula for propane?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: Propane has a linear chain of three carbon atoms, each bonded to two hydrogen atoms. Propane can exist in different conformations, or spatial arrangements of its atoms, due to rotation around its single bonds. The most stable conformation is the staggered conformation, where the carbon-hydrogen bonds are positioned as far apart from each other as possible. The eclipsed conformation, where the carbon-hydrogen bonds are positioned directly opposite each other, is less stable and higher in energy.

Thus, the correct answer is option (b).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q58) Which of the following is the structural formula for cyclohexane?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: Cyclohexane is a cyclic hydrocarbon with a ring of six carbon atoms, each bonded to two hydrogen atoms. One interesting feature of cyclohexane is its ability to adopt different conformations, or spatial arrangements of its atoms, due to the rotation around its carbon-carbon bonds. The most stable conformation is the chair conformation, where the carbon atoms are arranged in a chair-like shape, with alternating axial and equatorial bonds. The chair conformation is the most stable because it has the lowest energy and the most favorable steric interactions.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q59) Which of the following is the structural formula for benzene?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: Benzene is an aromatic hydrocarbon with a ring of six carbon atoms, each bonded to one hydrogen atom. The ring has alternating double bonds, resulting in a resonance structure. This delocalization of electrons over the ring makes benzene an aromatic compound. It is also a planar molecule, with all the carbon atoms and hydrogen atoms lying in the same plane.

Thus, the correct answer is option (d).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q60) Which of the following is the structural formula for ethyne?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: Ethyne is an alkyne with a triple bond between two carbon atoms. Ethyne is an unsaturated hydrocarbon with a triple bond between the two carbon atoms. It is the simplest alkyne, a class of hydrocarbons that contain at least one triple bond between two carbon atoms. The triple bond in ethyne is highly reactive and is susceptible to addition reactions with a variety of other compounds.

Thus, the correct answer is option (c).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q61) Which of the following is the structural formula for propene?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: Propene is an alkene with a double bond between two carbon atoms and a linear chain of three carbon atoms. Propene is an unsaturated hydrocarbon with a double bond between two carbon atoms. It is the simplest alkene, a class of hydrocarbons that contain at least one double bond between two carbon atoms. The double bond in propene makes it more reactive than similar alkanes, which only contain single bonds between carbon atoms.

Thus, the correct answer is option (b).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q62) Which of the following compounds has a linear structure?**

a) Isobutane

b) Cyclohexane

c) Propane

d) Benzene

Correct Answer: Option (c)

Explanation: Propane has a linear chain of three carbon atoms with the single bonds between them. Cyclohexane and benzene have cyclic form of structures, while isobutane has a branched chain structure.

Thus, the correct answer is option (c).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q63) Which of the following compounds has a branched structure?**

a) Methane

b) Ethene

c) Isobutane

d) Propene

Correct Answer: Option (c)

Explanation: Isobutane has four carbon atoms in a branched structure, while methane and ethene have linear structures with the single bond in between the carbon atoms. Propene has a double bond and a linear chain of three carbon atoms.

Thus, the correct answer is option (c).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q64) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1a2RGcTtpCLMm1jn74RJN-W2hWJqYhQqH/view?usp=share\_link**](https://drive.google.com/file/d/1a2RGcTtpCLMm1jn74RJN-W2hWJqYhQqH/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following compounds has a cyclic structure?**

a) Ethane

b) Ethene

c) Cyclohexane

d) Butene

Correct Answer: Option (c)

Explanation: Cyclohexane has a cyclic structure consisting of six carbon atoms with the molecular formula of . Ethane has a linear structure with single bond in between carbon atoms, whereas in ethene, and butene there is an unsaturation.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q65) Which of the following compounds is an alkyne?**

a) Ethene

b) Ethyne

c) Propane

d) Benzene

Correct Answer: Option (b)

Explanation: An alkyne is a hydrocarbon that contains a triple bond between two carbon atoms. Ethyne, also known as acetylene, is a two-carbon alkyne with the chemical formula . Its structure consists of two carbon atoms bonded by a triple bond and each carbon atom is also bonded to a single hydrogen atom.

Thus, the correct answer is option (b).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q66) Which of the following compounds is an isomer of butene?**

a) 2-methylpropene

b) Butane

c) Pentane

d) Propene

Correct Answer: Option (a)

Explanation: Isomers are compounds that have the same molecular formula but different structural arrangements. 2-methylpropene is an isomer of butene, also known as isobutylene. It has the same molecular formula as butene, but the double bond is located between a different set of carbon atoms, and it has a methyl group attached to one of the carbon atoms in the chain.

Thus, the correct answer is option (a).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q67) Which of the following functional groups is present in an aldehyde?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: Aldehydes have the functional group , which consists of a carbonyl group and a hydrogen atom. They are a class of organic compounds that contain a carbonyl group bonded to at least one hydrogen atom and a carbon atom. The general formula for an aldehyde is , where R represents an alkyl or aryl group.

Thus, the correct answer is option (b).

Difficulty Level- Easy

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q68) Which of the following functional groups is present in a ketone?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: Ketones have the functional group , which consists of a carbonyl group in between two carbon atoms. Ketones can be produced through various methods, such as the oxidation of secondary alcohols or the cleavage of carbon-carbon bonds in carboxylic acids. They have a wide range of applications in industry and daily life, including as solvents, fuel additives, and flavouring agents.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q69) Which of the following functional groups is present in an alcohol?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: Alcohols have the functional group , which consists of a hydroxyl group attached to a carbon atom. Alcohols can be produced through a variety of methods, such as the hydration of alkenes, the reduction of carbonyl compounds, and the fermentation of sugars. They have many important uses in industry and daily life, including as solvents, fuel additives, and in the production of chemicals such as esters and ethers.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q70) Which of the following functional groups is present in an ester?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: Esters have the functional group which consists of a carbonyl group and an alkoxy group attached to the same carbon atom. Esters are a class of organic compounds that are formed by the reaction between a carboxylic acid and an alcohol. The general formula for an ester is, where R and R' represent alkyl or aryl groups.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q71) Which of the following functional groups is present in an amine?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: Amines have the functional group , which consists of a nitrogen atom attached to two hydrogen atoms. Amines can be produced through various methods, such as the reduction of nitro compounds, the reaction of alkyl halides with ammonia, and the Gabriel synthesis. They have many important applications in industry and daily life, including as solvents, surfactants, and in the production of pharmaceuticals, dyes, and pesticides.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q72) Which of the following functional groups is present in an alkyl halides?**

a) Carboxyl

b) halides

c) Ketone

d) Aldehyde

Correct Answer: Option (b)

Explanation: Halide is a functional group attached to a carbon atom. The general formula for an alkyl or aryl halide is given as , where represents an alkyl or aryl group and impliesan halide group.

