Chapter 1 Chemical Reactions and Equations

Q 1. Why should a magnesium ribbon be cleaned before burning in air?

Ans. Before burning in air, the magnesium ribbon is cleaned by rubbing with a sandpaper. This is done to remove the protective layer of basic magnesium carbonate from the surface of magnesium ribbon so that it may readily combine with the oxygen of air (on heating).

Q 2. Write the balanced equation for the following chemical reactions:

(i) Hydrogen + Chlorine \rightarrow Hydrogen chloride

- (ii) Barium chloride + Aluminium sulphate \rightarrow Barium sulphate + Aluminium chloride
- (iii) Sodium + Water \rightarrow Sodium hydroxide + Hydrogen

Ans. (i) $H_2 + Cl_2 \rightarrow 2HCl$ (ii) $3BaCl_2 + Al_2 (SO_4)_3 \rightarrow 3BaSO_4 + 2AlCl_3$ (iii) $2Na + 2H_2O \rightarrow 2NaOH + H_2$

Q 3. Write a balanced chemical equation with state symbols for the following reactions.

(i) Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution

of sodium chloride.

(ii) Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride Solution and water.

Ans. (i) BaCl ₂ (aq)	+	Na_2SO_4 (aq)	\rightarrow	$BaSO_4(s)$	+	2NaCl (aq)
Barium chloride		Sodium sulphate		Barium sulphate		Sodium chloride
(ii) NaOH (aq)	+	HCl (aq)	\rightarrow	NaCl (aq)	+	$_{H_2O}(l)$
Sodium hydroxide		Hydrochloric acid		Sodium chloride		Water

 ${\bf Q}$ 4. A solution of a substance ' X ' is used for white washing.

(i) Name the substance 'X ' and write its formula.

(ii) Write the reaction of the substance 'X ' named in (i) above with water.

Ans. (i) Substance 'X ' is quick lime and its formula is CaO.

(ii) Reaction of (X) CaO with water (H_2O)

CaO (s)	+	$H_{2O}(l)$	\rightarrow	Ca (OH) ₂ (aq)
Quick lime				Slaked lime
or				or
Calcium oxide				Calcium hydroxide

Q 5. Why is the amount of gas collected in one of the test tubes in double of the amount collected in the other?

Name this gas.

Ans. electrolysis of acidulated water a few drops of sulphuric acid is carried out using graphite anode and cathode. The gas collected at cathode is hydrogen for which the volume is double to that of the oxygen which is collected at anode.

$$2\mathrm{H}_{2}\mathrm{O}^{(l)} \rightarrow 2\mathrm{H}_{2}(\mathrm{g}) + \mathrm{O}_{2}(\mathrm{g})$$

Q 6. Why does the colour of copper sulphate change when an iron nail is dipped in it?

Ans. When an iron nail is dipped in blue coloured copper sulphate solution, the blue colour fades as iron has displaced copper from copper sulphate solution to give iron sulphate and copper metal is produced. The above reaction is an example of displacement reaction:

Fe(s)	+	CuSO ₄ (aq)	\rightarrow	FeSO ₄ (aq)	+	Cu (s)	
Iron		Copper sulphate (blue)		Iron sulphate		Copper	
O 7. Give an example of a double displacement reaction other than the one given in Activity 1.10.							

Ans. An example of double displacement reaction other than activity 1.10 is given here:

