SOLUTION TO 5070/12/O/N/19

QUICK ACCESS GRID

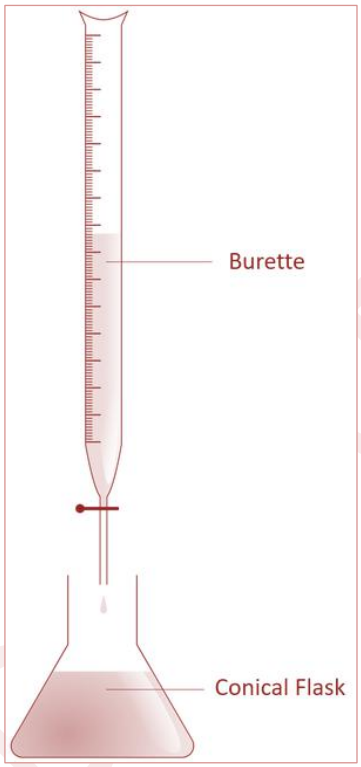
The solution to a particular question can be accessed instantly by clicking on the desired question number in the QUICK ACCESS GRID.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35
36	37	38	39	40

S1

C

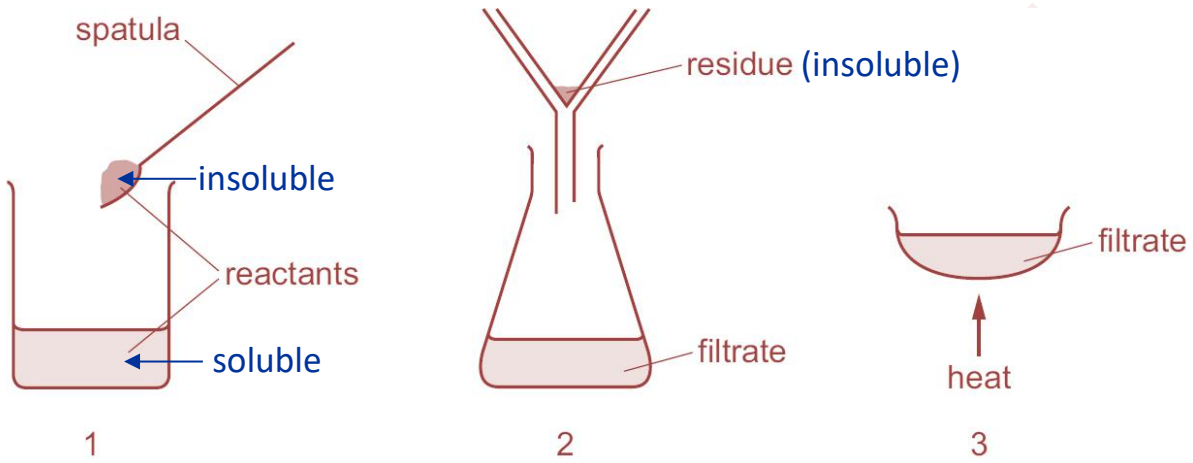
The method describes titration.
Burette, pipette, and conical flask are used for the technique.



BACK TO QUICK ACCESS GRID

S2

D



One of the reactants is soluble while the other is insoluble.
The insoluble reactant is used in excess.
Excess reactant is removed by filtration (residue).

The salt is soluble and passes in the filtrate.
It is obtained by the process of crystallisation.

BACK TO QUICK ACCESS GRID

S3

D

The nucleon number of an atom is typically greater than its proton number.
The difference between these two numbers indicates the number of **neutrons** in the atom.
Atoms that have different nucleon numbers but the same proton number are called **isotopes**.

BACK TO QUICK ACCESS GRID

S4

C

Nitrogen → N_2

Oxygen → O_2

Fluorine → F_2

BACK TO QUICK ACCESS GRID

S5

B

Ethanol is a pure compound.

Dry air, steel, and petrol are mixtures.

BACK TO QUICK ACCESS GRID

S6

B

The structure of a solid metal is best represented by **diagram B**.

It consists of a lattice of positive metal ions in a sea of electrons (delocalised electrons).