Thus, the correct answer is option (b).

Difficulty Level- Easy

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**Q73) Which of the following functional groups is present in an ethers?**

a) Carboxyl

b) Hydroxyl

c)

d) Aldehyde

Correct Answer: Option (c)

Explanation: Ethers are organic compounds that have two alkyl or aryl groups bonded to an oxygen atom. The oxygen atom is the central atom in the molecule and is singly bonded to two carbon atoms, each of which is bonded to an alkyl or aryl group. The -O- group is the characteristic functional group of ethers and is responsible for their unique chemical and physical properties.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q74) Which of the following statements describes the acidic character of hydrogen in acetylene?**

a) The hydrogen in acetylene is not acidic.

b) The hydrogen in acetylene is weakly acidic.

c) The hydrogen in acetylene is moderately acidic.

d) The hydrogen in acetylene is strongly acidic.

Correct Answer: Option (d)

Explanation: Acetylene is an unsaturated hydrocarbon with the chemical formula . It contains a triple bond between two carbon atoms and is an extremely weak base. The acidity of the hydrogen atom bonded to one of the carbon atoms in acetylene is due to the electronegative carbon atom withdrawing electron density from the hydrogen atom, which leads to a partial positive charge on the hydrogen atom. This partial positive charge makes the hydrogen atom in acetylene more likely to donate a proton and makes it a strong acid.

The acidity of acetylene is further enhanced by the stability of the resulting acetylide ion, which is formed by the loss of a proton from the hydrogen atom. The acetylide ion has a delocalized negative charge over the two carbon atoms and is resonance stabilized, making it more stable than other alkynyl anions.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q75) Which of the following is a chemical reaction characteristic of alcohols?**

a) Esterification

b) Saponification

c) Hydrolysis

d) All of the above

Correct answer: Option (d)

Explanation: Alcohols can undergo various chemical reactions due to the presence of the hydroxyl group . Esterification is a reaction in which an alcohol reacts with a carboxylic acid to form an ester and water. Saponification is a reaction in which an ester reacts with an alkali to form a carboxylate salt and an alcohol. Hydrolysis is a reaction in which an alcohol reacts with water to form an alcohol and an acid. All of these reactions are chemical characteristics of alcohols.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q76) Which of the following is a consequence of hydrogen bonding in alcohols?**

a) Increased boiling point compared to hydrocarbons of similar molecular weight

b) Decreased solubility in water

c) Weaker intermolecular forces compared to hydrocarbons of similar molecular weight

d) Reduced reactivity in chemical reactions

Correct Answer: (a)

Explanation: Alcohols have the ability to form hydrogen bonds due to the presence of the hydroxyl group. The hydrogen bonding in alcohols leads to increased intermolecular forces, which results in higher boiling points compared to hydrocarbons of similar molecular weight. Hydrogen bonding also leads to increased solubility of alcohols in water, as water molecules are able to form hydrogen bonds with the hydroxyl group of the alcohol molecule.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q77) Which of the following is the correct IUPAC name for the compound ?**

a) Propanol

b) Propanal

c) Propanone

d) Propane

Correct Answer: Option (b)

Explanation: The prefix "propan-" indicates a three-carbon chain. The "-al" suffix comes from the word "aldehyde", which was originally used to describe a class of organic compounds that were produced by the partial oxidation of alcohols. The word "aldehyde" is derived from the Latin words "alcohol" (meaning "subtle" or "fine") and "dehydrogenatus" (meaning "dehydrogenated").

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q78) Which of the following is the correct IUPAC name for the compound ?**

a) Propanol

b) Propanone

c) Butanol

d) Butanone

Correct Answer: Option (a)

Explanation: The prefix "propan-" indicates a three-carbon chain. The "-ol" suffix comes from the word "alcohol", which was originally used to describe a class of organic compounds that were produced by the fermentation of sugars. The word "alcohol" is derived from the Arabic word "al-kuhul", which means "the essence".

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q79) Which of the following is the correct IUPAC name for the compound ?**

a) Ethanoic acid

b) Methanoic acid

c) Propanoic acid

d) Butanoic acid

Correct Answer: Option (a)

Explanation: The prefix "ethan-" indicates a two-carbon chain. The "-oic acid" suffix comes from the word "carboxylic acid", which refers to organic compounds that contain a carboxyl group The word "carboxylic" is derived from the combination of "carbonyl" and "hydroxyl", which are the functional groups present in a carboxylic acid.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q80) Which of the following is the correct IUPAC name for the compound ?**

a) Propanol

b) Propanone

c) Ethanal

d) Ethanol

Correct Answer: Option (b)

Explanation: The prefix "propan-" indicates a three-carbon chain. The "-one" suffix comes from the word "ketone", which refers to organic compounds that contain a carbonyl group bonded to two alkyl or aryl groups. The word "ketone" is derived from the German word "Ketone", which means "acetone".

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q81) Which of the following is the correct IUPAC name for the compound ?**

a) Propanoic acid

b) Butanoic acid

c) Pentanoic acid

d) Hexanoic acid

Correct Answer: Option (a)

Explanation: The prefix "propan-" indicates a three-carbon chain. The "-oic acid" suffix comes from the word "carboxylic acid", which refers to organic compounds that contain a carboxyl group (-COOH). The word "carboxylic" is derived from the combination of "carbonyl" and "hydroxyl", which are the functional groups present in a carboxylic acid.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q82) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/16LtM-B-mJafJw5hLrGWnvbN6so2NwuWU/view?usp=share\_link**](https://drive.google.com/file/d/16LtM-B-mJafJw5hLrGWnvbN6so2NwuWU/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following statements is true regarding the Wurtz reaction?**

a) It involves the reduction of an alkene to an alkane

b) It is a method for preparing aldehydes and ketones

c) It involves the formation of a carbon-carbon bond by coupling two alkyl halides

d) It is a method for preparing primary amines

Correct Answer: Option (c)

Explanation: The Wurtz reaction is a method for preparing symmetrical alkanes by coupling two alkyl halides in the presence of sodium metal. The reaction involves the formation of a carbon-carbon bond, and the alkyl halides act as the alkylating agents.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q83) What is the product formed when chloromethane reacts with sodium in the presence of dry ether?**

a) Ethane

b) Propane

c) Butane

d) Pentane

Correct Answer: Option (a)

Explanation: This reaction is known as the Wurtz reaction, and it involves the coupling of two alkyl halides in the presence of sodium metal in dry ether solvent. In this case, two moles of which acts as an alkyl halide and reacts with sodium to form sodium chloride () and ethane , which is the final product.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q84) Which of the following is a method for the preparation of alkanes?**

a) Friedel-Crafts alkylation

b) Kolbe's electrolytic method

c) Cannizzaro reaction

d) Sandmeyer reaction

Correct Answer: Option (b)

