SOLUTION TO 5070/11/M/J/19

QUICK ACCESS GRID

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S1

D

apparatus to measure temperature→ **thermometer**

apparatus to measure amount of acid used → **measuring cylinder**

BACK TO QUICK ACCESS GRID

S2

D

Formation of a white precipitate indicates a positive test for Chloride ions.

white precipitate obtained → Silver chloride

solution of X → must be colourless and must contain chloride ions → Sodium chloride

NOTE:
Copper (II) chloride solution has a blue-green colour.

BACK TO QUICK ACCESS GRID

S3

B

chromatography paper and solvent: common to all options

locating agent: hydrolysis of a protein produces **colourless amino acids**, hence a locating agent is required for detection of spots

pencil and ruler: to mark the start line
(marker ink will dissolve in solvent but pencil will not)

BACK TO QUICK ACCESS GRID

S4

C

Higher the relative molecular mass of a gas, heavier the molecules, lower the rate of diffusion!

Higher the temperature, greater the average kinetic energy of the gas molecules, faster the diffusion rate!

Therefore, small molecular mass of a gas and high temperature will increase the diffusion rate.

BACK TO QUICK ACCESS GRID

S5

A

Atomic number of Cobalt = 27

Number of protons in an atom of Cobalt = 27

In an atom, the number of protons = number of electrons.

The particle has 3 lesser electrons, hence is an ion with 3+ charge.

BACK TO QUICK ACCESS GRID

S6

B

Diamond is extremely hard, hence is used in **glass cutters**.

Graphite conducts electricity, hence is used as an **electrode material**.

Graphite has a smooth and slippery texture. The layers of Carbon atoms can slide over each other. It is therefore used as a **solid lubricant**.

BACK TO QUICK ACCESS GRID

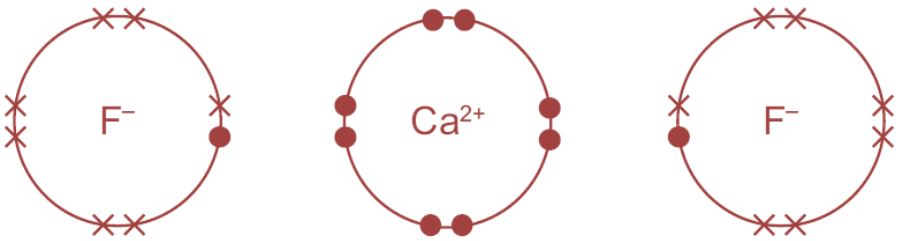
S7

C

Calcium fluoride is an ionic compound; diagrams A and B are incorrect.

The charge on a Calcium ion is 2+; diagram D is incorrect.

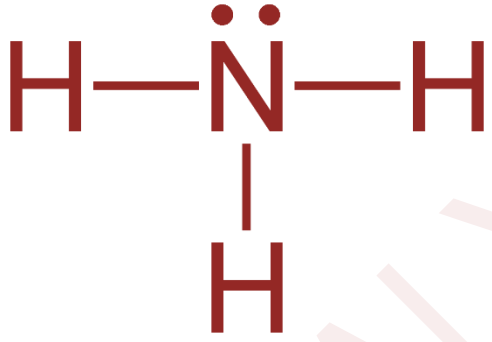
Diagram C shows the outer electron arrangement in calcium fluoride.



BACK TO QUICK ACCESS GRID

S8

A



number of shared pairs of electrons in an ammonia molecule = 3

BACK TO QUICK ACCESS GRID

S9

D

1. Metals contain a lattice of ~~negative~~ ions in a 'sea of electrons'.
   Metals contain a lattice of **positive** ions in a 'sea of electrons'.

2. The electrical conductivity of metals is related to the mobility of the electrons in the structure. ✓

Statement 2 is correct and statement 1 is incorrect.