Ans.	All example of double of				y 1.10 is given here.		
	AgNO ₃ (aq)	+ Na	Cl (aq)	\rightarrow	AgCl (s)	+	NaNO ₃ (aq)
	Silver nitrate	Sodiu	m chloride		Silver chloride(white ppt.)		Sodium nitrate
An e	xchange of ions takes pl	lace in this read	ction. The silve	r ions (Ag	g ⁺) of silver nitrate read	ct with cl	nloride ions (Cl ⁻) of
sodiı	am chloride to form a ne	ew compound,	silver chloride	$(Ag^+ Cl^-)$	or AgCl). Similarly, the	e sodium	ions (Na ⁺) of sodium
chlo	ride react with the nitrat	te ions $(NO_3^-)_{O_3}$	f silver nitrate t	o form an	other new compound,	sodium n	itrate $(Na^+NO_3^-)$ or
Nal	$(VO_3)_{. \text{Please note that in}}$	n the above do	uble displacem	ent reacti	on, silver chloride is fo	rmed as	an insoluble white solid
calle	d a 'white – precipitate'						
Q 8.	Identify the substances	that are oxidise	ed and the subs	tances that	t are reduced in the fol	lowing re	eactions.
	(i) $4Na(s) + O_2(g) \rightarrow 2$	2Na ₂ O (s)	(ii) Cu($O(s) + H_2$	$g_2(g) \rightarrow Cu(s) + H_2G$	_D (<i>l</i>)	
Ans.	(i) In this reaction, Na ((s) is oxidised t	to $Na_2O(s)$ and	$O_2(g)$ is	reduced to $Na_2O(s)$.		
				T () '			
	(II) In this reaction, CuC	J(s) is reduced	to Cu (s) and F	$H_2(g)$ 15 O	xidised to $H_2O(C)$.		
Q 9.	Which of the statements	s about the read	ction below are	incorrect	?		
	2PbO (s)	+ C ($(s) \rightarrow$	2Pb (s)	+ $CO_2(g)$		
	(a) Lead is getting redu	iced. (b) Carbo	on dioxide is ge	tting oxid	ised. (c) Carbon is gett	ing oxid	ised (d) Lead oxide is
	getting reduced.						
	(i) (a) and (b)	(ii) (a) and (c)	(iii) (a),	(b) and (c)	(iv) all	
Ans.	(i)						
Q10.	$Fe_2O_3 + 2Al \rightarrow A$	4l ₂ O ₃ +	2Fe This rea	action is a	in example of a		
	(a) combination reaction	on (b) doub	le displacemen	t reaction	. (c) decomposition rea	action (l) displacement reaction
Ans.	(d)						
Q11.	. What happens when di	lute hydrochlo	ric acid is adde	d to iron f	illings? Tick the correc	et answer	:
	(a) Hydrogen gas and i	ron chloride ar	e produced.	(b) Chlor	rine gas and iron hydro	xide are	produced.
	(c) No reaction takes pl	lace.		(d) Iron s	salt and water are produ	iced.	
Ans.	(a) Reaction: Fe +	2HCl	\rightarrow FeCl ₂	2 +	H ₂		
Q12.	. What is a balanced che	mical equation	? Why should	chemical	equations be balanced?	2	
Ans.	A balanced chemical ec	quation is the o	one in which nu	mber of a	toms taking part in a cl	nemical e	equation are the same

on the reactants and products sides of the equation. Mass can neither be created nor destroyed in a chemical reaction. That is, the total mass of the elements present in the products of a chemical reaction has to be equal to the total mass of the elements present in the reactants. In other words, the number of atoms of each element remains the same before and after a chemical reaction. Hence, we need to balance a chemical equation.

Q13. Translate the following statement in to chemical equations and then balance them.

(a) Hydrogen gas combines with nitrogen to form ammonia (b) Hydrogen sulphide gas burns in air to give water and sulpher dioxide.
(c) Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.
(d) Potassium metal reacts with water to give potassium hydroxide and hydrogen gas.

Ans. (a) $H_2(g) + N_2(g) \rightarrow NH_3(g)$

Balanced equation: $3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$

(b) $H_2S(g) + O_2(g) \rightarrow 2H_2O(l) + SO_2(g)$

Oxygen from air

- **Balanced equation:** $2H_2S(g) + 3O_2(g) \rightarrow 2H_2O(l) + 2SO_2(g)$
- $\textbf{(c)} \; BaCl_2 \; (aq) \; + \; Al_2 \; (SO_4)_3 \; (aq) \; \rightarrow \; AlCl_3 \; (aq) \; + \qquad BaSO_4 \; (s)$

Balanced equation: $3BaCl_2(aq) + Al_2(SO_4)_3(aq) \rightarrow 2AlCl_3(aq) + 3BaSO_4(s)$

(d) K (s) + H₂O^(l) \rightarrow KOH (aq) + H₂ (g)

Balanced equation: $2K(s) + 2H_2O^{(l)} \rightarrow 2KOH(aq) + H_2(g)$

Q14. Balance the following chemical equations.

(a) $HNO_3 + Ca (OH)_2 \rightarrow Ca (NO_3)_2 + H_2O$ (b) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$

(c) NaCl + AgNO₃
$$\rightarrow$$
 AgCl + NaNO₃ (d) BaCl₂ + H₂SO₄ \rightarrow BaSO₄ + HCl

Ans. Balanced chemical equations are as follows:

(a) $2NHO_3 + Ca (OH)_2 \rightarrow Ca (NO_3)_2 + 2H_2O$ (b) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

(c) NaCl + AgNO₃ \rightarrow AgCl + NaNO₃ (already balanced) (d) BaCl₂ + H₂SO₄ \rightarrow BaSO₄ + 2 HCl

Q15. Write the balanced chemical equations for the following reactions.