Explanation: This method involves the electrolysis of a solution of sodium or potassium salt of a carboxylic acid in the presence of an inert electrolyte, such as ammonium chloride. The electrolysis generates free radicals which combine to form alkanes. Friedel-Crafts alkylation is a method for the preparation of alkylbenzenes, not alkanes. The Cannizzaro reaction involves the oxidation-reduction reaction of an aldehyde in the presence of a strong base, and the Sandmeyer reaction is used for the preparation of aryl halides, not hydrocarbons.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q85) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1wJwdLk-eUPteE5-qop8\_tjMkPQrC8G90/view?usp=share\_link**](https://drive.google.com/file/d/1wJwdLk-eUPteE5-qop8_tjMkPQrC8G90/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following is not a method for the preparation of aldehydes?**

a) Wurtz reaction

b) Kolbe's electrolytic method

c) Friedel-Crafts alkylation

d) Rosenmund reduction

Correct Answer: Option (d)

Explanation: Rosenmund reduction method is used for the reduction of an acid chloride to an aldehyde. The Wurtz reaction involves the coupling of two alkyl halides to form an alkane. Kolbe's electrolytic method involves the electrolysis of a carboxylic acid salt to form an alkane. Friedel-Crafts alkylation involves the reaction of an alkyl halide with an aromatic compound to form an alkylbenzene.

Thus, the correct answer is option (d).

Difficulty Level- Hard

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**Q86)** **Which of the following methods is used for the preparation of alkanes with an odd number of carbon atoms?**

a) Decarboxylation of a carboxylic acid

b) Wurtz reaction

c) Kolbe's electrolytic method

d) Friedel-Crafts alkylation

Correct Answer: Option (a)

Explanation: Decarboxylation of a carboxylic acid involves the heating of a carboxylic acid with soda-lime (a mixture of sodium hydroxide and calcium oxide) to form an alkane with one less carbon atom than the carboxylic acid. The other methods mentioned, such as the Wurtz reaction, Kolbe's electrolytic method, and Friedel-Crafts alkylation, typically yield alkanes with an even number of carbon atoms.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q87) Which of the following is a limitation of the Wurtz reaction for the preparation of alkanes?**

a) It is a costly method

b) It is not suitable for the synthesis of branched alkanes

c) It can only be used for the preparation of alkanes with an odd number of carbon atoms

d) It requires high temperatures and pressures

Correct Answer: Option (b)

Explanation: It is not suitable for the synthesis of branched alkanes. The Wurtz reaction involves the coupling of two alkyl halides to form an alkane, but it does not produce branched alkanes efficiently. This is because the reaction is highly likely to produce secondary and tertiary carbon centers, which can lead to side reactions and isomerization.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q88) Which of the following methods can be used for the preparation of alkanes with a high degree of purity?**

a) Catalytic hydrogenation

b) Decarboxylation of a carboxylic acid

c) Wurtz reaction

d) Kolbe's electrolytic method

Correct Answer: Option (a)

Explanation: This method of Catalytic hydrogenation involves the reaction of an alkene with hydrogen gas in the presence of a metal catalyst, such as platinum or palladium. The reaction is highly selective and can yield alkanes with a high degree of purity. The other methods mentioned may produce impurities or side products.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q89) Which of the following methods is used for the preparation of alkanes with a halogen substituent?**

a) Catalytic hydrogenation

b) Decarboxylation of a carboxylic acid

c) Halogenation of an alkene

d) Friedel-Crafts alkylation

Correct Answer: Option (c)

Explanation: Halogenation of an alkene involves the addition of a halogen, such as chlorine or bromine, to an alkene to form a dihaloalkane. The dihaloalkane can then be reduced with a reducing agent, such as zinc or lithium aluminum hydride, to form an alkane with a halogen substituent. The other methods mentioned do not typically produce alkanes with halogen substituents.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q90) Which of the following statements about conformers is true?**

a) Conformers have the same molecular formula but different spatial arrangements

b) Conformers have the same physical and chemical properties

c) Conformers cannot be interconverted

d) Conformers have different molecular formulas

Correct Answer: Option (a)

Explanation: Conformers have the same molecular formula but different spatial arrangements due to its rotation around single bonds. They may have slightly different physical and chemical properties and can be interconverted by rotation around the single bond.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q91) According to the Markovnikov's rule, where does the electrophile attach in the addition of HBr to propene?**

a) To the more substituted carbon atom

b) To the less substituted carbon atom

c) To the middle carbon atom

d) To both carbon atoms equally

Correct Answer: Option (a)

Explanation: Markovnikov's rule is a principle in organic chemistry that helps predict the regiochemistry of addition reactions of unsymmetrical alkene compounds. It states that, in the addition of a protic acid (such as , where is a halogen) to an unsymmetrical alkene, the hydrogen atom of the acid will be added to the carbon atom that has the greater number of hydrogen atoms attached to it, while the halogen will be added to the carbon atom that has fewer hydrogen atoms attached to it.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q92) Which of the following is a consequence of the anti-Markovnikov's rule?**

a) Formation of a more stable carbocation

b) Formation of a less stable carbocation

c) Formation of a less substituted alkene

d) Formation of a more substituted alkene

Correct Answer: Option (d)

Explanation: Anti-Markovnikov's rule is a principle in organic chemistry that is the opposite of Markovnikov's rule. It states that, in the addition of a protic acid (such as HX, where X is a halogen) to an unsymmetrical alkene in the presence of a peroxide, the hydrogen atom of the acid will be added to the carbon atom that has fewer hydrogen atoms attached to it, while the halogen will be added to the carbon atom that has more hydrogen atoms attached to it.

Thus, the correct answer is option (d).

Difficulty Level- Medium

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**Q93) Which of the following reactions violates the Markovnikov's rule?**

a) Addition of to 1-butene

b) Addition of to propene

c) Addition of to 2-methylpropene

d) Addition of S to ethene

Correct Answer: Option (c)

Explanation: Addition of to 2-methylpropene violates the Markovnikov's rule, as the electrophile () attaches to the less substituted carbon atom. Markovnikov's rule is a principle in organic chemistry that helps predict the regiochemistry of addition reactions of unsymmetrical alkene compounds. It states that, in the addition of a protic acid (such as HX, where X is a halogen) to an unsymmetrical alkene, the hydrogen atom of the acid will be added to the carbon atom that has the greater number of hydrogen atoms attached to it, while the halogen will be added to the carbon atom that has fewer hydrogen atoms attached to it.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q94)Which of the following is a consequence of regiochemistry in addition reactions?**

a) The formation of multiple products with different functional groups

b) The formation of products with the same functional group, but different positions of attachment

c) The formation of products with the same functional group and the same position of attachment

d) The absence of any product formation in the reaction

Correct answer: Option (b)

Explanation: Regiochemistry is the study of how atoms and functional groups are distributed within a molecule during a chemical reaction. In the context of addition reactions, regiochemistry refers to the position at which the added molecule attaches to the original molecule. Depending on the reactants and conditions, addition reactions can result in different products with different regiochemical outcomes.