BACK TO QUICK ACCESS GRID

S10

D

$CaCO_3$ is insoluble in water. The state symbol is therefore **s**.

correct ionic equation:

$CaCO_3(s) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + H_2O(l) + CO_2(g)$

BACK TO QUICK ACCESS GRID

S11

A

Volume of NaOH, V = 25.0 cm^3 = 0.025 dm^3

n (NaOH) = 0.025 × 0.100 = 0.0025

mole ratio
2 mol of NaOH : 1 mol of H_2SO_4

∴ 0.0025 mol of NaOH : 0.00125 mol of H_2SO_4

Volume of H_2SO_4, V = 20.0 cm^3 = 0.020 dm^3

Concentration of Sulfuric acid = $\frac{0.00125}{0.020}$ = 0.0625 mol / dm^3

BACK TO QUICK ACCESS GRID

S12

C

Molar mass of bromoethane = 109 g

Molar mass of ethanol = 46 g

Mole ratio
1 mol of bromoethane : 1 mol of ethanol

Mass ratio
109 g of bromoethane : 46 g of ethanol

10.90 g of bromoethane : 4.6 g of ethanol

percentage yield of ethanol = $\frac{3.45}{4.6} \times 100 = 75\%$

percentage yield = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$

BACK TO QUICK ACCESS GRID

S13

C

$(CH_2O)_6 \rightarrow C_6H_{12}O_6$

Reaction for complete combustion of 1 mole of sugar:

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

n (O_2) required for complete combustion of 1 mole of sugar = 6

Volume of O_2 required for complete combustion of 1 mole of sugar = $6 \times 24 = 144\ dm^3$

BACK TO QUICK ACCESS GRID

S14

B

purification of Copper by electrolysis:

Anode = impure Copper

Cathode = pure Copper

Electrolyte = aqueous solution containing Cu^{2+} ions

BACK TO QUICK ACCESS GRID

S15

C

negative ions present in aqueous copper(II) sulfate:

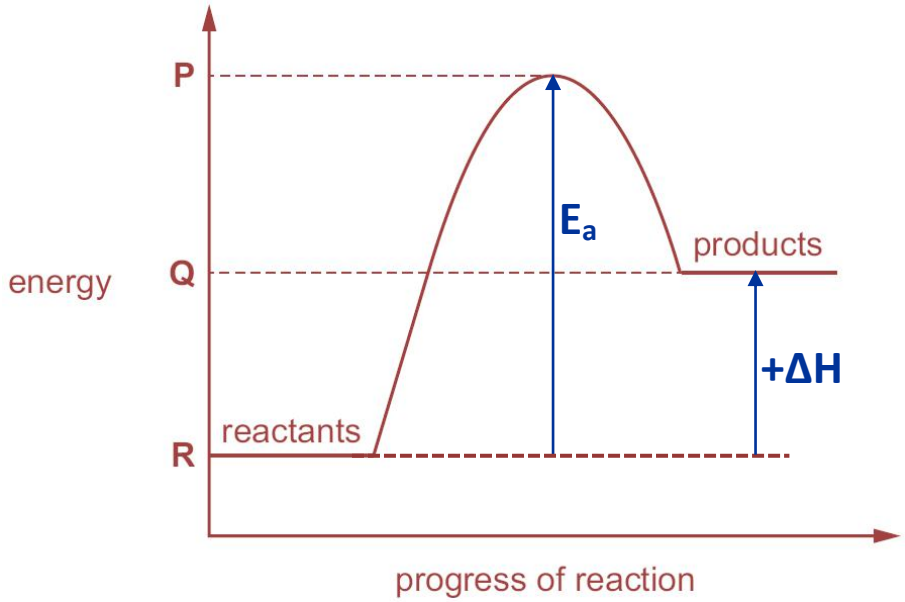
sulfate ions → from the dissociation of Copper(II) sulfate

hydroxide ions → from the dissociation of water

BACK TO QUICK ACCESS GRID

S16

B



The energy of products is greater than the energy of reactants.
The reaction is endothermic.
The activation energy is **P – R**.

