CHEMICAL DISPALCEMENT & DOUBLE DISPLACEMENT REACTIONS SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

1. Magnesium + Copper sulfate $\rightarrow$?

A) No reaction B) Copper + Magnesium sulfate C) Magnesium + Copper D) Magnesium sulfate + $CuSO_4$

Solution:When magnesium (Mg) reacts with copper sulfate ($CuSO_4$), a single displacement reaction occurs because magnesium is more reactive than copper (as seen in the reactivity series).

$MgCuSO \rightarrow MgSOCu$

Answer:B

2. Which of the following will not result in a displacement reaction?

A) Iron + Copper sulfate B) Zinc + Iron sulfate

C) Copper + Silver nitrate D) Silver + Copper sulfate

Solution:A displacement reaction occurs when a more reactive metal displaces a less reactive metal from its compound. The reactivity series determines this:

K > Na > Ca > Mg > Al > Zn > Fe > Sn > Pb > Cu > Ag > Au

Silver (Ag) is below copper (Cu) in the reactivity series, making this the only option where displacement cannot occur.

Answer:D

3. What is the product when potassium reacts with water?

A) $KOH + H_2$ B) $KH + H_2O$ C) $K_2O + H_2$ D) $KOH + O_2$

Solution:When potassium (K) reacts violently with water (H_2O), it undergoes a single displacement reaction, producing:

Potassium hydroxide (KOH)

Hydrogen gas (H_2)

Balanced Reaction: $2K + 2H_2O \rightarrow 2KOH + H_2$

Answer:A

4. Which of the following metals can displace iron from iron(III) chloride?

A) Copper B) Gold C) Zinc D) Silver

Solution:To displace iron from iron(III) chloride (FeCl3), the reacting metal must be more reactive than iron in the reactivity series.

Reactivity Series (Key Segment):

K > Na > Ca > Mg > Al > Zn > Fe > Sn > Pb > Cu > Ag > Au

Zinc (Zn) $\rightarrow$ Can displace iron

Answer:C

5. In the reaction: $Fe + Pb(NO_3)_2 \rightarrow$?

A) $Fe(NO_3)_2 + Pb$ B) $PbFe + NO_3$ C) No reaction D) $Pb(NO_3)_3 + Fe$

Solution:This is a single displacement reaction where iron (Fe) displaces lead (Pb) from lead(II) nitrate because iron is more reactive than lead.

$Fe + Pb(NO_3)_2 \rightarrow Fe(NO_3)_2 + Pb$

Answer:A

6. Identify the correct products of this reaction: $2Al + 3CuCl2 \rightarrow$?

A) AlCl + Cu B) $AlCl_3 + 2Cu$ C) $2AlCl_3 + 3Cu$ D) $2AlCl_3 + Cu$

Solution:$2Al + 3CuCl2 \rightarrow 2AlCl_3 + 3Cu$

Answer:C

7. Which of the following is a displacement reaction?

A) $NaOH + HCl \rightarrow NaCl + H_2O$ B) $CaCO_3 \rightarrow CaO + CO_2$

C) $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$ D) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + HCl$

Solution:Iron (Fe) displaces copper (Cu) from copper sulfate because Fe is more reactive than Cu.

Answer:C

8.. Which reaction produces a precipitate?

A) $HCl + NaOH \rightarrow NaCl + H_2O$ B) $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$

C) $Zn + HCl \rightarrow ZnCl_2 + H_2$ D) $Ca + O2 \rightarrow CaO$

Solution: $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$

Double displacement reaction that forms a white precipitate of silver chloride (AgCl)

Answer:B

9. Which of the following reactions is a redox and displacement reaction?

A) $Cu + AgNO_3 \rightarrow Cu(NO_3)_2 + Ag$ B) $NaOH + HCl \rightarrow NaCl + H_2O$

C) $H_2SO_4 + CaCO_3 \rightarrow CaSO_4 + CO_2 + H_2O$ D) $Fe + O_2 \rightarrow Fe_2O_3$

Solution:$Cu + AgNO_3 \rightarrow Cu(NO_3)_2 + Ag$

Displacement Reaction:

Copper (Cu) displaces silver (Ag) from silver nitrate because Cu is more reactive than Ag.

Redox Reaction:

Oxidation: $Cu \rightarrow Cu^{2+} + 2e^-$ (Copper loses electrons).