In some addition reactions, the added molecule can attach to different positions of the original molecule, resulting in products with different positions of attachment but the same functional group. This is the consequence of regiochemistry in addition reactions.

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q95) Which of the following is a consequence of geometrical isomerism in organic molecules?**

a) The presence of different functional groups in the molecule

b) The ability of the molecule to rotate around a carbon-carbon double bond

c) The presence of non-bonding electron pairs in the molecule

d) The presence of two or more different spatial arrangements of atoms in the molecule

Correct answer: Option (d)

Explanation: Geometrical isomerism occurs in molecules that have restricted rotation around a carbon-carbon double bond, due to the presence of bulky substituents or other factors. This results in the formation of two or more stereoisomers with different spatial arrangements of atoms, even though the chemical formula and connectivity of the atoms remains the same.

Thus, the correct answer is option (d).

Difficulty Level- Hard

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**Q96) Which of the following is a method for the preparation of alkenes?**

a) Reduction of alkanes

b) Halogenation of alkanes

c) Dehydration of alcohols

d) All of the above

Correct Answer: Option (c)

Explanation: Dehydration of alcohols is a common method for the preparation of alkenes. In this process, an alcohol is heated in the presence of a strong acid catalyst to remove a molecule of water, which leads to the formation of an alkene. Reduction of alkanes and halogenation of alkanes do not lead to the formation of alkenes.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q97) Which of the following reagents can be used for the preparation of alkenes by dehydrohalogenation of alkyl halides?**

a) in ethanol

b) S in water

c) in ethanol

d) in acetone

Correct Answer: Option (a)

Explanation: Dehydrohalogenation of alkyl halides is a common method for the preparation of alkenes. In this process, an alkyl halide is treated with a strong base like in ethanol to remove a hydrogen halide molecule, leading to the formation of an alkene. S in water, in ethanol, and in acetone are not commonly used reagents for this process.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q98) Which of the following is a method for the preparation of alkenes by elimination reactions?**

a) Dehydrohalogenation of alkyl halides

b) Dehydration of alcohols

c) Dehydrogenation of alkanes

d) All of the above

Correct Answer: Option (d)

Explanation: Elimination reactions like dehydrohalogenation of alkyl halides, dehydration of alcohols, and dehydrogenation of alkanes are common methods for the preparation of alkenes. In each of these processes, a molecule of , or is removed from the starting compound, leading to the formation of an alkene.

Thus, the correct answer is option (d).

Difficulty Level- Hard

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**Q99) Which of the following reagents can be used for the preparation of alkynes from alkyl halides?**

a)

b)

c)

d) S

Correct Answer: Option (a)

Explanation: Alkynes can be prepared from alkyl halides by using a strong base like . This process is known as dehydrohalogenation, where the halogen atom and a β-hydrogen atom are eliminated to form an alkyne.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q100) Which of the following is a method for the preparation of alkynes by elimination reactions?**

a) Dehydrohalogenation of alkyl halides

b) Dehydration of alcohols

c) Dehydrogenation of alkanes

d) All of the above

Correct Answer: Option (a)

Explanation: Dehydrohalogenation of alkyl halides is a common method for the preparation of alkynes. In this process, a β-hydrogen atom is eliminated along with the halogen atom to form an alkyne.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q101) Which of the following is not a method for the preparation of alkynes?**

a) Elimination of vicinal dihalides

b) Reduction of alkynes

c) Dehalogenation of geminal dihalides

d) Alkylation of acetylene

Correct Answer: Option (b)

Explanation: Reduction of alkynes is not a method for the preparation of alkynes, rather it leads to the formation of alkanes. Elimination of vicinal dihalides, dehalogenation of geminal dihalides, and alkylation of acetylene are all methods for the preparation of alkynes.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q102) What is the product obtained when an alkene is treated with ozone followed by reductive workup?**

a) Alkane

b) Alkene

c) Aldehyde/Ketone

d) Alcohol

Correct Answer: Option (c)

Explanation: Ozonolysis is a reaction where ozone (O3) is used to cleave an alkene into two carbonyl compounds. The reaction is followed by reductive workup with a reducing agent like zinc or sodium borohydride to obtain aldehydes or ketones. The alkene is converted to an ozonide intermediate which is then split into two carbonyl compounds upon reduction.

Therefore, the product obtained when an alkene is treated with ozone followed by reductive workup is an aldehyde or ketone.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q103) Which of the following is not a type of polymerisation?**

a) Addition polymerisation

b) Condensation polymerisation

c) Substitution polymerisation

d) Radical polymerisation

Correct Answer: Option (c)

Explanation: Polymerisation is the process of joining small molecules, called monomers, to form long chain molecules called polymers. There are two main types of polymerisation: addition polymerisation and condensation polymerisation. Addition polymerisation involves the reaction of unsaturated monomers to form polymers without the formation of any byproducts. Condensation polymerisation involves the reaction of two or more monomers with the elimination of a small molecule, such as water, to form a polymer.

Radical polymerisation is a type of addition polymerisation that involves the initiation of free radicals to initiate the polymerisation process. Substitution polymerisation is not a type of polymerisation.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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Very hard

**Q104) Which of the following is not an aromatic hydrocarbon?**

a) Benzene

b) Toluene

c) Cyclohexane

d) Naphthalene

Correct Answer: Option (c)

Explanation: Cyclohexane does not contain a benzene ring and is therefore not an aromatic hydrocarbon. Aromatic hydrocarbons are organic compounds that contain one or more benzene rings in their molecular structure. The benzene ring is a hexagonal ring of six carbon atoms, each of which is also bonded to a hydrogen atom. Aromatic hydrocarbons are characterized by their unique stability, reactivity, and electronic structure.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q105) Which of the following is a common method for the preparation of aromatic hydrocarbons?**

a) Friedel-Crafts alkylation

b) Dehydration of alcohols

c) Dehydrohalogenation of alkyl halides

d) All of the above

Correct Answer: Option (a)