BACK TO QUICK ACCESS GRID

S7

C

For gases, **mole ratio = volume ratio**, at a given temperature and pressure.

$2H_2S(g) + 3O_2(g) \rightarrow 2H_2O(g) + 2SO_2(g)$

Volume ratio

2 dm^3 of H_2S : 2 dm^3 of SO_2

∴ 48 dm^3 of H_2S : 48 dm^3 of SO_2

Volume of sulfur dioxide formed = 48 dm^3

BACK TO QUICK ACCESS GRID

S8

B

Sulfuric acid dissociates completely in aqueous solutions to form H^+ and SO_4^{2-} ions. These ions are free to move throughout the solution, hence can conduct electricity.

A. Covalent compounds, such as glucose, ~~conduct~~ when molten or dissolved in water.

do not conduct

C. Ionic compounds, such as sodium chloride, conduct due to movement of ~~electrons~~.

ions

D. Metals, such as copper, conduct due to movement of ~~positive ions~~.

electrons

BACK TO QUICK ACCESS GRID

S9

B

Molar mass of:
Ammonia = 17 g
Hydrogen = 2 g

Mole ratio
3 mol of Hydrogen : 2 mol of Ammonia

Mass ratio
6 g of Hydrogen : 34 g of Ammonia

6 kg of Hydrogen : 34 kg of Ammonia

60 kg of Hydrogen : 340 kg of Ammonia

Percentage yield = $\frac{60}{340} \times 100 = 17.6\%$

BACK TO QUICK ACCESS GRID

S10

A

Molar mass of:
Chlorine, Cl_2 = 71 g
Hydrogen, H_2 = 2 g

$n\ (Cl_2) = \frac{71}{71} = 1$

$n\ (H_2) = \frac{2}{2} = 1$

ratio of the number of molecules in 71 g of gaseous chlorine to the number of molecules in 2 g of gaseous hydrogen

= ratio of the number of moles in 71 g of gaseous chlorine to the number of moles in 2 g of gaseous hydrogen

= 1 : 1

BACK TO QUICK ACCESS GRID

S11

C

Dilute sulfuric acid would give colourless gases at both electrodes.

H^+ ions would get discharged at the cathode by reduction forming colourless H_2 gas.
$2H^+ + 2e^- \rightarrow H_2$

Hydroxide ions would get discharged by oxidation at the anode in preference to sulfate ions forming colourless Oxygen gas.
$4OH^- \rightarrow O_2 + 2H_2O + 4e^-$

NOTE:
If the electrolyte is an aqueous solution, hydroxide ions **ALWAYS** get discharged at the anode **EXCEPT WHEN** the electrolyte is a concentrated aqueous halide solution.
In that case, the halide ions get discharged forming the corresponding halogen.
For a dilute aqueous halide solution, hydroxide ions get discharged.

BACK TO QUICK ACCESS GRID

S12

A

(Very) Reactive metals that are above Carbon on the reactivity series are most likely to be extracted by the use of electrolysis.
These metals are more reactive than Carbon and therefore cannot be obtained by reduction of their oxides by heating with Carbon.

Accordingly, **Calcium** is most likely to be extracted from its molten chloride by the use of electrolysis.

Copper, Iron, and Silver are below Carbon on the series.

