






## CHEMISTRY

Using the valence electron pair repulsion theory, predict the shape of, and bond angles in a molecule of $\mathrm{OF}_{2}$.

## CHEMISTRY



2 bonding pairs and 2 lone pairs repel as far apart as possible. Lone pair-lone pair repulsion > lone-pair-bonding pair repulsion > bonding pair-bonding pair repulsion which results in a F -O-F angle of $104.5^{\circ}$ (bent shape)
You are required to recognise shapes that are based on the textbook examples.





ATOMIC STRUCTURE CHEMISTRY

Plot approximate second ionisation energies of period 3 elements Mg to S .




## ATOMIC STRUCTURE

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Explain the presence of peaks at $\mathrm{m} / \mathrm{z}=31.5$ and 32.5 in a mass spectrum of $\mathrm{Cu}-63$ and $\mathrm{Cu}-65$. Explain why these peaks are very small.

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## ATOMIC STRUCTURE

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The peak at $\mathrm{m} / \mathrm{z}=31.5$ is due to a ${ }^{63} \mathrm{Cu}^{2+}$ ion. The peak at $\mathrm{m} / \mathrm{z}=32.5$ is due to a ${ }^{65} \mathrm{Cu}^{2+}$ ion. As more energy is required to remove a second electron, few $2+$ ions are formed.

Remember that 63:2 $=31.5: 1$ which is where the peak for the $2+$ ion occurs on the mass spectrum.



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$\mathrm{ZCl}_{4}(\mathrm{l})+2 \mathrm{H}_{2} \mathrm{O}(\mathrm{l}) \rightarrow \mathrm{ZO}_{2}(\mathrm{~s})+4 \mathrm{HCl}(\mathrm{aq})$
$1.304 \mathrm{~g} \mathrm{of} \mathrm{ZCl}_{4}$ was added to water． $\mathrm{ZO}_{2}$ was removed and the resulting solution was made up to $250 \mathrm{~cm}^{3}$ ．A $25.0 \mathrm{~cm}^{3}$ portion of this solution was titrated against $0.112 \mathrm{~mol} \mathrm{dm}^{-3} \mathrm{NaOH}$ and 21.7 $\mathrm{cm}^{3}$ were required to reach the end point．Calculate the number of moles of HCl produced and the number of moles of $\mathrm{ZCl}_{4}$ present in the sample．Calculate the relative molecular mass，$M_{r}$ of $Z C_{4}$ ．Find the relative atomic mass of $\boldsymbol{Z}$ and hence its identity．



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$\mathrm{M}_{2} \mathrm{CO}_{3}+2 \mathrm{HCl} \rightarrow 2 \mathrm{MCl}+\mathrm{CO}_{2}+\mathrm{H}_{2} \mathrm{O}$
0.394 g of $\mathrm{M}_{2} \mathrm{CO}_{3}$ were reacted with $21.7 \mathrm{~cm}^{3}$ of $0.263 \mathrm{moldm}^{-3} \mathrm{HCl}$. Calculate the number of moles of HCl and $\mathrm{M}_{2} \mathrm{CO}_{3}$ used. Calculate the relative molecular mass, $\mathrm{M}_{\mathrm{p}}$ of $\mathrm{M}_{2} \mathrm{CO}_{3}$. Find the relative atomic mass of M and hence its identity.




 $6 \varepsilon=Z / 8 L=(W)^{\prime} V$
$8 L=\left(09={ }^{\varepsilon} 00\right) 09-8 \varepsilon 1=\left({ }^{2} W\right)^{1} \forall$




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## CHEMISTRY

$\mathrm{MgCO}_{3}+2 \mathrm{HCl} \rightarrow \mathrm{MgCl}_{2}+\mathrm{CO}_{2}+\mathrm{H}_{2} \mathrm{O}$
1.25 g of impure $\mathrm{MgCO}_{3}$ were reacted with $70 \mathrm{~cm}^{3}$ of $0.4 \mathrm{moldm}^{-3} \mathrm{HCl}$ ．After the reaction some acid was left over．Titration with NaOH required $25.3 \mathrm{~cm}^{3}$ of $0.4 \mathrm{moldm}^{-3}$ of NaOH to neutralise the left over acid．Calculate the $\%$ of $\mathrm{MgCO}_{3}$ in the impure sample．













