Combustion Reactions Chemistry Questions with Solutions

Q1: What is the general formula for combustion reaction?

Answer: The general formula of combustion is given as: Fuel + O_2 $\xrightarrow{Combustion}$ $CO_2 + H_2O$

Q2. Choose the correct option for the statement:
The amount of oxygen during combustion

a. First increases and then decreases
b. Does not vary with time
c. Increases with time
d. Decreases with time

Answer: (d.)

Explanation: The oxygen reacts with the fuel to form carbon dioxide and water. Hence , the oxygen gets used up in the reaction. In the absence of sufficient amounts of oxygen, incomplete combustion takes place.

Q3. Combustion does not necessarily require

a. Flame
b. Oxygen
c. A combustible material
d. Temperature greater than the kindling temperature

Answer: (a.)

Explanation: Some spontaneous combustion materials can ignite themselves at the desired temperatures without the need of a source of flame.

Q4. What is the type of reaction in between alkanes and hydroxyl radicals?

a. Exothermic
b. Endothermic
c. Isochoric
d. Isothermal

Answer: (a.)

Explanation: This is because the O-H bond is much stronger than the C-H bond.

$$CH_3CH_3 + OH \rightarrow CH_3CH_2 + \dot{H}$$

Q5. Balance the given reaction.

$$N_2 + O_2 \rightarrow N_2O_5$$

Answer: The given reaction equation is balanced by the following steps:

a. First, the number of atoms of each of the elements is counted both on the reactants' and the products' side.

Element	Reactants' side	Products' side
Nitrogen	2	2
Oxygen	2	5

Hence, we see that the number of nitrogen atoms are equal on both sides. We have to balance the number of oxygen atoms.

b. To balance the oxygen, the molecules containing oxygen are given stoichiometric coefficients such that the product of the coefficient and the initially present atoms of oxygen result in the common multiple of 2 and 5.

$$N_2 + 5O_2 \rightarrow 2N_2O_5$$

Now that the oxygen atoms are balanced on both sides. The nitrogen atoms need to be balanced.

$$2N_2 + 5O_2 \rightarrow 2N_2O_5$$

Hence, the given equation has been completely balanced.

Q6. How is a chemical change different from a physical change?

Answer: In a chemical change, the new product received has entirely different properties from that of the original reactants. However, in a physical change, no new product is formed.

Q7. "More reactants consumed implies that more products will be formed." Explain.

Answer: The addition of more reactants would mean that more atoms/ molecules are participating in the reaction. Hence, more reactant molecules would react to form more products.

Q8. Which of the following ions are present in water?

a. H_2O^+ and OH^-
b. HO^+ and HO^-
c. H_3O^+ and OH^-
d. HO^+ and H_2O^-

Answer: (c.)

Explanation: Water undergoes self-ionisation due to which some water molecules dissociates into H^+ and OH^- ions. The H^+ ions due to smaller size and very high mobility attacks another water molecule to form H_3O^+ ions. Hence, H_3O^+ and OH^- ions are present in water.

Q9. A hydrocarbon fuel is fully combusted consuming 18.214 g of oxygen to yield 23.118 g of CO_2 and 4.729 g of H_2O. Find the Empirical formula of the given hydrocarbon.

Answer: As we know, 44 g CO_2 contains carbon = 1 mol
23.118 g CO_2 contains carbon = (1/44) x 23.118 g = 0.5254 mol
Similarly, 18 g H_2O contains hydrogen = 2 mol
4.729 g H_2O contains hydrogen = (2/18) x 4.729 = 0.5254 mol
Hence, the given hydrocarbon contains equal moles of carbon and hydrogen. So, the empirical formula of the hydrocarbon must be CH.

Q10. The factor crucial for the beginning of a combustion reaction is/are:

a. Carbon dioxide
b. Water
c. Fuel
d. Fuel, oxygen and heat

Answer: (d.)

Explanation: The combustion reaction requires a fixed temperature in order to undergo combustion. For this purpose, heat, oxygen and fuel are required.

Q11. Do metals form ashes upon combustion?

Answer: The metals react in the presence of oxygen and form metal oxides. This is a combination reaction and since oxygen gets combined with the metal, the mass of the metal increases unlike ashes which are very lighter in mass.

Q12. What must the methane gas be combined with in order to undergo combustion?

Answer: The methane gas must be combined with oxygen to undergo combustion.

Q13. What happens when acetic acid is burnt in the presence of air (excess oxygen)?