BACK TO QUICK ACCESS GRID

S17

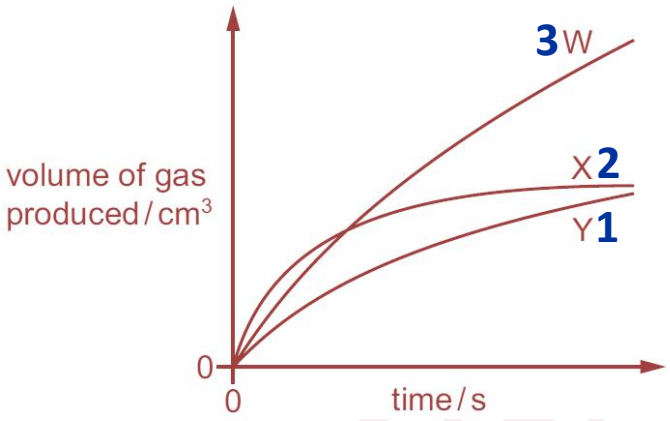
A

Compound	Energy released when 1 g of compound is completely burned / kJ (2 sf)
Benzene	$\frac{-3270}{78} = 42$
Heptane	$\frac{-4800}{78} = 62$
Octane	$\frac{-5510}{114} = 48$
Propane	$\frac{-2200}{44} = 50$

BACK TO QUICK ACCESS GRID

S18

D



experiment 1 Large pieces of Magnesium are used.

experiment 2 Small pieces of magnesium are used.

The same volume of Hydrogen gas is produced in experiments 1 and 2 as the same mass of Magnesium is reacted with the same volume of dilute Sulfuric acid of the same concentration.
The curve for experiment 2 is steeper (X) than that for experiment 1 (Y) as the particle size of Magnesium is larger. The surface area for reaction in experiment 1 is smaller, resulting in slower reaction rate.

experiment 3 Large pieces of magnesium are used but the concentration of the acid is increased.

As the concentration of acid is increased, the number of acid particles per unit volume increases. More of the Magnesium reacts. More Hydrogen gas is produced resulting in curve W.

BACK TO QUICK ACCESS GRID

S19

B

Increase in pressure favours the reaction side with fewer moles of gas.
Accordingly, the equilibrium moves to the right for reactions B and D when the pressure is increased.

Increase in temperature favours the endothermic reaction.
The equilibrium moves to the right for reactions B and C when the temperature is increased.

The equilibrium moves to the right for **reaction B** for both an increase in pressure and an increase in temperature.

BACK TO QUICK ACCESS GRID

S20

C

Acidified potassium manganate(VII) is an oxidising agent.
Change in colour from purple to colourless indicates the reduction of acidified potassium manganate(VII) by gas X.

Gas X is an oxidising agent.

Aqueous potassium iodide is a reducing agent.
Change in colour from colourless to brown indicates the oxidation of aqueous potassium iodide by gas Y.

Gas Y is a reducing agent.

BACK TO QUICK ACCESS GRID

S21

C

Weak acids dissociate partially in water. Strong acids dissociate completely in water.

Ethanoic acid is only slightly dissociated in water, hence is a weak acid.

NOTE:

All carboxylic acids are weak acids.

BACK TO QUICK ACCESS GRID

S22

D

Best method to prepare a pure sample of copper(II) sulfate:

Add Copper(II) oxide to dilute sulfuric acid.

Copper(II) oxide + dil. Sulfuric acid → Copper(II) sulfate + Water

Add copper to aqueous zinc sulfate → No reaction would occur as Zinc is more reactive than Copper.

Add copper to dilute sulfuric acid → No reaction would occur as Copper is below Hydrogen on the reactivity series. It doesn't react with dilute acids.