(a) Calcium hydroxide + Carbon dioxide \rightarrow Calcium carbonate + Water

(b) Zinc + Silver nitrate \rightarrow Zinc nitrate + Silver

(c) Aluminium + Copper chloride \rightarrow Aluminium chloride + Copper

(d) Barium chloride + Potassium sulphate \rightarrow Barium sulphate + Potassium chloride.

Ans. (a) Ca $(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

(b) $Zn + 2AgNO_3 \rightarrow Zn (NO_3)_2 + 2Ag$

(c) $2Al + 3CuCl_2 \rightarrow 2AlCl_3 + 3Cu$

(d) $BaCl_2 + K_2SO_4 \rightarrow BaSO_4 + 2KCl$

Q16. Write the balanced chemical equation for the following and identify the type of reaction in each case.

(a) Potassium bromide (aq) + Barium iodide (aq) \rightarrow Potassium iodide (aq) + Barium bromide (s)

(b) Zinc carbonate (s) \rightarrow Zinc oxide (s) + Carbon dioxide (g)

(c) Hydrogen (g) + Chlorine (g) \rightarrow Hydrogen chloride (g)

(d) Magnesium (s) + Hydrochloric acid (aq) \rightarrow Magnesium chloride (aq) + Hydrogen (g)

Ans. (a) Balanced equation: $2KBr(aq) + BaI_2(aq) \rightarrow 2KI(aq) + BaBr_2(s)$ This is an example of double displacement.

(b) Balanced equation: $ZnCO_3(s) \rightarrow ZnO(s) + CO_2(g)$ This is an example of decomposition.

(c) Balanced equation: $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$ This is an example of combination

(d) Balanced equation: Mg (s) + 2HCl (aq) \rightarrow MgCl₂ (aq) + H₂ (g) This is an example of displacement reaction.

Q17. What does one mean by exothermic and endothermic reactions? Give examples.

Ans. A chemical reaction is said to be exothermic when it releases energy in the form of heat and light.

Examples: (i) $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O^{(l)} + Energy (heat)$

(ii) 2Al (s) + Fe₂O₃ (s) \rightarrow Al₂O₃ (s) + 2Fe^(l) + Energy (heat)

A chemical reaction is said to be endothermic in which the energy is absorbed in the form of heat and light i.e. cooling is

produced. Examples: Ba (OH)₂. $8H_2O(s) + 2NH_4SCN(s) \rightarrow Ba (SCN)_2 (aq) + 2NH_3(aq) + 10H_2O(l)$

In the above reaction, the reaction mixture becomes so cold that moisture from the air forms a layer of frost on the surface of water.

Q18. Why is respiration considered an exothermic reaction? Explain.

Ans. We all know that we need energy to stay alive. We get this energy from the food we eat. During digestion, food is broken down in to simpler substances. For example, rice, potatoes and bread contain carbohydrates. These carbohydrates are broken down to form glucose. Glucose during respiration (inhalation of oxygen) is oxidised with the liberation of

Energy as shown below: $C_6H_{12}O_6(aq) + 6CO_2(g) \rightarrow 6CO_2(g) + 6H_2O(l) + Heat$

The above reaction occurs at body temperature of 37°C.

Q19. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions. **Ans.** A decomposition reaction is considered as the opposite of combination reaction; because in decomposition reaction, a single substance decomposes to produce two or more substance; whereas in combination reaction two or more substances combine to give a single substance.