Explanation: Friedel-Crafts alkylation is a common method for the preparation of aromatic hydrocarbons. In this process, an alkyl halide is reacted with an aromatic compound in the presence of a Lewis acid catalyst, such as aluminum chloride. The alkyl group is then substituted onto the aromatic ring to form an alkylated aromatic compound.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q106) Which of the following is a characteristic property of aromatic hydrocarbons?**

a) They are highly reactive

b) They are easily oxidized

c) They have a planar structure

d) They are soluble in water

Correct Answer: Option (c)

Explanation: Aromatic hydrocarbons have a planar structure due to the presence of the delocalized π electrons in the benzene ring. This planarity is what gives them their unique stability and characteristic properties, such as resistance to addition reactions. Aromatic hydrocarbons are typically insoluble in water due to their nonpolar nature.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q107) Which of the following compounds is not considered aromatic based on its character?**

a) Benzene

b) Pyridine

c) Cyclohexane

d) Thiophene

Correct Answer: Option (c)

Explanation: Aromatic compounds are those that exhibit a special type of stability known as aromaticity. A compound is considered aromatic if it meets the following criteria:

It is cyclic, planar, a fully conjugated system of π electrons (i.e., the π electrons are delocalized around the ring).

It follows Huckel's rule, which states that the number of π electrons in the ring must be , where n is an integer.

Benzene, pyridine, and thiophene all meet the above criteria and are considered aromatic. Cyclohexane does not have a fully conjugated system of π electrons and is therefore not considered aromatic.

Thus, the correct answer is option (c).

Difficulty Level- Very hard

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**Q108) Which of the following statements about resonance is correct?**

a) Resonance structures represent different molecules

b) Resonance structures have equal stability

c) Resonance stabilizes molecules by increasing electron density

d) Resonance is only observed in molecules with double bonds

Correct Answer: Option (c)

Explanation: Resonance is a concept used to describe the delocalization of electrons in certain molecules or ions. Resonance structures are different representations of a molecule or ion that differ only in the placement of electrons. These structures do not represent different molecules, but rather contribute to the overall picture of the molecule or ion.

Resonance structures are not necessarily of equal stability. Some structures may contribute more to the overall picture of the molecule or ion than others, and these are said to be more stable.

Resonance stabilizes molecules by increasing electron density, which makes the molecule less susceptible to attack by electrophiles. It is observed in molecules with double bonds, but can also be present in molecules with single bonds, such as benzene.

Thus, the correct answer is option (c).

Difficulty Level- Very hard

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**Q109) Which of the following functional groups exerts a strong meta-directing effect on monosubstituted benzene?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: Monosubstituted benzene refers to a benzene ring with one substituent attached. The position of the substituent is affected by the directive influence of functional groups attached to the ring.

Functional groups can have either an ortho- or para-directing effect, meaning they direct the incoming substituent to the ortho or para positions relative to themselves, or a meta-directing effect, meaning they direct the incoming substituent to the meta position.

In general, electron-withdrawing groups, such as , have a strong meta-directing effect. Among all, exerts the strongest meta-directing effect.

Thus, the correct answer is option (d).

Difficulty Level- Very hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q110) Which of the following statements about the carcinogenicity and toxicity of hydrocarbons is true?**

a) Only synthetic hydrocarbons are carcinogenic

b) Only aromatic hydrocarbons are toxic

c) Aliphatic hydrocarbons are generally less toxic than aromatic hydrocarbons

d) Hydrocarbons are not toxic or carcinogenic

Correct Answer: Option (c)

Explanation: Carcinogenicity refers to the ability of a substance to cause cancer, while toxicity refers to its ability to cause harm to living organisms.

Hydrocarbons can be either natural or synthetic, and both types can be carcinogenic and/or toxic. Aromatic hydrocarbons, such as benzene and polycyclic aromatic hydrocarbons (PAHs), are known to be carcinogenic and toxic. Aliphatic hydrocarbons, on the other hand, are generally less toxic than aromatic hydrocarbons.

The toxicity of hydrocarbons depends on factors such as their structure, volatility, and ability to accumulate in the body. Some hydrocarbons, such as the highly volatile and toxic gasoline additive MTBE, have been banned due to their toxicity.

Thus, the correct answer is option (c).

Difficulty Level- Very hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q111) What is the main reason for the stability of benzene?**

a) The presence of sp3 hybridized carbon atoms

b) The presence of double bonds between carbon atoms

c) The delocalization of π-electrons in a ring structure

d) The presence of functional groups attached to the ring

Correct Answer: Option (c)

Explanation: Benzene is a six-membered ring of carbon atoms with alternating double and single bonds. The π-electrons in the double bonds are not localized between two adjacent carbon atoms but are instead delocalized over the entire ring due to resonance. This delocalization results in a stable ring structure with an overall planar geometry.

The delocalization of π-electrons also results in a cancellation of the bond length alternation, which would have resulted in differing bond lengths between the carbon-carbon bonds in the ring. This leads to all carbon-carbon bond lengths being equal, which contributes to the stability of the ring.

Thus, the correct answer is option (c).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q112) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/15HfLy0Dl2LCgYncJU1Z8hW9\_LjOzx5Zv/view?usp=share\_link**](https://drive.google.com/file/d/15HfLy0Dl2LCgYncJU1Z8hW9_LjOzx5Zv/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following statements is true about the equilibrium state?**

a) The equilibrium state is a dynamic state where the forward and backward reactions occur at the same rate

b) The equilibrium state is a static state where no chemical reactions occur

c) The equilibrium state is a state where only the forward reaction occurs

d) The equilibrium state is a state where only the backward reaction occurs

Correct Answer: Option (a)

Explanation: Equilibrium state refers to a state in which the properties of a system remain constant over time, even though the system may be undergoing some changes. In chemistry, an equilibrium state is achieved when the rate of the forward reaction is equal to the rate of the reverse reaction, and the concentrations of reactants and products remain constant over time.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q113) A reaction reaches equilibrium when**

a) The rate of the forward reaction is greater than the rate of the backward reaction

b) The rate of the backward reaction is greater than the rate of the forward reaction

c) The rates of the forward and backward reactions are equal

d) The reaction has consumed all the reactants

Correct Answer: Option (c)

Explanation: At equilibrium, the rates of the forward and backward reactions are equal, and there is no net change in the concentrations of reactants and products. The system is said to be in a state of equilibrium when the concentrations of the reactants and products remain constant, but the reactions are still occurring. Chemical equilibrium can be reached in both reversible and irreversible reactions.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q114) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/1yc5RMMglVSyi1qHuDtKJo4EFTgsG5TNS/view?usp=share\_link**](https://drive.google.com/file/d/1yc5RMMglVSyi1qHuDtKJo4EFTgsG5TNS/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following statements is true about dynamic equilibrium?**

a) It occurs only in physical processes

b) It occurs when a reversible reaction is taking place in a closed system

c) It occurs only in irreversible reactions

d) It occurs when a reaction is taking place in an open system

Correct Answer: Option (b)

Explanation: Dynamic equilibrium occurs when a reversible reaction is taking place in a closed system. Dynamic equilibrium refers to a state of balance in a system where the rate of the forward reaction is equal to the rate of the reverse reaction, resulting in no overall change in the concentration of reactants or products. This means that the system is still undergoing chemical reactions, but the concentration of the reactants and products remain constant over time.