Reduction: $Ag^+ + e^- \rightarrow Ag$ (Silver ions gain electrons).

Answer:A

10. In which reaction does a more reactive halogen displace a less reactive one?

A) Cl2 + 2NaBr $\rightarrow$2NaCl + Br_2 B) $Br_2 + NaCl \rightarrow NaBr + Cl_2$

C) $I_2 + NaCl \rightarrow NaI + Cl_2$ D) $NaCl + NaBr \rightarrow NaClBr_2$

Solution:Cl2 + 2NaBr $\rightarrow$2NaCl + Br_2

This is a halogen displacement reaction, where a more reactive halogen (Cl_2) displaces a less reactive halogen (Br^-) from its compound.

Reactivity Trend for Halogens:$F_2 > Cl_2 > Br_2 > I_2$

(Fluorine is most reactive; iodine is least reactive)

Redox Process:

Oxidation: $Br^- \rightarrow Br_2 + 2e^-$ (Bromide ions lose electrons).

Reduction: $Cl_2 + 2e^- \rightarrow 2Cl^-$ (Chlorine gains electrons).

Observations:Color Change: Colorless NaBr solution turns orange/brown (Br2 forms).

Answer:A

11. Which of the following is both a precipitation and double displacement reaction?
A) $H2 + Cl_2 \rightarrow 2HCl$ B) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
C) $Pb(NO_3)_2 + KI \rightarrow PbI_2\downarrow + 2KNO_3$ D) $Fe + O_2 \rightarrow Fe_2O_3$
Solution:This reaction is both a precipitation and a double displacement reaction:
Double Displacement:
Pb^{2+} and K^+ swap partners:$Pb(NO_3)_2 + KI \rightarrow PbI_2\downarrow + 2KNO_3$
Precipitation:Lead(II) iodide (PbI_2) forms a bright yellow solid (insoluble in water).
Answer:C
12. Which of these is a thermal decomposition reaction?
A) $KBr + Cl_2 \rightarrow KCl + Br_2$ B) $CuSO_4 \cdot 5H_2O \rightarrow CuSO_4 + 5H_2O$
C) $Mg + HCl \rightarrow MgCl_2 + H_2$ D) $NaOH + HCl \rightarrow NaCl + H_2O$
Solution:This is a thermal decomposition reaction because:
A single compound (hydrated copper sulfate) breaks down into simpler substances (anhydrous $CuSO_4$ and water) upon heating.
The reaction is reversible (anhydrous $CuSO_4$ can reabsorb water).
Answer:B
13. Which reaction involves a gas evolution along with a displacement?
A) $Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow$ B) $Na_2CO_3 + HCl \rightarrow NaCl + H_2O$
C) $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$ D) $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$
Solution:$Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow$
Displacement:
Zinc (Zn) displaces hydrogen (H^+) from hydrochloric acid because Zn is more reactive than H.
Gas Evolution:
Hydrogen gas (H_2) is released, evident by effervescence.
Answer:A
14. Which of the following best illustrates all of the following: redox, displacement, and formation of a salt?
A) $CuSO_4 + H2O \rightarrow$ No change B) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
C) $H_2SO_4 + NaOH \rightarrow Na_2SO_4 + H_2O$ D) $CaCO_3 + HCl \rightarrow CaCl_2 + CO_2 + H_2O$
Solution: $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
This reaction perfectly illustrates all three required characteristics:
Redox Reaction:
Oxidation: $Zn \rightarrow Zn^{2+} + 2e^-$ (zinc loses electrons)
Reduction: $Cu^{2+} + 2e^- \rightarrow Cu$ (copper ions gain electrons)
Displacement Reaction:
More reactive zinc displaces less reactive copper from its compound
Formation of a Salt:
Zinc sulfate ($ZnSO_4$) is formed as the ionic salt product
Answer:B

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

15.Which of the following is/are redox reactions?

A) $2Na + Cl_2 \rightarrow 2NaCl$ B) $CaCO_3 \rightarrow CaO + CO_2$

C) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$ D) $HCl + NaOH \rightarrow NaCl + H_2O$

Solution:A) $2Na + Cl_2 \rightarrow 2NaCl$

Sodium (Na) is oxidized (loses electrons, goes from (0) to (+1)).

Chlorine ($Cl_{2)}$) is reduced (gains electrons, goes from (0) to (-1)).

This is a redox reaction.