Answer: On burning in the presence of air, the acetic acid undergoes a combustion reaction producing carbon dioxide gas and water.

$$CH_3COOH\ (l) + 2O_2\ (g) \xrightarrow{Combustion} 2CO_2\ (g) + 2H_2O\ (g)$$

Q14. Why do some materials burn with a flame while others burn without a flame?

Answer: The substances that produce a flame when they are burnt undergo an incomplete combustion reaction. Due to the incomplete combustion, carbon is produced as soot which causes the flames. However, the substances that undergo complete combustion do not produce any carbon and hence, do not burn with any flame.

Q15. Why does the wood burn but not iron?

Answer: This is because the wood has less dense structure than that of iron as the structure of wood contains many air pockets. Also, the ignition temperature of wood is lesser than that of carbon. Hence, wood burns easily but not iron. However, iron can be put to combustion by dividing it into very small particles or converting it into iron wool.

Practise Questions on Carbonyl Compounds

Q1. Can steam cause items to catch fire?

Answer: The steam does not cause the substances to catch fire. However, in the steam radiators, the accumulated dust and debris may catch fire.

Q2. Acetylene burns in air to form carbon dioxide and water. Give a balanced chemical equation for this reaction and mention the steps involved in balancing.

Answer: The reaction for the burning of acetylene is given hereunder.

$$C_2H_2 + O_2 \rightarrow CO_2 + H_2O$$

To begin with balancing the equation, at first, the molecular oxygen is written into its atomic form.

$$C_2H_2 + O \rightarrow CO_2 + H_2O$$

The rest of the elements are balanced in the order: C, H and O respectively.
The number of atoms of carbon on the left hand side are two while its number on the right hand side of the equation is only 1. Hence, CO_2 is multiplied by 2 in order to balance the carbon atoms on both sides.

$$C_2H_2 + O \rightarrow 2CO_2 + H_2O$$

Now that the carbon atoms are balanced, the hydrogen atoms are to be checked on both sides. As is clear from the equation, the number of hydrogen atoms are equal on both sides of the equation. Hence, hydrogen atoms need not to be balanced.
Now, as we see, the number of oxygen atoms is unequal, 5 on the R.H.S. and only 1 at the L.H.S. Hence, O on the L.H.S. is multiplied by 5 giving an atomic equation.

$$C_2H_2 + 5O \rightarrow 2CO_2 + H_2O$$

Now the above atomic equation is converted into a molecular equation by multiplying the whole equation by 2. Hence, the equation becomes:

$$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$$

Q3. Calculate the amount of water produced by the combustion of 16 g methane.

Answer: The balanced chemical equation for the combustion of methane is as follows:

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

From the above balanced equation, we can see that 1 mole of methane produces 2 moles of H_2O by undergoing combustion.
Mass of 1 mole of methane (CH_4) = 12 + 4 x 1 = 16 g mol^{-1}
Mass of 1 mole of water (H_2O) = 2x1 + 16 = 18 g mol^{-1}
Two moles of water would weigh = 18 g mol^{-1} x 2 mol = 36 g
Hence, 16 g methane upon combustion produces 36 g of water.

Q4. How many moles of the methane gas are required to produce 22 g of carbon dioxide gas as a result of its combustion?

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

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

This shows that 1 mole of CH_4 burns to form 1 mole of CO_2.
Mass of 1 mole of CO_2 = 12 + 2x16 = 44 g
Hence, 44 g of CO_2 is formed by moles of CH_4 = 1 mol
22 g of CO_2 is formed by moles of CH_4 = (1 / 44) mol g^{-1} x 22 g = 0.5 mol
Therefore, 0.5 moles of CH_4 are required to form 22 g of CO_2 after undergoing combustion.

Q5. Iron is converted into its oxide (Fe_3O_4) by the action of steam on it. Calculate the mass of iron that will be converted to its oxide by the action of 18 g of steam.

Answer: The balanced chemical equation for the reaction of iron with steam is:

$$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$$

Mass of 3 moles of Fe used in the reaction = 3 mol x 56 g mol^{-1} = 168 g
Mass of 4 moles of water (steam) used up by iron = 4 mol x 18 g mol^{-1} = 72 g
This implies that 72 g of steam reacts with 168 g of Fe.
Hence, 18 g steam will react with iron = (168 / 72) x 18 g = 42 g
Hence. 42 g of iron gets converted into its oxide by the action of 18 g of steam.