Thus, the correct answer is option (b).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q115) Which of the following is not a characteristic of chemical equilibrium?**

a) The rate of the forward reaction is equal to the rate of the backward reaction

b) The concentration of reactants and products remains constant

c) The equilibrium is reached only in the presence of a catalyst

d) The equilibrium is established in a closed system

Correct Answer: Option (c)

Explanation: In a chemical reaction that reaches equilibrium, the forward and reverse reactions occur at equal rates, and the concentration of the reactants and products remain constant. Adding a catalyst will not change the equilibrium position of the reaction, but it will increase the rate at which the reaction reaches equilibrium. This means that the catalyst will speed up both the forward and reverse reactions equally, allowing the equilibrium to be reached more quickly.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q116) In which of the following cases will the equilibrium shift towards the product side?**

a) Adding more reactants to the system

b) Decreasing the volume of the system

c) Increasing the temperature of the system

d) Adding a catalyst to the system

Correct Answer: Option (c)

Explanation: According to Le Chatelier's principle, when a system at equilibrium is subjected to a change in temperature, pressure, or concentration, the equilibrium position will shift in the direction that tends to counteract the change. In the case of increasing the temperature, the system will respond by shifting the equilibrium towards the endothermic reaction, which absorbs heat and helps to counteract the increase in temperature.

Thus, the correct answer is option (c).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q117) Answer the following with reference to the audio**

**(**[**https://drive.google.com/file/d/1uQlZf6re493GH5xs6fYSsGhymOZU1xba/view?usp=share\_link**](https://drive.google.com/file/d/1uQlZf6re493GH5xs6fYSsGhymOZU1xba/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following statements is true for solid-liquid equilibrium?**

a) It involves the equilibrium between a solid and a gas

b) It involves the equilibrium between a solid and a liquid

c) It involves the equilibrium between a liquid and a gas

d) It involves the equilibrium between a solid and a plasma

Correct Answer: Option (b)

Explanation: The Solid-liquid equilibrium involves the equilibrium between a solid phase and a liquid phase, where the rate of dissolution of the solid equals the rate of precipitation of the solid.

Thus, the correct answer is option (b).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q118) Which of the following statements is true for the boiling point of a liquid?**

a) It decreases with a decrease in the atmospheric pressure

b) It increases with an increase in the atmospheric pressure

c) It remains constant with a change in the atmospheric pressure

d) It depends on the volume of the liquid

Correct Answer: Option (b)

Explanation: The boiling point of a liquid increases with an increase in the atmospheric pressure. This is because the pressure on the liquid surface needs to be increased to allow the liquid to boil.

Thus, the correct answer is option (b).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q119) At constant temperature and pressure, the solubility of a gas in a liquid**

a) Increases with an increase in the pressure of the gas

b) Decreases with an increase in the pressure of the gas

c) Remains constant with a change in the pressure of the gas

d) None of the above

Correct Answer: Option (a)

Explanation: At constant temperature and pressure, the solubility of a gas in a liquid increases with an increase in the pressure of the gas. Henry's law is often used to describe the behavior of gases in solutions, such as the dissolution of carbon dioxide in soda or the absorption of oxygen in the bloodstream. It is also important in environmental chemistry, where it is used to understand the transport and fate of gases in natural systems.

Thus, the correct answer is option (a).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q120) Answer the following question with reference to the audio**

**(**[**https://drive.google.com/file/d/14GiQxqDtd3TDcu2X5GOdpTGtSgjzjOsL/view?usp=share\_link**](https://drive.google.com/file/d/14GiQxqDtd3TDcu2X5GOdpTGtSgjzjOsL/view?usp=share_link)**)**

**TYPE: Audio**

**Which of the following factors affect the rate of dissolution of a gas in a liquid?**

a) Temperature and pressure of the gas

b) Surface area of the gas

c) Nature of the gas

d) Nature of the liquid

Correct Answer: Option (a)

Explanation: The rate of dissolution of a gas in a liquid increases with an increase in the temperature and pressure of the gas. This is because an increase in temperature and pressure leads to an increase in the kinetic energy of the gas particles, which promotes their dissolution in the liquid.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q121) What happens to the solubility of a gas in a liquid as the temperature of the liquid increases?**

a) It increases

b) It decreases

c) It remains constant

d) It depends on the pressure of the gas

Correct Answer: Option (b)

Explanation: As the temperature of the liquid increases, the solubility of a gas in the liquid decreases. This is because an increase in temperature decreases the solubility of gases in liquids due to a decrease in the intermolecular forces between the gas and liquid molecules.

Thus, the correct answer is option (b).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q122) What happens to the equilibrium constant () when the concentration of the reactants is increased?**

a) It decreases

b) It increases

c) It remains constant

d) It depends on the nature of the reaction

Correct Answer: Option (a)

Explanation: When the concentration of the reactants is increased, the equilibrium shifts towards the product side to maintain the equilibrium constant, which leads to a decrease in the value of .

Thus, the correct answer is option (a).

Difficulty Level- Medium

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q123) Which of the following statements is true for a reaction at dynamic equilibrium?**

a) The rate of the forward reaction is equal to the rate of the backward reaction

b) The concentration of the reactants and products remains constant

c) The equilibrium constant depends on the initial concentrations of the reactants and products

d) All of the above

Correct Answer: Option (a)

Explanation: At dynamic equilibrium, the rate of the forward reaction is equal to the rate of the backward reaction, which leads to a constant concentration of reactants and products. The equilibrium constant () is a fixed value at a given temperature and does not depend on the initial concentrations of the reactants and products.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q124) For the reaction, , the equilibrium constant (Kc) is at a certain temperature. If the initial concentrations of , , and are, and respectively, what will be the equilibrium concentration of ?**a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: Let the equilibrium concentration of NH3 be x. Then, the equilibrium concentrations of andwill be respectively.

Substitute these values in the expression for to get:

On substituting the equilibrium concentrations, we get:

Solving this equation, we get

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q125) For the reaction, the equilibrium constant () is at a certain temperature. If the equilibrium concentration of**  **is and the equilibrium concentrations of and are and , respectively, what is the value of ?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The equilibrium constant () can be calculated using the equilibrium concentrations of the reactants and products, as follows:

, where x is the equilibrium concentration of . Solving for , we get .