Examples of decomposition reaction:

(a) NH ₄ Cl (s)	\rightarrow	HCl (g)	+	$NH_3(g)$		
Ammonium chloride		Hydro chloric acid		Ammonia	ì	
(b) CaCO ₃ (s)	\rightarrow	CaO (s)	+	$\text{CO}_2(g)$		
Calcium carbonate		Calcium oxide		Carbon dioxide		
(c) NH_4NO_3 (s)	\rightarrow	$N_2O(g)$	+	$2H_2O$		
Ammonium nitrate		Nitrous oxide		Water		
(d) 2NaNO ₃ (s)	\rightarrow	2NaNO ₂ (s)	+	$O_{2}(g)$		
Sodium nitrate		Sodium nitrate		Oxygen		
(e) 2Cu (NO ₃) ₂ (s)	\rightarrow	2CuO (s)	+	$4NO_2(g)$	+	$O_2(g)$
Copper nitrate		Cupric oxide	Ni	trogen dioxide	Oxy	voen

Examples of combination reaction:

(a) $NH_{3}(g)$	+	HCl (g)	\rightarrow	NH ₄ Cl (s)	
Ammonia	Н	ydrogen chloride	Ammonium chlorid		
(b) $CO_2(g)$	+	CaO (s)	\rightarrow	$CaCO_3(s)$	
Carbon dioxide		Calcium oxide	С	alcium carbonate	
(c) 2Mg(s)	+	$O_2(g)$	\rightarrow	2MgO (s)	
Magnesium		Oxygen	Ma	agnesium oxide	
(d) 2SO ₂ (g)	+	$O_{2}(g)$	\rightarrow	2SO ₃ (g)	
Sulphur dioxide		Oxygen		Sulphur trioxide	

Q20. Write one equation each for decomposition reactions where energy is supplied in the form of heat light of electricity. **Ans.** Examples of decomposition reactions :

(i) Decomposition by the use of heat : (a) $CaCO_3(s)$ Lime stone Uick lime(b)) 2Pb $(NO_3)_2 \xrightarrow{Heat}$ 2PbO $(s) + 4NO_2(g) + O_2(g)$ (ii) Decomposition by the use of electricity: $2H_2O(l) \xrightarrow{Electricity} 2H_2(g) + O_2(g)$

With few drops of H ₂ SO ₄	At anode	At cathode					
(iii) Decomposition by the use of light:							
(2) 2A (2) $Sunlight$ 2A (2) (2) (1)							
(a) 2AgCI (s)	2Ag (8)	$+ C1_2(g)$					
(b) $2 \text{AgBr} (s) \xrightarrow{Heat} \rightarrow$	2Ag(s)	+ $Br_2(g)$					
Q21. What is the difference b	etween displacer	nent and double disp	lacement r	eactions? Write equ	uations f	or these reactions.	
Ans. In displacement reaction	ns, an element dis	splaces or removes an	nother elen	nent, whereas in do	uble disp	olacement	
reactions Exchange of ions b	etween the reacta	ants take place.					
Examples of displacem	ent reactions:						
(i) Fe (s) + Cu	$iSO_4 (aq) \rightarrow$	$\bullet \text{FeSO}_4 \text{ (aq)}$	+	Cu (s)			
Iron Cop	per sulphate	Iron sulphate		Copper			
In this the element iror	has displaced co	opper from its salt so	lution copp	per sulphate.			
(ii) $Zn(s)$ + C	$CuSO_4(aq)$ –	\rightarrow ZnSO ₄ (aq)	+ (Cu (s)			
Zinc Co	opper sulphate	Zinc sulphate	C	Copper			
In this the element zinc	c has displaced co	opper from its salt so	lution copp	per sulphate.			
(iii) Pb (s) $+$ C	$\operatorname{CuCl}_2(\operatorname{aq})$ –	$\rightarrow \text{PbCl}_2 \text{ (aq)}$	+ (Cu (s)			
Lead Cup	oric chloride	Lead chloride	Co	opper			
In this the element lea	d has displaced c	copper from its salt so	olution cup	ric chloride.			
Examples of double dis	splacement reac	tion:					
(i) Na_2SO_4 (aq) +	BaCl ₂ (aq)	\rightarrow BaSO ₄ (s)	+	2NaCl (aq)			
Sodium sulphate	Barium chloride	Barium sulphate		Sodium chloride			
In the above reaction the	he exchange of ic	ons has taken place, i	.e., Na ⁺ ioi	n has replaced Ba ²⁺	and vice	e – versa.	
(ii) $\operatorname{FeCl}_3(\operatorname{aq}) + 2$	3NH ₄ OH (aq)	\rightarrow Fe (OH) ₃ (s)	+	3NH ₄ Cl (aq)			
Ferric chloride Am	monium hydroxide	Ferric hydroxide	А	mmonium chloride			
In the above reaction, F	Se ³⁺ has replaced	NH_4^- and vice- versa					
(iii) $CuSO_4(aq) +$	2NaOH (aq)	\rightarrow Cu (OH) ₂ (s)	+	Na_2SO_4 (aq)			
Copper sulphate Se	odium hydroxide	Copper hydroxide		Sodium sulphate			
In the above reaction,	Cu ²⁺ has replaced	l Na ⁺ and vice- versa	•				
Q22. In the refining of silver,	the recovery of s	silver from silver nitr	ate solutio	n involved displace	ement of	copper metal.	
Write down the reaction invo	olved.						
Ans. The involved reaction is	: Cu (s)	+ $AgNO_3(aq)$	\rightarrow	Cu (NO ₃) ₂ (aq)	+	2Ag (s)	
	Copper	Silver nitrate		Copper nitrate		Silver	
Q23. What do you mean by a	precipitation rea	ction? Explain by giv	ving examp	ples.			
Ans. Any reaction that produc	ces a precipitate	can be called a precip	oitation rea	ction. A double dis	placeme	nt reaction is also	
called precipitation reaction.							
Examples: (i) Na_2SO_4 ((aq) +	$BaCl_2(aq)$	\rightarrow	$BaSO_4(s)$	+	2NaCl (aq)	
Sodium sulp	phate	Barium chloride		Barium sulphate		Sodium chloride	
In the above reaction, a white precipitate of barium sulphate is formed.							
(ii) NaCl (a	(q) +	AgNO ₃ (aq)	\rightarrow	AgCl (s)	+	NaNO ₃ (aq)	
Sodium chlo	oride	Silver nitrate		Silver chloride		Sodium nitrate	
In the above reaction of	white precipitate	of silver chloride is f	formed				