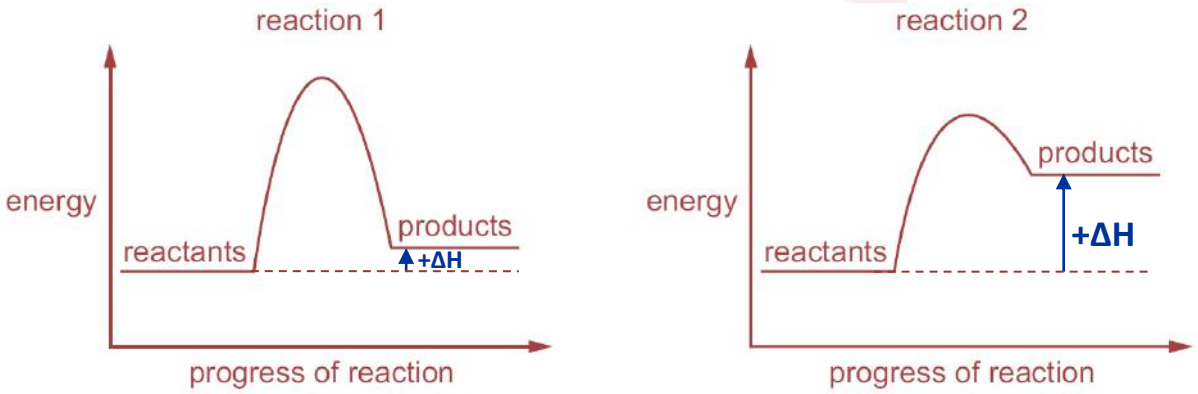
BACK TO QUICK ACCESS GRID

S13

D

The energy of products > energy of reactants for both reactions.
Both reactions are endothermic.

The difference in energies of products and reactants is greater for reaction 2.
The enthalpy change of reaction 2 is larger than the enthalpy change of reaction 1.



BACK TO QUICK ACCESS GRID

S14

D

ΔH is positive → the reaction is endothermic.

Heat energy is absorbed by the ammonium nitrate from the water → the water gets colder.

1,2 and 3 are correct.

BACK TO QUICK ACCESS GRID

S15

B

The graph for T_1 is steeper than that for T_2 indicating faster reaction.
T_1 is higher than T_2.

For gases, **volume ratio = mole ratio** at a given temperature and pressure.

Initial volume of P = 6 units

Final volume of Q = 9 units

Volume ratio
6 : 9 or 2 : 3

Mole ratio
2 : 3

2P → 3Q

Row A is correct.

BACK TO QUICK ACCESS GRID

S16

B

In reaction B, Cl_2 is reduced to Cl^- ions by gaining electrons from I^- ions.

I^- ions lose electrons to Cl_2 and get oxidised to I_2.

BACK TO QUICK ACCESS GRID

S17

C

Catalysts lower the activation energy of a reaction by providing an alternative reaction pathway.

A greater proportion of reactant particles now collide with an energy ≥ activation energy resulting in more successful collisions and higher reaction rate.

Catalysts do not alter the average kinetic energies of the reactant particles.

Statements 2 and 3 are correct.

BACK TO QUICK ACCESS GRID

S18

D

Solution T is acidic.

An acid can react with Magnesium (a reactive metal) to form the corresponding salt and Hydrogen gas.

An acid can react with Calcium carbonate to form the corresponding salt, water, and carbon dioxide gas.

Aqueous ammonia is (weakly) alkaline.

Solution T can therefore react with aqueous Ammonia and neutralise it.

BACK TO QUICK ACCESS GRID

S19

D

Copper(II) nitrate is soluble in water.

All nitrate salts are water-soluble.

BACK TO QUICK ACCESS GRID

S20

C

A It is a colourless, ~~odourless~~ gas. ✗
It is a colourless gas with a pungent, irritating odour.

B It is a gas that turns damp blue litmus paper red. ✗
It is a gas that turns damp red litmus paper blue. (weakly alkaline)

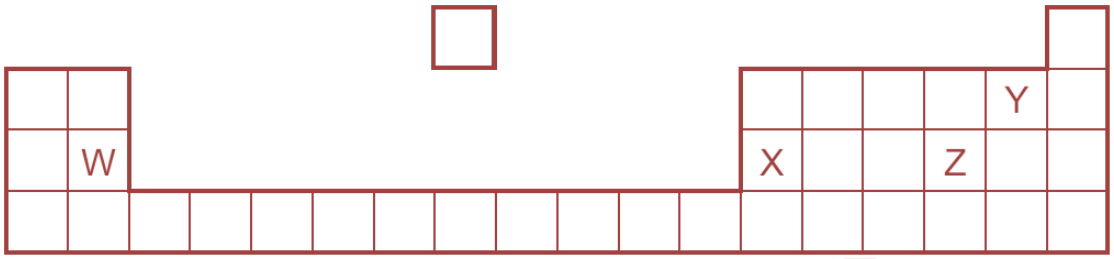
C It is formed when potassium nitrate is heated with aqueous sodium hydroxide and aluminium. ✓