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q126) For the reaction, the equilibrium constant is at a certain temperature. If the initial concentrations of and are both, and the final equilibrium concentration of is, what will be the equilibrium concentration of ?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The equilibrium constant expression for the reaction is:

Given that at a certain temperature, we can use the equilibrium constant expression to determine the equilibrium concentration of .

We are also given the initial concentrations of and as both and the equilibrium concentration of as.

Let's substitute the given values into the equilibrium constant expression and solve for:

The equilibrium concentration of is .

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q127) For the reaction, if the equilibrium constant is at a certain temperature, what is the value of for the reverse reaction at the same temperature?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: To calculate the equilibrium constant for the reverse reaction, we need to use the relationship between the equilibrium constants of the forward and reverse reactions, which is given by the expression:

Substituting the given values in the above equation, we get:

.

Thus, the correct answer is option (b).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q128) For the reaction if the equilibrium constant is at a certain temperature, what is the equilibrium constant for the same reaction at the same temperature if the standard molar enthalpy of formation of is ?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: To solve this problem, we need to use the relationship between  and for a gaseous reaction, which is given by the expression:

, where R is the gas constant, T is the temperature in kelvin, and is the difference between the sum of the stoichiometric coefficients of the gaseous products and the sum of the stoichiometric coefficients of the gaseous reactants.

For the given reaction, .

Substituting the given values in the above equation, we get:

Thus, the correct answer is option (c).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q129) Which of the following statements is true for heterogeneous equilibrium?**

a) The concentrations of all reactants and products are equal.

b) The equilibrium constant depends on the amount of reactants and products.

c) The concentration of a pure solid or liquid does not appear in the equilibrium constant expression.

d) The equilibrium constant depends only on the concentration of reactants.

Correct Answer: Option (c)

Explanation: In a heterogeneous equilibrium, the reactants and products are in different phases (solid, liquid or gas), and the concentration of a pure solid or liquid does not appear in the equilibrium constant expression. This is because the concentration of a pure solid or liquid remains constant throughout the reaction, and thus does not affect the equilibrium position. The equilibrium constant expression includes only the concentrations of the species that are present in the gas or solution phase.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q130) Consider the following reaction at equilibrium: . If the equilibrium constant is at a certain temperature, what is the concentration of in equilibrium when of and of are heated together in a closed vessel of volume ?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: To solve this problem, we need to use the equilibrium constant expression for the given reaction, which is:

We are given the values of the initial moles of and and the volume of the vessel. From this, we can calculate the initial concentrations of and, which are , respectively.

Let x be the concentration of CO2 at equilibrium. At equilibrium, the concentrations of and will be , respectively.

Substituting these values in the equilibrium constant expression, we get:

Solving this equation gives

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q131) The value of Q for a reaction is , while its equilibrium constant, , is . Which of the following statements is correct?**

a) The reaction is at equilibrium.

b) The reaction is proceeding in the forward direction.

c) The reaction is proceeding in the reverse direction.

d) It is impossible to determine the direction of the reaction.

Correct Answer: Option (b)

Explanation: If , the reaction will proceed in the forward direction to reach equilibrium. If , the reaction will proceed in the reverse direction to reach equilibrium. In this case, , which means that the reaction is not at equilibrium and it will proceed in the forward direction to reach equilibrium.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q132) For the reaction if the initial concentration of A is 0.1 M, B is 0.2 M and C is 0.01 M, what is the value of Q?**

a) 0.1

b) 0.2

c) 0.5

d) 0.8

Correct Answer: Option (c)

Explanation: The reaction quotient, Q, is calculated by substituting the initial concentrations of the reactants and products into the equilibrium expression. For this reaction,

Substituting the initial concentrations into the expression, we get:

Thus, the correct answer is option (c).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q133) For the reaction the equilibrium constant (Kc) is at a certain temperature. If the initial concentrations of and are both , what is the equilibrium concentration of NH3?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: Let x be the equilibrium concentration of NH3. Then, the equilibrium concentrations of and  will be , respectively, as per stoichiometry.

Solving this equation gives .

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q134) For the reaction the equilibrium constant is at a certain temperature. If the initial concentration of is , what is the equilibrium concentration of ?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: Let x be the equilibrium concentration of . Then, the equilibrium concentration of will also be x, and the equilibrium concentration of will be

Solving this equation gives

Thus, the correct answer is option (b).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q135) For the reaction at a certain temperature, what is the Gibbs energy change at equilibrium when?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation:

Thus, the correct answer is option (b).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q136) Which of the following is an example of an endothermic process?**

a) Burning of a candle

b) Melting of ice in a glass of water

c) Boiling of water on a stove

d) Rusting of iron

Correct Answer: Option (b)

Explanation: When ice melts, heat is absorbed from the surroundings to break the intermolecular forces between the ice molecules, making it an endothermic process. During an endothermic process, energy is used to break the bonds between the atoms or molecules in the reactants, which requires energy input. This energy input is usually in the form of heat, but it can also be electrical or mechanical. As a result, the energy is absorbed from the surroundings to compensate for the energy required to break the bonds. This causes the temperature of the surroundings to decrease.

Thus, the correct answer is option (b).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q137) Consider the reaction at equilibrium. If the volume of the container is reduced by half, what will be the effect on the concentration of NH3?**

a) The concentration of will increase

b) The concentration of will decrease

c) The concentration of will remain unchanged

d) It is impossible to predict the effect without additional information

Correct Answer: Option (b)

Explanation: According to Le Chatelier’s principle, if a stress is applied to a system at equilibrium, the system will respond by shifting its equilibrium position in such a way as to counteract the stress.

When the volume of the container is reduced by half, the total pressure of the system will increase. The reaction will respond to counteract this stress by shifting its equilibrium position in the direction that produces fewer moles of gas.

In this case, the forward reaction produces two moles of gas, while the reverse reaction produces four moles of gas. Therefore, the reaction will shift in the reverse direction to decrease the total pressure and reach a new equilibrium.

As a result, the concentration of will decrease because it is a product of the reverse reaction.

Thus, the correct answer is option (b).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q138) In the reaction if the pressure is increased by decreasing the volume of the container, what will be the effect on the equilibrium concentration of ?**

a) The concentration of will increase

b) The concentration of will decrease

c) The concentration of will remain unchanged

d) It is impossible to predict the effect without additional information

Correct Answer: Option (b)

Explanation: According to Le Chatelier's principle, if the pressure is increased, the equilibrium will shift in the direction that produces fewer moles of gas in order to decrease the pressure. In this case, the forward reaction produces two moles of gas, while the reverse reaction produces one mole of gas. Therefore, the equilibrium will shift to the left, decreasing the concentration of .