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## CHEMISTRY

I．5g of hydrated sodium carbonate $\left(\mathrm{Na}_{2} \mathrm{CO}_{3} \cdot \mathrm{xH}_{2} \mathrm{O}\right)$ was dissolved in $50 \mathrm{~cm}^{3}$ of water and made up to $250 \mathrm{~cm}^{3} .25 \mathrm{~cm}^{3}$ of this solution was titrated against $0.1 \mathrm{moldm}^{-3} \mathrm{NaOH}$ of which $10.6 \mathrm{~cm}^{3}$ were required．Calculate the value for x in $\mathrm{Na}_{2} \mathrm{CO}_{3} \cdot \mathrm{xH}_{2} \mathrm{O}$ ．
$\mathrm{Na}_{2} \mathrm{CO}_{3}+2 \mathrm{HCl} \rightarrow 2 \mathrm{NaCl}+\mathrm{H}_{2} \mathrm{O}+\mathrm{CO}_{2}$.









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## CHEMISTRY

Lead reacts with nitric acid according to the following equation：
$3 \mathrm{~Pb}+8 \mathrm{HNO}_{3} \rightarrow 3 \mathrm{~Pb}\left(\mathrm{NO}_{3}\right)_{2}+2 \mathrm{NO}+4 \mathrm{H}_{2} \mathrm{O}$ ．What volume of $\mathrm{I} .5 \mathrm{moldm}^{-3}$ acid is required to react with 9.00 g of lead？What volume of N 0 gas is produced at 101 kPa and 298 K ？（Gas constant $\mathrm{R}=$ $8.31 \mathrm{JK}^{-1} \mathrm{~mol}^{-1}$ ）



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\begin{aligned}
& 8: \varepsilon={ }^{\varepsilon} \text { ONH:9d } 70 \text { o!pey }
\end{aligned}
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## CHEMISTRY

Limestone reacts with nitric acid according to the following equation：
$\mathrm{CaCO}_{3}+2 \mathrm{HNO}_{3} \rightarrow \mathrm{Ca}\left(\mathrm{NO}_{3}\right)_{2}+\mathrm{CO}_{2}+\mathrm{H}_{2} \mathrm{O}$ ．What mass of limestone is required to neutralise $35 \mathrm{~cm}^{3}$ of $0.241 \mathrm{moldm}^{-3}$ acid． $\mathrm{Ca}\left(\mathrm{NO}_{3}\right)_{2}$ decomposes when heated strongly according to the equation $\mathrm{Ca}\left(\mathrm{NO}_{3}\right)_{2(s)}$ $\rightarrow 2 \mathrm{CaO}_{(s)}+4 \mathrm{NO}_{2(s)}+0_{2(s)}$ At 101 kPa and $30^{\circ} \mathrm{C}$ a total volume of $4.00 \times 10^{-3} \mathrm{~m}^{3}$ of gases will be produced．How many moles of gas are produced in total？How many moles of oxygen will be produced？



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## CHEMISTRY

Nitric acid（concentrated）reacts with magnesium to form a nitrogen oxide compound．If this nitrogen oxide compound is made of $30.4 \%$ by mass of nitrogen，what is its empirical formula？

## CHEMISTRY

| Nitrogen | Oxygen |  |
| :--- | :---: | :---: |
| $30.4 \%$ | $69.6 \%$ |  |
| $\mathrm{Ar}=14$ |  | $\mathrm{Ar}=16$ |
| $30.4 / 14$ | $69.6 / 16$ |  |
| 2.17 | 4.35 | $E F=\mathrm{NO}_{2}$ |
| I |  | 2 |

Empirical formula questions are the same at GCSE and AS level．
Always make sure you state the actual formula at the end of the question．If you leave it at the ratio，you will lose I mark overall（provided it is the correct ratio）．