D It is manufactured using vanadium(V) oxide as a catalyst. ✗
It is manufactured using Iron metal as a catalyst. (Haber process)

BACK TO QUICK ACCESS GRID

S21

B



Ions that the elements are most likely to form:

$W \rightarrow W^{2+}$

$X \rightarrow X^{3+}$

$Y \rightarrow Y^{-}$

$Z \rightarrow Z^{2+}$

Correct formulae:

WY_2 and WZ

BACK TO QUICK ACCESS GRID

S22

C

The chemical properties of elements largely depend upon the number of electrons in their outer shells.

Elements in the same group have the same number of electrons in their outer shell, hence similar chemical properties.

The elements in Group I therefore have similar chemical properties.

BACK TO QUICK ACCESS GRID

S23

B

All noble gases are chemically inert (unreactive).

Noble gases have a complete outer shell of electrons / octet (8) of electrons in their outer shell.

Helium has 2 electrons in its outer shell while Xenon has 8 electrons in its outer shell.

BACK TO QUICK ACCESS GRID

S24

D

Transition metal ions are generally coloured.

Charge on X in XI = 1+

The oxidation number of X decreases from +2 to +1, hence reduction.

From this information, it can be deduced that X is most likely a **transition** metal and the $X^{2+}(aq)$ ions are **reduced**.

BACK TO QUICK ACCESS GRID

S25

C

All metals conduct electricity in the solid state as well as in the molten state due to presence of delocalised electrons.
Metals typically have high melting points.
Substance C is therefore a metal.

BACK TO QUICK ACCESS GRID

S26

A

Cu is below H as well as below C on the reactivity series.
It can therefore be obtained from its oxide by using either carbon or hydrogen.

Copper oxide + Hydrogen → Copper + Water

Copper oxide + Carbon → Copper + Carbon dioxide

BACK TO QUICK ACCESS GRID

S27

A

The carbonate of the most reactive metal is most stable to heat.
Calcium is more reactive than Copper, Lead, and Zinc.
Calcium carbonate is therefore the most stable carbonate.

BACK TO QUICK ACCESS GRID

S28

C

The limestone decomposes in the blast furnace to form lime and carbon dioxide.

$CaCO_3 \rightarrow CaO + CO_2$

Calcium oxide is basic and neutralises the acidic impurities like Silica to form slag.

$CaO + SiO_2 \rightarrow CaSiO_3$ (slag)