Add copper(II) carbonate to aqueous sodium sulfate → No reaction would occur as Copper(II) carbonate will remain insoluble in aqueous Sodium sulfate.

BACK TO QUICK ACCESS GRID

S23

D

Mass of 1 mole of Ammonium nitrate = 14 + 1 × 4 + 14 + 16 × 3 = 80 g

Mass of Nitrogen in 1 mole of Ammonium nitrate = 14 + 14 = 28 g

Percentage by mass of nitrogen in ammonium nitrate = $\frac{28}{80}$ × 100 = 35%

BACK TO QUICK ACCESS GRID

S24

B

Haber process uses Nitrogen obtained by the fractional distillation of air.

Both processes involve the use of a catalyst.
Haber process uses Iron as the catalyst.
Contact process uses Vanadium pentoxide as the catalyst.

The product of each catalysed reaction has a formula of the type XY_3.
The product of Haber process is NH_3.
The product of the catalysed reaction in Contact process is SO_3.

BACK TO QUICK ACCESS GRID

S25

D

Sulfuric acid is used in the manufacture of fertilizers like Ammonium sulfate.

BACK TO QUICK ACCESS GRID

S26

D

Sulfur forms:

- a covalent compound, H_2S
- an ionic compound, Na_2S
- oxides SO_2 and SO_3.

Element X is Sulfur and belongs to **group VI**.

BACK TO QUICK ACCESS GRID

S27

B

Atom	Electronic configuration of atom	Ion formed	Electronic configuration of ion
^{40}Ca	2.8.8.2	$^{40}Ca^{2+}$	2.8.8
^{39}K	2.8.8.1	$^{39}K^{+}$	2.8.8
^{23}Na	2.8.1	$^{23}Na^{+}$	2.8

Answer: Their ions all have eight electrons in their outer shell.

BACK TO QUICK ACCESS GRID

S28

C

Palladium is a transition metal.
It has variable oxidation states.
Some Palladium compounds have catalytic activity.

BACK TO QUICK ACCESS GRID

S29

B

The elements form ions by losing electrons, hence are metals.
Metals generally form ions by losing all of their outer shell electrons.
The ions formed all have the electronic configuration 2,8 after losing their outer shell.
The elements belong to period 3.

Answer: The elements are in the same period.

BACK TO QUICK ACCESS GRID

S30

A

Aluminium satisfies all of the three conditions.

It conducts electricity (all metals conduct electricity).

It has a relatively low density (hence is generally used for making overhead power cables).

It is resistant to aerial oxidation due to the presence of an adherent oxide layer on its surface.

BACK TO QUICK ACCESS GRID

S31

B

Calcium carbonate is basic.
Sulfur dioxide and Nitrogen dioxide are acidic gases, hence can be removed by neutralisation with Calcium carbonate.

BACK TO QUICK ACCESS GRID

S32

B

Pure water can be obtained from river water by **distillation**.

Adding Chlorine can disinfect the water, not purify it.
Filtering can remove only insoluble impurities.
Passing through carbon can eliminate coloured impurities and odour-causing impurities.

BACK TO QUICK ACCESS GRID

S33

B

Compound Q does not decolourise bromine in the dark → Q is not an alkene. A and C are alkenes.

Compound Q is a hydrocarbon that has no isomers → **Q is C_3H_8** (Propane).

C_4H_{10} has isomers, hence cannot be Q.

BACK TO QUICK ACCESS GRID

S34

A

$C_3H_7OH + 4.5O_2 \rightarrow 3CO_2 + 4H_2O$ ✓

$C_3H_7COOH + 5O_2 \rightarrow 4CO_2 + 4H_2O$

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

$C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$

BACK TO QUICK ACCESS GRID

S35

A

Hydrocarbons are compounds whose molecules are made up of Hydrogen and Carbon atoms only.
Cracking of hydrocarbons can produce a mixture of lower alkanes and alkenes or alkene with the same number of Carbon atoms as the alkane and Hydrogen.
Options C and D are incorrect.