B) $CaCO_3 \rightarrow CaO + CO_2$

This is a decomposition reaction, but no change in oxidation states occurs.Not a redox reaction.

C) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

Zinc (Zn) is oxidized (goes from (0) to (+2)).

Copper Cu^{2+} is reduced (goes from (+2) to (0)).

This is a redox reaction (single displacement).

D) $HCl + NaOH \rightarrow NaCl + H_2O$

This is a neutralization (acid-base) reaction, with no change in oxidation states.

Not a redox reaction.

Answer:A,C

16.Which of the following is/are decomposition reactions?

A) $2H_2O \rightarrow 2H_2 + O_2$ (Electrolysis of water) B) $NH_4Cl \rightarrow NH_3 + HCl$ (Thermal decomposition)

C) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (Combustion)D) $2AgCl \rightarrow 2Ag + Cl_2$ (Photolysis)

Solution:A) $2H_2O \rightarrow 2H_2 + O_2$

Water decomposes into hydrogen and oxygen.Decomposition reaction.

B) $NH_4Cl \rightarrow NH_3 + HCl$

Ammonium chloride breaks down into ammonia and hydrogen chloride upon heating.Decomposition reaction.

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

Methane reacts with oxygen to form carbon dioxide and water.

This is a combustion reaction, not a decomposition.

D) $2AgCl \rightarrow 2Ag + Cl_2$ (Photolysis)

Silver chloride decomposes into silver and chlorine gas upon exposure to light.

Decomposition reaction.

Answer:A,B,D

17.Which of the following involve both precipitation and neutralization?

A) $H_2SO_4 + Ba(OH)_2 \rightarrow BaSO_4\downarrow + 2H_2O$ B) $Pb(NO_3)_2 + 2KI \rightarrow PbI_2\downarrow + 2KNO_3$

C) $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$ D) $CuSO_4 + H_2S \rightarrow CuS\downarrow + H_2SO_4$

Solution:A) $H_2SO_4 + Ba(OH)_2 \rightarrow BaSO_4\downarrow + 2H_2O$

Neutralization: An acid H_2SO_4 reacts with a base$Ba(OH)_2$ to form water.

Precipitation: Insoluble $BaSO_4$(barium sulfate) forms as a white precipitate.

This reaction involves both processes.

B) $Pb(NO_3)_2 + 2KI \rightarrow PbI_2\downarrow + 2KNO_3$

Precipitation only: PbI_2(lead iodide) forms a yellow precipitate, but there is no acid-

base reaction.
C) $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$
Neutralization only: A base Na_2CO_3reacts with an acid HCl , but no insoluble precipitate forms (all products are soluble or gaseous).

D) $CuSO_4 + H_2S \rightarrow CuS\downarrow + H_2SO_4$

Precipitation only: (CuS) (copper sulfide) forms a black precipitate, but no neutralization occurs (the product (H_2SO_4) is still acidic).

Answer:A

Statement Type:

18.Statement I:The reaction $Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow$ is a displacement reaction.
Statement II:A more reactive metal displaces hydrogen from an acid to form a salt and hydrogen gas.
Solution:Statement I:
The reaction $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ is indeed a displacement reaction because zinc (Zn) displaces hydrogen (H) from hydrochloric acid (HCl).
Statement II:
This statement provides the general rule that a more reactive metal (like Zn) can displace hydrogen from an acid, forming a salt and hydrogen gas.
Since zinc is more reactive than hydrogen, it displaces H? from HCl, confirming the nature of the reaction in Statement I.
Conclusion:
Both statements are correct, and Statement II correctly explains Statement I.
Answer:A

19.Statement I:The reaction $2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2\uparrow$ is a redox reaction.
Statement II:In this reaction, chlorine is oxidized from −1 to 0, while manganese is reduced from +7 to +2.
Solution:Statement I:
The reaction $2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$ is a redox reaction because oxidation and reduction occur simultaneously.
Statement II:
Oxidation: Chlorine (in HCl) is oxidized from −1 to 0 (in Cl_2).
Reduction: Manganese (in $KMnO_4$) is reduced from +7 to +2 (in ($MnCl_2$).
This change in oxidation states confirms that it is a redox reaction, supporting Statement I.
Answer:A
Comprehension Type:
Comprehension - I
20.When a zinc strip is placed in a solution of iron(II) sulfate (FeSO4), the reaction