Thus, the correct answer is option (b).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q139) If the temperature is increased for an exothermic reaction at equilibrium, what will be the effect on the equilibrium constant ()?**

a) will increase

b) will decrease

c) will remain unchanged

d) It is impossible to predict the effect without additional information

Correct Answer: Option (b)

Explanation: According to Le Chatelier's principle, if the temperature is increased, the equilibrium will shift in the direction that absorbs heat in order to decrease the temperature. For an exothermic reaction, heat is produced as a product, so the reaction will shift to the left, decreasing the concentration of products and increasing the concentration of reactants. As a result, will decrease.

Thus, the correct answer is option (b).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q140) In the reaction if the concentration of A is doubled while the concentration of B and C are held constant, what will be the effect on the equilibrium concentration of C?**

a) The concentration of C will increase

b) The concentration of C will decrease

c) The concentration of C will remain unchanged

d) It is impossible to predict the effect without additional information

Correct Answer: Option (a)

Explanation: According to Le Chatelier's principle, if the concentration of a reactant is increased, the equilibrium will shift in the direction that consumes that reactant in order to decrease its concentration. In this case, the forward reaction consumes A, so the equilibrium will shift to the right, increasing the concentration of C.

Thus, the correct answer is option (a).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q141) If a catalyst is added to a reaction at equilibrium, what will be the effect on the equilibrium constant ()?**

a) will increase

b) will decrease

c) will remain unchanged

d) It is impossible to predict the effect without additional information

Correct Answer: Option (c)

Explanation: A catalyst does not affect the position of equilibrium. It only speeds up the forward and reverse reactions to the same extent, so the rate of the reaction increases but the equilibrium constant remains unchanged.

Thus, the correct answer is option (c).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q142) According to Arrhenius concept, an acid is a substance that:**

a) donates a proton () in aqueous solution

b) accepts a proton () in aqueous solution

c) donates a hydroxide ion () in aqueous solution

d) accepts a hydroxide ion () in aqueous solution

Correct Answer: Option (a)

Explanation: According to Arrhenius concept, an acid is a substance that donates a proton () in aqueous solution, while a base is a substance that accepts a proton () in aqueous solution.

Thus, the correct answer is option (a).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q143) According to the Brönsted-Lowry concept, an acid is a substance that:**

a) donates a proton () in aqueous solution

b) accepts a proton () in aqueous solution

c) donates a hydroxide ion () in aqueous solution

d) accepts a hydroxide ion () in aqueous solution

Correct Answer: Option (a)

Explanation: According to the Brönsted-Lowry concept, an acid is a substance that donates a proton () in aqueous solution, while a base is a substance that accepts a proton () in aqueous solution.

Thus, the correct answer is option (a).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q144) According to the Lewis concept, an acid is a substance that:**

a) donates a proton () in aqueous solution

b) accepts a proton () in aqueous solution

c) donates an electron pair

d) accepts an electron pair

Correct Answer: Option (d)

Explanation: According to this concept, an acid is defined as an electron pair acceptor and a base is defined as an electron pair donor. This is in contrast to the Brønsted-Lowry theory, which defines an acid as a proton () donor and a base as a proton acceptor.

Thus, the correct answer is option (d).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q145) The ionization constant () of water is:**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The ionization constant () of water is the product of the concentrations of hydrogen ions () and hydroxide ions () in water, and it is equal to . This means that at equilibrium, the product of the concentrations of and in water is always equal to .

Thus, the correct answer is option (a).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q146) The scale is a measure of:**

a) the concentration of hydrogen ions () in a solution

b) the concentration of hydroxide ions () in a solution

c) the acidity or basicity of a solution

d) the temperature of a solution

Correct Answer: Option (c)

Explanation: The scale is a measure of the acidity or basicity of a solution. It is defined as the negative logarithm of the hydrogen ion concentration () in a solution.

Thus, the correct answer is option (c).

Difficulty Level- Hard

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

**Q147) The ionization constant () of a weak acid is . What is the percent ionization of the acid in a 0.1 M solution?**

a) 0.02%

b)

c) 2%

d) 20%

Correct Answer: Option (b)

Explanation: The ionization constant () of a weak acid is defined as the ratio of the concentration of products ( and) to the concentration of reactants () at equilibrium. It can be used to determine the extent of ionization of a weak acid in a solution.

Let's assume that x is the degree of ionization of the weak acid in a 0.1 M solution. Then the equilibrium concentrations of , , and can be expressed as x M, x M, and M, respectively.

Using the expression for the ionization constant of the weak acid, we can write:

Solving for x, we get:

The percent ionization of the weak acid can be calculated as:

percent ionization =

Thus, the correct answer is option (b).

Difficulty Level- Very hard

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**Q148) The and values for a weak acid and its conjugate base are and , respectively. What is the of asolution of the conjugate base?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The and values are related through the following equation:

where is the ionization constant of water ).

Using this equation, we can find the value of the conjugate base:

Since we know the value and the concentration of the conjugate base, we can find the concentration of ions in the solution using the expression for the ionization constant of a weak base:

where is the conjugate acid of the base and is the concentration of the base.

Assuming that the weak base is the only source of ions, we can write:

Using the expression for pH, we can find the pH of the solution:

Thus, the correct answer is option (c).

Difficulty Level- Very hard

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**Q149) What is the effect of adding to a solution of acetic acid in water?**

a) The degree of ionization of acetic acid will decrease

b) The degree of ionization of acetic acid will increase

c) The pH of the solution will decrease

d) The pH of the solution will increase

Correct Answer: Option (a)

Explanation: When a common ion is added to a solution of a weak acid or base, it reduces the ionization of the weak acid or base. This phenomenon is known as the common ion effect. In this case, is a salt of a strong acid and strong base, and it dissociates completely into its constituent ions in water. The addition of therefore increases the concentration of ions in the solution, which are common to both NaCl and acetic acid.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q150) A buffer solution is prepared by mixing acetic acid and sodium acetate. If the dissociation constant of acetic acid is , what is the of the buffer solution?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: To calculate the of the buffer solution, we can use the enderson-Hasselbalch equation, which is given by:

whereis the dissociation constant of the weak acid, is the concentration of the conjugate base, and is the concentration of the weak acid. In this case, the weak acid is acetic acid (CH3COOH) and its conjugate base is acetate . The dissociation constant () of acetic acid is . Using the Henderson-Hasselbalch equation, we get:

We are given that the initial concentrations of acetic acid and sodium acetate are both 0.1 M. Since sodium acetate completely dissociates in water to give acetate ions and sodium ions, the concentration of acetate ions is also 0.1 M. Therefore:

Plugging in these values, we get:

Thus, the correct answer is option (a).

Difficulty Level- Very hard

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