General formula of a saturated hydrocarbon = C_nH_{2n+2}

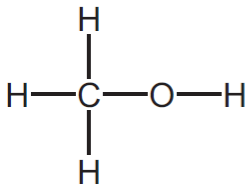
$C_nH_{2n+2} \rightarrow C_nH_{2n} + H_2$

BACK TO QUICK ACCESS GRID

S36

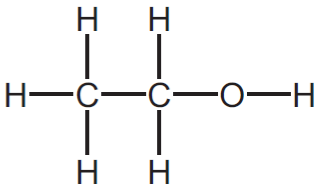
C

P



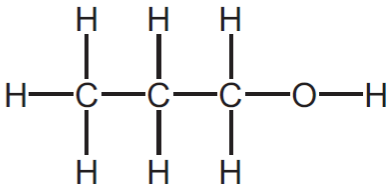
~~propanol~~
methanol

Q



ethanol

R



~~methanol~~
propan-1-ol

BACK TO QUICK ACCESS GRID

S37

A

Molecular formula of Ethanoic acid = CH_3COOH

Empirical formula of ethanoic acid = CH_2O

BACK TO QUICK ACCESS GRID

S38

D

Propyl methanoate is formed by condensation reaction between Methanoic acid and Propanol.

Propanol = $CH_3CH_2CH_2OH$

Methanoic acid = $HCOOH$

$CH_3CH_2CH_2OH + HCOOH \rightarrow CH_3CH_2CH_2OOCH + H_2O$

Propyl methanoate: $CH_3CH_2CH_2OOCH$

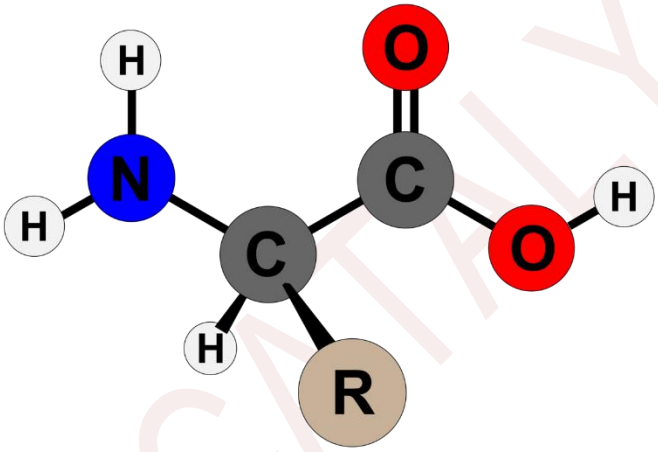
BACK TO QUICK ACCESS GRID

S39

B

Proteins are formed by condensation polymerisation of amino acids.

GENERAL STRUCTURE OF AMINO ACIDS



Proteins contain Nitrogen, hence produce oxides of nitrogen on combustion.

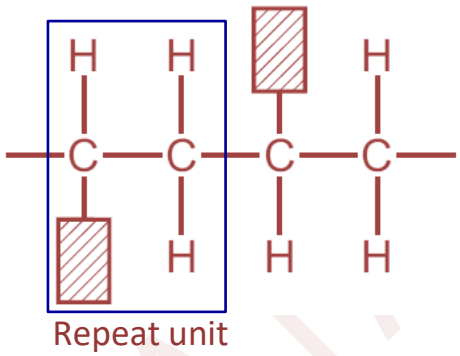
Fat, Starch, and Terylene contain the elements carbon, hydrogen and oxygen.
They do not contain Nitrogen.

BACK TO QUICK ACCESS GRID

S40

B

The monomer is an alkene.
Alkenes undergo addition polymerisation.
Polystyrene is formed by addition polymerisation of the monomer (Styrene).



Repeat unit = structure of monomer with a C–C instead of C=C.

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