occurs as:
Zn + FeSO4 $\rightarrow$ X + Fe
Identify X:
A) $ZnSO_3$ B) $ZnSO_4$ C) ZnO D)FeZn
Solution:Zn + FeSO4 $\rightarrow$ $ZnSO_4$ + Fe
Zinc (Zn) replaces iron (Fe) in the compound, forming zinc sulfate ($ZnSO_4$) and iron metal (Fe).
X = $ZnSO_4$
Answer:B
21.A student mixes $BaCl_2$(aq) with Na_2SO_4(aq). The correct equation and product are:
A) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4\downarrow + 2NaCl$ B) $BaCl_2 + Na_2SO_4 \rightarrow BaNa + Cl_2SO_4$
C) $BaCl_2 + Na_2SO_4 \rightarrow Ba(SO_4)_2 + NaCl$ D) $BaCl_2 + Na_2SO_4 \rightarrow BaO + Na_2Cl_2 + SO_3$
Solution:A) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4\downarrow + 2NaCl$
This is a double displacement (precipitation) reaction, where barium chloride($BaCl_2$)reacts with sodium sulfate (Na_2SO_4) to form:
Barium sulfate ($BaSO_4$) $\rightarrow$ A white precipitate (insoluble in water).
Sodium chloride (NaCl) $\rightarrow$ Remains in solution as a soluble salt.
Answer:A
Comprehension - II
22.In a hydrogen replacement reaction, what is replaced by an active metal?
A) Oxygen B) Water C) Hydrogen D) Carbon
Solution:In a hydrogen replacement reaction, an active metal (such as sodium, potassium, calcium, or zinc) replaces hydrogen from:
Acids (e.g., ($Zn + 2HCl \rightarrow ZnCl_2 + H_2$)
Water (e.g., ($2Na + 2H_2O \rightarrow 2NaOH + H_2$)
Answer:C
23.What is typically observed when an active metal reacts with an acid in a hydrogen replacement reaction?
A) A salt is formed and oxygen gas is releasedB) The solution turns green
C) Hydrogen gas is released D) The metal dissolves without any gas formation
Solution:
In a hydrogen replacement reaction, an active metal (e.g., zinc, magnesium, or aluminum) reacts with an acid (e.g., HCl or (H_2SO_4)), producing:
A salt (e.g., ($ZnCl_2$), ($MgSO_4$))
Hydrogen gas (H_2) $\rightarrow$ Observed as bubbles/fizzing
Answer:C
Integer type:
24. Among Ca, Pb, Au, Al — how many are more reactive than copper (Cu)?
Solution:Reactivity Series :K > Na > Ca > Mg > Al > Zn > Fe > Sn > Pb > Cu > Ag > Au
3 metals (Ca, Al, Pb) are more reactive than Cu.Gold (Au) is not more reactive.
Answer:3
25. Among Li, Fe, Ag, Hg, Na, Sn — how many can displace hydrogen from hydrochloric acid (HCl)?
Solution:Reactivity Series (Partial):

Lithium (Li)>Sodium (Na)>Iron (Fe)>Tin (Sn)>Hydrogen (H2) >Mercury (Hg)>Silver (Ag)
4 metals (Li, Na, Fe, Sn) can displace H2 from HCl.
Ag and Hg cannot.

Answer:4

Matrix Matching Type:

24. **COLUMN -I** **COLUMN-II**

A. $Zn + H_2SO_4 \rightarrow$ 1.$KCl + I_2$

B. $CaO + H_2O \rightarrow$ 2.$BaSO_4\downarrow + 2NaCl$

C. $BaCl2 + Na_2SO_4 \rightarrow$ 3.$ZnSO_4 + H_2\uparrow$

D. $Cl_2 + 2KI \rightarrow$ 4.$Ca(OH)_2$

Solution:

A. $Zn + H_2SO_4 \rightarrow$ 3.$ZnSO_4 + H_2\uparrow$

B. $CaO + H_2O \rightarrow$ 4.$Ca(OH)_2$

C. $BaCl2 + Na_2SO_4 \rightarrow$ 2.$BaSO_4\downarrow + 2NaCl$

D. $Cl_2 + 2KI \rightarrow$ 1.$KCl + I_2$

Answer:A-3,B-4,C-2,D-1

LEARNERS TASK

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ's)

1. Which of the following reactions is a displacement reaction?

A) $HCl + NaOH \rightarrow NaCl + H_2O$ B) $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$

C) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$ D) $CaO + CO_2 \rightarrow CaCO_3$

Solution:$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ Displacement Reaction: A more reactive element displaces a less reactive one from its compound.Mg (Magnesium) is more reactive than Cu (Copper) (refer to the reactivity series).