In the above reaction, a white precipitate of silver chloride is formed.

Q24. Explain the following in terms or loss of oxygen or removal of hydrogen with two examples each.

(a) Oxidation (b) Reduction.

Ans. (a) Oxidation : Addition of oxygen or removal of hydrogen is termed as oxidation.

Examples: (i) $2Cu + O_2 \rightarrow 2CuO$ (ii) $2Mg + O_2 \rightarrow 2MgO$

In above two reactions gain of oxygen has taken place.

(b) **Reduction :** Addition of hydrogen or removal of oxygen is termed as reduction.

Examples : (i) $H_2S + Cl_2 \rightarrow 2HCl + S$

In this reaction, chlorine is being reduced to hydrogen chloride.

(ii) CuO +
$$H_2 \rightarrow Cu$$
 + H_2O

In this reaction copper oxide is being reduced to copper.

Q25. A shiny brown coloured element 'X ' on heating in air becomes black in colour. Name the element 'X ' and the black coloured compound formed.

Ans. The element 'X ' seems to be copper metal. When copper metal is heated is air, it forms a black coloured compound

copper oxide (CuO). $2Cu(s) + O_2(s) \xrightarrow{Heat} CuO(s)$ Brown Black

Q26. Why do we apply paint on iron articles?

Ans. You must have observed that iron articles are shiny when new but get coated with a reddish brown powder when left for sometime. The process is called corrosion. In the case of iron, corrosion is replaced by term rusting. To check the rusting of iron paint is applied on iron articles.

Q27. Oil and fat containing food items are flushed with nitrogen. Why?

Ans. Oil and fat containing food items are flushed with nitrogen because the food containing fats and oil become rancid after sometime because of oxidation and give smell having a bad taste. Presence of nitrogen helps food to save from rancidity.

Q28. Explain the following terms with one example each.

(i) Corrosion (ii) Rancidity

Ans. (a) **Corrosion:** When a metal is attacked by substances in atmosphere such as moisture, acids, etc, it is said to corrode and the process itself is called corrosion. When iron is corroded, it is called rusting.

The black coating on silver and the green coating on copper are the examples of corrosion. Corrosion causes damage to car bodies, bridges, iron railing, ships and to all objects made of metals, specially those of iron. Corrosion of iron is a serious problem. Every year an enormous amount of money is spent to replace damaged iron.

(b) **Rancidity:** When fats and oils containing food materials are left for a long time they start giving bad taste and smell. This occurs due to the oxidation of oil and fats and they are said to be rancid and the process itself is called rancidity.

To prevent rancidity antioxidants (which prevent oxidation) are added to foods containing fats and oil. Keeping food in air tight containers helps to slow down oxidation. Chips manufactures usually flush bags of chips with gas such as nitrogen to prevent the chips from getting oxidised.