BACK TO QUICK ACCESS GRID

S29

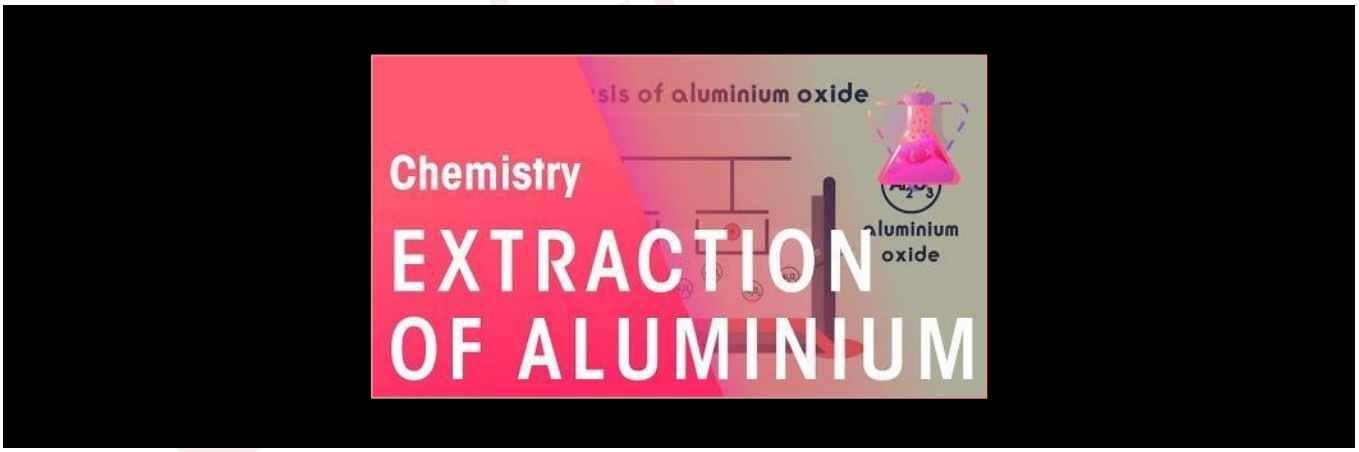
A

A Aluminium ions gain electrons to form aluminium. ✓
Aluminium ions get discharged at the Carbon cathode by reduction. Molten Al is formed.
$Al^{3+} + 3e^- \rightarrow Al$

B Cryolite ~~increases~~ the melting point of the electrolyte. ✗
decreases

C Cryolite reacts with impurities to form slag. ✗
No slag formation occurs in this extraction process.

D The carbon ~~cathode~~ ~~has~~ to be replaced regularly as it reacts with oxygen. ✗
anodes have



BACK TO QUICK ACCESS GRID

S30

B

The oxygen removes some of the carbon from the impure iron by combining with it to form carbon dioxide gas which escapes from the furnace.

$C (s) + O_2 (g) \rightarrow CO_2 (g)$

BACK TO QUICK ACCESS GRID

S31

D

Z is NO_2.

It is formed in internal combustion engines by the reaction between Oxygen and Nitrogen from air.

It is an acidic oxide, hence dissolves in water to form an acidic solution.

It is removed from the exhaust gases in a catalytic converter by reduction.
$NO_2 + 2CO \rightarrow N_2 + 2CO_2$

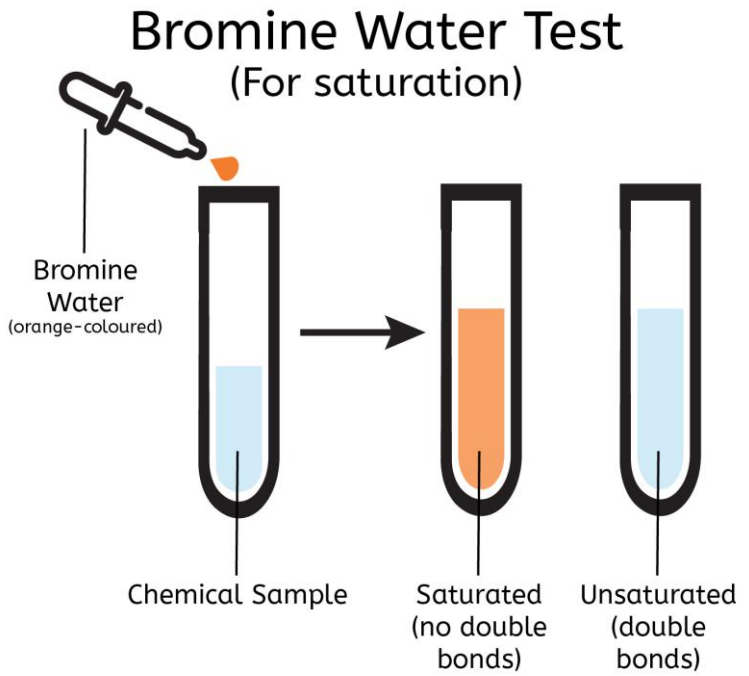
NOTE:
CO and H_2O are neutral.

BACK TO QUICK ACCESS GRID

S32

A

The liquid decolourises aqueous bromine – positive test result for unsaturated hydrocarbons like alkenes.



Unsaturated organic chemicals decolourise Bromine Water.