Mg displaces Cu from $CuSO_4$, forming $MgSO_4$ and Cu metal.

Answer:B

2. What type of reaction is: $CaCl_2 + Na_2CO_3 \rightarrow CaCO_3\downarrow + 2NaCl$

A) Combination reaction B) Displacement reaction

C) Precipitation reaction D) Neutralisation reaction

Solution:This is a double displacement reaction (ions exchange partners).

$CaCO_3$ (calcium carbonate) forms as a white precipitate, making it a precipitation reaction.

Answer:C

3. In the reaction $Fe + CuCl_2 \rightarrow FeCl_2 + Cu$, which element is displaced?

A) Iron B) Chlorine C) Copper D) Hydrogen

Solution:Copper (Cu) is displaced from $CuCl_2$ by the more reactive Iron (Fe).

Answer:C

4. Which of the following combinations results in the formation of a gas?

A) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$ B) $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

C) $NaOH + HCl \rightarrow NaCl + H_2O$ D) $Cu + FeSO_4 \rightarrow$ No reaction

Solution:Zinc (Zn) reacts with dilute sulfuric acid (H_2SO_4) to produce zinc sulfate ($ZnSO_4$) and hydrogen gas (H_2).

Observation: Bubbles/fizzing due to H2 gas release

Answer:A

5. Which of the following metals cannot displace hydrogen from acids?

A) Mg B) Al C) Cu D) Zn

Solution:Metals that can displace hydrogen from acids must be more reactive than hydrogen in the reactivity series.

Copper (Cu) is below hydrogen in the reactivity series, so it cannot displace hydrogen from acids

Answer:C

6. Which of the following reactions is a neutralisation reaction?

A) $K + H_2O \rightarrow KOH + H_2$ B) $NaOH + HNO_3 \rightarrow NaNO_3 + H_2O$

C) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$ D) $Pb(NO_3)_2 + KI \rightarrow PbI_2 + KNO_3$

Solution: Neutralization Reaction:

An acid (HNO_3) reacts with a base (NaOH) to form salt ($NaNO_3$) and water (H_2O).

General form: Acid + Base $\rightarrow$ Salt + Water.

$NaOH + HNO_3 \rightarrow NaNO_3 + H_2O$

Answer:B

7. Which of the following produces a white precipitate?

A) $AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$ B) $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$

C) $HCl + NaOH \rightarrow NaCl + H_2O$ D) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

Solution:When silver nitrate ($AgNO_3$) reacts with sodium chloride (NaCl), silver chloride (AgCl) forms as an insoluble white precipitate.

$AgNO_3 + NaCl \rightarrow AgCl\downarrow + NaNO_3$

Answer:A

8. Identify the precipitate in the reaction: $Ba(NO_3)_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaNO_3$

A) $NaNO_3$ B) $Ba(NO_3)_2$ C) $BaSO_4$ D) Na_2SO_4

Solution:Barium sulfate ($BaSO_4$) is insoluble in water, forming a white solid precipitate.

The other product, $NaNO_3$ (sodium nitrate), remains dissolved in water.

Answer:C

9. Which reaction involves both oxidation and reduction (redox)?

A) $Cu + AgNO_3 \rightarrow Cu(NO_3)_2 + Ag$ B) $HCl + NaOH \rightarrow NaCl + H_2O$

C) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + NaCl$ D) $CaCO_3 \rightarrow CaO + CO_2$

Solution:A) $Cu + AgNO_3 \rightarrow Cu(NO_3)_2 + Ag$

Redox Process:

Oxidation: Copper (Cu) loses electrons, going from 0 to +2 oxidation state.

$Cu \rightarrow Cu^{2+} + 2e^-$

Reduction: Silver (Ag^+) gains electrons, going from +1 to 0 oxidation state.

$Ag^+ + e^- \rightarrow Ag\}$

B) $HCl + NaOH \rightarrow NaCl + H_2O$ $\rightarrow$Neutralization (no oxidation state changes).

C) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + NaCl$ $\rightarrow$ Double displacement (no redox).

D) $CaCO_3 \rightarrow CaO + CO_2$ $\rightarrow$ Decomposition (no redox; oxidation states remain unchanged).

Answer:A

10. Which of the following statements is true regarding the reaction: $2Al + 3FeSO_4 \rightarrow Al_2(SO_4)_3 + 3Fe$

A) Aluminium is less reactive than iron B) Iron displaces aluminium

C) It's a neutralisation reaction D) Aluminium displaces iron from its salt solution

Solution:Aluminium (Al) displaces iron (Fe) from iron sulfate ($FeSO_4$), forming aluminum sulfate ($Al_2(SO_4)_3$) and iron metal (Fe).

Displacement occurs because Al is more reactive than Fe (higher in the reactivity series).

This is a classic single displacement (redox) reaction.

Answer:D

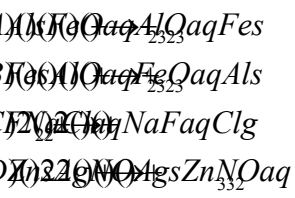
JEE MAINS LEVEL QUESTIONS

11. Which of the following would result in a displacement reaction?
A) Sodium with potassium chloride B) Potassium with sodium chloride
C) Sodium with calcium sulfate D) Platinum with gold nitrate
Solution:A displacement reaction occurs when a more reactive metal displaces a less reactive metal from its compound.
Reactivity Series (Key Metals):
K > Na > Ca > Mg > Al > Zn > Fe > Sn > Pb > Cu > Ag > Au > Pt
Analysis of Options:
A) Sodium (Na) + Potassium chloride (KCl) $\rightarrow$No reaction
Na is less reactive than K (cannot displace K).
B) Potassium (K) + Sodium chloride (NaCl) $\rightarrow$ Displacement occurs
K is more reactive than Na, so:K + NaCl $\rightarrow$KCl+ Na
C) Sodium (Na) + Calcium sulfate (CaSO4) $\rightarrow$No reaction
While sodium is more reactive than calcium, calcium is not in a free elemental state in calcium sulfate, so this is not a typical displacement reaction.
D) Platinum (Pt) + Gold nitrate ($AuNO_3$) $\rightarrow$No reaction
Pt is less reactive than Au (cannot displace Au).
Answer:B

12. What is produced when zinc reacts with sulfuric acid?
A) Zinc nitrate and hydrogen gas B) Zinc sulfate and hydrogen gas
C) Zinc oxide and oxygen gas D) Zinc chloride and hydrogen gas
Solution:When zinc (Zn) reacts with sulfuric acid (H_2SO_4), a single displacement reaction occurs, producing zinc sulfate ($ZnSO_4$) and hydrogen gas (H_2)
$Zn+H_2SO_4 \rightarrow ZnSO_4+H_2$
Answer:B

13. Which of the following will NOT undergo a reaction?
A) Aluminum metal + aluminum oxideB) Magnesium metal + copper oxide
C) Aluminum metal + iron oxide D) Sodium + magnesium oxide
Solution:For a reaction to occur, a more reactive metal must displace a less reactive metal from its compound.
Reactivity Series (Key Metals):
Na > Mg > Al > Zn > Fe > Cu
Analysis of Options:
A) Al + Al_2O_3 $\rightarrow$ No reaction
A metal cannot displace itself from its own oxide.
B) Mg + CuO $\rightarrow$Reaction occurs
Mg is more reactive than Cu:Mg + CuO $\rightarrow$MgO + Cu
C) Al + Fe_2O_3 $\rightarrow$ Reaction occurs (Thermite)
Al is more reactive than Fe: 2Al + Fe_2O_3 $\rightarrow Al_2O_3$ + 2Fe
D) Na + MgO $\rightarrow$Reaction occurs
Na is more reactive than Mg:2 Na + MgO $\rightarrow Na_2O$ + Mg
Answer:A

14. In which reaction does the solution turn green?
A) Iron + copper sulfate solution B) Zinc + hydrochloric acid
C) Copper + silver nitrate solution D) Sodium hydroxide + iron chloride
Solution::Reaction:
A)$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$
$FeSO_4$ (iron(II) sulfate) forms a pale green solution.
Copper (Cu) appears as a reddish-brown deposit.
B) $Zn + HCl \rightarrow$ Colorless solution ($ZnCl_2$ forms, no color change).
C) $Cu + AgNO_3 \rightarrow$ Blue solution ($Cu(NO_3)_2$ forms, not green).
D) $NaOH + FeCl_3 \rightarrow$ Rust-brown precipitate ($Fe(OH)_3$), not green solution.
Answer:A
15. Which of the following reactions does NOT occur?