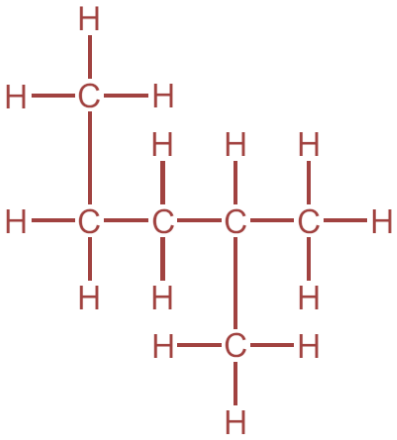
BACK TO QUICK ACCESS GRID

S33

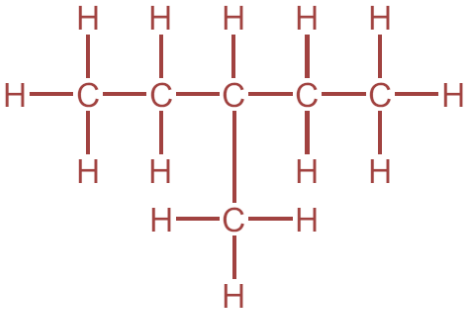
A

Isomers are compounds with the same molecular formula but different structural formulae.

1



2

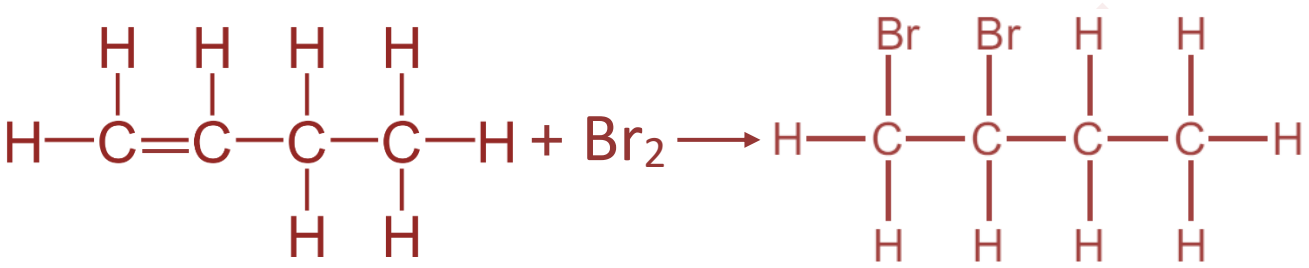


Compounds 1 and 2 have the same molecular formula C_6H_{14}, but different structural formulae.

BACK TO QUICK ACCESS GRID

S34

B



BACK TO QUICK ACCESS GRID

S35

A

Propene can be formed by cracking butane at high temperature and pressure.

Butane → Methane + Propene

$C_4H_{10} \rightarrow CH_4 + C_3H_6$

B It has the formula ~~C_3H_8~~.
C_3H_6

C It is a ~~saturated~~ hydrocarbon.
unsaturated

D It reacts with hydrogen to form ~~ethane~~.
propane

BACK TO QUICK ACCESS GRID

S36

C

Terylene is a polyester.

BACK TO QUICK ACCESS GRID

S37

A

$CH_2=CH_2 + H_2O \rightarrow CH_3CH_2OH$

Ethanol is formed by the addition of superheated steam to Ethene under high pressure using concentrated Phosphoric acid as the catalyst.

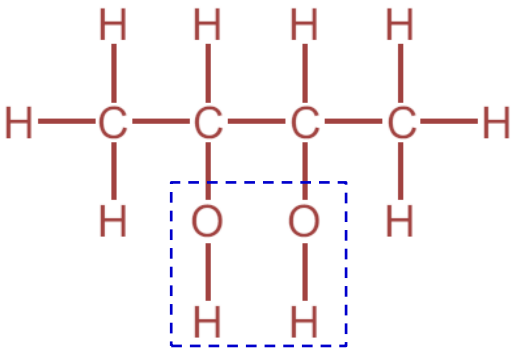
BACK TO QUICK ACCESS GRID

S38

B

Alcohols contain the hydroxyl group (–OH) group as the functional group.

B



BACK TO QUICK ACCESS GRID

S39

D

$CH_3CH_2COOH + CH_3OH \rightarrow CH_3CH_2COOCH_3 + H_2$

Propanoic acid and methanol react together to form $CH_3CH_2COOCH_3$.

BACK TO QUICK ACCESS GRID

S40

A

$CH_3CH_2CH_2COOCH_3$ is an ester. Esters are used as flavouring agents.

BACK TO QUICK ACCESS GRID

END OF DOCUMENT