Solution:Iron (Fe) is less reactive than aluminum (Al) (refer to the reactivity series: Al > Fe).
A less reactive metal cannot displace a more reactive metal from its oxide.
Hence, Fe cannot reduce Al_2O_3 to form Al.
B) $Fe + Al_2O_3 \rightarrow Fe_2O_3 + Al$ (this reaction does not occur).
Answer:B
16. In which reaction does a blue solution turn colorless?
A) Copper sulfate + zinc metal B) Silver nitrate + copper metal
C) Sodium hydroxide + copper sulfateD) Hydrochloric acid + sodium carbonate
Solution: Copper sulfate + zinc metal (the blue solution turns colorless due to the displacement of copper by zinc).
Answer:A
17. Which statement about halogens is correct?
A) Fluorine is the least reactive halogen
B) Chlorine is more reactive than bromine
C) Iodine is more reactive than chlorine
D) Bromine is the most reactive halogen
Solution:Reactivity Trend of Halogens (Group 17):
F > Cl > Br > I (Reactivity decreases down the group).
Analysis of Options:
A) Fluorine is the least reactive halogen $\rightarrow$ False. Fluorine is the most reactive halogen.
B) Chlorine is more reactive than bromine $\rightarrow$ True (Cl is above Br in the group).
C) Iodine is more reactive than chlorine $\rightarrow$ False. Iodine is less reactive than chlorine.
D) Bromine is the most reactive halogen $\rightarrow$ False. Fluorine holds this title.
Answer:B
18. Which of the following reactions occurs?

A) $Br_2(g) + 2NaCl(aq) \rightarrow 2NaBr(aq) + Cl_2(g)$

B) $I_2(s) + 2NaBr(aq) \rightarrow 2NaI(aq) + Br_2(l)$

C) Both A & B D) None of the above

Solution:Reactivity of Halogens:

$F_2 > Cl_2 > Br_2 > I_2$ (Reactivity decreases down Group 17).

Analysis of Reactions:

A) $Br_2 + 2NaCl \rightarrow 2NaBr + Cl_2$

Bromine (Br_2) is less reactive than chlorine (Cl_2), so it cannot displace Cl^- from NaCl.

This reaction does NOT occur.

B) $I_2 + 2NaBr \rightarrow 2NaI + Br_2$

Iodine (I_2) is less reactive than bromine (Br_2), so it cannot displace Br- from NaBr.

This reaction does NOT occur.

Answer:D

19. $HSO(aq) + KOH(aq) \rightarrow KSO(aq) + HOl$ is an example of:

A) Neutralization B) Decomposition

C) Double displacement D) Both A & C

Solution:. $HSO(aq) + KOH(aq) \rightarrow KSO(aq) + HOl$

This reaction fits both neutralization and double displacement categories.

Answer:D

20. Which reactions are precipitation reactions?

A) $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$

B) $CaCl_2(aq) + Na_2CO_3(aq) \rightarrow CaCO_3(s) + 2NaCl(aq)$

C) Both A & B D) None

Solution:Two soluble ionic compounds react to form one insoluble solid (precipitate) and one soluble compound.

Both reactions clearly form precipitates (PbI_2 and $CaCO_3$),

Answer:C

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

21. $(A^+ B^-) + (C^+ D^-) \rightarrow (A^+ D^-) + (C^+ B^-)$ represents:

A) Chemical displacement

B) Chemical double displacement reaction.

C) Chemical double decomposition reaction.

D) Chemical combination.

Solution:Double Displacement (B):

The positive ions ($A^+$and C^+) swap places with the negative ions (B^- and D^-).

Double Decomposition (C):

This is another name for double displacement in older terminology.

The reaction involves two compounds exchanging ions to form two new compounds.

Answer:B,C

Statement Type:

22. Statement I: When zinc reacts with dilute sulfuric acid, zinc sulfate and hydrogen gas are produced
Statement II: This reaction is an example of a displacement reaction where zinc replaces hydrogen from the acid.
Solution:Statement I:Correct: The reaction of zinc with dilute sulfuric acid produces zinc sulfate and hydrogen gas
$Zn+H_2SO_4 \rightarrow ZnSO_4+H_2$
Bubbles of hydrogen gas (H_2) are released, and zinc sulfate ($ZnSO_4$) forms in solution.
Statement II:
Correct: This is a displacement reaction because zinc (Zn), being more reactive than hydrogen, displaces H^+ from the acid.
Zinc loses electrons (oxidized to Zn^{2+}).
Hydrogen ions (H^+) gain electrons (reduced to H_2 gas).
Displacement confirmed: Zn pushes hydrogen out of the compound ($H_2SO_4 \rightarrow H_2$).

Answer:A

23. Statement I: When chlorine gas is bubbled through a sodium bromide solution, the solution turns reddish-brown due to the formation of bromine.
Statement II: Chlorine is a stronger oxidizing agent than bromine, so it oxidizes bromide ions to bromine in a redox displacement reaction.
Solution:Statement I:
Correct: When chlorine gas (Cl_2) is bubbled through a sodium bromide (NaBr)
$Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$
Observation: The solution turns reddish-brown due to the formation of bromine (Br_2), which is soluble in water and gives this characteristic color.
Statement II:
Correct: Chlorine is a stronger oxidizing agent than bromine (higher up in Group 17 reactivity: ($F_2 > Cl_2 > Br_2 > I_2$).
Redox Mechanism:
Oxidation: ($2Br^- \rightarrow Br_2 + 2e^-$) (Bromide ions lose electrons).
Reduction: ($Cl_2 + 2e^- \rightarrow 2Cl^-$) (Chlorine gains electrons).
Displacement Confirmed: (Cl_2) displaces (Br^-) from (NaBr), proving its stronger oxidizing ability.
Statement II explains why Statement I occurs: Chlorine's superior oxidizing power forces bromide ions to become bromine, causing the color change.

Answer:A

Comprehension Type:

24.Which of the following is an example of a double displacement reaction?

A) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

B) $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

C) $CaCO_3 \rightarrow CaO + CO_2$

D) $2H_2O \rightarrow 2H_2 + O_2$

Solution:$AgNO_3$+NaCl$\rightarrow$AgCl+$NaNO_3$ is adouble displacement reaction.

Answer:B

Integer type:

25. How many oxygen atoms are present in aluminum sulfate, $Al_2(SO_4)_3$?

Solution:Oxygen atoms=3(4)=12

Answer:12

26. Double displacement reactions are broadly classified into how many types based on product formation?

Solution: Precipitation, Gas-Formation, and Neutralization.

Answer:3

27. In the reaction $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$, how many moles of potassium nitrate (KNO_3) are produced when 5 moles of KI react completely?

Solution:2 moles of KI produce 2 moles of KNO_3.

Simplifying, 1 mole of KI produces 1 mole of KNO_3.

So 5 moles of KI produces 5 moles of KNO_3

Answer:5

28. In the reaction $Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$, what is the change in oxidation number of chlorine?

Solution:Reactant (Cl_2): 0 (each Cl atom).

Product (Cl^- in NaCl): -1 (reduced state).The oxidation number of chlorine changes from 0 to -1, indicating a decrease by 1.

Answer:-1

Matrix Matching Type:

29. Solution:

COLUMN -I	**COLUMN-II**
A) Combination	1) $2Mg + O_2 \rightarrow 2MgO$
B) Decomposition	2) $2H_2O_2 \rightarrow 2H_2O + O_2$
C) Displacement	3) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
D) Double Displacement	4) $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

Answer:A-1,B-2,C-3,D-4

KEY

				TEACHING TASK					
1	2	3	4	5	6	7	8	9	10
B	D	A	C	A	C	C	B	A	A
11	12	13	14	15	16	17	18	19	20
C	B	A	B	A,C	A,B,D	A	A	A	B
21	22	23	24	25	26				
A	C	C	3	4	A-3,B-4,C-2,D-1				
				LEARNERS TASK					
1	2	3	4	5	6	7	8	9	10
B	C	C	A	C	B	A	C	A	D
11	12	13	14	15	16	17	18	19	20
B	B	A	A	B	A	B	D	D	C
21	22	23	24	25	26	27	28	29	30
B,C	A	A	B	12	3	5	-1	A-1,B-2,C-3,D-4	